European Commission

Retrospective evaluation support study on State aid rules for environmental protection and energy

Final Report

Prepared by

e.CA economics

Centre for Competition Policy

Sheppard Mullin

Competition

EUROPEAN COMMISSION

Directorate-General for Competition
E-mail: comp-publications@ec.europa.eu

European Commission
B-1049 Brussels

Retrospective evaluation support study on State aid rules for environmental protection and energy

Retrospective evaluation support study on the EU Guidelines on State aid for environmental protection and energy applicable in 2014-2020 and the provisions applicable to aid for environmental protection and energy of the Commission Regulation (EU) 651/2014

Final report

LEGAL NOTICE

Luxembourg: Publications Office of the European Union, 2020

Catalogue number: KD-02-20-327-EN-N
ISBN 978-92-76-18710-3
doi: 10.2763/414004

Authors:

e.CA economics	• Ela Głowicka • Paula Mäkelä • Stefan Witte
ccp CENTRE FOR COMPETITION POLICY	• David Deller • Sean Ennis • Bryn Enstone • George Snaith
SheppardMullin	• Michael Hofmann • Robert Klotz
In collaboration with Julien Blanquart, Catalina Chilaru (both Sheppard Mullin Richter & Hampton LLP), Linda Gratz, Elias Schmidtlein (both E.CA Economics), Israel Gottschalk, Thanh Doan and Silvi Berger (all Centre for Competition Policy, University of East Anglia).	

TABLE OF CONTENTS

1 Executive Summary (EN)

This report provides input for the evaluation of the State aid rules related to environmental protection and energy, with a particular focus on the EU Guidelines on State aid for environmental protection and energy (EEAG) applicable in 2014-2020 and on the provisions applicable to aid for environmental protection and energy (Section 7) of Commission Regulation (EU) 651/2014 (GBER). The overall objective of the report is to provide background information for the review of these provisions. The topics covered in the report are related to the effectiveness, efficiency and relevance of the State aid rules.

Effectiveness

Bidding processes for renewable energy sources (RES) - EEAG and General Block Exemption Regulation (GBER) exemptions. Partly as a result of the new rules in place since 2014, renewable energy sources are often contracted via bidding processes such as auctions and tenders, rather than by the direct award of contracts. The sample of bidding processes in this study covers all bidding processes held in the period 2014-November 2019 under aid schemes (identified by the EC project team) approved under the EEAG or GBER in a selection of Member States jointly accounting for over 80% of installed renewables generation capacity in the EU in 2018. The sample thus excludes schemes from these Member States that ran during this period but which were based on schemes still approved under the guidelines previously applicable. The Member States selected accounted for 81% of installed renewables generation capacity in the EU in 2018. Within the sample, the largest number of bidding processes occurred in 2018 (71), while the highest volume awarded was in 2017 (25.6 GW). Within the sampled schemes, the weighted average price of wind capacity fell by 62% between 2015 and 2019, while the weighted average price of solar capacity fell by 51% between 2014 and 2019. Averaging across the sampled schemes, a consistent picture does not emerge as to whether average prices are lower in multi-technology than single-technology auctions. However, price comparisons are hampered by Member States' specific factors such as local climate conditions (e.g. sun and wind patterns), the size (in KW) of the installations admitted in the auctions or the length of support provided (in years). Nevertheless, within each major category of technology average prices were lower when the bidding volume exceeded the volume requested than when the reverse was true. Direct comparisons of prices between competitively awarded and administratively set support are hard to identify and should be treated with caution, although, out of 9 case study comparisons on 6 occasions the competitively set price was lower than the comparative administratively set prices. Many RES-related schemes have benefitted from exemptions under the EU rules. To understand the specific type of exemptions granted, information on 61 schemes involving an exemption were collected and examined: 39 of them relate to the EEAG and 28 to the GBER. Among the 61 schemes, 29 can be linked to point 125 EEAG, 19 to point 127 EEAG, and 21 to Article 43 GBER.

Support for high efficiency Combined Heat and Power (CHP) technologies. CHP regimes capture and use heat generated as a by-product of the electricity generation process or employ industrial heat processes to generate electricity as a by-product. This can reduce carbon emissions. Such schemes are common in some EU countries with substantial heat demands. Calculations of the lifetime aid levels per unit of installed capacity for hypothetical case study plants have been performed for Belgium, the Czech Republic, France, Germany, the Netherlands and Poland, schemes which all involve operating aid. These can be compared to the lifetime aid levels for actual plants built in

Denmark and Lithuania. For larger plants, competitive award processes have occurred in Germany since 2017 and Poland held a bidding process in 2019. The main finding is the scale of differences in the level of aid awarded across different plant types and plant sizes. These differences likely reflect the wide variety of CHP installations used, differences in the size of the installations and the context in which they are used. In Belgium (before 2018) the Czech Republic, France and Germany, the highest levels of aid were granted to the smallest plants and for technologies associated with small plants. Averaging across the hypothetical case study plants in Germany and the Czech Republic the lifetime aid per KW of electrical capacity for plants below 100 KW in size was around double the average for hypothetical case study plants in the 100 KW to 1 MW size range.

Capacity mechanisms – auction outcomes and scheme designs. To assess the performance of capacity mechanisms, various auctions outcomes and scheme designs were compared over the reference period. A sample of 11 schemes in 7 Member States was examined, based on a selection by the Commission. In Greece and Germany the capacity awarded is either predominantly or all demand side responsive. Greece, Poland and Ireland generally had higher capacity prices than France or the UK. In Germany, fast interruptible load auctions almost always cleared at their price caps in 2017 and 2018. In 2019, prices fell below price caps, though by no more than 4%. This is likely associated with limited competition, in terms of the volume participating, prior to 2019. In Greece, the auctions for the two types of demand-side capacity response have drifted towards their respective price caps. However, it is not obvious that this pricing trend in Greece can be associated with a reduction in competition. Overall, across the sampled schemes 65.5% of capacity was awarded on the basis of one-year contracts, more than three times as much as for the next most awarded contract length of 15 years.

Negative pricing in electricity generation. A phenomenon of electricity markets is that, to balance supply and demand, the price paid to producers of electricity can sometimes be negative, in order to discourage the delivery of excess electricity into the system. Such demand-supply imbalances can arise when suppliers have low costs of production and receive guaranteed payments for production. In Germany, between 2014 and 2019, 720 hours of negative day ahead prices occurred, with hundreds of negative day ahead price hours also occurring in Denmark's two energy markets. However, in Great Britain there were no negative day ahead price hours observed (unlike in Ireland) and in the Netherlands there were only two hours. Following the introduction of the EEAG, measures were put in place to reduce generators' incentives to produce during periods of negative prices, for example in Germany, by stopping support after six consecutive hours of negative pricing. Nevertheless, total RES generation has increased during negative day ahead price periods in Germany, France and Denmark. Also, the overall trend has been for the number of negative price hours to increase between 2014 and 2019. In Germany, for example, the number of negative price hours increased from under 70 in 2014 to more than 140 in the first eight months of 2019. However, data limitations restrict the ability to understand the precise behaviour of RES installations receiving aid subject to negative pricing rules.

Levies for energy from renewable sources (RES levies). The EU has established targets for the percentage of primary energy consumption to be supplied from RES in each Member State for 2020. Four Member States (Hungary, Italy, Spain and Sweden) have set targets for RES production for 2020 that exceed their binding EU targets. These more ambitious targets were all set prior to 2014. 12 Member States had reached their EU 2020 targets by 2018, with exceeding their target by more than one percentage point. One of the various mechanisms to finance RES support schemes is to charge levies on consumers.

RES levies as a percentage of electricity charges are examined for different types of example households, example non-energy intensive commercial users and example energy intensive users in 15 Member States. Averaging across the example users, RES levies account for less than 25% of the electricity bill in all Member States in all examined years, with the exception of non-energy intensive commercial users in Germany and Italy, where the percentage has increased from under 15% in 2009 to more than 40% in 2018.

Waste management. The review of the national State aid schemes officially communicated to the Commission by the Member States between 2014 and mid-2019 as falling under Article 47 GBER showed that 71 out of 129 schemes (55%) explicitly mention or quote this provision, while 13 (10%) mention waste management without referring explicitly to this provision. A third category contains 45 schemes (35%) not covering nor mentioning waste management at all. These schemes are of a more general nature, providing for basic rules and regulations to be complied with by beneficiaries in order to be eligible for State aid covering measures of a different and/or sometimes unspecified kind. In 73 of the 84 schemes (87%) explicitly covering measures falling under Article 47 GBER, the aid was limited to support for waste recycling and preparation for re-use. Four of the 84 schemes (5%) also included other kinds of projects, while seven (8%) did not address recycling or preparation for re-use projects. Among the 84 schemes, 71 (85%) do not contain eligible activities targeting specific types of waste, while the other 13 (15%) have such a focus. A survey conducted with all 32 relevant granting authorities from eight selected Member States, covering 56 schemes, led to 36 replies concerning 43 schemes in all eight selected Member States. The replies showed that nine authorities in five Member States actually granted aid for waste management and/or preparation for re-use projects in the reference period, sometimes under various schemes. These nine authorities indicated that they granted aid to a total of 975 individual projects (951 located in France) for a total of approx. EUR 133 million (approx. EUR 93 million in France). The authorities that did not grant aid at all or only in certain years indicated that the main reasons were the lack of applications, the narrow scope of Article 47 GBER, and the strict conditions and formalities to be fulfilled in order to qualify for such aid.

Efficiency

RES and CHP levy reductions to Energy Intensive Users (EIU). To assess whether the introduction of levy rebates for EIU led to increases of levies for other users, the development of levy rates over time for different user groups was analysed. The data allow identifying three broad groups of countries with different types of levies development. First, there are three countries with levy pattern consistent with a lasting redistribution effect: Germany (RES), Greece (RES), and Slovenia. In these countries, the RES levy reductions to EIUs were accompanied by the increase of levies on non-EIUs permanently. Second, there are countries with a pattern consistent with a short-lived redistribution effect that vanishes over time: Greece (CHP) and Poland (RES). Third, there are countries where no effect on rates for non-rebated customers could be observed: Denmark, France, Germany (CHP), Italy (introduction of rebates in 2014), Latvia, Poland (CHP), Romania, and the UK. The reductions in these countries were typically financed by the State and thus did not give scope for redistribution effects. In addition, the relevance of the grandfathering rule was assessed by measuring the proportion of sales by the grandfathered undertakings in their economy sector and country in 2017. Sectors not covered by the EEAG in Germany, Italy and Poland were considered. For Germany, there are four sectors (out of 30) with shares between 5% and 10%, while all other sectors have shares below 5%. For Poland, there are at most three sectors (out of 15+) with sales shares exceeding 5%, two of them being very high, between 20% and 35%. For Italy, there are 19 sectors (out of 83) with sales shares exceeding 5%, and in three of them the sales share exceeds 30%.

Financial instruments for energy efficiency in buildings. The review of all State aid schemes officially communicated to the Commission by the Member States as falling under Article 39 GBER between 2014 and mid-2019 showed that 47 out of 71 schemes (66%) contained explicit references to this provision or referred to energy efficiency in buildings in general terms. The 24 schemes which do not cover nor mention energy efficiency projects in buildings (34%) are of a more general nature, providing for basic rules and regulations to be complied with by beneficiaries in order to be eligible for State aid covering measures of a different and/or sometimes unspecified kind. Among the 47 relevant schemes, three categories can be identified: 19 reproduce entirely or almost completely the wording of Article 39 GBER (40%) and 14 mention that support shall be granted in accordance with this provision, but without giving further details (36%). For those two categories, the national provisions do not indicate how granting authorities verify the conditions of Article 39 GBER. A third category contains 11 schemes (24%) related to the support of energy efficiency in buildings without quoting Article 39 GBER and without referring to financial instruments. The stakeholder consultation into the relevant schemes comprised a sample of 21 granting authorities in eight selected Member States, covering 29 State aid schemes. Among these, 17 authorities from eight Member States participated by replying to the survey, which revealed that many granting authorities consider Article 39 GBER as lengthy and complex. Only one authority (in Greece) indicated that it provided loans for energy efficiency projects in buildings under Article 39 GBER. The same authority explained that it considered Article 39 of the GBER clear and not difficult to apply but regretted –like some other authorities - that the wording does not specify whether this provision can be combined with the *de minimis* Regulation. Other authorities stated that they prefer to rely on other, clearer provisions (e.g. Article 38 GBER). The contacted authorities were not aware of instances in which ESCOs or energy suppliers made energy supply contracts subject to the provision of energy-efficiency services or vice versa. Although there is evidence that ESCOs may provide both energy supply contracts and energy-efficiency services, the desk review of publicly available information did not suggest that they made the provision of the one conditional to the other.

Relevance

Zero subsidy bids. Based on publicly available information collected by 31 August 2019, the total volume of announced subsidy-free renewable energy projects currently in Europe is approx. 18 GW. Though the majority of this capacity results from zero-subsidy bids made in renewable energy auctions, the number of projects put forward outside of auction systems is rapidly increasing. Overall, one third of the 60 GW that Aurora (2018) has announced as the potential for subsidy-free renewables in North-West Europe by 2030, is in the pipeline. In light of this, the ability of markets to deliver zero-carbon electricity without public support seems promising. However, a significant part of the 18 GW volume comes from projects that are only at the planning stage, and it is not guaranteed that they will actually be built. Companies may have secured only enough finance to get a project through the planning process, rather than to build it. In the subsidy-free environment, lenders may be cautious about investing when the earning potential of the project is dependent on the wholesale electricity market. At the very least, subsidy-free deployment means financiers are likely to demand higher expected returns for their renewable energy stocks to match that risk. Moreover, the subsidy-free offshore wind projects in Germany and the Netherlands were not fully subsidy-free, given the guaranteed connection to the grid. As to the auctions in Spain, though the guaranteed price floors are so low that they are unlikely ever to materialize, they still help to reduce the risk faced by the projects and can therefore be viewed as an implicit subsidy. These observations combined support the view presented in Evans (2018), that in spite of the promising outlook, government contracts may still be needed to support the renewable expansion.

Alternative fuel infrastructure. The review of the schemes approved by the Commission for support of publicly accessible or dedicated alternative fuel infrastructure in the transport sector showed that all schemes (except one) were carried out by way of a bidding procedure or a call for applications. One scheme was addressed to only one beneficiary (a public authority in charge of general safety and water pollution control), and thus no tender was carried out. The projects concern the purchase of electric and/or natural gas buses and/or related charging/re-fuelling infrastructure. The technology referred to in these projects is related to standard or fast charging installations, alternative energy supply for cruise ships, as well as liquefied or compressed natural gas and hydrogen filling stations. The recharging infrastructure for buses is dedicated or semi-dedicated to public transport operators, whereas the infrastructure for electric cars and cruise ships is publicly accessible. The geographical coverage depends on the project: infrastructure of electric and/or natural gas buses only covers urban areas, whereas publicly accessible charging or refuelling infrastructure projects generally have a wider scope. The related charges for the use of the charging/re-fuelling infrastructure depend also on the type of project. There are no related charges applicable when the projects relate to the infrastructure of electric and/or natural gas buses. When the projects however concern electric vehicle charging infrastructure, the fees for the use of the funded charging facilities vary and depend usually on the tariff of the respective provider, on the duration of the charging session as well as on the charging power. The direct public funding with regard to the approved schemes for infrastructure for electric cars was in average ca. 34% in comparison to the total costs. The direct public financing for the bus schemes range from 32% for the Portuguese scheme to 69% for the German scheme, the high number for the German scheme resulting from the fact that majority of the funds were used to support the acquisition of buses and not for the installation of the infrastructure.

For the selected electric charging station projects in six selected Member States, the review of ten projects showed that nine of them were supported by public financing, either by the EU, via the CEF/Horizon 2020 program, and/or by the Member States. One project was financed entirely from private funds. It related to one electric charging station established in a shopping mall in Tallinn by the operator of the Mall, which was willing to achieve the highest energy performance standard for the Mall. The implementation period of the projects lasted from less than one to four years. With respect to the technology, eight projects are fully or partially based on fast charging technology, while two are exclusively providing standard charging technology. Nine projects are always accessible (24/7), while one project has limited access due to regulated opening hours. Users have to pay for the usage of eight of the electric charging station projects. The fees vary and depend on the charging time, charging location and charging technology. Some project operators offer packages with a monthly basic fee, with reduced prices charged per KWh. The financing for the selected electric charging station projects ranges from no direct public financing to 100% direct public financing.

2 Sommaire analytique (FR)

Ce rapport fournit des éléments d'information pour l'évaluation des règles relatives aux aides d'État liées à la protection de l'environnement et à l'énergie, en mettant particulièrement l'accent sur les lignes directrices concernant les aides d'État à la protection de l'environnement et l'énergie pour la période 2014–2020 (EEAG) et sur les dispositions applicables aux aides pour la protection de l'environnement et l'énergie (section 7) du règlement (UE) 651/2014 de la Commission (RGEC). L'objectif général du rapport est de fournir des informations contextuelles pour le réexamen de ces dispositions. Les thèmes abordés dans le rapport concernent l'efficacité, l'efficience et la pertinence des règles relatives aux aides d'État.

Efficacité

Procédures d'appel d'offres pour les sources d'énergie renouvelables (SER) - Exemptions en vertu des EEAG et du règlement général d'exemption par catégorie (RGEC). En partie à cause des nouvelles règles en vigueur depuis 2014, les sources d'énergie renouvelables sont souvent contractées par voie d’enchères et d’appels d'offres, plutôt que par l'attribution directe de contrats. L'échantillon de procédures d'appel d'offres dans cette étude couvre toutes les procédures d'appel d'offres organisées entre 2014 et novembre 2019 dans le cadre de régimes d'aide (identifiés par l'équipe de projet de la Commission européenne) approuvés en vertu des EEAG ou du RGEC dans une sélection d'États membres représentant conjointement plus de 80 % de la capacité de production d'énergie renouvelable installée dans l'UE en 2018. L'échantillon exclut donc les régimes de ces États membres qui étaient en vigueur durant cette période mais qui étaient fondés sur des régimes encore approuvés par les lignes directrices précédemment applicables. Les États membres sélectionnés représentaient 81 % de la capacité de production d'énergie renouvelable installée dans l'UE en 2018. Au sein de l'échantillon, le plus grand nombre de procédures d'appel d'offres a eu lieu en 2018 (71), tandis que le volume le plus élevé a été attribué en 2017 (25,6 GW). Au sein des régimes échantillonnés, le prix moyen pondéré de la capacité éolienne a baissé de 62 % entre 2015 et 2019, tandis que le prix moyen pondéré de la capacité solaire a baissé de 51 % entre 2014 et 2019. Au vu de la moyenne des systèmes de l'échantillon, il n'est pas possible de déterminer de manière cohérente si les prix moyens sont plus bas dans les enchères multi-technologies que dans les enchères mono-technologies. Toutefois, les comparaisons de prix sont entravées par des facteurs spécifiques aux États membres, tels que les conditions climatiques locales (par exemple, l'ensoleillement et la configuration des vents), la taille (en KW) des installations admises aux enchères ou la durée de l'aide fournie (en années). Néanmoins, dans chaque grande catégorie de technologie, les prix moyens étaient inférieurs lorsque le volume des offres dépassait le volume demandé par rapport à l'inverse. Les comparaisons directes des prix entre les aides attribuées par voie concurrentielle et celles fixées par voie administrative sont difficiles à identifier et doivent être traitées avec prudence, bien que, sur 9 comparaisons d'études de cas, à 6 reprises, le prix fixé par voie concurrentielle était inférieur aux prix comparatifs fixés par voie administrative. De nombreux régimes liés aux SER ont bénéficié d'exemptions en vertu des règles de l'UE. Pour comprendre le type spécifique d'exemptions accordées, des informations sur 61 régimes comportant une exemption ont été recueillies et examinées : 39 concernent les EEAG et 28 le RGEC. Parmi les 61 régimes, 29 peuvent être liés au point 125 EEAG, 19 au point 127 EEAG et 21 à l'article 43 RGEC.

Soutien aux technologies de production combinée de chaleur et d'électricité (PCCE) à haut rendement. Les régimes de cogénération capturent et utilisent la chaleur générée comme sous-produit du processus de production d'électricité ou emploient des processus industriels de production de chaleur pour produire de l'électricité comme sous-produit. Cela peut réduire les émissions de carbone. De tels systèmes sont courants dans certains pays de l'UE où la demande de chaleur est importante. Des calculs de niveaux d'aide sur la durée de vie par unité de capacité installée pour des usines hypothétiques ont été effectués pour la Belgique, la République Tchèque, la France, l'Allemagne, les Pays-Bas et la Pologne, où les régimes comportent tous des aides au fonctionnement. Ceux-ci peuvent être comparés aux niveaux d'aide à vie pour les centrales réelles construites au Danemark et en Lituanie. Pour les grandes centrales, des procédures d'adjudication concurrentielles ont eu lieu en Allemagne depuis 2017 et la Pologne a organisé une procédure d'appel d'offres en 2019. La principale conclusion est l'ampleur des différences dans le niveau d'aide accordé selon les différents types et tailles d'installations. Ces différences reflètent probablement la grande variété des installations de cogénération utilisées, les différences de taille des installations et le contexte dans lequel elles sont utilisées. En Allemagne, Belgique (avant 2018), France et en République Tchèque, les niveaux d'aide les plus élevés étaient accordés aux plus petites installations et aux technologies associées aux petites installations. En moyenne, pour les centrales d'étude de cas hypothétiques en Allemagne et en République Tchèque, l'aide à vie par KW de capacité électrique pour les centrales d'une taille inférieure à 100 KW était environ le double de la moyenne des centrales d'étude de cas hypothétiques dans la fourchette de 100 KW à 1 MW.

Mécanismes de capacité - résultats des enchères et conception des systèmes. Pour évaluer la performance des mécanismes de capacité, les résultats des différentes enchères et les modèles de systèmes ont été comparés pendant la période de référence. Un échantillon de 11 systèmes dans 7 États membres a été examiné, sur la base d'une sélection effectuée par la Commission. En Grèce et en Allemagne, la capacité est principalement ou entièrement attribuée en réponse à la demande. En Grèce, en Pologne et en Irlande, les prix des capacités étaient généralement plus élevés qu'en France ou au Royaume-Uni. En Allemagne, les enchères à charge interruptible rapide ont presque toujours été autorisées à leur prix plafond en 2017 et 2018. En 2019, les prix sont tombés en dessous des plafonds de prix, mais pas de plus de 4%. Cela est probablement lié à une concurrence limitée, en termes de volume de participation, avant 2019. En Grèce, les enchères pour les deux types de réponse de capacité côté demande ont dérivé vers leurs plafonds de prix respectifs. Toutefois, il n'est pas évident que cette tendance des prix en Grèce puisse être associée à une réduction de la concurrence. Globalement, dans l'ensemble des régimes de l'échantillon, 65,5 % des capacités ont été attribuées sur la base de contrats d'un an, soit plus de trois fois plus que pour la deuxième durée de contrat la plus adjugée, à savoir 15 ans.

Prix négatifs dans la production d'électricité. Dans le but d'équilibrer l'offre et la demande sur les marchés de l'électricité, le prix payé aux producteurs d'électricité peut parfois être négatif afin de décourager la livraison d'électricité excédentaire dans le système. De tels déséquilibres entre l'offre et la demande peuvent survenir lorsque les fournisseurs ont des coûts de production peu élevés et reçoivent des paiements garantis pour la production. En Allemagne, entre 2014 et 2019, 720 heures de prix à l'avance négatifs ont été enregistrées, et des centaines d'heures de prix à l'avance négatifs se sont produites sur les deux marchés de l'énergie du Danemark. Cependant, en Grande-

Bretagne, aucune heure de prix négatif n'a été observée (contrairement à l'Irlande) et aux Pays-Bas il n'y a eu que deux heures de ce type. Suite à l'introduction de l'EEAG, des mesures ont été mises en place pour réduire les incitations des producteurs à produire pendant les périodes de prix négatifs, par exemple en Allemagne, en mettant fin au soutien après six heures consécutives de prix négatifs. Néanmoins, la production totale de SER en Allemagne, en France et au Danemark a augmenté pendant les périodes de prix à l'avance négatifs. De plus, la tendance générale est à l'augmentation du nombre d'heures à prix négatifs entre 2014 et 2019. En Allemagne, par exemple, le nombre d'heures à prix négatifs est passé de moins de 70 en 2014 à plus de 140 au cours des huit premiers mois de 2019. Toutefois, les limites des données restreignent la capacité à comprendre le comportement précis des installations SER bénéficiant d'une aide soumise à des règles de tarification négatives.

Prélèvements pour l'énergie produite à partir de sources renouvelables (prélèvements sur les SER). L'UE a fixé des objectifs concernant le pourcentage de la consommation d'énergie primaire à fournir à partir de SER dans chaque État membre pour 2020. Quatre États membres (Hongrie, Italie, Espagne et Suède) ont fixé des objectifs de production de SER pour 2020 qui dépassent les objectifs contraignants de l'UE. Ces objectifs, plus ambitieux, ont tous été fixés avant 2014. Douze États membres avaient atteint leurs objectifs UE 2020 en 2018, avec un dépassement de plus d'un point de pourcentage. L'un des divers mécanismes de financement du régime d'aide aux SER consiste à prélever des taxes auprès des consommateurs. Les prélèvements sur les SER en pourcentage des redevances d'électricité sont examinés pour différents types de ménages types, par exemple les utilisateurs commerciaux non intensifs en énergie et les utilisateurs intensifs en énergie dans 15 États membres. En moyenne, les redevances SER représentent moins de 25% de la facture d'électricité dans tous les États membres pour toutes les années examinées, à l'exception des utilisateurs commerciaux à faible consommation d'énergie en Allemagne et en Italie, où le pourcentage est passé de moins de 15% en 2009 à plus de 40% en 2018.

La gestion des déchets. L'examen des régimes d'aides d'État nationaux officiellement communiqués à la Commission par les États membres entre 2014 et la mi-2019 comme relevant de l'article 47 RGEC a montré que 71 des 129 régimes (55%) mentionnent ou citent explicitement cette disposition, tandis que 13 (10%) mentionnent la gestion des déchets sans référence explicite à cette disposition. Une troisième catégorie comprend 45 régimes (35%) qui ne couvrent ni ne mentionnent la gestion des déchets. Ces régimes sont de nature plus générale et prévoient des règles et dispositions que les bénéficiaires doivent respecter pour pouvoir bénéficier d'une aide d'État couvrant des mesures de nature différente et/ou parfois non spécifiée. Dans 73 des 84 régimes (87%) couvrant explicitement des mesures relevant de l'article 47 RGEC, l'aide était limitée au soutien du recyclage des déchets et de la préparation en vue de leur réutilisation. Quatre des 84 régimes (5%) incluaient également d'autres types de projets, tandis que sept (8%) ne concernaient pas des projets de recyclage ou de préparation en vue de la réutilisation. Parmi les 84 régimes, 71 (85%) ne contiennent pas d'activités éligibles ciblant des types de déchets spécifiques, tandis que les 13 autres (15%) disposent d' une telle orientation. Une enquête menée auprès des 32 autorités compétentes, couvrant 56 régimes d'aides dans les huit États membres sélectionnés, a donné lieu à 36 réponses concernant 43 régimes dans les huit États membres sélectionnés. Les réponses ont montré que neuf autorités dans cinq États membres ont effectivement accordé des aides à des projets de gestion des déchets et/ou de préparation à la réutilisation au cours de la période de référence, parfois dans le cadre de différents régimes. Ces neuf autorités ont indiqué qu'elles avaient accordé des aides à un total de 975 projets individuels (951 situés en France) pour un total d'environ 133 millions d'euros (environ 93 millions d'euros en France). Les autorités n'ayant pas accordé d'aides ou seulement lors de certaines années ont indiqué que les principales raisons étaient l'absence de demandes, le champ d'application étroit de l'article 47 RGEC et les conditions et formalités strictes à remplir pour pouvoir bénéficier de ces aides.

Efficience

Les SER et la cogénération permettent de réduire les taxes pour les utilisateurs intensifs d'énergie (UIE). Afin d'évaluer si l'introduction de réductions de taxes pour les UIE a conduit à des augmentations de taxes pour d'autres utilisateurs, l'évolution des taux de taxes au fil du temps pour différents groupes d'utilisateurs a été analysée. Les données permettent d'identifier trois grands groupes de pays avec différents types de développement des prélèvements. Tout d'abord, dans trois pays le modèle de prélèvements est compatible avec un effet de redistribution durable: Allemagne (SER), Grèce (SER) et Slovénie. Dans ces pays, la réduction des prélèvements RES sur les UIE s'est accompagnée d'une augmentation permanente des prélèvements sur les non-UIE. Deuxièmement, plusieurs pays ont un schéma cohérent avec un effet de redistribution de courte durée qui disparaît avec le temps: Grèce (PCCE) et Pologne (SER). Troisièmement, dans certains pays, aucun effet sur les tarifs pour les clients non remboursés n'a pu être observé : Danemark, France, Allemagne (PCCE), Italie (introduction de rabais en 2014), Lettonie, Pologne (PCCE), Roumanie et Royaume-Uni. Les réductions dans ces pays étaient généralement financées par l'État et ne permettaient donc pas d'observer des effets de redistribution. En outre, la pertinence de la règle des droits acquis a été évaluée en mesurant la proportion des ventes des entreprises bénéficiant de ces droits dans leur secteur économique et leur pays en 2017. Les secteurs non couverts par l'EEAG en Allemagne, en Italie et en Pologne ont été pris en compte. Pour l'Allemagne, il y a quatre secteurs (sur 30) dont les parts se situent entre 5 et 10%, tandis que tous les autres secteurs ont des parts inférieures à 5 %. Pour la Pologne, il y a au plus trois secteurs (sur 15+) avec des parts de ventes supérieures à 5%, deux d'entre eux très élevés, entre 20% et 35%. Pour l'Italie, 19 secteurs (sur 83) ont une part de ventes supérieure à 5%, et dans trois d'entre eux, la part de ventes dépasse 30%.

Instruments financiers pour l'efficacité énergétique dans les bâtiments. L'analyse de tous les régimes d'aides d'État officiellement communiqués à la Commission par les États membres comme relevant de l'article 39 RGEC entre 2014 et mi-2019 a montré que 47 des 71 régimes (66%) contenaient des références explicites à cette disposition ou faisaient référence à l'efficacité énergétique dans les bâtiments en termes généraux. Les 24 régimes qui ne couvrent ni mentionnent les projets d'efficacité énergétique dans les bâtiments (34%) sont de nature plus générale, prévoyant des règles et dispositions que les bénéficiaires doivent respecter pour pouvoir bénéficier d'aides d'État, couvrant des mesures de nature différente et/ou parfois non spécifiées. Parmi les 47 régimes concernés, trois catégories peuvent être identifiées : 19 reproduisent entièrement ou presque entièrement le libellé de l'article 39 RGEC (40%) et 14 mentionnent que l'aide est accordée conformément à cette disposition sans toutefois donner plus de détails (36%). Pour ces deux catégories, les dispositions nationales n'indiquent pas comment les autorités chargées de l'octroi des aides vérifient le respect des conditions de l'article 39 RGEC. Une troisième catégorie contient 11 régimes (24%) liés au soutien de l'efficacité énergétique dans les bâtiments sans citer l'article 39 RGEC et sans faire référence aux instruments financiers. La consultation des parties concernées sur les régimes concernés a porté sur un échantillon de 21 autorités chargées de l'octroi des aides dans huit États membres sélectionnés, couvrant 29 régimes d'aides d'État. Parmi ceux-ci, 17 autorités dans huit États membres ont participé en répondant à l'enquête, qui a révélé que de nombreuses autorités considèrent l'article 39 RGEC comme étant long et complexe. Une seule autorité (en Grèce) a indiqué qu'elle accordait des prêts pour des projets d'efficacité énergétique dans les bâtiments au titre de l'article 39 RGEC. La même autorité a expliqué qu'elle considérait l'article 39 RGEC comme clair et non difficile à appliquer mais a regretté - comme certaines autres autorités - que la formulation ne précise pas si cette disposition peut être combinée avec le règlement de minimis. D'autres autorités ont déclaré qu'elles préfèrent s'appuyer sur d'autres dispositions plus claires (p.ex. l'article 38 RGEC). Les autorités contactées n'avaient pas connaissance de cas dans lesquels les fournisseurs de services énergétiques et les fournisseurs d'énergie conditionnaient les contrats de fourniture d'énergie à la fourniture de services d'efficacité énergétique, ou inversement. Bien qu'il y soit établi que les fournisseurs de services peuvent offrir à la fois de l'énergie et des services d'efficacité énergétique, l'examen des informations accessibles au public n'a pas suggéré qu'elles avaient conditionné la fourniture de l'un à l'autre.

Pertinence

Offres de subvention zéro. Sur la base des informations publiquement disponibles recueillies au 31 août 2019, le volume total des projets d'énergie renouvelable sans subventions annoncés actuellement en Europe est d'environ 18 GW. Bien que la majorité de cette capacité résulte d'offres à subvention zéro faites lors d'enchères sur les énergies renouvelables, le nombre de projets proposés en dehors des systèmes d'enchères augmente rapidement. Dans l'ensemble, un tiers des 60 GW qu'Aurora (2018) a annoncé comme le potentiel d'énergies renouvelables sans subventions dans le nord-ouest de l'Europe d'ici 2030, est déjà en cours de réalisation. Dans ce contexte, la capacité des marchés à fournir de l'électricité « zéro carbone », sans l'aide de soutiens publics, semble prometteuse. Toutefois, une partie importante des 18 GW provient de projets qui sont seulement au stade de la planification. Il n'est donc pas garanti que ces derniers seront effectivement réalisés. Il est possible que les entreprises aient obtenu un financement qui est suffisant pour planifier le projet mais qui ne l'est toutefois pas pour construire et réaliser celui-ci. Dans un environnement sans subventions, les prêteurs peuvent se montrer prudents dans leurs investissements lorsque le potentiel de gains du projet dépend du marché de gros de l'électricité. Au minimum, un déploiement sans subvention signifie que les financiers sont susceptibles d'exiger des rendements attendus plus élevés pour leurs stocks d'énergie renouvelable afin de compenser ce risque. En outre, les projets d'éoliennes en mer sans subventions en Allemagne et aux Pays-Bas n'étaient pas totalement exempts de subventions, étant donné la connexion garantie au réseau. Quant aux enchères en Espagne, bien que les prix planchers garantis soient si bas qu'il est peu probable qu'ils se concrétisent un jour, ils contribuent néanmoins à réduire le risque pour les projets et peuvent donc être considérés comme une subvention implicite. Ces observations combinées soutiennent l'opinion présentée dans Evans (2018), selon laquelle, malgré les perspectives prometteuses, des contrats gouvernementaux pourraient encore être nécessaires pour soutenir l'expansion des énergies renouvelables.

Infrastructure de carburant alternatif. L'examen des régimes approuvés par la Commission pour le soutien aux infrastructures accessibles au public ou réservées aux carburants de substitution dans le secteur des transports a montré que tous les régimes (sauf un) ont été mis en œuvre par le biais d'une procédure d'appel d'offres ou d'appel à candidatures. L'un des régimes ne s'adressait qu'à un seul bénéficiaire (une autorité publique chargée de la sécurité générale et de la lutte contre la pollution de l'eau), et aucun appel d'offres n'a donc été lancé. Les projets concernent l'achat d'autobus électriques et/ou au gaz naturel et/ou d'infrastructures de recharge/rechargement correspondantes. La technologie utilisée dans ces projets est liée aux installations de recharge standard ou rapide, à l'approvisionnement en énergie alternative pour les navires de croisière, ainsi qu'aux stations de remplissage de gaz naturel et d'hydrogène liquéfié ou comprimé. L'infrastructure de recharge pour les bus est dédiée ou semi-dédiée aux opérateurs de transport public, tandis que l'infrastructure pour les voitures électriques et les bateaux de croisière est accessible au public. La couverture géographique dépend du projet : l'infrastructure des bus électriques et/ou au gaz naturel ne couvre que les zones urbaines, alors que les projets d'infrastructure de recharge ou d'approvisionnement accessibles au public ont généralement une portée plus large. Les frais liés à l'utilisation de l'infrastructure de chargement ou d'approvisionnement en carburant dépendent également du type de projet. Il n'y a pas de frais connexes applicables lorsque les projets concernent l'infrastructure des bus électriques et/ou à gaz naturel. En revanche, lorsque les projets concernent l'infrastructure de recharge des véhicules électriques, les frais d'utilisation des installations de chargement financées varient et dépendent généralement du tarif du fournisseur respectif, de la durée de la séance de chargement ainsi que de la puissance de chargement. Le financement public direct en ce qui concerne les régimes approuvés pour les infrastructures pour les voitures électriques a été en moyenne environ 34% du coût total. Le financement public direct pour les régimes d'aide aux autobus varie entre 32% pour le régime portugais et 69% pour le régime allemand ; le chiffre élevé pour le régime allemand résultant du fait que la majorité des fonds ont été utilisés pour soutenir l'acquisition d'autobus et non pour l'installation de l'infrastructure.

Pour les projets de stations de recharge électrique dans six États membres sélectionnés, l'analyse de dix projets a montré que neuf d'entre eux étaient soutenus par un financement public, soit par l'UE, via le programme CEF/Horizon 2020, et/ou par les États membres. Un projet a été entièrement financé par des fonds privés. Il concernait une station de recharge électrique installée dans un centre commercial de Tallinn par l'exploitant du centre, qui souhaitait atteindre la performance énergétique la plus élevée pour ce centre. La période de mise en œuvre des projets était de moins d'un an à quatre ans. En ce qui concerne la technologie, huit projets sont entièrement ou partiellement basés sur la technologie de chargement rapide, tandis que deux projets fournissent exclusivement une technologie de chargement standard. Neuf projets sont toujours accessibles (24 heures sur 24, 7 jours sur 7), tandis qu'un projet a un accès limité en raison d'heures d'ouverture réglementées. Les utilisateurs doivent payer pour l'utilisation de huit projets de stations de recharge électrique. Les frais varient et dépendent du temps de chargement, du lieu de chargement et de la technologie de chargement. Certains opérateurs de projets proposent des forfaits avec une redevance mensuelle de base, avec des prix réduits facturés par KWh. Le financement des projets de stations de recharge électrique sélectionnés varie entre l'absence de financement public direct et un financement public direct à 100 %.

3 Zusammenfassung (DE)

Dieser Bericht enthält einen Beitrag zur Bewertung der Vorschriften für staatliche Beihilfen im Bereich Umweltschutz und Energie mit besonderem Schwerpunkt auf den zwischen 2014 und 2020 geltenden EU-Leitlinien für staatliche Umweltschutz- und Energiebeihilfen (EEAG) und auf den Bestimmungen für Beihilfen im Bereich Umweltschutz und Energie (Abschnitt 7) der Verordnung (EU) 651/2014 der Kommission (AGVO). Das allgemeine Ziel des Berichts ist es, Hintergrundinformationen für die Überprüfung dieser Bestimmungen zu liefern. Die in dem Bericht behandelten Themen beziehen sich auf die Wirksamkeit, Effizienz und Relevanz der Vorschriften für staatliche Beihilfen.

Wirksamkeit

Ausschreibungsverfahren für erneuerbare Energiequellen (EE) - Freistellungen nach EEAG und Allgemeiner Gruppenfreistellungsverordnung (AGVO). Erneuerbare Energiequellen werden, teilweise aufgrund der seit 2014 geltenden Regeln, häufig über Bieterverfahren wie Auktionen und Ausschreibungen, und nicht durch direkte Vergabe von Aufträgen vermarktet. Die Stichprobe der Bieterverfahren in dieser Studie umfasst alle Bieterverfahren, die von 2014 bis November 2019 im Rahmen von Beihilferegelungen (vom EU-Projektteam ermittelt) anhand der EEAG oder der AGVO in ausgewählten Mitgliedstaaten genehmigt wurden, welche zusammen über 80% der 2018 in der EU installierten EE-Erzeugungskapazität ausmachen. Die Stichprobe schließt daher Regelungen aus den Mitgliedstaaten aus, die in diesem Zeitraum liefen, aber auf Regelungen basierten, die noch nach den zuvor geltenden Leitlinien genehmigt worden waren. Auf die ausgewählten Mitgliedstaaten entfielen 2018 81% der installierten Erzeugungskapazität für erneuerbare Energien in der EU. In der Stichprobe fand die größte Anzahl von Ausschreibungen 2018 statt (71), während das höchste Volumen 2017 vergeben wurde (25,6 GW). In den ausgewählten Beihilferegelungen fiel der gewichtete Durchschnittspreis der Windkapazität zwischen 2015 und 2019 um 62%, während der gewichtete Durchschnittspreis der Solarkapazität zwischen 2014 und 2019 um 51% fiel. Bei der Durchschnittsbildung über die untersuchten Beihilferegelungen ergibt sich nicht eindeutig, ob die Durchschnittspreise bei Auktionen mit mehreren Technologien niedriger sind als bei Auktionen mit nur einer Technologie. Preisvergleiche werden jedoch durch spezifische Faktoren der Mitgliedstaaten erschwert, wie z.B. lokale Klimabedingungen (z.B. Sonnen- und Windverhältnisse), die Größe (in KW) der in den Auktionen zugelassenen Anlagen oder die Dauer der Förderung (in Jahren). Dennoch waren die Durchschnittspreise innerhalb jeder wesentlichen Technologiekategorie niedriger, wenn das Angebotsvolumen das beantragte Volumen überstieg, als im gegenteiligen Fall. Direkte Vergleiche der Preise zwischen der im Wettbewerb vergebenen und der administrativ festgelegten Förderung sind schwer zu ziehen und sollten mit Vorsicht angestellt werden, obwohl bei 9 Fallstudienvergleichen in 6 Fällen der im Wettbewerb festgelegte Preis niedriger war als die vergleichbaren administrativ festgelegten Preise. Viele EE-bezogene Beihilferegelungen haben von Freistellungen nach den EU-Vorschriften profitiert. Um die spezifische Art der gewährten Freistellungen zu verstehen, wurden Informationen über 61 freigestellte Regelungen gesammelt und untersucht: 39 betreffen die EEAG und 28 die AGVO. Von den 61 Regelungen fallen 29 unter Punkt 125 EEAG, 19 unter Punkt 127 EEAG und 21 unter Artikel 43 AGVO.

Unterstützung für hocheffiziente Technologien der Kraft-Wärme-Kopplung (KWK). KWK-Systeme erfassen und nutzen die als Nebenprodukt des Stromerzeugungsprozesses erzeugte Wärme oder setzen industrielle Wärmeprozesse zur

Stromerzeugung als Nebenprodukt ein. Dadurch können Kohlenstoffemissionen reduziert werden. Solche Beihilferegelungen sind in einigen EU-Ländern mit einem erheblichen Wärmebedarf üblich. Für Beihilferegelungen in Belgien, Deutschland, Frankreich, den Niederlanden, Polen und der Tschechischen Republik, die alle Betriebsbeihilfen beinhalten, wurden Berechnungen der Gesamt-Beihilfehöhen pro Einheit installierter Kapazität für hypothetische Fallstudien-Anlagen durchgeführt. Diese können mit den Gesamt-Beihilfehöhen für tatsächlich in Dänemark und Litauen gebaute Anlagen verglichen werden. Für größere Anlagen finden in Deutschland seit 2017 wettbewerbsorientierte Vergabeverfahren statt und in Polen wurde 2019 ein Bieterverfahren durchgeführt. Das wichtigste Ergebnis ist das Ausmaß der Unterschiede in der Höhe der gewährten Beihilfen für die verschiedenen Anlagentypen und -größen. Diese Unterschiede spiegeln wahrscheinlich die große Vielfalt der verwendeten KWK-Anlagen, die unterschiedliche Größe der Anlagen und den Kontext ihrer Nutzung wieder. In Frankreich, der Tschechischen Republik, Deutschland, und Belgien (vor 2018) wurden die höchsten Beihilfesätze für die kleinsten Anlagen und für Technologien i.V.m. kleinen Anlagen gewährt. Im Durchschnitt der hypothetischen Fallstudien-Anlagen in Deutschland und der Tschechischen Republik war die Gesamt-Beihilfe pro KW elektrischer Kapazität für Anlagen mit einer Größe von unter 100 KW etwa doppelt so hoch wie der Durchschnitt für hypothetische Fallstudien-Anlagen von 100 KW bis 1 MW.

Kapazitätsmechanismen - Auktionsergebnisse und Ausgestaltung der Beihilferegelungen. Um die Leistung der Kapazitätsmechanismen zu bewerten, wurden verschiedene Auktionsergebnisse und Ausgestaltungen der Beihilferegelungen im Referenzzeitraum verglichen. Aufgrund einer Auswahl der Kommission wurde eine Stichprobe von 11 Beihilferegelungen in 7 Mitgliedstaaten untersucht. In Griechenland und Deutschland werden die Kapazitäten überwiegend oder ausschließlich an Nachfragesteuerung vergeben. In Griechenland, Polen und Irland waren die Kapazitätspreise generell höher als in Frankreich oder im Vereinigten Königreich. In Deutschland erfolgte bei Auktionen für schnell unterbrechbare Last 2017 und 2018 der Zuschlag fast immer zu den Preisobergrenzen. Im Jahr 2019 fielen die Preise unter die Preisobergrenzen, aber nicht um mehr als 4%. Dies ist wahrscheinlich auf begrenzten Wettbewerb für die relevanten Volumen vor 2019 zurück zu führen. In Griechenland bewegten sich die Auktionen für beide Arten der Nachfragereaktion auf ihre jeweiligen Preisobergrenzen zu. Jedoch kann dieser Preistrend in Griechenland nicht eindeutig auf eine Verringerung des Wettbewerbs zurückgeführt werden. Insgesamt wurden in den untersuchten Beihilfeprogrammen 65,5% der Kapazität auf Grundlage von Einjahresverträgen vergeben, d.h. mehr als dreimal so viel wie bei der nächsthäufig verwendeten Vertragsdauer von 15 Jahren.

Negative Preisgestaltung bei der Stromerzeugung. Ein Phänomen der Strommärkte ist, dass zum Ausgleich von Angebot und Nachfrage der Preis, der an die Stromerzeuger gezahlt wird, manchmal negativ sein kann, um die Lieferung von überschüssigem Strom in das System zu verhindern. Solche Ungleichgewichte zwischen Angebot und Nachfrage können entstehen, wenn die Lieferanten niedrige Produktionskosten haben und garantierte Zahlungen für die Produktion erhalten. In Deutschland kam es 2014-2019 zu 720 Stunden negativer Day-Ahead-Preise und auf den beiden dänischen Energiemärkten gab es ebenfalls Hunderte von Stunden mit negativen Day-Ahead-Preisen. In Großbritannien wurden, anders als in Irland, keine Stunden mit negativen Day-Ahead-Preisen beobachtet und in den Niederlanden war dies nur bei zwei Stunden der Fall. Nach Einführung der EEAG wurden Maßnahmen ergriffen, um Anreize für Erzeuger, in Zeiten negativer Preise Strom zu produzieren, zu verringern, z.B. wurde in Deutschland die Förderung nach sechs aufeinanderfolgenden Stunden mit negativen Preisen eingestellt. Dennoch nahm die EE-Gesamterzeugung in Zeiten negativer Tagespreise in Deutschland, Frankreich und Dänemark zu. Außerdem ging der Trend dahin, dass die Anzahl der Stunden mit negativen Preisen zwischen 2014 und 2019 zunahm. In Deutschland stieg z.B. die Zahl der negativen Preisstunden von unter 70 im Jahr 2014 auf über 140 in den ersten acht Monaten 2019. Allerdings reduzieren Datenbeschränkungen die Möglichkeit, das genaue Verhalten von EE-Anlagen zu verstehen, die Beihilfen nach den Regeln für negative Preise erhalten.

Umlagen für Energie aus erneuerbaren Quellen (EEG-Umlagen). Die EU hat Zielvorgaben für den prozentualen Anteil des EE-Primärenergieverbrauchs in jedem Mitgliedstaat für 2020 festgelegt. Vier Mitgliedstaaten (Ungarn, Italien, Spanien und Schweden) haben dafür Ziele festgelegt, die über die verbindlichen EU-Ziele hinausgehen. Diese ehrgeizigeren Zielvorgaben wurden alle vor 2014 festgelegt. Zwölf Mitgliedstaaten haben ihre EU-Ziele für 2020 schon 2018 erreicht und um mehr als einen Prozentpunkt übertroffen. Ein Mechanismus zur Finanzierung des EE-Fördersystems ist die Erhebung von Verbraucherumlagen. EEG-Umlagen als Prozentsatz der Stromabgaben wurden für verschiedene Arten von Beispielshaushalten, für beispielhafte nicht energieintensive gewerbliche Nutzer und für beispielhafte energieintensive Nutzer in 15 Mitgliedstaaten untersucht. Im Durchschnitt aller Beispielsnutzer machen die EEG-Umlagen in allen Mitgliedstaaten in den untersuchten Jahren weniger als 25% der Stromrechnung aus, mit Ausnahme der nicht energieintensiven gewerblichen Nutzer in Deutschland und Italien, wo der Anteil von unter 15% im Jahr 2009 auf über 40% im Jahr 2018 stieg.

Abfallwirtschaft. Die Überprüfung der nationalen Beihilferegelungen, die der Kommission zwischen 2014 und Mitte 2019 offiziell von den Mitgliedstaaten als unter Artikel 47 AGVO fallend mitgeteilt wurden, ergab, dass 71 von 129 Regelungen (55%) diese Bestimmung ausdrücklich erwähnen oder zitieren, während 13 (10%) die Abfallwirtschaft erwähnen ohne ausdrücklich auf diese Bestimmung zu verweisen. Bei einer dritten Kategorie mit 45 Regelungen (35%) wird die Abfallwirtschaft gar nicht abgedeckt oder erwähnt. Diese Regelungen sind allgemeiner Natur und enthalten grundlegende Kriterien und Vorgaben, die von den Begünstigten einzuhalten sind, um Beihilfen anderer und/oder nicht näher bezeichneter Art zu erhalten. In 73 der 84 Regelungen (87%), die ausdrücklich Maßnahmen gem. Artikel 47 AGVO erfassen, beschränkten sich die Beihilfen auf die Förderung des Abfallrecyclings und der Vorbereitung zur Abfall-Wiederverwendung. Vier der 84 Regelungen (5%) umfassten auch andere Projektarten, während sieben (8%) nicht auf Recycling oder Vorbereitung zur Wiederverwendung ausgerichtet waren. Von den 84 Regelungen enthielten 71 (85%) keine förderfähigen Aktivitäten, die auf bestimmte Abfallarten abzielen, während die anderen 13 (15%) einen solchen Schwerpunkt hatten. Eine bei allen 32 relevanten Bewilligungsbehörden aus acht ausgewählten Mitgliedstaaten durchgeführte Umfrage, die 56 Beihilferegelungen betraf, führte zu 36 Antworten im Hinblick auf 43 Beihilferegelungen in allen ausgewählten Mitgliedstaaten. Aus den Antworten ging hervor, dass neun Behörden in fünf Mitgliedstaaten im maßgeblichen Zeitraum Beihilfen für die Abfallbewirtschaftung und/oder Vorbereitung zur Wiederverwendung gewährt haben, teilweise im Rahmen verschiedener Regelungen. Diese neun Behörden gaben an, dass sie für insgesamt 975 Einzelprojekte (davon 951 in Frankreich) Beihilfen von insgesamt ca. 133 Mio. EUR (davon ca. 93 Mio. EUR in Frankreich) gewährt haben. Die Behörden, die gar keine oder nur in bestimmten Jahren Beihilfen gewährten, nannten als Hauptgründe das Fehlen von Anträgen, den engen

Anwendungsbereich von Artikel 47 AGVO und die strengen Bedingungen und Formalitäten, die erfüllt werden müssen, um solche Beihilfen zu erhalten.

Effizienz

Begrenzung der EEG- und KWK-Umlagen für energieintensive Nutzer. Um zu beurteilen, ob die Einführung einer Begrenzung der Umlagen für energieintensive Nutzer zu einer Erhöhung der Umlagen für andere Nutzer führte, wurde die Entwicklung der Umlagen-Sätze im Laufe der Zeit für verschiedene Nutzergruppen analysiert. Die Daten ermöglichen die Identifizierung von drei Ländergruppen mit unterschiedlichen Arten der Umlagen-Entwicklung. Erstens gibt es drei Länder mit einem Abgabemuster, das zu einem dauerhaften Umverteilungseffekt führt: Deutschland (EE), Griechenland (EE) und Slowenien.

In diesen Ländern erfolgten Ermäßigungen der EEG-Umlagen an energieintensive Nutzer zusammen mit einer dauerhaften Erhöhung der Umlagen an nicht energieintensive Nutzer. Zweitens gibt es Länder mit einem Abgabemuster, das zu einem kurzlebigen Umverteilungseffekt führt, der mit der Zeit verschwindet: Griechenland (KWK) und Polen (EE). Drittens gibt es Länder, in denen keine Auswirkungen auf die Tarife für Kunden ohne Ermäßigungen beobachtet werden konnten: Dänemark, Frankreich, Deutschland (KWK), Italien (Einführung von Rabatten 2014), Lettland, Polen (KWK), Rumänien und das Vereinigte Königreich. Die Ermäßigungen in diesen Ländern wurden in der Regel vom Staat finanziert und boten daher keinen Spielraum für Umverteilungseffekte. Darüber hinaus wurde die Relevanz der Besitzstandsregel durch Messung des Anteils der Verkäufe der Unternehmen mit Besitzstandsregel in ihrem Wirtschaftssektor und Land im Jahr 2017 bewertet. Dabei wurden die nicht von den EEAG erfassten Sektoren in Deutschland, Italien und Polen berücksichtigt. Für Deutschland gibt es vier Sektoren (von 30) mit Anteilen zwischen 5% und 10%, während alle anderen Sektoren Anteile unter 5% haben. Für Polen gibt es höchstens drei Sektoren (von über 15) mit Umsatzanteilen von über 5%, wobei zwei davon mit 20-35% sehr hoch sind. In Italien gibt es 19 Sektoren (von 83) mit Umsatzanteilen von über 5% und in drei davon liegt der Umsatzanteil über 30%.

Finanzinstrumente für Energieeffizienz in Gebäuden. Die Überprüfung aller Beihilferegelungen, die der Kommission zwischen 2014 und Mitte 2019 offiziell von den Mitgliedstaaten als unter Artikel 39 AGVO fallend mitgeteilt wurden, ergab, dass 47 von 71 Regelungen (66%) ausdrückliche Hinweise auf diese Bestimmung enthielten oder sich allgemein auf die Energieeffizienz in Gebäuden bezogen. Die 24 Regelungen, die Energieeffizienzprojekte in Gebäuden weder abdecken noch erwähnen (34%), sind allgemeinerer Natur und sehen grundlegende Kriterien und Vorgaben vor, die von den Begünstigten einzuhalten sind, um Beihilfen anderer und/oder nicht spezifizierter Art zu erhalten. Die 47 relevanten Regelungen können in drei Kategorien unterteilt werden: 19 geben ganz oder fast vollständig den Wortlaut von Artikel 39 AGVO wieder (40%) und 14 erwähnen, dass Beihilfen nach dieser Bestimmung gewährt werden, jedoch ohne weitere Einzelheiten zu nennen (36%). Für diese beiden Kategorien geben die nationalen Bestimmungen nicht an, wie die gewährenden Behörden die Bedingungen von Artikel 39 AGVO überprüfen. Eine dritte Kategorie enthält 11 Regelungen (24%), die sich auf die Förderung der Energieeffizienz in Gebäuden beziehen, ohne Artikel 39 AGVO zu zitieren oder sich auf Finanzinstrumente zu beziehen. Die Konsultation der Interessenvertreter zu den relevanten Regelungen umfasste eine Stichprobe von 21 Bewilligungsbehörden in acht ausgewählten Mitgliedstaaten, die 29 Beihilferegelungen abdeckten. Davon nahmen 17 Behörden aus acht Mitgliedstaaten teil, indem sie auf die Umfrage antworteten, die ergab, dass viele Bewilligungsbehörden Artikel 39 AGVO als lang und komplex ansehen. Nur eine Behörde (in Griechenland) gab an, dass sie Darlehen für Energieeffizienzprojekte in Gebäuden im Rahmen von Artikel 39 AGVO gewährt. Dieselbe Behörde betrachtete Artikel 39 AGVO als klar und nicht schwer anwendbar, bedauerte jedoch, wie einige andere Behörden auch, dass der Wortlaut nicht klarstellt, ob diese Bestimmung mit der De-minimis-Verordnung kombiniert werden kann. Andere Behörden erklärten, dass sie sich eher auf klarere Bestimmungen berufen (z.B. Artikel 38 AGVO). Den befragten Behörden waren keine Fälle bekannt, in denen Energiedienstleistungsunternehmen (ESCOs) oder -lieferanten Energielieferverträge an den Bezug von Energieeffizienzdiensten knüpften oder umgekehrt. Obwohl es Hinweise darauf gibt, dass ESCOs sowohl Energielieferverträge als auch Energieeffizienzdienstleistungen anbieten können, ergab die Auswertung der öffentlich zugänglichen Informationen keinen Hinweis darauf, dass sie die Bereitstellung der einen von der Abnahme der anderen abhängig gemacht haben.

Relevanz

Null-Subventionsangebote. Anhand öffentlich zugänglicher Informationen, die bis zum 31. August 2019 gesammelt wurden, beträgt das Gesamtvolumen der angekündigten subventionsfreien EE-Projekte in Europa derzeit ca. 18 GW. Obwohl der Großteil dieser Kapazität aus Null-Subventionsangeboten bei EE-Auktionen stammt, steigt die Zahl der Projekte, die außerhalb von Auktionssystemen entwickelt werden, rasch an. Insgesamt ist ein Drittel der 60 GW, die Aurora (2018) als Potenzial für subventionsfreie erneuerbare Energien in Nordwesteuropa bis 2030 angekündigt hat, in Entwicklung. Vor diesem Hintergrund kann die Fähigkeit der Märkte, kohlenstofffreien Strom ohne öffentliche Unterstützung zu liefern, als vielversprechend eingeschätzt werden. Allerdings stammt ein erheblicher Teil der 18 GW aus Projekten, die sich erst in der Planungsphase befinden, und es steht nicht fest, ob sie tatsächlich gebaut werden. Die Unternehmen haben sich u.U. lediglich genügende Finanzierung gesichert, um ein Projekt durch den Planungsprozess zu bringen, anstatt um es zu bauen. In einem subventionsfreien Umfeld könnten Kreditgeber bei Investitionen zurückhaltend sein, wenn das Ertragspotenzial des Projekts vom Stromgroßhandelsmarkt abhängt. Zumindest bedeutet der subventionsfreie Einsatz, dass die Finanzierer wahrscheinlich höhere erwartete Renditen für ihre Bestände an erneuerbaren Energien verlangen werden, um diesem Risiko gerecht zu werden. Darüber hinaus waren die subventionsfreien Offshore-Windprojekte in Deutschland und den Niederlanden angesichts des garantierten Netzanschlusses nicht vollständig subventionsfrei. Was die Auktionen in Spanien betrifft, sind die garantierten Preisuntergrenzen zwar so niedrig, dass sie wahrscheinlich nie eintreten werden, aber sie tragen dennoch dazu bei, das Risiko der Projekte zu verringern und können daher als implizite Subvention angesehen werden. Diese Beobachtungen stützen die Ansicht von Evans (2018), dass trotz vielversprechender Aussichten zur Expansion der erneuerbaren Energien immer noch staatliche Förderung erforderlich sein könnte.

Infrastruktur für alternative Kraftstoffe. Die Überprüfung der von der Kommission genehmigten Beihilferegelungen zur Förderung öffentlich zugänglicher oder gewidmeter alternativer Kraftstoffinfrastruktur im Verkehrssektor zeigte, dass alle Regelungen (mit einer Ausnahme) im Wege eines Ausschreibungsverfahrens oder einer Aufforderung zur Einreichung von Bewerbungen durchgeführt wurden. Eine Regelung war nur an einen einzigen Begünstigten gerichtet (Behörde für allgemeine Sicherheit und Gewässerschutz), so dass keine Ausschreibung durchgeführt wurde. Die Projekte betrafen den Kauf von Elektro- und/oder Erdgasbussen und/oder entsprechende Lade- und Betankungsinfrastruktur. Die bei diesen Projekten verwendete Technologie bezieht sich auf

Standard- oder Schnellladeanlagen, alternative Energieversorgung für Kreuzfahrtschiffe sowie Flüssig- oder Druckgas- und Wasserstofftankstellen. Die Infrastruktur zum Aufladen von Bussen ist (quasi)gewidmet für öffentliche Verkehrsbetriebe vorgesehen, während die Infrastruktur für Elektroautos und Kreuzfahrtschiffe öffentlich zugänglich ist. Die geografische Abdeckung hängt vom Projekt ab: Infrastruktur für Elektro- und/oder Erdgasbusse deckt nur städtische Gebiete ab, während öffentlich zugängliche Lade- oder Betankungsinfrastruktur-Projekte generell einen größeren Anwendungsbereich haben. Die Gebühren für die Nutzung der Lade- und Betankungsinfrastruktur hängen auch von der Art des Projekts ab. Bei Infrastrukturprojekten für Elektro- und/oder Erdgasbusse fallen keine solchen Gebühren an. Bei Projekten für die Ladeinfrastruktur von Elektrofahrzeugen hängen die Gebühren für die Nutzung der finanzierten Ladeeinrichtungen in der Regel vom Tarif des jeweiligen Anbieters, von der Dauer des Ladevorgangs sowie von der Ladeleistung ab. Die direkte öffentliche Finanzierung der genehmigten Förderprogramme für Elektroauto-Infrastruktur betrug im Durchschnitt ca. 34% der Gesamtkosten. Die direkte öffentliche Finanzierung der Busprojekte schwankte von 32% für das portugiesische Projekt bis 69% für das deutsche Projekt, wobei der hohe Wert für Deutschland darauf zurückzuführen ist, dass der Großteil der Mittel für die Anschaffung von Bussen und nicht für die Installation der Infrastruktur verwendet wurde.

Bei den ausgewählten Stromtankstellen-Projekten in sechs ausgewählten Mitgliedstaaten ergab die Überprüfung, dass neun von zehn Projekten mit öffentlichen Mitteln unterstützt wurden, und zwar entweder von der EU über das CEF/Horizon 2020-Programm und/oder von den Mitgliedstaaten. Ein Projekt wurde vollständig aus privaten Mitteln finanziert. Es betrifft eine Stromtankstelle in einem Einkaufszentrum in Tallinn, die von dessen Betreiber eingerichtet wurde, um den höchsten Energieleistungsstandard zu erreichen. Der Durchführungszeitraum der Projekte betrug unter ein Jahr bis vier Jahre. Hinsichtlich der Technologie basieren acht Projekte ganz oder teilweise auf Schnell-Ladetechnik, während zwei Projekte ausschließlich Standard-Ladetechnik anbieten. Neun Projekte sind jederzeit (rund um die Uhr) zugänglich, wogegen eins aufgrund geregelter Öffnungszeiten nur begrenzt zugänglich ist. Die Nutzer müssen bei acht Projekten für die Nutzung der Stromtankstellen bezahlen. Die Gebühren variieren und hängen von Ladezeit, -ort und -technologie ab. Einige Projektbetreiber bieten Pakete mit einer monatlichen Grundgebühr an, bei denen pro KWh reduzierte Preise berechnet werden. Die Finanzierung der ausgewählten Stromtankstellen-Projekte reicht von keiner direkten öffentlichen Finanzierung bis zur 100%igen direkten öffentlichen Finanzierung.

4 Introduction

4.1 General objective of the evaluation support study

As part of the evaluation process of the current State aid rules, the European Commission ("Commission") awarded to the consortium led, for this specific project, by Sheppard Mullin Richter & Hampton LLP, in cooperation with E.CA Economics GmbH and Centre for Competition Policy, University of East Anglia ("consortium"), a contract to carry out a retrospective evaluation support study on the EU Guidelines on State aid for environmental protection and energy applicable in 2014-2020 ("EEAG") and the provisions applicable to aid for environmental protection and energy (Section 7) of the Commission Regulation (EU) 651/2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty ("GBER").

The objective of the retrospective evaluation support study ("Study") is to support the Commission with an evidence-based review of the implementation of the EEAG, applicable since 1 July 2014, and Section 7 of the GBER. The Study provides input to the Commission for assessing whether the EEAG and the relevant GBER provisions are fit for purpose taking into account the general State aid modernisation objectives, the European Green Deal objectives, the specific objectives of the legal framework and the current and future challenges, including the Clean Energy package, the long-term climate and energy strategy, the circular economy strategy and the evolution of the technology and of market conditions. The Study does not contain any such assessment in itself (with the sole exception of question 8), but provides and summarizes factual input for such an assessment by the Commission.

The Study generally covers the 27 EU Member States and the United Kingdom, ensuring sufficient granularity of the data per EU Member State. For some of the questions included in the Study, only specific Member States or a representative sample of Member States have been analysed, as indicated below, where applicable.

The Study has been prepared from an inter-disciplinary perspective, i.e. a State aid economic perspective, a State aid law perspective and an *ex-post* evaluation perspective, in accordance with the Tender Specifications of the Framework Contract ("FWC"). It is limited to providing input and data for answering the eleven specific study questions.

4.2 Description of the study questions

This section describes the study questions and the methodology adopted to perform the relevant tasks and to answer the study questions in line with the standards set out in the Commission's Better Regulation Guidelines and in the Better Regulation Toolbox.

For a number of questions, the relevant data was collected either from publicly available sources or provided by the Commission. The exact method for each specific data collection varies depending on the number of Member States covered by the respective questions. To the extent relevant for the data collection, the methodological requirements for retrospective evaluation support studies was followed as laid down in section 2.2.1 of Annex I (Tender Specifications) of the FWC. The methodology consisted in seeking data from the sources listed in the technical specifications, as well as other sources as needed, including but not limited to publicly available information published on the websites of Transmission System Operators ("TSO"), national regulatory authorities and national ministries. Careful attention was paid to ensuring comparability across Member States and documenting limits on comparability.

The responses contained in the report are the result of desk research to collate publicly available data and of targeted surveys with questionnaires and interviews. This task solely involved the collecting of data and background information, rather than the analysis of this data. The different sections below describe the samples, methodology and quality of the resulting data for each question. The actual data is provided in the respective Annexes. Significant efforts to identify the required data included Internet searches and relevant information obtained from Commission decisions. The precise data collected is a function of the availability and nature of data that has emerged. Major decisions regarding the specific data to collect have been taken in consultation with the Commission.

Throughout the data collection process an emphasis has been placed on traceability so that the data can be independently verified, if required. This was done by a system of folders containing copies of the sources of information. The web links of the most important data sources are included in the Annexes.

Question 1 – Effectiveness of RES schemes: This question seeks to understand the extent to which the EEAG and the GBER provisions been effective in allowing aid for RES deployment at lower costs or with less aid. This includes understanding the effectiveness of bidding processes and the impact, or not, of bidding processes being open to multiple technologies. The data gathered is the result of desk research to collate publicly available data. Where suitable data was not found, the general procedure has been to contact relevant national authorities by email and follow up with a second email if no response was received. Some preliminary data collected on RES bidding process outcomes from the AURES II project is provided. Data on administratively set support within the sampled schemes has also been collected; data on repowering has been collected to the extent available. The vast majority of the data has been collected by the project team following a 'maximum disaggregation' approach where 'pots' within auctions are counted as separate bidding processes.

Question 2 – RES schemes covered by GBER/EEAG exemptions: This question focuses on whether the absence of tendering requirements for certain categories of RES has been a barrier to achieving cost reductions, and whether the existence or size of exemptions to market integration have been a barrier to achieving market integration. The data gathered is the result of desk research to collate publicly available data. Where suitable data was not found, the general procedure has been to contact relevant national authorities directly. Initial data on RES volumes and aid levels covered by exemptions to the GBER and EEAG are provided. Identifying data relevant to this question, beyond that available in Commission documents, has proven particularly difficult, due to the challenge of identifying the subset of aid in larger schemes subject to a relevant exemption.

Question 3 – High efficiency cogeneration and district heating: This question focuses on the extent to which the EEAG ensured that support for high energy efficient cogeneration and district heating was effective. The data gathered is the result of desk research to collate publicly available data on schemes and then apply to hypothetical case study plants. It was found that the majority of the sampled schemes involve operating aid rather than investment aid. To allow comparisons across schemes, a methodology was developed to estimate the support that would be awarded to example CHP plants over their lifetime under each scheme.

Question 4 – Capacity mechanisms: This question seeks information related to whether the EEAG ensured that capacity mechanisms were cost-effective in providing security of supply and least-distortive to competition. Information is provided for auction/allocation processes under each of the eleven approved capacity mechanisms identified by the Commission, including the volume awarded split by technology. The data gathered is the result of desk research to collate publicly available data. Where suitable data was not found, the general procedure has been to contact relevant national authorities directly.

Question 5 – Negative prices in electricity generation: The question covers the extent to which the EEAG and the corresponding GBER provisions (and their application) facilitated the integration of RES into the electricity market. The question particularly focuses on instances of negative pricing for electricity for five Member States. The data gathered is the result of desk research to collate publicly available data. Where suitable data was not found, the general procedure has been to contact relevant national authorities directly. The available data on negative prices and RES generation during hours of negative prices is being provided. Generally, it was not possible to identify the subset of RES generation that has received State aid and is subject to negative pricing rules.

Question 6 – RES levies: This questions covers information on whether Member States have introduced a renewable energy policy in 2014-2020, going beyond their binding 2020 RES targets, and on the level of RES charges over the total electricity bill, where possible, per category of electricity consumers. The data gathered is the result of desk research to collate publicly available data. Where suitable data was not found, the general procedure has been to contact relevant national authorities directly. For Question 6.ii, 15 Member States are sampled. Due to the absence of aggregate data identifying the proportion of electricity bills devoted to RES charges for most of the time period, a specific methodology was developed, using the details contained in national legislation and Commission decision documents to calculate the RES charges for a series of example residential consumers, example commercial consumers and example energy intensive users.

Question 7 – Waste management: Question 7.a is related to all national State aid schemes which Member States had officially communicated to the Commission between 2014 and mid-2019 as containing measures falling under Article 47 GBER. These schemes were reviewed in light of whether they contain such measures, and if so, which are their specific features. The data collection exercise included desk research into publicly available sources as well as a targeted stakeholder consultation with a combination of surveys and interviews. The desk research covered 129 national State aid schemes in 20 Member States, which were reviewed under specific links shown in the Commission list, as well as with Internet research. Questions 7.b and c cover the practical implementation of the State aid schemes by the relevant granting authorities within a representative sample of eight Member States. The objective was to identify how much State aid was granted to what kind of projects in which years, as well as the reasons for not granting more State aid to more projects within the reference period. To collect this information, a survey was conducted with specific questionnaires being sent to all relevant granting authorities of the sample, followed by clarification questions and telephone interviews.

Question 8 – Reductions to energy intensive users: This question concerns the impact of the reductions in the RES levies and levies per analogy for energy intensive users ("EIU") on the levies paid by different consumer groups, as well as the relevance of the grandfathering rule. To show the development of levies paid by different users after the introduction of the reductions, development over time of RES and related levy rates for different user groups was presented, some of which benefited from the reduction while others did not. In addition, the total annual expenses for a period of equal length before to after the introduction of reductions were compared. For all consumer groups, the development of RES and other levy expenses were quantified in Euro/year and as a share of the total electricity bill. The relevance of the grandfathering rule was assessed according to the proportion of sales by the grandfathered undertakings in their industry sector in 2017. Grandfathered undertakings were identified as beneficiaries in sectors not listed in Annexes 3 and 5 to the EEAG nor in the two decisions in which the Commission approved exemptions under point 186 EEAG. Lists of beneficiaries were provided by the authorities regulating the energy markets in Germany, Italy and Poland. Grandfathered undertakings shares in sales were extracted from the professional firm-level data base Orbis by Bureau van Dijk. Sector-wide sales were provided by Eurostat.

Question 9 – Financial instruments for energy efficiency in buildings: Under Question 9.a, the data collection into schemes officially communicated to the Commission by Member States as containing provisions on State aid for energy efficiency measures in buildings falling under Article 39 GBER included desk research into publicly available sources and a targeted stakeholder consultation, using a combination of surveys and interviews. The desk research covered 71 national State aid schemes in 18 Member States, which were examined by using specific links provided in the Commission list, and with Internet research, to better understand how Member States had in practice structured schemes providing aid for energy efficiency in buildings through financial instruments. Question 9.b covers the practical implementation of the relevant State aid schemes by the relevant granting authorities within a representative sample of eight Member States. The objective was to better understand how much aid (if any) was granted to what kind of projects in which years, as well as the reasons for not granting aid under this provision within the reference period. To collect this information, a survey was conducted with specific questionnaires being sent to all relevant granting authorities, followed by clarification questions and telephone interviews.

Question 10 – Zero subsidy bids: Subsidy-free renewable energy projects in the EEA were defined as those where the project receives zero public funding, irrespective of any movements in energy market prices. Latest developments on subsidy-free renewable energy projects were collected in an extensive desk research covering publications by energy regulators, industry associations and academics. The information collection covered twelve European countries with the highest announced cumulative subsidy-free project volumes. The countries analysed are Spain, Germany, Netherlands, Norway, Italy, Finland, Sweden, UK, Finland, Portugal, Ireland and Denmark.

Question 11 – Alternative fuel infrastructure: The data collection included a targeted stakeholder consultation using a combination of surveys and interviews. Two different questionnaires were sent out as a basis for the survey, which covered a representative sample of relevant granting authorities and beneficiaries. These questionnaires contained questions indicating how the projects were implemented, e.g. companies involved, tender criteria used for the selection, costs, technology, access of users to the infrastructure, and related charges. A third questionnaire was sent to stakeholders of 20 selected projects in Austria, Belgium, Estonia, France, Spain and Sweden, which contained details on actors involved and geographical coverage, total costs, public financial sources and share of total costs, access to infrastructure and related charges for users, technology concerned, for projects constructed on the public domain, competitive conditions under which the concession was awarded, if public finance was provided, whether this was based on a tender, as well as budget and selection criteria, conditions imposed on the beneficiary of public finance, and the legal basis used to ensure State aid compliance. Based on projects identified and selected, the financing of the different selected alternative fuel infrastructure projects was compared, indicating the geographical coverage of the project concerned.

5 Effectiveness

5.1 Bidding processes providing support to RES schemes and schemes covered by EEAG and GBER tendering exemptions

Question 1: To what extent have the EEAG and corresponding GBER provisions been effective in allowing aid for Renewable Energy Sources ("RES") deployment at lower costs or with less aid?

Question 2: Has the absence of requiring a tender for certain categories of RES been a barrier to achieving cost reduction? Have the existence or size of exemptions to market integration been a barrier to achieving market integration? (see Annex 0 for a list of all questions).

5.1.1 Introduction

The first objective of this question is to obtain information on a large sample of bidding processes[1] awarding operating aid for renewable energy source (RES) electricity production to identify whether they are helping to lower the costs of RES for Member States. The second objective is to identify information relevant to assessing whether the absence of tendering requirements has been a barrier to cost reductions and/or market integration

17 Member States[2] have been sampled. In 2018 these Member States accounted for 100% of the installed renewable generation capacity in the subset of Member States that had schemes providing operating aid granted via a bidding process, and accounted for 81% of installed renewables generation capacity in the EU as a whole.[3] Within these Member States the data covers those schemes covered by measured approved under EEAG and GBER, as agreed with the Commission, and listed in Table A6.5.1 in **Annex 6.5**. Where a scheme had a relevant decision and the scheme commenced prior to the decision, data has been collected back to 2014. Additionally, where the sampled decision documents directly mentioned other bidding processes, data was also collected for these processes, with the earliest data featured in **Annex 1.1** beginning in 2012. Figure 1 to Figure 12 cover the period 2014-2019[4].

Even for the period 2014-2019 it is necessary to be cautious when interpreting time trends. The sample of bidding processes analysed does not claim to contain *all* processes conducted in this period, for example, there are likely to be additional bidding processes held as part of schemes approved under previously existing guidelines. Tendering became a full obligation under the EEAG 2014 only after 1 January 2017 (in 2015 and 2016 only pilot tenders needed to be organised which were to amount to at least 5% of new RES capacity, see point 126 of the EEAG). Also, when considering averages for particular years, it is important to note that 14 out of 17 Member States had sampled bidding processes

---

[1] The term 'bidding process' is used to cover both auctions and tenders (including tenders involving multiple criteria). The project team notes that the terms auction and tender are used interchangeably in documents and the distinction between the two may vary between documents. The term 'bidding process' should not be viewed as signifying that all the processes identified satisfy the legal definition of "competitive bidding processes".

[2] The sampled Member States are: Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovenia, Spain and the UK. Only 14 Member States are featured in Annex 1.1 as Estonia, Hungary and Portugal had not completed applicable bidding processes by November 2019.

[3] These percentages are based on figures from the International Renewable Energy Agency, https://www.irena.org/Statistics/View-Data-by-Topic/Capacity-and-Generation/Query-Tool

[4] Specifically, up to and including November 2019.

only in a subset of the years between 2014 and 2019[5], hence, the Member States composing annual averages are likely to change between years. Furthermore, the data behind Figure 1 to Figure 12 is often partial, with data for particular schemes in particular years not being available or expressed in non-equivalent units (e.g. Megawatt-peak or Megawatt-hours instead of Megawatts).

The data on bidding process outcomes incorporates some preliminary data from the AURES II Horizon 2020 project[6], however, most of the data has been independently collated by the project team. The full collated dataset on bidding process outcomes is provided in **Annex 1.1**.

As of November 2019, among the sampled Member States, bidding processes had not yet been completed in Estonia, Hungary or Portugal. In addition to data on competitively set support, information has also been collated on administratively set support where relevant and available. In sections 3.1 to 3.5 all monetary amounts are expressed in nominal terms unless stated otherwise.

Regarding RES schemes covered by "administrative support" exemptions to the EEAG and the GBER, 61 decisions/schemes were investigated[7] (33 under the EEAG and 28 under the GBER). Overall, limited data was identified that can be definitively and wholly attributed to an exemption. The challenge was that available data generally relates to schemes as a whole rather than to the parts of schemes covered by a specific exemption. Also, the information provided on aid in the GBER notification sheets is limited compared to those in EEAG decisions. Of the schemes that could be linked to a specific exemption, 29 of the 61 decisions/schemes involve the exemption from point 125 EEAG.[8] The data that has been identified regarding exemptions is reported in **Annex 2**.

5.1.2 Methodology

The choice of sampled Member States has been driven by the need to identify RES schemes involving operating aid that has been awarded via a (competitive) bidding process. The definition of what constitutes a distinct bidding process is less clear than it first appears. Events labelled in national documents as constituting 'an auction' may involve several 'pots' or 'groups' which are for specific technologies or plant capacities (in MW or KW). When one of these pots/groups has: (i) a separate target/budget volume to be achieved, and (ii) has separate price results, it is counted in the present analysis as a distinct bidding process. Thus a maximum disaggregation approach is followed, where the aim is to classify each major price-setting process separately. Bidding processes are allocated to the year when the process was conducted, specifically the deadline for bids, which can differ from the year used to label auctions/tenders in administrative documents. As a result, the number of bidding processes reported in the dataset may differ from other data sources, such as AURES II.

Publicly available information on repowering was sought, however, the amount of information found was limited. Also, the preliminary AURES II data on volumes built is

---

[5] *The exceptions with bidding processes in every year 2014 to 2019 are France, Germany and the Netherlands.*
[6] *This data from the AURES II project is available online in the AURES II Auction Database, see* *http://www.aures2project.eu/auction-database/.*
[7] *Initially 67 decisions were deemed relevant, however, on further investigation, 6 were found not to involve an exemption (SA.40348, SA.43995, SA.41528, SA.48066, SA.48238, SA.46552).*
[8] *For 6 GBER schemes (SA.51530, SA.46069, SA.51525, SA.40279, SA.52567, SA.43057) it was not possible to identify the specific exemption covered.*

inherently partial as the time period allowed for construction for many schemes has not yet ended.

Price comparisons have been undertaken but are hampered by specific factors such as local climate conditions (e.g. sun and wind patterns), the size (in KW) of the installations admitted in the auctions or the length of support provided (in years).

To assess EEAG and GBER schemes involving administratively set operating aid, the same set of Member States where competitively set operating aid had been identified was considered. Following discussions with the Commission, schemes relating to demonstration projects and/or where the operating aid solely constituted working capital loans were not considered. Relevant EEAG schemes were identified from a long list of EEAG schemes provided by the Commission. The relevant GBER schemes were identified using the Commission's case search tool.[9] As per the Commission's request schemes included in the final list involved at least one of the following exemption grounds: (i) point 125 EEAG, (ii) point 126(a) EEAG, (iii) point 126(b) EEAG, (iv) point 126(c) EEAG, (v) point 127 EEAG, (vi) Article 42.8 GBER, (vii) Article 42.9 GBER and (viii) Article 43 GBER. These exemption grounds allow plants, generally below certain size thresholds, to receive aid without a competitive bidding process or stop plants from having to meet market integration rules. A final list of the schemes where data has been sought is provided in Table A6.5.2 in **Annex 6.5**. The precise form of an exemption is not explicit in all cases and so, in some instances, the project team has used its judgement to assign a scheme to a particular category of exemption.

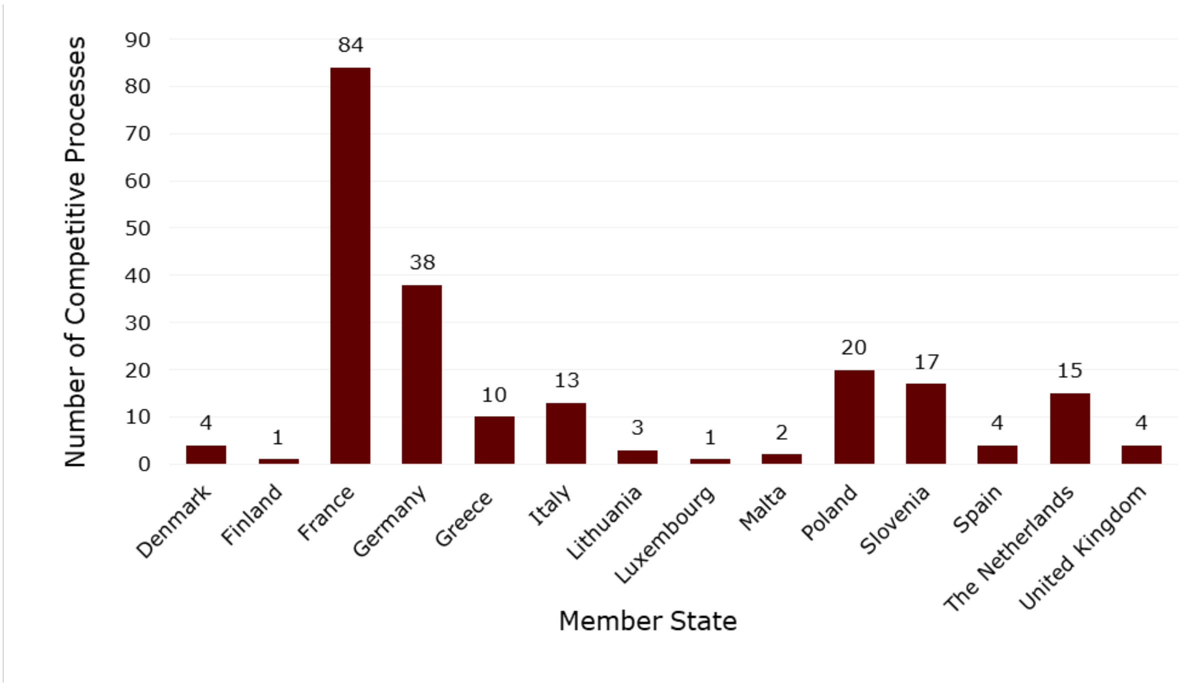
5.1.3 Results overview

Figure 1 through Figure 12 cover all bidding processes for the agreed schemes listed in Table A6.5.1. As noted above, the figures do not necessarily cover all the bidding processes that occurred in the sampled Member States between 2014 and 2019.

Figure 1 shows that the highest number of bidding processes within the sampled schemes occurred in France, with a total of 84, followed by Germany where 38 occurred. In contrast, Spain and the UK each conducted only 4 bidding processes. However, these numbers are difficult to interpret directly as each bidding process differed in size and scope, for example, some relate a specific sub-category of a technology (e.g. solar on building roofs, 500 KW to 8 MW) while others cover multiple high-level technologies (e.g. solar, wind onshore, wind offshore, hydro and biomass etc.).

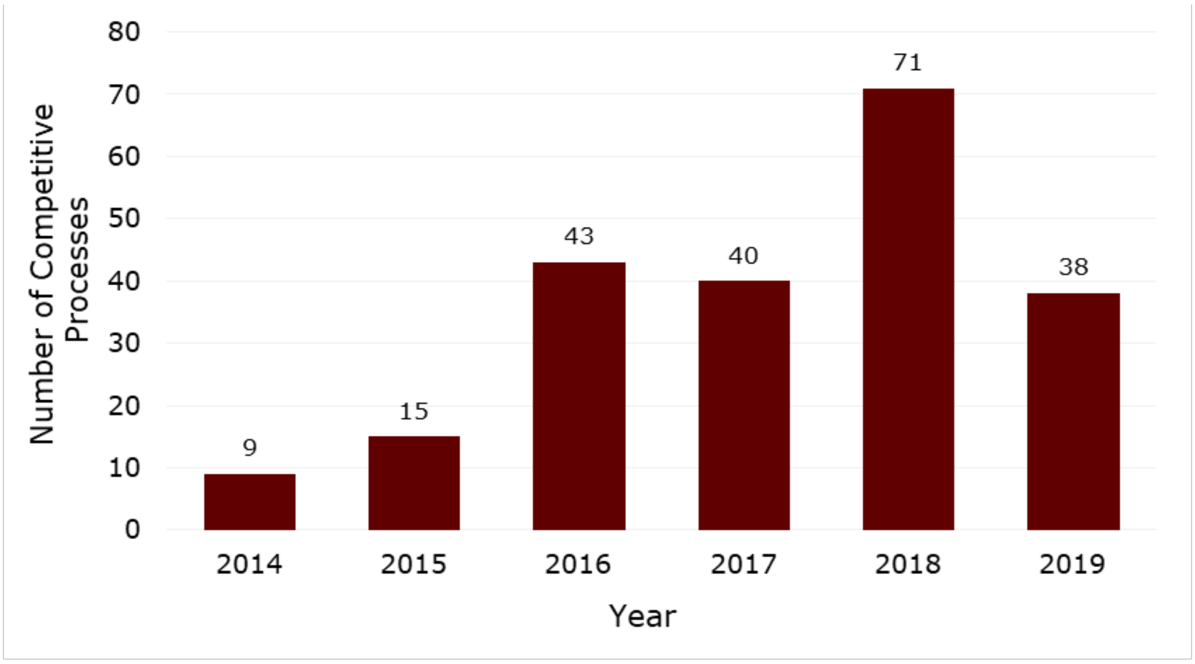
[9] *See http://ec.europa.eu/competition/elojade/isef/.*

Figure 1: Number of bidding processes in sampled schemes by Member State, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure 2: Number of bidding processes in sampled schemes by year, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure 2 records that within the sample a higher number of bidding processes occur from 2016 onwards. As noted above, this trend likely results from the sampling method, with it taking some time for schemes under the revised 2014 EEAG to be introduced. Between 2016 and 2019 the lowest number of bidding processes per annum in the sampled schemes is 38[10]. The peak in the number of processes in 2018 is influenced by France holding 27 bidding processes in this year.

While France had the highest number of bidding processes, over the period considered amongst the sampled schemes, Figure 3 shows it awarded only the fifth highest volume of support at 5,681 MW.[11] In contrast, the Netherlands' sampled schemes involved only 12 separate bidding processes, but awarded 22,780 MW in capacity. However, it should be noted that the Netherlands SDE+ scheme has a distinctive structure.

The SDE+ scheme involves an extensive system of pre-set maximum tariff levels and the volume awarded at support levels below these tariff rates was not identified.[12] Table 1 reports those volumes awarded that in source documents were expressed in terms of MWh and MWp and are not shown in Figure 3. To allow an assessment of the representativeness of the current sample Figure 3 and Table 1 include totals taken from the public version of the AURES II database of auctions.[13]

---

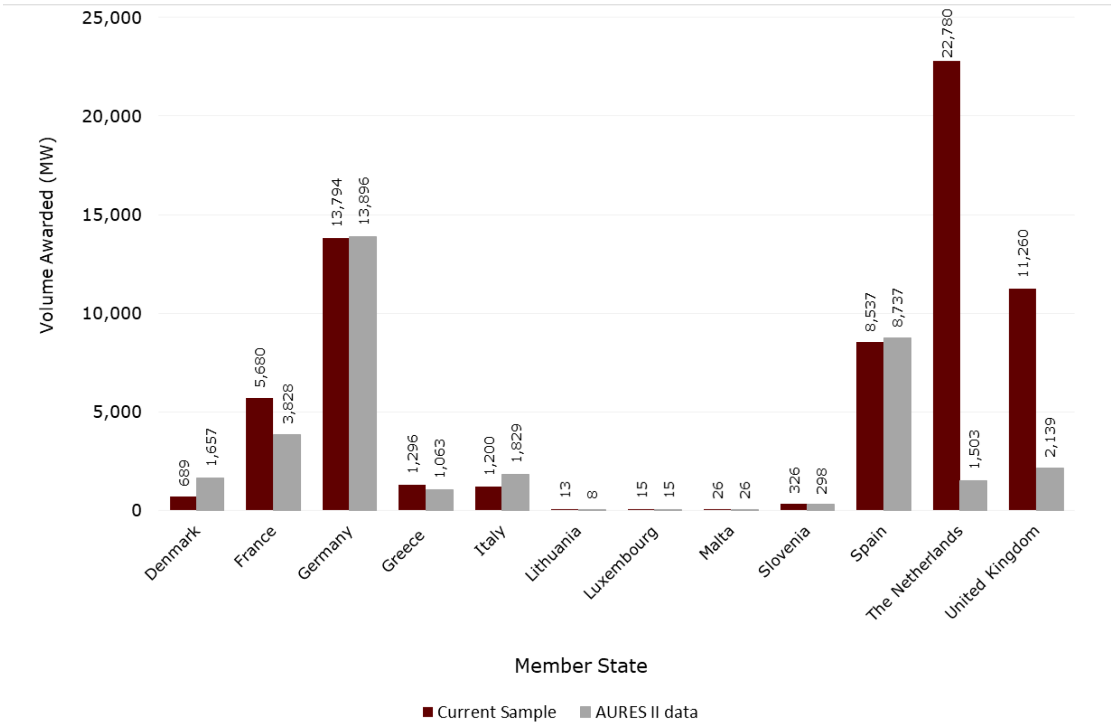
[10] *The 2019 figure only covers the period up to the end of November 2019.*

[11] *This figure does not include 2,949 MWp (megawatt-peak). If this MWp volume is added, France had the fourth highest volume of support.*

[12] *The SDE+ scheme is treated as a large bidding process since before aid is awarded at the administratively set maximum tariff rates there is a system of 'free' bids from any category which have first rights to the available budget. Also, the system of maximum tariff rates is itself set up to encourage a degree of competition: multiple rounds are held throughout the year and earlier rounds, frequently with the maximum tariff rate between rounds, have first call on the available budget.*

[13] *The AURES II database is downloadable from: aures2project.eu/auction-database/. The values are those downloaded on 3 February 2020. The low volume recorded for the Netherlands and for the UK in the AURES II data is due to the AURES II database not recording the relevant awarded volumes in MW, but only in their financial value (EUR). Even though the AURES II data gives a lower volume for France, within this volume value it appears an auction for 799.5MW 'Feed-in Tariff for installations over 250kW peak (Art. L311-12)' occurring in March 2015 may have been recorded twice. Similarly, within the volume for the Netherlands it appears an auction for 376MW appears to have been recorded twice.*

Figure 3: Total volume awarded (MW) through bidding processes in sampled schemes by Member State, 2014-2019[14]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and data from the AURES II project.

Table 1: Total volume awarded (MWh and MWp) through bidding processes in sampled schemes by Member State, 2014-2019[15]

Member State	Volume awarded (MWh)	Volume awarded (MWp)
Finland	1,360,000 (1,370,000)	-
France	-	2,949 (-)
Poland	64,003,610 (63,277,038)	-
The Netherlands	124,328,000 (-)	-

Note: The values in brackets are those taken from the AURES II database on 3 February 2020. The AURES II database does not appear to distinguish between MW and MWp, hence, the absence of AURES II data for France.

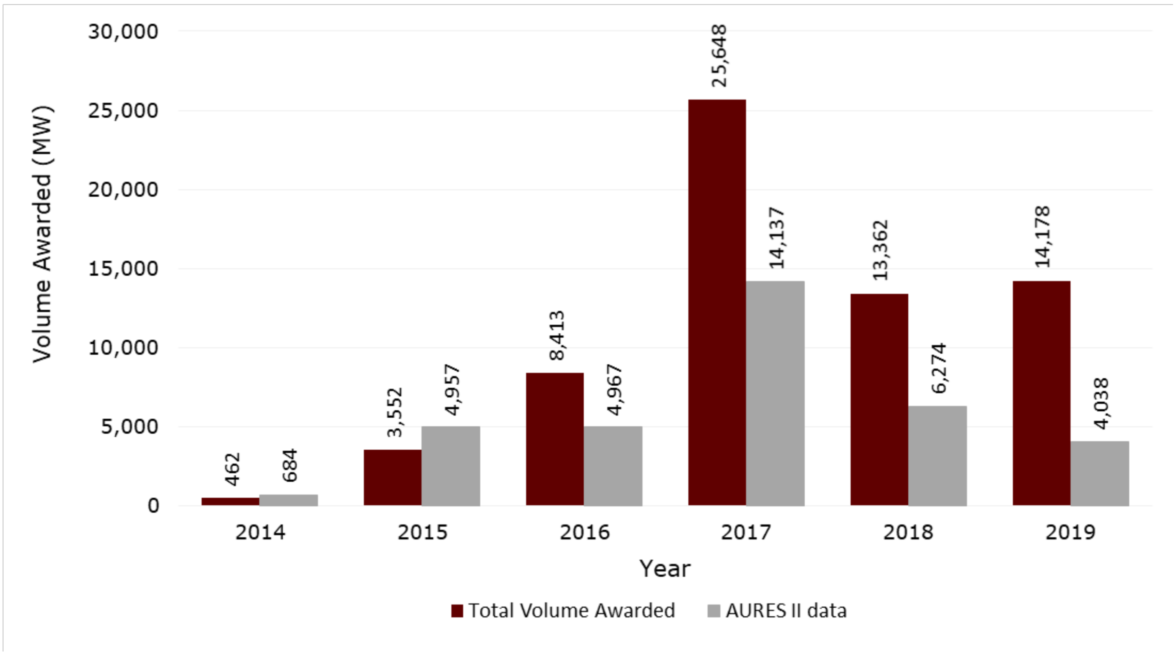
[14] See footnote 13 for a discussion of differences between the current sample and the AURES II data.

[15] The volumes in Table 1 are in addition to the volumes in Figure 3.

Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and data from the AURES II project.

Figure 4 shows that while the highest number of bidding processes in the sampled schemes occurred in 2017, the greatest volume was competitively awarded in 2014, 25.65GW. However, 2017 appears to be an outlier with the volumes in 2018 and 2019 being 13.36GW and 14.18GW respectively. Also, Table 2 shows that in 2017 a relatively low volume of support in terms of MWh occurred, while the only awards in MWp occurred in 2018 and 2019. Again, in Figure 4 and Table 2 data from the AURES II project is provided as a comparison, the volumes are noticeably lower in the AURES II data as they appear to record certain volumes for the Netherlands and the UK in monetary amounts.

Figure 4: Total volume awarded (MW) through bidding processes in sampled schemes by year, 2014-2019[16]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and data from the AURES II project.

Table 2: Total volume awarded (MWh and MWp) through bidding processes in sampled schemes by year, 2014-2019[17]

Year	Volume awarded (MWh)	Volume awarded (MWp)
2014	54,149,000 (0)	0 (-)
2015	70,179,000 (0)	0 (-)
2016	2,808,471	0

[16] *See footnote 13 for a discussion of differences between the current sample and the AURES II data. In the AURES II data a French auction involving 240.6MW has a year marked 2015-2016, in Figure 4 it has been included in the 2015 AURES II value.*
[17] *The volumes in Table 2 are in addition to those in Figure 4.*

	(2,081,900)	(-)
2017	5,033,403 (5,033,403)	0 (-)
2018	57,521,735 (57,531,735)	2,090 (-)
2019	0 (0)	859 (-)

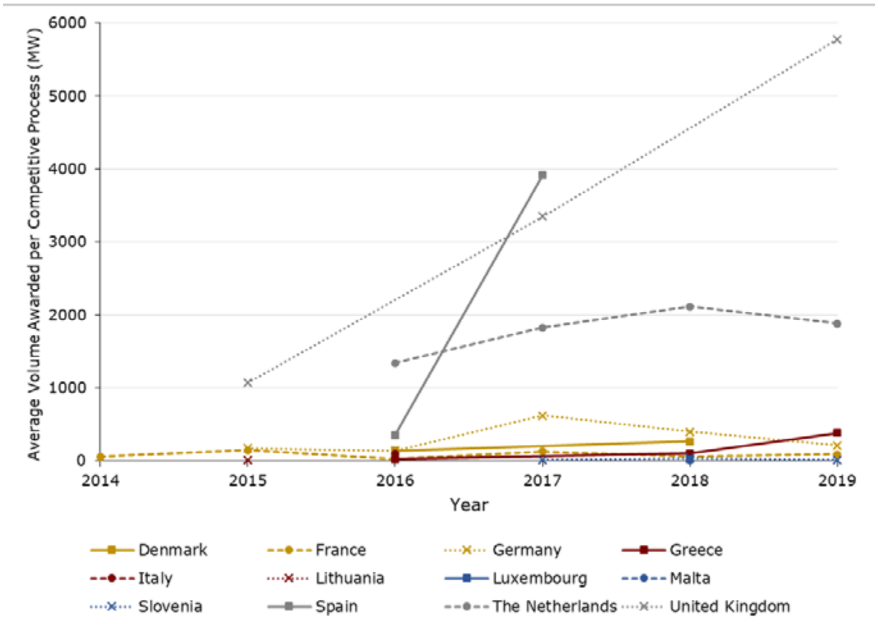
Note: The values in brackets are those taken from the AURES II database on 3 February 2020. The AURES II database does not appear to distinguish between MW and MWp. The 0 MWh values for the AURES II data in 2014 and 2015 are due to the AURES II data appearing to record volumes only in monetary terms for the Netherlands.

Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and data from the AURES II project.

Linking the data on the number of bidding processes and volumes awarded together, Figure 5 shows that in particular years the sampled Dutch, Spanish and UK schemes involved bidding processes with an average volume awarded per bidding process exceeding 2 GW. In contrast, in each year in the sampled French bidding processes the average awarded volume was below 200MW[18]. There is a contrast in process structure between those Member States running a small number of large processes and those running a large number of small processes.

[18] *Or 300MWp as shown in Table 3.*

Figure 5: Mean volume awarded (MW) per bidding process for sampled schemes by Member State over time, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Table 3: Mean volume awarded (MWh and MWp) per bidding process for sampled schemes by Member State over time, 2014-2019[19]

Member State	2014	2015	2016	2017	2018	2019
Finland (MWh)	-	-	-	-	1,360,000	-
Poland (MWh)	-	-	936,157	4,720,962	9,360,289	-
Netherlands (MWh)	54,149,000	70,179,000	-	-	-	-
France (MWp)	-	-	-	-	232	286

Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Turning to indicators of supply and the potential competitiveness of the processes held, across the period considered, in Poland 9 auctions were cancelled due to a lack of bidders. Figure A1.2.6 in **Annex 1.2** shows that 8 single technology bidding processes were cancelled compared to 4 multi-technology bidding processes. In France, 17 bidding processes were concluded where the volume participating was below the volume requested and the same occurred in Germany in 11 bidding processes, in Italy in 5 bidding processes and in Malta in 1 process. However, for 10 Member States, the ability to make this comparison, at least in some bidding processes, is limited by a lack of data on either the volume requested or the volume participating.

Looking across Member States and time, Figure A1.2.7 shows that on 30 occasions single technology bidding processes involved a volume participating below the volume requested,

[19] *The values in Table 3 are for bidding processes separate to those in Figure 5.*

while this occurred on 4 occasions for processes open to 4 or more technologies and on no occasions for processes open to 2 or 3 technologies. However, single technology processes with the required data are far more frequent than multi-technology processes; as a percentage of the observed processes with the required data, 26.5% of single technology processes were undersubscribed compared to 26.7% of processes open to 2 or more technologies.[20]

Another way to consider the relative competitiveness of each process is to compare the volume participating to the volume awarded. The results of this exercise are presented in Figure 6, for those Member States where the necessary data was available. This chart shows that, for the sampled schemes with sufficient data, Poland had the highest average volume participating relative to volume awarded ratio of 3.7, while Luxembourg[21] had the lowest ratio of 1.0. Other Member States with an average ratio below 2 are Malta, Greece and France (in its solar processes where volumes were expressed as MWp). Overall, Figures A1.2.3 and A1.2.8 in **Annex 1.2** do not show clear evidence of higher ratios (higher competitiveness) being associated with lower prices.

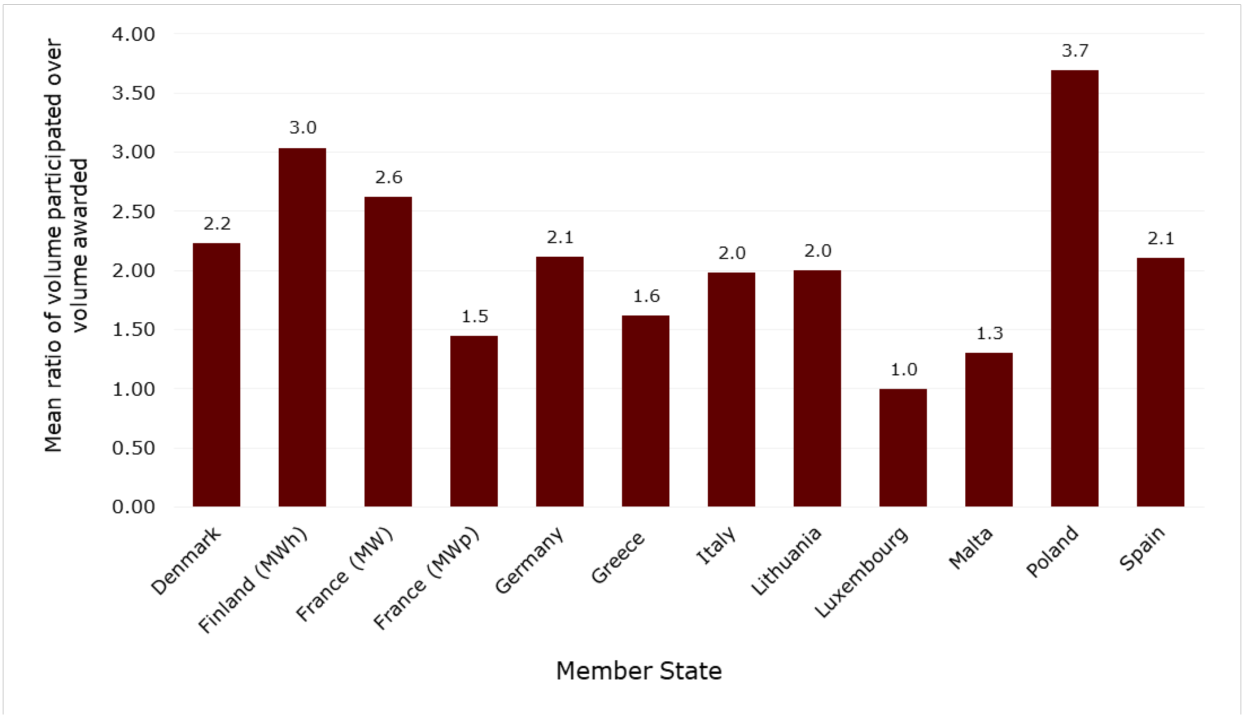
- Splitting the data by technology in Figure A1.2.3, possibly shows some weak evidence of such a relationship within processes providing awards to biomass/biogas and wind, however, this is based on a small number of observations.
- Also, Figure A1.2.5 shows that the trend is for the unweighted mean value of the volume participating over volume awarded ratio to decline over time.
- Figure A1.2.4 appears to show a negative correlation between the log of the volume awarded in a bidding process and the average price, however, this result may be influenced by larger processes tending to occur in more recent years.

---

[20] 6 bidding processes open to 2 or 3 technologies had the required data and none were undersubscribed. 9 bidding processes open to 4 or more technologies had the required data and 4 were undersubscribed, hence, 44.4% of bidding processes open to 4 or more technologies were undersubscribed. In total 113 single technology bidding processes with the required data were identified.

[21] The ratio for Luxembourg is based on a single bidding process with preliminary data from the AURES II project.

Figure 6: Mean of the volume participating over volume awarded ratio for bidding processes in sampled schemes by Member State, 2014-2019[22]



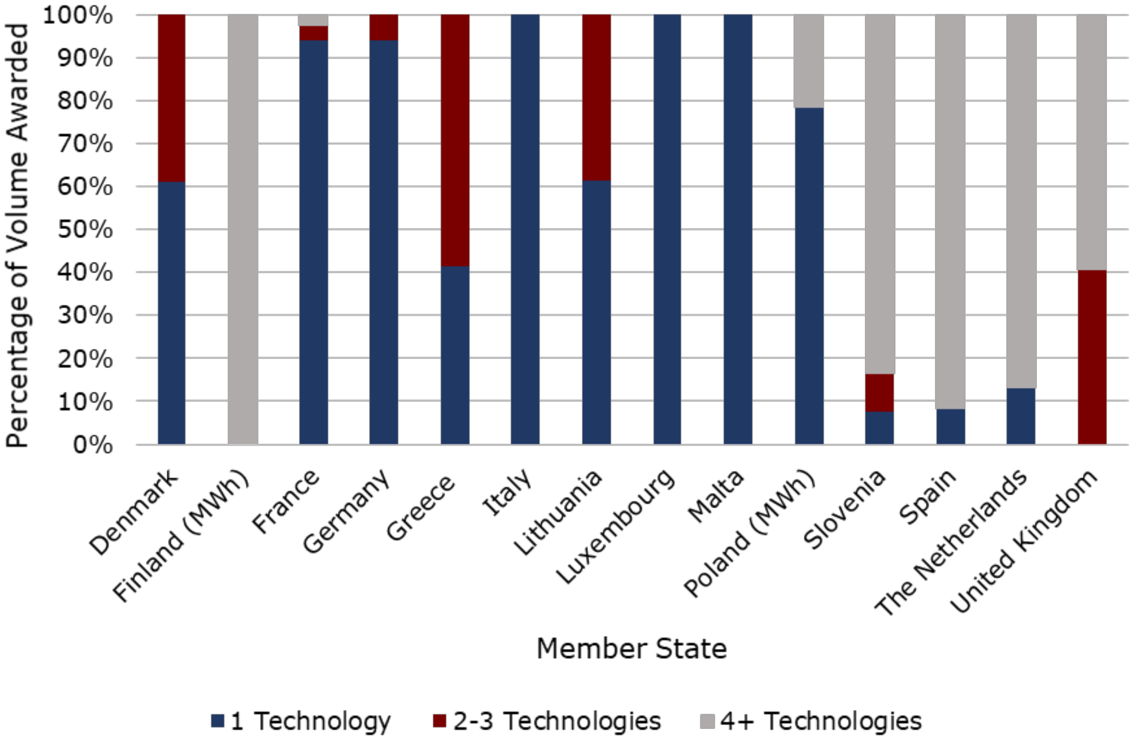
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure 7 shows that Member States take different approaches to the structuring of bidding processes with respect to their openness to multiple technologies. The high-level technological categories used in this analysis being: solar, hydro, onshore wind, offshore wind[23], bioenergy (biomass/biogas) and other[24]. In Italy, Luxembourg and Malta all volume was awarded via bidding processes involving a single technology. Similarly, more than 90% of volumes in France and Germany were awarded in single-technology processes. In contrast, all the volume awarded in the UK occurred through bidding processes involving two or more technologies, while at least 80% of the volume awarded in Finland, Spain, Slovenia and the Netherlands occurred in bidding processes where at least four technologies could participate. Figures A1.2.1 and A1.2.2 in **Annex 1.2** provide charts equivalent to Figure 7 and Figure 8, but in absolute (MW) rather than percentage terms. Figure 8 indicates that among the sampled schemes from 2016 to 2019 at least 45% of the volume awarded occurred in bidding processes open to 4 or more technologies.

---

[22] Includes bidding processes with required data only. Slovenia, the Netherlands and the United Kingdom are omitted due to a lack of volume participating data. For each bidding process the volume participating over volume awarded ratio was calculated and an unweighted mean of these ratios was taken. Figure 6 includes data for undersubscribed bidding processes (where volume participating is below volume requested). In these cases the ratio of volume participated over volume awarded is still generally above 1. This is because some bids are usually excluded due to a failure to meet qualifying criteria and these bids are included in the volume participating figures.
[23] Due to the specific type of wind capacity in some Member States being unspecified in Figure 10 to Figure 12 onshore wind and offshore wind are combined into the single category 'wind'.
[24] Other is used to cover CHP, geothermal and combustion technologies with an unspecified fuel.

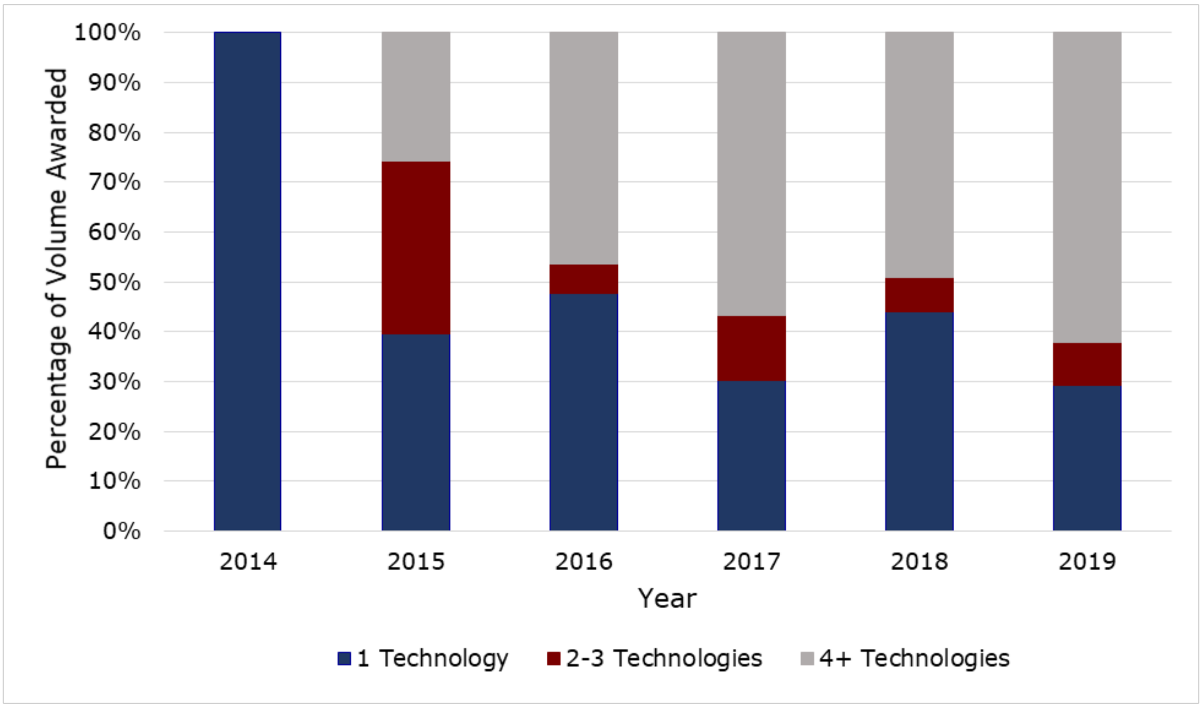
Figure 7: Percentage of total volume awarded (2014-2019) by bidding processes in sampled schemes open to different numbers of technologies, by Member State[25]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

[25] *French auctions involving MWp and Dutch auctions in MWh are excluded. A multi-technology auction in Poland was counted as a one technology auction as, although, it was open to all technologies the detailed requirements meant Hydro was the sole eligible technology. In Lithuania and Spain data for 'Wind' is taken to include both wind onshore and wind offshore. These points also apply to Figure 8.*

Figure 8: Percentage of volume awarded (MW) through bidding processes in sampled schemes open to different numbers of technologies, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure 9 to Figure 12 provide data on prices awarded per KWh in the sampled bidding processes. The prices are weighted means, where the weight is the volume awarded. Some caution is warranted with the results the averages pool all available pricing data.[26] Different types of prices were observed as the bidding object in bidding process. The most common type of price in the sampled schemes, observed in 8 Member States[27], was a guaranteed minimum price or variable premium, while in 4 Member States[28] guaranteed prices or two-way contract for differences were observed and in 3 Member States[29] feed-in tariffs for plants of a certain capacities (KW) were observed. In Denmark and France fixed prema over the market electricity price were observed, while Finland has a fixed premium that tapers to zero once the market electricity price is sufficiently high and in Spain bidding processes can involve bidding on the percentage reduction to a standardised investment value for a type of plant[30]. Additionally, the length of support varies across schemes and technologies, for example, co-firing with biomass in the Netherlands receives support for 8 years, while in Italy support can be awarded for up to 30 years.

From an economic perspective, the length of support and the differing risk characteristics of these various price types means that a firm with a specific type of plant will vary the price it bids (is willing to accept) according to the price type of each bidding process. As

---

[26] *Prices are clearing prices in pay as clear auctions and weighted average prices for pay as bid auctions.*
[27] *Denmark, Germany, Italy, Lithuania, Malta, Slovenia, Spain and the Netherlands.*
[28] *France, Greece, Poland and the UK.*
[29] *France, Italy, Poland and Slovenia.*
[30] *The winning bids are then converted into an equivalent unit price.*

such, the prices observed are not strictly comparable across the various bidding processes. Nevertheless, to provide initial insights the data is pooled. Also, the outcome prices of the bidding processes have been treated to ensure all constitute ‘whole prices’ rather than simply the premium above the wholesale market electricity price.[31]

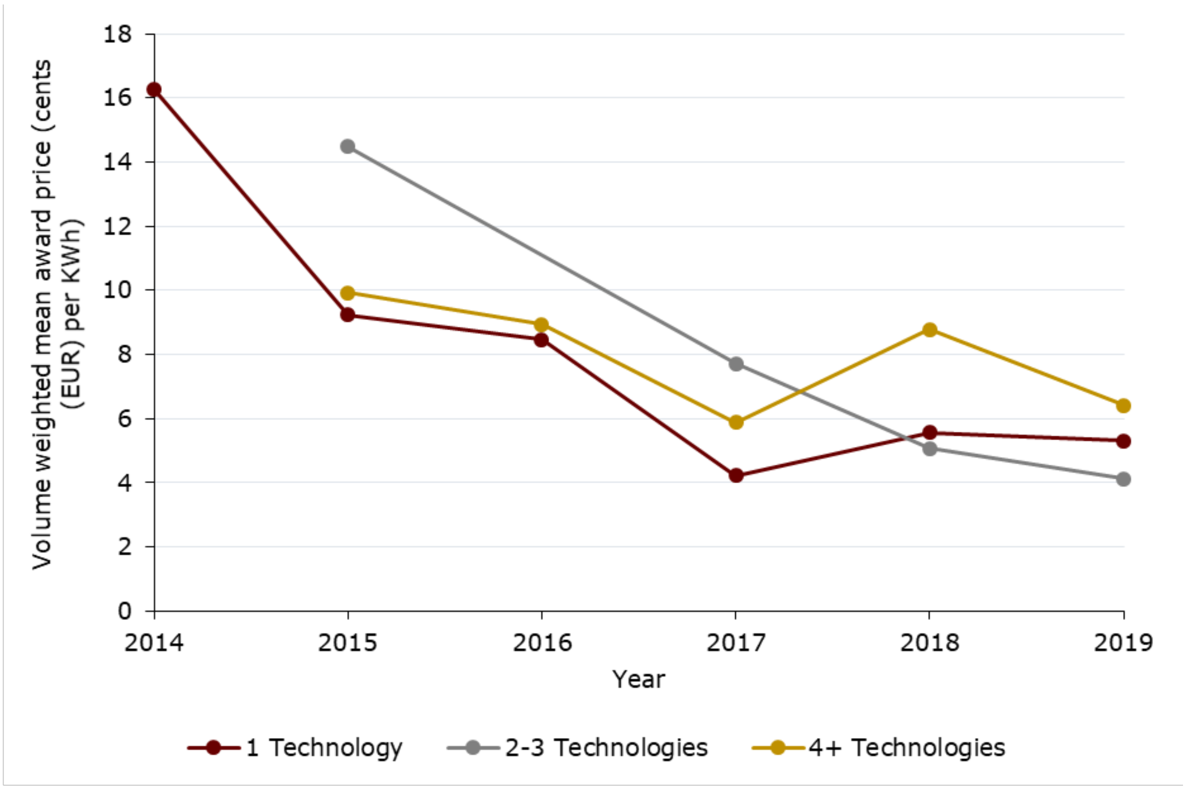
Below the main trends in Figure 9 to Figure 12 are described. As previously noted, time trends may be influenced by the sample not including all the bidding processes taking place in Member States, particularly in 2014 and 2015. Also, it is important to remember that trends may be influenced by correlations between factors, such as between single technology bidding processes and RES technologies/plant sizes with particular cost structures. Another potential factor that may influence the comparisons is that while particular Member States employ particular bidding process structures, their climate conditions, in terms of sunlight and wind patterns, are also likely to have particular characteristics, which impact upon the prices obtained.

In Figure 9, for the sampled schemes prior to 2018, on average, bidding processes involving a single technology achieved the lowest average award price, while in 2018 and 2019 bidding processes involving 2-3 technologies achieved the lowest average price. In 2019, for the sampled schemes, the weighted average award price in single technology bidding processes was 5.3 cents (EUR) per KWh compared to 4.1 cents (EUR) per KWh for bidding processes involving 2-3 technologies and 6.4 cents (EUR) per KWh for bidding processes involving 4 or more technologies. Thus, in 2019, bidding processes involving 4 or more technologies had the highest average award price, 55% above the average award price in sampled bidding processes involving 2-3 technologies.

Pooling all data from 2014 to 2019 across all technologies the average price in the sampled bidding processes involving 1 technology was 5.8 cents (EUR) per KWh, while for those involving 2-3 technologies it was 8.0 cents (EUR) per KWh and for those involving 4 or more technologies it was 7.0 cents (EUR) per KWh. In **Annex 1.2** Figure A1.2.12 to Figure A1.2.14 repeat Figure 9 but separately for the three main technological categories: (i) solar, (ii) wind and (iii) biomass/biogas, respectively. The main insight that can be gained from these additional figures is that among bidding processes including biomass/biogas in all years the average price is lower in bidding processes open to 4 or more technologies than in single technology bidding processes. In 2019, the average price awarded to biomass/biogas in single technology bidding processes was 12.4 cents (EUR) per KWh compared to 6.9 cents (EUR) per KWh in bidding processes open to 4 or more technologies. Figure A1.2.15 shows that, for the sampled schemes within each Member States with sufficient data, the variance of awarded prices was higher across single technology bidding processes than across the sub-categories of technology in multi-technology auctions.

[31] Competition around guaranteed minimum prices and guaranteed prices involves ‘strike prices’ that are automatically whole prices. For schemes involving fixed premiums, the annual average wholesale day ahead market electricity price (based on data from the entso-e transparency platform) was added to each of the premiums resulting from the bidding processes. Additionally, while bidding in the Dutch SDE+ scheme involved a strike price, the form of available data also required wholesale day ahead market electricity prices to be added.

Figure 9: Volume weighted mean price per KWh in sampled schemes split by number of technologies that could compete in bidding processes, 2014-2019[32]



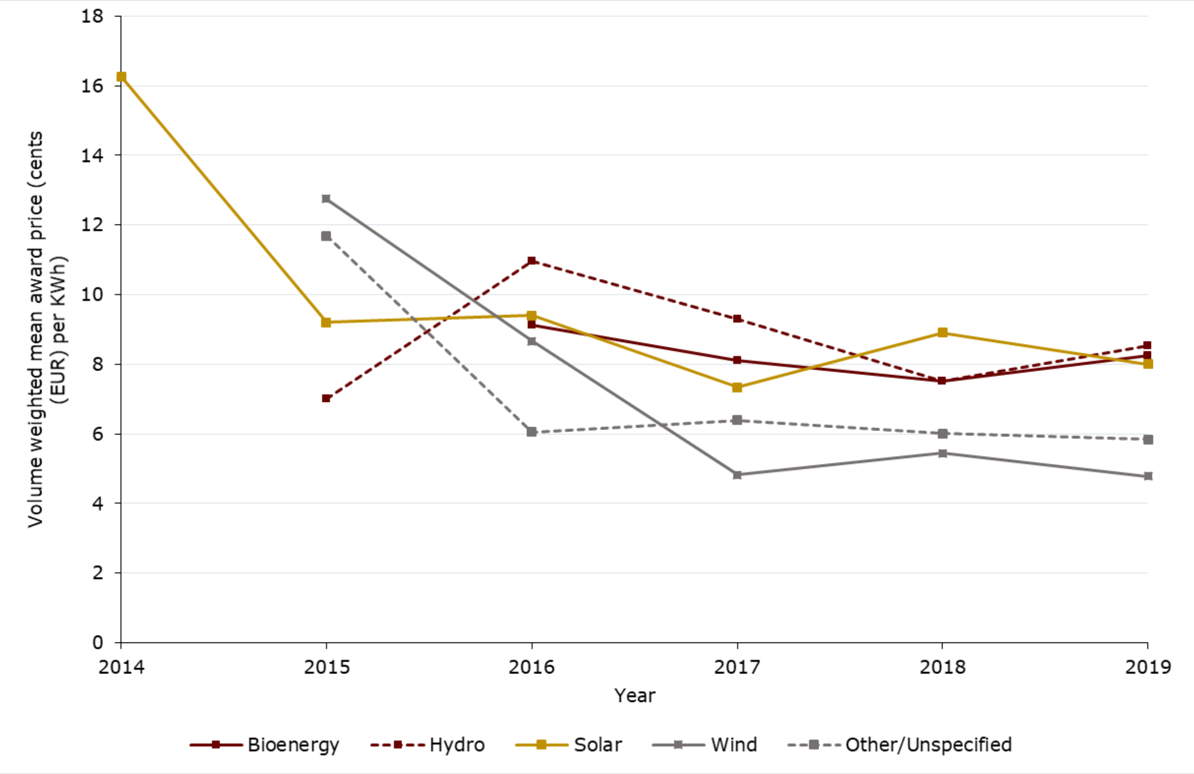
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure 10 shows that the weighted average award price for wind fell by 62% between 2015 and 2019, with most of this drop occurring between 2015 and 2017. The volume weighted mean price of wind in the sampled schemes dropped from 12.7 cents (EUR) per KWh in 2015 to 4.8 cents (EUR) per KWh in 2019. Also, the weighted average award price of solar in the sampled schemes fell by 51% between 2014 and 2019, with most of this fall occurring between 2014 and 2015. Since 2017, the average prices of all technologies in the sampled schemes have been below 9.5 cents (EUR) per KWh. Also, since 2017 wind has been the cheapest technology. In 2019 the average price for solar in the sampled schemes was 8.0 cents (EUR) per KWh, 67% above the average price of wind. In 2019 the weighted mean price for bioenergy plants was 8.2 cents (EUR) per KWh and for hydro it was 8.5 cents (EUR) per KWh.

---

[32] *This chart pools all available pricing data for bidding processes where volumes awarded were expressed in MW. No pricing data was available for Spain in 2016 or Italy or Luxembourg.*

Figure 10: Volume weighted mean price per KWh in sampled schemes split by high-level technology category, 2014-2019[33]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

In Figure 11 the mean price for each technology (pooling data across 2014-2019) is given in each Member State. Both the cheapest and most expensive technologies vary across Member States. For example, in France, Germany, Poland and Slovenia bioenergy was the most expensive technology, while in the Netherlands and Greece it was solar and in Denmark it was wind.

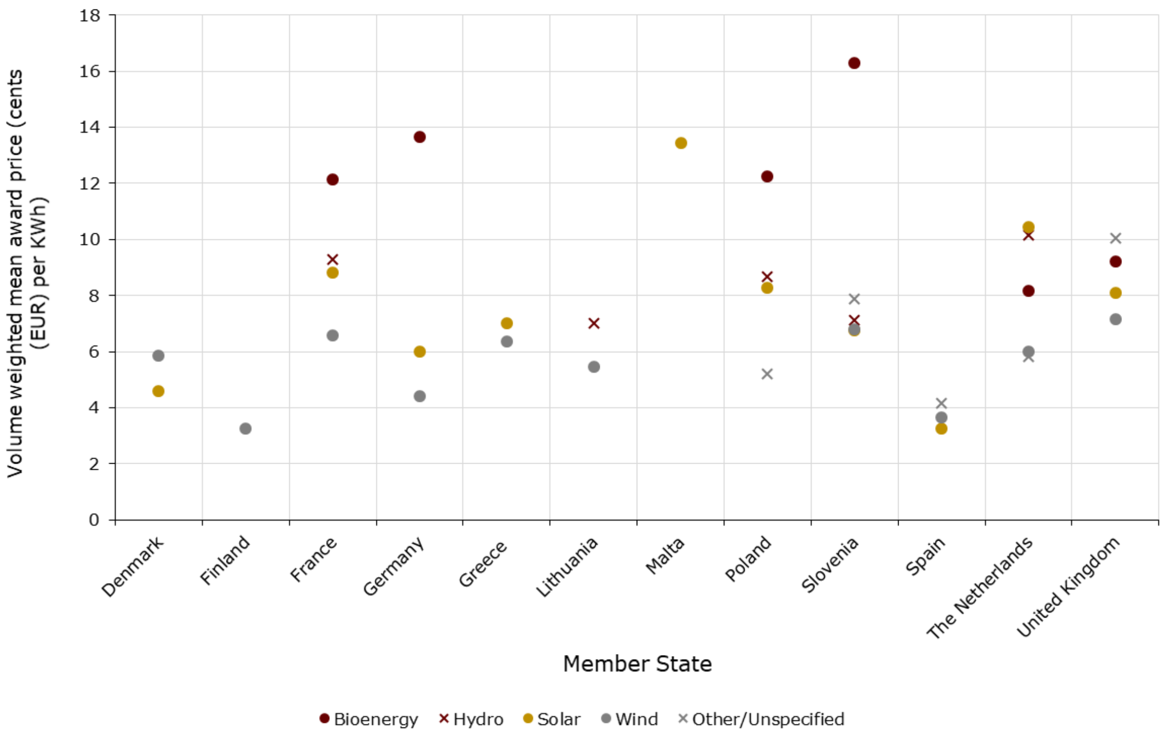
Figure 11 again highlights wind as a cheaper technology with it being, on average, the cheapest technology in the sampled schemes in 5 Member States[34], although, solar was on average cheaper in Denmark, Slovenia and Spain. Bioenergy appears particularly expensive relative to other technologies in Germany and Slovenia with it being, respectively, 128% and 112% above the weighted average price of the next most expensive technologies in each of these Member States.

In Figure A1.2.9 to Figure A1.2.11 in **Annex 1.2** the evolution of average prices over time within Member States for solar, wind and biomass/biogas are provided.

---

[33] This chart pools all available pricing data for bidding processes where volumes awarded were expressed in MW. No pricing data was available for Spain in 2016 or Italy or Luxembourg.
[34] France, Germany, Greece, Lithuania and the United Kingdom. Finland is not included in this figure as wind was the only technology receiving support.

Figure 11: Volume weighted mean price per KWh in sampled schemes split by technology and Member State, 2014-2019 pooled[35]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

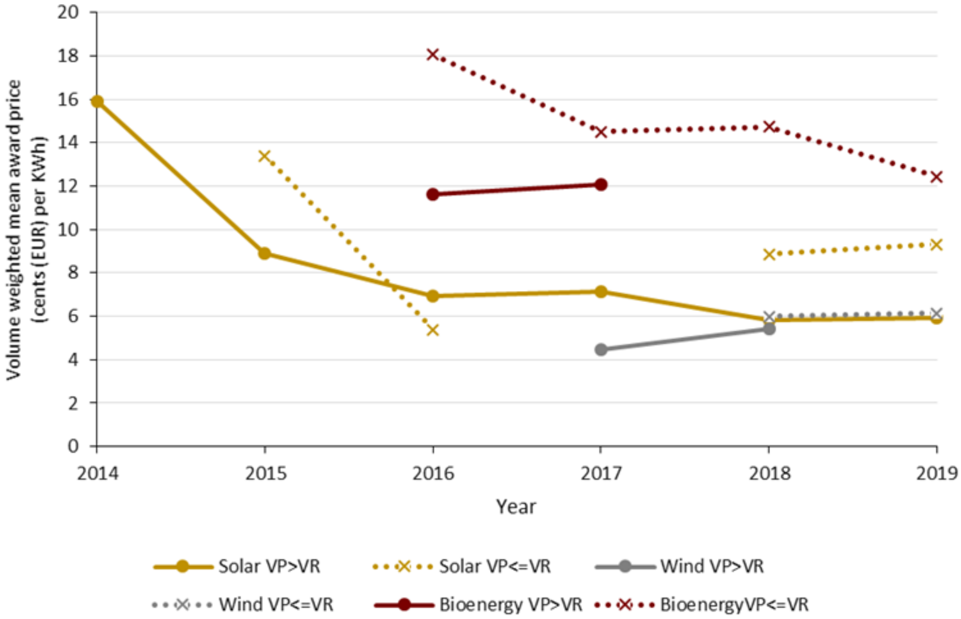
Figure 12 compares the volume weighted average award prices in oversubscribed bidding processes (volume participating>volume requested) to undersubscribed (volume participating≤volume requested) bidding processes. With the exception of solar in 2016[36], in all instances where a comparison is possible the average prices in the sampled oversubscribed processes were lower than the average prices in the sampled undersubscribed processes. The one note of caution with this finding is that many of the sampled schemes did not have the required data, in particular, none of the schemes in Slovenia, the Netherlands and the UK had the required data.

In Figure 12 the price gap between under -and over- subscribed bidding processes is larger for solar than for wind. In 2018 the average prices for under -and over- subscribed processes involving wind were 5.99 cents (EUR) and 5.43 cents (EUR) per KWh respectively, compared to 8.85 cents (EUR) and 5.81 cents (EUR) per KWh for solar.

---

[35] *The chart pools available pricing data for bidding processes. For France only bidding processes with volumes awarded expressed in MW are included. No pricing data was available for Spain in 2016, Italy or Luxembourg.*
[36] *Although this exception rests on a single data point for the 2016 undersubscribed solar value.*

Figure 12: Volume weighted mean price per KWh in sampled schemes (with required data)[37] for undersubscribed and oversubscribed bidding processes split by technology, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Comparing the prices in administratively set support schemes and bidding processes faces the inherent challenge that Member States are unlikely to award aid to identical plants through both routes at the same time. There are two main ways to compare prices between bidding processes and administrative schemes. One is to compare aid awarded in different years where one type of scheme precedes another and a second is to compare the support provided to different sized plants, as small plants can be exempt from EEAG and GBER tendering requirements. Both types of comparison should be treated with caution. If the costs of renewables fall over time and bidding processes replace administratively set support, there is the risk of a 'false positive' that bidding processes appear to be associated with lower prices. There is a similar risk of a 'false positive' if smaller plants have higher costs than larger plants and there is a legitimate reason for smaller plants to be built.

Table A1.2.1 in **Annex 1.2** provides 9 case studies where a competitively set price can be compared with an administratively set price for the same technology within a Member State. In Table A1.2.1 full details on the precise definition of the prices being compared is provided. 8 of the case studies compare plants of differing sizes/sub-types and 1 compares adjacent years. The case studies occur in the following Member States: Denmark (2 case studies), Finland, France, Germany (3 case studies), Greece and Malta.

---

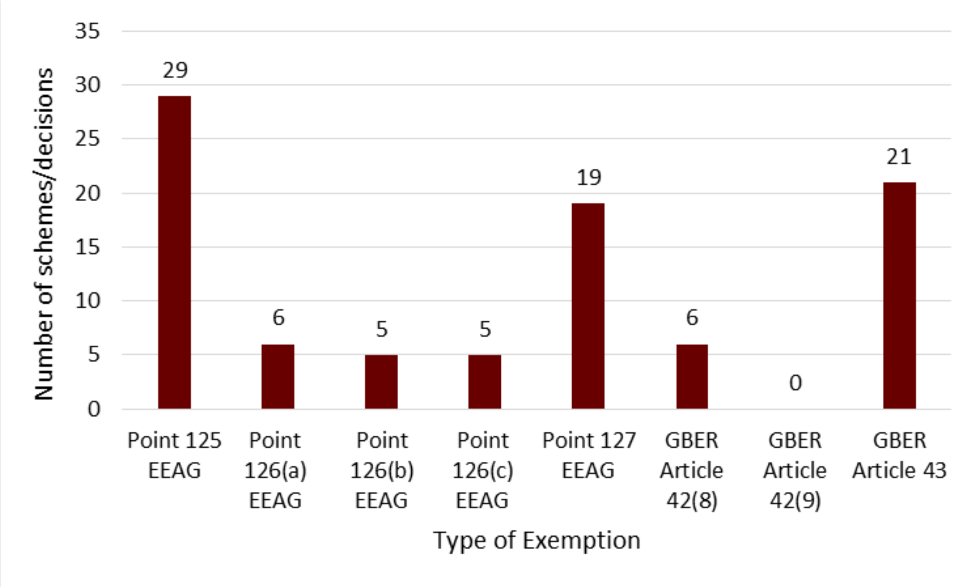
[37] This figure required data be available for volume participating, volume requested, volume awarded and award price. It also only considers bidding processes where the volumes were expressed in MW. These data requirements mean that for some technology-year combinations data is very limited, in some instances being only a single data point. One Spanish bidding process in 2017 is excluded from the figure where the volume participating exceeded the volume requested, but the auction authorities awarded support to all the volume that participated.

In the case studies in Denmark, Finland, Greece and Malta, together with the German case for offshore wind, the competitively set price is lower than all the possible equivalent administratively set prices. In the French solar case study from 2014, the challenge is the number of prices to compare (7 competitively set and 4 administratively set). In the French case study all the competitively set prices are higher than the lowest administratively set price[38] and 6 of the competitively set prices are higher than the 3 lowest administratively set prices. However, all the competitively set prices are lower than the highest administratively set price.[39] In the German case for onshore wind in 2017 the competitively set price is lower than 4 out of 6 administratively set prices.[40] Last, in the case study of German biomass support in 2017 the competitively awarded price is higher than all the administratively set prices. In a September 2017 bidding process aid was awarded to biomass installations of 150KW to 20MW at 14.3 cents (EUR) per KWh as a variable premium, in comparison an administratively set variable premium for installations under 100KW was 13.32 (EUR) per KWh. This German case study is the one case study where it is known that volume participating was below the volume requested.[41]

Figure 13 shows that the highest number of sampled schemes with EEAG and GBER exemptions, as detailed in Table A6.5.2, come under point 125 EEAG (29 schemes), followed by Article 43 GBER (21 schemes) and point 127 EEAG (19 schemes). However, the number of exemptions does not necessarily reflect the volume of aid granted under an exemption. Also, when considering Figure 13, it is worth noting that some schemes fall under multiple exemption categories. Point 125 EEAG exempts installations below 500 KW in capacity[42] or demonstration plants from market integration rules including that aid is provided as a feed-in premium that does not incentivise production when the electricity price is negative and that plants meet standard system balancing responsibilities. Point 127 EEAG exempts aid from a competitive bidding process for plants below 1 MW of capacity[43] or demonstration projects, while Article 43 GBER allows operating aid for RES installations below 500 KW in capacity,[44] subject to rules ensuring that the aid is not excessive.

[38] This lowest administratively set price is a catch-all price for installations below 12MW which do not fall into the specific sub-categories of solar technology for which bidding processes occur.
[39] This highest administratively set price is for solar units below 9KW built into the frame of buildings.
[40] The two lower administratively set rates are calculated as mechanical discounts from another of the administratively set rates and one is only available in exceptional circumstances.
[41] The volume requested in this bidding process was 122.5MW, the volume participating was 40.9MW and the volume awarded was 27.6MW.
[42] 3 MW or 3 generation units for wind energy.
[43] Below 6 MW or 6 generation units for wind energy.
[44] Below 3 MW or 3 generation units for wind energy; and capacity of less than 50,000 tonne per year for biofuels.

Figure 13: Number of sampled schemes/decisions per type of exemption



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

The volume of aid awarded under exemptions and the volume of capacity receiving exempt aid, by year and by Member State, were considered but not reported as it is uncertain whether the small quantity of available data is representative. Even for Member States where some relevant data is available, it covers a subset of schemes. The identified data is reported in **Annex 2**. However, it is possible to state that 11 schemes are covered in their entirety by an exemption; 4 of these are in France[45], 2 in Estonia[46] and one each in Hungary, Germany, Denmark, Malta and the Netherlands.[47] It is also possible to state that of the aid awarded in 2016 for the sampled Italian scheme, 32% of the capacity in MW built by the end of 2018 received administratively set support, while the other 68% received support awarded through a bidding process.[48]

5.1.4 Conclusions

The following main observations arise for the sampled schemes, subject to the caveats detailed above:

- The highest number of bidding processes occurred in 2018 with 71, while the highest volume awarded was 25.6GW in 2017. In 2016-2019, at least 45% of the volume awarded in each year was in bidding processes involving 4 or more technologies. However, it is unclear whether multi-technology auctions are associated with lower average award prices. Price comparisons are hampered by Member State specific

---

[45] SA.46898 (2016-2017), SA.47623 (2017), SA.43485 (2016) and SA.47957 (2017). The year in brackets is when aid was awarded.

[46] SA.36023 and SA.47354 (2014-2017) and SA.49198 (2018).

[47] Hungary: SA.44076 (2017); Germany: SA.48327 (2017-2019); Denmark: SA.51530 (2019); Malta: SA.42970 and SA.51961 (2015-2019); and the Netherlands: SA.53567 (2018).

[48] See SA.43756. The competitively set support includes counting the Italian 'Registry' system as a bidding process, with it being a multi-criteria tender. The percentages are based on capacity built by 31.12.2018 as listed in Table 2 of 'Activity Report 2018 – New Energy for the Future', Gestore Servizi Energetici (GSE), available at: https://www.gse.it/documenti_site/Documenti%20GSE/Rapporti%20delle%20attivit%c3%a0/GSE_RA2018.pdf

factors such as local climate conditions (e.g. sun and wind patterns), the size (in KW) of the installations admitted in the auctions or the length of support provided (in years).

- Between 2017 and 2019 wind had the lowest average award price. In 2019 the weighted average award price for wind was 4.8 cents (EUR) per KWh compared to 8.0 cents (EUR) per KWh for solar. The weighted average price of wind capacity fell by 62% between 2015 and 2019, while the weighted average price of solar capacity fell by 51% between 2014 and 2019.
- A greater number of single technology processes than multi-technology processes (30 against 4) had occasions where one might be concerned about competitiveness (in terms of the bid volume being below the requested volume). However, overall more single technology bidding processes took place, so that 26.5% of single technology bidding processes had a bid volume below the requested volume compared to 26.7% of bidding processes open to 2 or more technologies.
- Within the main technology categories undersubscribed bidding processes are found to have higher average award prices than oversubscribed bidding processes for the sampled schemes with the required data.
- Comparisons of prices between competitively awarded and administratively set support equally need to be treated with caution due to the lack of fully equivalent comparisons. Nevertheless, in 6 out of 9 case study comparisons, the competitively set price was lower than the administratively set prices. The clearest case where the administratively set price was lower involved a bidding process where the process was undersubscribed.
- Most exemptions fall under point 125 EEAG (29 schemes), Article 43 GBER (21 schemes) and point 127 EEAG (19 schemes).
- Data on value (EUR) and volume (MW) of aid awarded under exemptions is available for a minority of sampled schemes. Relevant data is hard to identify as exemptions cover only a small element of some schemes.
- Less data is available for schemes covered by GBER exemptions compared to EEAG exemptions due to the brevity of GBER notification sheets compared to EEAG decision documents.

5.2 Support for high efficiency Combined Heat and Power (CHP) technologies

Question 3: To what extent have the EEAG ensured that support for high energy efficient cogeneration and district heating was effective? (see Annex 0 for a list of all questions).

5.2.1 Introduction

The objective is to understand how support for high efficiency Combined Heat and Power (CHP) plants varies across technologies, plant sizes, time and Member States, as well as how the level of aid varies by the main features of the support schemes. The definition of high efficiency cogeneration is provided in Directive 2012/27/EU.[49] For plants with an electrical capacity of 1 MW or above, high efficiency is defined as a primary energy saving of at least 10% relative to the separate production of heat and electricity by reference

---

[49] *See https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:en:PDF.*

plants. For plants with an electrical capacity below 1MW, high efficiency is defined as a primary energy saving which is positive.[50]

Of the sampled State Aid cases, two, in Denmark (SA.44922) and Lithuania (SA.41539), involve investment aid and relate to specific named plants. The other cases involve operating aid. To allow a comparison of aid levels across both types of scheme, where operating aid is provided a discounted lifetime aid amount is calculated. Due to a lack of data on the actual aid distributed to specific plants by year in Member States beyond Denmark and Lithuania, for the other Member States aid levels are calculated for hypothetical 'case study' CHP plants that vary according to their technology and size.

One finding is that different schemes target support at different types of CHP. For example, Denmark and Lithuania provide support to plants over 15 MW of electrical capacity fired by biomass, whereas the sampled French scheme is specifically for natural gas plants with a capacity below 1 MW. Also, the Dutch SDE+ scheme provides support to biomass CHP plants as a form of renewable heat rather than due to them providing high efficiency cogeneration. There are differences in the level of aid awarded across different technologies, plant sizes and Member States.

These results reflect the fact that potential CHP installations vary in their characteristics. Initially, the chosen case study plants ranged from a fuel cell unit with a net electrical capacity of 0.7 KW to a gas turbine plant with a net electrical capacity of 44.5 MW. However, after calculating the primary energy saving for the case study plants, it was found that all the example gas turbine and steam turbine plants, when fuelled by natural gas, did not meet the required primary energy savings to be classified as high efficiency cogeneration. Calculations are performed for new build plants fuelled by natural gas, except for the Netherlands where calculations assume a solid biomass fuel to reflect the SDE+ scheme's support for CHP plants being focussed on bioenergy fuelled plants.[51]

5.2.2 Methodology

Data was gathered for the 10 combined heat and power (CHP) schemes detailed in Table A6.5.3 in **Annex 6.5**. These schemes were sampled on the direction of the Commission. Among schemes involving operating aid, Belgium (Flanders) and Poland (before 2019) involve certificate schemes. France, the Czech Republic and Germany (prior to 2019) involve calculations based on administratively set tariff rates. The SDE+ scheme in the Netherlands involves a bidding process and the calculations use the weighted average level of support implied by aggregate auction outcome data.[52] The German calculations for 2019 are based on the average weighted surcharge from the December 2017 tender.[53] An auction relating to CHP support was run in Poland in late December 2019, however, this

---

[50] See Annex II, Methodology for Determining the Efficiency for the Cogeneration Process, Directive 2012/12/EU, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:315:0001:0056:en:PDF.
[51] E.g., see plant types listed in: https://english.rvo.nl/sites/default/files/2019/10/Brochure%20SDE%20plus%20ENG%20Autumn%202019.pdf.
[52] The available pricing data aggregates across different types and sizes of biomass plant, including plants that do not explicitly refer to CHP.
[53] The year refers to the date of plant commissioning. In Germany it is assumed that plants commissioned in 2017/2018 made the necessary application before 31.12.2016 to receive an administratively set rate of support.

auction appears to provide support beginning in 2021, with aid for plants constructed in 2019 being administratively determined.[54]

A methodology was established to estimate the value of the operating aid received for a series of example 'case study' plants over their lifetime of operation. Not all technologies involve plants of equivalent sizes. Some technologies, such as microturbines, are small scale, the largest case study microturbine plant being 950KW. To calculate aid levels, plant characteristics beyond their electrical output were required, such as their heat and electrical efficiency, to estimate their primary energy savings. To estimate the aid received, it is therefore necessary to specify a large number of parameter values for each plant. To ensure plants involve plausible sets of characteristics (from an engineering perspective), the example CHP plants are those whose characteristics are listed in the US Environmental Protection Agency's 'Catalog of CHP Technologies'.[55] At times, additional parameters to those detailed in the catalogue have had to be specified or calculated. When specifying the combination of parameters for the example CHP plants the project team does not claim engineering expertise. Also, the relative frequency of these different case study plants in Member States is not known.

The full characteristics of the case study plants are provided in the 'EPA' tab of **Annex 3.1**. In Table A6.5.4 in **Annex 6.5** a summary is provided of the electricity and thermal outputs of the case study plants split by technology. In total, 24 types of case study CHP plant were considered: internal combustion engines (100 KW to 9.3 MW); gas turbines (3.3 to 44.5 MW); steam turbines (0.5 to 15 MW); microturbines (28 to 950 KW); and fuel cells (0.7 KW to 1.4 MW). However, 10 of these case study plants were not classified as high efficiency when fuelled by natural gas, while 14 did meet the high efficiency definition (5 internal combustion engine plants, 4 microturbine plants and 5 fuel cell plants).[56] Based on the plant characteristics detailed in **Annex 3.1**, the value of aid received on an annual basis has been calculated. These calculations are based on the project team's best interpretation of the support schemes' rules, which are generally complex. These annual figures (over the period of time given for the receipt of aid specified in national legislation/regulations) are then discounted to provide a lifetime figure for the aid provided. A common discount rate, the ECB's HICP Eurozone inflation rate, is used for all Member States.[57] To allow comparison across schemes two lifetime aid amounts per unit of installed capacity are provided, one where the denominator is a plant's electrical output and one where the denominator is a plant's thermal output.[58] The resulting lifetime aid amounts are provided in the 'Summary' tab of **Annex 3.1**.

---

[54] Details of the 2019/2020 administratively set support in Dz.U. 2019 poz.1671, available at: http://prawo.sejm.gov.pl/isap.nsf/download.xsp/WDU20190001671/O/D20191671.pdf; details of auction held in Dec. 2019 in 'Information from the President of the Energy Regulatory Office No. 103/2019 regarding the results of cogeneration premium auction No. ACHP/1/2019', available at: https://www.ure.gov.pl/pl/efektywnosc-kogenerac/energia-z-kogeneracji/aukcje-chp/8405,Ogloszenia-i-wyniki-aukcji.html

[55] U.S. Environmental Protection Agency Combined Heat and Power Partnership, 'Catalog of CHP Technologies', Sep. 2017, https://www.epa.gov/sites/production/files/2015-07/documents/catalog_of_chp_technologies.pdf.

[56] The primary energy saving calculations for plants with identical characteristics can vary slightly across Member States, and between years before and after 2016, due to variations in the reference efficiency values used for separate heat and electric plants. In borderline cases this can affect whether a plant is judged to be high efficiency.

[57] For years that have already occurred the actual inflation rate is used, while for future years the ECB's most recent projections are used.

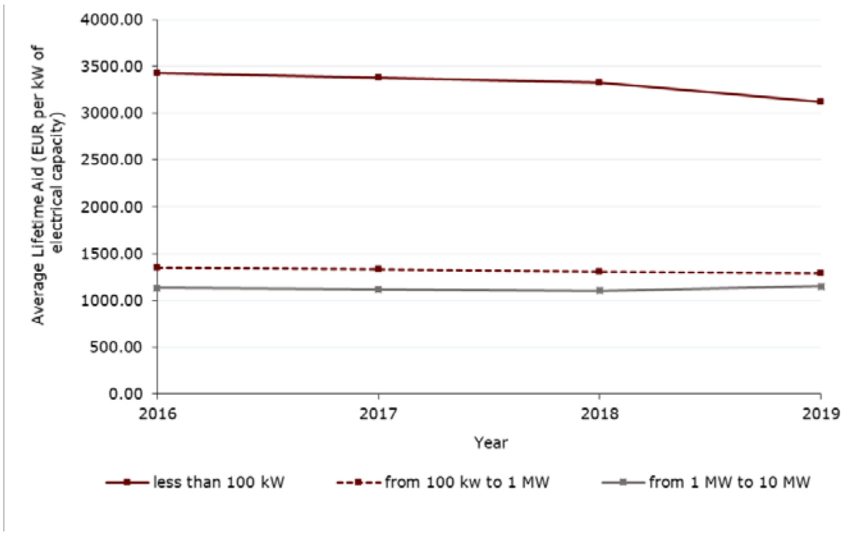
[58] How operating aid is spread over time and the discount rate applied will influence comparisons between schemes involving operating aid and those comprising upfront investment aid.

5.2.3 Results overview

The results below are based on the lifetime aid per unit of electrical capacity. Additional results, including those based on lifetime aid per unit of heat capacity are provided in **Annex 3.2**. As the balance between electricity and heat outputs can vary by technology, the results may differ between these two units of assessment. In particular, for the SDE+ scheme in the Netherlands in 2018 and 2019, the aid amounts per unit of electrical capacity are very high, because aid is awarded for heat and electrical output. For this reason, the Netherlands is discussed in the text rather than presented in Figure 15 to Figure 17. All lifetime investment aid amounts referred to below are expressed in 2019 prices as EUR per KW. The averages presented in Figure 14 to Figure 17 and in **Annex 3.2** are simple arithmetic averages taken over those case study plants in a given Member State that would have received a positive amount of aid in a given year.[59] As such, these averages do not claim to represent the actual distribution of different plant types observed in Member States. In Denmark, a 22.5 MW woodchip fired steam turbine plant received lifetime aid of EUR 2,588 per KW, whereas in Lithuania two steam turbine plants (one waste fuelled and one woodchip fuelled) totalling 88 MW received lifetime aid of EUR 1,782 per KW. The aid per KW was therefore 45% higher in the Danish case.

In all years for which lifetime aid amounts were calculated in France, Germany, the Czech Republic and Poland (plus Belgium prior to 2018) case study plants with a capacity below 100 KW on average received a higher level of lifetime aid per unit of electrical capacity than those with a capacity between 100 KW and 1 MW. In Poland the average aid for case study plants below 100 KW in size was 1-2% above those in the 100 KW to 1 MW range. In the Czech Republic average aid levels for the smaller plant category were 1.8 to 2.1 times higher than for the larger plant category, while in Germany it was around 2.5.[60] Figure 14 shows that in each year the lifetime aid per KW for case study plants below 100 KW in Germany was above EUR 3,100 per KW of electrical capacity, while for case study plants in the 100 KW to 1 MW size range, support never exceeded EUR 1,400 per KW.

Figure 14: Average lifetime aid for case study CHP plants (EUR per KW of electrical capacity), split by size of plant in Germany, 2016-2019



[59] *The number of case study plants forming each average can therefore vary between Member States and years.*
[60] *The figures for Poland and Czechia cover 2014 to 2019, while those for Germany cover 2016 to 2019.*

Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

In Germany, the higher level of aid for the smallest case study power plants is a mechanical result of the scheme's design. In general, the maximum number of operating hours for which CHP plants in Germany can receive aid is 30,000 hours. However, plants with an output below 50 KW can claim aid for 60,000 hours. The difference in aid levels by plant size in the Czech Republic is also a direct result of differences in the unit rates of support. In 2019 the Czech Republic's Green Premium for plants of 0-200 KW capacity is CZK 864 per MWh, for those of 200 KW to 1 MW capacity is CZK 549 per MWh and for those of 1-5MW capacity is CZK 318 per MWh.[61] The specifics of the changes to the top up tariffs are detailed in the 'Czech Republic' tab of **Annex 3.1**. In Belgium the average level of aid for the case study plants below 100KW fell between 2017 and 2018, with this change being driven by plants with an electrical capacity below 10 KW no longer being eligible for CHP certificates.

Figure 15 reports the average lifetime aid level per KW of electrical capacity for the case study plants with a capacity below 100 KW. It shows variations across Member States, from EUR 351 per KW in Belgium to EUR 3,124 per KW in Germany in 2019. While Belgium also provides the lowest level of support for the case study plants in the 100 KW to 1 MW range, Figure 16 shows that France provides a higher level of aid than Germany in this size range. In France, estimated lifetime aid was EUR 2,158 per KW of electrical capacity in 2019 compared to EUR 1,293 per KW in Germany.

One factor influencing the comparatively high value of lifetime aid for French plants in the 100KW to 1MW range is that in France aid is provided for 15 years, whereas in Germany plants in this size range would be subject to 30,000 hour limit which for the case study plants meant aid lasts for less than 8 years. In the French scheme there is also a much smaller reduction in aid by size of plant. French plants below 300KW can receive a set purchase price, while those above 300KW receive a top-up premium. The value of aid for plants above 300KW is slightly lower as there is a deduction linked to the cost of capacity certificates.[62]

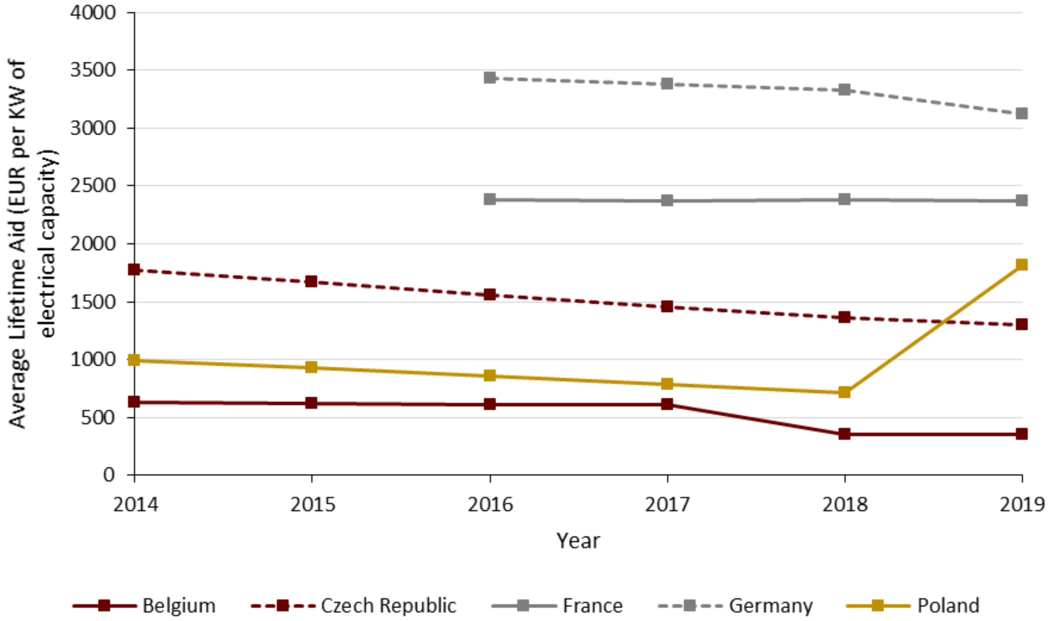
A feature of Figure 15 to Figure 17 is the increase in support in Poland between 2018 and 2019. In 2019, the Polish CHP certificate scheme was replaced by a new system involving both administrative support and a plan for competitively awarded support. However, the competitive auction process was only held for the first time in late December 2019 The lifetime aid levels for plants constructed before 2019 are held down because under the new scheme 'existing plants' are given a per unit level of support lower than the market value of the certificates that had previously been in place.

For example, in 2018 the market value of a 'yellow' certificate was PLN 108.76 per MWh, but existing plants below 1MW in size were due to receive only PLN 69.17 per MWh in 2019. In contrast, a new plant of equivalent size constructed in 2019 was scheduled to receive PLN 141.19 per MWh. The upward jump in support shown for Poland in 2019 is

[61] These unit rates are those for a plant not operating for more than 4,400 hours per annum. For plants operating no more than 3,000 hours per annum the equivalent rates are CZK 1,283, CZK 915 and CZK 626 per MWh.
[62] For both sizes of a plant the value of aid is set by a formula which is linked to the monthly average gas price and also includes an element directly linked to the size of the primary energy saving achieved by a plant. The formulae are provided in paragraphs 25 and 26 of the State Aid decision document SA.43719.

sensitive to the level of aid that plants built in 2019 will continue to receive in future years.[63]

Figure 15: Average lifetime aid for case study plants below 100KW (EUR per KW of electrical capacity, 2019 prices) by Member State, 2014-2019



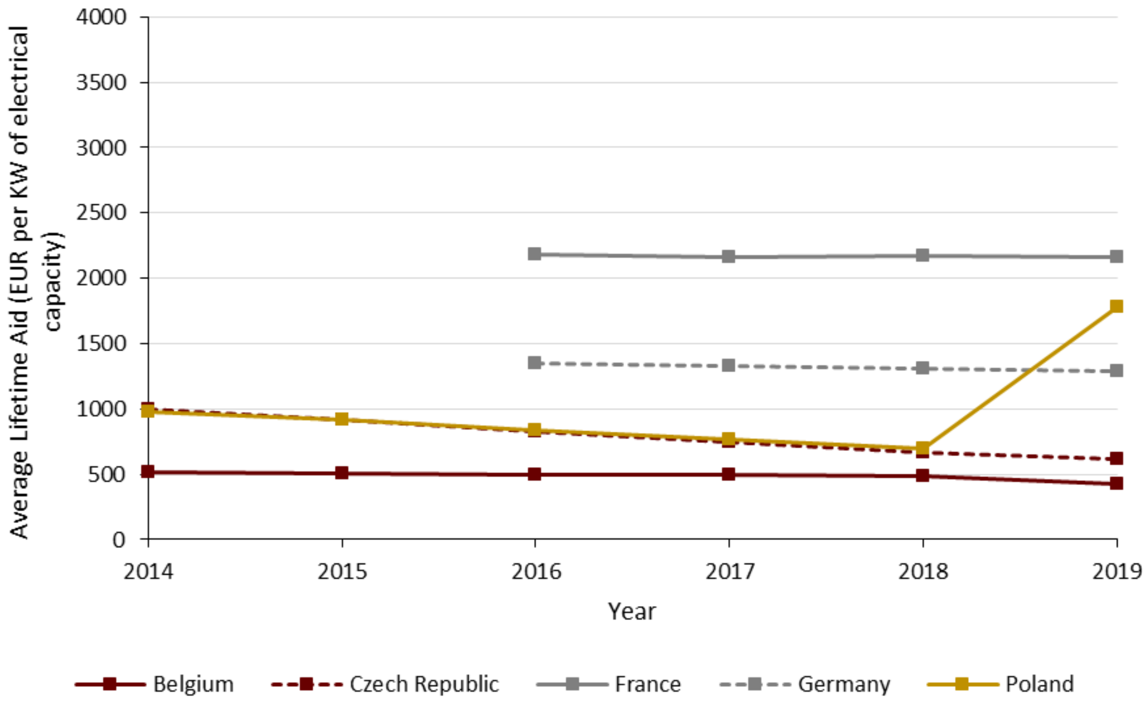
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

In **Annex 3.2** graphs are provided reporting lifetime aid amounts per unit of heat capacity. In Figure A3.2.5, which reports lifetime aid per unit of heat capacity for case study plants between 1 MW and 10 MW, the Netherlands is included.

---

[63] *The calculations are based on the assumption that support for a 2019 plant remains constant at the level stated for 'new' plants in 2020.*

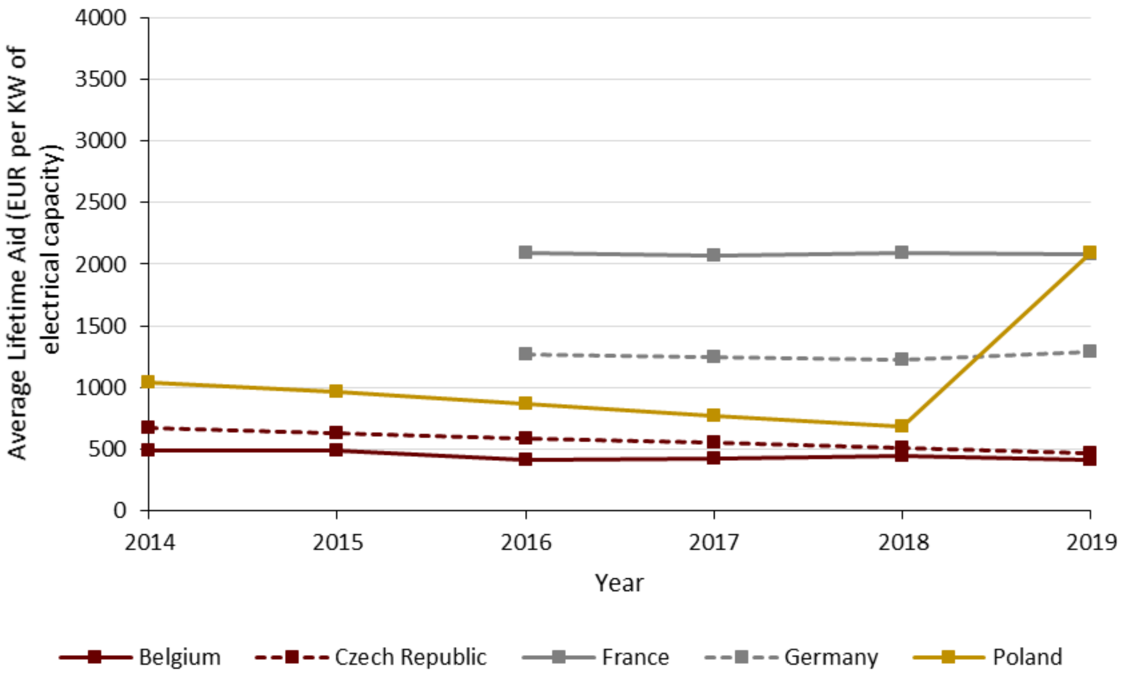
Figure 16: Average lifetime aid for case study plants 100 KW to 1 MW (EUR per KW of electrical capacity, 2019 prices) by Member State, 2014-2019



Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

In Figure 17 the average lifetime aid levels are shown for case study internal combustion engine plants. Compared to the average levels of aid by size of plant reported in Figure 15 and Figure 16, Figure 17 shows that the average support level provided in Poland for the case study internal combustion engine plants is higher than in the Czech Republic.

Figure 17: Average lifetime aid for case study internal combustion engine plants (EUR/KW electrical capacity, 2019 prices) by Member State, 2014-2019

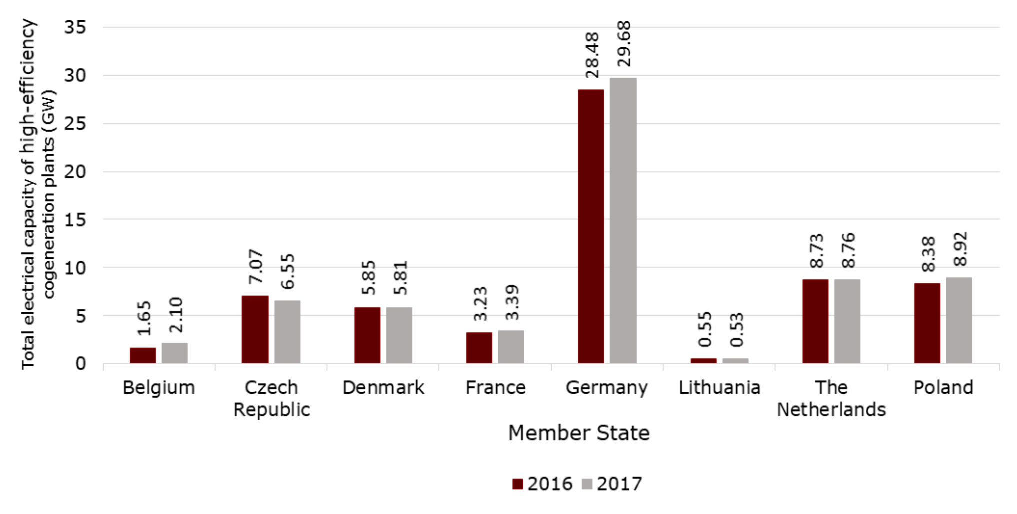


Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

In Table A3.2.1 in **Annex 3.2** the precise details of the two available case studies providing comparisons of the level of aid awarded to high efficiency cogeneration plants between bidding processes and administratively set support are provided. As with the case study comparisons discussed in section 5.1.3, these comparisons need to be treated with some caution. The first comparison is between a 2019 Polish tender awarding support from 2021 onwards with the administratively set premium in 2019. The competitively set fixed premium is 1.97 cents (EUR) per KWh, compared to an administratively set fixed premium of 3.29 cents (EUR) per KWh. The second comparison is between administratively set support in Germany in 2016 and the support awarded in a December 2017 tender. The tender awarded a fixed premium of 4.05 cents (EUR) per KWh to plants with a capacity of 1-50MW. This is above the below fixed premium in the 2016 administratively set support scheme of 4.4 cents (EUR) per KWh for plants between 250KW and 2MW of capacity, but above the rate of 3.1 cents (EUR) per KWh for plants with capacity above 2MW. A factor that may influence the value of aid in the 2017 tender is that the volume awarded was below the volume requested (82MW against 100MW).

Figure 18 shows that Germany in 2017 had high-efficiency cogeneration plants with the highest electrical capacity of sampled Member States at 29.7GW, with the next highest capacities being 8.9GW in Poland and 8.8 GW in the Netherlands. In terms of changes in capacity between 2016 and 2017, Figure A3.2.8 shows that the largest percentage increase occurred in Belgium with high-efficiency cogeneration electrical capacity increasing by 27.4%. In three Member States (the Czech Republic, Denmark and Lithuania) high-efficiency cogeneration electrical capacity fell between 2016 and 2017, with the largest percentage drop being in the Czech Republic at 7.3%.

Figure 18: Total electrical capacity (GW) of high-efficiency cogeneration plants for sampled Member States, 2016 and 2017

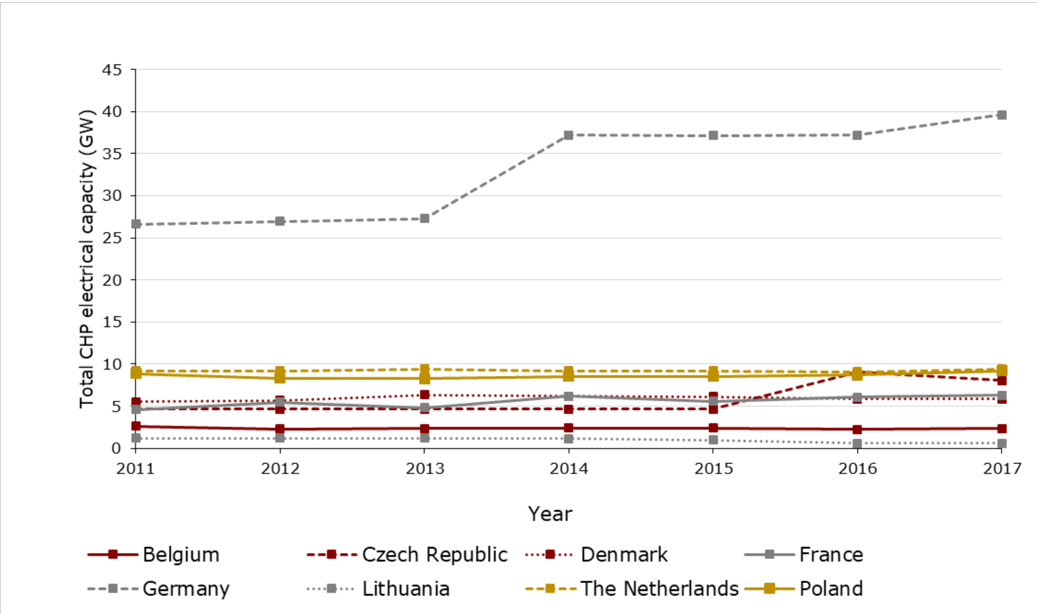


Source: Eurostat

As for total CHP capacity, Figure 19 shows that Germany has the greatest total capacity in 2017 at 39.6GW, while all other sampled Member States had total CHP capacity below 10GW. The increase in German CHP capacity between 2013 and 2014 is due to a change in the data reported to Eurostat; prior to 2014 the data only related to power units that were entirely dedicated to CHP. Aside from this, the largest increase in total CHP electrical capacity in absolute terms was for the Czech Republic between 2015 and 2016 when CHP electrical capacity increased by 4.4GW. In 2017 the sampled Member State with the lowest CHP electrical capacity was Lithuania with a capacity of 0.6GW. In Figure A3.2.9 in **Annex 3.2** CHP electrical capacity per capita is reported. Figure A3.2.9 shows that relative to the size of its population Denmark had the highest level of CHP capacity, with 1.0 KW per capita in 2017, while France had the lowest level of CHP capacity, with 0.1 KW per capita.

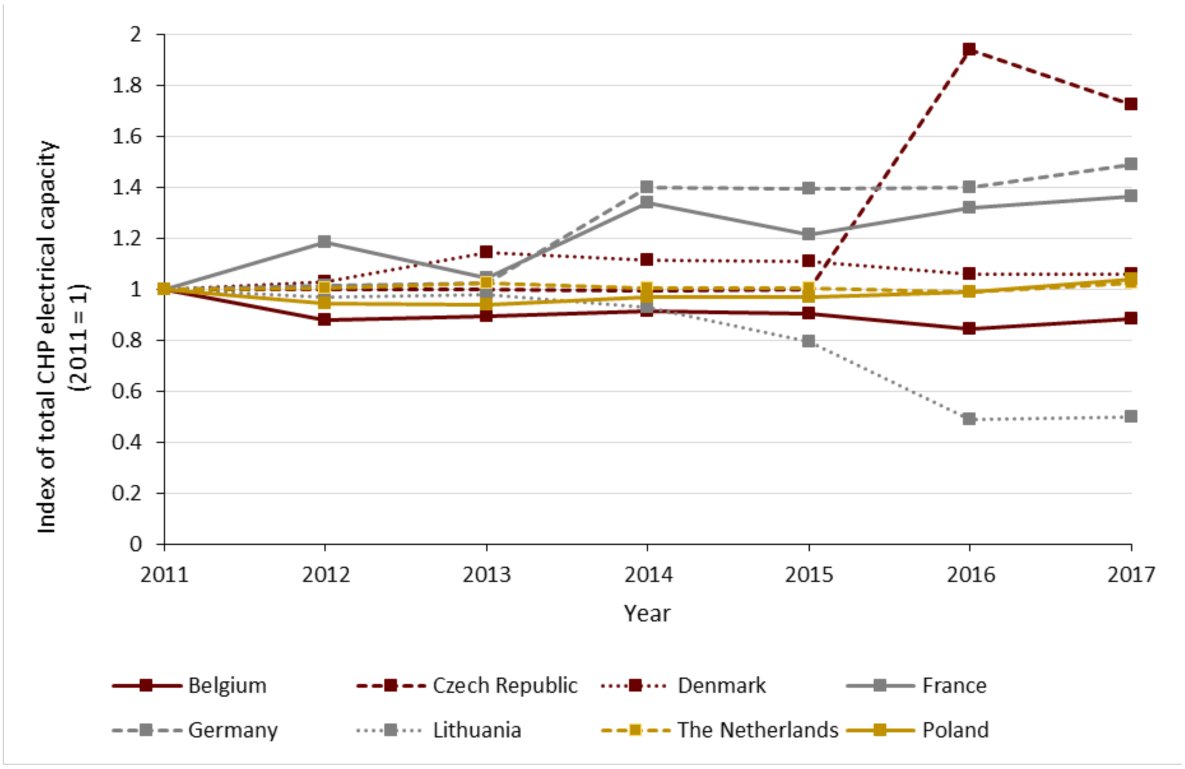
Figure 20 provides an index of total CHP capacity in each sampled Member State. This indicates the variation in the growth rates of CHP electrical capacity. In Belgium and Lithuania, total CHP electrical capacity was lower in 2017 than in 2011. In Lithuania total CHP electrical capacity fell by approximately 50% over the period.

Figure 19: CHP electrical capacity (GW) by sampled Member State, 2011-2017



Source: Eurostat

Figure 20: Index of total CHP electrical capacity by sampled Member State schemes, 2011-2017 (2011 = 1)



Note: The increase in recorded CHP capacity between 2013 and 2014 in Germany is the result of a change in the definition of the CHP plants reported to Eurostat.

Source: Calculations by Centre for Competition Policy, University of East Anglia using Eurostat data.

5.2.4 Conclusions

The following main observations arise, subject to the caveats detailed above:

- The average lifetime aid for the case study CHP plants varies across Member States. For example, for case study plants below 100 KW in capacity, lifetime aid per KW of electrical capacity in 2019 ranges from below EUR 500 in Belgium to more than EUR 3,000 in Germany. These differences likely reflect the wide variety of CHP installations used, differences in the size of the installations and the context in which they are used.
- The average lifetime aid is generally higher for case study CHP plants with smaller capacities. For example, in Germany, case study plants under 100 KW of capacity are calculated as receiving more than EUR 3,000 per KW of electrical capacity over their lifetime, while those of 100 KW to 1 MW are calculated as receiving between EUR 1,000 and 1,500 per KW of electrical capacity.
- There is variety in the growth rates of high efficiency CHP and total CHP capacity across Member States.
- The comparison of lifetime aid amounts for the case study plants is influenced by the modelling assumptions used, in particular, that levels of aid do not change significantly after 2019.

5.3 Capacity mechanisms – auction outcomes and scheme designs

Question 4: To what extent have the EEAG ensured that capacity mechanisms were cost-effective in providing security of supply and least-distortive to competition? (see Annex 0 for a list of all questions).

5.3.1 Introduction

To assess the performance of capacity mechanisms, while taking into consideration the design of schemes, a sample of 11 schemes across 7 Member States is considered (see Table A6.5.4 in **Annex 6.5**). For the sampled schemes, data was collected (and is reported below) from 2014 or the start of scheme, rather than from the date when a decision led to the capacity mechanism being adopted under the EEAG. The longer time series of data is provided for illustrative purposes.

The schemes vary in their design features, as shown in Table 4 below. The largest French scheme is a decentralised certificate scheme where energy suppliers must hold a certain number of certificates proportional to the quantity of energy supplied. Greece runs schemes on a quarterly rather than annual basis and Ireland has derating factors that vary by plant size as well as technology. Germany runs weekly capacity auctions where prices are set both for the quantity of capacity provided and for the level of electricity production. The German scheme also frequently clears at or near its price cap.

Table 4: Description of sampled capacity mechanisms by Member State

Member State	No. of schemes	No. of Rounds	Contract Length	Comments
Belgium	1	4	1 and 3 years	Data for 2014-15 and 2015-16 indicates a T1 scheme involving gas, CHP and Demand Side Response (DSR)

France	3	5	1 and 20 years	Scheme 1: Main scheme run in 2017 and 2018 is a certificates scheme where energy providers must each hold a certain amount of capacity to cover peak demand. Scheme 2: 'Erasure' scheme is T-1 involving DSR. Scheme 3: Additional capacity for Brittany with 20 year contracts.
Greece	2	32	Quarterly	Scheme 1: Main scheme involves DSR. It is split into two components one for DSR lasting up to 1 hour and one for DSR lasting up to 48 hours. Scheme 2: In 2018 and 2019 a transitory multi-technology mechanism was introduced where 95% of the capacity awarded was to hydro and gas plants
Ireland	1	3	-	Covers Republic of Ireland and Northern Ireland. Two T-1 rounds and one T-4 round. Contract length data unavailable
Poland	1	3	1, 5, 7, 15 and 17 years	T-5 scheme, includes both generation and DSR.
UK	2	9	1, 3, 4, 10, 12, 14, 15 years	Excludes Northern Ireland. Main scheme involves T-1 and T-4 auctions. Second scheme covers supplementary capacity auction in 2017. Schemes involve both generation and DSR.
Germany	1	273	Weekly	Provides DSR with rounds split into two types according to speed of response. Payment comprises two elements: one linked to capacity and one linked to energy production. The auctions always end at or close to the price caps for each element.

Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

5.3.2 Methodology

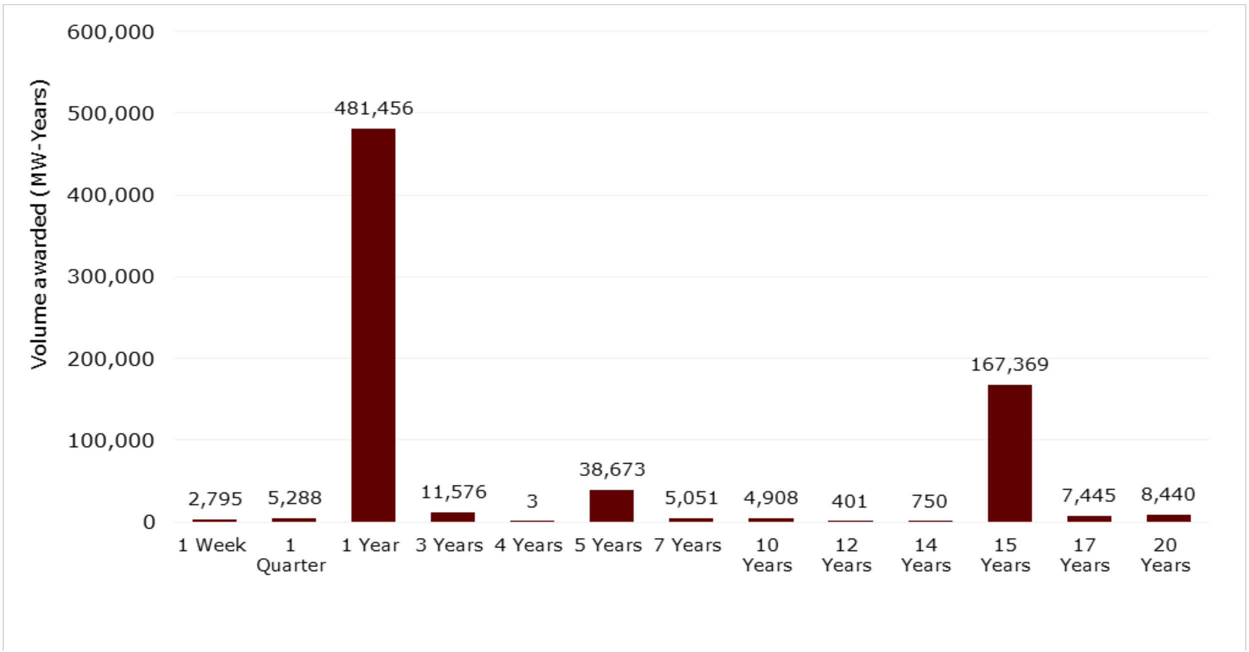
For each scheme, the aim was to collect data on derating factors, the nature of the scheme (T-1, T-4/5 or certificates), the capacity price, the price cap and amount of capacity awarded by technology/energy source. The information obtained is reported in **Annex 4.1**. The number of de-rating factors for the Republic of Ireland mean they are provided separately in **Annex 4.2**. In **Annex 4.3** obligations placed on those providing capacity for the delivery of capacity and testing for its presence are provided. In Poland and the UK the figures on capacity awarded are split between existing, refurbished and new capacity[64], but this split by different types of capacity (existing, refurbished, new) is not available for individual technologies.

5.3.3 Results overview

Figure 21 shows that when awarded capacity is expressed in megawatt-years[65], 65.5% of capacity has been awarded via one year contracts, almost three times as much as for the next most awarded contract length of 15 years.

[64] *This split has also been identified for the Britanny Additional Capacity scheme in France in 2011, and for the Irish Capacity Mechanism in 2017.*
[65] *One megawatt-year represents a megawatt of capacity being provided for one calendar year.*

Figure 21: Volume awarded by contract length in sampled capacity mechanisms



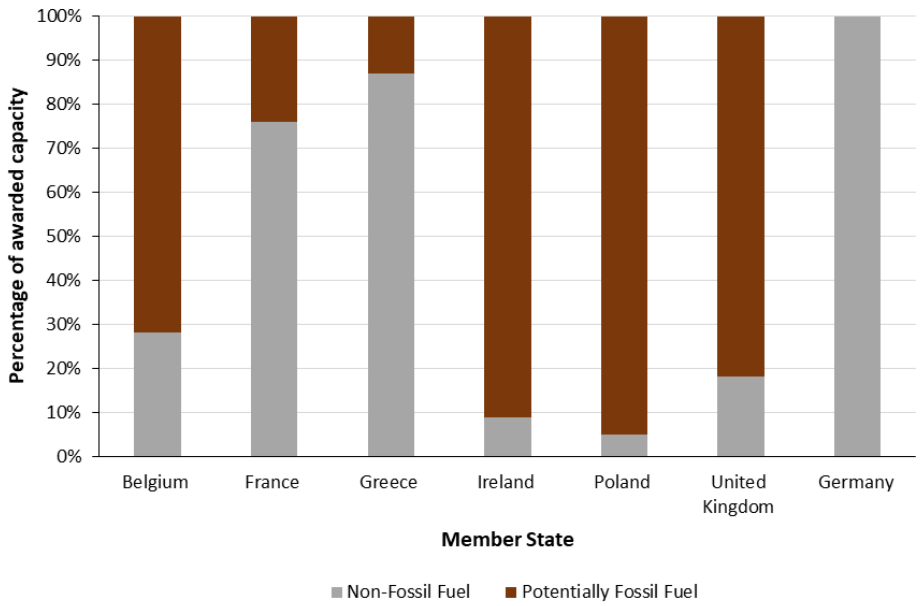
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

One question is the extent to which capacity mechanisms provide support to technologies using fossil fuels. Figure 22 shows the percentage of capacity that could be using fossil fuels over the period 2014-2019 for sampled schemes. Due to data limitations these percentages are not be weighted by the length of contracts awarded to different types of plants/capacity and so are based on MWs rather than MW-years.[66]

Also, as the data on awarded capacity is split by technology rather than fuel type, Figure 22 only provides an upper bound on the proportion of capacity that could be using fossil fuels.[67] That 100% of the capacity in Germany is non-fossil fuel results from its sampled scheme being DSR, which is also the reason for Greek capacity being 87% non-fossil fuel. That 76% of capacity in the sampled French schemes is non-fossil fuel is the result of around 60% of awarded capacity involving nuclear plants. In contrast, in Poland and Ireland over 90% of awarded capacity is potentially fossil fuelled.

[66] *Ireland, Poland and the UK do not report the length of contracts awarded to different technologies.*
[67] *In particular, capacity taking the form of interconnectors, storage and energy from waste were included in the category 'potentially fossil fuel'.*

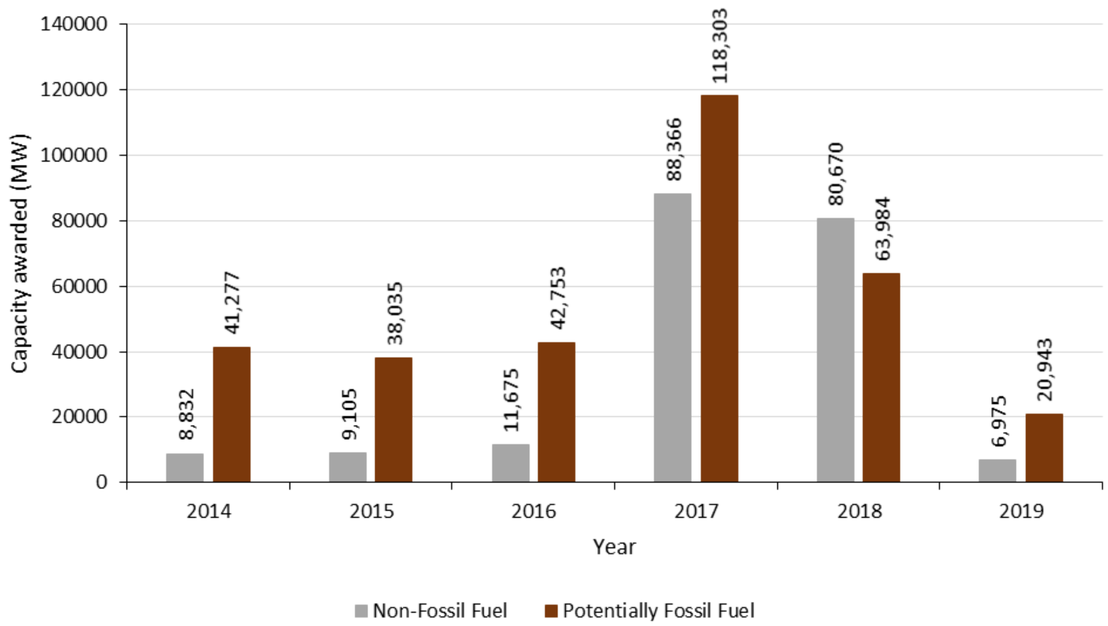
Figure 22: Percentage of capacity (MW) receiving support that may use fossil fuels in sampled capacity mechanisms by Member State, 2014-2019



Source: Calculations performed by Centre for Competition Policy, University of East Anglia based on material collated from national authority websites, national authority documents and European Commission decision documents.

Figure 22 shows that for the sampled capacity mechanisms in 5 out of 6 years the capacity awarded (in MW) potentially fuelled by fossil fuels was higher than the non-fossil fuel capacity awarded. In 4 years at least 80% of the capacity awarded was potentially fossil fuelled.

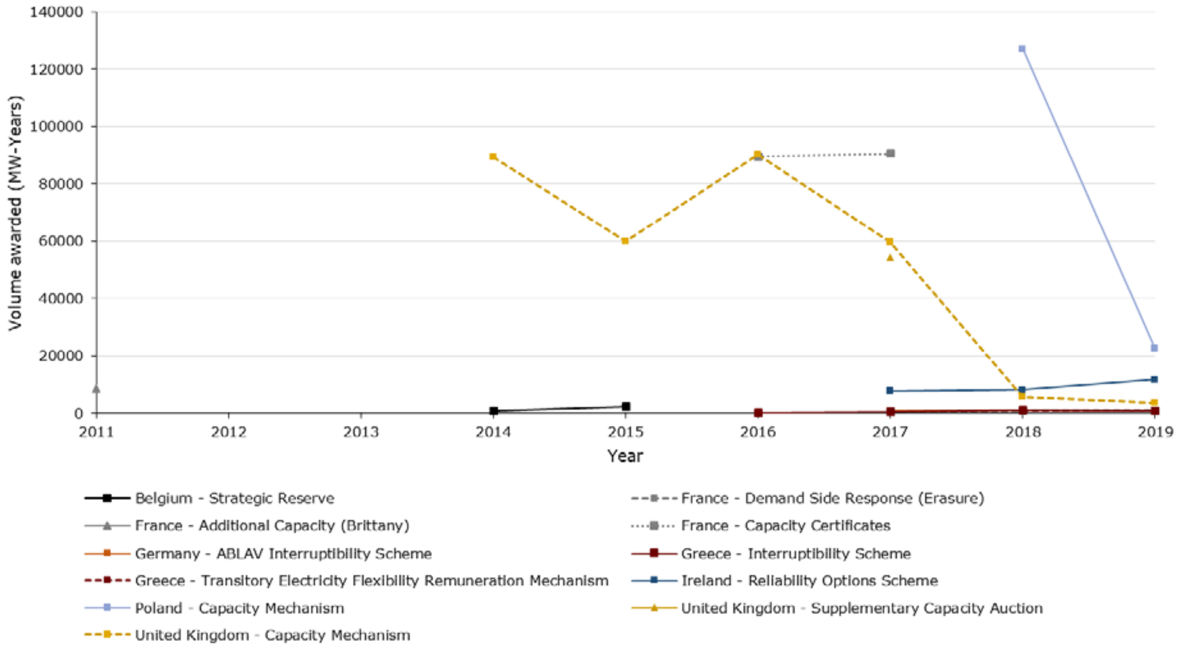
Figure 23: Capacity awarded (MW) in sampled capacity mechanisms split by potential fuel type, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

The volumes awarded in the capacity mechanisms vary by Member State. Figure 24 shows that Poland, France and the UK in certain years each purchased more than 80,000 MW-years of capacity. Germany, Belgium, Greece and Ireland never purchased more than 12,000 MW-years of capacity in a given year. Figure 24 also shows drops in the capacity awarded in Poland (from 126,968 MW-years to 22,567 MW-years between 2018 and 2019) and in the UK (from 90,210 MW-years in 2016 to 5,798 MW-years in 2018). The drop in Poland may be related to the number of multi-year contracts being awarded in 2018.

Figure 24: Volume awarded (MW-years) in sampled capacity mechanisms, 2011-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

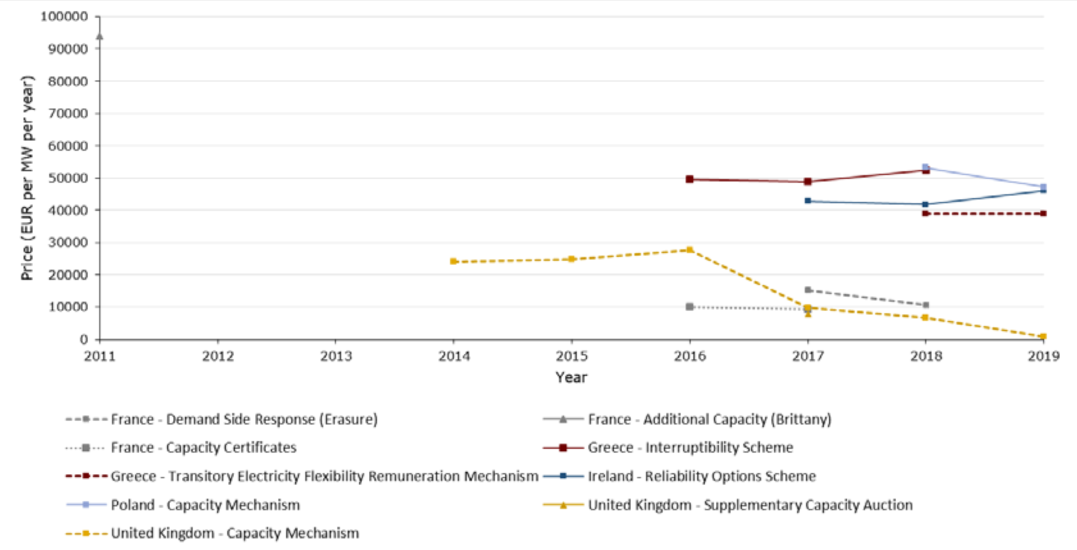
Turning to the average capacity prices over time, the UK and Poland have lower prices per MW-year in 2018 and 2019 when they were purchasing a lower quantity of capacity. The mechanisms in Greece, the Republic of Ireland and Poland have higher capacity prices than those in France[68] and the UK. Germany is not featured in Figure 25 due to the two-part pricing structure of its capacity mechanism. Belgian data is reported for 2014 and 2015 only, as no auction was held in 2016 and data for the 2017 auction was unavailable. In Figure 24 and Figure 25, the UK Supplementary Capacity Auction and the French Additional Capacity Mechanism (Brittany) are represented by single points, in 2017 and 2011 respectively, as the mechanisms only operated for single years.

In **Annex 4.4** additional charts are provided that chart price against a range of possible design features for capacity mechanisms, specifically: (i) maximum awarded contract length, (ii) the percentage of volume awarded that was demand side response, (iii) the percentage of volume awarded that was new generation capacity, (iv) the lead time to the

[68] *Excluding the additional capacity mechanism for Brittany.*

delivery of capacity, (v) maximum penalty as a proportion of annual capacity mechanism revenues. It is difficult to identify clear patterns from this exercise although this may be influenced by the limited number of data points for the different design variations.

Figure 25: Average capacity price (EUR per MW per year) by sampled mechanism, 2011-2019



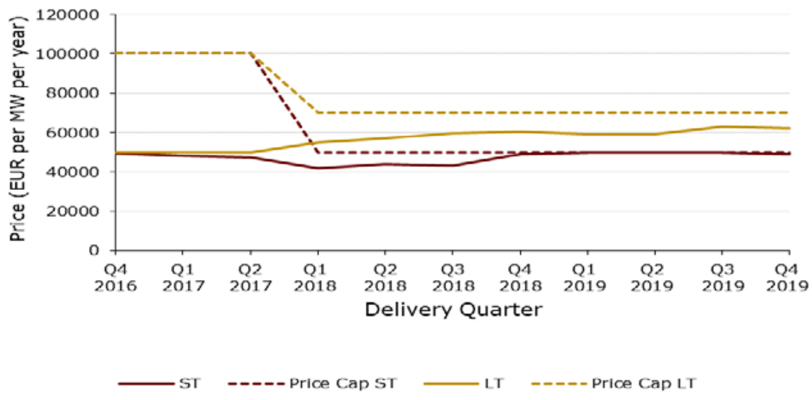
Source: Material collated by the Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

In **Annex 4.4** additional charts are provided that chart price against a range of possible design features for capacity mechanisms, specifically: (i) maximum awarded contract length, (ii) the percentage of volume awarded that was demand side response, (iii) the percentage of volume awarded that was new generation capacity, (iv) the lead time to the delivery of capacity, and (v) the maximum penalty as a proportion of annual capacity mechanism revenues. It is difficult to identify clear patterns from this exercise although this may be influenced by the limited number of data points for the different design variations. The high frequency of the capacity mechanism rounds in Greece and Germany allows a more detailed analysis of the price trend over time and the position of awarded prices relative to the capacity mechanisms' price caps. The Greek interruptibility scheme involves quarterly auctions for two types of demand side response (DSR): 'ST' and 'LT'. LT refers to an auction seeking to procure 1GW of DSR to remain available for 48 hours following the announcement of an event, while ST refers to an auction seeking 600MW of DSR that would remain available for 1 hour following the announcement of an event.

A feature of Figure 26, which shows the prices and price caps for these auctions, is the drop in the price caps before the Q1 2018 auction. Since the auction for Q2 2017 the clearing prices have risen towards the price caps, in particular for the ST DSR. For the LT DSR, the clearing price increased from EUR 50,000 per MW per year to EUR 62,000 per MW per year by the auction for Q4 2019. Correlating with the reduction in the ST price cap to EUR 50,000 per MW per year, the ST clearing price drops below its longer term level, never being above EUR 44,000 per MW per year in the Q1 2018, Q2 2018 and Q3 2018 auctions. However, from the auction for Q4 2018 onwards the ST clearing price is always above EUR 49,000 per MW per year, reaching EUR 49,900 per MW per year in the Q1 2019 and Q2 2019 auctions.

These changes in price do not appear to have a straightforward relationship with the 'competitiveness' of the auctions. In all the sampled ST and LT auctions the volume participating exceeded the volume awarded. Also, it is difficult to see a relationship in Figure A4.4.6 in **Annex 4.4** which charts auction clearing prices against volume participating over volume awarded.[69]

Figure 26: Capacity price and price caps for the Greek interruptibility scheme, 2016-2019[70]



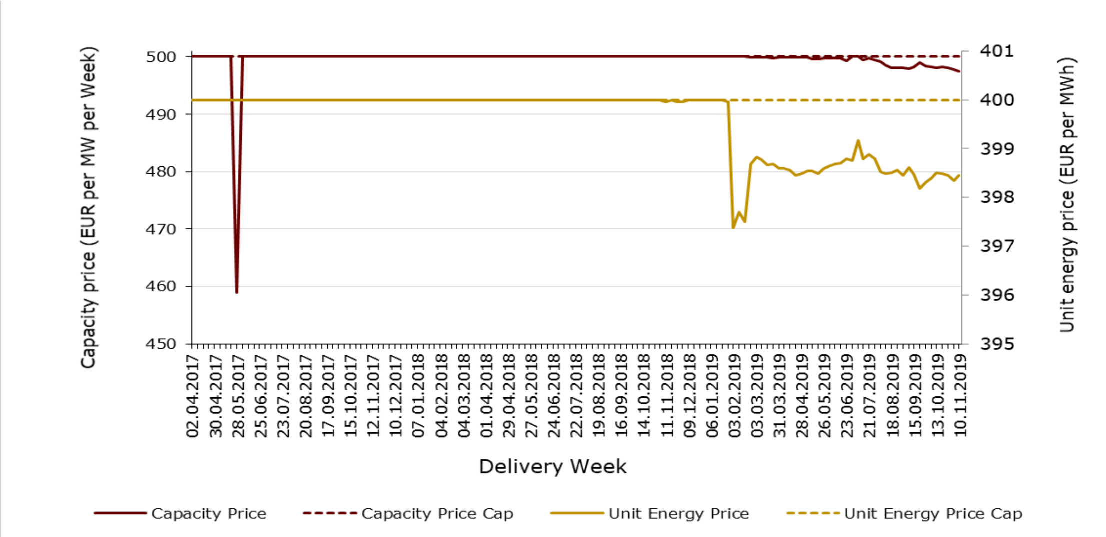
Source: Material collated by Centre for Competition Policy, University of East Anglia, from the Greek Independent Power Transmission Operator (IPTO)

The German DSR scheme is split into two categories: (i) 750 MW of 'Immediately Interruptible Load' to provide DSR at 350 msec notice, and (ii) 750 MW of 'Fast Interruptible Load' to provide DSR at 15 min notice. Weekly auctions for both types of DSR have been held since 27 March 2017 and involve one price linked to capacity and a unit price linked to the quantity of DSR actually employed. Throughout the period the capacity price cap has been EUR 500 per MW per week and the unit output price cap has been EUR 400 per MWh. The Immediately Interruptible Load auction has never met the target capacity of 750 MW and so, with one exception[71], has always cleared at the two price caps.

Figure 27 illustrates that while initially the Fast Interruptible Load auction cleared at the price caps, in 2019 the auctions have started to clear below each of the price caps. This corresponds to a time period when the capacity volume awarded increased; in 2019 the capacity volume awarded in the Fast Interruptible Load auction exceeded 750 MW on 17 occasions[72].

[69] *If there is a pattern in Figure A4.4.6, it would seem to be a weak positive correlation between the competitiveness indicator and clearing prices, the opposite of the expected relationship.*
[70] *Data was unavailable for 2016 Q2, 2016 Q3, 2017 Q3 and 2017 Q4.*
[71] *The auction for 1 April to 7 April 2019 had a capacity clearing price of EUR 499.88 per MW per week.*
[72] *Up to and including the week beginning 4 November 2019.*

Figure 27: Capacity and unit clearing prices, plus price caps, for the German ABLAV 'Fast Interruptible Load' mechanism, 2017-2019[73]



Source: Material collated by Centre for Competition Policy, University of East Anglia from Regelleistung.net

5.3.4 Conclusions

The following main observations arise, subject to the caveats detailed above:

- 65.5% of capacity in MW-years was awarded via one-year contracts.
- Greece, Poland and Ireland generally had higher capacity prices than France or the UK.
- Germany and Greece have frequent awards, allowing for more detailed study.
  - In Germany, fast interruptible load auctions almost always cleared at price caps in 2017 and 2018. In 2019, prices fell below the price caps, though by no more than 4%. This is likely associated with limited competition, in terms of the volume participating, prior to 2019.
  - In Greece, the auctions for the two types of demand-side response have drifted towards their respective price caps. Since Q4 2018 onwards, the clearing price in the ST auction has been between EUR 49,000 per MW per year and EUR 49,900 per MW per year, compared to the EUR 50,000 price cap. However, it is not obvious that this pricing trend can be associated with a reduction in competition.

5.4 Negative pricing

Question 5: To what extent have the EEAG and the corresponding GBER provisions and their application facilitated the integration of RES into the electricity market? (see Annex 0 for a list of all questions.)

5.4.1 Introduction

The objective is to understand the extent of negative electricity pricing in Denmark, France, Germany, the Netherlands and the UK, and whether rules restricting the aid received by RES installations during hours of negative prices have been effective in limiting the number

[73] *Covering the weeks from that beginning 27 March 2017 to that beginning 4 November 2019.*

of negative price hours. This question arises because, due to demand and supply conditions and the need for balance in the electricity system, electricity prices are sometimes negative in many EU Member States.

The observed schemes differ in the rules limiting support during hours of negative prices. In Germany, the UK and the Netherlands support is not paid when there are more than six consecutive hours of negative prices. In France and Denmark support is not paid during any hours of negative prices, although, in France, schemes can include a 'compensation mechanism' for suppliers if a large number of negatively priced hours occur within a given calendar year. Another variation between schemes is whether or not aid is awarded when the price is exactly zero.

It was not possible to isolate the aggregate level of RES generation occurring during negative price hours receiving aid approved under the EEAG. Using data for all RES generation (receiving aid or not) indicates that in Germany and Denmark considerable RES generation continues during hours of negative prices in the first eight months of 2019.

5.4.2 Methodology

Table A6.5.6 in **Annex 6.5** provides a summary of the total number of negative price hours observed on the relevant day ahead electricity market over the period 1 January 2014 to 4 September 2019. The data on the occurrence of negative day ahead prices was taken from the entso-e[74] transparency platform with additional data from the relevant electricity exchanges as required. The data on the occurrence of negative day ahead prices is collated in **Annexes 5.1 to 5.7**.[75] In **Annex 5.8**, for all the hours of negative day ahead prices identified, the total electricity generated by RES and the split of generation by different types of RES, is provided utilising entso-e data. For Denmark, Germany and France, five RES plants have been sampled where their generating output on five days when a particularly large number of hours of negative day ahead prices[76] were observed has been collected. This sampling approach faced challenges such that it was limited to the plant data available on entso-e.

Annex 5.9 provides generation data for the sampled RES plants[77] for the sample days identified in **Annexes 5.1 to 5.4**. The plant level data on entso-e is inherently partial for RES, as Regulation (EU) 543/201378 only requires TSOs to report production for generation units with a capacity of 100 MW or above. No solar generation units were observed on entso-e for the sampled days and the majority of RES plants identified were hydro-electric plants. Table A6.5.7 in **Annex 6.5** details the sampled plants and days. For the sampled days in Denmark the 'last' intraday electricity price for each time period has

---

[74] See https://transparency.entsoe.eu/.

[75] The Summary tab in these annexes splits the negative day ahead price hours by day and hour; also it details the days sampled for the collection of individual plant case studies. The days sampled for case studies were focused on 2018 and 2019 to maximise the likelihood of including RES plants subject to negative pricing rules.

[76] In Denmark Market 1 the min. number of negative price hours was 6 (except extra sample days for Horns Rev C), in Denmark Market 2 the min. was 5 hours, in France 3 hours and in Germany 8 hours. The variation between Member States reflects the variation in the frequency of negative day ahead prices in the different Member States.

[77] entso-e generation data is provided for fossil fuel and hydro plants by individual generating unit, i.e. individual turbine. Where a plant had multiple generating units we provide data for one randomly selected generating unit.

[78] See Article 16, https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:163:0001:0012:EN:PDF.

also been obtained and when the value of this price is negative it has been marked on Figure 34, Figure 35 and Figures A5.12.1 to A.5.12.10 in **Annex 5.12**.

Two plants that definitely received aid involving negative pricing rules and had usable data were Horns Rev C and Anholt in Denmark. The generation behaviour of these plants relative to periods of negative electricity prices are provided in Figure 34 and Figure 35 below. The German plants Rheinkraftwerk Iffezheim and Wikinger Prod received State aid, the latter probably being subject to negative pricing rules due to its production beginning in December 2017.[79] However, no usable data for Wikinger Prod was found on entso-e for the sampled days and a similar situation also applies to the sole Northern Irish RES plant identified on entso-e, Lisahally, and the sole Dutch RES plant on entso-e, Westereems 2 Tennet.[80] The limitations of the data available on entso-e are already known.[81] No plants in Great Britain were sampled as no hours of negative day ahead prices occurred.

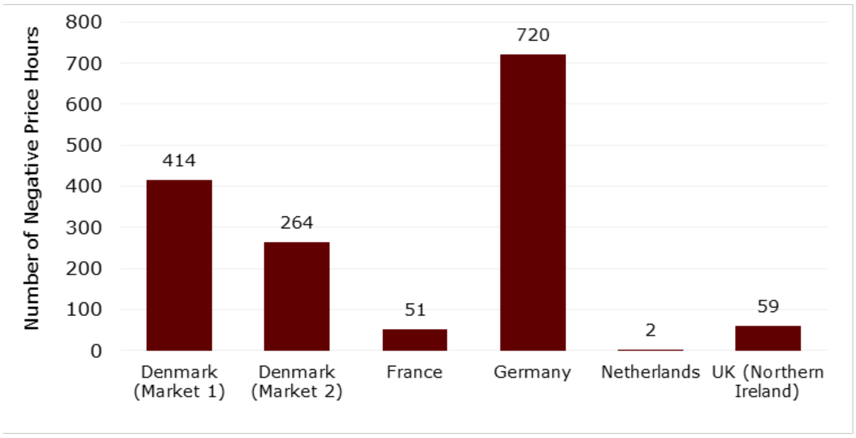
When selecting the plants on entso-e to sample, outside sources were used to identify their date of construction/start of operation. In practice, all the hydro plants identified for the sampled Member States began operation before the 1990s (apart from PSW Goldisthal PSS A in Germany) and so appear to be unlikely recipients of aid. Nevertheless, data is provided for these plants so that the behaviour of RES plants not receiving aid during negative day ahead price events can be understood, in particular, for pumped-storage hydro-electric plants which might increase their consumption during hours of negative prices.[82]

5.4.3 Results overview

The total number of negative day ahead price hours varies across Member States. Over the period considered, Figure 28 shows Germany experienced the highest number of negative day ahead price hours (720), while in Denmark Market 1 there were 414 hours. By contrast, the Netherlands experienced two hours of negative day ahead prices and in Great Britain there were none, although, in Northern Ireland there were 59 hours of negative day ahead prices. In this sub-section, references to 2019 mean the period up to and including 4 September 2019.

[79] The other German RES plants available on the entso-e platform did not receive aid from the EEG scheme.
[80] The missing data issue was not possible to solve by changing the sampled days.
[81] 'A review of the ENTSO-E Transparency Platform', Output 1 of the "Study on the quality of electricity market data" commissioned by the European Commission, 2017, https://ec.europa.eu/energy/sites/ener/files/documents/review_of_the_entso_e_plattform.pdf.
[82] However, the data is not designed to be conclusive on this point as one generating unit (rather than all) from the multiple units that pumped storage plants tend to possess is sampled and the precise rules on the remuneration of these plants during negative day ahead price hours have not been investigated.

Figure 28: Total hours of negative day ahead electricity prices in sampled Member States, 2014-2019

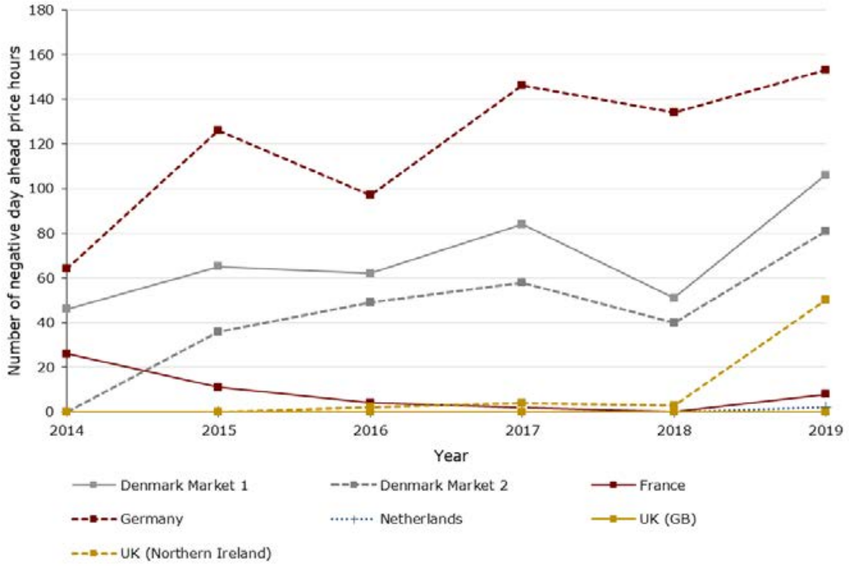


Source: Underlying data from the entso-e transparency platform, plus additional data from the Elspot market (Denmark), the EPEX Spot[83] market (France and Germany).

Figure 29 highlights that in Germany, Denmark and Northern Ireland the greatest number of negative day ahead price hours occurred in 2019. In Germany and Denmark the trend is for the number of negative day ahead price hours to rise over time. For example, in Denmark Market 2 there were no negative day ahead price hours in 2014, while 81 occurred in the first 8 months of 2019. In Denmark Market 1 the number negative day ahead price hours in the first 8 months of 2019 was 2.3 times the number in 2014. In Germany the number of negative day ahead price hours rose 2.4 times (from 64 hours to 153 hours). In France the number of negative day ahead price hours was lower in 2019 than in 2014. When considering the time trend for Germany, it is worth noting that the rules limiting support during hours of negative electricity prices apply to plants commissioned from 1 January 2016. Hence, for plants constructed before this date, one would not necessarily expect the rule change to alter their production decisions.

[83] *Epexspot is the name of the exchange it does not refer specifically to the on the day spot price. Similarly, there is a day ahead Elspot price.*

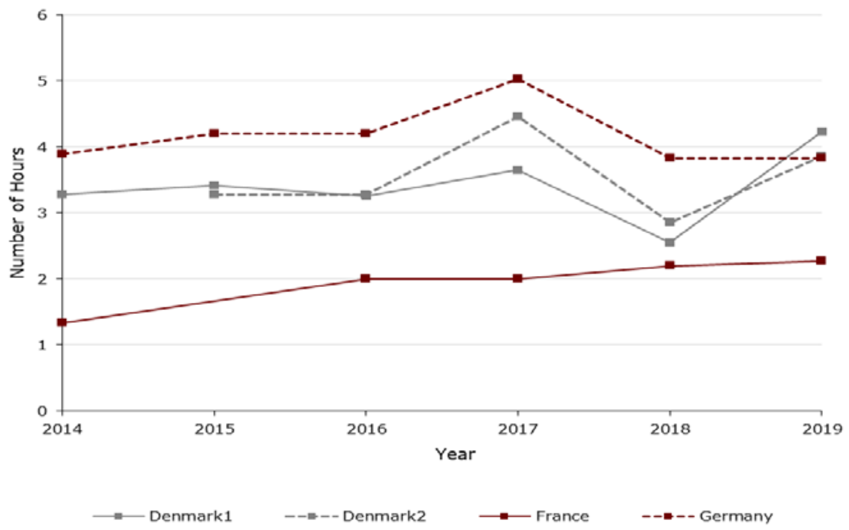
Figure 29: Number of negative day ahead price hours by year for sampled Member States, 2014-19



Source: Underlying data from the entso-e transparency platform, plus additional data from the Elspot market (Denmark), the epexspot market (France and Germany).

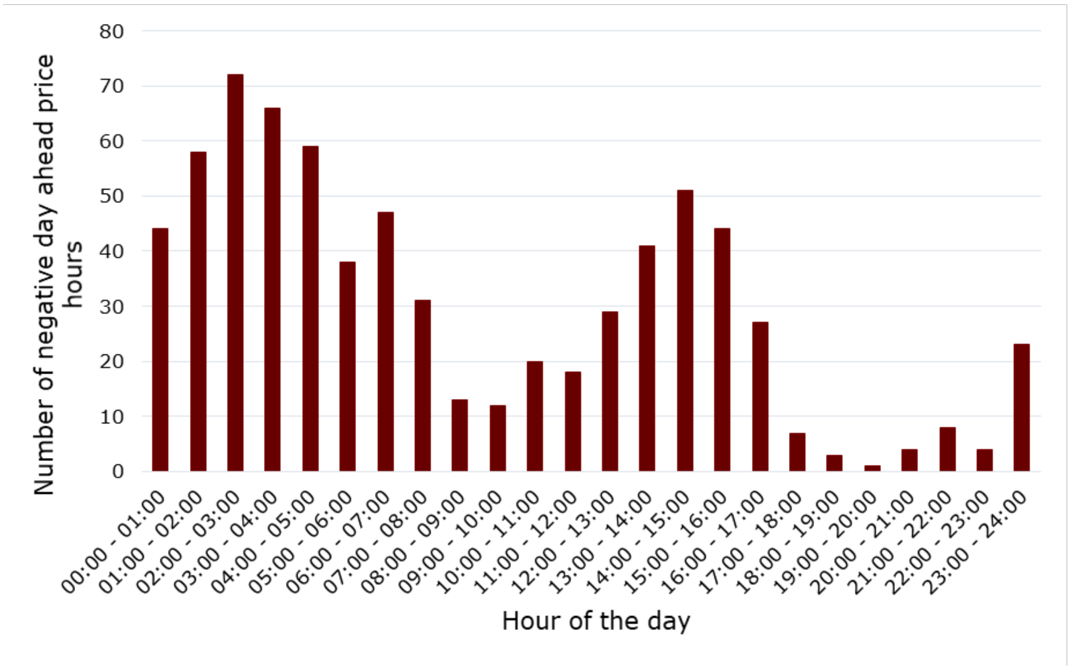
Beyond the number of negative day ahead price hours, one can consider the average length of negative day ahead price events. Figure 30 shows that in addition to Germany having more negative day ahead price hours occurring, on average each negative price event also lasted for a greater number of hours than in France or Denmark (with the exception of 2019). While Germany saw a greater number of negative day ahead price hours in 2019 than 2014, the average length of these episodes was similar at just under four hours.

Figure 30: Average length of negative day ahead price episodes by sampled Member State, 2014-2019



Source: Underlying data from the entso-e transparency platform, plus additional data from the Elspot market (Denmark), the epexspot market (France and Germany).

Figure 31: Number of hours of negative day ahead prices by time of day for Germany, 2014-2019 pooled

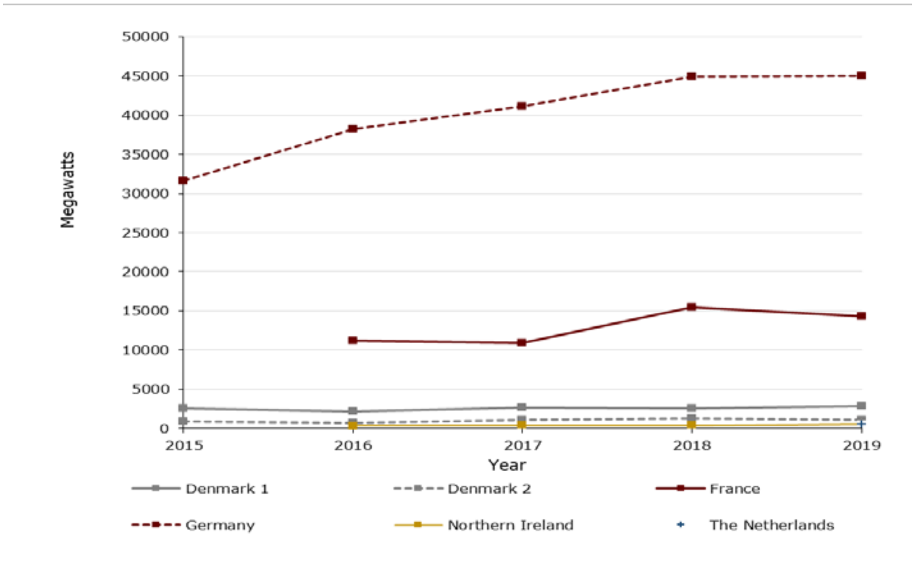


Source: Underlying data from the entso-e transparency platform, plus additional data from the epexspot market.

Figure 31 shows that in Germany over the period 2014-2019 the greatest number of negative day ahead price hours occurred between 12am and 7am with a second peak between 1pm and 4pm.

The quantity of RES generation occurring during the periods of negative day ahead prices is now considered. Figure 32 shows that the quantity of RES generation in Germany during hours of negative day ahead prices exceeds that in all other Member States combined. On average, during hours of negative day ahead prices in 2019 German RES generation totaled 45 GW, while in the Member State with the next highest RES generation per hour, France, it totaled 14.3 GW. While each of the Danish markets had a higher number of negative day ahead price hours than France, they had lower average hourly quantities of RES generation during negative day ahead price events in 2019 of 2.9 GW and 1.1 GW respectively.

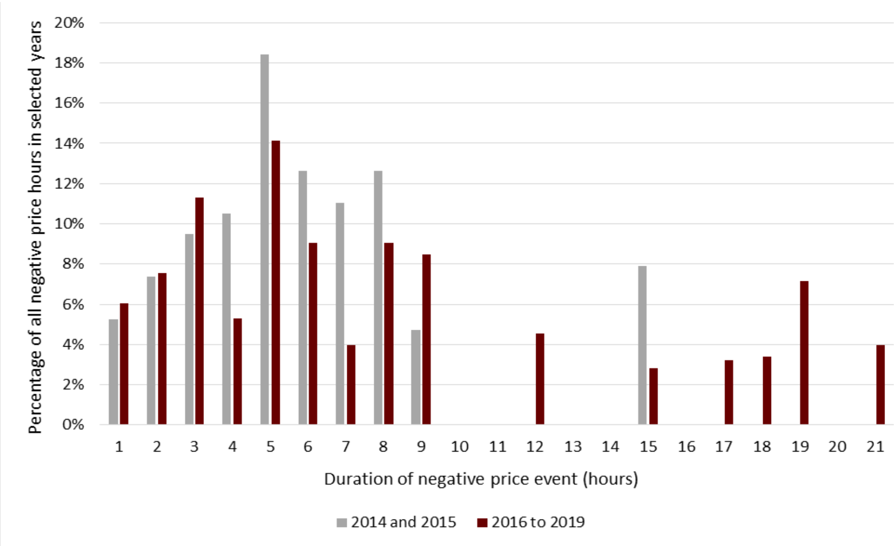
Figure 32: Average RES generation per hour during negative day ahead price episodes by sampled Member State, 2015-2019



Source: Underlying data from the entso-e transparency platform.

Although Figure 32 shows an upward trend in RES generation per hour in Germany over time, in other Member States the percentage increase between 2016 and 2019 was higher. Between 2016 and 2019, the average volume of RES generation during negative day ahead price hours in Germany rose by 17.8% compared to 28.0% in France, 34.4% in Denmark Market 1 and 60.7% in Denmark Market 2.

Figure 33: Percentage of negative day ahead price hours accounted for by negative price events of different durations in Germany, 2014-15 vs 2016-19

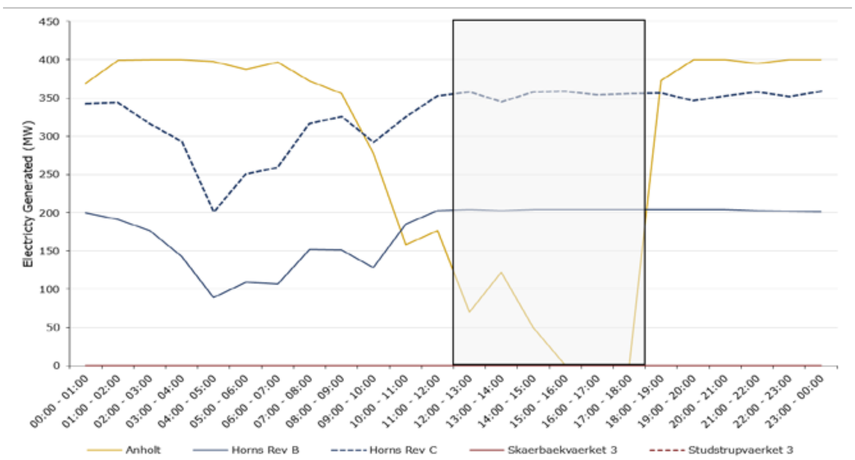


Source: Underlying data from the entso-e transparency platform, plus additional data from the epexspot market.

Given the large number of negative day ahead price hours and the high level of RES generation in Germany, the potential impact of the change to the German rules on support during hours of negative prices that took effect in 2016 are considered in more detail. Figure 33 compares the percentage of all negative day ahead price hours by duration of negative day ahead price event in the years before and after the rule change. Comparing the data for 2014-2015 and 2016-2019 shows that the percentage of hours in events lasting 7 hours fell from 11.1% to 4.0%, and the percentage of hours in events lasting 6 and 8 hours also fell. However, over the period 2016-2019 the percentage of hours accounted for by negative day ahead price events lasting 9 hours or more rose compared to 2014-2015, from 12.6% to 33.6%.

As explained in section 5.4.2, the generation of 'case study' RES plants was investigated on a sample of days with frequent hours of negative pricing. The best data available relates to plants in Denmark, specifically three offshore windfarms (Anholt, Horns Rev B and Horns Rev C) and two biomass plants (Skaerbaekvaerket 3 and Studstrupvaerket 3) in Denmark Market 1.[84] In general, it was not possible to identify which of the plants where generation data is available received State aid, nor the precise State aid rules applicable during periods of negative prices. Without this information only tentative conclusions about the impact of negative price rules on plant behaviour can be drawn from the case studies. However, for Horns Rev C (Horns Rev 3), the Commission decision states "*For hours in which the day ahead auction price is negative, no premium will be paid*."[85] Also, the tender documents for the Anholt windfarm state that no surcharge will be granted for hours when the spot price is not positive, although this applies for max. 300 hours annually.[86] While the specific rules applicable to Horns Rev B (start of operation in Sept. 2009) are unclear, the tender document does not contain a clause equivalent to that in the Anholt tender documents.[87] The rules applicable to the Studstrupvaerket 3 and Skaerbaekvaerket 3 biomass CHP plants are unclear, although, it is known that the former was converted to biomass in Oct. 2016 and the latter was converted to co-firing with biomass in Oct. 2017.

Figure 34: Hourly generation output (MW) of the case study Denmark Market 1 RES plants on 10 August 2019



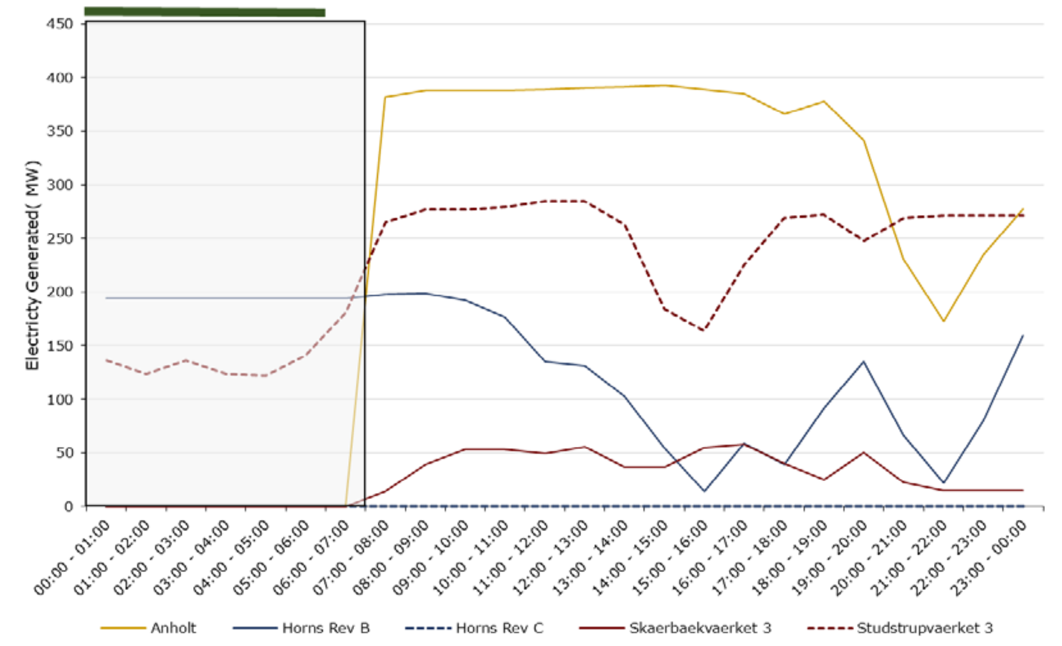
[84] *For additional data for Denmark Market 1 and four RES plants in Denmark Market 2, see Annex 5.12.*
[85] *SA.40305, paragraph 15.*
[86] *See point 2, 'Economic conditions', pg 43, 'Conditions for public tender – Anholt offshore wind farm, April 30, 2009', https://ens.dk/sites/ens.dk/files/Vindenergi/udbudsbetingelser_anholt_30_april09_endelig.pdf*
[87] *See 'Conditions for tender after negotiation on offshore wind turbine concession at Horns Rev (October, 2004)', https://ens.dk/sites/ens.dk/files/Vindenergi/udbudsbetingelser_anholt_30_april09_endelig.pdf*

Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. No negative price periods (inclusive of prices of zero) were observed on the intraday market.[88]

Source: Day ahead prices/generation data from entso-e transparency platform, intraday prices from Nord Pool.

In Figure 34 one of the offshore wind installations, Anholt, reduces its output during the negative day ahead price period. Both Horns Rev B and Horns Rev C maintain stable production during the negative day ahead price period. Indeed, the output of Horns Rev B and Horns Rev C is rising in the hours leading up to the negative day ahead price event. The pattern of Horns Rev B and Horns Rev C maintaining production during hours of negative prices on the day ahead market, while Anholt sharply reduces production, is representative of the patterns observed on the other sampled days.[89] On 10 August 2019, covered in Figure 34, the two biomass plants, Skaerbaekvaerket 3 and Studstrupvaerket 3, did not generate any electricity. Figure 35 covers a day when both of them were operating, but no data was available for Horns Rev C. It is representative of Studstrupvaerket 3 on three sampled days that during hours of negative day ahead prices its output is reduced but does not fall to zero. During the negative day ahead price event in Figure 35 both Anholt and Skaerbaekvaerket 3 produced zero output.

Figure 35: Hourly generation output (MW) of case study Denmark Market 1 RES plants on 2 January 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices/generation data from entso-e transparency platform, intraday prices from Nord Pool.

In Annex 5.12 additional charts are provided covering the other sampled days in Denmark Market 1 and Denmark Market 2 for the case study plants.

---

[88] The intraday prices used are the 'last' prices for the relevant time period. Intraday pricing data was missing for: 00:00-02:00, 21:00-22:00 and 23:00-00:00.
[89] The sampled days are 1 January, 2 January, 17 March, 23 April and 10 August 2019. As Horns Rev C has missing data on a number of these days, its output was also assessed on 30 June and 11 August 2019.

5.4.4 Conclusions

The following main observations arise, subject to the caveats detailed above:

- The total number of hours of negative day ahead prices have increased across the sampled Member States in recent years, from 118 in 2014 to 416 in the first 8 months of 2019.
- Looking at Denmark where plant specific data is available, two wind farms, Anholt and Horns Rev C, behave differently during negative day ahead price periods. Anholt substantially reduces production, while Horns Rev C maintains production.
- To draw firm conclusions about the impact of negative price rules on individual RES installations it is necessary to know the exact negative price rules that the installations face and have access to the matching form of pricing data (day ahead, intraday or imbalance settlement price). Horns Rev C and Anholt are the two plants where the necessary combination of data is available.
- In Germany negative price rules do not appear associated with reduced total RES generation at times of negative prices on the day ahead market. Comparing data from 2014-2015 to 2016-2019, while a lower proportion of negative day ahead price hours occurred during negative price events lasting 7 or 8 hours, the proportion of negative day ahead price hours occurring in negative price episodes lasting over 10 hours has increased since 2016. The percentage of negative day ahead price hours occurring in episodes lasting over 6 hours increased from 35% in 2014 and 2015 to 42% in 2016 to 2019.
- Plant level generation data was available for a limited number of RES plants on the entso-e transparency platform. General availability of plant-by-plant data for plants receiving State aid would be valuable for evaluating support schemes.

5.5 Proportion of electricity bills accounted for by RES charges

Question 6: The contractor shall prepare the following tables: (i) Table 1: should indicate, for each Member State, whether they have introduced a renewable energy policy in the period 2014-2020 going beyond their binding 2020 RES targets; (ii) Table 2: should list the level of RES charges over the total electricity bill for a sample of a minimum of 15 Member States in the period 2014-2020. For those Member States having implemented an approved scheme under section 3.7.2. of the EEAG, Table 2 should also indicate the level of the reductions on RES levies and the level of the reductions to other charges approved by the Commission by analogy, if applicable. (see Annex 0 for a list of all questions.)

5.5.1 Introduction

The key objectives of this section are to examine: (i) the RES targets pursued by Member States, (ii) the proportion of electricity bills accounted for by RES charges, and (iii) the proportion of electricity bills accounted for by other charges approved by analogy. Looking across all Member States, four (Hungary, Italy, Spain and Sweden) have set RES targets for 2020 that exceed their binding EU targets. These targets were all set prior to 2014. For the analysis of the proportion of electricity bills accounted for by RES charges, 15 Member States have been sampled.

As the data on these proportions was not readily available for all years and Member States, a methodology was created where the proportions were calculated for example households, example non-energy intensive commercial users and example energy intensive commercial users (EIU). The main results of this exercise are presented in section 6.1, which looks in detail at the changes over time within individual Member States to assess the possible relationship between the reductions in RES charges for EIUs and changes to the RES charges for other consumers.

In the analysis the definition of what constitutes an example EIU varies across Member States. Energy price data for Eurostat consumption bands IC-IF are used as the basis for the calculations for both EIU and non-EIU[90] commercial consumers. To calculate the RES charges for an example EIU in a particular Member State we assume that, compared to a non-EIU with an identical consumption level, our example EIU has the necessary characteristics to meet the Member State-specific definition of an EIU required to receive a reduction in their RES charge. If the reduction in a RES charge is linked to the electro-intensity of a business, we assume an electro-intensity of 20%.

The formal definition of undertakings that can receive reductions to RES charges, which all national definitions must comply with, is provided in Section 3.7.2 EEAG.[91] Reductions to RES charges can be provided to undertakings in the sectors listed in Annex 3 of the EEAG which have a high electro-intensity and high exposure to international trade. Additionally, undertakings not listed in Annex 3 of the EEAG can receive support if they have an electro-intensity of at least 20% and operate in a sector with a trade intensity of at least 4% at the EU level.

In terms of the extent of support that can be provided, the Commission considers aid to be proportionate if beneficiaries pay at least 15% of the RES charges that non-EIUs face. Alternatively, Member States can apply a threshold that undertakings do not pay more than 4% of their gross value added for RES charges, or 0.5% of their gross value added for undertakings with an electro-intensity of at least 20%.

5.5.2 Methodology

Detail on whether Member States have introduced policies going beyond their binding 2020 RES targets is provided in **Annex 6.1**. The data primarily comes from national renewable energy action plans[92] and the Grantham Institute's database of climate related legislation.[93] To ensure that policy changes during the period 2014-2019 were not missed relevant national authorities were contacted twice in all Member States. National targets with deadlines after 2020 were not included in the data collection exercise. Data has been collected for 12 of the 13 Member States[94] where the Commission has approved 'reductions to EIU charges', plus three additional Member States. The sampled Member States are: Denmark, France, Germany, Greece, Italy, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and the United Kingdom) plus Austria, Croatia and Estonia.

For the proportion of the total electricity bill accounted for by RES charges, the possibility of using DG Energy data was explored, but most of the required data was unavailable. As a result, DG Energy data has been used to inform the data verification process rather than as the primary source of data. Eurostat identifies the proportion of electricity prices attributable to 'Renewable taxes' in 2017 and 2018 and, even in these years, data for some

---

[90] Additionally, for non-EIUs, calculations are performed for consumption bands IA and IB.
[91] See https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014XC0628(01)&from=EN.
[92] See https://ec.europa.eu/energy/en/topics/renewable-energy/national-renewable-energy-action-plans-2020.
[93] See www.lse.ac.uk/GranthamInstitute/countries/.
[94] No data was found for Bulgaria.

Member States (e.g. France, Germany, Italy and Spain) is missing. Hence, a procedure was adopted to construct the requested data in all required years.

The present dataset was built up from analysing the legislation in each Member State and then applying the project team's best understanding of the legislation to a range of example consumers. The proportion of electricity bills accounted for by RES charges has been calculated for 15 example consumer types (5 household types, 6 types of non-energy intensive commercial users and 4 types[95] of energy intensive commercial users).

The consumer types match the consumption bandings used by Eurostat (DA to DF for households and IA to IF for commercial users) to provide the electricity price data on which the calculations were based.[96] The calculated RES charges were compared to DG Energy's figures for 2017. The largest differences were found for Croatia, Italy, Latvia and Slovenia. One possible explanation for these is that the project team has calculated charges for specific example consumer types, while the DG energy figures are likely to average across different consumers.

The structure of levies are diverse across Member States, as are the technical definitions used in policies. In addition to levy bands being determined by consumption volume, in some instances, other factors are involved such as electricity voltage.[97] Another complexity is that in some cases not all a levy's revenues are used to support RES, requiring the proportion going to RES to be identified. In addition to the general complexity of the RES levies, a number of Member States (Italy, Poland, Romania and the United Kingdom) use or have used certificate schemes.[98]

In these cases, RES charges were calculated based on the market (or minimum) price of the certificates, the number of certificates that have to be held for a particular level of electricity generation/consumption, and the rules used to pass through the cost of certificates to particular consumers. **Annex 6.2** provides detailed information on the structure of the reductions to RES and other charges. The estimates of the proportion of electricity bills devoted to RES charges are presented in the 'Summary' tab of **Annex 6.3**.

Reductions for EIUs related to 'other charges approved by the Commission by analogy' and the proportion of electricity bills accounted for by these other charges were estimated. The sampled charges/State Aid cases listed in Table A6.5.9 in **Annex 6.5** relate to France, Germany, Greece, Italy, Poland and Slovakia.

The proportion of the electricity bill represented by these other charges is provided for these Member States in the 'Summary' tab of **Annex 6.4**. The methodology for calculating these proportions, and their presentation in **Annex 6.4**, is the same as for the proportion of electricity bills represented by RES charges. In terms of the extent to which the results in **Annex 6.4** may be driven by assumptions, the 'other charge' rates for Germany, Italy and Slovakia were taken directly from legislation, the rates for France required some

---

[95] In France and in Italy prior to 2018 the definition of EIUs means calculations are performed for only 3 types of energy intensive commercial users.
[96]http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_pc_204&lang=enand http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_pc_205&lang=en.
[97] Electricity voltage is a factor determining the RES charge in Austria, Greece, Italy and Slovenia.
[98] In Italy the green certificates scheme's last year of effective operation was 2014, in Poland the certificates scheme's last year of operation was 2018, while in Romania and the UK the green certificate schemes continues to operate.

manipulation, while the rates for Poland and Greece involved the project team's own estimates or assumptions.

5.5.3 Results overview

Four Member States (Hungary, Italy, Spain and Sweden) have 2020 RES targets exceeding their binding EU commitments. Table 2 shows that Italy has a target exceeding its commitments by the largest margin, with its target being 19-20% instead of 17%.

Table 5: Member States with 2020 RES targets exceeding EU commitments

Member State	Year Policy Introduced	Policy Title	Binding EU 2020 Target (% of energy consumption from RES)	Alternative higher target	Increase in Target
Hungary	2010	National Action Plan 2010	13.00%	14.65%	1.65 %age pts
Italy	2013	National Energy Strategy	17.00%	19-20%	2.00-3.00 %age pts
Spain	2011	Plan for Renewable Energy PER 2011-2020	20.00%	20.80%	0.80 %age pts
Sweden	2009	Government Bills 2009/09:162 and 163	49.00%	50.00%	1.00 %age pts

Source: Grantham Institute database of climate related legislation and national renewable energy action plans.

Table 6 shows that by 2018, 12 Member States[99] were exceeding their 2020 targets with Croatia doing so by the largest margin of 8.0 percentage points. Denmark and Sweden also exceeded their targets by more than 5.5 percentage points in 2018. In contrast, the Netherlands was 6.6 percentage points below its 2020 target as of 2018.[100] However, the nature of the available Eurostat tracking statistics needs to be recognised. The binding EU 2020 targets were constructed on the basis of a statistical object 's2005', the share of energy consumption from RES as calculated in 2005.

However, the Eurostat time series of RES shares in energy consumption incorporates methodological changes to make the time series as accurate as possible. This inconsistency between the time series and the origins of the 2020 targets has the greatest impact for Croatia: Eurostat now estimates the RES share in Croatia in 2005 as 23.7%, a figure 11.1 percentage points above the value of 's2005' used to calculate Croatia's 2020 target.[101] The Eurostat time series also increases the RES share relative to 's2005' for Hungary by 2.6 percentage points, Italy by 2.3 percentage points and Sweden by 0.9 percentage points, 3 of the Member States featured in Table 5.

---

[99] Greece's RES share in 2018 exceeded its 2020 target by 0.002 percentage points.
[100] These values are taken from the Eurostat spreadsheet 'SHARES summary results 2018' downloaded from https://ec.europa.eu/eurostat/web/energy/data/shares on 21 January 2020.
[101] The discrepancy for Croatia is discussed in section 15.2 'Comparability – over time' of the Eurostat metadata for 'Share of energy from renewable sources (nrg_ind_ren)', available at: https://ec.europa.eu/eurostat/cache/metadata/en/nrg_ind_ren_esms.htm . Eurostat explains the Croatia discrepancy as resulting from more detailed survey data becoming available regarding the use of biomass fuel sources by households leading to an upwards revision of the share of energy consumption from renewable sources.

Table 6: Progress towards binding EU 2020 renewables target by Member State, 2018 position

Member State	(1) Value of 's2005' (% of energy consumption from RES)	(2) Current Eurostat timeseries value for 2005 (% of energy consumption from RES)	Value of (2) less (1), %pts	(3) Binding EU 2020 Target (% of energy consumption from RES)	(4) % of energy consumption from RES in 2018	2018 RES share less 2020 target (value of 4 less 3), %pts
Croatia	12.6	23.7	11.1	20.0	28.0	**8.0**
Denmark	17.0	16.0	-1.0	30.0	36.1	**6.1**
Sweden	39.8	40.7	0.9	49.0	54.6	**5.6**
Estonia	18.0	17.4	-0.6	25.0	30.0	**5.0**
Bulgaria	9.4	9.2	-0.2	16.0	20.5	**4.5**
Finland	28.5	28.8	0.3	38.0	41.2	**3.2**
Czechia	6.1	7.1	1.0	13.0	15.1	**2.1**
Lithuania	15.0	16.8	1.8	23.0	24.4	**1.4**
Cyprus	2.9	3.1	0.2	13.0	13.9	**0.9**
Italy	5.2	7.5	2.3	17.0	17.8	**0.8**
Latvia	32.6	32.3	-0.3	40.0	40.3	**0.3**
Greece	6.9	7.3	0.4	18.0	18.0	**0.0**
Romania	17.8	17.6	-0.2	24.0	23.9	**-0.1**
Hungary	4.3	6.9	2.6	13.0	12.5	**-0.5**
Austria	23.3	24.4	1.1	34.0	33.4	**-0.6**
Portugal	20.5	19.5	-1.0	31.0	30.3	**-0.7**
Germany	5.8	7.2	1.4	18.0	16.5	**-1.5**
Luxembg	0.9	1.4	0.5	11.0	9.1	**-1.9**
Malta	0.0	0.1	0.1	10.0	8.0	**-2.0**
Slovakia	6.7	6.4	-0.3	25.0	11.9	**-2.1**
Spain	8.7	8.4	-0.3	20.0	17.4	**-2.6**
Belgium	2.2	2.3	0.1	13.0	9.4	**-3.6**
Poland	7.2	6.9	-0.3	15.0	11.3	**-3.7**
Slovenia	16.0	16.0	0.0	14.0	21.1	**-3.9**
UK	1.3	1.1	-0.2	15.0	11.0	**-4.0**
Ireland	3.1	2.8	-0.3	16.0	11.1	**-4.9**

France	10.3	9.6	-0.7	23.0	16.6	**-6.4**
Netherlds	2.4	2.5	0.1	14.0	7.4	**-6.6**

Together, Figure A6.6.16 and Figure A6.6.17 in **Annex 6.6** report each Member State's progress against their individual binding EU target for the percentage of total energy consumption to come from renewable energy sources. Over the period 2010-2018, Denmark recorded the largest improvement in the proportion of energy consumption from RES, with it increasing by 14.0 percentage points, while the lowest change was in Hungary which saw a decrease of 0.3 percentage points.

Figure 36 to Figure 41 show differences between Member States in the average proportions of electricity bills devoted to RES charges, and in the evolution of these proportions over time. Here the focus is on discussing cross-country comparisons as the detail on comparing RES charges over time within individual Member States is provided in section 6.1. In Figure 36 and Figure 37 the reported values are the simple arithmetic average of the values for the 5 example household types, while in Figure 38 and Figure 39 the average is taken across 4 of the example non-energy intensive commercial users[102] and in Figure 40 and Figure 41 the average is taken across the 4 example energy intensive commercial users.[103]

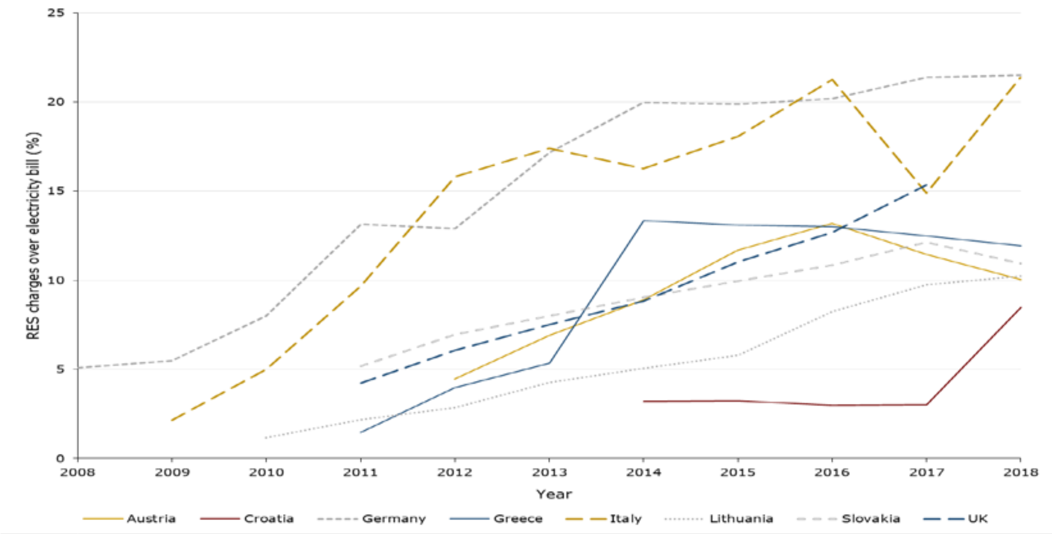
Germany and Italy are characterised by the largest increases in the proportion of electricity bills represented by RES charges for households and non-EIU commercial users over the period considered. For example, between 2008 and 2018 the average percentage of the electricity bill represented by RES charges in Germany for household consumers rose by 16.4 percentage points, while for non-EIU commercial consumers the increase was 37.1 percentage points. This contrasts with the case of Slovenia where between 2011 and 2018 the average proportion for households rose by 1.9 percentage points and for non-EIU commercial consumers by 6.5 percentage points.

While the proportion of the electricity bill accounted for by RES charges in Germany is the highest (or second highest) for all three classes of consumers among the sampled Member States in 2018, the difference to other Member States varies across the classes. It is highest for the example non-EIU commercial consumers. For both Germany and Italy, the average proportion of the electricity bill accounted for by RES charges for the example non-EIU commercial consumers was over 45% (see Figure 38). In contrast, in no other sampled Member State the proportion for the example non-EIU commercial consumers exceeded 21%. For the example EIUs, the average proportion of the electricity bill represented by RES charges in Germany (see Figure 40) is closer to the other sampled Member States with 19.4% in 2018, compared to 13.1% in Slovakia, which has the second highest average proportion for the example EIUs. For the example EIUs, Italy had the fifth highest average proportion of the electricity bill devoted to RES charges. In 2018 the lowest average proportion for non-EIU commercial consumers was in Poland (2.2%, see Figure 39), while for EIUs it was in Latvia (0.6%, see Figure 41).

---

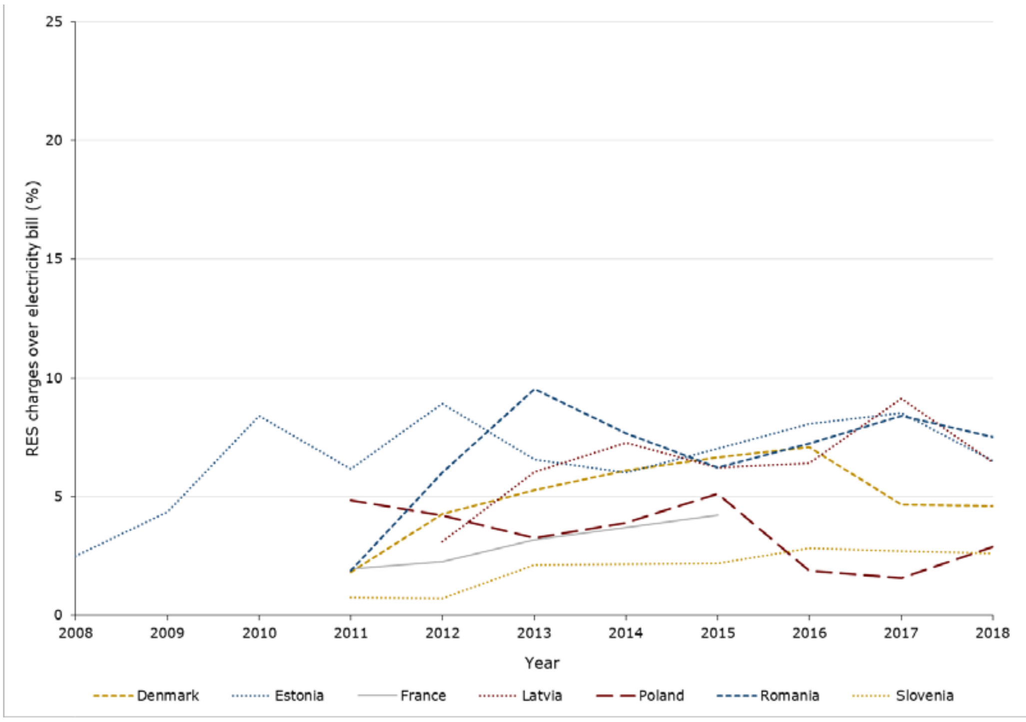
[102] Consumption bands IC to IF. The averages do not include the example IA and IB users to ensure the averages for non-EIUs are directly comparable to those for EIUs.
[103] 3 example energy intensive commercial users in the case of France and Italy (prior to 2018).

Figure 36: Average example RES charge over electricity bill by sampled Member State (first eight), household consumers (consumption bands DA to DF)



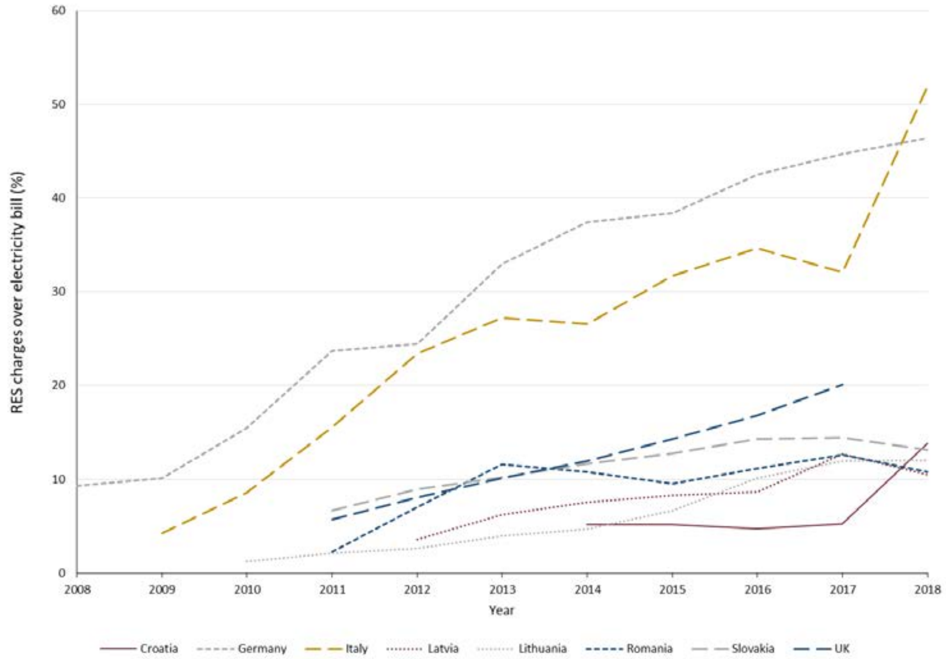
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure 37: Average example RES charge over electricity bill by sampled Member State (second seven), household consumers (consumption bands DA to DF)



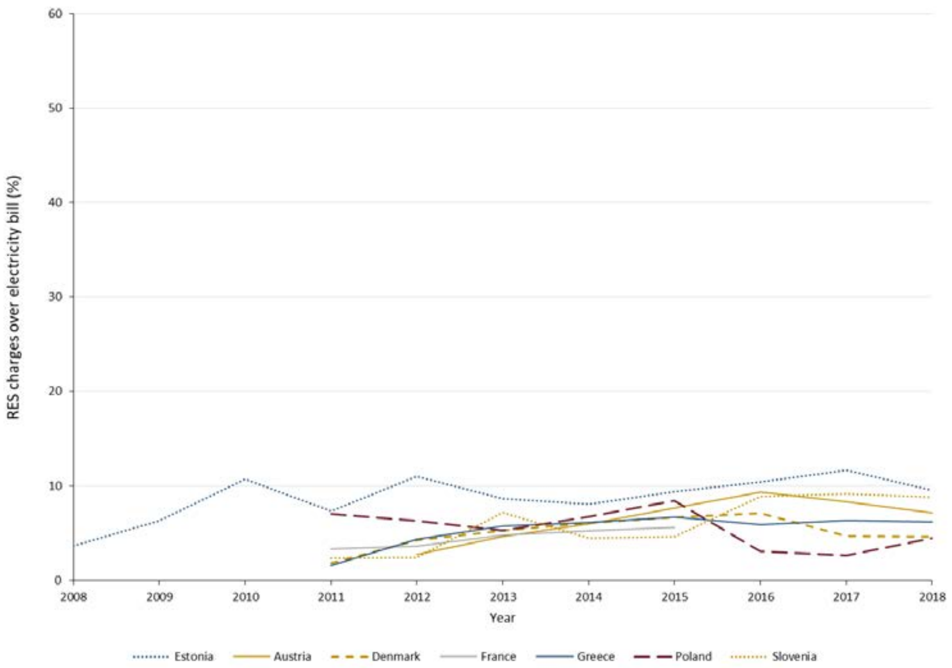
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure 38: Average example RES charge over electricity bill by sampled Member State (first eight), non-energy intensive commercial consumers (consumption bands IC to IF)



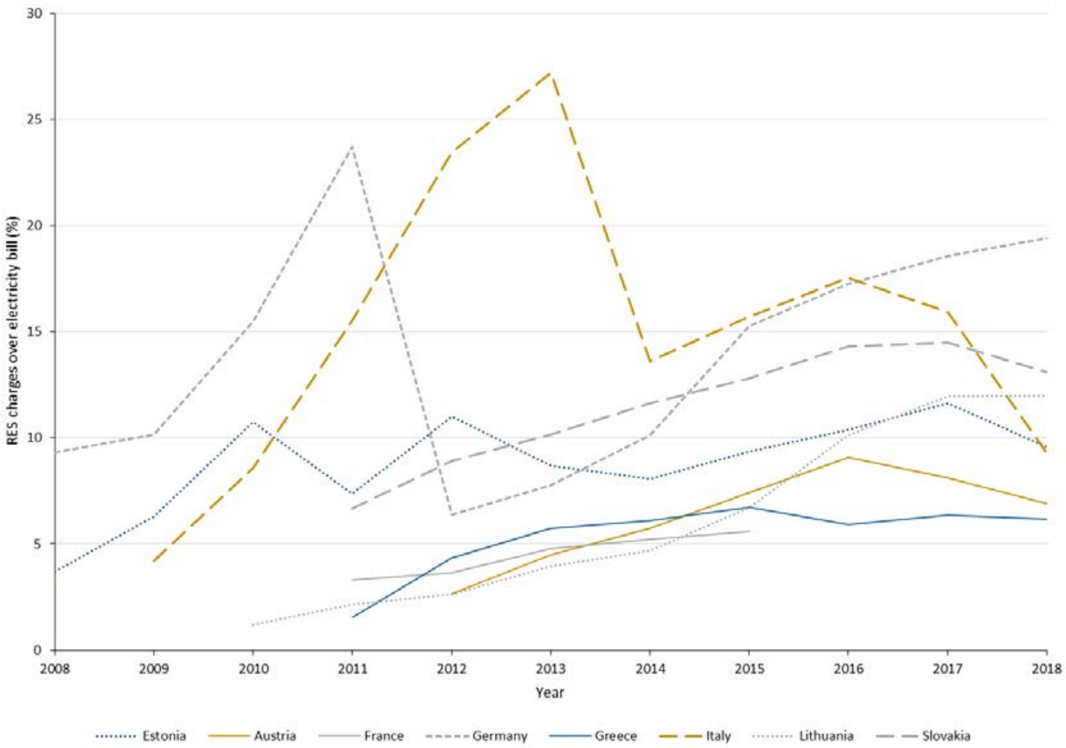
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure 39: Average example RES charge over electricity bill by sampled Member State (second seven), non-energy intensive commercial consumers (consumption bands IC to IF)



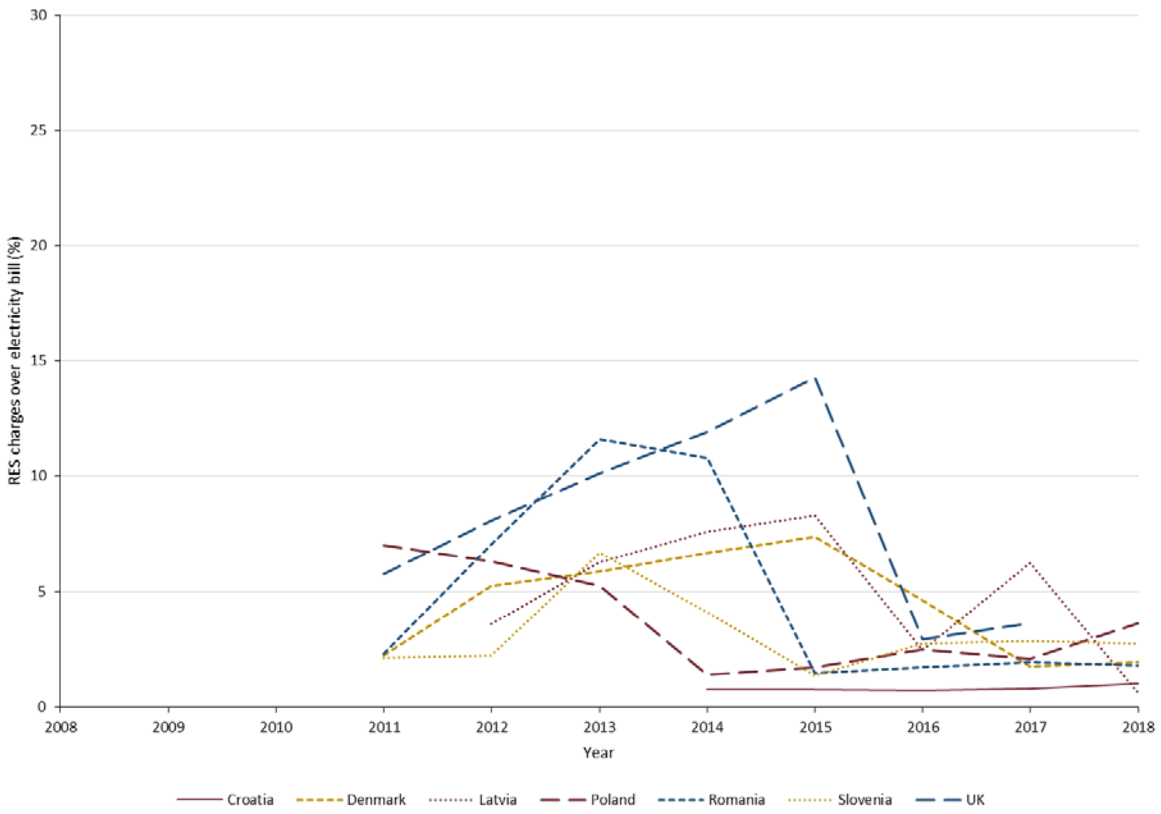
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure 40: Average example RES charge over electricity bill by sampled Member State (first eight), energy intensive commercial users (consumption bands IC to IF)



Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure 41: Average example RES charge over electricity bill by sampled Member State (second seven), energy intensive commercial users (consumption bands IC to IF)



Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

In **Annex 6.6** additional charts are provided for: (i) the proportion of electricity bills accounted for by other charges approved by analogy, (ii) electricity prices in EUR per MWh for the three categories of consumer, and (iii) detail on the proportion of electricity bills accounted for by RES charges for each individual consumption band in Italy and Germany.

5.5.4 Conclusions

The following main observations arise, subject to the caveats detailed above:

- Four Member States (Hungary, Italy, Spain and Sweden) have 2020 RES targets exceeding their binding EU commitments.
- In 2018 12 Member States had a RES share in total energy consumption exceeding their binding 2020 target according to Eurostat data.
- Of these 12 Member States, Bulgaria, the Czech Republic, Denmark, Estonia, Croatia, Lithuania, Finland and Sweden exceeded their respective binding RES targets by at least one percentage point.
- In 2018 the RES charge as a percentage of household electricity bills varied from under 5% to just over 20% across the EU. The RES charge as a percentage of the bill for non-energy intensive commercial customers varied from under 5% in Poland to more than 40% in Germany and Italy.

In 2018 the RES charge as a percentage of the bill for energy intensive commercial customers was under 10% for all Member States examined except in Germany, Lithuania and Slovakia.

5.6 Waste management

Question 7: Waste management is an important element in achieving resource efficiency. To what extent has Article 47 GBER, which sets out the compatibility criteria for aid for waste recycling and re-utilisation, been effective in allowing aid to foster sustainable and smart growth in re-use and recycling of waste while avoiding disproportionate distortions of competition? (see Annex 0 for a list of all questions.)

5.6.1 Review of waste management schemes

Question 7.a: Do the schemes containing provisions on waste management limit eligible activities to recycling of waste and preparation for re-use? Do they target specific types of waste, and if so, which ones? Do they also cover waste-to-energy projects?

To provide input for assessing the effectiveness of State aid measures in the field of waste management, the review started with desk research into 129 national State aid schemes, based on a list provided by the Commission, containing all national schemes that Member States had until mid-2019 officially communicated to the Commission as falling under Article 47 GBER. The list covered schemes stemming from 20 Member States. All 129 schemes were assessed and reviewed individually, either by using a specific link provided in the Commission list, or by carrying out Internet research based on the scheme number and/or title.

The outcome of this research is presented in a comprehensive excel table (**Annex 7.1)**, indicating, for each of the 84 schemes containing provisions on State aid for waste management (including recycling and preparation for re-use, but excluding wastewater treatment), whether:

- eligible activities are limited to recycling of waste and preparation of waste for re-use,
- eligible activities target specific types of waste, and
- eligible activities can also be related to waste-to-energy projects.

The scope and nature of the schemes vary considerably. While 71 of 129 schemes (55%) explicitly mention or quote Article 47 GBER,[104] 13 others (10%) cover waste management measures in general terms without referring to Article 47 GBER.[105] Eight of these 13 schemes however contain a general reference to the GBER and/or State aid rules. A third category of 45 schemes (35%) do not cover nor mention waste management at all.[106] The schemes are of a more general nature, providing for basic rules and regulations to be complied with by beneficiaries to be eligible for State aid, covering measures of a different and/or sometimes unspecified kind. One scheme in the third category covers only wastewater treatment (SA.40647 for France[107]).

---

[104] *These schemes are marked in green in Annex 7.1.*
[105] *These schemes are marked in grey in Annex 7.1*
[106] *These schemes are left in white in Annex 7.1. and the three above mentioned specific questions are marked as "N.A." in the respective columns.*
[107] *This scheme is marked in red in Annex 7.1.*

All the 84 schemes actually covering waste management were systematically screened with regard to the three issues listed above. In 73 of these 84 schemes, the granting of aid is limited to support for waste recycling and preparation for re-use. Four of the 84 schemes also contain other measures, in addition to waste management:

- **SA.40714 - Germany**: Under this scheme, aid may also be granted for (1) air pollution control, noise and vibration protection, (2) circular economy and resource conservation as well as climate protection.
- **SA.45005 - Germany**: Under this scheme, aid may also be granted for (1) market information, company profiles and support services, especially with regard to innovative capacity of SMEs; (2) feasibility studies abroad as proof of suitability and purposeful applicability of technologies abroad; (3) country studies (including demand-side legislation) under environmental cost-benefit analysis and registration of priority regions; (4) development of advisory, demonstration and training services related to environmental infrastructure and innovation abroad; (5) technical assistance for environmental infrastructure and innovation projects in tenders abroad; (6) pilot and model projects of German companies abroad focusing on environmental infrastructure measures and environmental relevance for exports; (7) international networking with involvement of public and municipal actors, exchange of knowledge and experience (cooperation with selected partner countries).
- **SA.45686 - Finland**: Under this scheme, aid may also be granted for (1) research and development on nutrient recycling for biomass; (2) innovation in biomass nutrient recycling and processes and organization in biomass nutrient recycling; (3) investments promoting recycling of nutrients from biomass, new and untested compared to the state of the art, and which do not optimize or extend existing technology; as well as (4) renewable energy production measures closely linked to and carried out as part of activities referred to in (1).
- **SA.40795 – Italy:** Under this scheme, aid may also be granted for (1) the prevention and reduction of gaseous emissions, (2) waste water, (3) other pollution factors.

Of all 84 schemes explicitly covering measures falling under Article 47 GBER, 71 (85%) do not contain eligible activities targeting specific types of waste and 13 (15%) focus on specific types of waste. These are the following:

- **SA.41223 – Austria**: This scheme has a focus on biomass, biogenic waste and hazardous waste.
- **SA.41622 – Estonia**: This scheme has a focus on separately collected construction and demolition waste, separately collected glass waste, separately collected plastic waste (including agricultural plastic waste), large waste separately collected, separately collected biodegradable waste, separately collected textile waste, separately collected packaging waste, tires collected separately; separately collected batteries and accumulators.
- **SA.45686 – Finland**: This scheme has a focus on nutrients from biomass.
- **SA.53395 – Germany**: This scheme has a focus on garden, green and biowaste, reduction of greenhouse gas emissions in abandoned municipal waste landfills.
- **SA.49641, SA.50107, SA.52476 - Netherlands**: These schemes have a focus on manure minerals.

- **SA.53946 – Netherlands :** This scheme has a focus on organic waste, plastics, textiles, furniture and mattresses.
- **SA.48088, SA.51745 – Spain**: These schemes have a focus on industrial waste.
- **SA.51394 – Spain**: This scheme has a focus on investments into (1) identification and separation of brominated plastics in waste streams, (2) computer systems for management of reusable parts at the end of their life-cycle (CTVFU) in authorised Waste Electrical and Electronic Equipment (WEEE) treatment centres, (3) devices/machinery for rapid and efficient decontamination of different wastes from end-of-life vehicles (ELVs), including heavy industrial vehicles, such as airbag neutralisation equipment, liquid suction equipment (e.g. for shock absorber oil), advanced fluorinated gas recovery equipment, and cutting-edge electro-hydraulic catalysts (excl. fuel recovery equipment), (4) devices/machinery and organisation systems to prevent mixing of construction and demolition waste and enable separation of mixtures of construction and demolition waste that allow for subsequent recovery of resulting fractions, (5) promoting reuse of construction elements through facilitating methodologies/technologies for dismantling of construction elements, and procedures that ensure custody of quality of articles/materials to be reused.
- **SA.39221 – United Kingdom**: This scheme has a focus on recycling, reprocessing and reuse of waste in Scotland, including but not limited to, treated/contaminated wood, glass, plastics, metals, aggregates, quarry mineral wastes organics/compost, WEE, textiles batteries, tyres, plasterboard and gypsum.
- **SA.39528 – Czechia**: This scheme has a focus on hazardous wastes, biologically degradable wastes, take-back products, municipal waste.

Among the 84 schemes, 78 (93%) explicitly covering measures under Article 47 GBER do not contain eligible activities related to waste-to-energy projects. It should be noted that waste-to-energy is a broad term and encompasses various waste treatment processes generating energy (e.g. in the form of electricity and/or heat to produce waste-derived fuel), each of which has different environmental impacts and circular economy potential.[108] Three schemes contain eligible activities (also) related to waste-to-energy projects. These are the following:

- **SA.41223 – Austria**: This scheme explicitly covers investments for (i) the production of energy from renewable energy sources for the purpose of avoiding or reducing environmental pollution caused by climate-relevant gases; and (ii) the generation of energy from biogenic waste or waste containing relevant biogenic waste.
- **SA.42719 – Czechia**: This scheme explicitly covers investments for the construction and modernization of facilities for energy recovery and related waste infrastructure. It aims at promoting waste management and technologies for reuse, recycling and waste recovery, including its energy recovery.
- **SA.46496 – Greece**: This scheme explicitly covers investments for energy production from waste or biogas. The investments eligible for State aid can be related to recycling,

[108] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — The role of waste-to-energy in the circular economy, COM(2017) 34 final, OJ 2017 C 345/102.

waste reuse, standardization of final waste recovery products, and energy production from waste or biogas.

5.6.2 Stakeholder consultation

Question 7.b: For schemes containing provisions of waste management, how many waste recycling and preparation for re-use projects have obtained aid under these schemes, in which Member States, and what budget has been allocated to these schemes?

Question 7.c: If no aid was granted under the schemes based on Article 47 GBER, what were the reasons?

To collect the relevant data for these two questions, a targeted stakeholder consultation was conducted, using a combination of surveys and interviews. For that purpose, a web-based survey was designed specifically for State aid measures for waste management falling under Article 47 GBER and transmitted to the addressees, together with an accompanying letter from the Commission. Telephone interviews were conducted with the granting authorities when this was considered more effective than the mere questionnaire, in particular when there was insufficient feedback, or when the replies were not clear enough. Certain interviews were conducted on the recipients' request. Given that more than eight Member States adopted relevant support schemes based on Article 47 GBER, the review was limited to a representative sample of eight Member States as set out in Table 7.

Table 7: Member State sample

Member State	Geographic location	Country size	Recycling rate	Schemes with expenditures
Croatia	South/East	Small	20%	No
Czechia	Central/East	Medium	32%	Yes
Estonia	North/East	Small	28%	Yes
France	West	Large	40%	Yes
Germany	Central/West	Large	65%	Yes
Hungary	Central/East	Medium	32%	No
Netherlands	West	Medium	52%	Yes
Sweden	North	Medium	48%	Yes

The sample was chosen to include large and small Member States as well as "new" and "old" Member States, located in the South/North/East/West of the EU, and includes all reported spenders of public support under Article 47 GBER (apart from the UK). The sample also reflects a diverse selection of the recycling rates of Member States.

The questionnaire covered the following questions:

- Among the schemes communicated to the Commission as containing aid for recycling of waste and preparation for re-use, (i) how many beneficiaries obtained aid?, (ii) which were these?, and (iii) which total/individual budget was allocated to (each of) these projects?
- For schemes under which no aid has been granted at all, or not in a particular year within the reference period, what were the main reasons?

The questionnaires were sent to all granting authorities having adopted measures for which the Commission was informed about actual expenditure in the relevant period, as well as certain additional granting authorities for which the existence of actual expenditure was not reported to the Commission, so that it had to be verified why no (additional) aid was granted. On this basis, the survey included 32 identified granting authorities, in charge of 56 schemes in total. Among these 56 schemes, 14 (25%) did not contain provisions on waste management nor explicit references to Article 47 GBER. However, these 14 schemes contained general references to compliance with State aid rules and the GBER.

5.6.2.1 Details on aid granted under Article 47 GBER

From the 56 identified addressees, 36 replies were received, concerning 43 schemes, all of which are reproduced in a separate column in **Annex 7.2.** and provided in **Annex 7.3.** Among these 43 schemes, 11 do not contain provisions in accordance with Article 47 GBER, and the stakeholders declared that no aid was granted on the basis of these schemes. Among the responding authorities, nine actually granted aid for waste management/preparation for re-use projects in the reference period, sometimes under various schemes. Under the following schemes, aid was granted in the following manner:

(1) SA.40264/SA.40266 – Agence de l'Environnement et de la Maîtrise de l'Energie - ADEME (FR): These schemes are managed by the ADEME and came into effect on January 1, 2015. The mobilization of de minimis aid is also used by ADEME for these aid schemes.

- Under scheme SA.40264 (renewed as SA.49422 in 2017 and again as SA.55400 in 2019), aid was granted to 611 projects related to waste recycling and to 313 to projects related to the preparation for re-use. The names of the projects and respective amounts of aid granted are shown in **Annex 7.4**. The costs differ from one project to another, depending on the aim of the project. In case of waste recycling, the minimum costs were related to sorting and preparation centers, and the maximum costs were related to the recycling of materials (including construction waste) or organic recovery (including anaerobic digestion). The projects were implemented in 18 different French regions, and the amount of aid actually granted ranges between EUR 770 and EUR 443,828. Regarding the preparation for re-use, the minimum costs were faced by projects related to the prevention of food waste (EUR 271). The most expensive project was related to the creation of an innovative wet-delaminated talc milling unit for the eco-design of polymer parts for the automotive industry (EUR 840,000). The minimum amount of aid effectively received by the beneficiaries to implement the re-use projects was EUR 380 and the maximum amount of aid received was EUR 840,000.
- Under scheme SA.40266, aid was granted to 27 projects related to waste recycling and preparation for re-use, all benefiting from aid under the program "Investissement d'avenir". The names of the projects and respective amounts of aid granted to these projects are shown in **Annex 7.4**. The estimated average budget per project is around EUR 1.2 million (ranging from EUR 51,204 to EUR 12 million). The total cost is around EUR 51.4 million and the total amount of aid effectively granted is around EUR 26.2 million (ranging from EUR 12,000 to EUR 8.3 million per project). The project for which EUR 12 million where estimated effectively obtained EUR 8.3 million.
- The total amount of aid reserved under both schemes was EUR 190.4 million, of which EUR 93 million were effectively paid out to the 951 beneficiaries. A waste fund was put in place and aid was granted and paid out each year since the schemes entered in force.

(2) SA.40624 – Kreditanstalt für Wiederaufbau - KfW (DE) allocated aid to seven waste recycling/preparation for re-use projects in Germany for a total amount of approx. EUR 9 million, of which approx. EUR 6.8 million were paid to five beneficiaries. More details on these projects are provided in **Annex 7.5**. The total budget allocated to the scheme (*Umweltinnovationsprogramm*-UIP) is EUR 40.6 million.

- In 2015, an amount of approx. EUR 1.5 million was approved, but the project was not implemented by the beneficiary, and so the aid was not paid out.
- In 2016, an amount of EUR 136,000 for investments and an additional amount of approx. EUR 11,000 for a measuring program were approved and fully paid out to the beneficiary following the completion of the project.
- Still in 2016, an amount of approx. EUR 550,000 was approved, but so far only approx. EUR 450,000 were paid out to the beneficiary, given that the project has not yet been fully completed.
- In 2017, an amount of approx. EUR 670,000 was approved, but the aid was not paid out, due to technical reasons, because the project is being implemented in a different manner compared to the original plan, so that the conditions for the financing under the scheme were not fulfilled anymore.
- Still in 2017, an amount of approx. EUR 2.9 million was approved and fully paid out to the beneficiary following the completion of the project.
- Still in 2017, an amount of approx. EUR 2.7 million was approved. The project has been fully completed and the final payment to the beneficiary was made at the end of 2019.
- In 2018, an amount of approx. EUR 510,000 was approved and fully paid out to the beneficiary following the completion of the project.

(3) SA.41622 – Keskkonnaininvesteeringute Keskus (EE) granted aid for three specific waste recycling projects for a total amount of about EUR 10.7 million, while no aid was granted for any waste preparation for re-use projects.

- The aid granted in 2018 to one beneficiary aims at the establishment of a separate waste bio-waste management plant (EUR 2.42 million). The project started on 30 October 2018 and will be implemented by 30 June 2021.
- The aid granted in 2018 to one beneficiary aims to provide a solution for the sustainable management of sewage sludge and separately collected biowaste in regional anaerobic digestion centers (EUR 4.53 million). The pilot project will establish a waste management center in Pärnu, which will solve the city's sewage sludge problem by circulating all waste inputs and outputs (fermentation residue and biomethane). The project started on 1 October 2018 and will be implemented by 1 March 2021.
- The aid granted in 2018 to one beneficiary aims at the construction of a glass foam chipping plant, which will be established in the Järvakandi industrial area, in order to solve the problems related to Estonian glass waste (EUR 3.77 million). The project started on 1 October 2018 and will be implemented by 31 December 2020.

(4) SA.42457 – Caisse des Dépots et Consignations (FR) granted aid in 2019 for one specific waste recycling and preparation for a waste re-use project linked to the partial demolition and re-construction of a large building located in Paris under the budget «*Ville de Demain*». The aid of EUR 60,000 was granted to support engineering works ("*Assistance à Maîtrise d'Ouvrage*": AMO) to be provided by a large enterprise. The total amount for the AMO is EUR 120,000, and so the aid granted covers 50% of that amount. The AMO shall support the optimization of the treatment of waste generated specifically by the (partial) demolition and reconstruction of the building/site. The treatment options include recycling, re-use outside of the specific site and re-use on the specific site. For that purpose, the AMO shall contribute to the following activities:

- Identification of re-usable materials on the site
- Analysis of legal and financial feasibility of their re-use on the site
- Guidance on the organization and waste management plan ("*SOGED*") to be implemented by demolition and construction companies
- Management of storage space and coordination of re-use in the re-construction phase

(5) SA.45168 – Landesamt für Natur, Umwelt und Verbraucherschutz (LANUV) Nordrhein-Westfalen (DE) granted aid to six waste recycling and preparation for re-use projects, in a series of five calls for proposals organized under the EFRE program, starting in April 2017, following the official publication of the State aid scheme in April 2016. Initially three calls for proposals had been arranged, each with a total budget of EUR 5 million. After their successful implementation, two additional calls for proposals we set up, the last one in June 2019. All five calls were given a total budget of EUR 35 million form the EFRE budget, with some flexibility among them. All calls for proposals were limited to SMEs under the EU definition for innovative projects of various kinds, including but not limited to waste management. For each of the calls, all proposals received were competing with each other. The total amount of aid granted to the six following beneficiaries, after careful review by LANUV NRW and Effizienz-Agentur NRW, and separate decisions of a dedicated jury, was approx. EUR 9 million:

- One beneficiary received EUR 1.3 million (45% of total eligible cost) for a waste sorting plant with innovative technology to increase the level of reusability of light weight packaging material.
- One beneficiary received EUR 250,000 (50% of total eligible cost) for the set up and operation of serial production of pallets from plastic waste.
- One beneficiary received approx. EUR 390,000 (50% of total eligible cost) for the resource efficient and low-emission production of FRT thermofiber cellulose insulation material.
- One beneficiary received approx. EUR 360,000 (50% of total eligible cost) for innovative recycling of waste containing keratin.
- One beneficiary received approx. EUR 3.4 million (50% of total eligible cost) for the innovative and resource efficient production of recycling materials from waste containing minerals.
- One beneficiary submitted an application for approx. EUR 3.6 million (45% of total eligible cost) for an innovative plant for the recycling of textile residuals and their integration into construction panels. This application for State aid is still under review by the relevant authorities.

(6) SA.47601 – Riigi Tuigteenuste Keskus (EE) Aid of approx. EUR 600,000 was approved in June 2018 for one specific waste recycling project for the application of eco-friendly underground solutions for solid waste management at municipal institutions. However, the grant contract has not been signed yet and the project is subject to amendments. Its overall objective is to decrease environmental risks in the cross-border region by improving solid waste management systems, ensuring effective waste separation, and constructing at municipal institutions modern waste collection points with sealed underground containers. Specific objectives are (i) the construction of waste collection points; (ii) the education and popularisation of the need for the separation of solid waste, and (iii) the creation of favorable conditions for cost-effective recycling of waste materials. As a result, 25 waste collection points will be installed in Kohtla-Järve town.

(7) SA.49641 - Provincie Gelderland (NL) granted aid to one waste preparation for re-use project ("*Groene Mineralen Centrale GZV - Hygiënisatie project*"). The amount granted was EUR 250,000 for a total budget of approx. EUR 800,000. Based on this aid, the beneficiary invested in the following components: (i) installation for hygienization and post-drying, (ii) bunker for buffering the hygienized thick fraction, (iii) installation for transportation of the hygienized thick, and (iv) utilities. With these installations, the beneficiary seeks to recover minerals from manure, of which there is a surplus in the Achterhoek region. This project aims to develop a refining method to enhance the value of manure and expand the possibilities of further refinement of manure/thick fraction.

(8) SA.50809 – Management autoriteit West Nederland (NL) granted aid in 2017 to one specific waste recycling project for the processing of concrete to recycle cement products. The project is implemented by an undertaking that developed and successfully tested an innovative concrete dryer. By using this concrete dryer, cement dust is recovered from concrete rubble, resulting in high-quality recycling of 100% concrete rubble. The impact of the project is a significant reduction in CO2 emissions, given that less cement and sand is required for new concrete. The total cost was approx. EUR 2.8 million, of which approx. one third was contributed by the Dutch authority. The project started on 25 July 2017 and is set to last until 31 March 2021.

(9) SA.42456, SA.49001, SA.50267 – Naturvårdsverket (SE) granted aid in 2015, 2017 and 2018 for four waste recycling projects and for two re-use projects under scheme SA.42456, renewed as SA.49001 in 2017 and as SA.50267 in 2018. The total budget allocated was EUR 15.8 million and the total budget actually used for the following projects was EUR 11.6 million.

- KKL-02186-2017: the beneficiary implementeda waste management project with a budget of EUR 12.8 million. The objective is to build a sorting plant to develop a waste treatment service in Stockholm County, to coordinate waste management in one place and to increase the proportion of recycled materials. In addition to allowing a drastic increase in the recycling of plastic packaging from households, the facility permits to sort metal, plastic and paper packaging. The project is planned to be completed by the end of 2020 and is implemented by AB Fortum Heat.
- KKL-04307-2018: the beneficiary implemented a waste management project with a budget of ca. EUR 2 million. The project targets the collection, disposal and recycling of used plastic and mainly covers a specific type of waste (silage plastic). Mainly, it consists of processing the farmers' used silage plastic into recycled plastic raw material. The recycled plastic raw material is returned to the Swedish plastic industry where the it is used instead of new raw material, thus saving carbon dioxide emissions. The project will be completed by 31 December 2019 and is implemented in the Jönköping County.
- KKL-05251-2018: the beneficiary will implement a waste management project with a budget of EUR 38,518. The project aims to ensure an efficient way of waste management and is intended to increase the capacity of sorting machines as more than

35,000 tons of mixed waste are transported into the sorting plant. The machine is able to sort a variety of materials in different shapes and sizes after scanning the waste flow. The project will be implemented by 31 December 2020 in the Skåne County.

- KKL-02613-2017: the beneficiary implemented a waste management project with a budget of EUR 368,482. The project aims at increasing the mix of recycled asphalt in manufacturing new asphalt. The project was planned to be implemented from 1 January 2018 until 1 April 2018 in the Västra Götaland County, however it was cancelled.
- KKL-02864-2017: the beneficiary implemented a re-use project, with a budget of EUR 167,510. The aim of the project is to develop waste re-use in Linköping Recycling centers (located in the Linköping municipality). The project was completed on 1 September 2019.
- NV-06312-15: the beneficiary implemented a preparation for re-use project with a budget of EUR 321,601. The project aims at increasing the capacity of the recycling park for reusable products in Uppsala Municipality in order to be able to offer a better collection for reusable products. The project was implemented by 31 May 2019.

5.6.2.2 Reasons for not granting aid under Article 47 GBER

The nine authorities having granted aid in the reference period reported that they did not do so in each year. The 17 authorities (in charge of 27 schemes) that did not grant State aid for waste management projects in the reference period at all, as well as the nine stakeholders that granted aid, received follow-up questions to identify the reasons for not granting aid at all or for granting aid only in certain years.

The main reasons reported by the authorities that did not grant aid, are related to the lack of applications for relevant projects and to the scope of Article 47 GBER and the specific conditions and formalities to be fulfilled in order to qualify for such aid. This granting authorities were asked, when replying to the online survey, to indicate the relevant reasons, which were presented as multiple choices questions. The following choices were proposed, and respondents could select one or several reasons:

- Lack of applications for relevant projects (mentioned by 12 granting authorities)
- Difficulty to apply the “state of the art” criterion under Article 47 GBER (mentioned by no granting authority)
- Difficulty to satisfy the “treatment of waste from others” criterion under Article 47 GBER (mentioned by 5 granting authorities)
- Low aid intensities (mentioned by 2 granting authorities)
- Other reasons (mentioned by 7 granting authorities)

The authorities had the opportunity to indicate what “other reasons” would be for not granting aid. Those other reasons mentioned more specifically by the granting authorities were the following:

- Not covering all relevant costs (mentioned by 2 granting authorities)
- Focus on extra investment cost with difficult calculation method, leading to certain grants being based on Article 17 GBER instead (mentioned by 1 granting authority)
- Other provisions better suited, e.g. Article 20, 25 GBER (mentioned by 1 granting authority)

- Not suited for projects involving transfer of know-how and application for environmental and climate technologies to countries in need (mentioned by 1 granting authority)
- Supported projects do not fall under Article 47 GBER (mentioned by 3 granting authorities)
- Complexity of Article 47 GBER (mentioned by 2 granting authorities)

The following reasons behind the decision to not grant aid in certain years within the reference period were given by the granting authorities in the context of follow-up interviews:

- Lack of applications for relevant projects (mentioned by 2 granting authorities)
- Difficulty to apply the "state of the art" criterion under Article 47 (mentioned by 3 granting authorities)
- Difficulty to satisfy the "treatment of waste from others" criterion under Article 47 GBER (mentioned by 2 granting authorities)
- Complexity of Article 47 GBER (mentioned by 2 granting authorities)
- Other provisions better suited (mentioned by 1 granting authority)

In cases where incomplete answers were provided, i.e. in the absence of specific replies to one or several questions, or (for complete replies) to get more background information about the reasons for not granting any (or more) aid under the respective schemes, a series of telephone interviews was conducted with the granting authorities concerned.

- With regard to schemes SA.39140 and SA.39143, a representative of the BMWi stated that there have not been any cases with regard to waste management. They were not aware of any request of aid in this field. Moreover, even if aid would have been granted for waste management, this would not have been explicitly recorded under the current schemes as those schemes provide federal guarantees.
- With regard to schemes SA.40264 and SA.40266, a representative of ADEME stated that difficulties may arise because of the cumulation of aid with other public financing tools that are subject to different rules. Certain candidates, notably SMEs, have revoked their requests in light of such difficulties.
    - For instance, in case of coordinated calls for proposals involving several regional actors and financing authorities, it is not possible to maintain confidentiality for projects aiming at new market entry. ADEME has accepted confidentiality, limited in time and scope, in duly motivated situations and in full respect of transparency and publicity rules, by including such a clause in the contract awarding the aid, but other organisation have not done this.
    - It has also been essential to provide guidance to candidate at an early stage which requires significant human resources for ADEME. For SMEs, the GBER does not define precisely the type of eligible candidates, so that many of them were not able to request aid given the administrative hurdles. This leads to a distortion of competition to the benefit of larger companies having a better knowledge of the State aid rules and procedures. ADEME has therefore launched a review of its processes to put in place a simplified procedure.
    - Requests have been rejected for the following reasons: projects were commercially viable without State aid or had a too high ROI, projects were carried out by actors not in line with the ADEME regulations (e.g. collectives or temporary groupings of SMEs, when the liabilities are not clearly shared or allocated), non-priority projects

or projects not falling under ADEME's competences, difficulties to present all relevant documents (CERFA form required above EUR 23,000 aid), too long duration for the analysis and award of the requested aid.

  - The 'State of the Art' criterion has been sometimes difficult to apply. The EU nomenclature does not always match the broad range of requests received, in terms of actors, technical nature of the proposed solution, relevant documentation, regulatory or technical constraints applicable. However, ADEME accepts a wide range of projects including, for the re-use of waste, investments for the prevention and upfront reduction (as well as food spoiling), pre-collection, preparation for upcycling, valuation of materials and substitution. This heterogeneity makes the review and award process longer and more complex.
  - The 'waste generated by others' criterion has also been difficult to apply in practice. Innovative solutions should therefore be adopted in order to support environment-friendly projects outside of Article 47 GBER, e.g. under Articles 36, 37 or 29 GBER, carried out by innovative SMEs rather than by less innovative dominant operators.

- With regard to scheme SA.40624, a representative of *KfW* stated that Article 47 GBER is too complex for many beneficiaries, in particular smaller ones, to be used more widely in practice. In case of doubt on the fulfilment of all relevant criteria, companies often prefer to match their funding requests under the de minimis rules, even if the amounts of aid become lower than under the GBER. The UIP-scheme has not led to many requests for public funding of waste management, while energy related projects are more frequent. According to a rough estimate, more than 50% of all funding requests were rejected, both in the field of waste management and in other areas. This is because they do not fulfil the relevant criteria under Article 47 GBER, which are difficult to understand and implement for requestors, in particular if they are small or medium-size companies. KfW explained that it was difficult for several companies to fulfil the 'state of the art' criterion. Moreover, among all criteria, the one which has been particularly problematic is the calculation of the investment cost surplus based on reference cost which is difficult to define for many requestors. The principles governing this calculation are being regarded as too rigid and a more flexible interpretation/application would have led to more (successful) requests for public funding.
- With regard to scheme SA.43249, a representative of the *Fond za zaštitu okoliša i energetsku učinkovitost* of Croatia explained that the decision to not grant aid under Article 47 GBER was due to the complexity of the article and especially its wording. In practical terms it is difficult to satisfy the treatment of waste from others criterion under Article 47 GBER.
- The *Ministerium für Umwelt, Energie, Ernährung und Forsten Rheinland-Pfalz (MUEEF, DE)* manages a budget of approx. EUR 15 million for the promotion of new technological developments to reduce C02 emissions and to save resources through model and demonstration projects. These projects may also be relevant for waste recycling and preparation for re-use, e.g. scheme SA.45476 focused on energy efficiency measures, but may include aid for waste management projects as well. However, this scheme does not cover any projects specifically geared towards waste management, and so there was little demand for such kind of aid. As a result, no aid has been granted at all under Article 47 GBER in the reference period. One project having received aid, and showing a link to waste management, concerns the construction of an innovative sewage sludge incineration plant by Thermische Verwertung Mainz GmbH (TVM) in 2018. The aid granted to TVM under the administrative ordinance 'Verringerung der CO2-Emissionen und Ressourcenschutz durch regenerative und effiziente

Energienutzung' amounted to EUR 5 million (for further details see Annex 7.2). This aid was however based on Article 38 rather than Article 47 GBER.

- With regard to the schemes SA.42456, SA.49001, SA.50267, a representative of the *Naturvårdsverket* (SE) explained that the Agency is facing several difficulties while implementing Article 47 GBER. In general, it could be due to the Swedish translation of the title of Article 47 GBER, but re-utilisation ("återanvändning") is not possible when something has been classified as waste (avfall).
    - Article 47.3: The simple case is when waste would otherwise be incinerated. In other cases, it can be quite difficult to assess whether alternative management means a "less environmentally friendly way" of handling the waste.
    - Article 47.4: An example is that the aid must not relieve the applicant from producer responsibility. But it is difficult to assess what is included in the producer responsibility in the individual cases.
    - Article 47.5: This is also difficult to judge. It is also odd to consider in terms of increased demand for waste.
    - Article 47.6: Probably the most difficult to assess, especially the meaning of "improvement over the latest technology".
    - Article 47.7: It is not always easy to get the applicant to explain what the alternative is and thus the point becomes difficult to assess.

5.6.3 Conclusions

The review of the State aid schemes officially communicated to the Commission by the Member States between 2014 and mid-2019 as falling under Article 47 GBER showed that 71 of 129 schemes (55%) explicitly mention or quote this provision, while 13 (10%) mention waste management without explicit reference. A third category of 45 schemes (35%) do not cover nor mention waste management at all. These schemes are of a more general nature, providing for basic rules and regulations to be complied with by beneficiaries in order to be eligible for State aid covering measures of a different and/or sometimes unspecified kind.

For 71 out of 84 schemes (84%) covering waste management measures with explicit reference to Article 47 GBER, Member States limited themselves to either quote or reproduce this provision without any specific amendments or adaptations. In 73 out of 84 schemes (87%) explicitly covering measures falling under Article 47 GBER, the granting of aid was limited to support for waste recycling and preparation for re-use, while four of them (5%) also included other kinds of projects and the other seven (8%) do not address recycling or preparation for re-use projects. Among all the 84 schemes covering measures under Article 47 GBER, 71 (85%) do not contain eligible activities targeting specific types of waste, while 13 (15%) do have such a focus.

The survey conducted with the 32 relevant granting authorities in charge of 56 schemes in the selected eight Member States showed that, among the 26 granting authorities (from 8 Member States) that replied to the survey with regard to 43 State aid schemes, nine granted aid for waste management and/or preparation for re-use projects in the reference period, sometimes under various schemes, but eight of them granted aid only in certain years. Those authorities indicated that they granted aid to a total of 975 individual projects (951 located in France) for a total of approx. EUR 133 million (approx. EUR 93 million in France). The main reasons for them not granting more aid in the reference period are the lack of applications for relevant projects, the narrow scope of Article 47 GBER, the strict conditions and formalities to be fulfilled in order to qualify for such aid, as well as the difficulty to satisfy the “treatment of waste from others” criteria.

6 Efficiency

6.1 Reductions to energy intensive users

Question 8.a: As regards the Member States which have granted reductions to energy intensive users, the contractor shall identify and assess what impact have those reductions had - cumulated with reductions to CHP charges approved by the Commission by analogy – on RES and CHP levies paid by energy intensive industrial consumers, non-energy intensive industrial consumers and households in terms of EUR/year? (see Annex 0 for a list of all questions.)

In the spirit of the EEAG, energy intensive users ("EIU") are undertakings with a high ratio between electricity cost and gross value added (electro-intensity in %, see Annex 4 EEAG). The precise definition of EIU depends on the country. In some cases, it is clarified based on official documents and in others it is based on assumptions. In many cases, it depends (amongst others) on the Eurostat's electricity consumption band of a given undertaking.[109] For Denmark, firms with an electro-intensity of 20% or more and belonging to bands IC through IF are assumed to be EIU. In France, an undertaking must exceed 7 GWh of annual electricity consumption to be defined as an EIU. In Germany, an undertaking must exceed 1 GWh of annual electricity consumption to be defined as an EIU. In Greece, the Medium Voltage group (bands IC, ID and IE) was split by consumption level to reduce the ETMEAR rate for medium voltage users, which consumed more than 13 GWh of electricity. This split is comparable to a reduction of levy for bands IC, ID and IE. In Italy, an undertaking must exceed 2.4 GWh of annual electricity consumption to be defined as an EIU. Furthermore, they must be connected to least in one point in medium, high or very high voltage. For Poland and Romania, it was assumed that EIU only fall into the bands IC-IF if they have an electro-intensity of 20% or more. In Slovenia, an undertaking must exceed 1 GWh of annual electricity consumption to be defined as an EIU. For the UK, it was assumed that undertakings with an electro-intensity of 20% or more are EIU.

Section 3.7.2. EEAG authorizes reductions of RES-related surcharges for Energy Intensive Users ("EIU") under five conditions:

i) support is limited to the additional cost resulting from RES (point 184 EEAG),

ii) reductions are limited to companies from energy-intensive sectors exposed to international trade listed in Annex 3 EEAG (point 185 EEAG),

iii) or to undertaking from another sector with trade intensity of at least 4% at EU level and electro-intensity of at least 20% (point 186 EEAG) as listed in Annex 5 EEAG,

iv) eligibility criteria are objective, transparent and not discriminatory (point 187 EEAG),

v) at least 15% of additional cost is paid without reduction (proportionality, point 188 EEAG), with possibilities to further reduce this share (point 189 EEAG).

Section 3.7.3 EEAG allows for a transitional period with two identified milestones for Member States to adapt their existing reduction schemes. Member States had until June 2015 to notify the Commission of an adjustment plan to put their existing scheme in line with the EEAG. Such plans had to be implemented by 1 January 2019 to ensure that as of that date, any aid granted to compensate costs of RES financing would be in line with the EEAG. In addition, the EEAG recognizes (in point 197) that some Member States have

[109] The definitions of consumption bands are given in Table 10 in Appendix 8.1.

introduced reductions or exemptions from RES surcharges before the EEAG came into force based on different eligibility criteria. The EEAG determines that such aid is compatible "provided that the adjustment plan foresees a minimum own contribution of 20 % of the additional costs of the surcharge without reduction, to be established progressively and at the latest by 1 January 2019."[110] This is referred to as the grandfathering rule.

6.1.1 Relevant decisions

From 2014 until August 2019, the Commission approved reductions to EIU in twelve Member States: Bulgaria (SA.45861), Denmark (SA.42424), France (SA.36511), Germany (SA.33995, SA.38632, SA.44679), Greece (SA.52413), Italy (SA.38635), Latvia (SA.42854), Lithuania (SA.50484), Poland (SA.37345, SA.43697), Romania (SA.39042), Slovenia (SA.41998), and the United Kingdom (SA.43657, SA.45155, SA.52615).

Bulgaria and Lithuania were excluded from the descriptive analysis, because no data is available for Bulgaria and there were no reductions to EIU in Lithuania. Furthermore, in two decisions the Commission accepted reductions to EIU in sectors other than those listed in Annex 3+5 EEAG, in line with point 186 EEAG: Denmark (SA.44863) and Germany (SA.41381).

Six decisions concern reductions to CHP levies approved by the Commission by analogy since 2017: France (SA.36511), Germany (SA.42393), Greece (SA.52413), Italy (SA.38635), and Poland (SA.52530). In addition, the Commission approved by analogy reductions to levies financing nuclear decommissioning in Slovakia (SA.50877) and financing social tariffs and equivalent electricity price levels between continental France and Outermost regions (SA.36511).

References to the grandfathering clause is included in five RES schemes: Germany (SA.33995)[111], Greece (SA.52413)[112], France (SA.36511)[113], Italy (SA.38635)[114], and Poland (SA.37345).[115] These references are interpreted such that the grandfathered undertakings can belong to three categories:

---

[110] Point 197 EEAG.

[111] Point 200-201 EEAG: "Germany has indicated that only a number of the beneficiaries of the BesAR in 2013 and 2014 were eligible for State aid in the form of reductions in the funding of support for electricity from renewable sources in accordance with section 3.7.2. Germany has therefore submitted an adjustment plan which is examined in section 7.3.5 for those beneficiaries that were not eligible. [...]".

[112] Point 26, 104-114 EEAG: "The adjustment plan is based on the following minimum ETMEAR contributions in line with the EEAG: [...] c) 20% of ETMEAR contribution for undertakings which benefitted from reductions before 1 July 2014 but operating in sectors other than those listed in Annex 3 or 5 of the EEAG or operating in a sector included in Annex 5 of the EEAG and having an electro-intensity below 20% (EEAG point 197).

[113] Point 268-275 EEAG: "The information provided by France, for certain years only for which it has statistics, has shown that for these years a significant number of beneficiaries have obtained reductions higher than the reduction levels authorised by the 2014 Guidelines. For example, in 2004, 124 beneficiaries of the CSPE cap at 0.5% of value added paid a CSPE below 15 cent and 202 paid a CSPE below 20 percent of its maximum level. In addition, 27 beneficiaries of the per-site cap paid less than 15 percent of the CSPE, 39 less than 20 percent of CSPE. In addition, the Commission notes that the 934 beneficiaries of the CSPE ceiling of 0.5% of value added belong to 135 different sectors of activity (131 NACE codes), a broader base than that authorised by Annexes 3 (68 NACE codes) to the 2014 Guidelines."

[114] Point 116-132 EEAG: 35 companies were identified as having potentially not paid the minimum required RES levies. These 35 companies would all be electro-intensive within the meaning of point 185-186 EEAG.

[115] Point 253 EEAG: "In Poland, energy-intensive consumers generating energy for their own use bear at least 15% of the costs of the RES support system, while other consumers generating energy for their own use bear at least 20% of these costs. On the basis of this information, the Commission concludes that the firms which benefited from these reductions before the entry into force of the EEAG on 1 July 2014 can be considered as undertakings that can maintain their contribution to the financing of the RES-E support scheme at a level of at least 20%, in accordance with the provisions of point 197 EEAG."

- Undertakings benefiting from RES levy reductions before 1 July 2014 from sectors other than those listed in Annex 3 or Annex 5 EEAG or in the two decisions on approved exemptions under point 186 EEAG (Germany, Greece, France)
- Undertakings benefiting from RES levy reductions before 1 July 2014 from sectors listed in Annex 5 EEAG, but with energy intensity lower than 20% (Greece)
- Undertakings benefiting from RES levy reductions before 1 July 2014 from sectors covered by the EEAG, but paying less than 20% of the RES levies (France, Italy, Poland).

6.1.2 Data sources

The following types of data were used and reviewed:

- RES and CHP yearly levies paid on top of the electricity price for groups of consumers with different levels of energy consumption until 2019 in all 13 Member States in which reductions have been granted. This data collection was done for question 6ii.
- Beneficiaries of reductions in RES and CHP levies, including those affected by the grandfathering rule in point 197 EEAG, and their NACE code. This information was collected from energy regulators in three Member States using the grandfathering rule, Germany, Italy and Poland. For France and Greece, the information was not available.
- Sector- and country-level sales data for 2017: Data on sales was collected per sector per Member State in 2017 to calculate the proportion of grandfathered undertakings. This data is (partially) available at Eurostat.
- Sales data in 2017 for the grandfathered undertakings: This data was collected from the professional firm-level database Orbis provided by Bureau van Dijk.

6.1.3 Impact of reductions on the level of levies

This section evaluates the impact of reductions to rebates on RES and related levies as approved by the Commission. This evaluation is done both for consumers that benefitted from the reduction (i.e. EIU) and for consumers who did not (i.e. non-EIU and households).[116] It is based on a comparison of levy rates over time and a comparison of total expenses in EUR/year between periods of equal length before to after the introduction of the rebate.[117]

The review covers all countries that introduced a reduction on RES or CHP levies over the period of observation: Denmark, France, Germany, Greece, Italy, Latvia, Poland, Romania, Slovenia and the UK.[118] The discussion below focuses on main developments and general patterns illustrated by examples. Discussions and descriptive evidence for each country

[116] Electricity prices, RES levies and reductions to the latter generally depend on the consumption intensity. Table 1 in Annex 8.1 provides an overview of consumption bands and the consumption range.
[117] Levy rates come from different sources as outlined in the answer to Question 6ii. These sources are: (1) Legislation: Rates were given in legal documents directly. (2) Calculation: Rates were calculated if the legal background provided a functional relationship (e.g. a rate but a maximal cap) rather than fixed values. (3) Adjusted: Rates were adjusted based on estimations (e.g. regarding the level of cost-pass-through, combining the levy and green certificate price or the valuation of the costs of a scheme).
[118] For some countries, data on RES levies or reductions to RES levies have been collected and presented in the answer to Question 6 but these data are cannot be used here. Austria introduced an exemption for households in 2012 because but data are only available from 2012 onwards, so it was disregarded. Estonia, Lithuania and Slovakia were disregarded for there were no reductions applied to EIU during the period covered by the study. For Bulgaria, there is no data available.

individually including Euro-values of the total burden per year for each consumption band are presented in **Annex 8.1**.

The analysis is based on an assessment of the development of RES and related levies over time. It identifies whether this development is consistent with a redistribution effect, i.e. whether a decrease of levy rates for EIU is observed at the same time as an increase of levy rates for other consumption groups. This assessment only allows identifying patterns of redistribution (i.e. levy rates of some groups increasing because rates for EIU decreased) and cannot be interpreted as evidence or causality for such an effect, because the development of levies is influenced by multiple factors.

Those factors can either be unobserved political decisions, or, insofar as levy rates are linked to the price of electricity, unobserved market factors. As a result, even if one rate (e.g. for EIU) decreases and another rate (e.g. for households) increases, this does not prove that one caused the other. The analyses, based on the data at hand, allows depicting developments and identifying patterns but it does not allow making conclusions on causality.

6.1.3.1 Heterogeneous Development

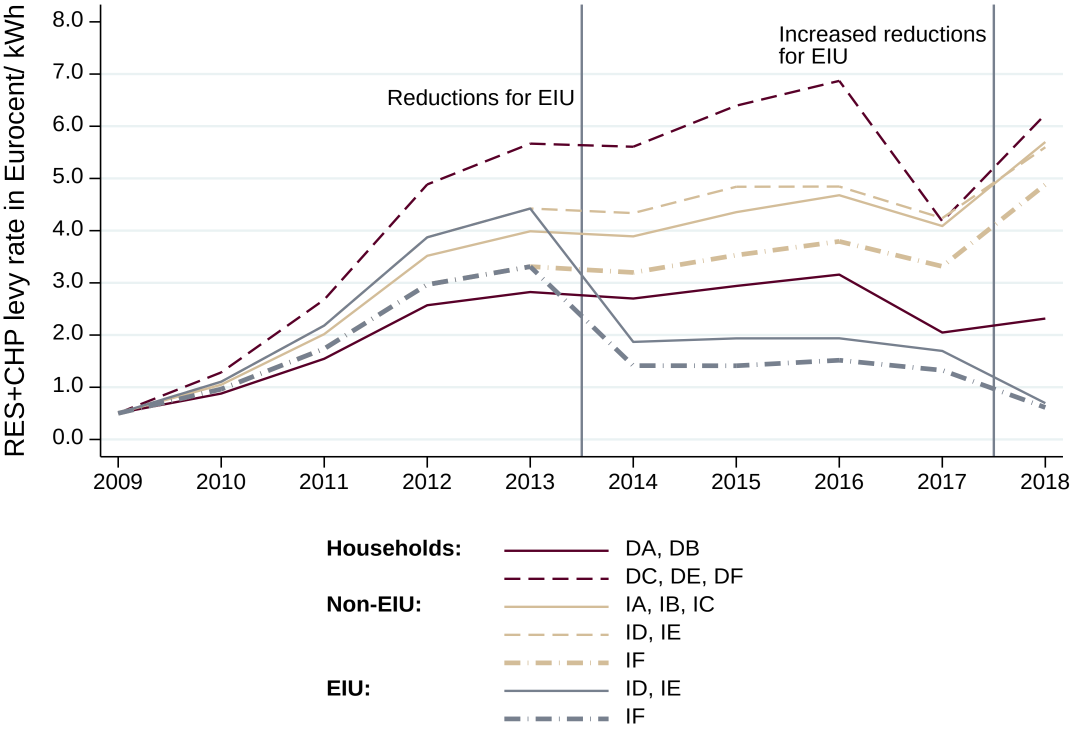
The development of the levies for both rebated and non-rebated consumers is very heterogeneous across countries and consumer groups. Some countries show clear increases in levy rates (and burden) for non-rebated customer groups, i.e. households and non-EIU when rates for EIU decline. In other countries, rates are rather flat over time or show a hump-shaped pattern (increasing first and then decreasing).

6.1.3.2 Main groups regarding potential impact

Whether or not a development is consistent with a redistribution effect depends not only on the country but also on the kind of levy (RES or related) because these might develop differently over time. In some cases, the effects are even heterogeneous across consumption bands, i.e., levy rates increase for some non-rebated customer groups (which is consistent with redistribution) but not for others.

- **Pattern not consistent with redistribution effect (no effect):** Levy rates for non-rebated customer groups appear unaffected by the introduction of rebates for EIU. While the introduction of rebates for EIU necessarily led to a drop in levy rates for these, the rates for all other consumption bands might be largely unaffected. Figure 42 below depicts the development of RES and CHP levy rates for Italy. In 2014, levies for EIU (plotted in grey) were reduced and thus declined. However, rates for all other consumption bands appear unaffected.

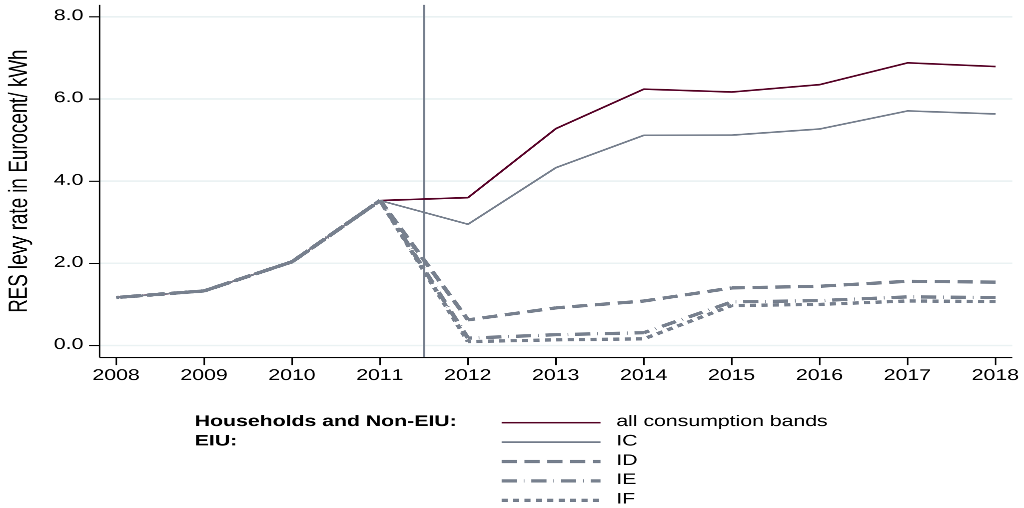
Figure 42: RES+CHP levy rates per consumption band in Italy



Source: E.CA Economics based on data collected as answer to Question 6. CfD Levy rates are adjusted, green certificate and FiT rates are calculated by the University of East Anglia. Note: Reductions are available for EIU as of January 2016.

- **Pattern consistent with lasting redistribution effect:** Levy rates of non-rebated customer groups increase after rebates for EIU were introduced. In some cases, levy rates for non-rebated customer groups increased around the time when reductions for EIU were introduced. Such a development can be observed for Italy around the increase of reductions in 2018 (see above) or for RES levies in Germany (see Figure 43 below).

Figure 43: RES levy rate per consumption band in Germany



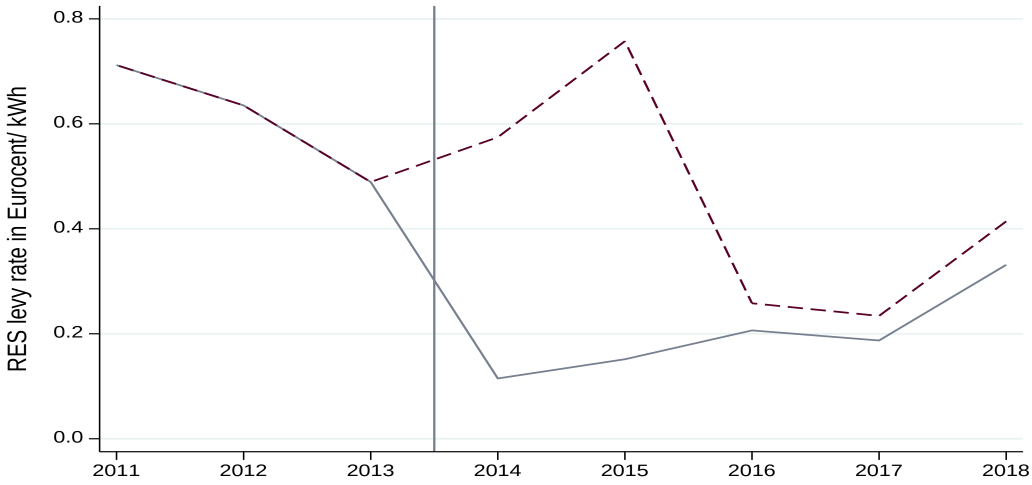
Source: E.CA Economics based on data collected for Question 6. Levy rates are taken from legislation. Reductions applied as of 2014. There is no data for consumption band IF for 2017 and 2018.

For Germany, the interpretation of a redistribution effect is supported by an additional source: the total budget spend on RES-support in Germany (i.e. money collected via levies across different customer groups) has increased between 2008 and 2015.[119] The combination of no reduction in the total budget with a significant reduction in RES levies for EIU implies that the money needs to be collected from other customer groups.

- **Pattern consistent with short-lived redistribution effect:** Levy rates diverge but then re-converge. Some cases show a pattern consistent with redistribution but this is only short-lived. Figure 44 below shows the development of RES levy rates for Poland as an example: With the reduction for EIU in 2014, rates for non-rebated customer bands increased in 2014 and 2015. However, these then decreased to almost the same level as the rate for EIU in 2016 and remained largely similar for the following years.

[119] As reported by the BMWi ("EEG in Zahlen: Vergütungen, Differenzkosten und EEG-Umlage 2000 bis 2019, 15 October 2018"), the total budget spent was 9.02 (2008), 10.78 (2009), 13.18 (2010), 16.76 (2011), 21.01 (2012), 21.91 (2013), 23.95 (2014), 27.50 (2015), 27.47 (2016), 30.41 (2017), and 32.02 (2018).

Figure 44: RES levy rate per consumption band in Poland



Source: E.CA Economics based on data collected for Question 6. Levy rates taken from legislation. Green certificate rate calculated by the University of East Anglia. Reductions available for EIU as of Jan 2014.

Table 8 below shows a classification of the different countries and levy rates around the introduction of rebates for EIU. If developments are identical, different levies (RES and CHP) are grouped. For details and discussions per country, see **Annex 8.1**.

Table 8: Overview of patterns of development of levy rates

Country (levy)	Pattern consistent with	Discussion
Denmark (RES)	No effect	Decision SA.42424 explains that levies are financed directly from the State budget (point 23), suggesting limited scope for redistribution effects.
France (RES)	No effect	The advantages from reductions were financed by the State (opening decision SA.36511 of 27.03.14,point 79-82), suggesting limited scope for redistribution effects.
France (CHP)	No effect	According to decision SA.36511 (349, 350), the costs of the policies exceeded the revenues collected and this deficit was covered by the state budget, suggesting limited scope for redistribution effects.
Germany (RES)	Lasting redistribution	RES levy rates before the introduction show an upwards trend; total budget spent increases continuously between 2008 and 2018
Germany (CHP)	No effect	Levies for some consumption bands adapted upwards
Greece (RES)	Lasting redistribution	Reduction introduced in 2014; slight re-convergence from 2015 onwards
Greece (HECHP)	Short-lived redistribution	Reduction introduced in 2014 leads to severe divergence but rates re-converge from 2015 onwards
Italy (RES and other)	2014: no effect 2018: redistribution	2014: Reductions for EIU were financed by the State, thus little scope for redistribution (SA.38635) 2018: not clear if lasting or not, due to data limitations
Latvia	No effect	Decision SA.42854 explains that levies are financed directly from the State budget (point 28), suggesting limited scope for redistribution effects.
Poland (RES)	Short-lived redistribution	Decision SA.37345 in para 175 notes that the reductions for EIUs in relation to certificates of origin were to be financed by end-consumers.

Country (levy)	Pattern consistent with	Discussion
Poland (CHP)	No effect	Reduction introduced in 2019, thus no effect because still too early to assess. In principle, redistribution effects likely because the CHP scheme will be financed just by the levies (SA.52530, point 74).
Romania (RES)	No effect	Decision SA.39042 does not provide explanations for the absence of an effect consistent with redistribution.
Slovenia (RES + CHP)	Heterogeneous but lasting redistribution	Strong increase for consumption band IF of non-EIU Moderate but lasting increase for other groups
UK (RES)	No effect	The reductions for the Renewable Obligation scheme and Feed-In-Tariffs scheme are financed from state budget, thus there is no scope for redistribution. (SA.43657, point 47 and 48) In the third Contract for Difference (CfD) scheme, there is scope for redistribution, because energy suppliers pass on their additional RES costs on consumers and may compensate the reductions for EIU by higher charges in other user groups.

Source: E.CA Economics based on data collected as answer to Question 6. Note: HECHP is the Greek name and implementation of CHP.

6.1.4 Conclusions

To assess whether the introduction of RES levy rebates for EIU led to increases of levies for other consumers, the development of levy rates over time for different consumer groups was analysed. The data allow identifying three broad groups. First, there are three countries with a pattern consistent with a lasting redistribution effect: Germany (RES), Greece (RES), and Slovenia. Second, there are countries with a pattern consistent with a short-lived redistribution effect that vanishes over time: Greece (CHP) and Poland (RES). Third, there are countries where no effect on rates for non-rebated customers could be observed: Denmark, France, Germany (CHP), introduction of rebates in Italy in 2014, Latvia, Poland (CHP), Romania, and the UK. The reductions in these countries were typically financed by the State and thus did not give scope for redistribution effects.

6.2 Relevance of grandfathering rule

Question 8.b: As regards the Member States which have granted reductions to energy intensive users the contractor shall identify and assess to what extent has the grandfathering rule foreseen in point 197 of the EEAG been relevant in different sectors in terms of proportion of grandfathered undertakings? (see Annex 0 for a list of all questions.)

The assessment covers the countries using the grandfathering rule and publishing lists of RES levy reduction beneficiaries: Germany, Italy and Poland.[120]

6.2.1 Identification of the grandfathered undertakings and sales data collection

The grandfathered undertakings were identified as beneficiaries in sectors not listed in Annexes 3 and 5 of the EEAG nor in the two decisions, in which the Commission approved exemptions under point 186 of the EEAG (Denmark - SA.44863 and Germany – SA.41381) in the following way:

[120] *For the remaining countries using the grandfathering rule, France and Greece, information on beneficiaries was not available.*

- **Poland**: The lists of beneficiaries were collected from the Polish energy regulator Urząd Regulacji Energetyki (URE). This included the names and tax identifying number (NIP) of beneficiaries of the RES levy reductions in 2016 to 2019, as well as beneficiaries of the CHP levy reductions in 2013 to 2019. The corresponding NACE code of each undertaking were identified by matching the NIP to the Orbis database of Van Dijk and extracting the primary NACE code for all matched companies. Consequently, the grandfathered undertakings were identified by filtering out the beneficiaries active in NACE codes covered by the EEAG Annex 3 and 5.
- **Germany**: The lists of beneficiaries were collected from the German Ministry of Economy (Bundesamt für Wirtschaft und Ausfuhrkontrolle; BAFA). This included the names and NACE codes of the beneficiaries of RES levy reductions in 2006 to 2018. Consequently, the grandfathered undertakings were identified by filtering out the beneficiaries active in NACE codes covered by the EEAG Annex 3 and 5 as well as the two additional NACE sectors exempted in Germany.
- **Italy**: The lists of beneficiaries were collected from the L'Autorita di Regolazione per Energia (ARERA). This included the names and tax identification numbers of the beneficiaries of RES levy reductions in 2017. The corresponding NACE code of each undertaking were identified by matching the tax id to the Orbis database of Van Dijk and extracting the primary NACE code for all matched companies. Consequently, the grandfathered undertakings were identified by filtering out the beneficiaries active in NACE codes covered by the EEAG Annex 3 and 5.

To calculate the proportion of the grandfathered undertakings in their sector, the number of enterprises and the total yearly sales of the relevant undertakings and their entire sector in 2017 were collected. The year 2017 was selected, since this is likely to be the most recent year for which firm-level financial data is available in professional databases.

- **NACE sector yearly sales and number of enterprises in 2017** were collected from Eurostat:[121]
    - **Poland:** In regards to RES 2017 data, the grandfathered undertakings are active within 15 NACE sectors. Eurostat provides yearly sales data and the data on the number of enterprises for 12 out of 15 of the relevant NACE sectors. In result, the proportion of both yearly sales and the number of grandfathered undertakings were calculated compared to total sales or total number of active undertakings in the respective NACE sector in 2017. In respect to CHP 2017, all grandfathered undertakings have been also grandfathered from the RES levy. Therefore, the proportion of grandfathered undertakings, in respect to sales or number of undertakings, calculated for RES levies' beneficiaries is valid also for the beneficiaries of the CHP levies.
    - **Germany:** In 2017, the grandfathered undertakings are active within 30 NACE sectors. Eurostat provides yearly sales data for 26 out of 30 of the relevant NACE

[121] *Source: Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E) [sbs_na_ind_r2], https://ec.europa.eu/eurostat/web/products-datasets/-/SBS_NA_IND_R2 accessed on 17.10.2019; Annual detailed enterprise statistics for construction (NACE Rev. 2, F) [sbs_na_con_r2], https://ec.europa.eu/eurostat/web/products-datasets/-/sbs_na_con_r2 accessed on 23.10.2019; Annual detailed enterprise statistics for trade (NACE Rev. 2, G) [sbs_na_dt_r2], https://ec.europa.eu/eurostat/web/products-datasets/-/SBS_NA_DT_R2 accessed on 23.10.2019; Annual detailed enterprise statistics for services (NACE Rev. 2, H-N and S95) [sbs_na_1a_se_r29], https://ec.europa.eu/eurostat/web/products-datasets/-/SBS_NA_1A_SE_R2 accessed on 23.10.2019.*

sectors. In two cases, the sales data were not available due to confidentiality. In one case, the NACE code was not available was not within of available code on Eurostat. In one case, the particular NACE code did not appear on Eurostat. Additionally, we retrieved the number of enterprises. Eurostat provides the number for 26 out of the relevant 30 NACE codes. In result, we calculated the proportion of both, yearly sales as well as the number of grandfathered undertakings, compared to total sales or total number of active undertakings in the respective NACE sector in 2017.

  - **Italy:** In 2017, the grandfathered undertakings are active within 83 NACE sectors. Eurostat provides yearly sales data for 74 out of 83 of the relevant NACE sectors. In seven cases, the NACE code was not within the range of available codes on Eurostat. In one case, sales data was not available due to confidentiality. In one case, the particular NACE code did not appear on Eurostat. Additionally, we retrieved the number of enterprises. Eurostat provides this number for 74 out of the relevant 83 NACE codes. In result, we calculated the proportion of both, yearly sales as well as the number of grandfathered undertakings, compared to total sales

- **Grandfathered undertakings' sales** in the respective Member States were collected from the firm-level database Orbis provided by *Bureau van Dijk*:

  - **Poland:** Overall, in regards to RES 2017 data, there were 388 beneficiaries on the list provided by the URE, out of which 17 were identified as grandfathered undertakings. For 15 of these undertakings, there were yearly sales data available for 2017 on the Orbis database. For one undertaking sales data of 2018 was used, as no other data was available. There was one undertaking which did not show any yearly sales data in the years 2014 to 2018. Based on the NIP, four out of the 388 undertakings could not be found in the Orbis database; hence, they have been neglected. As all grandfathered undertakings in respect of CHP 2017 are also grandfathered in respect of RES 2017, the same ratios are applicable.

  - **Germany:** The list of beneficiaries, retrieved from the BAFA, contains 2092 undertakings in 2017. Filtered by the NACE code, 179 were identified as grandfathered undertakings. The grandfathered undertakings active in NACE sectors 4910 and 4930[122] were scrutinised with respect to their geographic distribution rather than their sales numbers, because these undertakings operate locally. These sectors combined encompass 80 grandfathered undertakings. The remaining 99 grandfathered undertakings were analysed in respect to their proportion of sales and number of firms compared to the entire NACE sector. For 54 undertakings there was yearly sales data available for 2017 on the Orbis database. For 2 undertakings, sales data from years preceding 2017 were used. For the remaining undertakings, there was no sales data available on the Orbis database.

  - **Italy:** The list of beneficiaries in 2017, retrieved from the L'Autorita di Regolazione per Energia (ARERA), contains 2776 undertakings. There is an additional list containing 144 undertakings, yet their exemption has been under investigation and not finally determined. Hence, these additional undertakings were negleted and potentially lead to underestimation of the number of grandfathered undertakings.

---

[122] *NACE 4910 is passenger rail transport, NACE 4930 is other passenger land transport.*

Based on the tax ID (Partita IVA and/or Fiscal Code), we found information for 2722 out of 2776 undertakings on the Orbis database. For 2703 undertakings, Orbis shows a NACE code, which allowed us to identify the grandfathered undertakings. 19 undertakings did not show a NACE code on Orbis, although other information was available. They could either be grandfathered or exempted. Within the available data, we found at least 809 grandfathered undertakings. In respect to the proportion of sales and the number of firms compared to the entire NACE sector, we found yearly sales data of 2017 for 784 grandfathered undertakings. For 7 undertakings we used sales data from years preceding 2017. For 6 undertakings we used sales data from 2018. For 12 undertakings, there was no sales data available on the Orbis database.

- **Limitations:** The methodology described above has several limitations. First, it does not identify all grandfathered undertakings. It does not allow identifying the grandfathered undertakings active in sectors listed in Annex 3 or 5 EEAG, but benefiting from reductions higher than those allowed by the EEAG or those with energy intensity lower than 20%. Also the 144 Italian undertakings under investigation remain not identified, although some of them may end up as grandfathered. Second, when NACE sectors are larger than true antitrust markets, the share of grandfathered undertakings' sales in full NACE sector sales will underestimate the true relevance of the grandfathered undertakings in the market. Finally, in instances where the Orbis database does not assign the NACE code to the undertakings in an economically sensible way, the estimated share may be biased. This appears to be the case for coal mining in Poland (see next subsection).

6.2.2 Relevance of grandfathered undertakings

Two measures of the relevance of the grandfathered undertakings in their sector and country are provided in this section. For each relevant NACE code per country, the aggregated sales by grandfathered undertakings are compared to the total sales in that sector and Member State. This measure of the relevance of the grandfathered undertakings in their sector has a potentially useful interpretation.

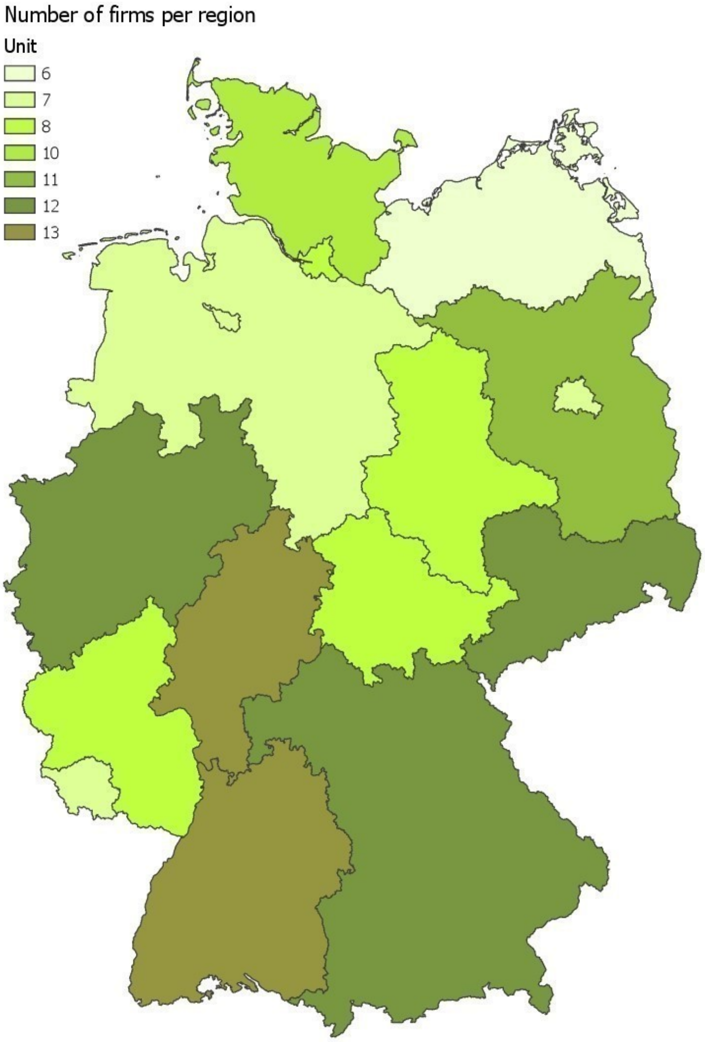
As long as the sector definitions roughly correspond to the relevant product market definitions, the share of aggregated sales by grandfathered undertakings signals the potential for competitive biases due to grandfathering. In addition, the number of grandfathered undertakings is compared to the total number of undertakings in the same NACE sector in the Member State. This section describes the results for Poland, Germany and Italy.

- **Poland:** Table 13 in Annex 8.2 shows that in most of sectors the share of grandfathered undertakings in the total number of undertakings is below one percentage. The proportion of grandfathered undertakings is low also when measured in terms of sales, with three exceptions. In sectors 6810 (buying and selling of own real estate) and 4671 (wholesale of solid, liquid and gaseous fuels and related products), the share of grandfathered undertakings sales out of the total sales are 32.8% and 8.26% respectively. However, when looking at the company names we note that the Orbis database allocated holding companies of coal mine producers under these sectors. If the holding entities of the coal producers are assessed against NACE 0510 (Mining of coal and lignite), the proportion of grandfathered undertakings in respect to sales is 56.22% and 3.51% in respect to the number of undertakings. In the sector 4675 (wholesale of chemical products) the sales share of the grandfathered undertaking is

21.1%. These sectors appear likely to be affected by competition distortions due to grandfathering.

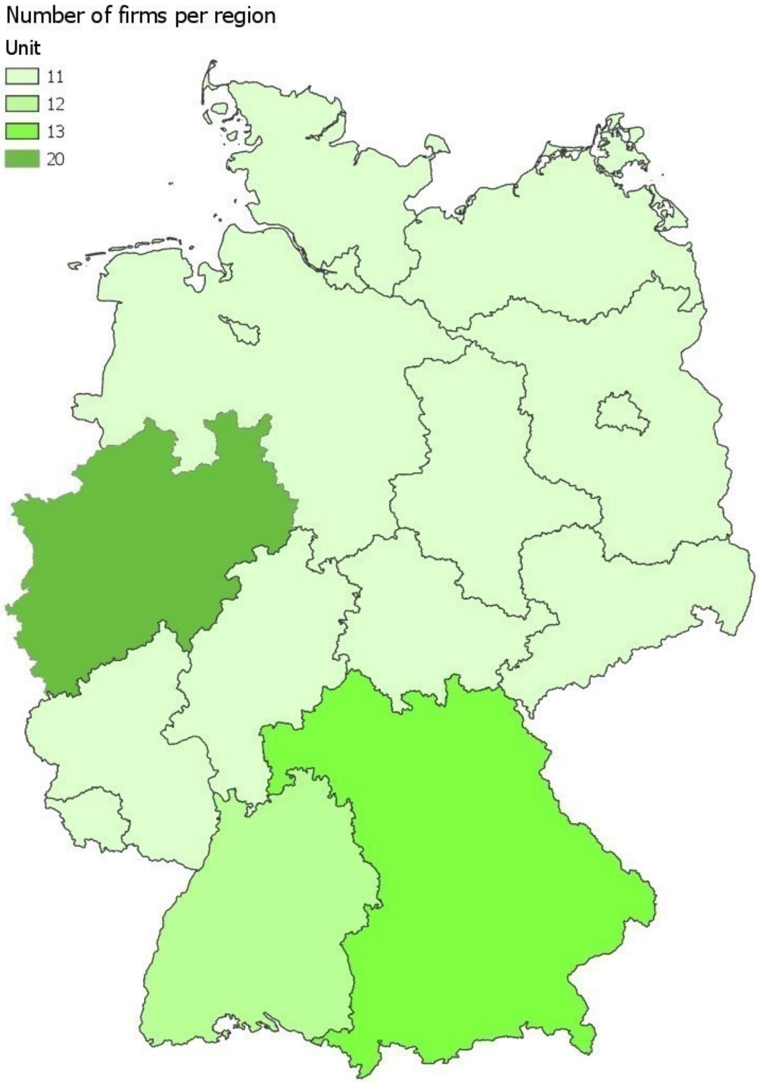
- **Germany:** Table 14 in Annex 8.2 shows that in each sector, the share of grandfathered undertakings from the total number of undertakings is below one percentage. The proportion of grandfathered undertakings is low also when measured in terms of sales, with four exceptions. In sectors 1052 (Manufacture of ice cream), 1812 (Other printing), 4312 (Site preparation), and 5222 (Service activities incidental to water transportation), the share of grandfathered undertakings sales out of the total sales are 9.25%, 9.32%, 14.41%, and 5.05% respectively. These sectors appear the most likely to be affected by competition distortions due to grandfathering in Germany. Additionally in Germany, there are also grandfathered undertakings active locally in passenger transport. This is the case for the NACE codes 4910 (Passenger rail transport, interurban) and 4930 (Other passenger land transport). In these sectors, the number of grandfathered undertakings varies strongly by region. The following two maps show the number of grandfathered undertakings per Federal State for each of the NACE codes.

Figure 45: Number of grandfathered undertakings per Federal State in passenger rail transport, interurban (NACE: 4910), in Germany



Source: E.CA Economics. Note: Based on the Orbis database, three additional grandfathered undertaking are active in NACE 4910 and their activities cover all regions in Germany. These undertakings are neglected in the map as there is conflicting information on their NACE code between Orbis data and the list received from BAFA.

Figure 46: Number of grandfathered undertakings per Federal State in other passenger land transport (NACE: 4930) in Germany



Source: E.CA Economics.

For interurban passenger rail transport, the highest concentration of the grandfathered undertakings is in Baden-Württemberg and Hessen (13), followed by Nordrhein-Westfalen, Bavaria and Sachsen (12). The lowest number of grandfathered undertakings were active in Mecklenburg-Vorpommern (6). In other passenger land transport, the largest number of grandfathered undertakings were active in Nordrhein-Westfalen (20), followed by Bavaria (13) and in Baden-Württemberg (12). These were mainly regional providers of public transport, e.g. tram or metro services ("Verkehrsbetriebe", "Stadtwerke" and "Straßenbahn" amongst others).

- **Italy:** Table 15 in Annex 8.2 shows that in most of sectors (64 out of 83), the share of grandfathered undertakings sales in the total of the NACE code in 2017 is below five percentage points. There are 19 NACE sectors (out of 83), where the share exceeds 5%: 0890 (mining and quarrying), 1052 (Manufacture of ice cream), 1330(Finishing of textiles), 1710 (Manufacture of pulp, paper and paperboard), 1811 (Printing of newspapers), 1812 (Other printing), 1814 (Binding and related services), 2010 (Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms), 2210 (Manufacture of rubber products), 2220

(Manufacture of plastics products), 2310 (Manufacture of glass and glass products), 2340 (Manufacture of other porcelain and ceramic products), 2364 (Manufacture of mortars), 2450 (Casting of metals), 2550 (Manufacture of fabricated metal products, except machinery and equipment), 2561 (Treatment and coating of metals), 2562 (Machining), 2610 (Manufacture of electronic components and boards), 3521 (Manufacture of gas). In three of these sectors, the share is particularly high: 71.9% in manufacture of gas, 38% in manufacture of ice cream and 31% in manufacture of fabricated metal products, except machinery and equipment. These sectors appear the most likely to be affected by competition distortions due to grandfathering in Italy.

6.2.3 Conclusions

The relevance of the grandfathering rule was assessed according to the proportion of sales by the grandfathered undertakings in their economy sector and country in 2017. Sectors not covered by the EEAG in Germany, Italy and Poland were considered. For Germany, there are four sectors (out of 30) with shares between 5% and 10%, while all other sectors have shares below 5%. For Poland, there are at most three sectors (out of 15) with sales shares exceeding 5%, two of them being very high, between 20% and 35%. For Italy, there are 19 sectors (out of 83) with sales shares exceeding 5%, and in three of them the sales share exceeds 30%.

6.3 Financial instruments for energy efficiency

Question 9: Based on Member States' implementation of the requirements of Article 39 GBER in energy-efficiency schemes and on financial intermediary and energy service companies' ("ESCOs") market behaviour, to what extent has the administrative burden linked to Article 39 GBER been proportionate to the potential distortions on the financial intermediary markets and on the energy efficiency service market? (see Annex 0 for a list of all questions.)

6.3.1 Review of energy efficiency schemes

Question 9.a: For the schemes containing provisions on energy-efficiency projects in buildings:

(i) How is the selection of financial intermediaries (or funds) organized?

(ii) How the national legal basis purposes to verify that the independent private investment share reached 30% and that private investors obtained a fair rate of return?

(iii) How does the national legal basis purposes to verify that financial intermediaries were passing-on full advantages to beneficiaries and were managed on a commercial basis?

(iv) Whether the national legal basis allows that the subsidized loans be concluded between financial intermediaries (or funds) and ESCOs?

(v) What types of expenditures and projects are eligible under the national legal basis?

(vi) Whether subsidized loans or guarantees are limited to households or also available between financial intermediaries and SMEs or large undertakings?

To provide input for assessing the effectiveness of State aid measures in the field of energy efficiency in buildings, the review started with desk research into 71 national State aid schemes, based on a list provided by the Commission, indicating all national schemes falling under Article 39 GBER which had been officially communicated to the Commission by the Member States until mid-2019 as constituting schemes falling under Article 39 of the GBER. These 71 schemes stemmed from 18 Member States. The outcome of this research is presented in a comprehensive excel table (**Annex 9.1**), containing all above mentioned schemes, with a particular focus on provisions related to:

- selection of funds/financial intermediaries;
- independent private investment share of 30% and private investors' fair rate of return;
- financial intermediaries passing on full advantages to building owners or tenants and being managed on a commercial basis;
- subsidized loans concluded between financial intermediaries (or funds) and ESCOs;
- eligible expenditures and projects, notably building insulation, heating renovation, installation of RES production, or combinations of those; and
- subsidized loans or guarantees being limited to households or also available between financial intermediaries and SMEs or large undertakings.

Based on the list of 71 schemes provided by the Commission, 47 schemes (66%) were identified as directly referring to Article 39 GBER.[123] Nine of the other 24 schemes (38%) refer to the provisions of the GBER more generally, or to Regulation (EU) No 1407/2013 ("*de minimis* Regulation") without quoting any specific article, while 15 of them (62%) do not contain any reference to State aid rules. Among these 24 schemes, 16 (66%) do not refer to energy efficiency projects in buildings specifically, but contain provisions on financial instruments for energy efficiency.

Of the 47 schemes with explicit reference to Article 39 GBER, 7 (15%) reproduce its entire wording, 12 (26%) reproduce certain parts of it,[124] 17 (36%) simply mention that projects should be carried out in accordance with its conditions without explaining further the content of this provision, and 11 (23%) simply indicate that energy efficiency projects in buildings are covered.[125]

On the selection of financial intermediaries or funds, schemes that refer to, or contain, the wording of Article 39(8) a.-f. GBER require an "*an open, transparent and non-discriminatory call in accordance with applicable Union and national laws*". As many granting authorities simply refer to, or copy, the wording of this GBER provision, it was not possible to indicate how it is verified if the investment by an independent private investor reaches 30%, and if the investors obtain a fair rate of return.[126]

Among the 47 relevant schemes, 20 (43%) require explicitly that private investment should reach at least 30%, while the other 27 schemes (57%) do not. The national provisions implementing the schemes often do not address the management of financial intermediaries, including energy efficiency funds on a commercial basis. Six of the 47 schemes (13%) indicate the identity of financial intermediaries and 23 (49%) refer to the requirements in Article 39(9) GBER, while 18 (38%) do not indicate anything on the management of the financial intermediaries involved or to be involved. The national provisions implementing the schemes often do not address the passing on of the full advantage to building owners or tenants either. Among the 47 schemes, 22 require that

[123] Those schemes are highlighted in green in Annex 9.1.
[124] These schemes mainly reproduce the conditions set out in Article 39(8) and 39(9) GBER.
[125] This category contains the schemes: SA.39273, SA.43600 and SA.51442, for which the responsible granting authorities indicated that they were covering Article 39 GBER.
[126] For the Greek scheme (SA.48981) see further details below, section 4.3.2.1.

the full advantage is passed to the owners or tenants (47%), while 25 of them (53%) do not contain any indications as regard the pass-on advantage to building owners.

Under the Greek scheme SA.48981, however, an invitation for expression of interest by financial intermediaries was published. It contains a general reference to Art. 39 of the GBER and a reference to paragraphs 8 and 9 of the same article on the conditions that apply for the selection of financial intermediaries. In addition, there is a reference to a maximum intensity of 70% of the financing needed for the eligible works. The remaining financing must be financed by the beneficiary. The invitation also refers to the Fund covering the costs of two energy audits and the remuneration of a “project advisor”. It also refers to the possibility for beneficiaries to contract a loan for the amount (maximum 30%) not covered by the Fund, with a “100% subsidization of the interest”. Finally, the Fund which is created for this scheme is to be financed at 1/3 by national/EU funds, and 2/3 by the financial intermediaries. The scheme does not contain any indication as to the identity of the selected financial intermediaries. The 1/3-2/3 ratio is also applied at project level, meaning that the maximum intensity would be lower than 70%.

Among the 47 schemes directly referring to Article 39 GBER, three (SA.44392, SA.46156 and SA.51024) indicate that the subsidized loans have to be concluded between the financial intermediary (or fund) and an ESCO. Still among the 47 schemes, 14 (30%) specify which energy efficiency projects related to buildings are covered, while 33 (70%) schemes do not specify this. Among these 33 schemes, 17 (52%) contain specific provisions on the definition of energy-efficiency measures, while 12 (36%) do not, and 4 (12%) implicitly refer to the definition of energy-efficiency by mentioning that the terms in the national legislation have the same meaning as in the GBER.

In six schemes (13%), it is specified what the projects cover, e.g. building insulation to reduce energy consumption by improving thermal performance of buildings (including new windows, double-glazing etc.), renovation of heating system or production of hot water from RES, and that a combination of those investments would be covered, while the remaining 41 schemes (87%) do not contain such provisions.

In 16 schemes (34%) containing a reference to Article 39 GBER, the wording does not contain any indication as to the beneficiaries of energy efficiency investments in buildings in the form of loans or guarantees. 12 schemes (26%) indicate that the aid is limited to homeowners and tenants and four schemes specify that only homeowners should be eligible beneficiaries. 19 schemes (40%) extend the beneficiaries to public bodies, private companies, associations or institutions and nine refer to companies as being the sole beneficiaries of aid. The Lithuanian scheme (SA.51024) specifies that only municipal administrations are being considered as final beneficiaries.

6.3.2 Stakeholder consultation on energy efficiency schemes

Question 9.b: For schemes containing provisions on energy-efficiency projects in buildings, how many energy-efficiency projects in buildings have obtained aid under these schemes, how the selection process of financial intermediaries (or funds) was organized, and if granting authorities were aware of any instances in which ESCOs or energy suppliers have made energy supply contracts subject to the conclusion of energy-efficiency services or vice versa?

To collect the relevant data, a targeted stakeholder consultation was conducted, using a combination of surveys and interviews. For that purpose, a web-based survey was transmitted to the addressees together with an accompanying letter from the Commission.

Telephone interviews were conducted with the granting authorities when this was considered more effective than the mere questionnaire, in particular when there was insufficient feedback from the addressees or when the replies were not clear enough. Certain interviews were conducted on the recipients' request.

Given that more than eight Member States adopted relevant support schemes based on Article 39 GBER, the review was limited to a representative sample of eight Member States.

Table 9: Sample of Member States

Member State	Geographic location	Country size	Close/far from energy-efficiency target	Schemes with expenditures for energy efficiency projects (Art. 39)
Croatia	South/East	Small	2%	No
France	West	Large	12%	Yes
Germany	Central/West	Large	14%	Yes
Greece	South/East	Small	6%	Yes
Hungary	Central/East	Medium	9%	No
Poland	Central/East	Large	10%	Yes
Spain	South/West	Large	10%	Yes
Sweden	North	Medium	17%	No

Source: Sheppard Mullin

The sample includes large and small, as well as "new" and "old" Member States, located in the South/North/East/West of the EU. It includes all reported spenders of public support under Article 39 GBER (apart from the UK).

It also reflects a diverse selection of the progress made by Member States towards reaching energy efficiency targets. Table 9 shows the percentage of the target for 2015 that the Member States already reached.[127]

The questionnaire covered the following questions:

- Whether Member States provided loans or guarantees under the relevant schemes to funds or financial intermediaries and what budget was allocated to each scheme?
- Whether Member States organized tenders or calls for application to select financial intermediaries or funds, and which types of institutions were selected to provide subsidized energy-efficiency loans?
- Whether Member States were aware of any instances in which ESCOs or energy suppliers have made energy supply contracts subject to the conclusion of energy-efficiency services or vice versa? (also based on Internet search)

The questionnaires were sent to relevant granting authorities in the selected Member States, including all granting authorities having adopted measures for which the Commission was informed about actual expenditure in the relevant period, as well as additional authorities for which the existence of expenditure was not reported to the Commission, so that it had to be verified why no (additional) aid was granted.

The survey, carried out with the questionnaire, followed by a series of interviews, comprised 21 granting authorities, in charge of 29 schemes, in the 8 selected Member

[127] *Report from the Commission to the European Parliament and the Council, 2017 assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and the implementation of the Energy Efficiency Directive as required by Article 24(3) of Directive 2012/27/EU.*

States. It revealed that among the 29 schemes, 5 do not contain explicit provisions on financial instruments for energy efficiency, nor a reference to Article 39 GBER. A total of 17 stakeholders in charge of 22 State aid schemes and covering eight Member States replied to the survey, and their replies are outlined below and summarized in the last column of **Annex 9.2**. The full replies are provided as **Annex 9.3**.

6.3.2.1 Details on aid granted under Article 39 GBER

Of the 17 granting authorities that replied to the survey, only one (the Greek authority, SA.48981) indicated that it granted aid under Article 39 GBER. In a telephone interview, this authority stated that 18,134 loans were approved for a total of EUR 30 million to homeowners for energy saving interventions, such as replacement of windows, insulation etc. As per October 2019, 4,839 loans were disbursed for an average amount of EUR 6,700 per homeowner. The same authority organised a public call for application to select established financial institutions operating in Greece to provide these subsidised energy-efficiency loans. During an interview with the Special Service for State Aid of the Greek granting authority,[128] it was stated that Article 39 GBER was considered clear and not difficult to apply. However, it was regretted that, unlike other GBER provisions, the wording does not specify whether this provision can be combined with the *de minimis* Regulation.[129]

The remaining 16 granting authorities did not grant any loans or guarantees under Article 39 GBER. However, some of them indicated that they granted aid under other provisions of the national scheme and listed those projects (SA.43254 and SA.42457). For instance, the French "*Caisse des Dépôts et Consignations*" indicated that aid was granted to 14 projects with amounts varying between EUR 80,000 and EUR 2.5 million. None of the interviewees however indicated on which GBER provisions those subsidies where based.

Interviews were conducted with seven granting authorities with regard to the reasons for the lack of application of Article 39 GBER, and all of them stated, among others, the complexity of the wording and the difficulties due to its practical implementation, because Article 39 GBER is long, complex and not user-friendly. This complexity further results in difficulties in the implementation, and interviewees tended to prefer other clearer and more practical provisions from the GBER. Interviewees regretted this, especially where the demand for energy efficiency projects tends to increase. On the wording of the provision, some authorities mentioned that it is too lengthy, and that it does not address its combination with *de minimis* rules.[130] Other granting authorities stated that, besides the complexity of the wording of Article 39 GBER, the construction of the aid via a financial intermediary is very complex and difficult to apply in practice.[131]

Some interviewees indicated that Article 39 GBER is often included in much broader national schemes about environmental protection aid, and that other types of GBER exemptions were more suitable for the objectives of the programs.[132] Some interviewees stated that these difficulties have been addressed by applying Article 38 GBER instead.[133]

[128] *Interview with members of the Special Service for State Aid, Υπουργειο Αναπτυξης Και Επενδυσεων.*
[129] *See, for instance, Art. 21(18) GBER.*
[130] *Interviews with Referat EA6 – Beihilfenkontrollpolitik Bundesministerium für Wirtschaft und Energie, and with Befektetési menedzse.*
[131] *Interview with Handläggare, Klimatklivet, Naturvårdsverket Klimatklivsenheten, and with Referat EA6 – Beihilfenkontrollpolitik Bundesministerium für Wirtschaft und Energie.*
[132] *Interview with Head of the Renewable Energy and Resource Use Area, EVE.*
[133] *Interview with Handläggare, Klimatklivet, Naturvårdsverket Klimatklivsenheten.*

6.3.2.2 Tying of energy supply contracts

As regards publicly available evidence on the tying of energy supply contracts to energy efficiency services, or vice versa, all 17 authorities replying to the survey stated that they were not aware of potential instances in which such contracts were tied to energy efficiency services or vice versa. This result is consistent with the preliminary findings of the research carried out on several websites of national competition authorities, among others, in Belgium, France, Germany and Austria, in order to identify any competition enquiries those authorities might have conducted, without any such findings.

Further research was conducted on so called energy performance contracting ("EPC") and energy supply contracting ("ESC") as defined by the Energy Efficiency Directive.[134] An EPC is "a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored throughout the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criteria, such as financial savings".[135] An ESC is a contractual arrangement for the efficient supply of energy.[136] In other words, ESC focuses on efficient energy supply where ESCOs provide products such as heat, chilling, compressed air or electricity. EPC aims for energy savings such as HVAC, lighting, controls and building fabric improvements.[137] EPC may include additional services related to efficient energy supply. Further, pursuant to Country Reports made for the *QualitEE* project, ESCOs may operate on both EPC and ESC markets.[138] However, although EPC and ESC can be offered jointly by ESCOs, no evidence of cases was identified where providers would make the signature of the one conditional to the conclusion of the other contract.

6.3.3 Conclusions

The review of the 71 State aid schemes officially communicated to the Commission by the Member States as falling under Article 39 GBER between 2014 and mid-2019 showed that 47 schemes (66%) contained explicit references to this provision or referred to energy efficiency in buildings in general terms. The 24 schemes (34%) which do not cover nor mention energy efficiency projects in buildings are of a more general nature, providing for basic rules and regulations to be complied with by beneficiaries in order to be eligible for State aid covering measures of a different and/or sometimes unspecified kind.

Among the 47 schemes covering Article 39 GBER, three categories can be identified: 19 (40%) reproduce (almost) entirely the wording, while 17 others (36%) simply mention that support shall be granted in accordance with this provision without further details. For those two categories, the wording of the national legal bases does not indicate how granting authorities verify that the conditions of Article 39 GBER are respected. A third category contains 11 schemes (24%) related to the support of energy efficiency in buildings without quoting Article 39 GBER.

---

[134] Directive 2012/27/EU of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.

[135] Art. 2(27) of Directive 2012/27/EU.

[136] This definition is a simplified version of the IEA DSM Task Force 16 definition.

[137] See European Association of Energy Service Companies, Energy Contracting: Successful energy services business models, available at: https://www.euesco.org/cms/upload/downloads/brochures/101006_euesco_ContractingFlyer_A4_final_low.pdf

[138] See QualitEE Country Reports on the Energy Efficiency Services Market and Quality, available at: https://qualitee.eu/country-reports-on-the-energy-efficiency-services-market-and-quality/.

The stakeholder consultation into the relevant schemes included 21 granting authorities in the eight selected Member States, of which 17 replied to the questionnaire. It appeared that many granting authorities consider Article 39 GBER as rather lengthy and complex. Only one authority (in Greece) provided loans for energy efficiency projects in buildings, considering Article 39 GBER as clear and not difficult to apply. Four granting authorities explained that they prefer to rely on other, clearer provisions in the GBER. The autorithies in charge of implementing three State aid schemes, including the Greek authority having implemented a scheme under Article 39 of the GBER, were concerned that the drafting of Article 39 GBER does not allow to understand if the provision can be combined with the de-minimis exemptions.

Finally, consistent with the answers given by the granting authorities to that aspect, the desk review of publicly available information does not suggest that either ESCOs or energy suppliers have made energy supply contracts subject to the conclusion of energy-efficiency services or vice versa. Although there is evidence that ESCOs may provide both energy supply contracts and energy-efficiency services, there is no indication that they had made the performance of the one conditional to the signature of the other.

7 Relevance

7.1 Zero-subsidy bids

Question 10: Do the EEAG and GBER still adequately address recent market developments such as zero subsidy bids? What are zero subsidy bids made under RES support schemes? What were auctioned technologies, auction dates, volumes, bids, as well as other advantages? Where contracts were awarded to projects that bid at zero, what were award criteria on the basis of which winning project (or projects) were selected? (see Annex 0 for a list of all questions.)

7.1.1 Introduction

This section focuses on 'subsidy-free' renewable energy projects in eleven Member States, i.e. Spain, Germany, Netherlands, Norway, Italy, Finland, Sweden, UK, Portugal, Ireland and Denmark, for which subsidy-free projects were found in publicly available information, collected by 31 August 2019.

Subsidy-free projects were defined as those receiving zero public funding irrespective of movements in the energy market price. Thus, although no subsidy is received in relation to electricity generated, these projects may benefit from support in terms of e.g. subsidised grid connection costs, or access to land/seabed.

Based on the collected data, the total announced subsidy-free renewable energy capacity currently in Europe is approx. 18 GW. The capacity of onshore wind outstrips solar, offshore wind and biomass, with 47% of total volume represented by onshore wind technology. Solar is second, with 34% capacity share. There is a split in technologies between northern-European countries that have announced a greater volume of wind projects, and southern European countries with a higher concentration of solar.

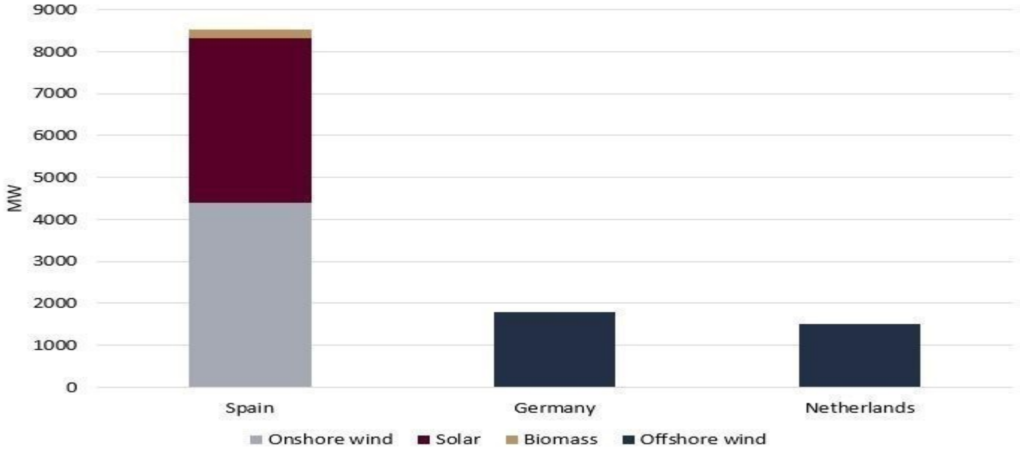
Countries leading the way in subsidy-free wind are Germany and the Netherlands. The largest subsidy-free projects by capacity tend to be wind in the north of Europe. Solar projects are typically more numerous but smaller in volume (ICIS, 2019). In spite of this, Spain currently leads the subsidy-free market with the highest number of projects and total capacity announced, accounting for almost 50% of all subsidy-free renewables announced in terms of volume.

A subsidy-free project can be a result of a zero bid in renewable energy auction, or it may come about as project concluded outside of an auction system[139]. The majority of the cumulative subsidy-free announced project volume results from zero bids in renewable energy auctions.

At the time when data was collected, seven renewable energy auctions with zero subsidy bids had taken place in three countries: Spain (3 auctions, 83 zero bids), Netherlands (2 auctions, 2 zero bids) and Germany (2 auctions, 4 zero bids). The total volume of these auctions is approximately 11.8 GW or 66% of the total announced project volume. The auctioned volumes by country and technology are presented in Figure 47.

[139] *If the auction is based on a Contract for Difference (CfD) model, then zero bid corresponds to bidding at or below projected electricity market price.*

Figure 47: Subsidy-free auctioned capacity by country and by technology

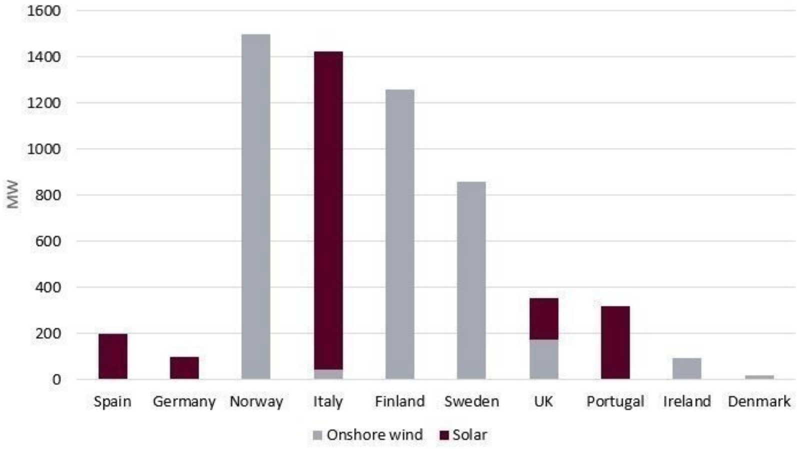


Source: BOE 2016, 2017a, 2017b (ES), Müsgens and Riepin 2018 (DE) and s Enterprise Agency n.d. (NL).

Renewable energy projects can also be approved outside of an auction format. In such cases, developers typically attempt to secure a long-term revenue stream for their projects by signing a power purchase agreement (PPA) with either a corporate or utility buyer (ICIS, 2019). A PPA is a long-term electricity supply agreement between an installation operator (seller) and an electricity customer (buyer). The buyer can be an intermediary energy trader or energy supplier, or a major direct industrial consumer such as an IT company who needs renewable power for its data centres. (Nasner, 2019)

The generator of the renewable energy receives a fixed price per megawatt hour, meaning that it can expect fixed returns on its investment and offer the bank the certainty it requires for the loans (Nasner, 2019). In the dataset collected for this review, all projects approved outside of an auction format are backed up by a PPA. Figure 48 summarises cumulative project volumes by country and technology that are approved outside of an auction format. For convenience, the plethora of references for subsidy-free projects approved outside of an auctions system are listed separately by project and can be found in **Annex 10**.

Figure 48: Subsidy-free capacity approved outside of an auction format by country and by technology[140]



Source: See references listed in Annex 10.

As can be seen from Figure 48, all projects approved outside of an auction format are either onshore wind or solar projects.

7.1.2 Renewable energy auctions with zero subsidy bids

Spain, Germany and the Netherlands are the three countries in Europe that have seen zero subsidy bids in their renewable energy auctions. Below the auctions in each of these three countries are discussed in turn, starting with the largest auctioned capacity.

7.1.2.1 Spain

The first renewable energy auction was held in January 2016, after being delayed from November 2015. The country also held two additional auctions in 2017 (Kruger et al. 2018). Unlike in other European countries, the auction participants in Spain are bidding for subsidies on installed rather than generated power (BOE 2016, 2017a, 2017b). In more detail, the Spanish scheme is essentially a standardised regulated asset-based system in which the government remunerates each plant to ensure a "reasonable rate of return" based on a recognised asset value. The reasonable rate is the government bond yield plus a spread. The bidders bid at a discount over the Regulated Asset Base – effectively ensuring that the government provides subsidies only if the market power prices are insufficient for the project to reach the reasonable rate of return. The winner of the auction is determined purely based on price and pricing is uniform, meaning that all winning projects get the same discount rate. (Del Río 2016, Losana 2017, Kruger et al. 2018)

Though the awarded projects are guaranteed a minimum price for the generated power, the price floors are so low that effectively the awarded projects remain fully exposed to market prices (Kruger et al. 2018, ICIS 2018b). To this end, in this report, all projects that

---

[140] For some of the solar projects, the capacities were announced in terms of direct current (DC) as the power is generated from the panel. However, solar power needs to be converted from DC to alternate current (AC) to be injected into the power grid. In this process, some of the power is lost. To this end, in cases where solar power capacities were announced in DC, a loss of 15% of a direct current was assumed in the transformation process. Subsequently, the capacities announced in DC were multiplied by 0.85 in order to unify the capacity measures across different technologies (Gipe, 2009). In addition, for some of the wind projects in Italy, capacities were announced in terms of megawatt hours. Since there was no information provided on the actual operating hours, the number of hours in a year was used to convert the volume to megawatts.

have bid zero investment subsidies in the Spanish auctions are interpreted as projects that are built without public funding. Table 10 summarises the design elements of the three renewable energy auctions in Spain.

Table 10: Overview of renewable energy auction design in Spain.

Design element	Round 1 (Jan 2016)	Round 2 (May 2017)	Round 3 (Jul 2017)
Volume requested per auction	700 MW	3,000 MW	3,000 MW requested; 5,037 MW awarded
Technology requested	Onshore wind, biomass	Technology neutral	Onshore wind, solar
Prequalification requirements (e.g. to post collateral to help ensure winning projects are built)	• Minimum volume of the bid: 1 KW • Bid bond of EUR 20/KW • No previous experience required, no administrative permits (incl. land) required	• Minimum volume of the bid: 1 KW • A bid bond of EUR 60/KW and a building permit required • No previous experience required	• Minimum volume of the bid: 1 KW • A bid bond of EUR 60/KW and a building permit required • No previous experience required
Remuneration characteristics	Investment-based support. The outcome of the auction is a discount on the standard value of the initial investment of the reference standard plant (RSP).		
Other advantages	• Guaranteed floor price (value not known) • No guaranteed connection to the grid	• Guaranteed floor price of EUR 40/MWh • No guaranteed grid connectio	• Guaranteed floor price of EUR 32/MWh • No guaranteed connection to the grid.
Selection criteria: price vs. other	Price-only auction (discount on the initial investment).		
Auction format: single vs. multiple	Multi-item. Bidders bid for a given capacity, not for a given project /plant.		
Auction type	Static, sealed bid, price-only.		
Pricing rule: pay as bid vs. uniform	Uniform pricing. All the winners receive the discount of the last bid being accepted, which will set such discount.		
Price ceilings	• Bid on discount from initial remuneration for standard plants, thus auction has inherent price ceiling • No maximum discount rate	• Bid on discount from initial remuneration for standard plants, thus, auction has inherent price ceiling • Max. discount 64.43% for onshore wind, 51.22% for solar, and 99.98% for biomass	• Bid on discount from initial remuneration for standard plants, thus auction has inherent price ceiling • Max. discount 69.9% for onshore wind and 87.1% for solar.
Realisation periods	Deadline to build the project is 48 months (counting from the publication of the Resolution in the official government journal BOE).		

Penalties	In event of non-compliance by agreed date (48 months), OMI-Polo Español SA (OMIE) – in charge of the management of the auction - enforces bid bonds.

Sources: Altozano (2019), BOE (2016, 2017a, 2017b), Kruger et al. (2018), Losana (2017), Del Rio (2016).

There are several institutions involved in Spain's auction programme. The State Secretariat for Energy is the regulator setting the rules of the auctions and passes the relevant legislation. The Comisión Nacional de los Mercados y la Competencia is an independent organisation that supervises and manages the auction procedure and outcome, while the OMI-Polo Español S.A is in charge of the management of the auction (Del Río, 2016). In the first Spanish renewable energy auction, no maximum discount rate was set, resulting in all projects bidding at a 100% discount rate. This means that the projects are fully exposed to the spot market, with no subsidies from the government. In the second and third auctions, the government defined maximum discount rates (or minimum levels of investment support) for each technology, at which all developers again bid. Table 11 summarises the outcomes of Spanish renewable energy auctions.

Table 11: Overview of renewable energy auction outcomes in Spain.

Outcome element	Round 1 (Jan 2016)	Round 2 (May 2017)	Round 3 (Jul 2017)
MW procured	700 MW (13 projects)	3,000 MW	5,037 MW
Technology procured / installed	• Onshore wind (500 MW, 8 projects) • Biomass (200 MW, 5 projects)	• Onshore wind (2,780 MW, 14 projects) • Solar (1,000 MW, 7 projects) • Biomass (19 MW, 9 projects)	• Onshore wind (1,128 MW, 10 projects) • Solar (3,909 MW, 30 projects)
Prices	Everyone bid 100% discount	• Onshore wind producers bid max. discount of 64.43% • Solar producers bid max. discount of 51.22%. • Biomass producers bid max. discount of 99.98%.	• Onshore wind producers bid max. discount of 69.9% • Solar producers bid max. discount of 87,1%

Sources: Del Rio (2016), Kruger et al. (2018), BOE (2016, 2017a, 2017b).

Table 11 indicates that there is over 8,700 MW subsidy-free renewable energy capacity currently in the pipeline in Spain. However, given the loose pre-qualification requirements in Spanish auctions, concerns on whether the awarded projects ever realize have been raised. (Kruger et al. 2018). To this end, research on the awarded projects was made in order to determine the share of projects that actually realize. The findings suggest that at least 7,108 MW (81%) of the awarded capacity is currently finished, under construction or has been able to secure the necessary project financing. With this capacity alone, Spain maintains its position as the clear leader of subsidy-free market in Europe.

7.1.2.2 Germany

The first renewable energy auctions in Germany that received zero subsidy bids were held in 2017 and 2018 (Harman, 2018). Both auctions allocated offshore wind projects, for which the system operator provided sites and grid connections (Kruger et al. 2018). In particular, winning the auction was the only way to become eligible for grid connection and access the electricity market. Given the long realization periods, many of the bidders considered winning as an option for the future. Willingness to secure market share and opt-out option contributed to aggressive bidding at zero (Klessmann, 2017) Table 12 summarises the design elements of the two offshore wind auctions held in Germany.

Table 12: Overview of the offshore wind energy auction design in Germany

Design element	Round 1 (Apr 2016)	Round 2 (Apr 2017)
Volume requested	1,550 MW (4 sites)	1,610 MW (6 sites)
Technology requested	Offshore wind	
Prequalification requirements / obligations (e.g. requirement to post collateral to help ensure winning projects are built)	• A guarantee of EUR 100,000/MW capacity that a participant is bidding for. • Participant has to be an owner of existing pre-developed projects (Existing projects are offshore wind farms that had already been approved or planned prior to 1 August 2016 or for which at least one consultation date had been implemented.)	• A guarantee of EUR 100,000/MW capacity that a participant is bidding for. • Only existing projects not awarded during the first round were eligible to participate.
Remuneration characteristics	Over a 20-year period starting from the delivery year, the auction winners will receive a market premium that is a top-up payment equal to the difference between their **individual strike price** and the **technology average market price** realized by all German offshore wind farms each month[141]. The strike price is not indexed to inflation and the system is one-way: If the technology average price exceeds the strike price, the operator gets to keep its wholesale market revenues and does not have to pay back the difference.	
Other advantages	The system operator provides sites and grid connections. After the 20-year subsidy period elapses, all operators can sell their output on the wholesale market for an additional five to 10 years before the license to use the site is transferred back to the state.	
Selection criteria: price vs. other	Price. The bidder with the lowest “reference value”, i.e. the base amount for the guaranteed grid supply compensation, receives the auction award. If two or more bidders make this lowest reference value bid, the bidder with the smaller capacity bid will receive the award. In the 2018 auction, a minimum of 500 MW was allocated to projects in the Baltic Sea.	
Auction format: single vs. multiple	Single. Bidders bid for given projects /sites.	
Auction type	Static, sealed bid, price-only.	
Pricing rule: pay as bid vs. uniform	Pay as bid. All the winners receive the own reference value bid.	
Price ceilings	EUR 120/MWh	EUR 100/MWh

[141] *If the strike price exceeds the technology average price, an operator whose wholesale market sales are exactly in line with the average offshore wind farm obtains the strike price exactly (because its revenues are equal to wholesale market revenues plus the calculated market premium), while an operator whose wholesale market revenues exceed or fall short of the technology average price earns more or less, respectively, than the strike price.*

Realisation periods	2022-2025
Penalties	Cancellation of the award and a penalty that may be as low as 30% of the bid bond. The eventual interpretation of the penalties clause in the Offshore Wind Act is disputed in the legal community

Sources: Huebler et al. (2017), Knight 2018, Müsgens and Riepin (2018), Offshore Wind (2018), Shumkov (2018), Volz and Waldmann (2019).

The auction rules and procedures are determined by Germany's ministry of Economic Affairs and Energy and the tendering procedures are carried out by the Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (Bundesnetzagentur) (Norton Rose Fulbright, 2017). In the April 2017 offshore wind auction, three out of four winning projects made bids of EUR 0/MWh. The second April 2018 auction saw two out of six winning projects awarded with zero bids. In the two auctions combined, more than 50% of winning capacity was bid at zero. (Müsgens and Riepin, 2018) A more detailed information on the auction outcomes is presented in Table 13.

Table 13: Overview of the offshore wind energy auction outcomes in Germany

Outcome element	Round 1 (Apr 2017)	Round 2 (Apr 2018)
MW procured	• With zero bids: 1,380 MW (3 sites) • Total: 1,490 MW (out of 1,550 MW)	• With zero bids:_420 MW (1 site) • Total: 1,610 MW (out of 1,610 MW)
Technology procured / installed	Offshore wind.	
Prices	• EUR 0/MWh (1380 MW) • EUR 60/MWh (110 MW) Average:_Euro 4.40/MWh	• EUR 0/MWh (420 MW, of which 10 MW for Wikinger Süd, Baltic Sea) • EUR 64/MWh (476 MW, all for Baltic Eagle park, Baltic Sea) • EUR 98.30/MWh (131.75 MW) • Prices for the remaining 582.25 MW not known, but less than 98.30/MWh. Average: EUR 46.60/MWh

Sources: Deutsche Windguard (2018), Huebler et al. (2017), Müsgens and Riepin (2018), Shumkov (2018).

The results from Table 13 show that though zero subsidy bids were submitted in both auctions, the average successful bid in the 2018 auction was over ten times higher than the average winning bid at the 2017 auction. There are at least two potential reasons for this. First, there was less competition in the second auction as only existing permitted or far-advanced projects that were unsuccessful in the 2017 auction were allowed to participate. Second, the 2018 auction allocated a minimum of 500 MW for projects in the Baltic Sea, where most bidders were not able to benefit from the same scale effects as in the North Sea.

7.1.2.3 Netherlands

The focus is on the two offshore wind auctions held in 2018 and 2019, which were the first renewable energy auctions in the Netherlands that received zero subsidy bids (ICIS, 2018a). Like in Germany, also under the existing Dutch offshore wind regime, the Government develops each site and TSO (TenneT) provides the grid connection (Mardsen et al. 2018). A distinguishing feature in the two Dutch auctions was that they were based on procedures without subsidies to begin with. In particular, due to the zero bids in the German offshore wind auctions and low strike prices in UK renewable energy auctions, the Netherlands authorities altered the rules of their tendering processes.

Under the new rules, zero subsidies were assumed right from the start and companies were assessed according to predetermined set of criteria: 1) the knowledge and experience of the parties involved; 2) the quality of the design of the wind farm; 3) the capacity of the wind farm; 4) the social costs (incl. grid connection costs); 5) the quality of the inventory and analysis of the risks; and 6) the quality of the measures to assure cost efficiency. Only in the event that none of the applications had satisfied the pre-qualification requirements, the tender had been extended to a subsidy-based second round of bidding. Table 14 summarises the design elements of these two offshore wind auctions.

Table 14: Overview of offshore wind energy auction design in the Netherlands

Design element	**Round 1 (Mar 2018)**	**Round 2 (Jul 2019)**
Volume requested per auction	700 MW (two sites)	700 MW (two sites)
Technology requested	Offshore wind	
Prequalification requirements / obligations (e.g. requirement to post collateral to help ensure winning projects are built)	<u>All applications must submit the following:</u> • Project plan • Wind report • Operational calculation • Annual account(s) (The applicant must have at its disposal equity capital amounting to at least 20% of the total investment costs.) • Financing plan • Table of wind turbine details and locations and table of cabling plan details <u>The winner of the tender must submit:</u> • A bank guarantee for compliance with timely operation of the production installation or the payment of a 10 million Euro fine of an EU based bank laid down in a model bank guarantee within 4 weeks after the issue date of the subsidy award. • A bank guarantee for compliance of 35 million Euro within 12 months after the issue date of the subsidy award. If the bank guarantee is not issued the penalty is EUR 10 million.	
Remuneration characteristics	The auctions were conducted on a non-subsidy basis where the bids were evaluated in a comparative assessment on a range of (non-price) criteria. Only in the event that there had been no successful bidders, the auctions would have proceeded to a subsidy stage.	
Other advantages	Free usage of the sites and a guaranteed free connection to the grid: The auctioned sites are located outside the 12 miles zone of the	Permission to use the sites and a guaranteed connection to the grid. However, since the auctioned sites are located within 12 miles zone of the

	Dutch territories. As a result, the wind farm operator is not required to pay fees neither for using the sites nor for the infield cabling between the wind turbines and the TenneT grid platform.	Dutch territories, the wind farm operator has to establish a) a seabed lease for the wind turbines and b) a rental agreement for the infield cabling between the wind turbines and the TenneT grid platform.
Selection criteria: price vs. other	Other. The applications were assessed based on the following criteria: • The knowledge and experience of the parties involved • The quality of the design of the wind farm • The capacity of the wind farm • The social costs (incl. grid connection costs) • The quality of the inventory and analysis of the risks • The quality of the measures to assure Cost Efficiency. The last two criteria had the highest weighting and were divided into three categories: 1) risk on electricity prices and value of Guarantees of Origin; 2) risks during construction; and 3) risks during operational period of wind farm.	
Single / multiple auction	Single. Bidders bid for given projects /sites.	
Auction type	Static. Sealed bid.	
Pricing rule: pay as bid vs. uniform	N.A.	
Price ceilings	N.A.	
Realisation periods	The entire wind park must be realized within 5 years from the moment the results of the auction are published.	
Penalties	In the event of non-compliance with these obligations, the Minister has the power to impose an administrative enforcement order or an order subject to a penalty and, if necessary, to withdraw the permit. In the event of an order subject to a penalty being applied, the Minister will determine an amount for the periodic penalty payment which is proportionate to the loss inflicted on the national government as a result of the non-compliance with the obligations.	

Sources: Clarke (2017), Kyberg/de Rijke (2016), Marsden et al. (2018), Netherlands Enterprise Agency (n.d.).

The Netherlands Enterprise Agency executes the offshore wind energy subsidy and permit tenders on behalf of the Ministry of Economic Affairs and Climate Policy, coordinating potential subsidies, building permits, site data of the wind farms and a connection to the electricity network of TenneT. Table 15 summarises the outcomes of the two auctions.

Table 15: Overview of offshore wind energy auction outcome in the Netherlands

Outcome element	Round 1 (Mar 2018)	Round 2 (Jul 2019)
MW procured	700 MW (two sites)	700 MW (two sites)
Technology procured / installed	Offshore wind	
Prices	EUR 0/MWh	

Source: Netherlands Enterprise Agency (n.d.)

Swedish Vattenfall, who has promised to utilize economies of scale created by building all four sites, won both of the two auctions. Not only has Vattenfall promised to build the sites without government subsidies, but also in fact it has to pay around EUR 2 million per year in ground rent for the seabed area where two of the four offshore wind farms are being built. (Hill, 2019).

7.1.3 Subsidy-free projects approved outside of an auction system

Based on the research conducted for this report, funding for the projects awarded outside of an auction system is always secured via a power purchase agreement (PPA). In on-site PPA's, the developer and operator of the wind or solar farm sells the electricity directly to a high-demand customer. In sleeved PPA's the power plant is not located on the premises of the high-demand customer, but the electricity is supplied via the grid. The electricity is purchased and sold by a trader who usually offers other services, such as forecasts or optimisation of electricity generation. Finally, in synthetic or financial PPA's the electricity supply is virtual rather than physical and the electricity is traded on the electricity exchange. In this type of agreement, the market risk is hedged and the electricity supply is covered by guarantees of origin (GO). (Nasner, 2019)

PPA's do not automatically mean that a project is not subsidised. Nor does it mean that the project has been approved outside of an auction system. In particular, a generator of renewable energy whose project has been approved within an auction system and who is receiving subsidies may also sign a PPA. However, this subsection focuses only on projects that a) have not received any public funding; and b) have been approved outside of an auction system.

Figure 48 in subsection 7.1.1 depicts announced volumes of subsidy-free projects that have been approved outside of an auction system by country. Based on the figure, such projects are particularly prevalent in Norway, Italy, Finland and Sweden. In Norway, the entire 1500 megawatt capacity is due to one onshore wind project developed by Norsk Vind Energi AS. In Italy there are multiple subsidy-free projects completed or under construction with total volume more than 1400 megawatts. The largest ones are the 425 megawatt project developed by Limes Renewables Italia and the 400 megawatt project of Horus Capital. In Finland, Google is the PPA partner in five out of the 20 subsidy-free projects (652.4 MW in terms of capacity) and IKEA is the PPA partner in four of the projects (110.2 MW in terms of capacity). In Sweden, majority of the 860 megawatt capacity is due to an onshore wind project called Markbygden ETT (650 MW) developed by Svevind. References to each of the project can be found from **Annex 10**.

7.1.4 Conclusions

The total volume of announced subsidy-free renewable energy projects currently in Europe is approximately 18 GW. Though majority of this capacity results from zero subsidy bids made in renewable energy auctions, the number of projects put forward outside of auction systems is rapidly increasing. In particular, there were no subsidy-free projects approved outside of an auction system until 2017, when the total annual capacity of such projects reached approximately 250 MW. This figure surged to approximately 3250 MW in 2018, and by the late August 2019, the capacity announced during that calendar year was already 2180 MW. Overall, one third of the 60 GW that Aurora (2018), has announced as the potential for subsidy-free renewables in North-West Europe by 2030 is in the pipeline. In light of this, the ability of markets to deliver zero-carbon electricity without policy support seems promising.

However, as pointed out already earlier, a significant part of the 18 gigawatts volume comes from projects that are only at the planning stage and it is not guaranteed that they will actually be built. Companies may have secured only enough finance to get a project through the planning process, rather than to build it. In the subsidy-free environment, lenders may be scared of investing when the earning potential of the project is left to the wholesale electricity market. At the very least, the riskier world of subsidy-free deployment means financiers are likely to demand higher returns to match that risk.

Moreover, the subsidy-free offshore wind projects in both Germany and the Netherlands were not fully subsidy-free given the guaranteed connection to the grid. Magnus Hall, the CEO of Vattenfall, which won both of the two Dutch offshore wind projects, has estimated that the value of free grid connection is up to EUR 10/MWh, which is more than 20% of the market electricity prices in the region of EUR 45/MWh (Evans, 2018), and Vattenfall paid EUR 2 million/year for the seabed sites. As to the auctions in Spain, though the guaranteed price floors are so low that they are unlikely ever to materialize, they still help to reduce the risk faced by the projects and can therefore be viewed as an implicit subsidy. These observations combined may support the view presented in Evans (2018), that in spite of the promising outlook, government contracts are may still be needed to support the largescale renewable expansion. However, given the speed with which renewable energy prices have decreased and the potential for successful projects to benefit from advantages beyond the subsidy linked to electricity generation, future competitive processes should be designed to ensure that no advantages (for example grid connections, seabed concessions) are transferred to beneficiaries without being fully accounted for.

7.2 Alternative fuel infrastructure

Question 11: To what extent are the process (assessment under the Treaty) and the compatibility rules developed by the Commission in its decision practice for alternative fuel infrastructure (publicly accessible or dedicated infrastructure) adapted to subsequent market developments and technological advances? (see Annex 0 for a list of all questions.)

7.2.1 Assessment of implementation of schemes

Question 11.a: For the schemes approved by the Commission, indicate how the projects have been implemented: companies involved in the projects, tender criteria used for the selection of companies (where applicable), costs of project, selected technology (when the scheme was open to several technologies), how access of the users to the infrastructure was organized (entirely open or not) and how much the user is charged for the access to and/or the use of the infrastructure.

In order to provide input for assessing the relevance of State aid measures in the field of alternative fuel infrastructure, and in response to Question 11.a, the review started with an assessment of the nine schemes and two amendments for the support of publicly accessible or dedicated alternative fuel infrastructure, which were approved by the Commission. After an analysis of the publicly available information, the beneficiaries of the schemes were identified. In case of lack of publicly available information, the granting authorities were contacted with an inquiry regarding the disclosure of the beneficiaries. Based on the answers received, the relevant stakeholders were contacted by phone and email in order to ensure the participation in the survey. Five granting authorities provided the main characteristics of the implementation of the State aid decisions. More detailed answers are provided in **Annex 11.1**.

(1) Germany - Charging infrastructure for e-mobility (SA.46574)

The measure under scheme SA.46574 aims to support the installation and upgrade of electric charging infrastructure across Germany. The total budget of the scheme is EUR 300 million coming from federal funds (Energy and Climate Fund). The program runs for four years, starting in 2017. The beneficiaries of the schemes are natural and legal persons, without restrictions (both private investors and cities/municipalities).

The aid is awarded in the form of grants by means of calls for applications. So far, the first three calls for funding have received more than 4,000 applications for funding. As of August 2019, applications have been approved for a total of more than 17,000 charging points (equivalent to around EUR 80 million). On 19 August 2019 the fourth call for funding started, with a deadline for applications on 30 October 2019. Following the Commission decision, an eligibility criterion is that the electricity required for the charging process must come from renewable energy sources (RES) or from renewable electricity self-generated on site. According to the granting authority, 5,200 of the supported charging points are already in operation and more than 1,600 beneficiaries were involved in the project. As agreed with the Commission, information of 56 beneficiaries was gathered, based on a sample list with regard to the first three calls for applications. The total amount of aid granted to the selected beneficiaries, which have a total charging capacity of 404,568 KW, amounts to EUR 66,157,556.51. The following section provides an overview of the actual implementation of the scheme:

Tender criteria: The first call for applications, which was launched on 15 February 2017, was based on the first-come, first-served principle. This means that aid was granted to a beneficiary according to the order of the reception of the complete application. With the first call the authority supported standard charging points up to EUR 10 million as well as 2,500 fast charging points. Normal charging points were supported with up to 40% of the eligible costs with a maximum of EUR 3,000 per charging point. Fast charging points were supported with up to 40% of the eligible costs with a maximum of EUR 12,000 per charging point under 100 KW and EUR 30,000 per charging point from 100 KW onwards. The maximum number of fast charging points for each of the 16 Federal States has been indicated by the authority in the call (2,500 in total).

With the second call for applications, which was launched on 14 September 2017, 12,100 normal charging points and 1,001 fast charging points (with 150 KW) as well as modernisation measures were supported. Normal charging points were supported with a maximum of 40% of the eligible costs and a maximum of EUR 2,500 per charging point. Fast charging points were supported with a maximum of 40% of the eligible costs and a maximum of EUR 30,000 per charging point. The maximum number of both standard and fast charging points for each of the 16 Federal States has been indicated by the authority. Once the applications have reached the maximum number of charging points in a Federal State, the selection process was based on the principle of economic efficiency (best-value-for-money), meaning that a contract was awarded to the tenderer offering the best quality-price ratio in a Federal State. The authority therefore created a ranking with the most efficient applicants, which was based on the support per KW charging capacity. There were two rankings and selection processes for standard and fast charging points respectively. The granting authority awarded the aid to the applicants with the lowest grants requested per KW of total charging capacity of the charging infrastructure to be set up. Grid connection costs were not considered as relevant in the selection process.

The third call for applications was launched on 19 November 2018 with the aim to support ca. 10,000 standard charging and 3,000 fast charging points. For this call, in order to reach a regional coverage in the entire country, the authority established two charging maps, one for standard charging points and one for fast charging points. For both maps, the country was divided into 283 tiles with a size of 40 km x 40 km per tile. This should be an indicator for the needs for charging infrastructure and indicating a maximum number of charging points to be approved. Moreover, in the fast charging point map there are different colours used: blue colour indicates a higher and yellow a lower demand of charging points. Normal charging points were supported with a maximum of 40% of the eligible costs and a maximum of EUR 2,500 per charging point. Fast charging points (50-100 KW) in the blue area were supported with a maximum of 50% of the eligible costs and a maximum of EUR 12,000 per charging point. Fast charging points with 100 KW and more were supported with a maximum of EUR 30,000. In the yellow areas, fast charging points (50-100 KW) were supported with a maximum of 30% of the eligible costs and a maximum of EUR 9,000. Fast charging points with 100 KW and more were supported with a maximum of EUR 23,000. In addition, the call aimed to provide support for the grid connection with a maximum of EUR 5,000 for the connection to the low voltage network and a maximum of EUR 50,000 to the medium voltage grid. Modernisation measures for the improvement or replacement of charging infrastructure was supported with a maximum of 40% of the eligible costs. As in the second call, the authority selected the beneficiaries based on aspects of economic efficiency of their applications, i.e. the granting of aid was based on the support per KW charging capacity.

The fourth call for applications was launched on 19 August 2019 with the aim to support ca. 5,000 normal charging and 5,000 fast charging points. As in the third call for applications, the authority established one map for standard charging points and one map for fast charging points and therefore divided Germany into tiles (40km to 40km). Moreover, in the map for fast charging points different colours were used: blue colour indicates a higher and grey a lower demand of charging points. Normal charging points were supported with a maximum of 40% of the eligible costs and a maximum of EUR 2,500 per charging point. Fast charging points (50-100 KW) in the blue area were supported with a maximum of 50% of the eligible costs and a maximum of EUR 12,000 per charging point. Fast charging points with 100 KW and more were supported with a maximum of EUR 30,000. In the grey areas, fast charging points (50-100 KW) were supported with a maximum of 30% of the eligible costs and a maximum of EUR 9,000. Fast charging points with 100 KW and more were supported with a maximum of EUR 23,000. As in the third call for applications, also grid connection and modernisation measures were supported (same amount as in the third call for application).

Costs and duration of construction of the project: The granting authority indicated that due to the large number of funded projects, the investment costs can vary between a thousand euros for smaller standard charging points and several million euros for large fast-charging projects. Therefore, based on the sample lists of beneficiaries, the minimum costs of one project is estimated around EUR 10,685 and the maximum costs are estimated around EUR 28.6 million. The amount of aid received varies as well from EUR 3,693 to EUR 10.99 million. The duration of the construction of the electric infrastructure stations varies between half a year and three years.

Geographical scope: The approved projects have a broad scope, covering the whole country. As explained in the tender specifications, the granting authority established a regional distribution covering the needs of a certain area. Thus, the projects approved are implemented at national level, some of them covering the whole country, and some of them some specific regions.

Technology: The infrastructure of the projects implemented relates to standard charging and/or fast charging stations. Therefore, the projects implemented by the beneficiaries cover either both types of charging, or just one of them. The majority of the projects cover standard charging.

Access to infrastructure: In the first call for applications, the full financial support was only granted if the infrastructure is accessible 24 hours a day, 7 days a week, otherwise the funding rate will be cut by 50%. It is nevertheless necessary that the infrastructure is accessible during the week at least for 12 hours per day. In the second, third and fourth call for applications it is explicitly required that the charging points were accessible 24/7.

Charges: The fees for the use of the funded charging facilities vary depending on the tariff of the respective provider. Some operators are also offering free usage of their charging infrastructure. The user charges range from EUR 0.29/KWh to EUR 8 per charging session. The costs mainly depend on the duration of the charging session as well as on the charging power.

General comments: In follow-up interviews, the beneficiaries contacted indicated that the general difficulties faced were related to the practical implementation of the project, especially because of the large geographical scope of their project.[142] Since the receipt of subsidies binds the beneficiary to certain procurement regulations, it is often difficult to plan the construction of charging infrastructure nationwide on a larger scale. Another difficulty mentioned was the gain of know-how for the installation of the projects, which could be either acquired by third parties or inhouse.

(2) Germany - Acquisition of electric buses for urban public transport (SA.48190)

The scheme aims to support the acquisition of plug-in hybrid buses and battery-based buses in public passenger transport, to replace diesel buses and to increase the number of electric buses in public transport in Germany. The scheme also supports recharging infrastructure in connection with the purchase of plug-in hybrid or battery-based buses. The total budget is EUR 70 million and the scheme will be in place until the end of 2021. EUR 35 million should be made available at federal level under the National Climate Initiative. The overall budget at federal level was increased, with the amendment of 28 May 2018 (SA.50776 (2018/N)), to EUR 155 million. With the amendment of 4 February 2019 (SA.52677 (2018/N)) the budget was increased to EUR 350 million. The beneficiaries are commercial undertakings and public entities providing public passenger transport services. The support is granted as investment aid to cover the additional costs of acquiring low emission electric buses compared to diesel buses as well as the respective recharging infrastructure. The granting procedure follows a transparent, non-discriminatory procedure. According to the granting authority, twelve bus companies have received State

[142] *Interview with EnBW Energie Baden-Württemberg AG conducted on 14 October 2019; interview with Lechwerke AG, conducted on 21 October 2019; interview with Pfalzwerke Aktiengesellschaft conducted on 21 October 2019.*

aid under the scheme. Additional information on the actual implementation of the project was collected via publicly available sources. The following section provides an overview:

Tender criteria: Aid may only be granted for plug-in hybrid buses, electric buses, and electric charging infrastructure in connection with the purchase of such buses. The tender is organised in a two-stage process. After the call for applications, the interested parties first submit a meaningful project outline in which the conditions for a possible support have to be proven. Provided the prerequisites have been fulfilled and the project outline is selected, the second stage will take place by sending out to the relevant stakeholders an invitation to submit a formal application for funding. The tender criteria include: (i) project outline (40%), number of new battery or plug-in hybrid buses and integration in the fleet; power supply for auxiliary units; expected use of subsidized vehicles; (ii) reduction of greenhouse gas (CO_2) emissions and ratio of greenhouse gas emissions avoided and support needs (25%); (iii) contribution to compliance with air quality limit values and requirements of the EU Environmental Noise Directive (25%); (iv) role model impact, transferability of results, visibility through public relations (10%). Therefore, eligible projects must aim at the purchase of plug-in hybrid and/or battery electric buses, and the project must meet different standard criteria (e.g. technical specification for purchase of new vehicles; more than five vehicles need to be procured; vehicles need to be used in public transport; use of renewable energy needs to be ensured; profitability calculation should be done). Other specifications include the reduction by at least 35% of the CO_2 emission compared to a bus without hybrid technology; the need for the bus to meet the Euro VI standards, and a limitation of noise emissions to 73 dB or 76 dB, depending on the engine power).

Costs and duration of the construction of the project: The costs of the project vary for each beneficiary, depending on the type and scope of each project. The average costs of the projects is EUR 20.7 million, ranging from EUR 1.9 million up to EUR 64.96 million. The beneficiaries received aid between EUR 761,570 and EUR 44.8 million, whereas the majority of the costs and granted aid relates to the acquisition of buses (and less to the recharging infrastructure). The maximum aid intensity for plug-in hybrid buses and recharging infrastructure is 40% of the eligible investment costs. For battery buses, the maximum aid intensity amounts to 80% of the eligible investment costs. The duration of the project depends on whether the project is related to the purchase of battery buses/plug-in hybrid buses; or to the construction of recharging infrastructure, the average duration being three years.

Geographical scope: The geographical scope of the projects is restricted to the respective cities in which the bus companies operate.

Technology: The technology used for the projects is the standard charging as well as fast charging stations.

Access of users to infrastructure: The infrastructure is dedicated to actual beneficiaries only (commercial undertakings and public entities providing public passenger transport services) who access their own charging infrastructure in the bus depots and in public areas at (last) stops of public transport. The beneficiaries indicated that buses are charged at last stop/turning point of routes and/or in the bus depots. The beneficiaries explained that this saves expensive investments (road space is limited, difficult to find suitable locations). Moreover, if the bus route changes, the charging station on the initial route cannot be approached anymore. Charging in bus depots allows more operational flexibility and is easier to monitor and control.

Charges: There are no charges for the use of the infrastructure.

(3) Germany - Alternative power supply for cruise ships in the Hamburg City Port / Altona-HafenCity (SA.37322)

The measure has an environmental objective and concerns two connection facilities: a static shore-side power supplying connection fed by the national electricity grid in the Altona cruise terminal and an infrastructure for the provision of electricity by liquefied natural gas (LNG)-powered ships at the HafenCity cruise terminal for cruise ships in the Hamburg City Port, to provide an alternative source of energy supply during a port call. Hamburg Port Authority (HPA) is in charge of the project. The following section provides an overview of the actual implementation of the scheme:

Tender criteria: There was no tender carried out as HPA is the only beneficiary. HPA is also the owner of the new infrastructure.

Costs and duration of construction of the project: Besides the support by national funds (ca. EUR 3.7 million), the project was also supported by EU funds amounting to ca. EUR 3.5 million.[143] The duration of the construction was 2.5 years (for further details see annex 11.1).

Geographical scope: The geographical area covered by the project is the Hamburg City Port (Altona-HafenCity).

Technology: The electricity provided via the infrastructure is not used for recharging, but serves cruise ships as an alternative energy supply while they are lying down in the Port of Hamburg. The shore connection provides: voltage supply from the public grid (10kV), frequency converter (from 50 Hz to 60 Hz), mobile transfer station including cable management system.

Access of users to infrastructure: Cruise ship companies are able to acquire electricity charging services directly and have non-discriminatory access to the infrastructure. The access is based mainly on the use of the cruise terminal.

Charges: The usage fees are ca. EUR 2,800 (for handling the transfer trolley and switching the system on/off), plus the variable costs depending on the amount of electricity purchased.

(4) Portugal – PO SEUR Programme for Clean Buses in urban areas (SA.45694)

This scheme aims to support the purchase of new low carbon buses and the costs of the infrastructure necessary to operate these buses, with the objective to reduce polluting emission of public buses in Portugal. The public support of the measure comes from the Cohesion Fund to 85% of the eligible costs, while 15% are supported by the bus operators. The total budget is EUR 60 million and each beneficiary can benefit from a maximum funding of EUR 20 million. The scheme will last until 31 December 2020. With the amendment of 16 May 2018, the Portuguese authorities increased the budget by EUR 30 million. The modification does not affect the duration of the scheme. Out of EUR 60 million ca. EUR 47 million were actually allocated to the beneficiaries. The maximum aid allocated to one beneficiary was EUR 14.72 million. The following section provides an overview of the actual implementation of the scheme:

[143] *Cf. https://ec.europa.eu/inea/en/ten-t/ten-t-projects/projects-by-country/germany/2012-de-92052-s).*

Tender criteria: The scheme is based on a bidding process available to any operator with a public service remit that runs a bus service in urban areas in Portugal. The main criteria of the selection process were (i) contribution to the reduction of CO_2 emissions (35%); (ii) contribution to the promotion of the use of renewable energy in transport (25%); (iii) evaluation of the economic rationale of the intervention (40%). Out of eleven applications, nine projects have been approved. They are related to the acquisition of vehicles for public urban passenger transport using cleaner energy sources (compressed natural gas, liquefied natural gas, electric power, hydrogen). Consequently, the scheme is open to (i) Euro VI compressed natural gas (CNG) or LNG buses; (ii) electric buses or electricity hybrid buses and (iii) hydrogen buses. Applicants could also receive aid for the installation of charging or re-filling stations and other actions like technical assistance or monitoring, which is however conditional to the acquisition of clean buses and limited to 20% of the total eligible costs of the application.

Costs and duration of the construction of the project: The cost and duration differ from one project to another. The average costs of the project are around EUR 6.5 million, ranging from EUR 413,000 to EUR 51.8 million. The amount of aid varies from EUR 199,325 to EUR 14.7 million. Regarding the duration of the project, a distinction should be made between the installation and the lifetime of the equipment. The duration of the construction lasts up to three years, whereas the period of exploitation is usually around 15 years.

Geographical scope: The projects cover urban areas in Portugal. This is in line with the scheme, since the local authorities, private and public bus operators which benefited from State aid run their services in Portuguese cities, i.e. Lourosa, Bragança, Porto, Braga, Coimbra, Guimarães, Lisboa, Barreiro.

Technology: Eligible technologies include new CNG, LNG, hydrogen, electricity or plug-in hybrids, with emissions at least 15% lower than the applicable ceilings set in the Euro VI Standard. The beneficiaries could also acquire the necessary infrastructure to operate the clean buses. For instance, the operation of an infrastructure might require the construction of CNG/LNG fuel pumps, electricity recharging stations, or re-filling stations for CNG/LNG. Out of the nine beneficiaries, one project exclusively referred to the acquisition of electric buses. Three projects were related to the acquisition of electric buses, the installation of electric charging points, the acquisition of natural gas buses, and the installation of LNG and/or CNG filling stations. Four projects referred to the acquisition of electric buses and the installation of charging points, whereas one project was exclusively dedicated to the acquisition of natural gas buses and the installation of a LNG filling station.

Access of users to infrastructure: The infrastructure is a semi-dedicated infrastructure which is accessible both by the beneficiaries as well as by other public transport operators. Access also depends on the opening hours of the infrastructure. The infrastructure is not open to the general public.

Charges: The use or access to the infrastructure is free of charge.

(5) Netherlands - Green Deal for Publicly Accessible Charging Infrastructure (SA.38769)

The scheme has the objective to support the use of environmentally friendly electric vehicles in the Netherlands by developing a nation-wide infrastructure of publicly accessible electric charging posts at local level. The scheme covers the period from 2015 until 2018 (three years of committed installation), with a total budget of EUR 33.7 million for the installation of publicly accessible electric charging posts. The scheme is funded by the

Central Government of the Netherlands as well as by the budgets of local governments and private contributions. The following section provides an overview of the actual implementation of the scheme:

Tender criteria: Tenders are organised at local level. The operator that wins the tender is allowed to build and operate the posts for a period specified in the tender. The applicant with the lowest bid (most favourable price per charging unit and quality) wins the tender to install and operate the charging posts within the specified territory for the duration set in the tender. The eligibility criteria for the tender are as follows:

- Both public and private parties must each contribute an average of at least EUR 500 per charging point;
- The charging points must be publicly accessible 24/7;
- Charging stations are only awarded in response to a specific request from an electric vehicle driver;
- A publicly accessible charging station is made available to electric vehicle drivers only if they have demonstrated that they cannot charge on their own premises;
- Electric vehicle drivers must not be excluded because of the car brand;
- The operating period of a publicly accessible charging station shall not exceed 10 years;
- Ownership of the charging station stays with the municipality at the end of the operating period.

The publicly accessible charging infrastructure is rolled-out by means of (i) public contract, (ii) concessions and (iii) direct grants.

Costs and duration of construction of project: The total budget is EUR 33.7 million. The Central Government has contributed ca. EUR 4.1 million, the private sector ca. EUR 2.8 million (EUR 500/charging pole). All the charging poles are public and publicly accessible, as they do not belong to a specific electric vehicle driver. The private contribution of EUR 500 per charging point was paid in almost all cases from electric vehicle drivers. In practice, the charging fee of the charging poles was higher during the first couple of years, in order to allow the achievement of EUR 500 per charging pole through the contribution of all electric vehicle drivers using the pole, and was subsequently reduced after. For instance, for one specific project, the charging fee was EUR 0.33/kWh during the first three years, and EUR 0.30/kWh after this period, meaning that the income of EUR 0.03/kWh accumulated during the three years made possible the financing of EUR 500. The exact calculations were realised for each projects as regards the charging fee to be applied and the period of time needed in order to obtain the contribution of EUR 500. In addition, local governments have contributed up to EUR 22 million. The total budget actually allocated by the Central Government is EUR 4.6 million, with a minimum contribution of EUR 300,000 for one project (Provincie Noord-Holland) and a maximum of EUR 1.11 million for another one (Provincie Noord-Brabant/Limburg).

Geographical scope: The scheme consists of a country wide program installing publicly accessible electric charging posts at local government levels throughout the Netherlands. Four beneficiaries cover urban areas as well as the country with their projects, while one of them focuses only on urban areas and another one only on rural areas.

Technology: The scheme relates to publicly accessible electric charging posts and the technology used for all projects are standard chargers with a capacity of 11 KW.

Access of users to infrastructure: The charging posts for electric vehicles are publicly accessible 24/7 (e.g. public car park).

Charges: The fees vary from EUR 0.25/KWh to EUR 0.35/KWh and depend on the charging hour. For instance, during the off-peak hours, from 8pm to 5am the following day, a maximum charging fee of EUR 0.32/KWh is applied. At the peak hour, the charging fee is fixed around EUR 0.07/KWh.

7.2.2 List of electric charging station projects

Question 11.b: For Austria, Belgium, Estonia, France, Spain and Sweden identify the list of existing projects of publicly accessible infrastructure (electric charging stations and hydrogen refuelling stations for road vehicles only, excluding bicycles, motorcycles and similar vehicles).

The Connecting Europe Facility ("CEF") website maintains a database of CEF Transport grants between 2014 and 2019 by country which contributed to the gathering of a list of existing CEF transport supported projects regarding Electric Recharging or Hydrogen Refueling Infrastructures.[144] This list is attached as **Annex 11.2**. Based on the database maintained by European Alternative Fuels Observatory ("EAFO")[145], a list of up to ten operators per selected Member State with publicly accessible infrastructures for electric charging stations and hydrogen charging stations were identified as set out in **Annex 11.3**.

7.2.3 Electric charging station projects

Question 11.c: For each selected project, the contractor shall indicate i) which actors are involved and the geographical coverage of the project, ii) whether public financing was provided and the sources of the public financing as well as the share of the public financing in the total costs, iii) the total costs of the project, iv) how access to the infrastructure is organised, v) the technology concerned by the project, vi) if the project was constructed on public domain, vii) whether the public funding was granted in a tender, the budget of the tender and the tender criteria used for the selection of companies (if any), viii) the selected technology, ix) conditions imposed on the beneficiary of public financing, x) which legal basis was used by the Member State for the State aid compliance.

To collect the relevant data, a targeted stakeholder consultation was conducted using a combination of surveys and interviews. A specific questionnaire was prepared and addressed to selected stakeholders in six Member States, which were provided by the Commission, i.e. Austria, Belgium, Estonia, France, Spain, and Sweden. The selection included, for each of the relevant Member States, the project with the broadest geographical coverage; if all projects are local ones, at least the one for the most populated city; for each Member State at least one project in a low population area; at least three projects for France and Spain. The selected projects are provided in the table below:

Table 16: Selected electric charging station projects

Member State	Broadest geographical scope	Most populated city or regional coverage	Low population density

[144] *https://ec.europa.eu/inea/connecting-europe-facility/cef-transport/projects-by-country.*
[145] *https://www.eafo.eu/.*

Austria	EVA+ Project (SMARTICS)	Wien Energie	Energie Steiermark
Belgium	NewMotion (Shell)	BENEFIC Project	ORES commune de Malmedy
Estonia	Elmo (Elektrilevi)	T1 Mall of Tallinn	SmartEnCity
France	Corri-door Project (Izivia, Groupe EDF)	Belib Paris	ERDF / Région Limousin
		Bluely Lyon	E-Totem
Spain	CIRVE Project	Movilidad eléctrica Madrid	SIRVE Project
	CargaCoches	Live Barcelona	
Sweden	GREAT	Bee charging	Flens Kommun Charging Stations

Source: Sheppard Mullin

Ten responses to the survey were received from stakeholders of the following projects: SIRVE, CIRVE, ELMO, Ladestationen der Stadt Wien, BENEFIC, Flens Kommun, T1 Mall of Tallinn, SmartEnCity, Corri-Door, and Great. Seven of these projects involve more than one company providing specific input for the project in their field of expertise (e.g. financing, charging technology, specialisation in certain vehicles such as busses etc.). The cost of the projects may differ significantly and range from ca. EUR 90,000 (Flens Kommun) to EUR 37 million (BENEFIC Project).

Nine of the projects were supported by public financing, either by the EU via the CEF program or by the Member States. Two projects (Ladestationen Wien and Flens Kommun) are driven by public authorities or public undertakings. Eight projects are based on fast charging technology, and two are additionally providing standard charging technology. Two projects are exclusively providing standard charging. Nine projects are accessible 24/7, whereas one has limited access due to the opening hours of a car park in a shopping mall. Users have to pay for the usage of the infrastructure in eight projects. The preliminary outcome of the desk research and survey with regard to those projects is presented in a comprehensive excel table, attached as **Annex 11.4**.

(1) SIRVE

The SIRVE Project (Sistemas Integrados para la Recarga de Vehículos Eléctricos) was selected based on the criterion of low population density in Spain. It was supposed to be deployed in Zaragoza with the main objective to provide solutions for the charging of electric vehicles. The SIRVE stations should have been composed of a quick and a moderate charger, three slow chargers, a battery pack, a regulator and solar power panels.[146] However, after the test phase of the project and the installation of two demonstrators in Zaragoza, the project was stopped due to the high costs involved.

Companies involved and construction: Three companies were involved in this project: Fundacion cince centro de investigacion de recursos y consumos energeticos; Sistemas urbanos de energieas renovabiles; and Pronimetal. The geographical scope of the project

[146] *http://www.fcirce.es/smart-mobility-es/sirve?_sft_category=smart-mobility-es.*

was urban (Zaragoza) and it would not have been constructed on public domain. The expected duration of the construction of the infrastructure was 3 years.

Financing and costs: The expected total cost of the project was EUR 2.4 million, the share of the consortium member Sistemas urbanos being EUR 703,000 who also had to cover annual maintenance cost of EUR 1,500, mainly for insurance as the demonstrator was set up next to a petrol station. The Ministry of Science and Innovation was supposed to provide public financing amounting to EUR 1.6 million. Local authorities did not have a share in the project. The financing was provided in a tender with several conditions, e.g. to be an innovative company; to have a minimum share capital; to ensure the development of research and also to adhere to the "INNPACTO subprogram" as defined in Art. 15.3 of Order CIN/699/2011, to promote projects in cooperation between research organizations and companies for the joint realization of R&D&I projects that help to enhance innovative activities and improve the technological balance of the country.[147] This subprogram is supported by the European Regional Development Fund.

Access and technology: The technology used includes fast (higher than 22 KW) and standard (up to 22 KW) charging stations. The planned infrastructure was meant to be publicly accessible 24/7 (e.g. public car park). Because the project was not implemented, no fees were charged to users, and it is not possible to provide an exact charging price. However, it was indicated that users would have been charged for the usage of the infrastructure, and the price would have varied according to the charging time and the electricity price.

(2) CIRVE

The CIRVE Project (Iberian UE Corridors for EV Fast Charging Infrastructure) is operated in Spain and Portugal. The consortium members will deploy 58 multi-standard quick charging points (40 in Spain, 18 in Portugal) located along the Mediterranean and Atlantic area with special attention to cross-border areas between Portugal, Spain and France.

All the information set out below concerns the "CIRVE Project" in Spain which consists of the installation of 25 new charging points and the adaptation of another 15 already installed. Its objective is to increase the use of electric vehicles in Spain under a fully interoperable cross-border framework that allows electric vehicle users to enter the Iberian Peninsula, ensuring a link between the southern and northern parts of the EU.[148]

Companies involved and construction: There are six companies involved in the project: (i) IBIL, GESTOR DE CARGA DE VEHÍCULO ELÉCTRICO, S.A.; (ii) IBERDROLA CLIENTES SAU; (iii) ENDESA ENERGÍA S.A.; (iv) EDP COMERCIALIZADORA, S.A.U.; (v) GIC; (vi) RENAULT SAS. The project was constructed both on public and on private domain and the geographical scope is nation-wide and covers the whole of Spain.

Financing and costs: The total costs of the entire project in Spain were EUR 3,523,232. The project is supported by the Connecting Europe Facility (CEF) with 50% of the costs (maximum EU contribution EUR 1,761,616), which each consortium member received.[149] The members of the consortium, which are all electric recharge operators supported the remaining costs.

---

[147] *http://www.ciencia.gob.es/portal/site/MICINN/menuitem.dbc68b34d11ccbd5d52ffeb801432ea0/?vgnextoid=c8e371e47ecfe210VgnVCM1000001d04140aRCRD.*
[148] *http://cirveproject.com/about-cirve/#project.*
[149] *https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/2015-eu-tm-0409-s.*

Access and technology: The technology consists of multi-standard quick charging points (50KW). Access is organized as an open access 24/7 (e.g. public car park). The responsible consortium member stated that for the private domain it was sometimes difficult to find areas which are accessible 24/7. Users are charged EUR 0.39/KWh.

(3) ELMO

ELMO (Estonian Electro-Mobility) is a nation-wide project with the broadest geographical scope in Estonia. It comprises 168 quick chargers, of which 102 are installed in towns and 66 on roads. The purpose is to create an all-Estonian network of quick chargers.[150]

Companies involved and construction: SA Kredex and ABB Eesti AS. The project was not constructed on public domain and the duration of the construction was ca. 3 years.

Financing and costs: The project was 100% publicly financed (for further details see Annex 11.4). The financing was based on a CO_2 emission trade agreement between the Estonian government and Japan's Mitsubishi Corporation.[151]

Access and technology: The technology consists of quick charging points (up to 62.5 KW). Access is organized as an open access 24/7 (e.g. public car park). For the usage the users can choose between several packages, with and without a monthly basic fee (EUR 10/month or EUR 30/month), with charges ranging from EUR 1.50 and EUR 4.50 per charging session.[152]

(4) Ladestationen der Stadt Wien

The project is set up in Vienna, the most populated city in Austria. The objective is to install 500 electric charging stations for electric vehicles (two charging points per station with 11 KW) by the end of 2020. In a first phase in 2018, the operator of the project Wien Energie GmbH (Wien Energie) has already installed, in each commune of Vienna, five electric charging stations with two charging points each (in total 230 stations with standard chargers of 11 KW). When choosing a location, specific criteria are taken into account such as the attractiveness of the location (transfer to public transport, shopping facilities, etc.), frequency and capacity utilization, connection options to the power grid and economic efficiency.[153]

Companies involved and construction: Wien Energie is the only company involved in the project. The project covers the city of Vienna and was constructed on public domain. Wien Energy GmbH stated that the concession for the construction of the infrastructure was awarded via a public tender.

Financing and costs: Wien Energie received public financing of ca. EUR 600,000, based on the GBER scheme "Bundesförderung – Umweltförderung im Inland"[154] (for further details see Annex 11.4). More precisely, Wien Energie received EUR 1,000 per charging station plus EUR 200 per additional charging point per station. The granting authority imposed conditions on Wien Energie such as the requirement of public accessibility of the electric charging stations. Moreover, Wien Energie had to provide a mobility concept for the

[150] http://elmo.ee/charging-network-2/.
[151] Mitsubishi Corporation has concluded an agreement with the Estonian Government to purchase 10 million tons of emissions rights. Under the terms of this contract, Mitsubishi Corporation will also be providing 507 electric vehicles as well as support with regard to quick charging technology.
[152] http://elmo.ee/pricing/.
[153] https://www.wienenergie.at/eportal3/ep/channelView.do/pageTypeId/67856/channelId/-51202.
[154] SA.29531 – Umweltförderung im Inland.

operation of the charging points including the calculation of their environmental effects. For such calculation it was estimated how many conventional cars will be replaced by electric vehicles with the installation of these electric charging stations, which will lead to a CO_2 reduction. Only those environmental effects had been taken into account which will be achieved by implementing the measure in Austria. Finally, there was a requirement to use 100% electricity from renewable energies.

Access and technology: As regards technology, Wien Energie installed standard charging points and open access is organised 24/7 (e.g. public car park). The charges for the users depend on the tariff class and the day time. The user can subscribe to pay a monthly basic fee (EUR 9.90/month or EUR 34.90/month). The higher the monthly fee, the cheaper the tariffs. The tariffs range from EUR 0.60/hour to EUR 15/hour, depending on the day time, subscription and charging type.

(5) BENEFIC

The BENEFIC Project (BrussEls NEtherlands Flanders Implementation of Clean power for transport) is carried out, among others, in Brussels, the most populated city in Belgium, as well as in Flanders and in the Netherlands. It is a cross-border project for the development of charging and refueling infrastructure for alternative fuels for transport. The various partners aim to construct ca. 1,000 additional loading and refueling points for passenger cars, electric taxis, electric buses, freight transport and inland waterway vessels by September 2020.

The project should provide recharging infrastructure for electric vehicles, electric taxis and electric buses, CNG and LNG infrastructure, hydrogen refueling infrastructure and onshore electricity supply facilities for inland navigation.[155] BENEFIC obtained funds under the Connecting Europe Facility (CEF) funded by the Commission. The Flemish Department of the Environment is coordinating the project.

Companies involved and construction: There are eleven companies involved: (i) Fastned; (ii) Allego; (iii) Pitpoint; (iv) Shell; (v) Q8; (vi) Blue Corner; (vii) Orange Gas; (viii) STIB-MIVB (buses); (ix) De Lijn (buses); (x) EBS (buses); (xi) Brussels Airport (buses). The project covers Brussels, Flanders and the Netherlands, and focusses on urban and rural areas. The project is not constructed on public domain. The duration of the construction is expected to last from 2018 to 2020.

Financing and costs: The total costs amount to EUR 37.15 million, of which EUR 7.3 million are financed by CEF.[156] The maximum financial support amounts to 20% of the costs allocated for the infrastructure works. The remaining costs were covered by private parties that actually installed the charging infrastructure. The consortium has to comply with various criteria, defined in the call for projects, such as: public accessibility of the infrastructure; no other EU funding; interoperability and other technical conditions as imposed in Directive 2014/94/EU on the deployment of alternative fuels infrastructure.[157]

Access and technology: The project comprises several technologies and infrastructure facilities: 832 fast and standard chargers for electric cars, electric taxis, and electric buses; (518 in Flanders, 11 in the Netherlands, 176 in Brussels-Capital Region, 107 in all 3 regions and 20 in the Netherlands and Flanders), 30 electric busses for passenger transport; (in

---

[155] *http://www.benefic.eu/en/home.*
[156] *https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport/2016-eu-tm-0277-s.*
[157] *OJ 2014 L 307/1.*

Flanders), 4 hydrogen filling stations; (4 in the Netherlands), 39 shore power installations; (39 in Flanders) and 11 CNG stations (4 in Flanders, 3 in Brussels-Capital Region and 4 in the Netherlands). Access to the electric infrastructure charging stations is organized in an open access 24/7 (e.g. public car park). The stakeholder stated that there are no costs for the actual access, but there will be charges for the use of the infrastructure.

(6) Flens Kommun

The project was carried out in Sweden in the cities Flen and Malmköping which belong to the municipality of Flen in the region of Södermanland. The project comprises two electric charging stations with three charging points each. Flens Kommun is both the owner as well as the operator of the charging stations.

Companies involved and construction: There are seven companies involved in the project: (i) ABB; (ii) Granlunds grävmaskiner AB; (iii) Flens Eltjänst; (iv) Team Tejbrant; (v) NCC; (vi) Vattenfall; (vii) Tekniska avdelningen, Flens kommun. The project covers a rural area in Sweden and was constructed on public domain. The construction time was less than one year.

Financing and costs: 50% of the costs were covered by Flens Kommun, the remaining 50% by Klimatklivet, a public fund for local and regional actions that reduce emissions of carbon dioxide and other gases that affect the climate, administered by the Swedish environmental protection agency (Naturvårdsverket). The funds invested should provide the greatest possible emission reduction per invested money. Applications for the “Klimatklivet” are assessed and handled in accordance with the so-called “Klimatklivetförordningen” which is a GBER scheme. In order to benefit from this fund, Flens Kommun needed to provide the costs and bills paid of the project. The main difficulty for this project was to increase the power capacity on site, which had to be carried out by the power company. This had to be accomplished within one year as the public financing required that the project is carried out in one year. There was no public tender but Flens Kommun applied for public financing (for further details see Annex 11.4).

Access and technology: Access to the charging stations, which contain both standard and fast charging points, is organized in an open access 24/7 (e.g. public car park). The charging station in Flens is located at a public parking spot and charging station in Malmköping is located next to a bus stop. Flens Kommun stated that users are not charged for using the infrastructure. Flens Kommun has not made a decision yet about the model for charging fees at this stage.

(7) T1 Mall of Tallinn

The project was established in Tallinn, the most populated city in Estonia, in a city mall. The main driver of this project was the operator of the Mall of Tallinn, who wanted to get for the construction of the mall the highest energy efficiency standards possible in form of an energy efficiency certificate. For this purpose it was necessary to install electric charging stations in the mall.

Companies involved and construction: Elektritransport installed 15 standard charging stations in 2018 and the duration of the construction was less than 1 year.

Financing and costs: Elektritransport did not receive any public funds for the installation of the stations. There are no charging costs for users of the stations, who are able to drive into the Mall of Tallinn and charge their cars for free (for further details see Annex 11.4).

Access and technology: Elektitransport installed standard chargers with up to 22 KW/hour. The charging stations are in principle accessible for everybody, the opening hours of the mall have to be respected though.

(8) SmartEnCity

The project was implemented, among others, in the Estonian city of Tartu and aims to transform European cities into sustainable, smart and resource-efficient cities. The project is funded under the EU's Horizon 2020 research and innovation program and is planned and implemented in three cities: Vitoria-Gasteiz (Spain), Tartu (Estonia) and Sonderborg (Denmark); Lecce (Italy), and Asenovgrad (Bulgaria) should follow. SmartEnCity also comprises the installation of electric charging stations for electric vehicles. The information below only refers to the project in Tartu.

Companies involved and construction: Elektritransport installed five electric charging stations. The owner of the charging stations is the city of Tartu, Elektritransport is the operator. The city of Tartu carried out two tenders for the project, one for the installation and one for the operation of the charging stations. Elektritransport won both tenders. The main criteria for the tender was the price. The construction of the charging stations took less than 1 year, but it should be noted that the connection to the electric grid was already pre-installed by city of Tartu.

Financing and costs: Elektritransport stated that the project was fully funded by the city of Tartu, which itself received the respective funds under the EU's Horizon 2020 research and innovation program. The received funds covered the purchase of the charging stations, the transportation costs (from Portugal to Estonia), and the installation of those (for further details see Annex 11.4).

Access and technology: Elektritransport installed quick chargers with 50 KW/hour. The users of those chargers have to pay a fee of EUR 0.15/KWh.

(9) Corri-Door

This project has the objective to foster electric vehicle deployment in France with the aim to enable the viability of an interoperable fast charging network. The project comprises 200 fast charging points distributed every 80 km all over France.

Companies involved and construction: There are seven companies involved in the project: (i) IZIVIA (previous name: Sodetrel) as the owner of the charging stations, (ii) EDF, (iii) Renault, (iv) BMW, (v) Nissan, (vi) Volkswagen, (vii) ParisTech. The project was constructed on public domain (motorway) and the construction of the charging stations lasted ca. three years (from 2014 to 2016). As regards the construction on the public domain, the negotiations mainly took place with the concessionaires and sub-concessionaires of the motorway.

Financing and costs: The overall costs of the project amounted to ca. EUR 12 million. The project belongs to the TEN-T programme and was supported by the Commission, which covered ca. 50% of the eligible investment costs.[158] The public financing was arranged by an open and competitive call for applications. The best proposals were selected according to criteria defined by the Commission in its call. A condition to receive public financing was to be compliant with the Grant Agreement that was concluded with the Commission.

---

[158] *Commission, TEN-T Annual Programme, CORRI-DOOR, 2013-EU-92055-S.*

Access and technology: The “Corri-Door Project” comprises 200 fast charging stations (50KW) which are accessible 24/7 on the French motorways. Users have to pay for charging with the option to pay a subscription-fee (EUR 3 or EUR 30 per month) which results in lowers charging tariffs. The charging fees range from EUR 1 per 5min to EUR 0.50 per 5 min.

(10) GREAT

The “GREAT Project” (Green Region for Electrification and Alternative fuels for Transport) is a cross-national project which was implemented in Sweden, Denmark and Germany. The project comprises 69 electric fast charging stations and three LNG/CNG stations, over more than 900 km of the Scandinavian-Mediterranean Corridor. 50 charging stations have been deployed in Sweden, 17 in Denmark and 2 in Germany; the three LNG/CNG stations for heavy trucks were installed in Sweden. The project belongs to the CEF Transport programme and was financially supported by the EU.[159]

Companies involved and construction: The companies involved in the project were: (i) E.ON Danmark A/S, (ii) E.ON Sverige AB, and (iii) E.ON Energilösningar AB. The charging stations are established on public domain and the implementation of the project lasted ca. 5 years. One of the conditions to get the concession for the construction of the public domain was the need to lease the land.

Financing and costs: The project was 50% co-financed by the EU. The remaining 50% of the costs regarding the electric charging infrastructure was covered by E.ON (for further details see Annex 11.4).

Access and technology: Users have open access to the charging stations without limitations. The users are charged for the use of the infrastructure and the tariffs differ among the countries involved.

7.2.4 Financing of projects

Question 11.d: Based on the projects identified under Question 11.a. and c. that have been selected based on a tender, what are the funding gaps (or bids) of the different selected alternative fuel infrastructure projects and what is the geographical coverage of the project concerned?

The percentage figures regarding the financing in Table 17 and Table 18 below refer to the amount of aid received by the beneficiaries in comparison to the total costs of the project. In addition to the “direct public contribution”, Table 17 and Table 18 also indicate the shareholdings or contributions in projects by cities or municipalities as well as the share of private contributions.

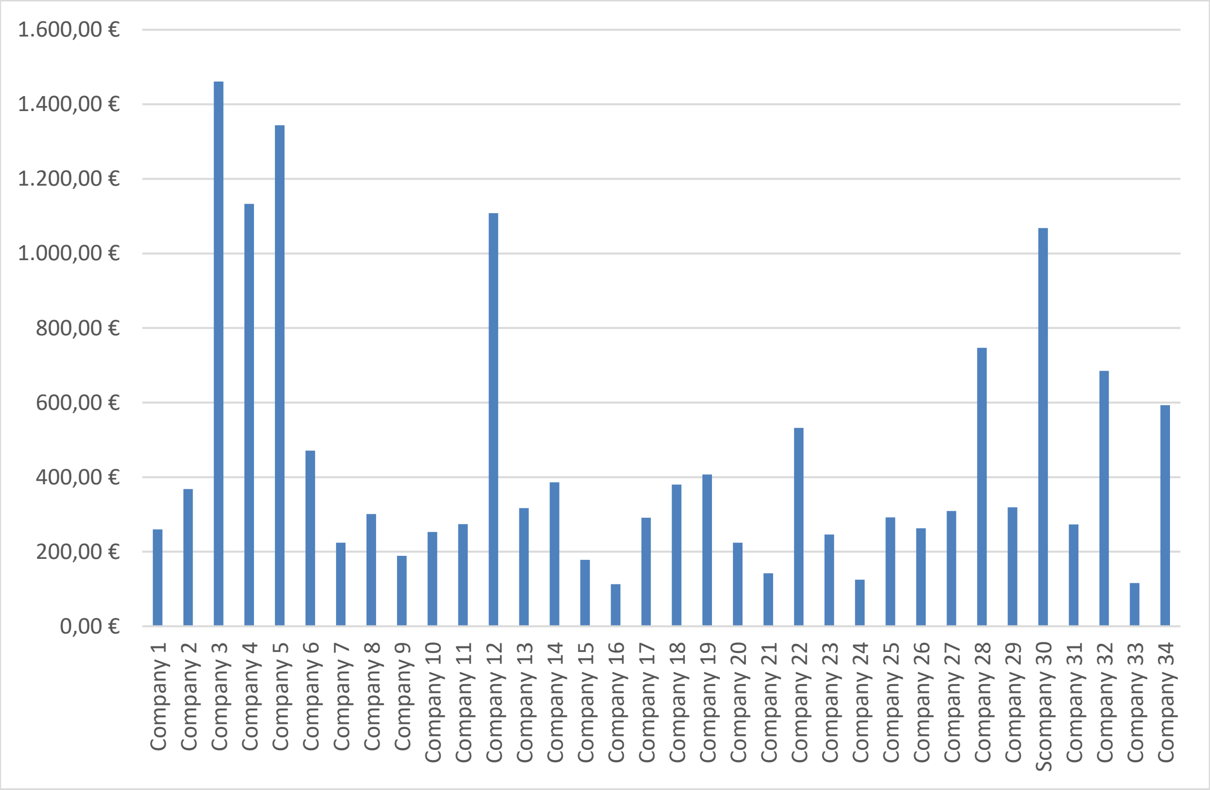
As shown in **Annex 11.1**, the direct public contribution of the beneficiaries of the different State aid decisions regarding alternative fuel infrastructure is to a certain extent homogeneous. For the decision on charging infrastructure for e-mobility in Germany (SA.46574), the average ratio between the support requested by beneficiaries under the approved scheme and the total costs of the project is 34%, whereas most beneficiaries received a similar share, i.e. between 30 and 40% of aid with regard to the total costs of the project.

---

[159] Commission, CEF Transport Programm, GREAT (Green Region for Electrification and Alternatives fuels for Transport), 2014-EU-TM-0477-S.

Out of 56 beneficiaries, eight received below 30% and three received above 40%. Expressed in EUR/KW charging capacity, the direct public contribution for the beneficiaries with regard to this scheme (SA.46574) for the first call for applications ranged from EUR 113/KW to EUR 1,461/KW, as demonstrated in Figure 49 below.

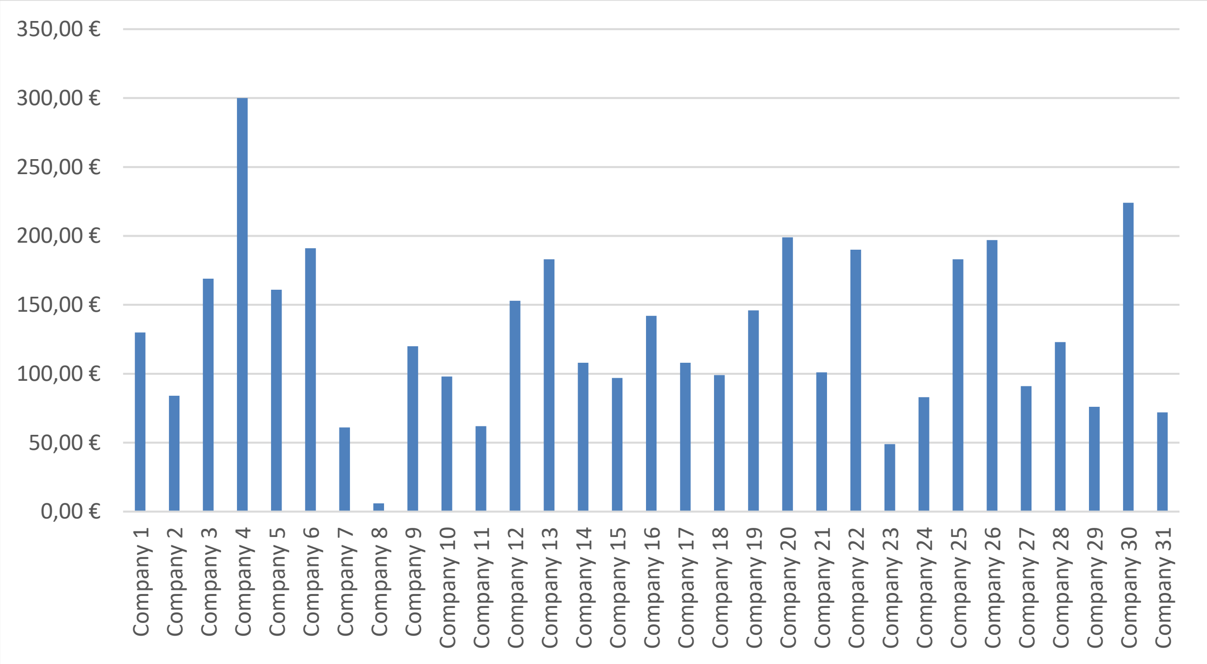
Figure 49: Granted aid in EUR/MW in first call for applications



Source: Bundesanstalt für Verwaltungsdienstleistungen

For the second call for applications, the direct public contribution for the beneficiaries with regard to this scheme ranged from EUR 6/KW to EUR 300/KW, as demonstrated in Figure 50 below.

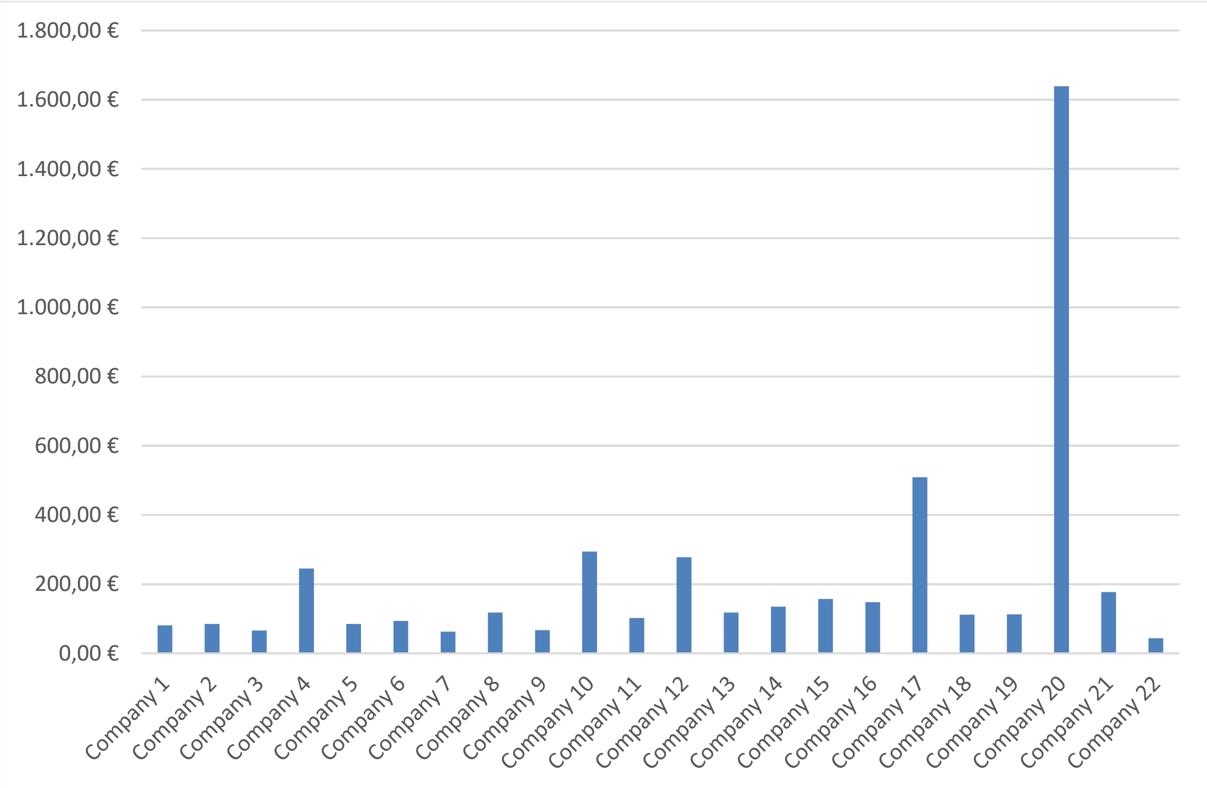
Figure 50: Granted aid in EUR / MW in second call for applications



Source: Bundesanstalt für Verwaltungsdienstleistungen

For the third call for applications, the direct public contribution for the beneficiaries with regard to this scheme ranged from EUR 44/KW to EUR 1,639/KW, whereas the vast majority of beneficiaries received aid below EUR 200/KW, as demonstrated in Figure 51 below.

Figure 51: Granted aid in EUR / MW in third call for applications



Source: Bundesanstalt für Verwaltungsdienstleistungen

By contrast, for the support scheme for the acquisition of electric buses and the respective infrastructure for urban public transport in Germany (SA.48190), the direct financing amounted to an average 69% in comparison to the total costs, whereas the granting authority indicated that the main part of the funding was used for the acquisition of buses. There was no information provided on the allocation of the funds between vehicles and infrastructure. For this scheme, nine out of twelve beneficiaries received between 69% and 80% of funds in comparison to the total costs, only three out of twelve received 40% and below. The geographical scope covers urban areas (cities in Germany). For the alternative power supply for cruise ships in the Hamburg City Port/Altona-HafenCity (SA.37322), there was only one beneficiary obtaining investment aid under the approved scheme that represent 26% of total infrastructure costs. The beneficiary received additional 25% of the total costs from the EU as the project was considered to be a TEN-T project. The geographical scope is urban, as the beneficiary is an harbor operator.

The beneficiaries under the State aid scheme regarding PO SEUR Programme for Clean Buses in urban areas in Portugal (SA.45694) received in average a direct public contribution of ca. 32% in comparison to the total costs. Four out of eight beneficiaries received a fund ratio of 48% and higher, the others received 38% and below. The aid requested under the scheme concerned both the acquisition of clean vehicles as well as the charging infrastructure and there was no information provided on the allocation of the funds between vehicles and infrastructure. The geographical scope covers urban areas (Portuguese cities).

The funding requested by beneficiaries for decision on the Green Deal for Publicly Accessible Charging Infrastructure Scheme in the Netherlands (SA.38769) was in average 34% of total costs. The amount of the granted aid by the central government corresponds with the amount of the requested aid by the beneficiaries. Moreover, the private contribution, which was required by the tender specifications, was EUR 500 per pole, which leads to an average share of 23% private contribution. The remaining share per pole was covered by the local governments. The geographical scope covers both urban areas as well as broader areas.

Table 17: Overview of beneficiaries' financing regarding Commission decisions

Commission decision	Direct public contribution (avg.)	Other financing source		Geographical scope
		Public involvement of different nature (avg.)	Private contribution (avg.)	
SA.46574	34%	66%		Country wide
		of which ca. 40% of beneficiaries are municipalities and publicly owned undertakings	of which ca. 60% of beneficiaries are privately owned undertakings	
SA.48190	69%	31% (beneficiaries are publicly owned undertakings)		Urban
SA.37322	51%	49% (beneficiary is a public agency)		Urban/harbor

SA.45694	32%	68%		Urban
		of which ca. 80% of beneficiaries are publicly owned undertakings	of which ca. 20% of beneficiaries are privately owned undertakings	
SA.38769	34%	43% (beneficiaries are municipalities/provinces)	23%	Urban and country wide

Source: Sheppard Mullin

As regards the electric charging projects selected under Question 11.c., the share of direct investment support allocated by public authorities appears to be very diverse and ranges from a 0% (T1 Mall of Tallinn) to 100% (SmartEnCity and ELMO Project) share of public funds. It also appears that especially the very large cross-border projects such as BENEFIC, Corri-Door and GREAT are supported by EU funds. Smaller projects such as Ladestationen Wien or Flens Kommun are supported by GBER schemes or owned by local authorities or publicly owned undertakings. An overview of the financial contributions is provided in Table 18 below.

Table 18: Overview of financing of electric charging stations projects

Project	Direct public contribution	Public involvement of different nature	Private contribution	Geographical scope
SIRVE	Project was not implemented			
CIRVE	50%		50%	Country wide
ELMO	100%			Country wide
Ladestationen Wien	5%	95% (beneficiary is publicly owned company)		Urban
BENEFIC	20%		80%	Cross-national
Flens Kommun	50%	50% (beneficiary is municipality)		Urban
T1 Mall of Tallinn			100%	Urban
SmartEnCity	100%			Urban
Corri-Door	50%		50%	Country wide
GREAT	50%		50%	Cross-national

Source: Sheppard Mullin

7.2.5 Conclusions

With regard to the assessment of the schemes for the support of publicly accessible or dedicated alternative fuel infrastructure, which were approved by the Commission, all schemes analysed, except one, were carried out based on a tender or a call for applications. One scheme was addressed to only one beneficiary (a public authority in charge of general safety and water pollution control), and no tender procedure was needed. The beneficiaries of three schemes are municipalities or publicly owned undertakings. Two of the schemes include also private operators, thus no distinction is made between the private or public nature of the organization. The projects concern the purchase of electric and/or natural gas buses and/or related charging/re-fuelling infrastructure. The technology referred to in these projects is related to standard or fast charging installations, alternative energy supply for cruise ships, as well as liquefied or compressed natural gas and hydrogen filling stations. The geographical coverage depends on the project. Usually, infrastructure of electric buses only covers urban areas, whereas publicly accessible infrastructure projects have a wider scope. No related charges are applicable for the projects relating to buses. On the contrary, if the projects concern the electric vehicle charging infrastructure, the fees for the use of the funded charging facilities vary and depend on the respective provider, on the duration of the charging session as well as the charging power. The electric charging stations for cars (Germany, SA.46574; Netherlands, SA.38769) and cruise ships (Germany, SA.48190) are generally publicly accessible, whereas the electric infrastructure projects for buses are dedicated (Germany, SA.48190) or semi-dedicated to public transport operators (Portugal, SA.45694).

The average direct public funding under the approved schemes regarding the acquisition of electric buses and the related infrastructure amounts to 32% on average for the scheme regarding PO SEUR Programme for Clean Buses in Portugal (SA.45694) and 69% on average for the support scheme for the acquisition of electric buses and the respective infrastructure for urban public transport in Germany (SA.48190). The average direct public contribution for the charging infrastructure for electric vehicles amounts both in Germany (SA.46574) and in the Netherlands (SA.38769) to 34% funding in comparison to the total costs.

As regards the ten reviewed electric charging station projects, nine of them were supported by public financing, either by the EU, via the CEF/Horizon 2020 program, or by the Member States. One project was financed entirely from private funds. It related to one electric charging station established in a shopping mall in Tallinn by the operator of the Mall, which was willing to achieve the highest energy performance standard for the Mall. The implementation period lasted from less than one to four years. With respect to technology, eight of the selected projects are fully or partially based on fast charging technology, while two are exclusively providing standard charging technology. Two projects are also providing CNG, LNG and hydrogen refueling infrastructure and one of them also provides onshore electricity supply facilities for inland navigation. Nine of the projects are accessible 24/7. Users have to pay for the usage of eight of the electric charging station projects. The fees vary and depend on the charging time, charging location, and charging technology. Some operators offer packages with a monthly basic fee, which reduces the price charged per KWh. With regard to the financing for the selected electric charging station projects, one project did not receive direct public financing at all whereas other projects received public contribution of 100% in comparison to the total project costs.

8 Abstract

The objective of this study is to support the Commission with independent evidence-based facts and data on the implementation of the EU Guidelines on State aid for environmental protection and energy (EEAG), applicable since July 2014, and of the provisions applicable to aid for environmental protection and energy of Commission Regulation (EU) 651/2014 (GBER). The aim is to provide input for the Commission's assessment of whether the EEAG and the relevant GBER provisions are fit for purpose. The topics covered in this study relate to the effectiveness, efficiency and relevance of the rules. With regard to effectiveness, the study provides, among others, information on Renewable Energy Sources (RES) schemes in order to understand their particular features and the evolution of prices. It also focuses on the question whether the absence of a tender for certain categories of RES has been a barrier to achieving cost reductions, and whether the existence or size of exemptions to market integration has been a barrier to achieving market integration. Moreover, data has been gathered on the question to which extent the EEAG ensured that support for high energy efficient cogeneration and district heating was effective. The study also contains information on whether Member States have introduced a renewable energy policy in the period 2014-2020 beyond their binding 2020 RES targets. Moreover, the performance of capacity mechanisms has been assessed by comparing various auctions outcomes and scheme designs. With regard to efficiency, the study provides information on the impact of reductions of RES levies and other comparable levies for energy intensive users (EIU), as well as on levies paid by different consumer groups and on the relevance of the grandfathering rule. It also focuses on data collection into schemes communicated to the Commission by Member States for containing provisions on State aid for energy efficiency measures in buildings. With regard to relevance, the study provides input regarding subsidy-free renewable energy projects in the EEA as well as on alternative infrastructure projects, with a particular focus on the financing of the projects. The study contains the outcome of in-depth desk-research and stakeholder consultations, to highlight relevant details about the impact of the EU rules in practice.

Résumé

L'objectif de cette étude est de fournir à la Commission des données et des faits indépendants, fondés sur des preuves, concernant la mise en œuvre des lignes directrices sur les aides d'État à la protection de l'environnement et l'énergie (EEAG), applicable depuis juillet 2014, et des dispositions applicables aux aides pour la protection de l'environnement et l'énergie du règlement (UE) n° 651/2014 de la Commission (RGEC). L'objectif est de contribuer à l'évaluation, par la Commission, de l'adéquation entre les dispositions de l'EEAG et celles du RGEC. Les thèmes abordés dans cette étude portent sur l'efficacité, l'efficience et la pertinence des règles. En ce qui concerne l'efficacité, l'étude fournit, entre autres, des informations sur les régimes d'aide aux sources d'énergie renouvelables (SER), afin de comprendre leurs caractéristiques particulières et l'évolution des prix. Elle traite également la question de savoir si l'absence d'appel d'offres, pour certaines catégories de SER, a constitué un obstacle à la réalisation de réductions de coûts, et si l'existence ou l'importance des exemptions à l'intégration du marché a constitué un obstacle à la réalisation de l'intégration du marché. En outre, des données ont été recueillies sur la question de savoir dans quelle mesure les EEAG ont veillé à ce que le soutien à la cogénération et au chauffage urbain à haute efficacité énergétique soit efficace. L'étude contient également des informations sur l'introduction par les États membres d'une politique en matière d'énergies renouvelables au cours de la période 2014-2020, au-delà de leurs objectifs contraignants en matière de SER pour 2020. En outre, la performance des mécanismes de capacité a été évaluée en comparant les résultats de différentes enchères et conceptions de régimes. En ce qui concerne l'efficience, l'étude fournit des informations sur l'impact des réductions des prélèvements sur les SER et d'autres prélèvements comparables pour les utilisateurs intensifs d'énergie (UIE), ainsi que sur les prélèvements payés par différents groupes de consommateurs et sur la pertinence de la règle des droits acquis. Elle se concentre également sur la collecte de données dans les régimes communiqués à la Commission par les États membres pour contenir les dispositions relatives aux aides d'État en faveur des mesures d'efficacité énergétique dans les bâtiments. En ce qui concerne la pertinence, l'étude fournit des informations sur les projets d'énergie renouvelable non subventionnés dans l'EEE ainsi que sur les projets d'infrastructure alternatifs, en mettant l'accent sur le financement des projets. L'étude contient les résultats d'une recherche documentaire approfondie et de consultations des parties concernées, afin de mettre en évidence les détails pertinents concernant l'impact des règles de l'UE dans la pratique des Etats membres.

Abstrakt

Ziel der Studie ist es, die Kommission mit unabhängig erhobenen, belegbaren Fakten und Daten über die Umsetzung der seit Juli 2014 geltenden EU-Leitlinien für staatliche Umweltschutz- und Energiebeihilfen (EEAG) und der für Umweltschutz- und Energiebeihilfen geltenden Bestimmungen der Verordnung (EU) 651/2014 der Kommission (AGVO) zu unterstützen. Sie soll einen Beitrag für die Beurteilung der Kommission leisten, ob die EEAG und die relevanten Bestimmungen der AGVO praxistauglich sind. Die in der Studie behandelten Themen beziehen sich auf die Wirksamkeit, Effizienz und Relevanz der Regeln. Im Hinblick auf die Wirksamkeit liefert die Studie u.a. Informationen über Regelungen für erneuerbare Energiequellen (EE), um deren besondere Merkmale und die Preisentwicklung zu verstehen. Sie befasst sich auch mit der Frage, ob das Fehlen einer Ausschreibung für bestimmte Kategorien erneuerbarer Energiequellen ein Hindernis für Kostensenkungen war, und ob die Existenz oder der Umfang von Ausnahmen für die Marktintegration ein Hindernis für die Erzielung der Marktintegration darstellte. Darüber hinaus wurden Daten zu der Frage gesammelt, inwieweit die EEAG sichergestellt haben, dass die Förderung der hochenergieeffizienten Kraft-Wärme-Kopplung und der Fernwärme wirksam war. Die Studie enthält auch Informationen darüber, ob die Mitgliedstaaten im Zeitraum 2014-2020 Politikziele für erneuerbare Energien eingeführt haben, die über ihre verbindlichen Ziele für 2020 hinausgeht. Darüber hinaus wurde die Leistung der Kapazitätsmechanismen durch den Vergleich verschiedener Auktionsergebnisse und Ausgestaltungen der Beihilferegelungen bewertet. Im Hinblick auf die Effizienz liefert die Studie Informationen über die Auswirkungen von Senkungen der EEG-Umlagen und anderer vergleichbarer Umlagen für energieintensive Nutzer, über Umlagen, die von verschiedenen Verbrauchergruppen gezahlt werden, und über die Relevanz der Besitzstands-Regel. Ein weiterer Schwerpunkt ist die Datenerfassung im Hinblick auf nationale Beihilferegelungen, die der Kommission von den Mitgliedstaaten mitgeteilt wurden, da sie staatliche Beihilfen für Energieeffizienzmaßnahmen in Gebäuden enthielten. Hinsichtlich der Relevanz liefert die Studie Aussagen über subventionsfreie EE-Projekte im EWR sowie zu alternativen Infrastrukturprojekten mit besonderem Schwerpunkt auf deren Finanzierung. Die Studie beruht auf intensiven Recherchen und Konsultationen von Interessengruppen und enthält relevante Details über die Auswirkungen der EU-Vorschriften in der Praxis.

Annexes

Annex 0 – Evaluation questions

Effectiveness

1. To what extent have the EEAG and the GBER corresponding provisions been effective in allowing aid for Renewable Energy Sources ("RES") deployment at lower costs or with less aid?

   In order to provide input to the Commission to reply to this question, the contractor shall identify, for a sample of a minimum of 10 Member States covering at least 85% of the total installed renewable generation capacity in the EU, using publicly available data:

   a. How has each approved RES scheme (list to be provided by the Commission) fared in terms of volume awarded and built or repowered (in total, per technology, new/repowered and split by administratively set support and tenders)? Under each approved RES scheme, how many and which tenders (technology(ies), sources or RES) were carried out? What was the volume participating in the auction, the awarded volume and the price?

   b. Under each approved RES scheme, how many and which tenders (technologies, design features) open to several technologies and energy sources were carried out? What was the volume participating in the auction, the awarded volume and the price?

   c. Under each approved RES scheme, how many and which tenders open to repowering were carried out? What was the volume of new capacity / repowered capacity participating in the auction, the awarded volume of new / repowered capacity and the price? Which schemes were successful in encouraging cost-effective repowering and why? How has competition been ensured when there are a limited number of possible repowering projects and/or sites are all controlled by a limited number of undertakings?

2. Has the absence of requiring a tender for certain categories of RES been a barrier to achieving cost reduction? Have the existence or size of exemptions to market integration been a barrier to achieving market integration?

   In order to provide input to the Commission to reply to this question, the contractor shall identify, using publicly available data:

   a. RES volume and aid level (per scheme and technology) covered by exemptions in GBER and the EEAG (i) for small installations, (ii) from tendering requirement.

3. To what extent have the EEAG ensured that support for high energy efficient cogeneration and district heating was effective?

   The contractor shall, for maximum 10 measures (list to be provided by the Commission) using publicly available data, identify:

   a. How has each support measure for high energy-efficient cogeneration fared in terms of the amount of capacity built and the level of aid paid per unit of installed capacity (e.g. per MW installed high efficient CHP)?

b. Under each scheme, how many and which tenders/allocation processes were carried out? For each allocation process, what were the eligible technologies and what were the levels of aid awarded?

4. To what extent have the EEAG ensured that capacity mechanisms were cost-effective in providing security of supply and least-distortive to competition?

   In order to provide input to the Commission to reply to this question, the contractor shall identify, using publicly available data:

   a. For each auction/ allocation process (both T-4/5 and T-1 where applicable) under each of the 10 approved and launched capacity mechanisms, including strategic reserves and interruptibility schemes[160]:

      - Actually calculated derating factors (where applicable)
      - Capacity price
      - The applicable obligations for beneficiaries, and the potential penalties
      - Price cap(s)
      - Awarded amount (MW) of capacity per fuel-type/technology (including demand response, interconnection, etc.) and as existing, refurbished and new capacity
      - Amount (MW) of capacity contracted per contract length

5. To what extent have the EEAG and the corresponding GBER provisions and their application facilitated the integration of RES into the electricity market?

   In order to provide input to the Commission to reply to this question, the contractor shall identify, using publicly available data:

   a. Rules regarding support at negative prices under operational support schemes and occurrence of negative prices (number of hours of negative prices, RES production during those hours supported under each applicable aid scheme) in the following Member States: UK, Germany, France, Netherlands and Denmark[161]. Any available input from other Member States would be also welcome.

6. The contractor shall prepare the following tables: (i) the first table should indicate, for each Member State, whether they have introduced a renewable energy policy in the period 2014-2020 going beyond their binding 2020 RES targets; (ii) the second table should list the level of RES charges over the total electricity bill – where possible, per category of electricity consumers (i.e. EIUs vs. other companies) – for a sample of a minimum of 15 Member States in the period 2014-2020. For those Member States having implemented an approved scheme under section 3.7.2. of the EEAG, the second table should also indicate the level of the reductions on RES levies and the level of the reductions to other charges approved by the Commission by analogy (e.g. reductions

---

[160] Schemes in UK (SA.35980 and SA.44475), France (SA.39621), Germany (SA.43735), Ireland (SA.44464), Belgium (SA.48648), France (SA.48490), France (SA.40454), Greece (SA.48780), Greece (SA.50152), Poland (SA.46100). The decisions can all be accessed here: http://ec.europa.eu/competition/sectors/energy/state_aid_to_secure_electricity_supply_en.html.

[161] This sample of Member States has been selected as they have regulated the occurrence of negative prices by different modalities.

to CHP levies), if applicable. For this purpose, the Commission will provide a list of cases where reductions to other charges were approved by analogy (maximum 5).

7. Waste management is an important element for achieving resource efficiency. To what extent has Article 47 GBER, which sets out the compatibility criteria for aid for waste recycling and re-utilisation, been effective in allowing aid to foster sustainable and smart growth in re-use and recycling of waste while avoiding disproportionate distortions of competition?

   In order to provide input to the Commission to reply to this question, the contractor shall, for the list of schemes communicated to the Commission as falling under Article 47 GBER (list to be provided by the Commission; the Member States concerned are listed in section 7 of the technical specifications):

   a. using the content of the legal basis, identify the schemes that actually contain provisions on the granting of aid for waste management (with the exclusion of support schemes dedicated to wastewater treatment) and indicate i) whether the eligible waste management activities are limited to recycling of waste and preparation for re-use, ii) whether they target specific types of waste (and which ones) and iii) whether they can also relate to waste-to- energy projects under the national legal basis.

   b. for the schemes actually containing provisions on the granting of aid for waste management, indicate how many recycling of waste and preparation for re-use projects have obtained aid under these schemes, in which Member States, and what budget has been allocated to those schemes. If the number of Member States concerned is higher than eight, limit your examination to a representative and balanced sample of 8 Member States (large/small, North/South, East/West/Central, low/high recycling rates[162]).

   c. If for some Member States examined under data request 6b above, no aid was granted under the scheme based on Article 47 GBER, the contractor shall identify the reasons (absence of recycling or re-use projects, difficulty to apply the “state of the art” criterion, difficulty to satisfy the “treatment of waste from others” criterion, too low aid intensities, etc.).

Efficiency

8. As regards the Member States which have granted reductions to energy intensive users the contractor shall identify and assess:

   a. What impact have those reductions had - in cumulation with reductions to other charges approved by the Commission by analogy (e.g. reductions to CHP levies) - on the RES levy and other relevant levies paid by non-energy intensive industrial consumers and households in terms of EUR/year?

   b. To what extent has the grandfathering rule foreseen in point 197 of the EEAG been relevant in the different sectors in terms of proportion of grandfathered undertakings?

9. Based on Member States' implementation of the requirements of Article 39 GBER in energy-efficiency schemes and on financial intermediary and energy service companies'

[162] *Recycling rates of Member States are reproduced in a table under section 7 of the technical specifications.*

("ESCOs") market behaviour, to what extent has the administrative burden linked to Article 39 GBER been proportionate to the potential distortions on the financial intermediary markets and on the energy efficiency service market?

In order to provide input to the Commission to reply to this question, the contractor shall, based on the list of schemes communicated to the Commission as falling under Article 39 GBER (list to be provided by the Commission; the Member States concerned are listed in section 7 of the technical specifications):

a. using the content of the legal basis, identify the schemes that actually contain provisions on the granting of aid for energy efficiency measures in buildings based on financial instruments. For the Member States having provided for aid measures for energy efficiency measures in building based on financial instruments, indicate:

   - How in the national legal basis the selection of funds/financial intermediaries is organised.
   - How the national legal basis proposes to verify that the investment by independent private investor was reaching 30% and that the private investors were obtaining a fair rate of return.
   - How the national legal basis proposes to verify that the financial intermediaries were passing on the full advantage to the building owners or tenants and were managed on a commercial basis.
   - Whether the national legal basis allows that the subsidized loans be concluded between the financial intermediary (or fund) and an ESCO.
   - What types of expenditures and projects are eligible under the national legal basis and in particular whether under the legal basis it is possible for building owners or tenants to obtain a subsisied loan or guarantee for projects relating to i) the building insulation, ii) renovation of the heating and iii) installation of renewable energy production and whether the eligible costs under the legal basis also allow for a combination of those investments (for instance building insulation together with renewable energy production).
   - Whether the national legal basis limits the subsidised loans or guarantees to households or also allows that the subsidised loans be concluded between the financial intermediary and SMEs or large undertakings.

b. for the schemes actually containing provisions on the granting of aid for energy efficiency measures in buildings based on financial instruments, indicate:

   - Whether the Member State actually provided loans or guarantees under that scheme to funds or financial intermediaries and what budget has been allocated to the scheme concerned.
   - If the concerned Member State has organized a tender or a call for application to select the financial intermediary (or the fund) and which types of financial institution have been selected to provide subsidized energy-efficiency loans (established financial institutions, specialized financial institutions, funds, ESCOs, etc.).

- Whether there is publicly available evidence (for instance, have there been competition enquiries by national competition authorities) of ESCOs or energy suppliers tying energy supply contracts to energy-efficiency services or tying energy-efficiency contracts to energy supply.

If the number of Member States concerned is higher than eight, the contractor can limit the data request to a representative and balanced sample of 8 Member States (large/small, North/South, East/West/Central, close/far from reaching energy-efficiency target[163]).

Relevance

10. Do the EEAG and GBER still adequately address recent market developments such as zero subsidy bids?

In order to provide input to the Commission to reply to this question, the contractor shall identify, using publicly available data:

a. List of zero subsidy bids awarded under RES support schemes, detailing the technology, auction date, volume, bid, as well as other advantages (such as guaranteed and/or free connection to the grid), and any obligations (e.g. requirement to post collateral to help ensure winning projects are built) linked to the award. These advantages could be quantified where possible.

b. Where contracts were awarded to projects that bid at zero, what were the award criteria on the basis of which the winning project (or projects) were selected?

11. To what extent are the process (assessment under the Treaty) and the compatibility rules developed by the Commission in its decision practice for alternative fuel[164] infrastructure (publicly accessible or dedicated infrastructure) adapted to subsequent market developments and technological advances?

In order to provide input to the Commission to reply to this question, the contractor shall:

a. For the schemes approved by the Commission (list of 8 decisions to be provided by the Commission), indicate how the projects have been implemented: companies involved in the projects, tender criteria used for the selection of companies (where applicable), costs of project, selected technology (when the scheme was open to several technologies), how access of the users to the infrastructure was organized (entirely open or not) and how much the user is charged for the access to and/or the use of the infrastructure.

b. For Austria, Belgium, Estonia, France, Spain and Sweden[165] identify the list of existing projects of publicly accessible infrastructure (electric charging stations and hydrogen refueling stations for road vehicles only, excluding bicycles, motorcycles and similar vehicles)[166].

---

[163] The progress made by each Member States towards reaching energy efficiency targets is described in Section 7 of the technical specifications.
[164] Within the meaning of Article 2(1) of The Alternative Fuels Infrastructure Directive (2014/94/EU).
[165] These Member States were selected based on information from the European Alternative Fuels Observatory and in order to have a selection of large and small Member States, North/South/Center and with high number of charging stations/low number or middle range number of charging stations.
[166] Information on projects can be found on the European Alternative Fuels Observatory website and on the Connecting Europe Facility (https://ec.europa.eu/inea/en/connecting-europe-facility) website.

c. Select among the projects identified under letter b) twenty projects (electric charging stations only), subject to the following criteria:

- The selection shall at the minimum include for each of the Member States listed under b) the project with the broadest geographical coverage in the Member State.
- If the existing projects in a Member States all only relate to local projects (no national or regional coverage), the selection must include at least the project for the most populated city.
- The selection must at minimum contain for each Member State listed under b) a project in an area with low population density.
- At minimum the selection shall include three projects for France and Spain as they represent two biggest member States in the sample.

For each selected project, the contractor shall indicate i) which actors are involved and the geographical coverage of the project (entire region or country, urban area, motorway, countryside, etc.), ii) whether public financing was provided and the sources of the public financing as well as the share of the public financing in the total costs, iii) the total costs of the project, iv) how access to the infrastructure is organised, in particular whether the user is charged for the access to and/or the use of the infrastructure, v) the technology concerned by the project, vi) if the project was constructed on public domain, the conditions under which the concession for the construction of the infrastructure was awarded, and in particular assess whether the concession was awarded in a competitive manner. In addition, if public financing was provided, the contractor shall indicate: vii) whether the public funding was granted in a tender, the budget of the tender and the tender criteria used for the selection of companies (if any), viii) the selected technology, ix) conditions imposed on the beneficiary of public financing, x), which legal basis was used by the Member State for the State aid compliance.

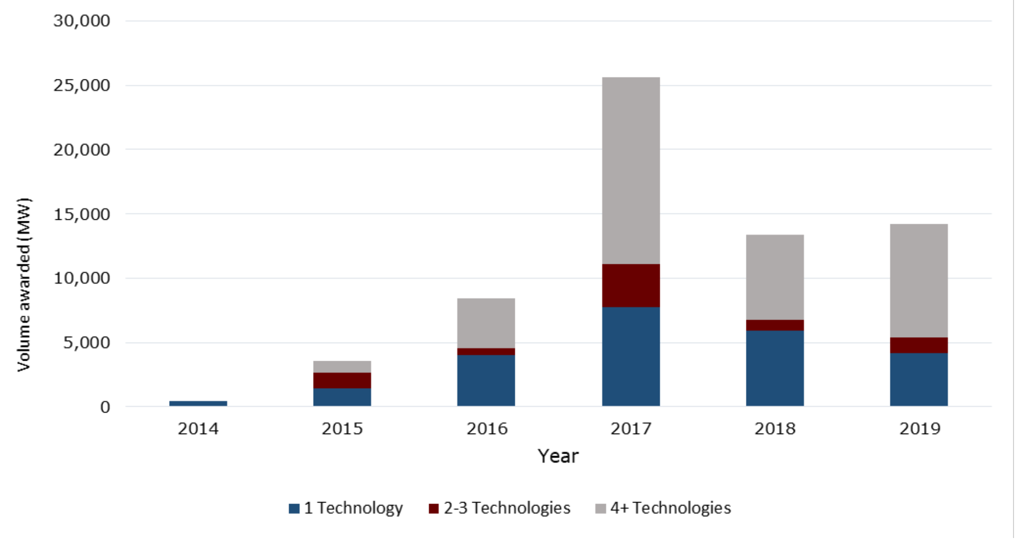
d. Based on the projects identified under a) and c) that have been selected based on a tender, make a comparison of the funding gap (or bids) of the different selected alternative fuel infrastructure projects and indicate the geographical coverage of the project concerned.

Annex 1.1 – Aures II and additional data on RES auctions

(see accompanying Excel file)

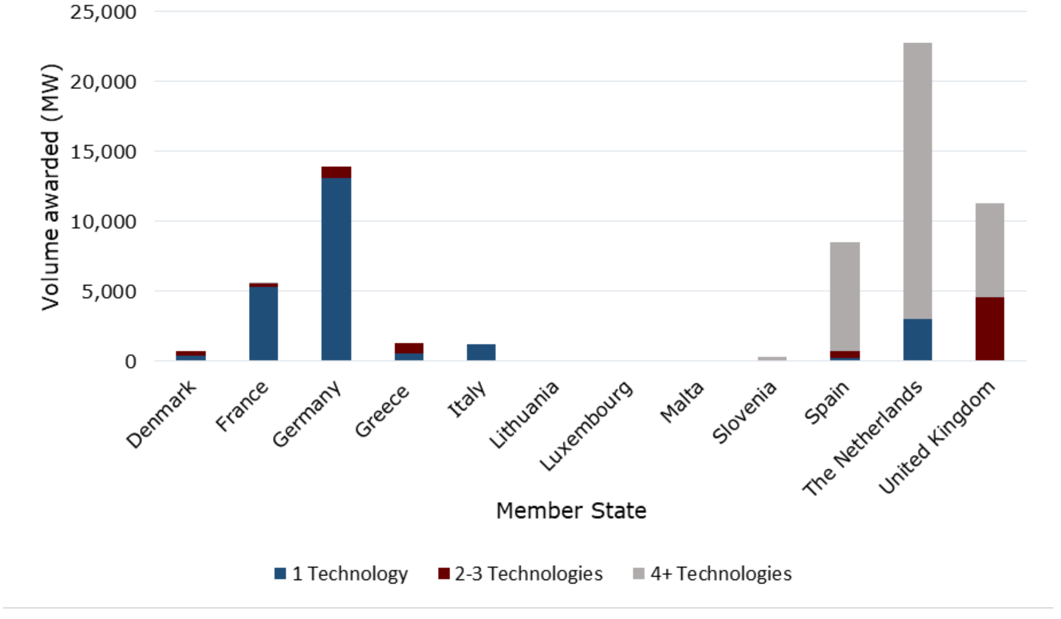
Annex 1.2 – Additional analysis of RES auctions

Figure A1.2.1: Volume awarded (MW) through bidding processes in sample schemes over time split by number of technologies that could enter each bidding process, 2014-2019[167]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

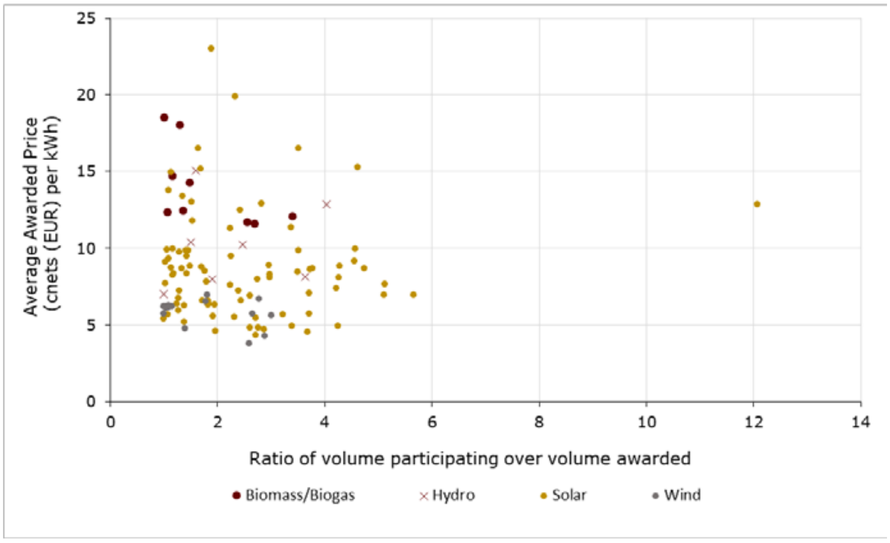
Figure A1.2.2: Volume awarded (MW) through bidding processes in sampled schemes across Member States split by number of technologies that could enter each bidding process, 2014-2019[168]



[167] *Excludes volumes awarded in MWh or MWp.*
[168] *Excludes volumes awarded in MWh or MWp.*

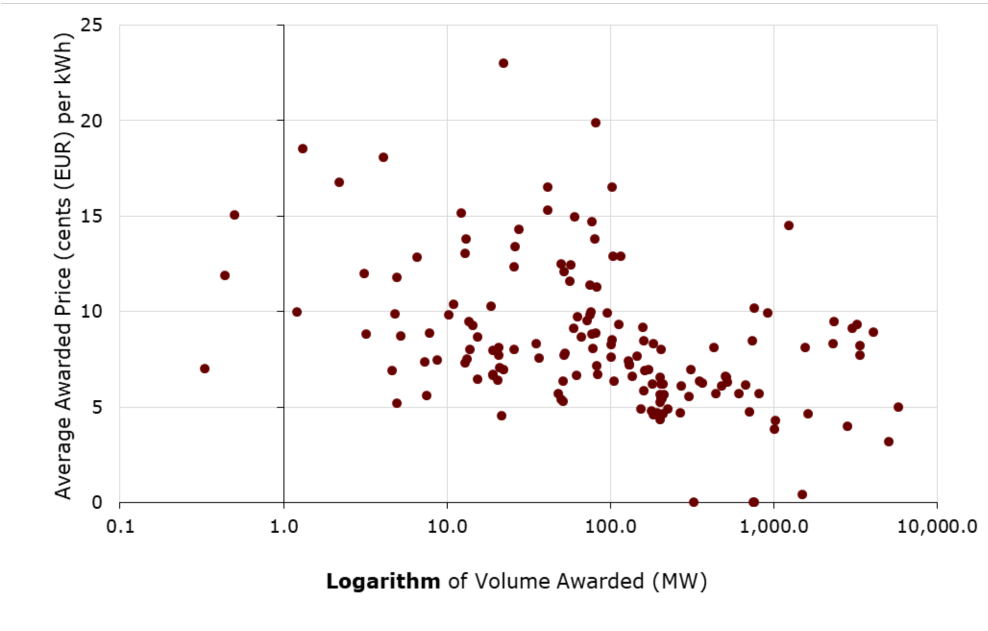
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.3 Scatterplot of average awarded price against volume participating over volume awarded for each bidding process in sampled processes involving a single technology award, 2014-2019[169]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.4 Scatterplot of average awarded price against the logarithm of volume awarded (MW) for sampled bidding processes, 2014-2019[170]

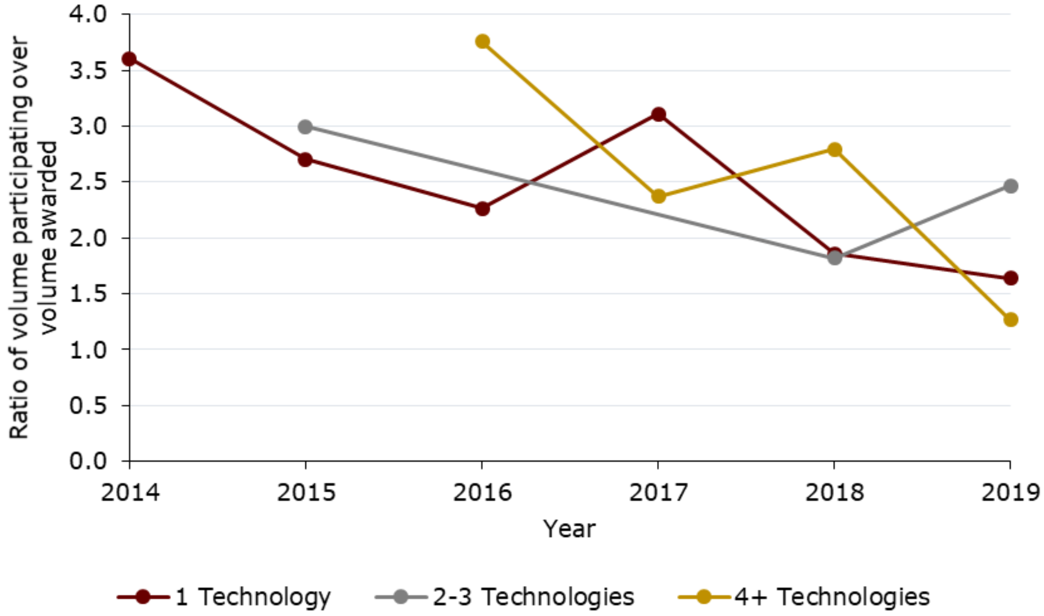


Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

---

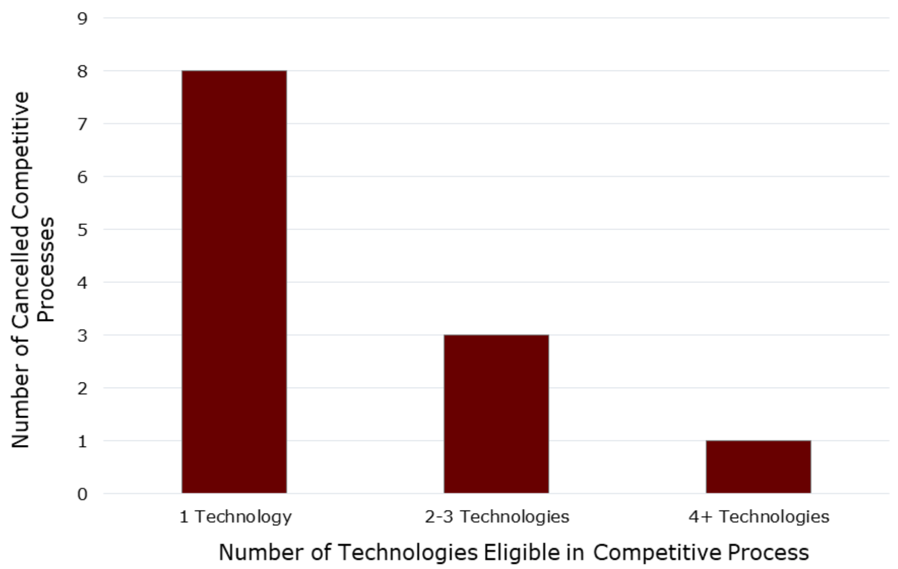
[169] *Only includes bidding processes with required data.*
[170] *Only includes bidding processes with required data.*

Figure A1.2.5 Mean of the volume participating over volume awarded ratio in sampled bidding processes split by number of eligible technologies, 2014-2019



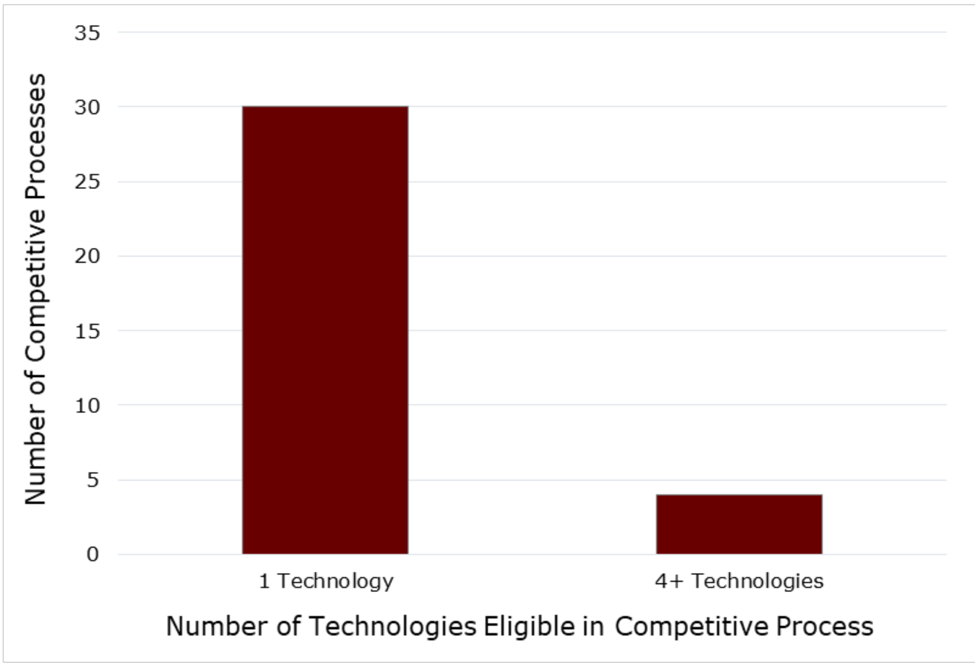
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.6 Number of cancelled bidding processes within sampled schemes by number of technologies eligible to enter the bidding process, 2014-2019



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

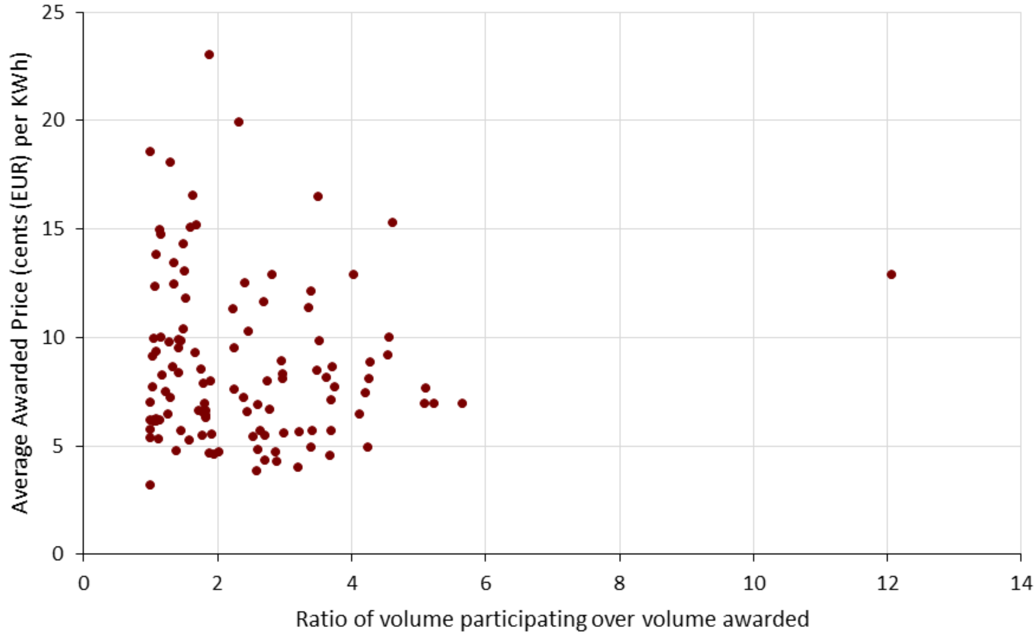
Figure A1.2.7 Number of bidding processes in sampled schemes where the volume requested exceeded the volume participating split by number of technologies eligible to enter the bidding process, 2014-2019[171]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

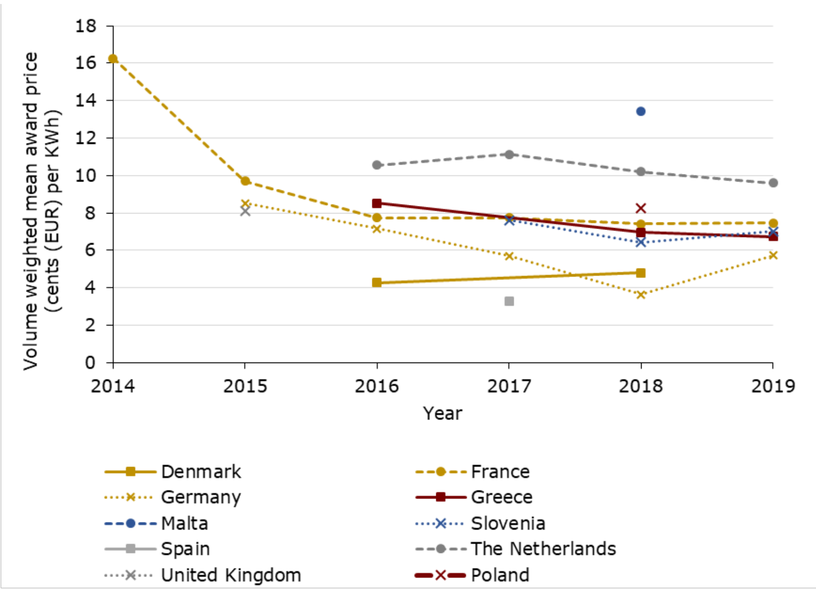
[171] *Based on bidding processes with required data only.*

Figure A1.2.8 Scatterplot of average awarded price against volume participating over volume awarded for each bidding process in sampled schemes, 2014-2019[172]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.9 Volume weighted mean price for solar per KWh in sampled schemes by Member State, 2014-2019

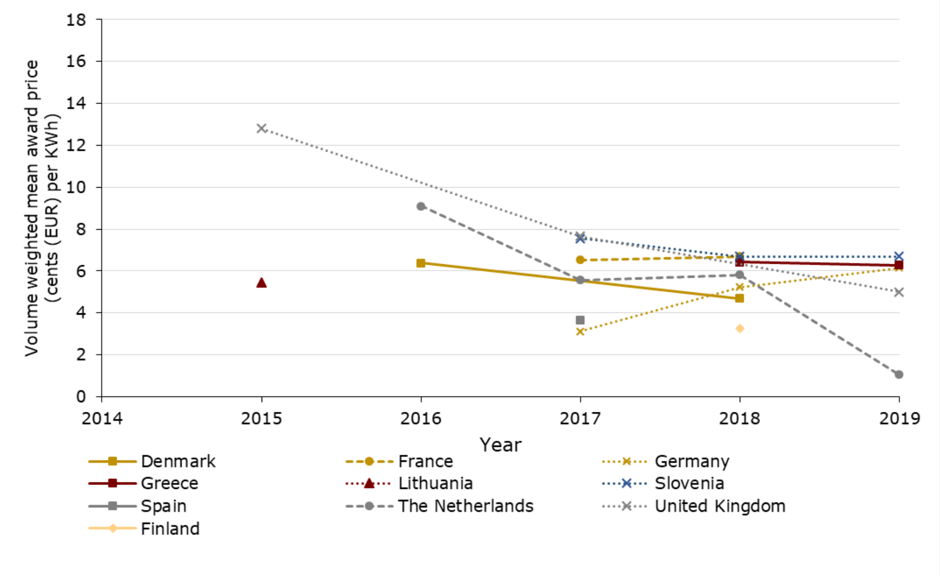


Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

---

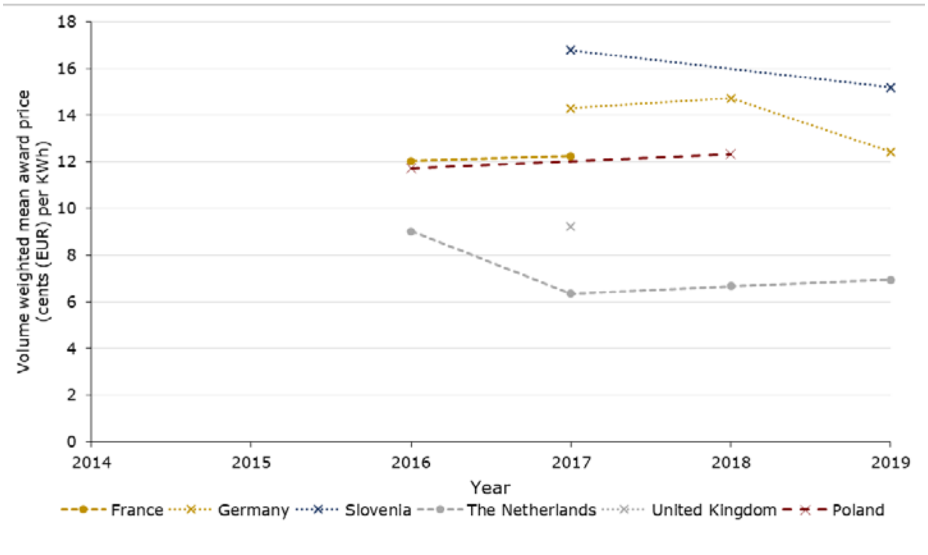
[172] *Based on bidding processes with required data only.*

Figure A1.2.10 Volume weighted mean price for wind per KWh in sampled schemes by Member State, 2014-2019



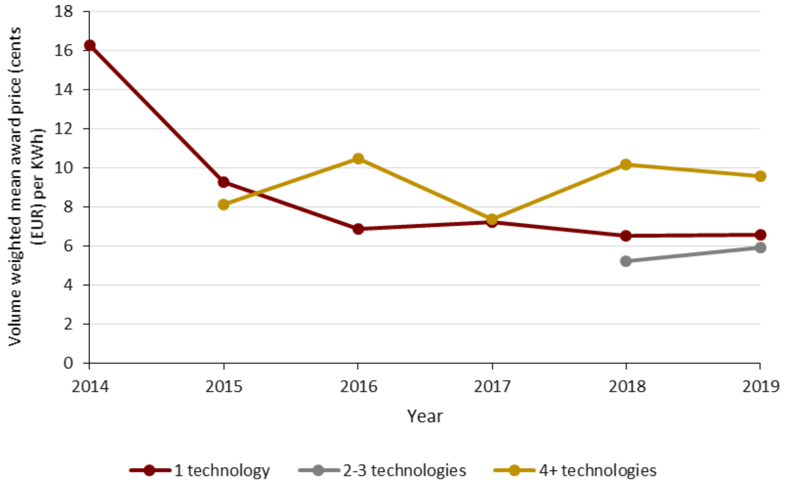
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.11 Volume weighted mean price for biomass/biogas per KWh in sampled schemes by Member State, 2014-2019



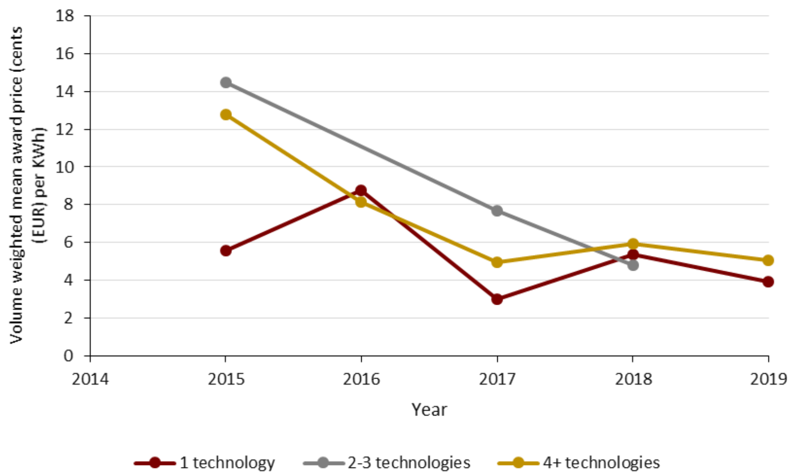
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.12 Volume weighted mean price for solar per KWh in sampled schemes by number of technologies that can enter the bidding process, 2014-2019[173]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.13 Volume weighted mean price for wind per KWh in sampled schemes by number of technologies that can enter the bidding process, 2014-2019[174]



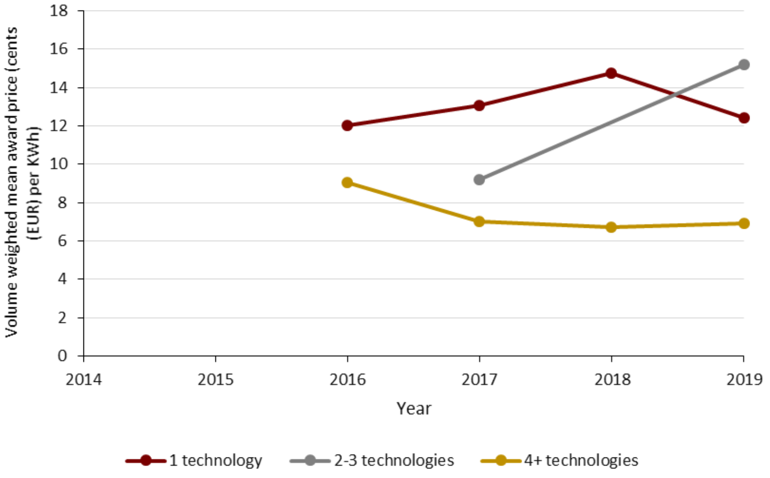
Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

---

[173] *This chart pools all available pricing data for bidding processes where volumes awarded were expressed in MW. No pricing data was available for Spain in 2016 or Italy or Luxembourg.*

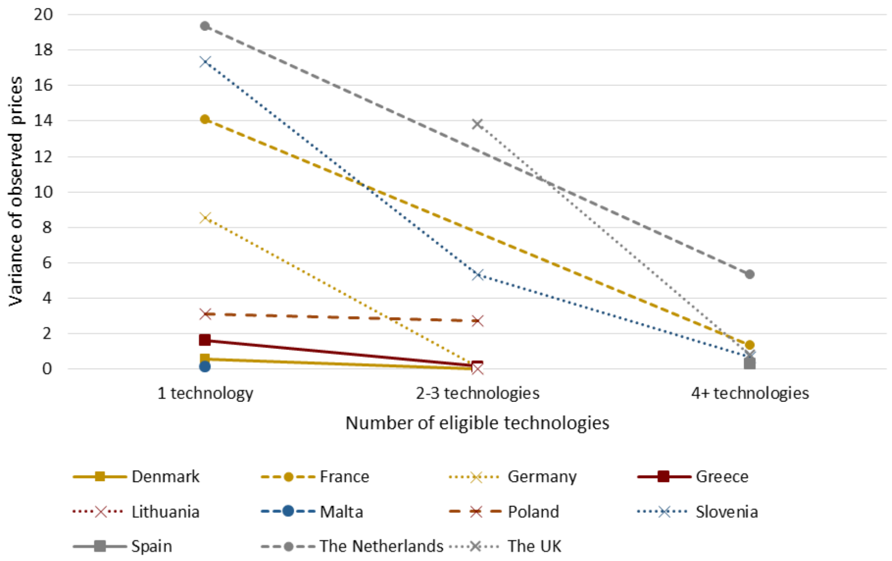
[174] *This chart pools all available pricing data for bidding processes where volumes awarded were expressed in MW. No pricing data was available for Spain in 2016 or Italy or Luxembourg.*

Figure A1.2.14 Volume weighted mean price for biomass/biogas per KWh in sampled schemes by number of technologies that can enter the bidding process, 2014-2019[175]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Figure A1.2.15 Variance of awarded prices, cents (EUR) per KWh, in sampled bidding processes open to differing numbers of eligible technologies by Member State, 2014-2019[176]



---

[175] This chart pools all available pricing data for bidding processes where volumes awarded were expressed in MW. No pricing data was available for Spain in 2016 or Italy or Luxembourg.

[176] Data is only included where there were at least two price observations within a Member State for a type of process open to a given number of technologies. In bidding processes involving more than one technology price observations relate to each sub-category of technology stated in the source documentation, as a result the sub-categories can vary between bidding processes. In bidding processes involving more than 1 technology where a price breakdown by technology subcategory is not provided, the overall price for the bidding process as a whole is used.

Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and preliminary data from the AURES II project.

Table A1.2.1 Case study comparisons of prices between bidding processes and administratively set support

<table>
<tr><td colspan="2">Case Study 1: Denmark 2016 (large vs small plants)</td></tr>
<tr><td colspan="2">Technology: Solar</td></tr>
<tr><td>Bidding process price(s), cents (EUR) per KWh:</td><td>Administratively set price(s), cents (EUR) per KWh:</td></tr>
<tr><td>4.53</td><td>(i) 8.06 (First 10 Years), then 5.37 (Following 10 Years)
(ii) 11.82
(iii) 12.63
(iv) 9.67</td></tr>
<tr><td><u>Details:</u>
State Aid Decision(s): SA.44626
Overview: 2016 pilot tender (open to Danish and German producers, only Danish producers applied). Aid granted for 20 years.
Price type(s): Fixed premium (pay as clear auction). Clearing price: 1.73 cents (EUR) per KWh, to which project team added average 2016 electricity price of 2.80 cents (EUR) per KWh (ensto-e data).
Bidding process volumes: volume requested: 20.0MW, volume participating: 79.5MW, volume awarded: 21.6MW</td><td><u>Details:</u>
State Aid Decision(s): SA.36204, SA.47440
Overview: Awarded under VE-loven § 47. Requests had to be made before May 2016.
(i) is open to installations of any size, (ii) is for solar panels for own consumption ≤ 6 kW per household, (iii) is for shared solar panels integrated into a building (under 500KW or for community facilities), and (iv) is for solar installations under 500KW.
Price type(s): (i) variable premium (guaranteed minimum price) with one minimum price for the first 10 years and another for the second 10 years; (ii)-(iv) variable premium (guaranteed minimum price) within a pool of 20MW with support lasting 10 years
State aid exemption(s):</td></tr>
<tr><td colspan="2">Case Study 2: Denmark 2018 (large vs small plants)</td></tr>
<tr><td colspan="2">Technology: Onshore wind</td></tr>
<tr><td>Bidding process price(s), cents (EUR) per KWh:</td><td>Administratively set price(s), cents (EUR) per KWh:</td></tr>
</table>

4.70	(i) 18.25 (ii) 12.88 (iii) 6.15 (iv) 4.81
Details: *State aid Decision(s):* SA.49918 *Overview:* 2018 Multi-Technology Tender. Aid is granted for 20 years. *Price type(s):* Fixed premium (pay as bid auction). Weighted average price of successful onshore wind bids: 0.29 cents (EUR) per KWh, to which project team added average 2018 electricity price of 4.41 cents (EUR) per KWh (ensto-e data) *Bidding process volumes:* volume requested: unavailable, volume participating: 540MW, volume awarded: 267MW	**Details:** *State Aid Decision(s):* (i) SA.37122, (ii)-(iv) SA.50715 *Overview: (i)-(ii)* Awarded through VE-loven § 41 stk. 4 og BEK 82/2017. Aid granted to household wind turbines for 12 years within a pool of 1MW. (iii)-(iv) Awarded through Act No. 504 of 23 May 2018 om ændring af lov om fremme af vedvarende energi, lov om elforsyning og lov om Energinet. (iii)-(iv) cover projects which able to claim under previous provisions but delayed due to appeals. (iii) was set at the price cap of the 2018 Multi-Technology Tender. Once the results of this tender were known rate was set at the highest accepted price of the tender which is (iv). *Price type(s):* (i) and (ii) are variable premium (guaranteed minimum price). (i) awarded to household wind turbines under 10KW, (ii) awarded to household wind turbines over 10KW and up to 25KW (iii) fixed premium of 1.74 cents (EUR) per KWh to which the project team added average 2018 electricity price of 4.41 cents (EUR) per KWh (ensto-e data) (iv) fixed premium of 0.40 cents (EUR) per KW to which the project team added average 2018 electricity price of 4.41 cents (EUR) per KWh *State aid exemption(s):* (i) point 125 EEAG (See SA.37122), also point EEAG 127 applies due to size of installations. ii-iv) point 127 EEAG (See SA.50715)

Case Study 3: Finland 2018 (large vs small plants)	
Technology: Onshore wind	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
3.26	8.35
Details: *State aid Decision(s):* SA.51525 *Overview:* 2018 Technology Neutral Tender. Aid granted for 20 years. *Price type(s):* Sliding premium, a fixed premium that tapers to zero (pay as bid auction). Weighted average price of successful onshore wind bids: 0.26 cents (EUR) per KWh, to which project team added an electricity price of 3.00 cents (EUR) per KWh as the variable premium is paid in addition to the lower of: (i) the market price of electricity or (ii) 3.00 cents (EUR) per KWh. (average 2018 electricity market price on ensto-e was under 3.00 cents (EUR) per KWh) *Bidding process volumes:* volume requested: 1,400,000 MWh, volume participating: 4,130,000 MWh, volume awarded: 1,360,000 MWh	**Details:** *State aid Decision(s):* SA.51525 *Overview:* Awarded through § 23 Act No. 1396/2010. Aid is awarded for 12 Years. Wind farms must be under 2.5 MW in capacity. *Price type(s):* Sliding premium *State aid exemption(s):* GBER article 42
Case Study 4: France 2014 (large vs small plants)	
Technology: Solar	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
(i) 15.90 (ii) 23.01 (iii) 19.90 (iv) 12.88	(i) 27.97 (ii) 13.74 (iii) 13.05 (iv) 6.80

(v) 14.96 (vi) 16.52 (vii) 15.18	
Details: *State aid Decision(s):* SA.41528 *Overview:* (i) PV installations on buildings (100-250KW) Both types of aid are granted for 20 years, (ii) 100% Concentrated Solar < 12MWp, (iii) 50% Concentrated Solar < 12 MWp, (iv) Solar Tracker < 12 MWp, (v) Solar - Car Parking Shades < 4.5 MWp, (vi) Solar on Buildings < 3MWp and (vii) Solar on Buildings between 3MWp and 12MWp *Price type(s):* (i) Variable premium (pay as bid auction), price is weighted average from auctions under 'Appel d'offers portant sur des installations photovoltaïques sur bâtiment de puissance crête comprise entre 100 et 250 kW', (ii) – (vii) Variable premium (pay as bid auction), price is weighted average *Bidding process volumes:* (i) volume requested: 80MW, volume participating: 333MW, volume awarded: 82MW; (ii) volume requested: unavailable, volume participating: 41.7MW, volume awarded: 22.1MW; (iii) volume requested: unavailable, volume participating: 187.9 MW, volume awarded: 80.8MW; (iv) volume requested: unavailable, volume participating: 1240.3MW, volume awarded: 102.7MW; (v) volume requested: unavailable, volume participating: 68.4MW, volume awarded: 60.2MW; (vi) volume requested: unavailable, volume participating: 167.6MW, volume awarded: 102MW; and (v) volume requested: unavailable, volume participating: 20.5MW, volume awarded: 12.2MW	**Details:** *State aid Decision(s):* SA.40349 *Overview:* Set quarterly by CRE, rates given as of December 2014. Aid is granted for a period of 20 years. (i) Less than 9KW - Built into the frame of Buildings, (ii) Less than 36KW - Integrated but not built into buildings, (iii) Between 36KW and 100KW - integrated but not built into buildings, (iv) less than 12 MW (Ground installations or Buildings). *Price type(s):* Feed-in tariff *State aid exemption(s):* From 2016 this would have been covered by points 125 and 127 EEAG (see SA.40349). Additional exemptions for larger installations may apply, but this scheme fell outside the sample for Q2.
Case Study 5: Germany 2017 (large vs small plants)	

Technology: Offshore wind	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
0.44	(i) 3.9 (ii) 3.12
<u>Details:</u> *State aid Decision(s):* SA.45461 *Overview:* First call for existing projects according to § 26 WindSeeG. Auction included Zero subsidy bids. Aid can be granted under the EEG for a maximum of 20 years. *Price type(s):* Variable premium (pay as bid auction), price is weighted average of successful bids. *Bidding process volumes:* (i) volume requested: 1,550MW, volume participating: unavailable, volume awarded: 1,610MW	**<u>Details:</u>** *State aid Decision(s):* SA.45461 *Overview:* Set under § 47 of EEG 2017. Aid can be granted under the EEG for a maximum of 20 years. *Price type(s):* Feed in Tariff. (i) Producers under 100KW (unclear whether offshore wind farms this small exist), (ii) producers over 100KW receive 80% of (i) for up to 6 months a year in exceptional circumstances (tariff is designed as a fall back if producers cannot sell their electricity directly to the market) *State aid exemption(s):* (i) point 125 EEAG, (ii) justified as rarely used measure of last resort (see SA.45461, paragraphs 188-190)
Case Study 6: Germany 2017 (large vs small plants)	
Technology: Onshore wind	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
4.53	(i) 8.38 (ii) 4.66 (iii) 7.98 (iv) 4.26 (v) 6.70 (vi) 3.73
<u>Details:</u> *State aid Decision(s):* SA.45461	**<u>Details:</u>** *State aid Decision(s):* SA.45461

Overview: May, August and November 2017 Auctions. Aid can be granted under the EEG for a maximum of 20 years. *Price type(s):* Variable premium (Pay as bid auction, with the exception of energy communities where the auction is pay as clear). Price is weighted average of successful bids. *Bidding process volumes:* (i) volume requested: 2,800MW, volume participating: 7654.5MW, volume awarded: 2819.9MW f	*Overview:* Set under § 47 EEG 2017. For installations under 750KW. Aid can be granted under the EEG for a maximum of 20 years. *Price type(s):* (i) and (ii) are a variable premium. (i) is for the first 5 years after commissioning (this can be extended if the investment yield is low) and after this it is (ii). (iii) and (iv) are a feed-in tariff option for installations under 100KW where the feed-in tariff is (i) and (ii) but reduced by 0.4 cents (EUR) per KWh (§ 53 no. 2 EEG 2017). (v) and (vi) are a feed in tariff for installations over 100KW available for 6 months of a year in exceptional circumstances set at 80% of (i) and (ii) (this is a fall back tariff if producers cannot sell their electricity directly into the market) *State aid exemption(s):* (i)-(ii) unknown, scheme fell outside the sample for Q2; (iii)-(iv) point 125 EEAG; (v)-(vi) justified as rarely used measure of last resort (see SA.45461, paragraphs 188-190)
Case Study 7: Germany 2017 (large vs small plants)	
Technology: Biomass	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
i) 14.30[177] ii) 14.81 iii) 16.90 iv) 14.13	i) 13.12 ii) 13.32 iii) 11.49 iv) 10.66 v) 9.19 vi) 8.23 vii) 4.57

[177] *This is the price quoted in Annex 1.1. The prices (ii) to (iv) are not quoted in Annex 1.1 as they did not result from separate bidding processes; they are simply added detail on subcategories of bids in the bidding process for (i) to assist the comparison with the administratively set support rates.*

Details: *State aid Decision(s):* SA.45461 *Overview:* September 2017 Auction. New providers of 150KW to 20MW must the enter auction; auction also open to existing providers and installations under 150KW. Aid is limited to 10 years for existing producers and 20 years for new installations. *Price type(s):* Variable premium (Pay as bid for installations over 150KW, pay as clear for installations equal to or under 150KW). Prices are weighted average of successful bids. (i) is the overall weighted average price for the auction, (ii) weighted average price for new plants, (iii) weighted average price for existing plants (equal to or less than 150KW), (iv) weighted average price for existing plants (>150KW) *Bidding process volumes:* volume requested: 122.45MW, volume participating: 40.91MW, volume awarded: 27.55MW **(volume participating is below volume requested)**	**Details:** *State aid Decision(s):* SA.45461 *Overview:* Set under § 42 EEG 2017. Aid can be granted under the EEG for a maximum of 20 years. *Price type(s):* (i) feed-in tariff, installations under 100KW; (ii) variable premium, installations under 100KW; (iii) variable premium, installations of 100KW-150KW; installations over 100KW can receive a reduced (80%) feed-in tariff for 6 months of a year in exceptional circumstances (a fall back tariff if producers cannot sell their electricity directly into the market), (iv) is for installations 100-150KW, (v) is for installations 150-500KW, (vi) is for installations 500KW-5MW and (vii) is for installations 5-20MW. *State aid exemption(s):* (i) point 125 EEAG; (ii) unknown, scheme fell outside the sample for Q2; (iii)-(iv) justified as rarely used measure of last resort (see SA.45461, paragraphs 188-190)
Case Study 8: Greece 2018 (large vs small plants)	
Technology: Onshore wind	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
6.42	9.8
Details: *State aid Decision(s):* SA.48143 *Overview:* July and December 2018 tenders. Only onshore wind installations between 3MW and 50MW are eligible. Aid granted for 20 years *Price type(s):* Variable premium (pay as bid), price is weighted average of July and December tenders	**Details:** *State aid Decision(s):* SA.44666 *Overview:* Aid awarded under art.4 para.1b Law No.4414/2016. Aid awarded for 20 years. Plants less than or equal to 3MW are eligible. *Price type(s):* feed-in tariff

Bidding process volumes: volume requested: unavailable, volume participating: unavailable, volume awarded: 330.58MW	*State aid exemption(s):* points 125 and 127 EEAG
Case Study 9: Malta 2018 vs 2019 (between year comparison)	
Technology: Solar	
Bidding process price(s), cents (EUR) per KWh:	**Administratively set price(s), cents (EUR) per KWh:**
13.42	i) 15.5 ii) 14
<u>Details:</u> *State aid Decision(s):* SA.43995 *Overview:* Two 2018 auctions for solar PV installations with capacity of > 1000KWp. Aid granted for 20 years. *Price type(s):* Variable Premium (pay as bid), price is weighted average of the two auctions. *Bidding process volumes:* volume requested: 50MW, volume participating: 33.68MW, volume awarded: 25.88MW	**<u>Details:</u>** *State Aid Decision Number:* SA.51961 *Overview:* Awarded under Second Schedule of LN2, 2019. Aid granted for a period of 20 years. (i) Installations of 1KWp but less than 40KWp; (ii) Installations of 40KWp but less than 1MWp. *Price type(s):* Feed-in tariff *State aid exemption(s):* GBER article 42

Annex 2 – Data on RES aid covered by EEAG and GBER exemptions

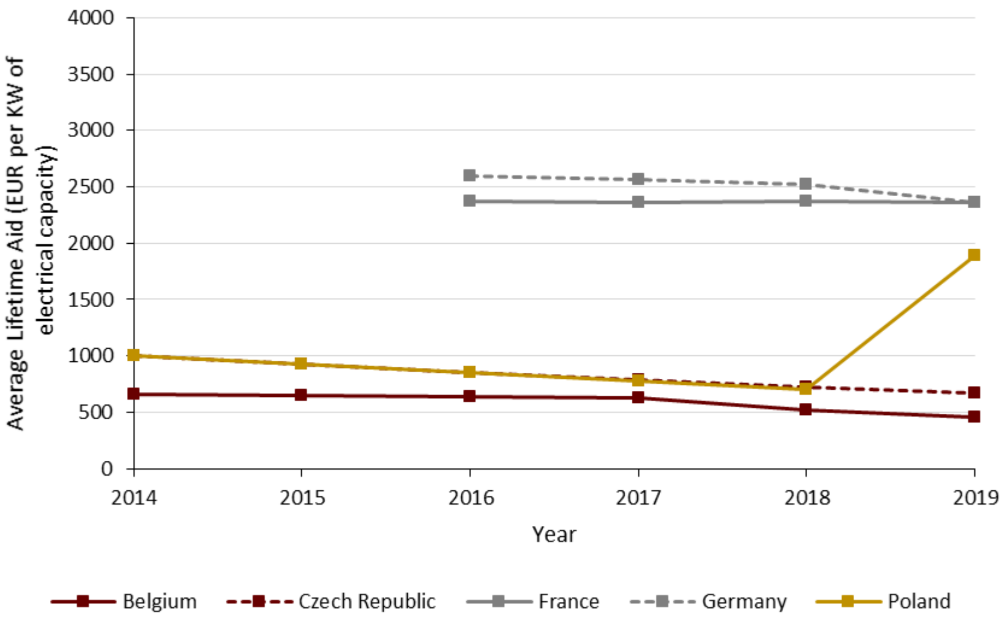
(see accompanying Excel file)

Annex 3.1 – Aid levels per unit of installed CHP capacity

(see accompanying Excel file)

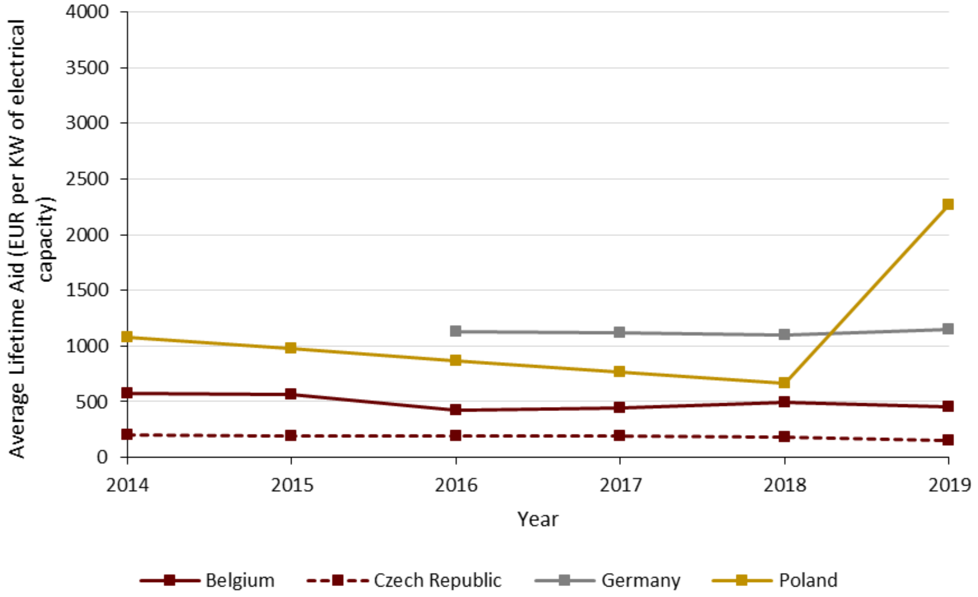
Annex 3.2 – Additional analysis of aid for high efficiency CHP

Figure A3.2.1 Average lifetime aid for case study fuel cell plants (EUR per KW of electrical capacity) by sampled Member State, 2014-2019



Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

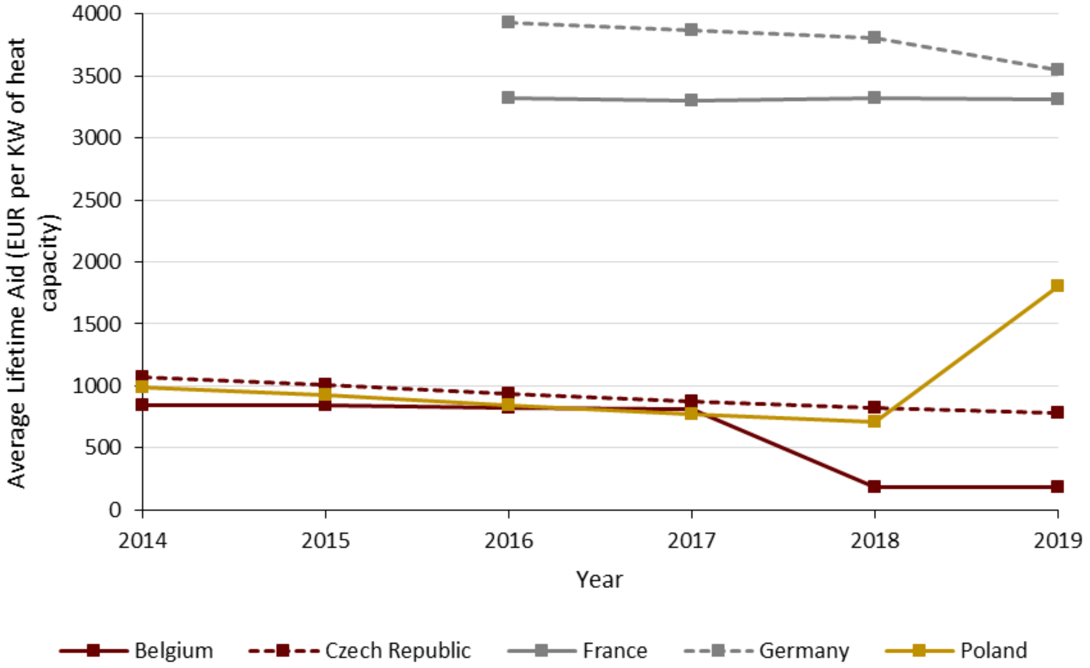
Figure A3.2.2 Average lifetime aid for case study plants over 1MW and up to 15MW (EUR per KW of electrical capacity) by sampled Member State, 2014-2019[178]



Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

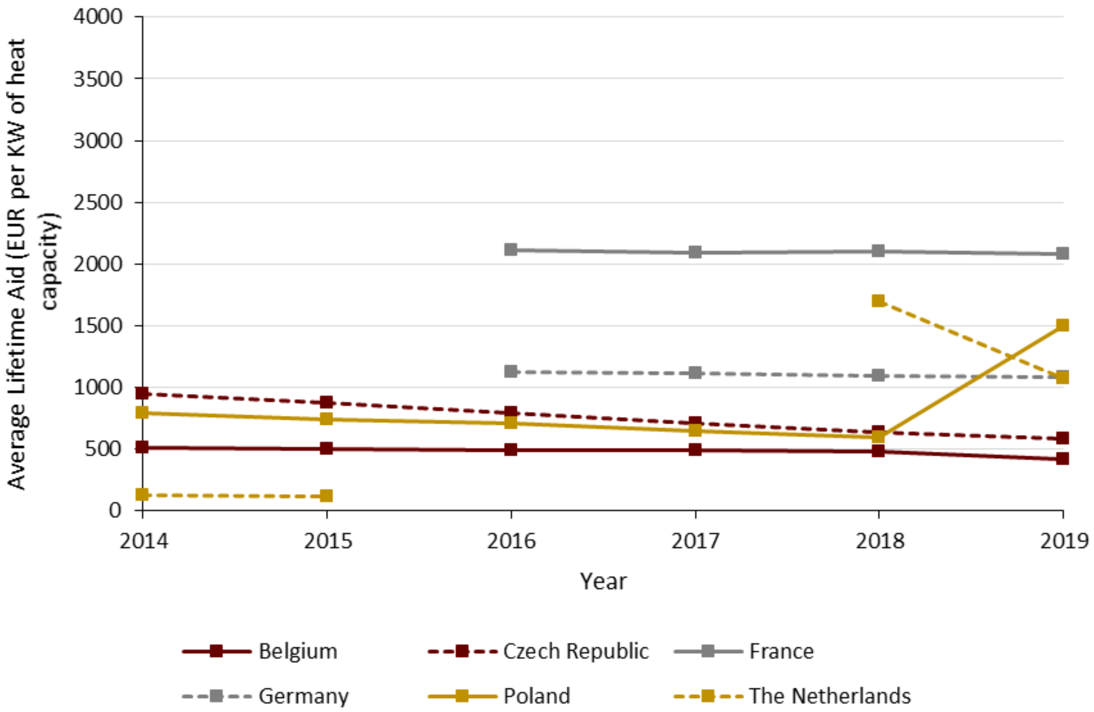
[178] *France is not featured on this graph as its sampled scheme is for plants not exceeding 1MW.*

Figure A3.2.3 Average lifetime aid for case study plants under 100KW of electrical capacity (EUR per KW of *heat* capacity) by sampled Member State, 2014-2019



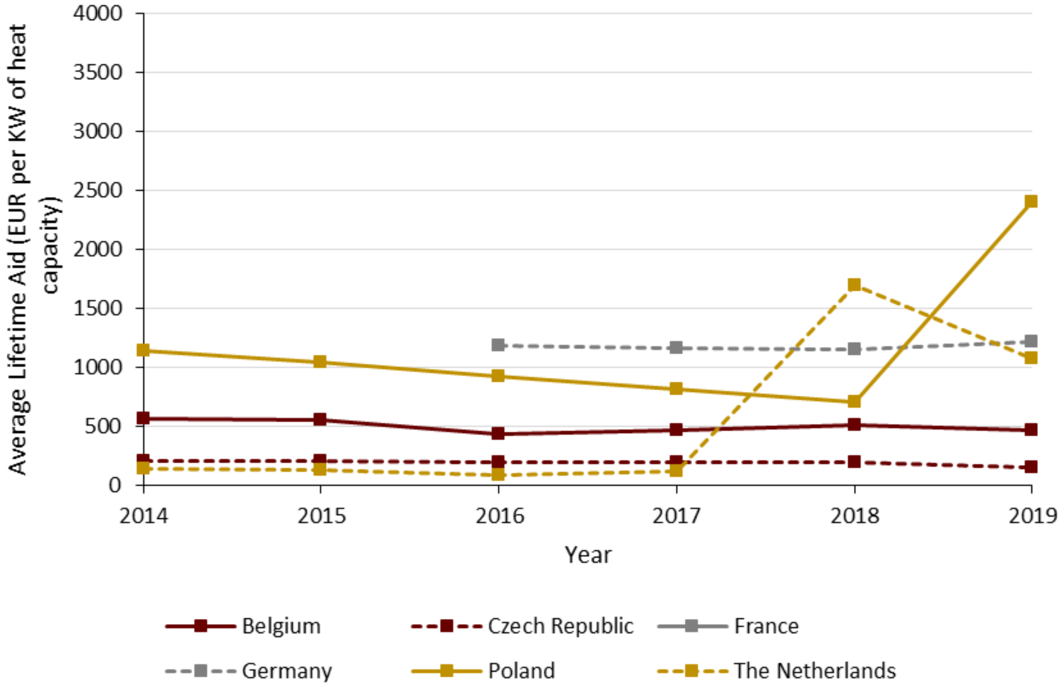
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A3.2.4 Average lifetime aid for case study plants 100KW to 1MW of electrical capacity (EUR per kW of *heat* capacity) by sampled Member State, 2014-2019



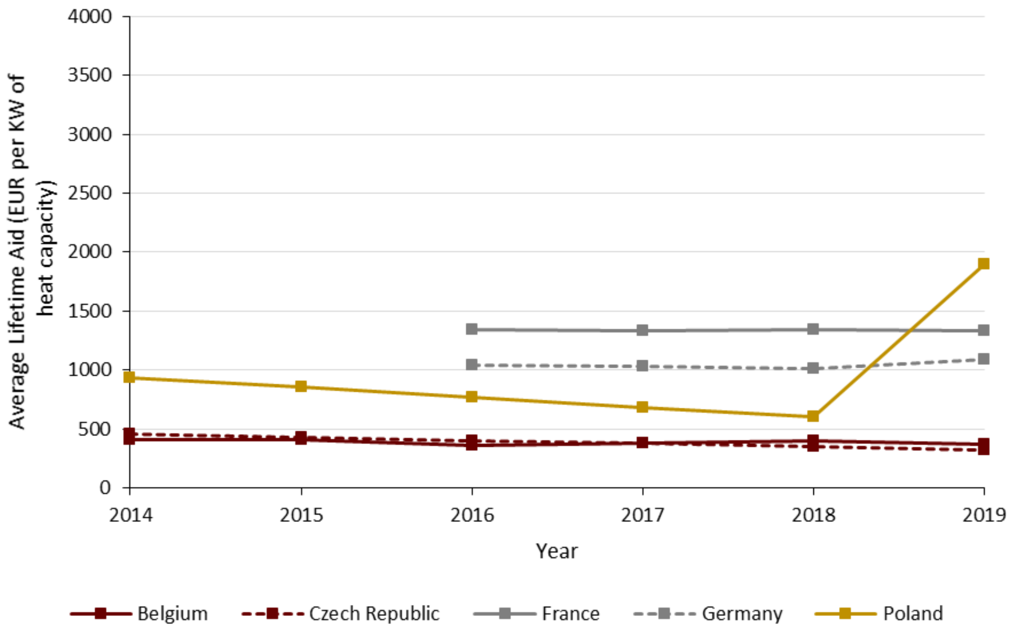
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A3.2.5 Average lifetime aid for case study plants over 1MW and up to 15MW of electrical capacity (EUR per KW of *heat* capacity) by sampled Member State, 2014-2019



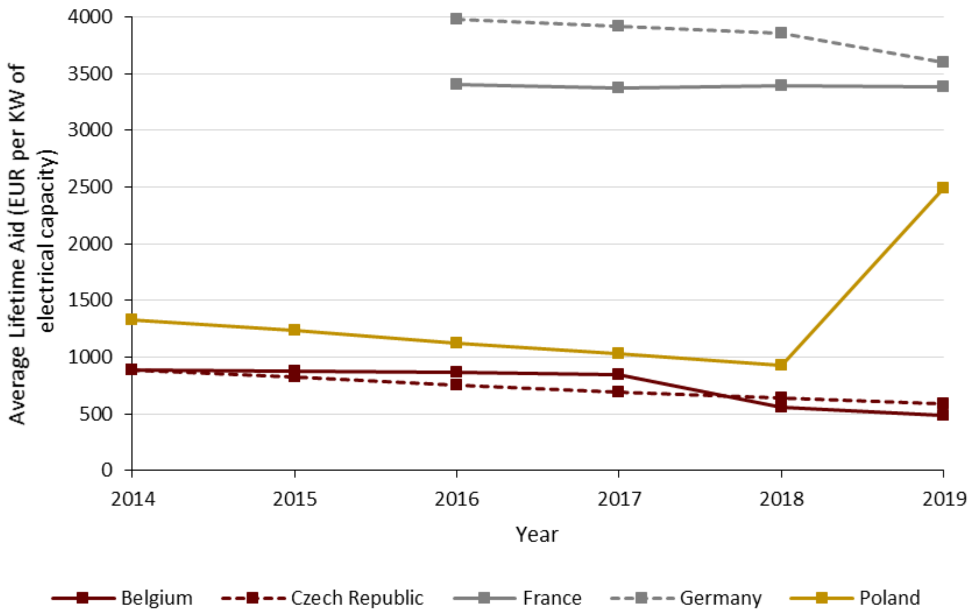
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A3.2.6 Average lifetime aid for case study internal combustion engine plants (EUR per KW of *heat* capacity) by sampled Member State, 2014-2019



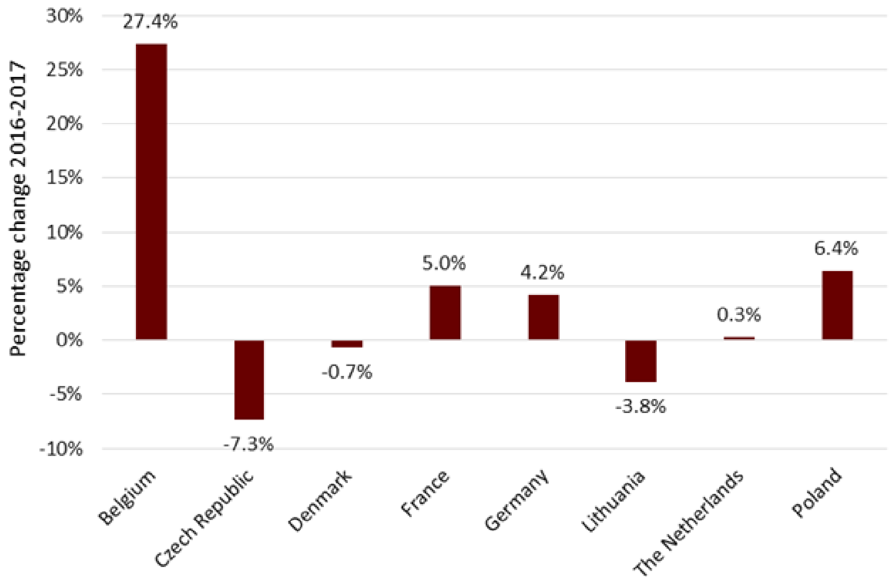
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A3.2.7 Average lifetime aid for case study fuel cell plants (EUR per KW of *heat* capacity) by sampled Member State, 2014-2019



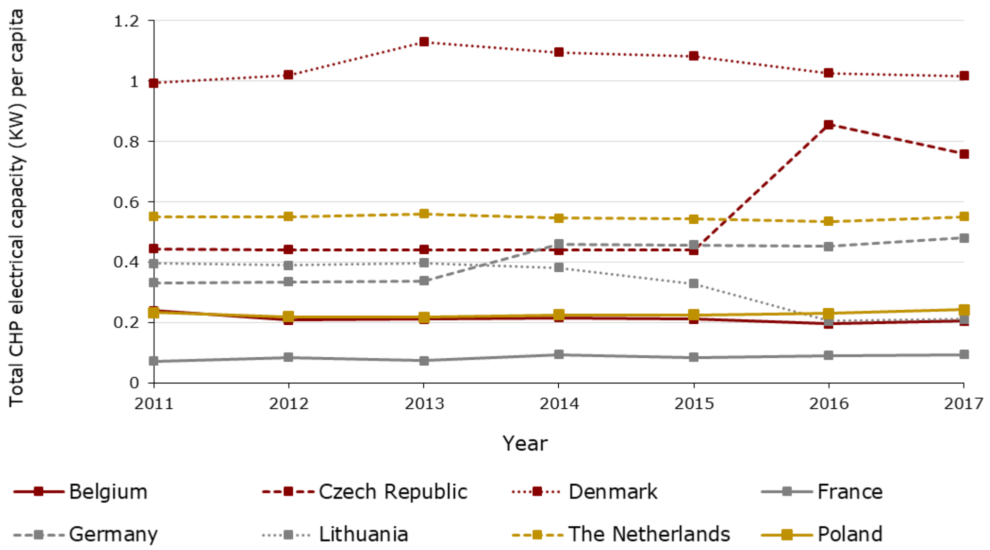
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A3.2.8 Percentage change in the total electrical capacity of high-efficiency cogeneration plants for sampled Member States between 2016 and 2017



Source: Calculations by Centre for Competition Policy, University of East Anglia using Eurostat data

Figure A3.2.9 Total CHP electrical capacity (KW per capita) for sampled Member States, 2011-2017



Source: Calculations by Centre for Competition Policy, University of East Anglia using Eurostat data

Table A3.2.1: Case study comparisons of prices between CHP aid awarded through bidding processes and administratively set support

Case Study 1: Poland 2021 vs 2019 (between year comparison)	
Bidding process premium, cents (EUR) per KWh:	**Administratively set premium(s), cents (EUR) per KWh:**
1.97	i) 3.29 ii) 0.25
Details: *State Aid Decision Number:* SA.51192 *Overview:* Awarded at 'aukcji na premię kogeneracyjną Nr ACHP/1/2019' auction for new cogeneration units ≥1MW and <50MW (Or significantly modernized cogeneration units, investment has to be 25-50% of the cost of a comparable new build site) *Premium type(s):* Stated price is paid on 100% of electricity supplied to grid, however, if an installation supplies a heat network with less than 70% of it generated heat the price decreases in proportion to the share of heat supplied. *Bidding process volumes:* volume requested: 100MW, volume participating: Unavailable, volume awarded: 3,633,079 MWh	**Details:** *State Aid Decision Number:* SA.51192 *Overview:* Aid granted under Article. 56 section 1 and art. 104 of the Act of December 14, 2018 on the promotion of electricity from high-efficiency cogeneration (Journal of Laws of 2019, items 42 and 412). Aid for all categories of CHP is awarded administratively in 2019. Premiums are for new installations of under 50MW. *Premium type(s):* (i) Rates for new installations fired with gaseous fuels. (ii) is paid to installations not fired by gas, solid fuels or biomass. (Installations fired by solid fuels and Biomass receive no premium). *Administratively set support volumes:* 50MW (Total estimated figure for construction/significant refurbishment)

Case Study 2: Germany 2017 vs 2016 (between year comparison)	
Bidding process premium(s), cents (EUR) per KWh:	**Administratively set premium(s), cents (EUR) per KWh:**
4.05	i)4.4 ii) 3.1 iii)2.4 iv)1.8 v) 1.5 vi) 1.0 vii) 4.7 viii) 3.4 ix) 2.7

	x) 2.1 xi) 1.8 xii) 1.3 xiii) 5.0 xiv) 3.7 xv) 3.0 xvi) 2.4 xvii) 2.1 xviii) 1.6
Details: *State Aid Decision Number:* SA.42393 *Overview:* December 2017 tender for CHP, new or modernized plants with 1-50MW of capacity. Aid awarded under KWKG 2016. Also see KWK Tendering Ordinance - KWKAusV *Premium type(s):* Fixed Premium. The weighted average premium is quoted. *Bidding process volumes:* volume requested: 100MW, volume participating: Unavailable, volume awarded: 81.98MW **(volume awarded is below volume requested)**	**Details:** *State Aid Decision Number:* SA.42393 *Overview*: Aid is paid as a fixed premium under KWKG (Heat and Power Generation Act) 2016. Aid is payable for up to 30,000 or 60,000 hours depending on the size and sector of the plant. Support level does not vary by fuel type; biogas, biomass, natural gas, oil, waste and waste heat are eligible. *Premium type(s):* Fixed premium (i) > 250KW, ≤2MW; (ii) >2MW. (iii) and (iv) are lower rates for Energy Intensive Users, (iii) > 250KW, ≤2MW; (iv) >2MW. (v) and (vi) are the levels for those supplying third parties using a private network (industrial parks), (v) > 250KW, ≤2MW; (vi) >2MW. (vii)-(xii) Include an additional premium of 0.3 cents (EUR) per KWh for installations subject to the Greenhouse gas emission trading law. (xiii)-(xviii) Include an additional premium of 0.6 cents (EUR) for installations replacing coal-fired or lignite plants with gas-fired installations.

Annex 4.1 – Auction / allocation data for capacity mechanisms

(see accompanying Excel file)

Annex 4.2 – Derating factor tables for the Republic of Ireland

In the Republic of Ireland derating factors vary both by technology and the size of plant. Here we provide copies of the tables providing the derating factors for all possible combinations.

2018-2019: The following table is taken from 'Final Auction Information Pack 2018/2019 T-1', available at: https://www.sem-o.com/documents/general-publications/18_19-T-1-Final-Auction-Information-Pack.pdf

D.3.1.2 (a) the final De-Rating Curves, defining De-Rating Factors by unit Initial Capacity and by Technology Class (including for Interconnectors) to be used in the Capacity Auction;

The De-Rating Curves have been calculated by the System Operators based on the approved methodology (SEM-17-040) and submitted to the Regulatory Authorities for their determination. The approved De-Rating Curves are set out in Table 17, Table 18, Table 19 and Table 20 below:

Table 17 - De-Rating Curves by Technology Class and Initial Capacity

Initial Capacity Band (MW not de-rated)	DSU	Gas Turbine	Hydro	Steam Turbine	Interconnector[9]	System Wide[10]
1 -> 10	0.922	0.926	0.906	0.909	0.921	0.922
11 -> 20	0.921	0.925	0.904	0.908	0.919	0.921
21 -> 30	0.920	0.924	0.903	0.906	0.917	0.920
31 -> 40	0.919	0.923	0.901	0.904	0.915	0.919
41 -> 50	0.918	0.923	0.900	0.902	0.913	0.918
51 -> 60	0.917	0.922	0.898	0.900	0.910	0.917
61 -> 70	0.916	0.921	0.897	0.899	0.908	0.916
71 -> 80	0.915	0.921	0.896	0.897	0.906	0.915
81 -> 90	0.914	0.920	0.894	0.895	0.904	0.914
91 -> 100	0.913	0.919	0.893	0.893	0.902	0.913
101 -> 110	0.911	0.918	0.891	0.891	0.900	0.911
111 -> 120	0.909	0.917	0.890	0.888	0.898	0.909
121 -> 130	0.907	0.915	0.888	0.886	0.896	0.907
131 -> 140	0.905	0.914	0.886	0.883	0.894	0.905
141 -> 150	0.904	0.912	0.885	0.881	0.892	0.904
151 -> 160	0.902	0.911	0.883	0.879	0.890	0.902
161 -> 170	0.900	0.911	0.880	0.876	0.887	0.900
171 -> 180	0.898	0.910	0.878	0.874	0.885	0.898
181 -> 190	0.897	0.909	0.876	0.872	0.882	0.897
191 -> 200	0.895	0.909	0.873	0.870	0.879	0.895
201 -> 210	0.893	0.908	0.871	0.868	0.877	0.893
211 -> 220	0.891	0.906	0.869	0.865	0.874	0.891
221 -> 230	0.889	0.905	0.868	0.863	0.871	0.889
231 -> 240	0.887	0.904	0.866	0.860	0.868	0.887
241 -> 250	0.886	0.903	0.864	0.858	0.866	0.886
251 -> 260	0.884	0.902	0.863	0.855	0.863	0.884
261 -> 270	0.881	0.900	0.861	0.853	0.860	0.881
271 -> 280	0.879	0.899	0.859	0.850	0.857	0.879
281 -> 290	0.877	0.897	0.857	0.847	0.855	0.877
291 -> 300	0.875	0.896	0.855	0.844	0.852	0.875

[9] The final de-rating factor for Interconnectors is calculated by multiplying the marginal de-rating factor that applies to their size class by the External Market De-rating Factor. The External Market De-rating Factor for this auction will be 0.60 for interconnectors from Great Britain to Ireland or Northern Ireland.

[10] New Technology (i.e. a technology for which there is currently no technology class) should use the System Wide derating curve.

51 -> 60	0.229	0.407	0.537	0.625	0.686	0.730	0.760	0.782	0.802	0.823	0.846	0.868
61 -> 70	0.228	0.405	0.535	0.623	0.684	0.729	0.759	0.782	0.803	0.825	0.846	0.867
71 -> 80	0.224	0.400	0.528	0.617	0.679	0.724	0.755	0.779	0.801	0.823	0.844	0.864
81 -> 90	0.219	0.394	0.521	0.610	0.673	0.718	0.750	0.774	0.797	0.819	0.841	0.861
91 -> 100	0.215	0.387	0.513	0.602	0.665	0.711	0.744	0.769	0.792	0.815	0.836	0.856
101 -> 110	0.211	0.381	0.506	0.595	0.659	0.705	0.738	0.763	0.787	0.809	0.830	0.850
111 -> 120	0.208	0.376	0.500	0.589	0.652	0.699	0.731	0.757	0.781	0.803	0.824	0.844
121 -> 130	0.206	0.371	0.494	0.583	0.646	0.692	0.725	0.751	0.775	0.797	0.818	0.838
131 -> 140	0.203	0.367	0.488	0.577	0.640	0.686	0.719	0.745	0.768	0.791	0.812	0.831
141 -> 150	0.200	0.362	0.483	0.570	0.633	0.679	0.712	0.739	0.762	0.785	0.805	0.825
151 -> 160	0.197	0.357	0.477	0.564	0.627	0.673	0.706	0.733	0.756	0.779	0.799	0.819
161 -> 170	0.195	0.352	0.471	0.558	0.620	0.667	0.699	0.727	0.750	0.773	0.793	0.812
171 -> 180	0.192	0.347	0.465	0.552	0.614	0.660	0.693	0.721	0.744	0.767	0.787	0.806
181 -> 190	0.189	0.342	0.459	0.545	0.608	0.654	0.687	0.715	0.738	0.760	0.780	0.800
191 -> 200	0.187	0.338	0.453	0.539	0.601	0.648	0.680	0.709	0.732	0.754	0.774	0.794

Note: the values of Initial Capacity in units of MW are values prior to the application of De-Rating Factors.

Table 20 - De-rating Factors for Wind and Solar

Wind	Solar
0.103	0.055

2019-2020: The following tables are taken from 'Final Auction Information Pack 2019/2020 T-1', available at: https://www.sem-o.com/documents/general-publications/Final-Auction-Information-Pack_FAIP1920T-1.pdf

EIRGRID SONI

FAIP1920T-1

Table 17 –De-Rating Curves by Technology Class and Initial Capacity

Initial Capacity (IC)(MW not de-rated)	DSU >6 hrs[9]	Gas Turbine	Hydro	Steam Turbine	Interconnector[10]	System Wide[11]
0 ≤ IC ≤ 10	0.922	0.926	0.906	0.909	0.921	0.922
10 < IC ≤ 20	0.921	0.925	0.904	0.908	0.919	0.921
20 < IC ≤ 30	0.920	0.924	0.903	0.906	0.917	0.920
30 < IC ≤ 40	0.919	0.923	0.901	0.904	0.915	0.919
40 < IC ≤ 50	0.918	0.923	0.900	0.902	0.913	0.918
50 < IC ≤ 60	0.917	0.922	0.898	0.900	0.910	0.917
60 < IC ≤ 70	0.916	0.921	0.897	0.899	0.908	0.916
70 < IC ≤ 80	0.915	0.921	0.896	0.897	0.906	0.915
80 < IC ≤ 90	0.914	0.920	0.894	0.895	0.904	0.914
90 < IC ≤ 100	0.913	0.919	0.893	0.893	0.902	0.913
100 < IC ≤ 110	0.911	0.918	0.891	0.891	0.900	0.911
110 < IC ≤ 120	0.909	0.917	0.890	0.888	0.898	0.909
120 < IC ≤ 130	0.907	0.915	0.888	0.886	0.896	0.907
130 < IC ≤ 140	0.905	0.914	0.886	0.883	0.894	0.905
140 < IC ≤ 150	0.904	0.912	0.885	0.881	0.892	0.904
150 < IC ≤ 160	0.902	0.911	0.883	0.879	0.890	0.902
160 < IC ≤ 170	0.900	0.911	0.880	0.876	0.887	0.900
170 < IC ≤ 180	0.898	0.910	0.878	0.874	0.885	0.898
180 < IC ≤ 190	0.897	0.909	0.876	0.872	0.882	0.897
190 < IC ≤ 200	0.895	0.909	0.873	0.870	0.879	0.895
200 < IC ≤ 210	0.893	0.908	0.871	0.868	0.877	0.893
210 < IC ≤ 220	0.891	0.906	0.869	0.865	0.874	0.891
220 < IC ≤ 230	0.889	0.905	0.868	0.863	0.871	0.889
230 < IC ≤ 240	0.887	0.904	0.866	0.860	0.868	0.887
240 < IC ≤ 250	0.886	0.903	0.864	0.858	0.866	0.886
250 < IC ≤ 260	0.884	0.902	0.863	0.855	0.863	0.884
260 < IC ≤ 270	0.881	0.900	0.861	0.853	0.860	0.881
270 < IC ≤ 280	0.879	0.899	0.859	0.850	0.857	0.879
280 < IC ≤ 290	0.877	0.897	0.857	0.847	0.855	0.877
290 < IC ≤ 300	0.875	0.896	0.855	0.844	0.852	0.875
300 < IC ≤ 310	0.872	0.894	0.854	0.841	0.849	0.872
310 < IC ≤ 320	0.870	0.893	0.852	0.838	0.846	0.870
320 < IC ≤ 330	0.867	0.892	0.850	0.835	0.843	0.867
330 < IC ≤ 340	0.864	0.890	0.848	0.832	0.840	0.864
340 < IC ≤ 350	0.861	0.889	0.846	0.829	0.836	0.861
350 < IC ≤ 360	0.858	0.887	0.844	0.826	0.833	0.858
360 < IC ≤ 370	0.855	0.886	0.842	0.822	0.830	0.855
370 < IC ≤ 380	0.853	0.884	0.839	0.819	0.826	0.853
380 < IC ≤ 390	0.850	0.883	0.837	0.816	0.823	0.850
390 < IC ≤ 400	0.847	0.881	0.834	0.813	0.820	0.847
400 < IC ≤ 410	0.844	0.880	0.832	0.809	0.816	0.844
410 < IC ≤ 420	0.842	0.878	0.829	0.805	0.812	0.842
420 < IC ≤ 430	0.839	0.876	0.827	0.801	0.809	0.839
430 < IC ≤ 440	0.836	0.874	0.825	0.797	0.805	0.836
440 < IC ≤ 450	0.833	0.872	0.822	0.794	0.801	0.833
450 < IC ≤ 460	0.830	0.870	0.819	0.790	0.798	0.830
460 < IC ≤ 470	0.827	0.867	0.817	0.786	0.794	0.827
470 < IC ≤ 480	0.824	0.865	0.814	0.782	0.790	0.824
480 < IC ≤ 490	0.821	0.863	0.811	0.777	0.785	0.821
490 < IC ≤ 500	0.818	0.861	0.808	0.773	0.781	0.818

[9] In accordance with SEM Committee decision SEM-18-030, DSUs with a Maximum Down Time of more than 6 hours should apply the appropriate de-rating factor based on the values set out in Table 17. DSUs with a Maximum Down Time of 6 hours or less should apply the appropriate de-rating factor based on the values set out in Table 19- Other Storage.

[10] The final de-rating factor for Interconnectors is calculated by multiplying the marginal de-rating factor that applies to their size class by the External Market De-rating Factor. The External Market De-rating Factor for this auction will be 0.60 for interconnectors from Great Britain to Ireland or Northern Ireland.

[11] New Technology (i.e. a technology for which there is currently no technology class) should use the System Wide derating curve.

Table 18 –De-Rating Curves for pumped hydro storage units by Initial Capacity and duration

	Hours of Storage (at full load)												
Initial Capacity (IC) (MW)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0 or greater
0 ≤ IC ≤ 10	0	0.249	0.420	0.543	0.630	0.690	0.731	0.759	0.779	0.796	0.813	0.835	0.859
10 < IC ≤ 20	0	0.241	0.412	0.535	0.621	0.681	0.722	0.749	0.769	0.787	0.805	0.827	0.851
20 < IC ≤ 30	0	0.232	0.403	0.527	0.613	0.672	0.712	0.740	0.760	0.778	0.796	0.819	0.843
30 < IC ≤ 40	0	0.224	0.395	0.519	0.604	0.663	0.703	0.731	0.751	0.769	0.788	0.811	0.835
40 < IC ≤ 50	0	0.219	0.390	0.514	0.599	0.657	0.698	0.726	0.746	0.765	0.785	0.807	0.830
50 < IC ≤ 60	0	0.218	0.388	0.513	0.597	0.655	0.697	0.725	0.747	0.766	0.786	0.807	0.828
60 < IC ≤ 70	0	0.215	0.385	0.508	0.592	0.651	0.694	0.723	0.745	0.764	0.785	0.806	0.826
70 < IC ≤ 80	0	0.210	0.379	0.501	0.586	0.645	0.688	0.718	0.740	0.761	0.782	0.803	0.822
80 < IC ≤ 90	0	0.205	0.372	0.494	0.578	0.638	0.682	0.712	0.735	0.757	0.778	0.798	0.817
90 < IC ≤ 100	0	0.200	0.364	0.485	0.570	0.630	0.674	0.704	0.728	0.750	0.772	0.792	0.811
100 < IC ≤ 110	0	0.196	0.358	0.478	0.563	0.623	0.667	0.698	0.722	0.745	0.766	0.787	0.805
110 < IC ≤ 120	0	0.193	0.353	0.472	0.557	0.617	0.661	0.693	0.718	0.740	0.762	0.782	0.801
120 < IC ≤ 130	0	0.191	0.349	0.466	0.551	0.611	0.656	0.687	0.713	0.736	0.758	0.778	0.797
130 < IC ≤ 140	0	0.188	0.344	0.461	0.545	0.606	0.650	0.682	0.708	0.731	0.753	0.774	0.793
140 < IC ≤ 150	0	0.186	0.339	0.455	0.540	0.600	0.644	0.677	0.703	0.727	0.749	0.770	0.789
150 < IC ≤ 160	0	0.183	0.335	0.449	0.534	0.594	0.639	0.671	0.699	0.722	0.745	0.765	0.785
160 < IC ≤ 170	0	0.180	0.330	0.444	0.528	0.588	0.633	0.666	0.694	0.718	0.740	0.761	0.781
170 < IC ≤ 180	0	0.178	0.325	0.438	0.523	0.583	0.628	0.661	0.689	0.713	0.736	0.757	0.777
180 < IC ≤ 190	0	0.175	0.321	0.432	0.517	0.577	0.622	0.656	0.684	0.709	0.732	0.753	0.773
190 < IC ≤ 200	0	0.173	0.316	0.427	0.511	0.571	0.616	0.650	0.680	0.704	0.727	0.748	0.769

Table 19 –De-Rating Curves for Other Storage units by Initial Capacity and duration

	Hours of Storage / Demand Side Response (at full load)												
Initial Capacity (IC) (MW)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0 or greater
0 ≤ IC ≤ 10	0	0.251	0.429	0.556	0.646	0.708	0.751	0.780	0.801	0.819	0.838	0.862	0.888
10 < IC ≤ 20	0	0.244	0.422	0.550	0.640	0.701	0.744	0.773	0.794	0.812	0.832	0.856	0.881
20 < IC ≤ 30	0	0.237	0.415	0.544	0.633	0.695	0.737	0.766	0.787	0.806	0.826	0.849	0.875
30 < IC ≤ 40	0	0.231	0.409	0.538	0.627	0.688	0.730	0.759	0.781	0.799	0.819	0.843	0.868
40 < IC ≤ 50	0	0.228	0.406	0.536	0.624	0.685	0.728	0.757	0.779	0.798	0.818	0.842	0.866
50 < IC ≤ 60	0	0.229	0.407	0.537	0.625	0.686	0.730	0.760	0.782	0.802	0.823	0.846	0.868
60 < IC ≤ 70	0	0.228	0.405	0.535	0.623	0.684	0.729	0.759	0.782	0.803	0.825	0.846	0.867
70 < IC ≤ 80	0	0.224	0.400	0.528	0.617	0.679	0.724	0.755	0.779	0.801	0.823	0.844	0.864
80 < IC ≤ 90	0	0.219	0.394	0.521	0.610	0.673	0.718	0.750	0.774	0.797	0.819	0.841	0.861
90 < IC ≤ 100	0	0.215	0.387	0.513	0.602	0.665	0.711	0.744	0.769	0.792	0.815	0.836	0.856
100 < IC ≤ 110	0	0.211	0.381	0.506	0.595	0.659	0.705	0.738	0.763	0.787	0.809	0.830	0.850
110 < IC ≤ 120	0	0.208	0.376	0.500	0.589	0.652	0.699	0.731	0.757	0.781	0.803	0.824	0.844
120 < IC ≤ 130	0	0.206	0.371	0.494	0.583	0.646	0.692	0.725	0.751	0.775	0.797	0.818	0.838
130 < IC ≤ 140	0	0.203	0.367	0.488	0.577	0.640	0.686	0.719	0.745	0.768	0.791	0.812	0.831
140 < IC ≤ 150	0	0.200	0.362	0.483	0.570	0.633	0.679	0.712	0.739	0.762	0.785	0.805	0.825
150 < IC ≤ 160	0	0.197	0.357	0.477	0.564	0.627	0.673	0.706	0.733	0.756	0.779	0.799	0.819
160 < IC ≤ 170	0	0.195	0.352	0.471	0.558	0.620	0.667	0.699	0.727	0.750	0.773	0.793	0.812
170 < IC ≤ 180	0	0.192	0.347	0.465	0.552	0.614	0.660	0.693	0.721	0.744	0.767	0.787	0.806
180 < IC ≤ 190	0	0.189	0.342	0.459	0.545	0.608	0.654	0.687	0.715	0.738	0.760	0.780	0.800
190 < IC ≤ 200	0	0.187	0.338	0.453	0.539	0.601	0.648	0.680	0.709	0.732	0.754	0.774	0.794

Note: the values of Initial Capacity in units of MW are values prior to the application of De-Rating Factors.

Table 20 –De-rating Factors for Wind and Solar

Wind	Solar
0.103	0.055

2022-2023: The following tables are taken from 'Final Auction Information Pack 2018/2019 T-1', available at: https://www.sem-o.com/documents/general-publications/Final-Auction-Information-Pack_FAIP2223T-4.pdf

Table 17 – De-Rating Curves by Technology Class and Initial Capacity

Initial Capacity (IC) (MW not de-rated)	DSU >6 hrs[9]	Gas Turbine	Hydro	Steam Turbine	Interconnector[10]	System Wide[11]
0 ≤ IC ≤ 10	0.900	0.920	0.864	0.877	0.866	0.900
10 < IC ≤ 20	0.899	0.919	0.862	0.875	0.864	0.899
20 < IC ≤ 30	0.898	0.918	0.859	0.873	0.862	0.898
30 < IC ≤ 40	0.896	0.918	0.857	0.871	0.860	0.896
40 < IC ≤ 50	0.895	0.917	0.855	0.869	0.858	0.895
50 < IC ≤ 60	0.894	0.916	0.852	0.867	0.856	0.894
60 < IC ≤ 70	0.892	0.916	0.850	0.865	0.853	0.892
70 < IC ≤ 80	0.891	0.915	0.848	0.863	0.851	0.891
80 < IC ≤ 90	0.890	0.914	0.845	0.861	0.849	0.890
90 < IC ≤ 100	0.888	0.913	0.843	0.860	0.847	0.888
100 < IC ≤ 110	0.887	0.913	0.841	0.857	0.844	0.887
110 < IC ≤ 120	0.886	0.913	0.839	0.855	0.842	0.886
120 < IC ≤ 130	0.884	0.912	0.837	0.852	0.839	0.884
130 < IC ≤ 140	0.883	0.912	0.835	0.850	0.836	0.883
140 < IC ≤ 150	0.881	0.911	0.832	0.847	0.833	0.881
150 < IC ≤ 160	0.879	0.910	0.830	0.844	0.830	0.879
160 < IC ≤ 170	0.877	0.909	0.827	0.842	0.827	0.877
170 < IC ≤ 180	0.875	0.908	0.824	0.839	0.824	0.875
180 < IC ≤ 190	0.873	0.906	0.821	0.836	0.821	0.873
190 < IC ≤ 200	0.871	0.905	0.819	0.833	0.818	0.871
200 < IC ≤ 210	0.868	0.903	0.816	0.830	0.815	0.868
210 < IC ≤ 220	0.865	0.902	0.814	0.827	0.811	0.865
220 < IC ≤ 230	0.862	0.901	0.812	0.824	0.808	0.862
230 < IC ≤ 240	0.859	0.900	0.809	0.820	0.804	0.859
240 < IC ≤ 250	0.857	0.899	0.807	0.817	0.801	0.857
250 < IC ≤ 260	0.854	0.898	0.805	0.814	0.797	0.854
260 < IC ≤ 270	0.852	0.896	0.803	0.810	0.794	0.852
270 < IC ≤ 280	0.850	0.894	0.801	0.807	0.790	0.850
280 < IC ≤ 290	0.848	0.893	0.799	0.804	0.787	0.848
290 < IC ≤ 300	0.846	0.891	0.798	0.801	0.783	0.846
300 < IC ≤ 310	0.844	0.889	0.796	0.797	0.779	0.844
310 < IC ≤ 320	0.842	0.888	0.794	0.793	0.775	0.842
320 < IC ≤ 330	0.839	0.886	0.791	0.790	0.771	0.839
330 < IC ≤ 340	0.837	0.884	0.789	0.786	0.767	0.837
340 < IC ≤ 350	0.834	0.882	0.787	0.782	0.763	0.834
350 < IC ≤ 360	0.832	0.881	0.785	0.778	0.759	0.832
360 < IC ≤ 370	0.829	0.879	0.782	0.775	0.755	0.829
370 < IC ≤ 380	0.826	0.877	0.780	0.771	0.751	0.826
380 < IC ≤ 390	0.822	0.876	0.777	0.767	0.747	0.822
390 < IC ≤ 400	0.819	0.874	0.775	0.763	0.743	0.819
400 < IC ≤ 410	0.816	0.872	0.772	0.759	0.739	0.816
410 < IC ≤ 420	0.814	0.870	0.769	0.755	0.735	0.814
420 < IC ≤ 430	0.811	0.868	0.766	0.751	0.730	0.811
430 < IC ≤ 440	0.808	0.866	0.763	0.747	0.726	0.808
440 < IC ≤ 450	0.805	0.864	0.760	0.742	0.721	0.805
450 < IC ≤ 460	0.801	0.862	0.757	0.738	0.717	0.801
460 < IC ≤ 470	0.798	0.860	0.754	0.734	0.712	0.798
470 < IC ≤ 480	0.794	0.857	0.751	0.730	0.708	0.794
480 < IC ≤ 490	0.791	0.855	0.748	0.725	0.703	0.791
490 < IC ≤ 500	0.787	0.853	0.745	0.721	0.699	0.787

[9] In accordance with SEM Committee decision SEM-18-030, DSUs with a Maximum Down Time of more than 6 hours should apply the appropriate de-rating factor based on the values set out in table 17. DSUs with a Maximum Down Time of 6 hours or less should apply the appropriate de-rating factor based on the values set out in table 19 - Other Storage.

[10] The final de-rating factor for Interconnectors is calculated by multiplying the marginal de-rating factor that applies to their size class by the External Market De-rating Factor. The External Market De-rating Factor for this auction will be 0.60 for interconnectors from Great Britain to Ireland or Northern Ireland.

[11] New Technology (i.e. a technology for which there is currently no technology class) should use the System Wide derating curve.

Table 18 – De-Rating Curves for pumped hydro storage units

	Hours of Storage												
Initial Capacity (IC) (MW)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0 or greater
0 ≤ IC ≤ 10	0	0.207	0.353	0.469	0.550	0.607	0.648	0.678	0.702	0.726	0.751	0.779	0.811
10 < IC ≤ 20	0	0.205	0.351	0.466	0.547	0.604	0.645	0.675	0.700	0.724	0.749	0.777	0.808
20 < IC ≤ 30	0	0.193	0.339	0.452	0.532	0.589	0.632	0.663	0.689	0.714	0.739	0.766	0.796
30 < IC ≤ 40	0	0.187	0.333	0.445	0.524	0.582	0.625	0.657	0.683	0.708	0.734	0.761	0.789
40 < IC ≤ 50	0	0.181	0.326	0.438	0.516	0.574	0.618	0.651	0.678	0.703	0.729	0.755	0.783
50 < IC ≤ 60	0	0.175	0.320	0.430	0.508	0.567	0.611	0.644	0.672	0.697	0.723	0.750	0.776
60 < IC ≤ 70	0	0.169	0.314	0.423	0.501	0.559	0.604	0.638	0.666	0.692	0.718	0.744	0.769
70 < IC ≤ 80	0	0.166	0.310	0.418	0.496	0.554	0.599	0.634	0.662	0.689	0.715	0.741	0.765
80 < IC ≤ 90	0	0.167	0.309	0.416	0.494	0.553	0.598	0.632	0.661	0.687	0.714	0.739	0.763
90 < IC ≤ 100	0	0.167	0.308	0.415	0.492	0.551	0.596	0.631	0.660	0.686	0.712	0.737	0.761
100 < IC ≤ 110	0	0.168	0.307	0.413	0.491	0.549	0.595	0.629	0.658	0.685	0.711	0.736	0.759
110 < IC ≤ 120	0	0.169	0.307	0.411	0.489	0.548	0.593	0.628	0.657	0.684	0.710	0.734	0.757
120 < IC ≤ 130	0	0.167	0.304	0.407	0.485	0.544	0.589	0.624	0.653	0.680	0.706	0.731	0.754
130 < IC ≤ 140	0	0.164	0.299	0.402	0.479	0.538	0.583	0.618	0.647	0.674	0.700	0.725	0.748
140 < IC ≤ 150	0	0.161	0.294	0.396	0.473	0.532	0.577	0.612	0.641	0.669	0.695	0.720	0.743
150 < IC ≤ 160	0	0.158	0.289	0.391	0.467	0.526	0.571	0.606	0.635	0.663	0.689	0.714	0.738
160 < IC ≤ 170	0	0.155	0.285	0.385	0.461	0.520	0.564	0.599	0.629	0.657	0.684	0.709	0.732
170 < IC ≤ 180	0	0.152	0.281	0.380	0.456	0.514	0.558	0.593	0.623	0.652	0.678	0.703	0.727
180 < IC ≤ 190	0	0.150	0.277	0.375	0.450	0.508	0.552	0.587	0.618	0.646	0.673	0.698	0.721
190 < IC ≤ 200	0	0.148	0.273	0.370	0.445	0.502	0.546	0.581	0.612	0.640	0.667	0.692	0.716

Table 19 – De-Rating Curves for Other Storage

	Hours of Storage												
Initial Capacity (IC) (MW)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0 or greater
0 ≤ IC ≤ 10	0	0.241	0.394	0.516	0.599	0.659	0.701	0.731	0.754	0.777	0.800	0.827	0.858
10 < IC ≤ 20	0	0.237	0.390	0.512	0.595	0.655	0.697	0.727	0.751	0.774	0.797	0.824	0.855
20 < IC ≤ 30	0	0.220	0.373	0.492	0.575	0.635	0.679	0.711	0.736	0.760	0.785	0.812	0.841
30 < IC ≤ 40	0	0.211	0.364	0.482	0.565	0.625	0.670	0.702	0.729	0.753	0.779	0.806	0.834
40 < IC ≤ 50	0	0.202	0.355	0.472	0.554	0.615	0.660	0.694	0.721	0.746	0.772	0.799	0.827
50 < IC ≤ 60	0	0.193	0.346	0.462	0.544	0.604	0.650	0.685	0.713	0.739	0.766	0.793	0.820
60 < IC ≤ 70	0	0.184	0.337	0.451	0.533	0.594	0.641	0.676	0.705	0.732	0.759	0.786	0.812
70 < IC ≤ 80	0	0.179	0.330	0.444	0.526	0.587	0.634	0.670	0.700	0.727	0.755	0.782	0.807
80 < IC ≤ 90	0	0.177	0.327	0.440	0.522	0.583	0.631	0.667	0.697	0.725	0.752	0.779	0.805
90 < IC ≤ 100	0	0.175	0.324	0.436	0.518	0.580	0.628	0.664	0.694	0.722	0.750	0.777	0.802
100 < IC ≤ 110	0	0.173	0.320	0.432	0.514	0.576	0.624	0.661	0.692	0.720	0.748	0.774	0.799
110 < IC ≤ 120	0	0.172	0.317	0.427	0.510	0.573	0.621	0.658	0.689	0.718	0.745	0.772	0.797
120 < IC ≤ 130	0	0.170	0.314	0.424	0.506	0.569	0.617	0.654	0.685	0.714	0.742	0.768	0.793
130 < IC ≤ 140	0	0.169	0.311	0.420	0.502	0.564	0.613	0.650	0.681	0.710	0.738	0.764	0.789
140 < IC ≤ 150	0	0.168	0.309	0.417	0.498	0.560	0.608	0.645	0.676	0.706	0.734	0.760	0.785
150 < IC ≤ 160	0	0.167	0.306	0.413	0.494	0.556	0.604	0.640	0.672	0.701	0.729	0.756	0.781
160 < IC ≤ 170	0	0.166	0.303	0.410	0.490	0.552	0.599	0.636	0.668	0.697	0.725	0.752	0.776
170 < IC ≤ 180	0	0.165	0.301	0.406	0.486	0.547	0.594	0.631	0.663	0.693	0.721	0.747	0.772
180 < IC ≤ 190	0	0.164	0.298	0.402	0.482	0.542	0.589	0.626	0.658	0.688	0.716	0.743	0.768
190 < IC ≤ 200	0	0.163	0.295	0.398	0.477	0.538	0.584	0.621	0.653	0.683	0.712	0.739	0.763

Note: the values of Initial Capacity in units of MW are values prior to the application of De-Rating Factors.

Table 20 – De-rating Factors for Wind and Solar

Wind	Solar
0.089	0.109

Annex 4.3 – Obligations and penalties for those providing capacity

Following guidance from the Commission we focus on obligations and penalties related to the delivery of capacity, as opposed those relating to reporting requirements.

4.3.1 Belgium SA.48648 Strategic Reserve

4.3.1.1 Applicable Obligations of Beneficiaries

Obligation to deliver capacity: The Strategic Reserve is split into a generating capacity element, the Strategic Generation Reserve (SGR) and a demand side element, the Strategic Demand Reserve (SDR). The SGR can be operational for any number of hours during the winter period and the SDR can only be operational for 100 hours per winter period, with two possible availability durations, 4 hours and 12 hours.[179]

SGR units have a 'warm up' phase of 5 hours, when they are turning the asset on. After this they have a maximum 'ramp up' phase of 1.5 hours. The TSO can cancel the capacity obligation during warm up or ramp up.[180]

Obligations to make power plant/demand response projects operational by a certain date: The strategic reserve only operates over winter (1st November to 31st March each year).[181] SGR providers have to register by the 31st of July the year before the winter in question.[182]

Testing Requirements: At least one activation test per asset per winter, each test has both a 'start and control' and an 'energy criterion' to check that the provider promptly makes the promised amount of energy available for the required amount of time. Additionally, each asset must be tested at the start of the winter.[183]

4.3.1.2 Penalties

Penalties are split into two categories:

Availability Penalties: These are MW-based penalties for not having capacity available. They consist of reimbursement plus 30% for both the SDR and SGR.[184]

Activation Penalties: These are MWh-based penalties for when beneficiaries fail to activate when called on to do so:

There are different levels for the SDR and SGR:

SDR:

1) If volume reduced is smaller than it should be, the difference is paid as a penalty (with a tolerance of 1%)

---

[179] *See https://ec.europa.eu/competition/state_aid/cases/272020/272020_1964726_118_2.pdf p11.*
[180] *See https://ec.europa.eu/competition/state_aid/cases/272020/272020_1964726_118_2.pdf p15.*
[181] *See https://ec.europa.eu/competition/state_aid/cases/272020/272020_1964726_118_2.pdf p2.*
[182] *See https://ec.europa.eu/competition/state_aid/cases/272020/272020_1964726_118_2.pdf p13.*
[183] *See https://ec.europa.eu/competition/state_aid/cases/272020/272020_1964726_118_2.pdf p12.*
[184] *See Functioning Rules 2019-2020, https://www.elia.be/en/electricity-market-and-system/adequacy/strategic-reserves p17.*

2) If volume is not 'shut down' within the disaster down period, a 3 day lump-sum penalty is applied.[185] (1 and 2 are cumulative)

3) After 3 incidents which trigger 1 or 2, or if they turn off under 10% of the required demand in any activation situation, or if they turn off less than 30% of the required demand across all their activations over one winter period, an SDR is forbidden from participating in the following auction.[186]

SGR:

1) If the volume injected is less than it should be, any penalty is double the activation fee. (Tolerance of 1%)

2) If the volume is not provided during ramp up, a 3 day lump-sum penalty is applied.[187]

4.3.2 France SA.39621 Capacity Mechanism

4.3.2.1 Applicable Obligations of Beneficiaries

Obligation to deliver capacity: Note that the Capacity Mechanism is a certificate scheme and therefore there is an obligation for producers to deliver capacity and to register for capacity certificates, see excerpt from SA.39621 below[188]:

"Law No 2010-1488 of 7 December 2010 on the new organisation of the electricity market ('the NOME Act') made it obligatory for electricity suppliers, network operators (for losses), and consumers (for consumption outside a supply contract) – 'the suppliers' – to contribute to the security of electricity supply in France in line with their own and their customers' power and energy consumption. In order to fulfil this obligation, every year each of them must prove that they have a certain volume of capacity guarantees in relation to their own and their customers' peak-period consumption.

Capacity guarantees are obtained by suppliers either directly for resources they own (generation plants or demand-side response capacities), or must be purchased on a decentralised market from other holders (capacity operators, other suppliers, traders, consumers who are their own suppliers, etc.).

Operators of generation or demand-side response capacity ('capacity operators' or 'operators'), on the other hand, are obliged to have their capacity certified by the operator of the public electricity transmission grid (RTE). Operators will be allocated capacity guarantees by RTE according to the projected contribution of their plant to reducing the risk of shortfall at times of peak demand.

Capacity guarantees are tradable and transferable. The purchase by suppliers of capacity guarantees from capacity operators to meet their legal obligation will be organised on the basis of a decentralised market for capacity guarantees.''

For the case of this document, beneficiaries are taken to mean capacity operators. See the further excerpt from SA.39621 below[189]:

---

[185] *This is 3 x 24 hours x the 'booking price' for capacity.*
[186] *See Functioning Rules 2019-2020 https://www.elia.be/en/electricity-market-and-system/adequacy/strategic-reserves p17.*
[187] *See Functioning Rules 2019-2020 https://www.elia.be/en/electricity-market-and-system/adequacy/strategic-reserves, p36.*
[188] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1873332_314_5.pdf.*
[189] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1873332_314_5.pdf, p5-6.*

"Obligations of capacity operators and certification principles

A request for certification must be made to RTE by the operator of every generation plant (a technologically neutral mechanism) connected to the public transmission grid or to the public distribution network. A request for certification may be made to RTE for every demand-side response facility, whichever network it is connected to. It is therefore the capacity operator who makes an initial estimate of the capacity volume that it could have available during peak consumption periods (PP2) in a given delivery year.

There are between 10 and 25 PP2 days in a delivery year. In addition, PP1 days[190] are necessarily PP2 days. PP2 days that are not PP1 days are selected one day in advance by RTE on the basis of stress on the electricity system. The time-slots during the PP2 days are the same as those for PP1 days. There are therefore between 100 and 250 PP2 peak hours per year.

The certified level is then calculated by RTE on the basis of the data submitted using the calculation methods laid down in the legal basis for the mechanism. Corrections are applied, for example, to take into account of the potential number of successive days of activation of the certified capacities, or the actual contribution to reducing the shortfall risk when a capacity's primary energy source is subject to the vagaries of the weather.

The operator may then change its availability forecasts throughout the duration of the mechanism, including during the delivery year, using a rebalancing mechanism. Rebalancing corresponds to 're-certification' of the capacity and enables the operator to adjust its forecasts as and when new information on its capacity becomes available. Rebalancing may be upwards or downwards.

This declaration system is supplemented by a capacity control system: the principle is that all certified capacities must be activated at least once per year. Random tests are made for each capacity without notifying the operator in advance. A capacity may not be tested more than three times per delivery period.''

Obligations to make power plant/demand response projects operational by a certain date: Existing production capacity can begin to be certified 4 years before the delivery period and must be certified 3 years before the delivery period. Projected production capacities can request to be certified up to two months before the start of a delivery period.[191]

Testing Requirements: Activation tests involving random tests for each capacity unit with no notice given to the operator. Certified capacity must be tested at least once a year, but a capacity unit cannot be tested more than three times per delivery period.[192]

4.3.2.2 Penalties

The capacity mechanism includes a balancing mechanism whereby RPCs (certificate portfolio managers: operators or legal bodies responsible for their obligations under the balancing mechanism) have to pay the difference between the forecast and actual capacity

---

[190] *Note that PP1 days are days for which suppliers have to hold certificates.*
[191] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1711140_20_2.pdf p7.*
[192] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1711140_20_2.pdf p12.*

availability.[193] If significant rebalancing takes place, then RPCs can be subject to a penalty.[194]

4.3.3 Germany SA.43735 ABLAV Interruptibility Schemes

4.3.3.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: The scheme is a demand side response (DSR) scheme; it allows the German Transmission System Operator (TSO) to enter into contracts with electricity consumers who receive payments in exchange for committing to reducing their consumption.

TSOs are allowed to contract up to 1500 MW of demand response:

- 750MW of Immediately Interruptible Load: 350 milliseconds notice[195]
- 750MW of Quickly Interruptible Load: 15 minutes notice[196]

In order to be eligible for participation in the ABLAV scheme, there is a minimum capacity threshold of 10 MW. The aggregation of loads is allowed. Finally, the DSR providers need to be connected to a grid that is not more than two voltage levels lower than the transmission grid.[197]

The requirements are such that the demand side response does not have to be available 100% of the time. The maximum non-availability during the weekly contract is 120 x 15-minute blocks. The DSR providers must have demonstrated that they can deliver load reduction for a consecutive period of one hour. A load reduction cannot last longer than eight hours, i.e. 32 x 15-minute blocks.[198]

Obligations to make power plant/demand response projects operational by a certain date: No further relevant information available.

Testing Requirements:

The TSOs carry out Remote Controlled Release tests to ensure that the DSR provider is able to switch off capacity. These are designed to not interrupt power. In addition, providers have to prove they can hit certain criteria when connected to the network. These are detailed in 3.2.6.1 and 3.2.6.2 of the switchable loads prequalification requirements[199] and are detailed below:

3.2.6.1 SOL - immediately switchable load: proof of the amount and duration of switching power (§ 5 and § 2 No. 10 AbLaV)

The ability to deliver the SOL in terms of level and duration of the load reduction is demonstrated by the following evidence:

---

[193] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1873332_314_5.pdf p5.*
[194] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1873332_314_5.pdf p42.*
[195] *See https://www.next-kraftwerke.de/wissen/abschaltverordnung.*
[196] *See https://ec.europa.eu/competition/state_aid/cases/264060/264060_1841480_86_2.pdf, p2.*

[197] *See Switchable Loads: Prequalification Requirements) Präqualifikationsanforderungen für abschaltbare Lasten der deutschen Übertragungsnetzbetreiber 3.2.6.1 available through https://www.regelleistung.net/ext/static/abla.*
[198] *See https://ec.europa.eu/competition/state_aid/cases/264060/264060_1841480_86_2.pdf p3.*
[199] *See 'Präqualifikationsanforderungen für abschaltbare Lasten der deutschen Übertragungsnetzbetreiber', downloadable at https://www.regelleistung.net/ext/static/abla.*

• **Gradient detection:** The provider must demonstrate that shutdown is triggered within 350 milliseconds. Documentary proof of the switch-off process must be provided by a power/time diagram with a suitable minimum temporal resolution. The performance measurements at the transfer points, e.g. to the upstream network operator should also be provided.

• **Evidence to evaluate the quality of service:** When a disconnectable load is switched off, the reference value used to determine the disconnection performance is the minimum power consumption. When switching off, in every minute the shutdown power must fall within 100% and 120% of the requested amount.

The provider indicates compliance with the requirements described above in the form of a gapless operation log. The operating log includes the period from 15 minutes before the beginning of the reduction of power consumption to 15 minutes after the return to full power consumption.

The operation log of the shutdown process contains the following data in tabular form and graphical form according to the specifications of the connecting TSO:

1) Time (in hh: mm)

2) Power consumption (1-minute average, MW with three decimal places)

3) Planned minimum power consumption of the quarter-hour concerned (constant over the quarter of an hour; 1-minute average value; MW with three decimal places)

4) Target value of the reduction capacity (1-minute mean value, MW with three decimal places)

5) Power reduction provided as a difference between (3) and (2)

The measurement accuracy must be commensurate with the amount of prequalified shutdown power. The provider will provide written information on how they measured the minimum and maximum call duration and, where appropriate, information on intermediate call periods and outside call periods.

The prequalification requirements have to be demonstrated for at least 15 minutes.

3.2.6.2 SNL - Fast switchable load: proof of the amount and duration of the load switching power (§ 5 (1) no. 2 b and no. 3 AbLaV)

The DSR provider checks that the shutdown takes place within 15 minutes after the start of the shutdown time notified by the TSO. This check also includes the performance at the transfer points, e.g. to the upstream network operator.

Providers of Fast Switchable Loads must demonstrate the following:

Assessment of the quality of service: When a disconnectable load is switched off, the reference value used to determine the disconnection performance is the minimum power consumption. The in every minute the average power reduction must fall within 100% and 120% of the requested amount.

The provider indicates compliance with the requirements described above in the form of a gapless operation log. The operation log includes the period from 15 minutes before the beginning of the reduction of power consumption up to 15 minutes after the return to full power consumption.

The operation log of the shutdown process should contain the following data in tabular and graphical form according to the specifications of the connecting TSO:

1) Time (in hh: mm)

2) Power consumption (1-minute average, MW with three decimal places)

3) Planned minimum power consumption of the quarter-hour concerned (constant

over the quarter of an hour; 1-minute average value; MW with three decimal places)

4) Target value of the reduction capacity (1-minute mean value, MW with three decimal places)

5) Power reduction provided as a difference between (3) and (2)

The measurement accuracy must be commensurate with the amount of prequalified shutdown power. The provider will provide written information on how they measured the minimum and maximum call duration and, where appropriate information on intermediate call periods and outside call periods.

The prequalification requirements have to be demonstrated for at least 15 minutes.

4.3.3.2 Penalties

If the availability falls below the minimum availability bid, then the provider does not receive payment for the entire tender period.

If a provider is grossly negligent/intentionally reports that their DSR is available when it is not then they lose their right to participate in tenders for two years. They also lose the right to payment for the tender period when the negligence occurred.[200]

4.3.4 France S.A.48490 Erasure Scheme

4.3.4.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: The scheme is for companies to deliver erasure (Demand Side Response).

Sites under 1MW can enter into contracts of up to 4 years. Sites over 1MW can enter into contracts of up to 6 years. The contracts can last for up to 20 days per year. (Unless the user is also participating in the separate fast and complementary reserves scheme)[201]

Obligations to make power plant/demand response projects operational by a certain date: Operators that wish to enter the scheme must register and have their capacity certified at least 2 months before the delivery year commences.[202]

Testing Requirements: A maximum of three tests can occur. A test is considered successful when the realized power reduction is greater or equal, on each half-hourly step of the test, to the power for which the provider of the demand response has committed.[203]

---

[200] *See https://www.gesetze-im-internet.de/ablav_2016/BJNR198400016.html recital 14.*
[201] *See https://ec.europa.eu/competition/state_aid/cases/272157/272157_1966994_95_2.pdf p11.*
[202] *See https://ec.europa.eu/competition/state_aid/cases/261326/261326_1711140_20_2.pdf p7.*
[203] *See https://ec.europa.eu/competition/state_aid/cases/272157/272157_1966994_95_2.pdf p18.*

4.3.4.2 Penalties

Failure to meet testing requirements or to provide erasure can lead to a reduction in remuneration, or for repeat offences no remuneration and additional penalties.[204]

4.3.5 France SA.40454 Additional Capacity (Brittany)

4.3.5.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: This scheme relates to a tender for the installation and operation of a combined cycle gas plant in Brittany.[205] The winner had to offer guaranteed capacity of 450MW (+15/ -10%)[206]. The chosen plant needs to be able to supply power to the activation service in 15 hours (when machine stopped) or two hours (when machine in operation) and be able to supply output to the adjustment mechanism (tertiary reserve) within 3 hours (when in operation) or 8 hours (when off).[207]

Obligations to make power plant/demand response projects operational by a certain date: The commissioning date of the plants was given a 25% weighting in deciding which plant to select.[208]

Testing Requirements: No details have been found. The relevant French authority has been contacted, but we are yet to receive a response.

4.3.5.2 Penalties

No details have been found. The relevant French authority has been contacted, but we are yet to receive a response.

4.3.6 Greece SA.48780 Interruptibility Scheme

4.3.6.1 Applicable Obligations of Beneficiaries

Obligation to deliver capacity: The scheme is a demand side response scheme, and it is split into two auctions (types):

***Type 1*:** An auction to procure up to 1000MW of capacity. Providers of this capacity have to be able to reduce their consumption within 5 minutes and remain available for 48 hours, with a maximum of 288 hours per year. Maximum of 3 power reduction orders can occur per month, with a period of 1 day between orders.

Type 2: An auction to procure up to 600MW of capacity. Providers of this capacity have to be able to reduce their consumption within 5 minutes and remain available for 1 hour, for a maximum of 24 hours a year. A maximum of 4 power reduction orders per month can occur with a period of 5 days between orders.[209]

Obligations to make power plant/demand response projects operational by a certain date: Auctions are held quarterly, approximately a week in advance of when

[204] See https://ec.europa.eu/competition/state_aid/cases/272157/272157_1966994_95_2.pdf p12.
[205] See https://ec.europa.eu/competition/state_aid/cases/261325/261325_1711139_35_3.pdf p2.
[206] See https://ec.europa.eu/competition/state_aid/cases/261325/261325_1711139_35_3.pdf p8.
[207] See https://ec.europa.eu/competition/state_aid/cases/261325/261325_1711139_35_3.pdf p20.
[208] See https://ec.europa.eu/competition/state_aid/cases/261325/261325_1711139_35_3.pdf p4.
[209] See https://ec.europa.eu/competition/state_aid/cases/272092/272092_1984402_93_2.pdf p2.

beneficiaries need to make their power available. Applicants need to register on the interruptibility register in order to apply for auctions.[210]

Testing Requirements: ADMIE (independent Power Transmission Operator) randomly issues tests to check that the capacity and availability of beneficiaries. If they fail these tests they are subject to penalties.[211]

4.3.6.2 Penalties

For each Power Reduction Order issued by the Administrator, a value called the NCC is calculated.

$$NCC = \left[1 + \frac{\sum_{1}^{N_{NC}} \left(\frac{L_t - MCL_i}{MIL_i}\right)}{N_{NC}}\right] \times \left(1 + \frac{N_{NC}}{N_t}\right) - 1$$

MCL_i : The Maximum Agreed Power in MW for the TSI Type for which a Power Reduction Order was issued.

MIL_i : The Maximum Intermittent Load in MW for the TSI Type for which a Power Reduction Order was issued.

L_t : The average load of the Intermittent Consumer in MW as determined by the measurement of the energy consumed during the period t.

N_{NC} : The number of periods during which the Power Limitation Order was not observed.

N_t : The total number of periods when the Reduction Order was valid.

t: A measurement period equal to 15 minutes.

i: Indicator specifying the Interrupted Load Service Type, i.e. Type 1 or Type 2.

Failure to comply with a Power Reduction Order is defined as a case where the NCC is greater than 0.25. Failure to comply with a Power Reduction Order will result in the imposition of a penalty on the consumer providing demand response.

The penalty for the first non-compliance with a Power Reduction Order (as defined by the NCC formula) is calculated as the total fee of the consumer providing demand side response during the contract.

If the demand side response consumer fails to comply for a second time, the contract shall be terminated and the consumer shall be obliged to pay back all the remuneration received under this contract and in addition to pay the System Operator a penalty equal to 20% of the total remuneration during the contract. From the date of termination of the contract the consumer shall be deleted from the Interruptibility Register.

The above penalties shall be calculated by the System Operator on a monthly basis and a be sent monthly to the demand side response consumer no later than thirty days after the month concerned. The relevant invoice shall be payable within ninety days of its

---

[210] *See Ministerial Decision ΑΠΕΗΛ/Γ/Φ1/οικ 184898.*
[211] *See Ministerial Decision ΑΠΕΗΛ/Γ/Φ1/οικ 184898 Article 4, Section 2.*

issue. Revenue received by the Transmission System Operator from penalties is credited to the Special Supply Security Reserve Account.

In addition, if a consumer fails to comply with a power reduction order twice they cannot re-apply for one year.[212]

4.3.7 Greece SA.50152 Flexibility Mechanism

4.3.7.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: Plants have to be able to hit a ramping rate of 8MW per minute for at least three hours in order to participate.[213] In the first period (until March 2019) only closed cycle gas turbines, open cycle gas turbines, CHP and hydro-electric plants were eligible for the mechanism. In the second period DSR and storage are also eligible.[214]

Fossil fuel technologies have to confirm that they can provide the required service on a day-to-day basis.[215] Hydro plants are de-rated to take into account seasonal variations.

Obligations to make power plant/demand response projects operational by a certain date: Providers must register with the register of flexible providers in order to participate in the auctions.[216] The first auction covers the period 1st January 2019 to 31st March 2019, while the second auction covers April 2019 to December 2019.[217]

Testing Requirements: No details have been found. The relevant French authority has been contacted, but we are yet to receive a response.

4.3.7.2 Penalties

If providers are unavailable, the following penalties are applied:

a. The measured historical available capacity is reduced which reduces potential revenues in future periods.

b. Through the ex-post Imbalance Settlement mechanism, the power plant is obliged to pay the non-produced energy at the imbalance price, which is higher (by 10%-20%) than the received ex-ante spot price.

c. Additional administratively defined Non-Compliance Charges apply for failing to follow the instructions set by the TSO for energy production and ancillary service provision, or for deviations from declared availability and techno-economic data related to articles 18, 22, 61, 117, 168 of the Greek Grid Code.[218]

---

[212] *Entre Section taken directly from Ministerial Decision ΑΠΕΗΛ/Γ/Φ1/οικ 18489.*

[213] *See https://ec.europa.eu/competition/state_aid/cases/275343/275343_2009943_90_2.pdf p16.*
[214] *See https://ec.europa.eu/competition/state_aid/cases/275343/275343_2009943_90_2.pdf p32.*
[215] *See https://ec.europa.eu/competition/state_aid/cases/275343/275343_2009943_90_2.pdf p17.*
[216] *See ΦΕΚ ΡΑΕ ΜΜΑΕ 3974 / 2018.*
[217] *See https://ec.europa.eu/competition/state_aid/cases/275343/275343_2009943_90_2.pdf p16.*
[218] *See https://ec.europa.eu/competition/state_aid/cases/275343/275343_2009943_90_2.pdf p18.*

4.3.8 Ireland SA.44464 Capacity Mechanism

4.3.8.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: The Irish Capacity Mechanism is a reliability options (RO) scheme and therefore RO holders are subject to difference payments at times when prices are high. The capacity providers have a financial incentive to be available at times of scarcity, because the payment has to be made irrespective of whether they were selling electricity during the relevant settlement period.[219]

This is augmented by the load following obligation. This obligation requires that the quantity that a capacity provider is contracted for under its RO varies with the actual overall system need for capacity. The authorities explain that when scarcity happens outside a period of peak demand or because of low plant availability during the summer, it is not necessary for the capacity requirement in that period to be equal to the total volume of ROs sold in the auction. This allows each individual RO obligation to be scaled down pro-rata to reflect the actual demand for capacity. This load-following rule thus leaves the hedge of both providers and suppliers intact and balances the difference between payments paid and received. Moreover, the difference payments reflect the actual value of scarcity.[220]

Obligations to make power plant/demand response projects operational by a certain date: New capacity is allowed to compete, however, new capacity can only acquire contracts of up to one year. Existing capacity can acquire contracts of up to 10 years. New capacity has a 18 month 'lead time' in t-4 auctions meaning that they can commence operation 18 months after the specified delivery date. Existing capacity does not have this lead time flexibility and therefore must have operational capacity available on the delivery date.

Testing Requirements: New capacity has to complete an implementation plan before it is allowed into the reliability options scheme. The implementation plans involve having to meet certain milestones which include testing. There are two types of test: performance testing and acceptance testing.[221]

4.3.8.2 Penalties

New capacity has to provide a performance bond shortly after the auction, and enter into milestones to ensure that capacity is built. If the capacity is not built or, if milestones are not hit, then any payments related to the capacity are forfeited.[222] In 2019[223] the value of these performance security bonds were EUR 10,000 per MW when it is more than 13 months prior to the beginning of the capacity year, EUR 30,000 per MW from 13 months prior to the beginning of the capacity year, and EUR 40,000 per MW from the beginning of the capacity year. These values are also the termination charges for ending a capacity contract.[224]

---

[219] *See https://ec.europa.eu/competition/state_aid/cases/267880/267880_1948214_166_2.pdf p16.*
[220] *See https://ec.europa.eu/competition/state_aid/cases/267880/267880_1948214_166_2.pdf p17.*
[221] *See I-SEM Capacity Market Code p142.*
[222] *See https://ec.europa.eu/competition/state_aid/cases/267880/267880_1948214_166_2.pdf p16.*
[223] *For the 2020/21 T-1 and 2021/22 T-2 capacity auctions.*
[224] *Capacity Remuneration Mechanism 2020/21 T-1 Capacity Auction and 2021/22 T-2 Capacity Auction Parameters, Decision Paper, SEM-19-018, 1 May 2019, see p6, https://www.semcommittee.com/sites/semc/files/media-files/SEM-19-018%20CRM%202020-21%20T-1%20and%202021-22%20T-2%20Parameters%20Decision.pdf*

4.3.9 Poland SA46100 Capacity Mechanism

4.3.9.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: Below is an excerpt from Decision SA.46100:

As a general principle, the capacity market will follow a "delivered energy" model: capacity providers will be obliged to deliver energy whenever needed to ensure security of supply, i.e. in so-called system stress events.

A system stress event is defined as an hour in which the planned dispatchable capacity reserve available to PSE (the TSO) (in excess of demand) is lower than the level of reserve margin required to safely operate the grid. A system stress event may occur in any hour of peak demand between 7:00 and 22:00 hours on working days. No limitation is introduced as to the number and duration of breaks between sequentially occurring system stress events. A system stress event must be preceded by a warning issued by PSE at least 8 hours in advance.

Obligations under the capacity agreements are "load following". That means that capacity providers will only be required to be generating electricity or reducing demand up to the total level of their obligation if all capacity, for which capacity agreements have been concluded in the market, is necessary to meet demand. In a stress event where only 70 % of such total capacity is necessary to meet demand, each provider will only be required to generate electricity or reduce demand up to 70 % of their full capacity obligation.

PSE will verify that a given domestic capacity market units (CMU) has delivered its obligation according to the following criteria: (a) for a CMU active in the Polish central balancing mechanism (be it a generating or a demand side response CMU), the verification will be based on the dispatchable capacity available to PSE in the balancing market processes; (b) for other generating CMUs, the verification will be based on the CMU's physical net electricity generation; (c) for other demand side response CMUs, the verification will be based on the difference between the CMU's baseline electricity consumption and the amount of electricity actually consumed. [225]

Obligations to make power plant/demand response projects operational by a certain date: Each delivery year has a T5 auction and then an additional set of four auctions (one per quarter) that occur during the delivery year. If suppliers want to enter into agreements longer than one year they need to hit CAPEX requirements.

Testing Requirements: In order to enter the auction, generating CMUs must provide the TSO with evidence showing that the CMU is able to continuously deliver their net capacity for at least 4 hours without interruption and without any specific technical harm. Non-Generating CMUs must pass a demand side response (DSR) test. The DSR test seeks to verify the ability of prospective DSR CMUs to respond to a stress event. For Aggregated DSR CMUs, the test is performed at the pool level. The DSR test takes one hour and

[225] *See https://ec.europa.eu/competition/state_aid/cases/272253/272253_1977790_162_2.pdf p23. This also provides additional rules for 'foreign' CMUs.*

replicates the conditions of a stress event (including the time of call for capacity delivery, the methods for baseline calculations, etc.)[226]

Also, there is a system of performance demonstrations to ensure that capacity providers are able to deliver energy when needed and only receive capacity payments if reliable. This is especially important for those delivery years with no stress events in which testing providers' performance ensures that providers are physically capable of delivering as per their capacity obligations.[227]

4.3.9.2 Penalties

The penalty regime aims to provide capacity providers with incentives to deliver energy when needed. CMUs which perform below the expected level of performance will be penalised, while those that exceed the expected level will receive 'over delivery' payments, so that at the end of the year each unit's capacity payments will broadly reflect their performance. The penalty regime consists of three main elements: (a) an overall annual liability cap of 200 % of a CMU's annual capacity revenues; (b) a monthly cap of 20% of the annual cap; (c) an hourly penalty rate expected to be set at 750 euros per MW. The penalties are the same for Polish and foreign CMUs.[228]

4.3.10 UK SA.35980 Capacity Mechanism

4.3.10.1 Applicable Obligations of Beneficiaries

Obligations to deliver capacity when required: The following are excerpts from the Commission's SA.35980 decision document.

"The Capacity Market follows a 'delivered energy' model: capacity providers are obliged to deliver energy whenever needed to ensure security of supply, i.e. in real system stress situations.'' [229]

"Under the capacity agreement obligation, system stress events are defined as any half hour settlement periods in which either voltage control or controlled load shedding are experienced at any point on the system for 15 minutes or longer. Providers are required to determine their own response at such times, and avoid breaching any existing code or licence conditions. To date, there have been no Capacity Market Notices issued by the system operator. The winter (2018/19) was the first year of the measure's operation in full.

To ensure participants are able to adequately manage the risk of exposure to penalties, e.g. the risk that a number of plants simultaneously trip, the System Operator publishes a notice of system stress via a 'Capacity Market warning', based on the methodology set out in the Capacity Market Rules (8.4.6)18. Unless this warning has been issued, a scarcity event will not trigger Capacity Market penalties or 'over-delivery' payments.

Capacity agreements oblige participants to deliver a specified quantity of electricity. A provider's obligation at the time of stress events is calculated from the obligations they entered into through the four-year and year-ahead auctions, plus any secondary traded

---

[226] *https://ec.europa.eu/competition/state_aid/cases/272253/272253_1977790_162_2.pdf see p13.*
[227] *See https://ec.europa.eu/competition/state_aid/cases/272253/272253_1977790_162_2.pdf p25.*
[228] *See https://ec.europa.eu/competition/state_aid/cases/272253/272253_1977790_162_2.pdf p24.*
[229] *See https://ec.europa.eu/competition/state_aid/cases/277359/277359_2054365_76_2.pdf p19.*

obligations they entered into for the specific settlement periods in which a stress event occurs.'' [230]

Obligations to make power plant/demand response projects operational by a certain date: See the following excerpt from the Commission's SA.35980 decision document:

"In stress periods preceded by a Capacity Market warning of at least four hours notice, providers' obligations are 'load following'. This means they are only required to be generating electricity or reducing demand up to the total level of their obligation if all capacity, for which capacity agreements have been concluded in the market, is necessary to meet demand. In a stress event where only 70% of such total capacity is necessary to meet demand, each provider is only required to generate electricity or reduce demand up to 70% of their full capacity obligation.'' [231]

Testing Requirements: See the following excerpt from the Commission's SA.35980 decision document:

"Capacity providers are required to undertake a rigorous system of performance demonstrations to ensure capacity providers are able to deliver energy when needed if reliable. This is especially important for those delivery years with no stress events in which testing providers' performance ensures that providers are physically capable of delivering as per their capacity obligations."[232]

Penalty Requirements: See the following excerpt from the Commission's SA.35980 decision document:

"The penalty regime aims to provide capacity providers with incentives to deliver energy when needed. Units which perform below the expected level of performance are penalised, while those that exceed the expected level receive 'over delivery' payments, so that at the end of the year each unit's capacity payments broadly reflects their performance. The penalty regime consists of three main elements:

- a monthly liability cap of 200% of a provider's monthly capacity revenues, which, given the weighting of monthly payments according to system demand, may expose providers to a penalty liability of up to 20% of their annual revenue in any one month.
- an overarching annual cap of 100% of annual revenues.
- a penalty rate set at 1/24th of a provider's annual capacity payments." [233]

4.3.11 UK SA.44475 Additional Capacity Mechanism

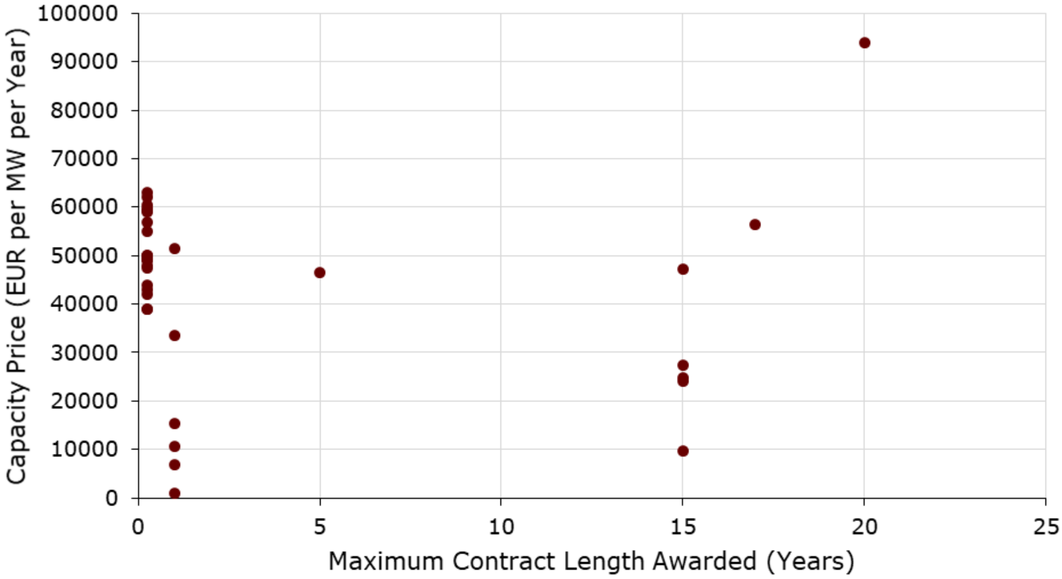
This scheme operates under the same conditions as that covered by SA.35980 above except that:

- The lead time for auctions is not T1 or T4, it is 8 months.
- Agreements of longer than one year are not permissible in this auction.

[230] See https://ec.europa.eu/competition/state_aid/cases/277359/277359_2054365_76_2.pdf p19.
[231] See https://ec.europa.eu/competition/state_aid/cases/277359/277359_2054365_76_2.pdf p20.
[232] See https://ec.europa.eu/competition/state_aid/cases/277359/277359_2054365_76_2.pdf p20.
[233] See https://ec.europa.eu/competition/state_aid/cases/277359/277359_2054365_76_2.pdf p20.

Annex 4.4 – Additional Analysis on Capacity Mechanisms

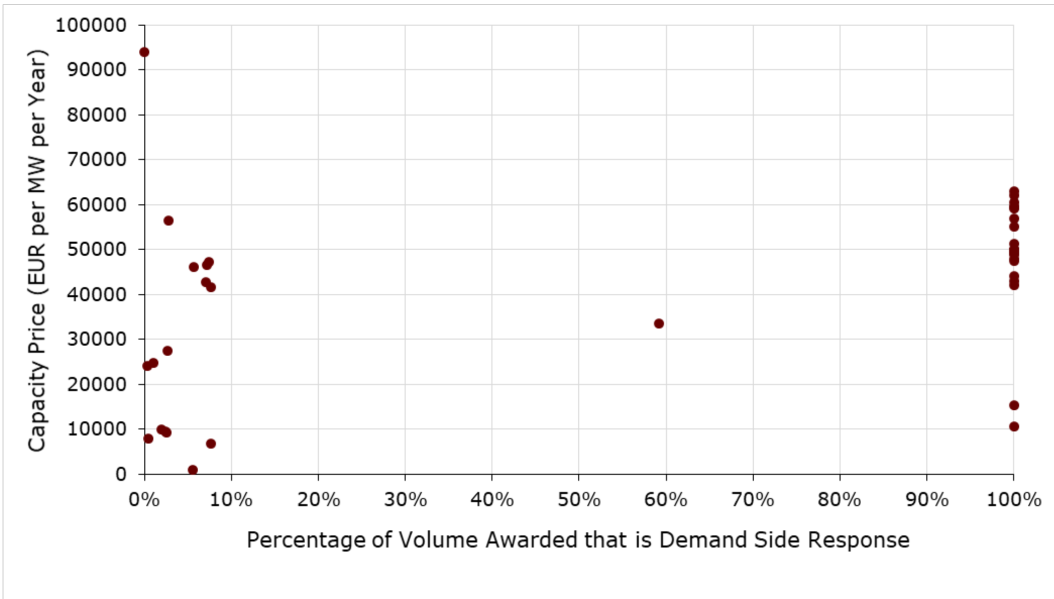
Figure A4.4.1: Scatterplot of the price of capacity against maximum contract length awarded for sampled capacity mechanisms[234]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

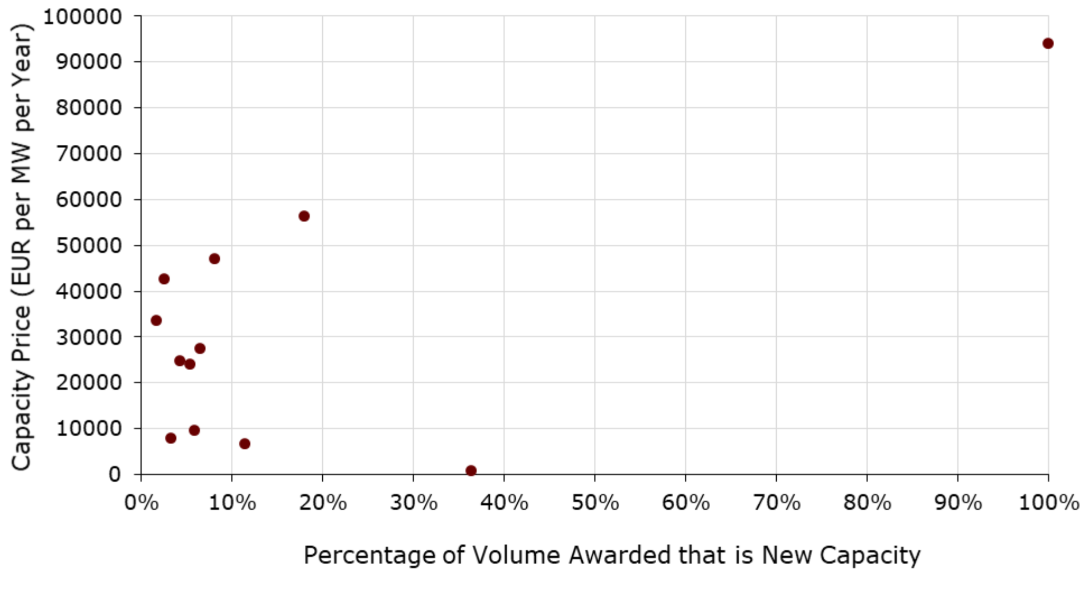
[234] *The data points on the far left relate to a contract length of three months. Data is unavailable for Belgium and Ireland. Data for France and Germany is not included due to the nature of their schemes.*

Figure A4.4.2: Scatterplot of the price of capacity against the percentage of volume awarded that is Demand Side Response for sampled capacity mechanisms [235]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

Figure A4.4.3: Scatterplot of the price of capacity against the percentage of volume awarded that is new generation capacity for sampled capacity mechanisms [236]

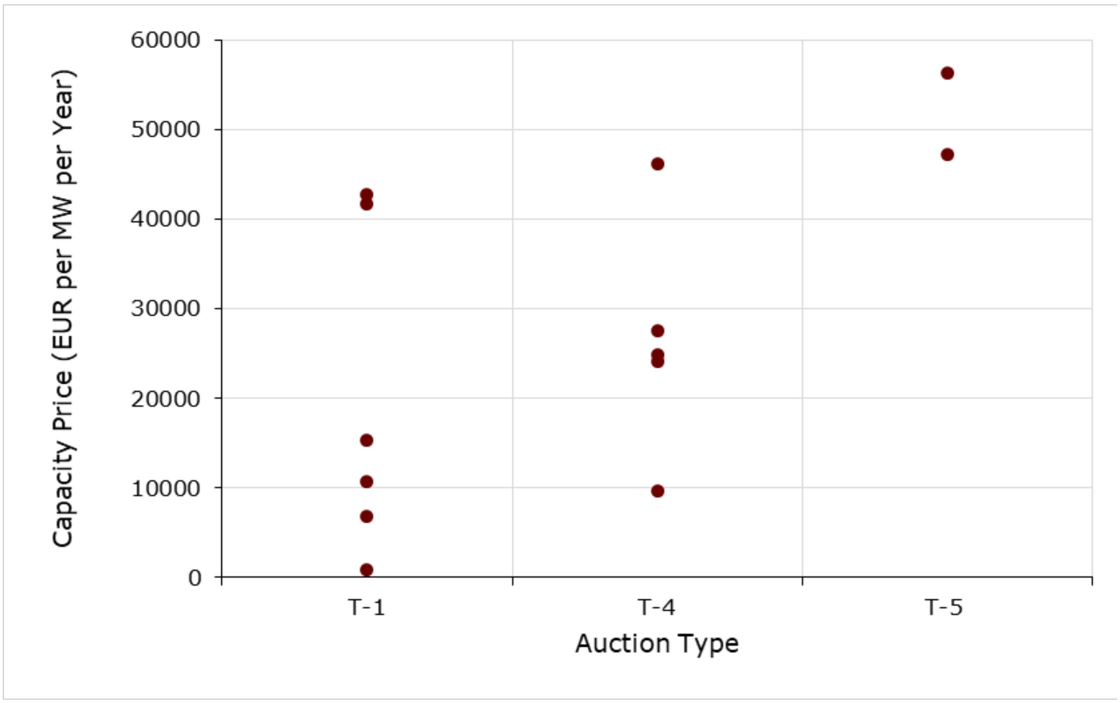


Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

---

[235] *Data unavailable for Belgium. Data for France and Germany is not included due to the nature of their schemes.*
[236] *Data unavailable for Belgium. Data for France, Germany and Greece not included due to the nature of their schemes.*

Figure A4.4.4: Scatterplot of the price of capacity split by lead time to delivery of capacity for sampled capacity mechanisms[237]



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

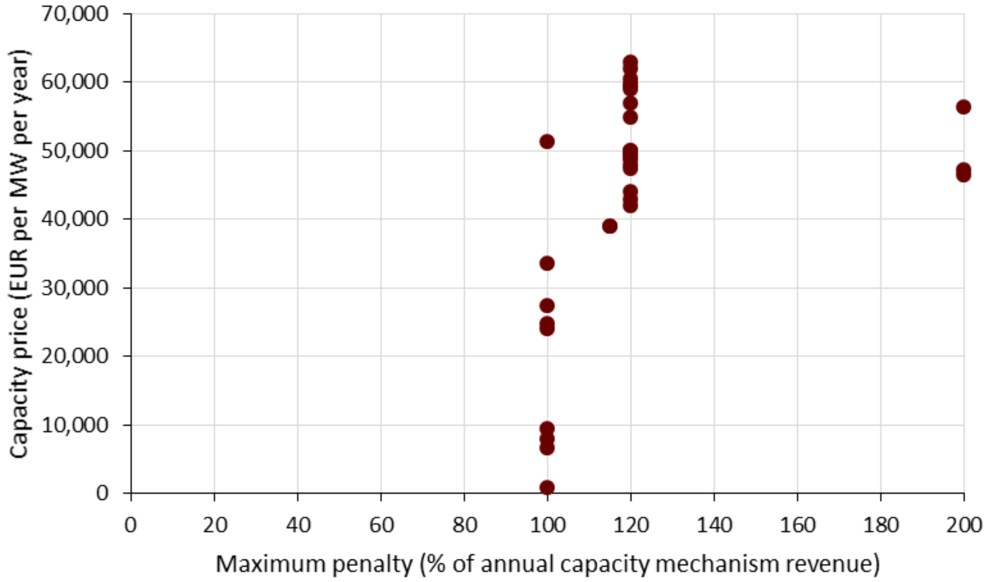
Figure A4.4.5 attempts to investigate whether a relationship exists between the maximum penalties that firms are exposed to in capacity mechanisms and the capacity price achieved by the mechanisms. In Figure A4.4.5 schemes are ordered according to the maximum total penalty payment as a proportion of a firm's annual revenue from the capacity mechanism.[238] When interpreting Figure A4.4.5 it is important to note that penalty terms in the capacity mechanisms can be complex and multi-faceted. It is possible that the true expected value of the penalty clauses may be noticeably different to the project team's interpretation of the maximum penalty and so Figure A4.4.5 should be treated with caution. Also, Figure A4.4.5 only covers those schemes where usable data in a broadly equivalent form is available.

Figure A4.4.5: Scatterplot of capacity prices against the maximum liability of firms (as a percentage of their annual capacity mechanism revenues) for sampled capacity mechanisms[239]

[237] Data unavailable for Belgium. Data for France, Germany and Greece not included due to the nature of their schemes.

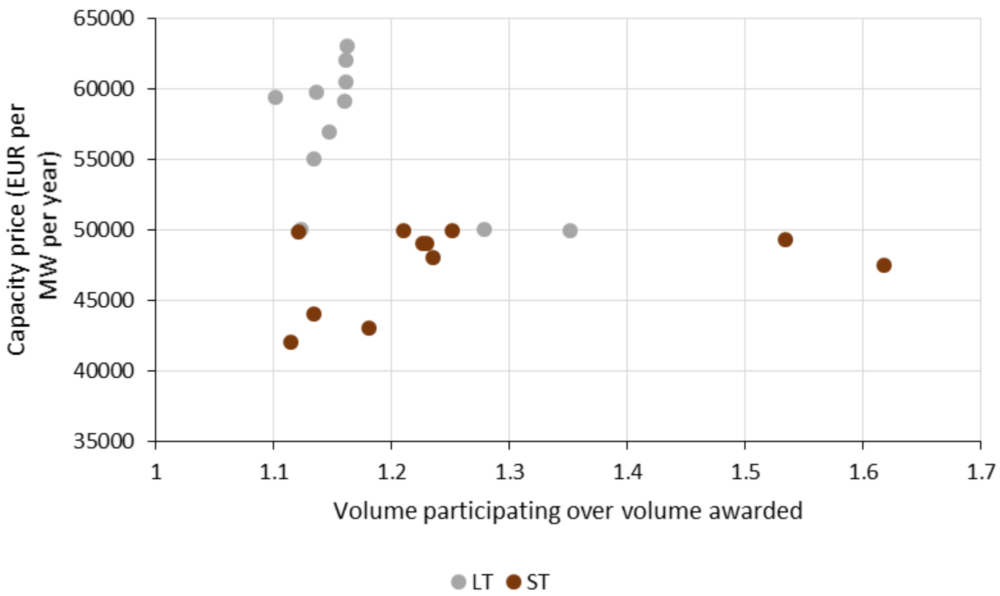
[238] A value of 100% represents a firm forgoing or returning all of the revenue from the capacity mechanism that it was due during a given year.

[239] Data included is from the following schemes (maximum penalty in brackets): UK SA.35980 and SA.44475 (100%), Greece SA.50152 (110-120%, marked on chart as 115%), Greece SA.48780 (120%) and Poland SA.46100 (200%). Data is not included for: Germany SA.43735 (100%) as the mechanism involves two prices; France SA.48490 (over 100%) as a precise maximum penalty is not provided; Belgium SA.48648 (130%) as no pricing data is available; and Ireland SA.44464 plus France SA.40454 and SA.39621 as their penalties were non-equivalent or not specified.



Source: Material collated by Centre for Competition Policy, University of East Anglia from national authority websites, national authority documents and European Commission decision documents.

Figure A4.4.6: Scatterplot of clearing prices versus volume participating over volume awarded for the Greek LT and ST interruptibility schemes, Q4 2016-Q4 2019[240]



Source: Material collated by Centre for Competition Policy, University of East Anglia from the Greek Independent Power Transmission Operator (IPTO)

[240] *Q3 and Q4 2017 are not included as pricing data is not available for these auctions.*

Annex 5.1 – Denmark (Market 1) electricity pricing data

(see accompanying Excel file)

Annex 5.2 – Denmark (Market 2) electricity pricing data

(see accompanying Excel file)

Annex 5.3 – France electricity pricing data

(see accompanying Excel file)

Annex 5.4 – Germany electricity pricing data

(see accompanying Excel file)

Annex 5.5 – Netherlands electricity pricing data

(see accompanying Excel file)

Annex 5.6 – UK (Great Britain) electricity pricing data

(see accompanying Excel file)

Annex 5.7 – UK (Northern Ireland) electricity pricing data

(see accompanying Excel file)

Annex 5.8 – Aggregated generation data for RES during hours of negative prices

(see accompanying Excel file)

Annex 5.9 – Generation data for case study RES plants

(see accompanying Excel file)

Annex 5.10 – Rules on aid when negative electricity prices occur

(see accompanying Excel file)

Annex 5.11 - Detail on French rules on aid when negative electricity prices occur

This annex contains translations of the rules covering the receipt of aid when the day ahead wholesale electricity price is negative provided in European Commission decision documents for relevant French cases where the rules are particularly complex.

5.11.1 SA.47753, Support through tenders for the development of solar power generation facilities located on buildings

Treatment of negative market prices

Only energy produced during positive or zero price hours may give entitlement to the payment of the additional remuneration. Conversely, no aid is paid during periods of negative prices to an installation that produces electricity during this period. However, a compensatory measure has been in place for the facilities that do not produce during the hours of negative prices beyond a certain number of hours of negative prices recorded per year. This measure takes into account the production profile of the sector and the rate of annual load of the sector so as not to compensate projects beyond what they would have received in the absence of negative prices. The ceiling of hours beyond which compensation would be paid is 15 hours (in full power equivalents), corresponding to 1% of operating hours for the solar industry.

In application of Article R. 314-39 of the Energy Code, over a calendar year, beyond the first 15 hours of negative spot prices for overnight delivery recorded on the EPEX Spot SE electricity exchange for the France zone between 8:00 am and 8:00 pm, called "spot peak price", the additional remuneration is increased by the following premium:

$$Premium_{negative\ price} = 0.5 \times P \times T \times n_{negative\ prices}$$

Formula in which:

- P is the installed power;

- $n_{negative\ prices}$ is the number of hours during which the "spot peak prices" has been strictly negative beyond the first 15 hours of negative "spot peak price" for the calendar year, and during which the installation did not produce. This number of hours is bounded annually by the following condition:

$$n_{negative\ prices} < 1600 - \frac{\sum_{i=1}^{12} E_i}{P}$$

In the formula, the coefficient of 0.5 represents the rate of load of during the hours of negative prices concerned. In addition, an installation would not be compensated in the case of a negative price at night (between 8pm and 8am), so there will be no payment for an installation that would not be able to produce.

[E_i is the sum of the hours at positive spot price or zero on the EPEX Spot SE electricity exchange for the France zone, electricity volumes allocated by the network operator, where appropriate via a calculation of losses or a settlement agreement, at the balance perimeter designated by the producer for the production of his installation in the month i. These volumes are net of auxiliary consumption necessary for the operation of the installation during the production period.]

In order to ensure that this premium cannot lead to the overpayment of projects, the number of negative price hours giving rise to the premium shall be set so that the installation cannot receive a remuneration corresponding to more than 1,600 hours of annual operation.

The calculation of the reference market price used for the calculation of the premium does not take into account the hours during which prices were negative, giving a global incentive for the industry not to produce at times of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the production costs of the sector) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the electricity affected by the network manager for hours at spot prices positive or zero on the EPEX Spot SE electricity exchange for the France zone.

Since the payment is known in advance and accessible to all candidates, the latter will integrate the compensation mechanism in case of a significant number of negative prices in the price proposed at the end of the tender procedure. Moreover, the ceiling to the number of hours of payment of the sector ensures that there is no situation of overcompensation in case of prolonged negative price periods.

Source: pg12-13, pg35 and pg40-41, European Commission Decision Document, Subject: State aid SA.46552 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy; State aid SA.47753 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy, installed on buildings; State aid SA.48066 (2017 / NN) – France Triennial call for tenders for onshore wind; State aid SA.48238 (2017 / N) – France Support through tenders for the development of electricity production from photovoltaic solar energy or wind turbine, C (2017) 6685 final, https://ec.europa.eu/competition/state_aid/cases/271172/271172_1942309_15_2.pdf

5.11.2 SA.46552, Tendering support for the development of electricity generation facilities from solar energy

Treatment of negative market prices

Only energy produced during hours of positive or zero spot prices may give entitlement to the payment of the additional remuneration. However, a compensatory measure is in place for the facilities that do not produce during the hours of negative prices beyond a certain number of hours of negative prices recorded per year. In application of Article R. 314-39 of the Energy Code, over a calendar year, beyond the first 15 hours of negative spot prices for overnight delivery recorded on the EPEX Spot SE electricity exchange for the France zone between 8:00 am and 8:00 pm, called "spot peak price", the additional remuneration is increased by the following premium:

$$Premium_{negative\ price} = 0.5 \times P \times T \times n_{negative\ prices}$$

Formula in which:

- P is the installed power;

- $n_{negative\ prices}$ is the number of hours during which the "spot peak prices" have been strictly negative beyond the first 15 hours of negative "spot peak price" for the calendar year, and during which the installation did not produce. This number of hours is bounded annually by the following condition:

$$n_{negative\ prices} < 1600 - \frac{\sum_{i=1}^{12} E_i}{P}$$

The tender specifications provide for the payment of installations which will not have produced at negative price hours to compensate for some of the loss of earnings related to this lower production beyond a certain number of hours of negative prices. In any case, the facilities that will produce at times of negative prices will not receive any compensation corresponding to this production.

[E_i is the sum of the hours at a positive spot price or zero on the EPEX Spot SE electricity exchange for the France zone, electricity volumes allocated by the network operator, where appropriate via a calculation of losses or a settlement agreement, at the balance perimeter designated by the producer for the production of his installation during the month i. These volumes are net of the auxiliary consumption necessary for operation of the installation during the production period.]

The ceiling of hours beyond which compensation is paid is 15 hours (in equivalent full power hours), corresponding to 1% of hours of operation for the solar industry.

This premium paid in case of non-production during negative price hours will be weighted by a coefficient of 0.5, representative of the load ratio of the hours of negative prices concerned. In addition, an installation will not be compensated in case of negative prices at night (between 8pm and 8am), in order not to pay for an installation that would not be able to produce.

In order to ensure that this premium cannot lead to the overpayment of projects, the number of negative price hours giving rise to the premium shall be set so that the installation cannot receive remuneration corresponding to more than 1,600 hours of annual operation.

The calculation of the reference market price used for the calculation of the premium does not take into account the hours during which prices were negative, giving a global incentive for the industry not to produce at times of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the production costs of the sector) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the electricity affected by the network manager for hours at spot prices positive or zero on the EPEX Spot SE electricity exchange for the France zone.

Since the payment is known in advance and accessible to all candidates, the latter will integrate the compensation mechanism in case of a significant number of negative prices in the price proposed at the end of the tender procedure. Moreover, the ceiling to the number of hours of payment of the sector ensures that there is no situation of overcompensation in case of prolonged negative price periods.

Source: pg14-15, pg35 and pg40-41, European Commission Decision Document, Subject: State aid SA.46552 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy; State aid SA.47753 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy, installed on buildings; State aid SA.48066 (2017 / NN) – France Triennial call for tenders for onshore wind; State aid SA.48238 (2017 / N) – France Support through tenders for the development of electricity production from photovoltaic solar energy or wind turbine, C (2017) 6685 final, https://ec.europa.eu/competition/state_aid/cases/271172/271172_1942309_15_2.pdf

5.11.3 SA.48238, Tendering support for the development of electricity generation facilities from solar photovoltaic or wind energy

Treatment of negative market prices

Only energy produced during positive or zero price hours may give entitlement to the payment of the additional remuneration. Conversely, no aid is paid during periods of negative prices to an installation that produces electricity during this period. However, a compensatory measure has been put in place for the facilities that do not produce during the hours of negative prices beyond a certain number of hours of negative prices recorded per the year (15h for the solar sector and 20h for the wind industry). This measure takes into account the annual production profile of the sector so as not to compensate for projects beyond what they would have received in the absence of negative prices.

Photovoltaic installations not producing during negative price hours will receive compensation beyond the first 15 hours of strictly negative spot prices (over a calendar year) for overnight delivery observed on the EPEX Spot SE electricity exchange for the France zone between 08:00 and 20:00. The compensation ($Premium_{negative\ price}$) is calculated as follows:

$$Premium_{negative\ price} = 0.5 \times P \times T \times n_{negative\ prices}$$

Formula in which:

- P is the installed power;

$n_{negative\ prices}$ is the number of hours during which the "spot peak prices" were strictly negative beyond the first 15 hours of negative spot peak prices of the calendar year, and during which the installation did not produce. This number of hours is limited annually by the following condition:

$$n_{negative\ prices} < 1600 - \frac{\sum_{i=1}^{12} E_i}{P}$$

The 50% coefficient applied to photovoltaic installations in case of a negative price is the average load factor of the sector during the day (from 8h to 20h).

[E_i is the sum of positive spot hours ("spot price") and for overnight delivery on the French organized electricity supply market platform, electricity volumes affected by the network manager, where appropriate by a loss calculation formula or a settlement agreement, at the balance perimeter designated by the Producer for the production of his installation on the month i. These volumes are net of the auxiliary consumption required for operation of the installation during the production period.]

Wind farms not producing during negative price hours will receive compensation beyond the first 20 hours, consecutive or not, of strictly negative spot prices for overnight delivery noted on the EPEX Spot SE electricity exchange for France. The compensation ($Premium_{negative\ price}$) is calculated as follows:

$$Premium_{negative\ prices} = 0.35 \times P_{max} \times T \times n_{negative\ prices}$$

formula in which:

- T is the electricity reference rate in € / MWh determined by the Candidate when submitting his offer;

- $n_{negative\ prices}$ is the number of hours during which the spot prices for next day delivery on the French organized electricity market platform were strictly negative beyond the first 20 hours of negative prices of the calendar year and during which the installation has not produced energy. This number of hours is limited annually by the following condition:

$$n_{negative\ prices} < 2300 - \frac{\sum_{i=1}^{12} E_i}{P}$$

The 35% coefficient applied to wind installations in case of negative prices corresponds to the average load factor observed during negative price periods. This calculation was made thanks to the history of negative prices observed in France since 2012 (EpexSpot data). The load factor considered is that observed for the wind energy sector, for installations installed on 1st January, during each negative price period (TEN data, transmission and electricity network). The load factor observed during these periods is highly variable and represents on average 35%.

The calculation of the reference market price used for the calculation of the premium does not take into account the hours during which prices were negative, giving a global incentive for the industry not to produce at times of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the production costs of the sector) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the electricity affected by the network manager for hours at spot prices positive or zero on the EPEX Spot SE electricity exchange for the France zone.

Since the payment is known in advance and accessible to all candidates, the latter will integrate the compensation mechanism in case of a significant number of negative prices in the price proposed at the end of the tender procedure. Moreover, the ceiling to the number of hours of payment of the sector ensures that there is no situation of overcompensation in case of prolonged negative price periods.

Source: pg18-19, pg35 and pg40-41, European Commission Decision Document, Subject: State aid SA.46552 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy; State aid SA.47753 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy, installed on buildings; State aid SA.48066 (2017 / NN) – France Triennial call for tenders for onshore wind; State aid SA.48238 (2017 / N) – France Support through tenders for the development of electricity production from photovoltaic solar energy or wind turbine, C (2017) 6685 final, https://ec.europa.eu/competition/state_aid/cases/271172/271172_1942309_15_2.pdf

5.11.4 SA.48066, Triennial call for tenders for onshore wind

Treatment of negative market prices

Only energy produced during hours of positive or zero spot prices may give entitlement to the payment of the additional remuneration. However a compensatory measure has been put in place for the installations that do not produce during negative price hours beyond a certain number of hours of negative prices recorded over the year.

Over a calendar year, beyond the first 20 hours, consecutive or not, of strictly negative spot prices for overnight delivery on the EPEX Spot SE electricity exchange for the France zone, an installation that does not produce during the hours of negative prices receives a bonus equal to $Premium_{negative\ prices}$, defined below:

$$Premium_{negative\ prices} = 0.35 \times P_{max} \times T \times n_{negative\ prices}$$

formula in which:

- *T* is the electricity reference rate in € / MWh determined by the Candidate when submitting his offer,

- $n_{negative\ prices}$ is the number of hours during which the spot prices for next day delivery on the French organized electricity market platform were strictly negative beyond the first 20 hours of negative prices of the calendar year and during which the installation has not provided energy,

- the coefficient of 35% applied in the case of a negative price corresponds to the average load factor of wind turbines observed during negative price periods. This calculation was made thanks to the negative price history observed in France since 2012 (EpexSpot data). The load factor considered is that observed for the wind energy sector, installed on the 1st January, during each negative price period (TEN data, Network transport and electricity). The load factor observed during these periods is very variable and represents an average 35%.

The calculation of the reference market price used for the calculation of the premium does not take into account the hours during which prices were negative, giving a global incentive for the industry not to produce at times of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the production costs of the sector) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the electricity affected by the network manager for hours at spot prices positive or zero on the EPEX Spot SE electricity exchange for the France zone.

Since the payment is known in advance and accessible to all candidates, the latter will integrate the compensation mechanism in case of a significant number of negative prices in the price proposed at the end of the tender procedure. Moreover, the ceiling to the number of hours of payment of the sector ensures that there is no situation of overcompensation in case of prolonged negative price periods.

Source: pg16-17, pg35 and pg40-41, European Commission Decision Document, Subject: State aid SA.46552 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy; State aid SA.47753 (2017 / NN) – France Support through tenders for the development of electricity production from solar energy, installed on buildings; State aid SA.48066 (2017 / NN) – France Triennial call for tenders for onshore wind; State aid SA.48238 (2017 / N) – France Support through tenders for the development of electricity production from photovoltaic solar energy or wind turbine, C (2017) 6685 final, https://ec.europa.eu/competition/state_aid/cases/271172/271172_1942309_15_2.pdf

5.11.5 SA.46698, Tenders for biomass plants

Compensation supplement

Production taken into account for the calculation is capped and is reduced from the production eventually indemnified in the event of a period of negative prices

P_{ef} is a premium linked to the use of livestock manure installations. This coefficient applies only to the family "methanisation". Whereas the use of livestock effluents in methanisation allows optimization of the nitrogen cycle at the local level, the use of livestock effluents is encouraged by a premium for filling the gap of biogas production, and therefore of electricity, related to this low methane input category. So, for the winning installations of livestock effluents is encouraged by a premium for filling the gap of biogas production, and therefore of electricity, related to this low methane input category. So, for the winning installations of the "Methanisation" family, the bonus for the treatment of livestock manure has a value applicable to an installation is defined as follows:

Value of Ef	**PEF value** **[€ / MWh]**
0%	0
≥60%	50

a. Where Ef is the amount of livestock manure (in tonnes of inputs) of the facility's supply calculated on an annual basis. Livestock effluents are liquid or solid manure, manure, rainwater dripping on open areas accessible to animals, silage juice and wastewater from livestock farming and its annexes.

b. Intermediate values of P_{ef} are determined by linear interpolation

$P_{participatoryinvestment}$ is a bonus that values participation in the capital of the project of a local authority or of companies where a large share of the capital is held by twenty individuals, or one or several communities. If the candidate is a local authority or, in the case of a joint-stock company or a cooperative, if he undertakes that capital is held at least 40% by such actors, it benefits from a bonus of € 5 / MWh. This premium becomes negative (-€ 5

/ MWh) if this commitment is not respected later by the candidate.

P_{fumes} a coefficient applicable only to the facilities of the family "wood energy" and intended to enhance the projects where power generation equipment deals with deadly heat fumes. If this is the case, the candidate receives a bonus in his rating. On the other hand, if it does not respect this commitment, it is subject to a penalty equal to € 10 / MWh for the duration of the contract (P_{fumes} is 0 if the candidate lives up to his / her commitment).

P_{air} is a coefficient applicable only to installations of the family "energy-wood" and is designed to promote projects that go beyond environmental standards for air emissions of dust and nitrogen oxides. If a candidate commits to the objectives fixed by the specifications, it benefits from a bonus in its rating. On the other hand, if it does not respect this commitment, at any moment of the relevant calendar year, it is subject to a penalty equal to 10 € / MWh for the year in question (P_{air} is equal to 0 if the candidate respects his commitment).

Only energy produced during hours of positive or zero spot prices may give entitlement to the payment of the additional remuneration. However, the charges in the tender specification provide for the compensation of facilities that have not produced at negative price hours for part of the loss of compensation related to this lower production. Thus, over a calendar year, beyond the first 70 hours, consecutive or not, of strictly negative day ahead spot prices on the EPEX Power Exchange Spot SE for the France zone, if the installation does not produce during the hours of negative prices, she receives a bonus equal to:

$$Premium_{negative\ prices} = P_{project} \times (T_0 + P_{ef} + P_{participatoryinvestment} - P_{air} - P_{fumes}) \times n_{negative\ prices}$$

$P_{project}$ is the Project Power in MWe;

$n_{negative\ prices}$ is the number of hours the prices for next day delivery on the EPEX Spot SE electricity exchange for the France zone were strictly negative beyond the first 70 hours of negative prices in the calendar year and during which the installation did not produce energy.

The 70 hour threshold corresponds to 1% of the expected operating hours for the biomass sector.

As mentioned in paragraph (33), measures are also in place to prevent producers from being incentivized to produce electricity at negative prices. Indeed, the calculation of the reference market price used for the calculating the premium does not take into account the hours during which prices were negative, giving a global incentive for the industry not to produce during hours of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the costs of sector production) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the volumes of electricity received by the network operator for hours at a positive or zero spot price on the EPEX Spot SE electricity exchange for the France zone.

As mentioned above (see paragraph (33)), the support scheme provides for compensation in the event of a significant recurrence of negative prices. Given that the payment is known in advance and accessible to all candidates, the latter will integrate the clearing mechanism in the event of a large number of negative price hours proposed following the tendering procedures. Otherwise the ceiling on the number of hours of load of the sector that receives payment ensures that there is no overcompensation situation in the event of an extended period of negative prices.

Source: pg8-10, pg19 and pg22, European Commission Decision Document, State aid SA.46698 (2017 / NN) – France Tenders for biomass plants, C (2018) 1210 final, available at:
https://ec.europa.eu/competition/state_aid/cases/271174/271174_2032504_64_2.pdf

5.11.6 SA.51190, Support by tender for the development of electricity production from solar energy in the Department of Haut-Rhin

Treatment of negative market prices

Only energy produced during positive or zero price hours may give entitlement to the payment of the additional remuneration. However a compensatory measure has been put in place for the installations that do not produce during negative price hours beyond a certain number of hours of negative prices recorded over the year.

Over a calendar year, beyond the first 15 hours of spot prices for next day delivery on the EPEX Spot SE electricity exchange for the France zone between 8 am and 8 pm, so-called "peak spot price", that are strictly negative, the additional remuneration is increased by the following premium:

$$Premium_{negative\ price} = 0.5 \times P \times T \times n_{negative\ prices}$$

Formula in which:

- *P* is the installed power

- *T* is the reference electricity rate in EUR / MWh determined by the candidate when submitting his offer,

- $n_{negative\ prices}$ is the number of hours during which the "peak spot prices" were strictly negative beyond the first 15 hours of negative "peak spot prices" for the calendar year and during which the installation did not provide energy. This number of hours is limited annually by the following condition:

$$n_{negative\ prices} < 1600 - \frac{\sum_{i=1}^{12} E_i}{P}$$

[E_i is the sum over the hours at positive or zero spot prices for next day delivery on the French organized electricity supply market platform, electricity volumes allocated by the network manager, where appropriate by a loss calculation formula or a settlement agreement, at the balance perimeter designated by the producer for the production of his installation on the month i off corrections, in calculating the difference in scope under the rules referred to in Article L.321-14, linked, where appropriate, to the participation of installations to the services necessary for the operation of the network or adjustment mechanism. These volumes are net of auxiliary consumption necessary for the operation of the installation during production]

As mentioned in paragraphs (48) and (49), measures are also in place to prevent producers from being induced to produce when electricity prices are negative. Indeed, the calculation of the reference market price used for the calculation of the premium does not take into account the hours during which the prices were negative, giving a global incentive for the industry not to produce during hours of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the costs of sector production) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the volumes of electricity allocated by the network operator for hours at a positive or zero spot price on the EPEX Spot SE electricity exchange for the France zone.

As mentioned above (see paragraphs (48) and (49)), support schemes provide for compensation in the event of a significant recurrence of negative prices. Since the payment is known in advance and accessible to all candidates, the latter will integrate the compensation mechanism for a significant number of negative price hours into the price they propose at the end of the tender procedure. Moreover, the ceiling on the number of hours of payment to the sector ensures that there is no situation of overcompensation in the case of prolonged negative price periods.

Source: pg11-12, 22 and 25 of European Commission Decision Document, Object: State aid SA.51190 (2018 / N) - France- Support by tender for the development of electricity production from solar energy in the Department of Haut-Rhin, C (2019) 317 final, https://ec.europa.eu/competition/state_aid/cases/274758/274758_2049151_113_2.pdf

5.11.7 SA.48642, Support by tender for the development of Innovative electricity generation from solar energy

Treatment of negative market prices

Only energy produced during positive or zero spot price hours may give entitlement to the payment of the additional remuneration. However a compensatory measure has been put in place for the installations that do not produce during negative price hours beyond a certain number of hours of negative prices recorded over the year. In application of Article R. 314-39 of the Code of Energy, over a calendar year, beyond the first 15 hours of spot prices negative for overnight delivery, recorded on the EPEX electricity exchange Spot SE for the France zone between 8:00 and 20:00, called "spot peak price", the Compensation supplement is increased by the following premium:

$$Premium_{negative\ price} = 0.5 \times P \times T \times n_{negative\ prices}$$

Formula in which:

- P is the installed power

- T is the reference electricity rate in EUR / MWh determined by the candidate when submitting his offer,

- $n_{negative\ prices}$ is the number of hours during which the "peak spot prices" were strictly negative beyond the first 15 hours of negative "peak spot prices" for the calendar year and during which the installation did not provide energy. This number of hours is limited annually by the following condition:

$$n_{negative\ prices} < 1600 - \frac{\sum_{i=1}^{12} E_i}{P}$$

[E_i is the sum over the hours at positive or zero spot prices ("spot price") for next day delivery on the French organized electricity market platform, electricity volumes allocated by the system operator, where appropriate by a loss calculation or accounting formula, at the balancing perimeter designated by the producer for the production of his installation in the month i . These volumes are net of auxiliary consumption necessary for the operation of the installation in the production period.]

The tender specifications provide for the payment of the installations that did not produce during negative price hours to compensate for some of the loss of earnings related to this lower production beyond a certain number of hours of negative prices. In any case, the facilities that will produce at times of negative prices will not receive any compensation corresponding to this production.

The ceiling of hours, beyond which compensation is paid, is fixed at 15 hours (in equivalent full power hours), corresponding to 1% of the hours of operation for the solar industry.

This premium, paid in the event of non-production during hours of negative prices, will be weighted by a coefficient of 0.5, representative of the load ratio of during the hours of negative prices concerned. In addition, an installation will not be compensated in case of negative prices at night (between 8pm and 8am) in order not to pay for an installation that would not be able to produce.

In order to ensure that this bonus cannot lead to overpayment of projects, the number of negative price hours giving rise to the premium shall be limited so that the installation cannot receive a remuneration corresponding to more than 1,600 hours of annual operation.

As indicated in section 2.7.3, measures are also put in place to prevent producers from being induced to produce electricity at negative prices. Indeed, the calculation of the reference market price used for the calculation of the premium does not take into account the hours during which the prices were negative, giving a global incentive for the industry not to produce during hours of negative prices since in these cases the premium obtained will be less than the difference between the reference tariff (which reflects the costs of sector production) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for the volumes of electricity allocated by the network operator for hours at a positive or zero spot price on the EPEX Spot SE electricity exchange for the France zone.

As indicated in section 2.7.3, the aid scheme provides for compensation in case of significant recurrence of negative prices. Since the payment is known in advance and accessible to all candidates, they will integrate the compensation mechanism for a significant number of negative prices into the price proposed at the end of the tendering procedure. Moreover, capping the number of hours payment ensures there is no overcompensation situation in the event of a period prolonged negative prices.

Source: pg11-12, pg20 and pg23, of Object: State aid SA.48642 (2018 / NN) – France Support by tender for the development of innovative electricity generation from solar energy, C (2018) 7753 final, https://ec.europa.eu/competition/state_aid/cases/275755/275755_2049031_99_2.pdf

5.11.8 SA.43485, Support Mechanism for Electricity Generation Facilities using biogas from wastewater treatment

No additional remuneration is paid for delivery in the event of strictly negative spot prices recorded on the EPEX Spot SE electricity exchange for the France zone. However, beyond the first 70 hours, consecutive or not, of strictly negative spot prices recorded on the EPEX Spot SE electricity exchange for the France zone an installation that does not produce during the negative price hours receives a premium equal to:

$$Premium_{negative\ prices} = P_{max}\ x\ T\ x\ n_{negative\ prices}$$

formula in which:

• T is the reference tariff defined in paragraph (38) [in euro per MWh]

• $n_{negative\ prices}$ is the number of hours during which the spot prices for delivery recorded on the EPEX Spot SE electricity exchange for the France zone were negative beyond the first 70 hours and during which installation did not provide energy. Thus the installation will receive no remuneration for approximately 1% of the time of expected operation. France has however provided that this compensation can only be paid within the limit of a certain number of reference operating hours over the year for the installation (i.e. 6,000 hours).

France has implemented a mechanism to prevent producers being encouraged to produce electricity at negative prices. In the calculation of the reference market price used for the calculation of the premium the hours during which the prices were negative are not taken into account, which gives a global incentive for the industry not to produce at times of negative prices, since in these cases the premium obtained will be lower than the difference between the reference tariff (which reflects the production costs of the sector) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for electricity volumes allocated by the network operator during hours at a positive or zero spot price on the EPEX Spot SE electricity exchange for the France zone.

Remuneration is provided for installations which have not produced after 70 hours when the quoted price of electricity is negative in order to compensate for a part of the loss of pay related to this reduced production. The purpose of this measure is to reduce uncertainty about the number of negative price hours in the coming years. To date, the number of negative price hours in France has never exceeded 15 hours per year. The threshold 70 hours corresponds to approximately 1.17% of the annual operating time expected for an installation of the STEP industry, i.e. 6000 hours. Above the threshold of

70 hours the production facility will receive a premium whose parameters are presented in paragraph (44).

This provision does not lead to a risk of overcompensation as compensation can only be paid within the limit of the reference number of hours of operation for an installation during a year. In other words, once an installation has received support (whether as a supplement compensation or compensation for non-production beyond 70 hours of negative prices) for a number of full power equivalent hours equal to the reference number of operating hours (6000 hours) used to determine the level of support, the facility will no longer receive compensation.

Source: pg9-10 and pg19, European Commission Decision Document, Object: State aid SA.43485 (2015 / N) – France Support Mechanism for Electricity Generation Facilities using biogas from wastewater treatment. https://ec.europa.eu/competition/state_aid/cases/261160/ 261160_1900821_256_2.pdf

5.11.9 SA.46898, Support Mechanism for Electricity Generation Facilities using the biogas produced by methanisation and the installations of electricity production using energy extracted from deposits geothermal

It follows from the definition of E_{elec} that no additional remuneration is paid in the event of strictly negative spot prices recorded on the EPEX Spot SE electricity exchange for the France zone. However, beyond the first 70 hours, consecutive or not, of spot prices that are strictly negative recorded on the EPEX Spot SE electricity exchange for the France zone an installation that does not produce during the negative price hours receives a premium equal to:

$$Premium_{negative\ prices} = P_{max} \times T \times n_{negative\ prices}$$

Formula in which:

T is the reference rate defined in subsection (65).

$n_{negative\ prices}$ is the number of hours during which spot prices observed on the EPEX Spot SE electricity exchange for the France zone were negative beyond the first 70 hours and during which the installation was not delivering energy. Thus the installation will not receive any remuneration during a maximum 9% of the expected operating time. France, however, has planned that compensation can only be paid within the limit of a number of reference hours of operation over the year of the installation (i.e. 8,000 hours in the case of geothermal energy).

[E_{elec} (in MWh) is the sum over the hours at positive or zero spot prices on the EPEX Spot SE electricity exchange for the France zone, volumes allocated by the network operator, where appropriate via a loss calculation or settlement agreement, at the balance perimeter designated by the producer for the production of his installation. These volumes are net of the auxiliary consumption necessary for the functioning of the installation]

No incentive to produce in the case of negative prices

France has also implemented a mechanism to prevent producers from being encouraged to produce electricity at negative prices. The calculation of the reference market price used for the calculation of the premium does not take into account the hours during which the prices were negative, which gives a global incentive for the industry not to produce at times of negative prices, since in these cases the premium obtained will be lower than the difference between the reference tariff (which reflects the production costs of the sector) and the market price. In addition, it is explicitly provided that the additional remuneration is only paid for electricity volumes allocated by the network operator for hours at a positive or zero spot price on the EPEX Spot SE electricity exchange for the France zone.

(150) Remuneration is provided for installations which have not produced electricity beyond the first 70 hours where the electricity spot price is negative in order to compensate for a part of the loss of pay related to this reduced production. The purpose of this measure is to reduce uncertainty about the number of negative price hours in the coming years. To date, the number of negative price hours in France has never exceeded 15 hours per year. The threshold 70 hours corresponds to approximately 9% of the annual operating time for a geothermal installation.

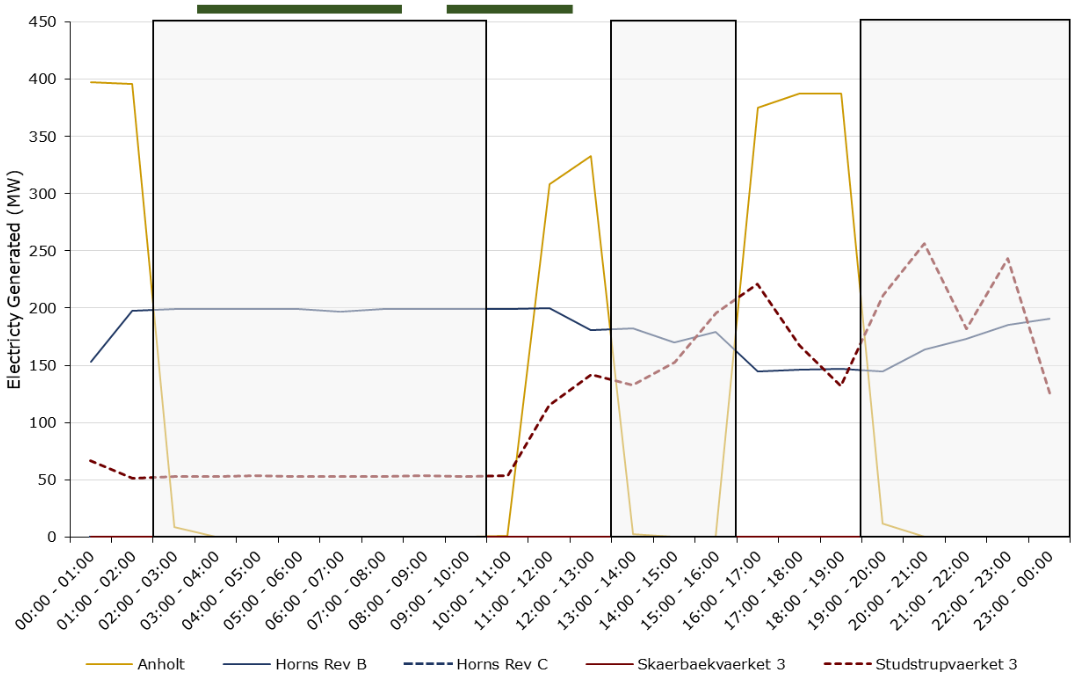
Beyond the 70 hour threshold, the production facility will receive a premium based on the parameters in paragraph (71). The remuneration received according to this formula cannot exceed the remuneration that an installation would have received in normal circumstances.

It does not lead to a risk of overcompensation as the compensation can only be paid within the limited number of reference operating hours over the year for the installation. Once the facility has received support over a number of hours equivalent to full power for the number of reference hours of operation (8,000 hours) used to determine the level of support, the installation will no longer receive compensation.

Source: pg 17-18 and pg30-31, European Commission decision document, Object: State aid SA.46898 (2016 / N) – France Support Mechanism for Electricity Generation Facilities using the biogas produced by methanisation and the installations of electricity production using energy extracted from geothermal deposits, https://ec.europa.eu/competition/state_aid/cases/267053/267053_1871207_76_2.pdf

Annex 5.12 – Additional analysis of RES generation during hours of negative day ahead electricity prices

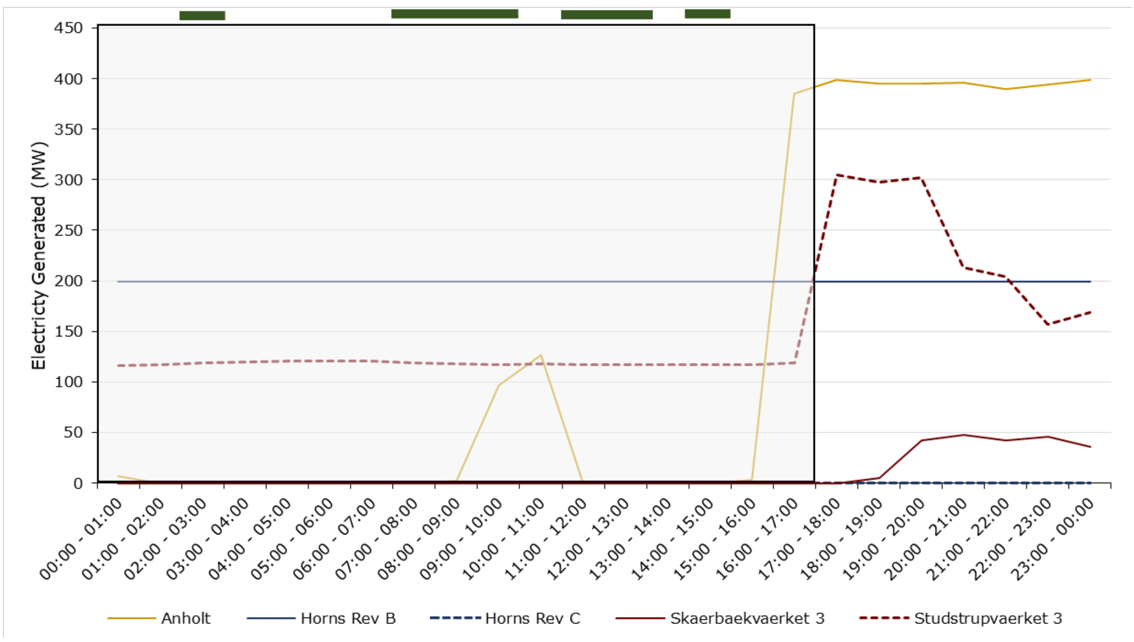
Figure A5.12.1 Hourly generation output (MW) of the case study Denmark Market 1 RES plants on 1 January 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

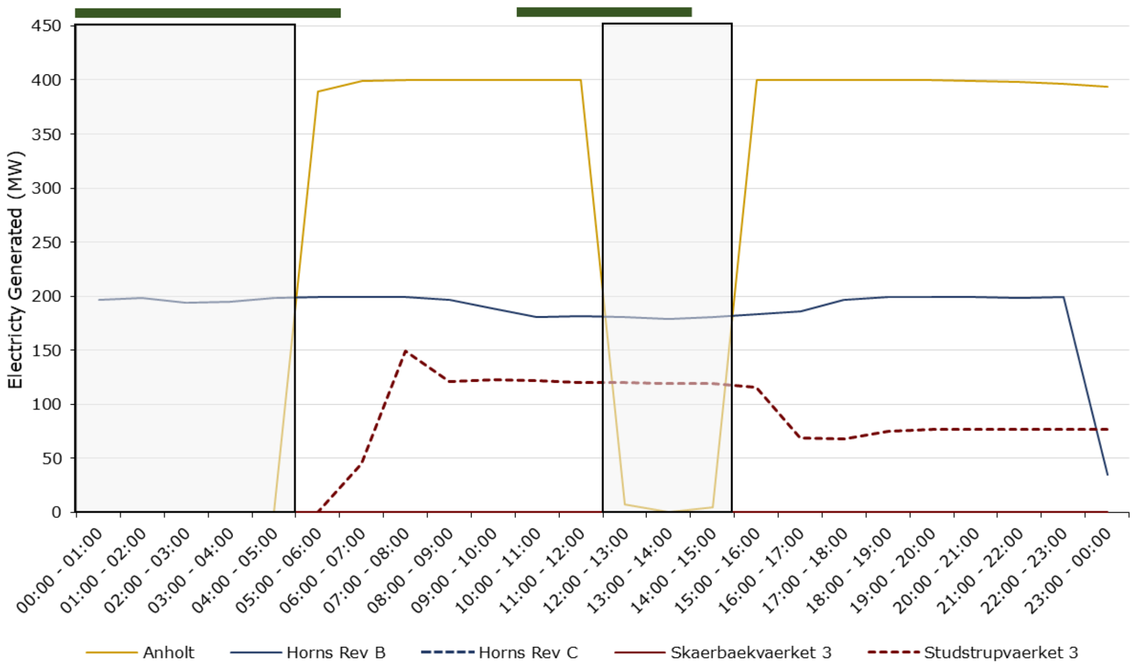
Figure A5.12.2 Hourly generation output (MW) of the case study Denmark Market 1 RES plants on 17 March 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

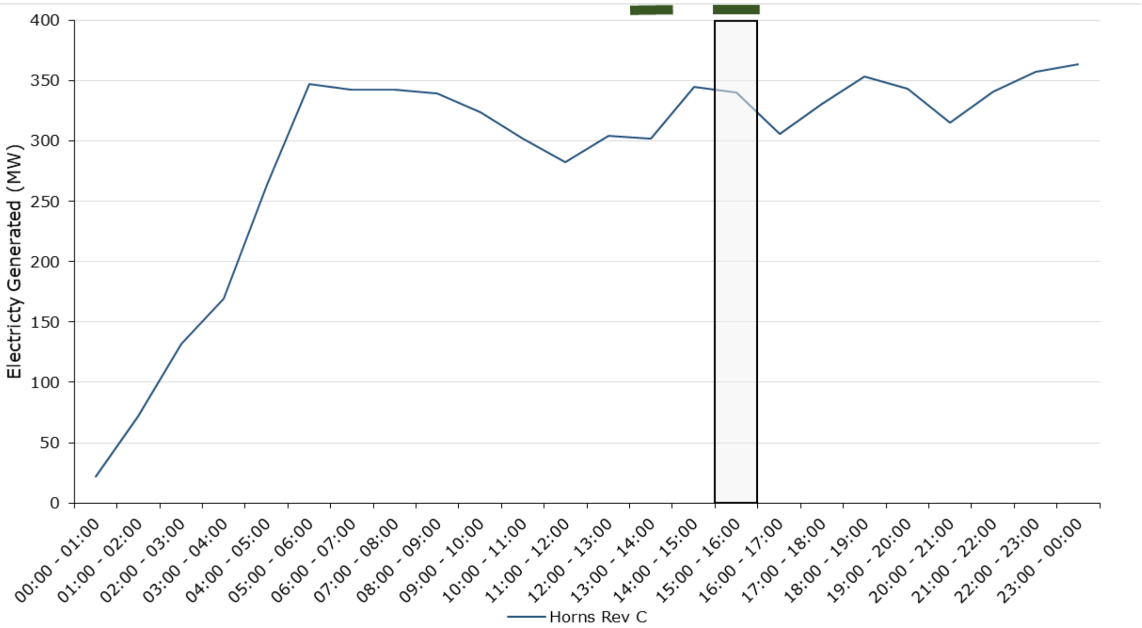
Figure A5.12.3 Hourly generation output (MW) of the case study Denmark Market 1 RES plants on 23 April 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

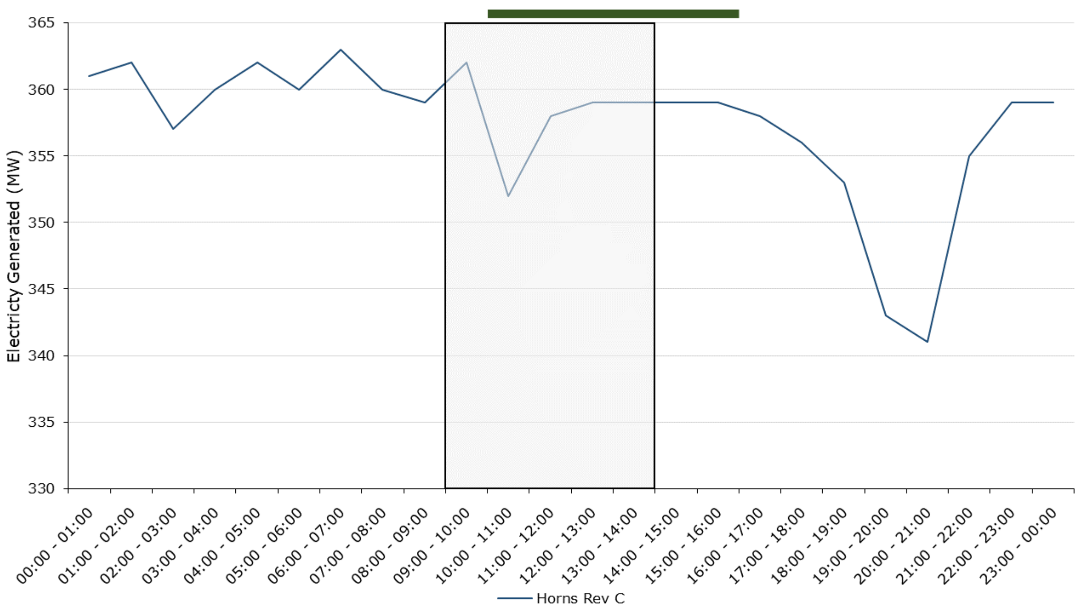
Figure A5.12.4 Hourly generation output (MW) of the Horns Rev C offshore windfarm on 30 June 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

Figure A5.12.5 Hourly generation output (MW) of the Horns Rev C offshore windfarm on 11 August 2019

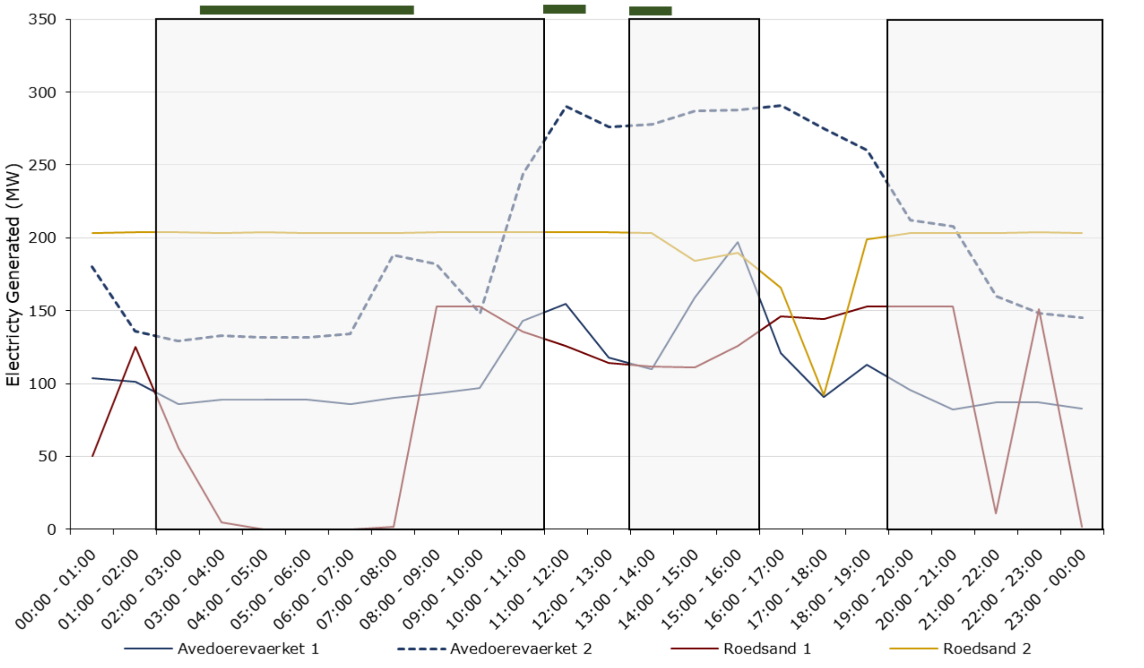


Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market[241] are illustrated by the thick green line.

[241] *Intraday price data was missing for 17:00-18:00.*

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

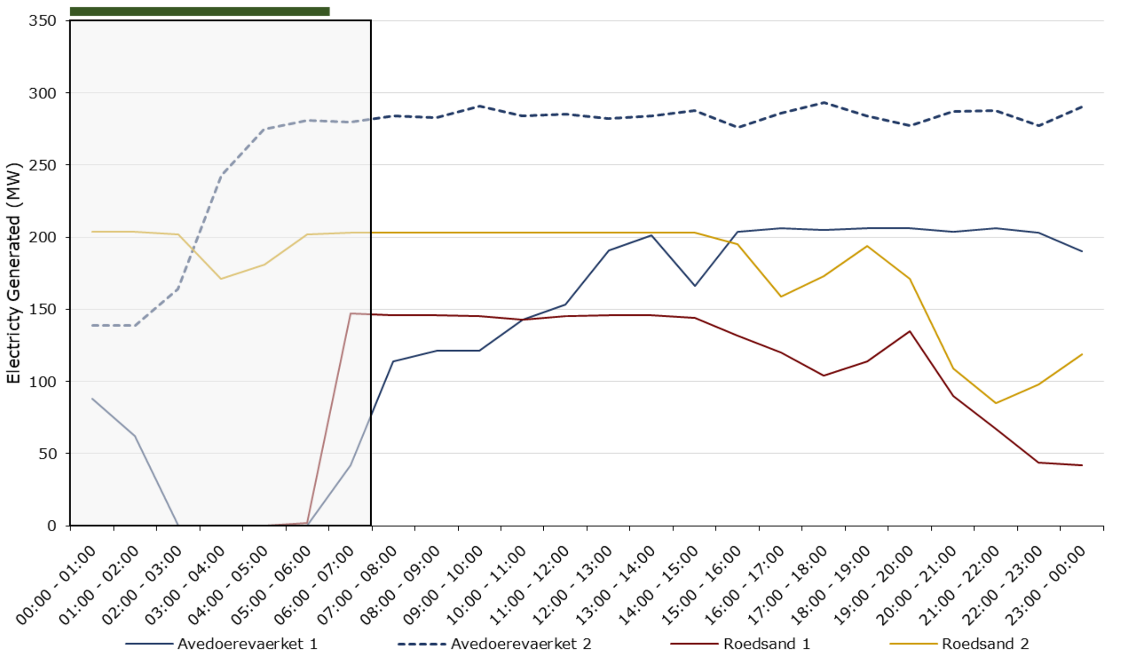
Figure A5.12.6 Hourly generation output (MW) of the case study Denmark Market 2 RES plants on 1 January 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

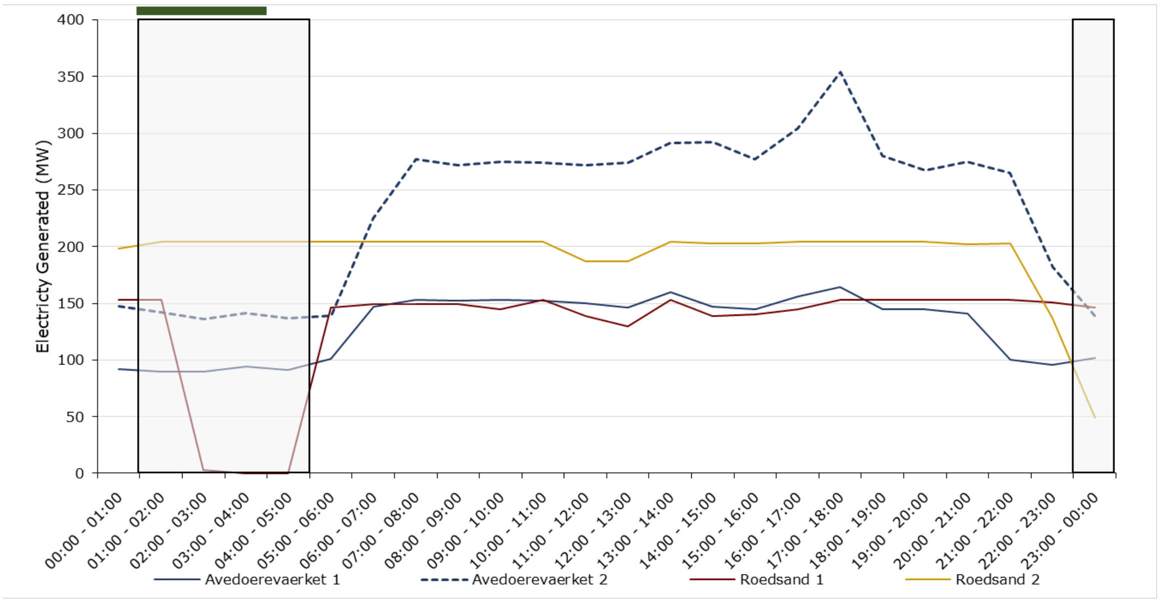
Figure A5.12.7 Hourly generation output (MW) of the case study Denmark Market 2 RES plants on 2 January 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market[242] are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

Figure A5.12.8 Hourly generation output (MW) of the case study Denmark Market 2 RES plants on 4 March 2019

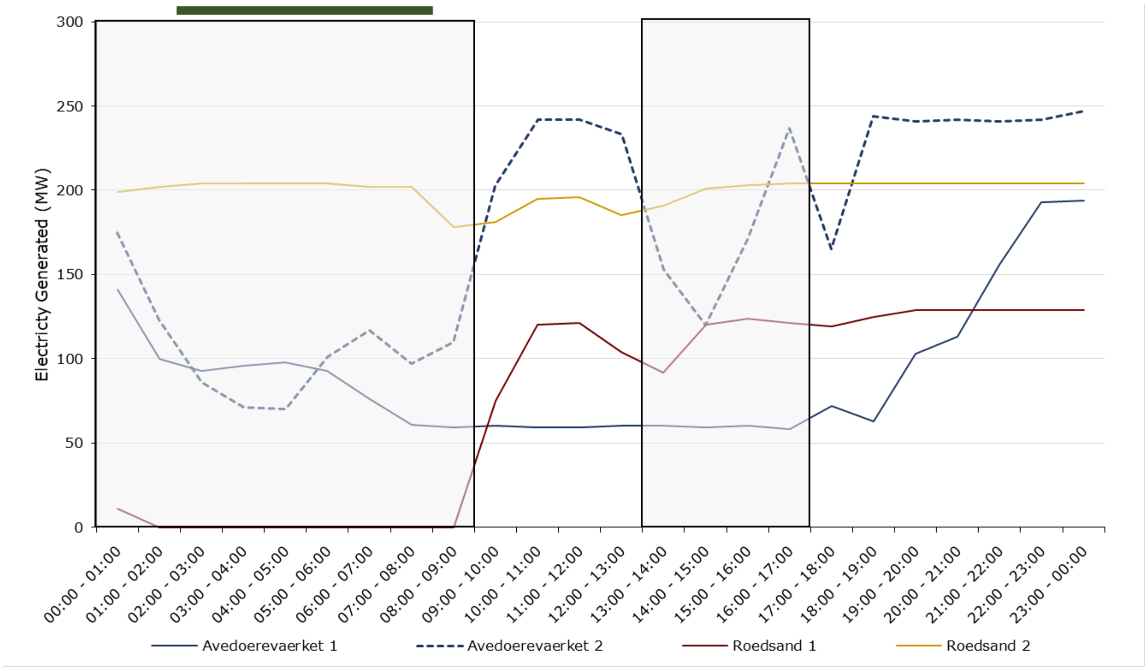


Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market[243] are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

[242] *Intraday price data was missing for 14:00-15:00.*
[243] *Intraday price data was missing for 04:00-05:00.*

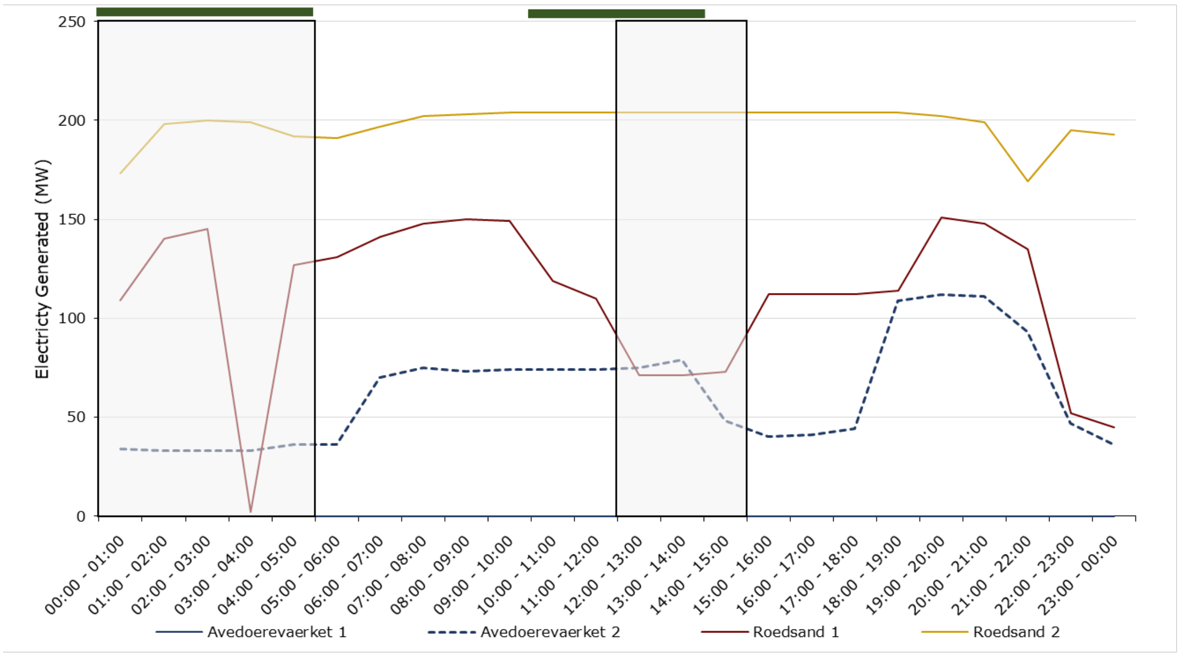
Figure A5.12.9 Hourly generation output (MW) of the case study Denmark Market 2 RES plants on 17 March 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

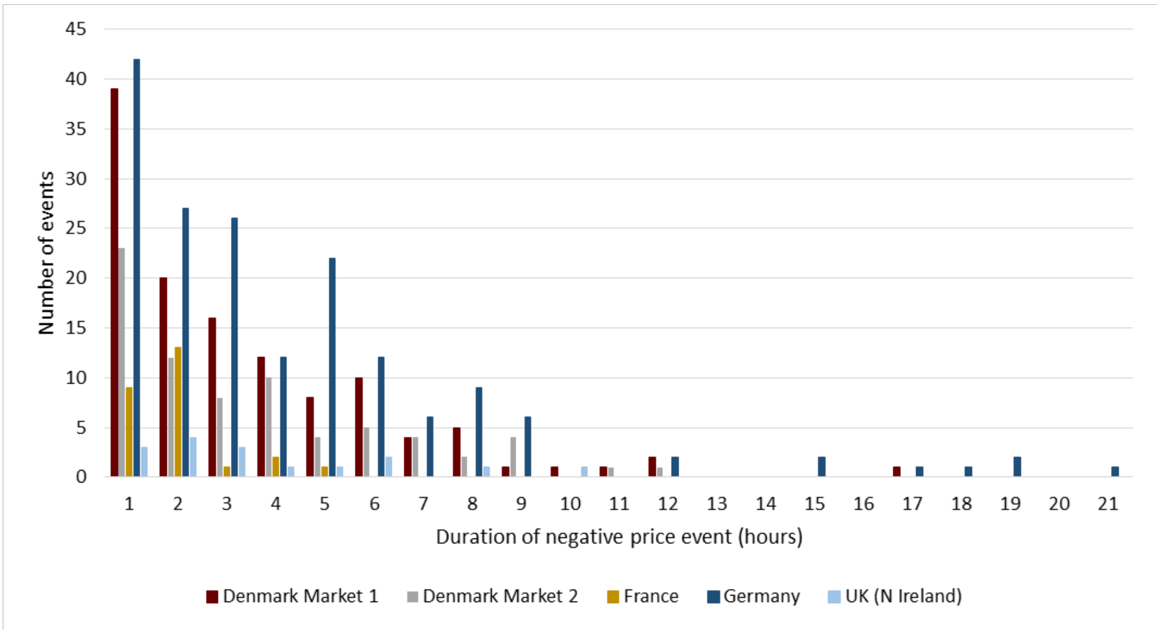
Figure A5.12.10 Hourly generation output (MW) of the case study Denmark Market 2 RES plants on 23 April 2019



Note: Negative day ahead price periods (inclusive of prices of zero) are illustrated by the shaded box. Negative price periods (inclusive of prices of zero) on the intraday market are illustrated by the thick green line.

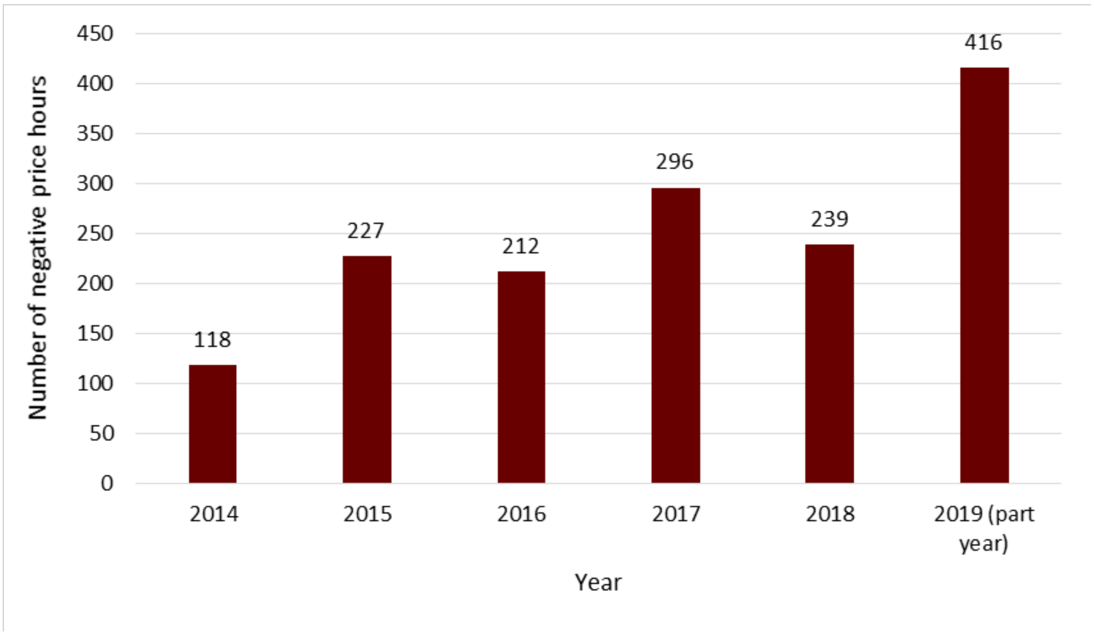
Source: Day ahead prices and generation data from the entso-e transparency platform, intraday prices from Nord Pool.

Figure A5.12.11 Number of negative day ahead price events of different durations for sampled Member States, 2014-2019



Source: Underlying data from the entso-e transparency platform, plus additional data from the Elspot market (Denmark), the EPEX spot market (France and Germany).

Figure A5.12.12 Total number of negative day ahead price hours across sampled Member States, 2014-2019



Source: Underlying data from the entso-e transparency platform, plus additional data from the Elspot market (Denmark), the epexspot market (France and Germany).

Annex 6.1 – 2020 RES targets and policies exceeding them

(see accompanying Excel file)

Annex 6.2 – Details on the rules covering reductions to RES and other charges

(see accompanying Excel file)

Annex 6.3 – Estimated proportion of electricity bills devoted to RES charges

(see accompanying Excel file)

Annex 6.4 – Estimated proportion of electricity bills devoted to ‘other charges’

(see accompanying Excel file)

Annex 6.5 – Tables for Section 3.1 to 3.5

Table A6.5.1: RES schemes covered by EEAG and GBER decisions which involve competitively awarded operating aid

Member State	RES Schemes covered by EEAG decisions and involving competitively awarded operating aid (state aid case number)	RES Schemes covered by GBER decisions and involving competitively awarded operating aid (state aid case number)
Denmark	SA.36204, SA.44626, SA.49918	No relevant case
Estonia	SA.36023, SA.47354	No relevant case
Finland	No relevant case	SA.51525
France	SA.46259, SA.41528, SA.47753, SA.46552, SA.48238, SA.48066, SA.49181, SA.47752, SA.46698, SA.49180, SA.51190, SA.48642	No relevant case
Germany	SA.38632, SA.45461	No relevant case
Greece	SA.44666, SA.48143	No relevant case
Hungary	SA.44076	SA.47331
Italy	SA.43756, SA.53347	No relevant case
Lithuania	SA.45765	No relevant case
Luxembourg	SA.37232, SA.43128	No relevant case
Malta	SA.43995	No relevant case
Netherlands	SA.39399, SA.43442, SA.46960	No relevant case
Poland	SA.43697	No relevant case
Portugal	SA.41694	No relevant case
Slovenia	SA.41998	No relevant case
Spain	SA.40348	No relevant case
UK	SA.36196, SA.47267, SA.52960	SA.39216, SA.39316, SA.43144

Table A6.5.2: RES schemes covered by EEAG and GBER exemptions which involve operating aid

Member State	RES Schemes covered by EEAG exemptions and involving	RES Schemes covered by GBER exemptions and

	operating aid (state aid case number)	involving operating aid (state aid case number)
Denmark	SA.36204, SA.37122, SA.42498, SA.50715	SA.47403, SA.47404, SA.47408, SA.47440, SA.47441, SA.50264, SA.50266, SA.50279, SA.51529
Estonia	SA.47354	SA.49198
Finland	No relevant case	SA.46069, SA.51525
France	SA.40349, SA.41528, SA.43485, SA.43780, SA.46259, SA.46552, SA.46655, SA.46898, SA.47205, SA.47623, SA.47752, SA.47753, SA.47957, SA.48066, SA.48238, SA.48642, SA.51190	SA.43057
Germany	SA.38632, SA.45461, SA.48327	No relevant case
Greece	SA.44666, SA.48143	No relevant case
Hungary	SA.44076	No relevant case
Italy	SA.43756, SA.53347	SA.40279, SA.53666
Lithuania[244]	No relevant case	No relevant case
Luxembourg	SA.37232, SA.43128, SA.48601	No relevant case
Malta	SA.43995	SA.42970, SA.51961
Netherlands	SA.46960	SA.48966
Poland	SA.43697	SA.51852
Portugal	SA.41694	No relevant case
Slovenia	SA.41998	No relevant case
Spain	SA.40348	SA.42837, SA.51070
UK	No relevant case	SA.39216, SA.39316, SA.40460, SA.43144, SA.43600, SA.49638, SA.52852

[244] *Lithuania is included in this table as it was part of the Q1 sample, however, it does not have scheme with a relevant exemption.*

Table A6.5.3: Combined heat and power schemes selected for data collection

Member State	CHP Schemes (state aid case number)
Belgium	SA.46013
Czech Republic	SA.38701, SA.45768
Denmark	SA.44922
France	SA.43719
Germany	SA.42393
Lithuania	SA.41539
Netherlands	SA.39399
Poland	SA.36518, SA.51192

Table A6.5.4: Electrical and thermal outputs of example CHP plants used in modelling of aid per unit of installed capacity

Plant Title	Net Electricial Output (kW)	Thermal Output (kW)	Primary Energy Saving (natural gas, post-2016)[245]	High efficiency co-generation?
Internal Combustion Engine A	100	196	10.68%	Yes
Internal Combustion Engine B	633	815	13.91%	Yes
Internal Combustion Engine C	1,121	1,266	14.73%	Yes
Internal Combustion Engine D	3,326	3,126	16.55%	Yes
Internal Combustion Engine E	9,941	7,857	15.75%	Yes
Gas Turbine A	3,304	5,760	-7.35%	No
Gas Turbine B	7,038	10,092	2.11%	No
Gas Turbine C	9,950	15,340	0.03%	No

[245] *The primary energy savings utilize the standard reference efficiency values for separate heat and electricity plants when fueled by natural gas and constructed after 2016, respectively 87.0% and 53.0%.*

Gas Turbine D	20,336	22,801	5.27%	No
Gas Turbine E	44,488	40,645	5.32%	No
Backpressure Steam Turbine A	500	5,844	-4.06%	No
Backpressure Steam Turbine B	3,000	45,624	-5.06%	No
Backpressure Steam Turbine C	15,000	148,484	-3.12%	No
Microturbine A	28.0	61.0	1.15%	Yes
Microturbine B	61.0	119.8	3.16%	Yes
Microturbine C	190.0	258.9	-2.64%	No
Microturbine D	240.0	375.6	1.44%	Yes
Microturbine E	320.0	450.2	3.87%	Yes
Plant Title	**Net Electricial Output (kW)**	**Thermal Output (kW)**	**Primary Energy Saving (natural gas, post-2016)**	**High efficiency co-generation?**
Microturbine F	950.0	1,299.0	-2.49%	No
Fuel Cell A	0.7	1.0	19.54%	Yes
Fuel Cell B	1.5	0.5	20.10%	Yes
Fuel Cell C	300.0	223.9	22.23%	Yes
Fuel Cell D	400.0	548.0	15.57%	Yes
Fuel Cell E	1,400.0	1,296.3	20.37%	Yes

Table A6.5.5: Capacity mechanisms selected for data collection

Member State	Capacity Mechanism (state aid case number)
Belgium	SA.48648
France	SA.39621, SA.48490 and SA.40454
Germany	SA.43735
Greece	SA.48780 and SA.50152
Republic of Ireland	SA.44464

Poland	SA.46100
UK	SA.35980 and SA.44475

Table A6.5.6: Total number of hours of negative electricity prices observed on selected markets 1/1/14 to 4/9/19

Annex Number	Member State (Market)	Number of Hours of Negative Electricity Prices
5.1	Denmark (Market 1)	414
5.2	Denmark (Market 2)	264
5.3	France	51
5.4	Germany	720
5.5	Netherlands	2
5.6	UK (Great Britain)	0
5.7	UK (Northern Ireland)	59

Table A6.5.7: RES plants and days sampled to understand generation outputs around negative price events

Member State (Market)	Sampled Plants	Sampled Days
Denmark (Market 1)	Anholt – Wind Offshore Horns Rev B – Wind Offshore Horns Rev C[246] – Wind Offshore Skaerbaekvaerket 3 - Biomass Studstrupvaerket 3 – Biomass	1 January 2019 2 January 2019 17 March 2019 23 April 2019 30 June 2019[247] 10 August 2019 11 August 2018[17]

[246] This is the Horns Rev 3 wind farm (SA.40305) that the Commission requested be considered for inclusion in the sample. The two other possible wind farms proposed for sampling by the Commission (in SA.45974 and SA.43751) are still to be under development/construction at the time of writing.
[247] These two dates were added for the Horns Rev C plant due to no other dates with negative prices (apart from 10 August 2019) having the data for Horns Rev C on entso-e. These two dates were not chosen for the sampling of other plants due to the relatively small number of negative price hours on these days.

Member State (Market)	Sampled Plants	Sampled Days
Denmark (Market 2)[248]	Avedoerevaerket 1 - Biomass Avedoerevaerket 2 - Biomass Roedsand 1 – Wind Offshore Roedsand 2 – Wind Offshore	1 January 2019 2 January 2019 4 March 2019 17 March 2019 23 April 2019
France	Aigle 6 – Hydro Water Reservoir Chastang 3 – Hydro Run of River and Poundage Combe D'Aurieux 1 – Hydro Water Reservoir Montezic 2 – Hydro Pumped Storage Provence 4 Biomasse[249] - Biomass Revin 4 – Hydro Pumped Storage	1 January 2018 17 March 2019 12 May 2019 8 June 2019 23 June 2019
Germany	Koepchenwerk – Hydro Pumped Storage PSW Goldisthal PSS A – Hydro Pumped Storage Rheinkraftwerk Iffezheim – Hydro Run of River and Poundage Waldeck II M6 - Hydro Pumped Storage Wehr – Hydro Pumped Storage Wikinger_Prod – Wind Offshore	18 March 2018 21 May 2018 1 January 2019 17 March 2019 23 April 2019
Netherlands	Westereems 2 Tennet – Wind Onshore	2 June 2019
UK (Great Britain)	N/A	N/A
UK (Northern Ireland)	Lisahally - Biomass	9 February 2019 17 February 2019 13 March 2019

[248] *Only four RES plants were identified on entso-e for Denmark Market 2.*
[249] *Reflecting the Commission's request for sampling across technologies we initially selected this biomass plant for sampling, but its generating output was zero on all sampled days.*

Member State (Market)	Sampled Plants	Sampled Days
		14 March 2019 15 March 2019

Table A6.5.8: Degree to which RES charges involved manipulation or estimation

RES charges taken directly from legislation	RES charges involving manipulation of values in legislation	RES charges where an estimation methodology was required
Austria – Flat Rate	Croatia	Denmark
Austria – Green Subsidy	France	Greece (2018)
Estonia	Lithuania	Italy – Green Certificates
Germany	UK - CfD	Poland – CO scheme
Greece (2011-2017)	-	UK – RO
Italy - Levy	-	UK – FiT
Latvia	-	-
Slovakia	-	-
Slovenia	-	-
Poland - Surcharge	-	-
Romania	-	-

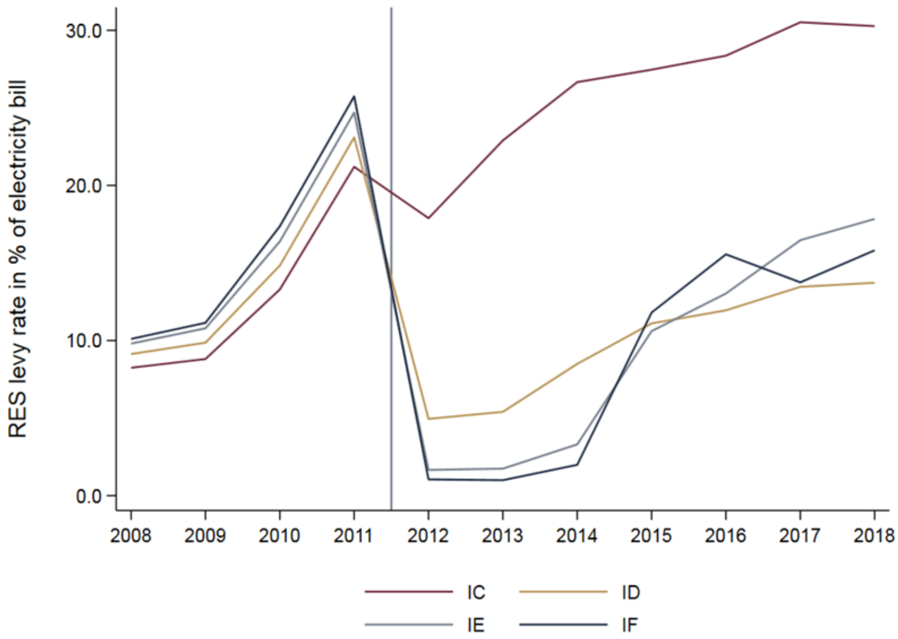
Table A6.5.9: Other charges approved by analogy selected for data collection

Member State	State Aid Case Number	Name of Charge	Name of Charge (English)
France	SA.36511	Contribution au service public de l'électricité (CSPE)	Contribution to the electricity utility
Germany	SA.42393	KWKG Umlage	KWKG Surcharge
Greece	SA.52413	Ειδικό Τέλος Μείωσης Εκπομπών Αερίων Ρύπων	ETMEAR Levy
Italy	SA.38635	Oneri generali di Sistema (A3)	General system Charges (A3)

Poland	SA.52530	Opłata kogeneracyjna	Cogeneration Charge
Slovakia	SA.50877	Jadrového fondu	The Nuclear Levy

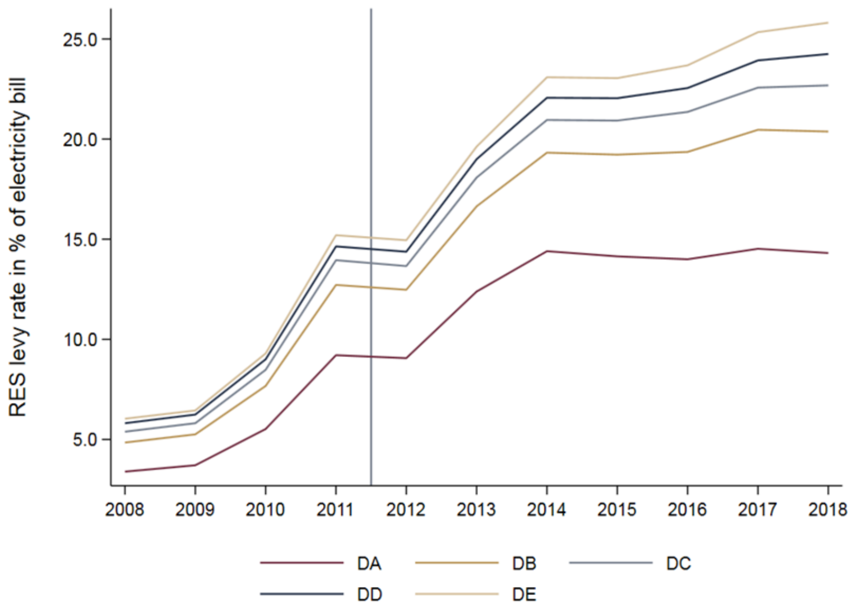
Annex 6.6 – Additional figures on RES targets and the proportion of electricity bills accounted for by RES and other charges

Figure A6.6.1: Percentage of the electricity bill accounted for by RES charges for example EIUs in Germany, rates per consumption band



Source: E.CA Economics based on data collected for Question 6. RES levy rates calculated by the University of East Anglia.

Figure 6.6.2: Percentage of the electricity bill accounted for by RES charges for example households in Germany, rates per consumption band



Source: E.CA Economics based on data collected for Question 6. RES levy rates calculated by the University of East Anglia.

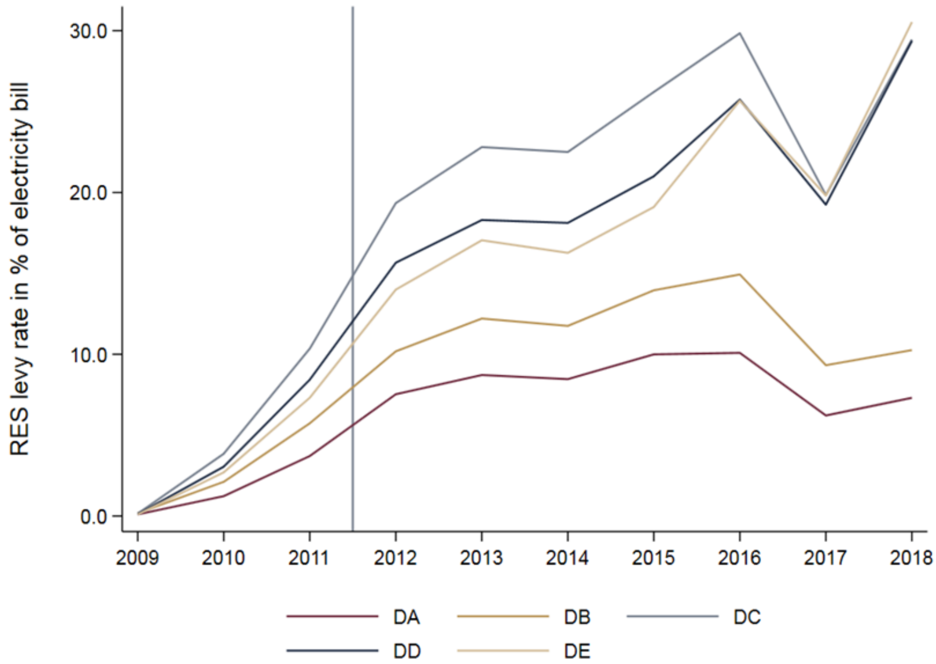
Figure A6.6.3: Percentage of the electricity bill accounted for by RES charges for example non-EIU commercial users in Germany, rates per consumption band

Source: E.CA Economics based on data collected for Question 6. RES levy rates calculated by the University of East Anglia.

Figure A6.6.4: Percentage of the electricity bill accounted for by RES charges for example EIUs in Italy, rates per consumption band

Source: E.CA Economics based on data collected for Question 6. RES levy rates calculated by the University of East Anglia.

Figure A6.6.5: Percentage of the electricity bill accounted for by RES charges for example households in Italy, rates per consumption band

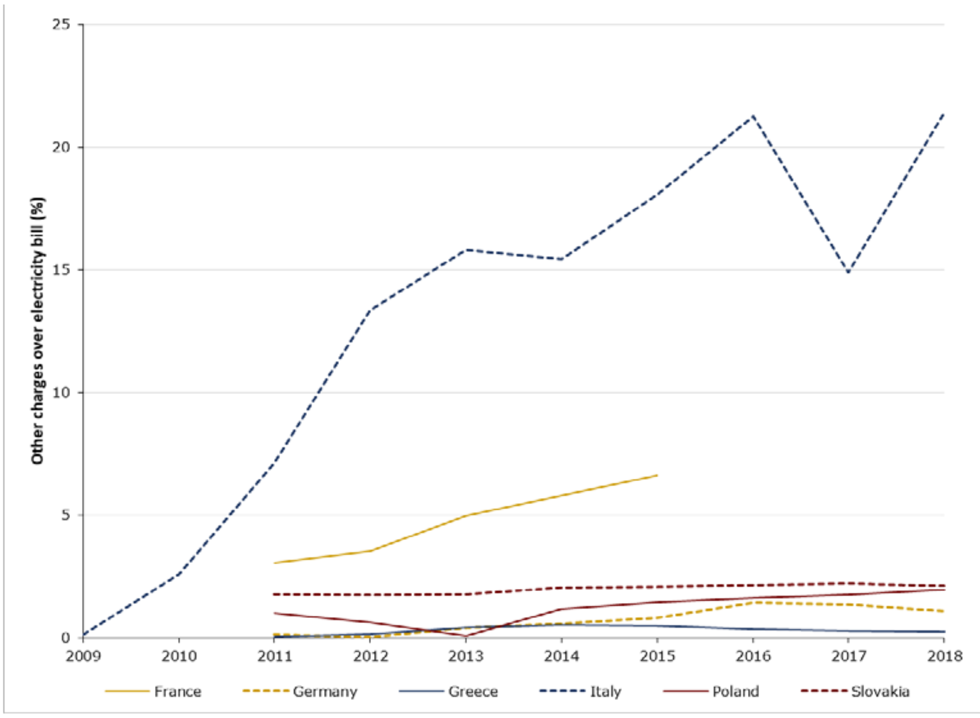


Source: E.CA Economics based on data collected for Question 6. RES levy rates calculated by the University of East Anglia.

Figure A6.6.6: Percentage of the electricity bill accounted for by RES charges for example non-EIU commercial users in Italy, rates per consumption band

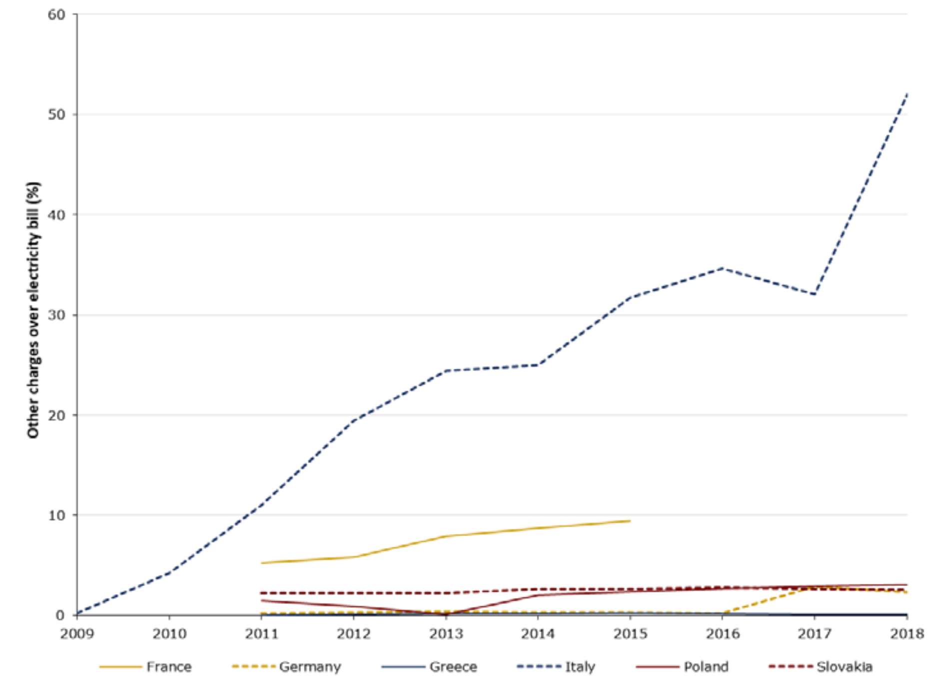
Source: E.CA Economics based on data collected for Question 6. RES levy rates calculated by the University of East Anglia.

Figure A6.6.7: Other charges approved by analogy over electricity bill by sampled Member States over time (percentage, averaged across all example household consumers)



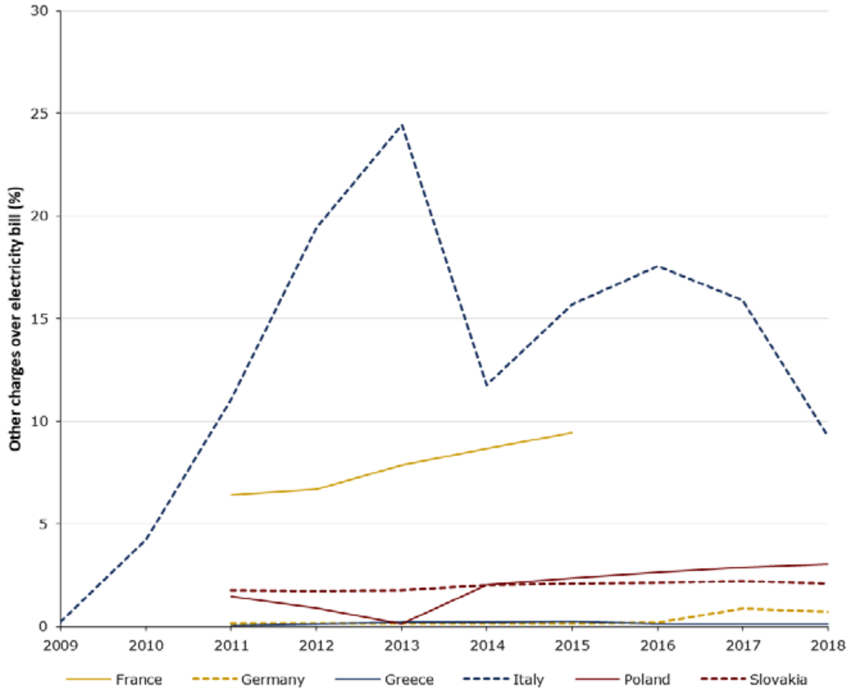
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A6.6.8: Other charges approved by analogy over electricity bill by sampled Member States over time (percentage, averaged across example non-energy intensive commercial consumers, consumption bands IC to IF)



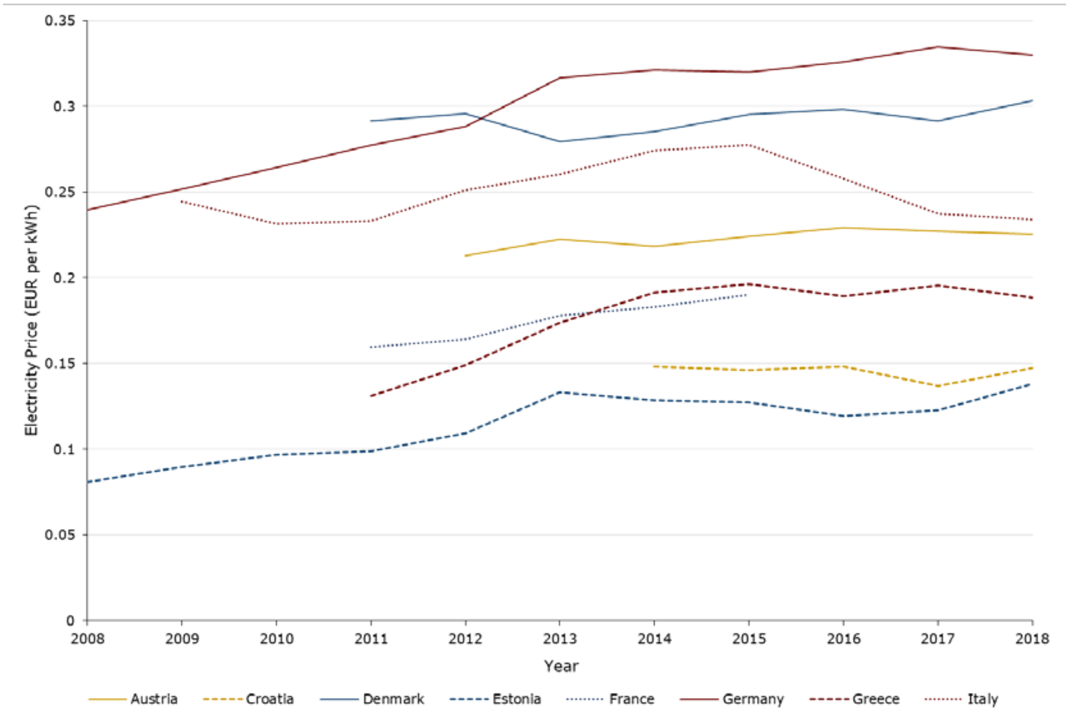
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A6.6.9: Other charges approved by analogy over electricity bill by sampled Member States over time (percentage, averaged across all example energy intensive commercial consumers)



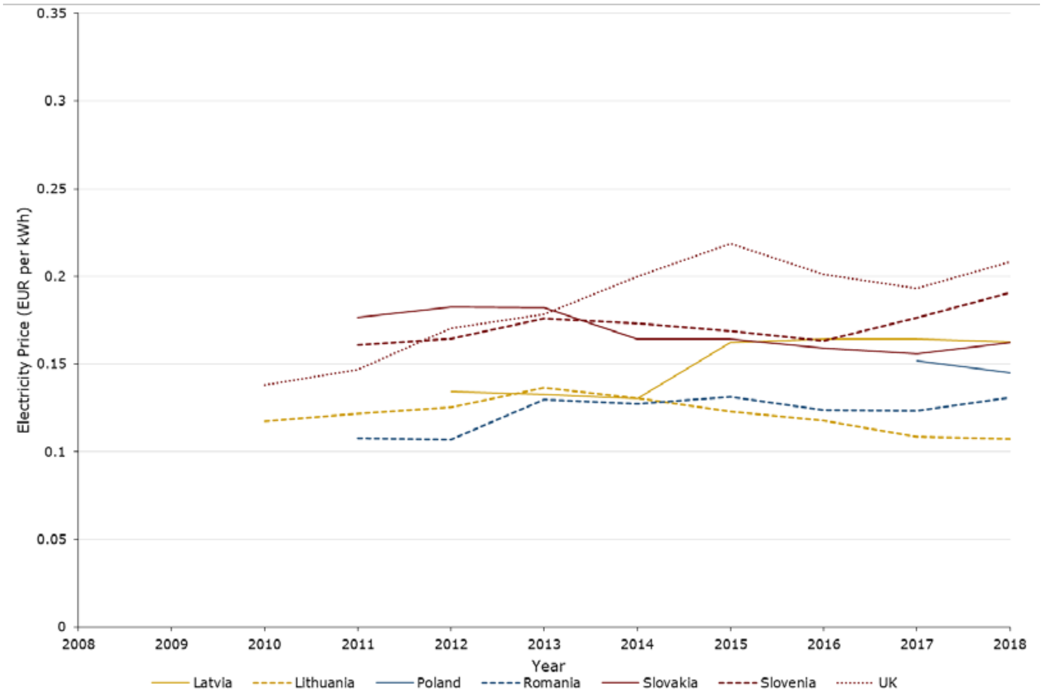
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A6.6.10: Electricity prices inclusive of all taxes and charges by sampled Member States over time (averaged across all example household consumers), Austria to Italy



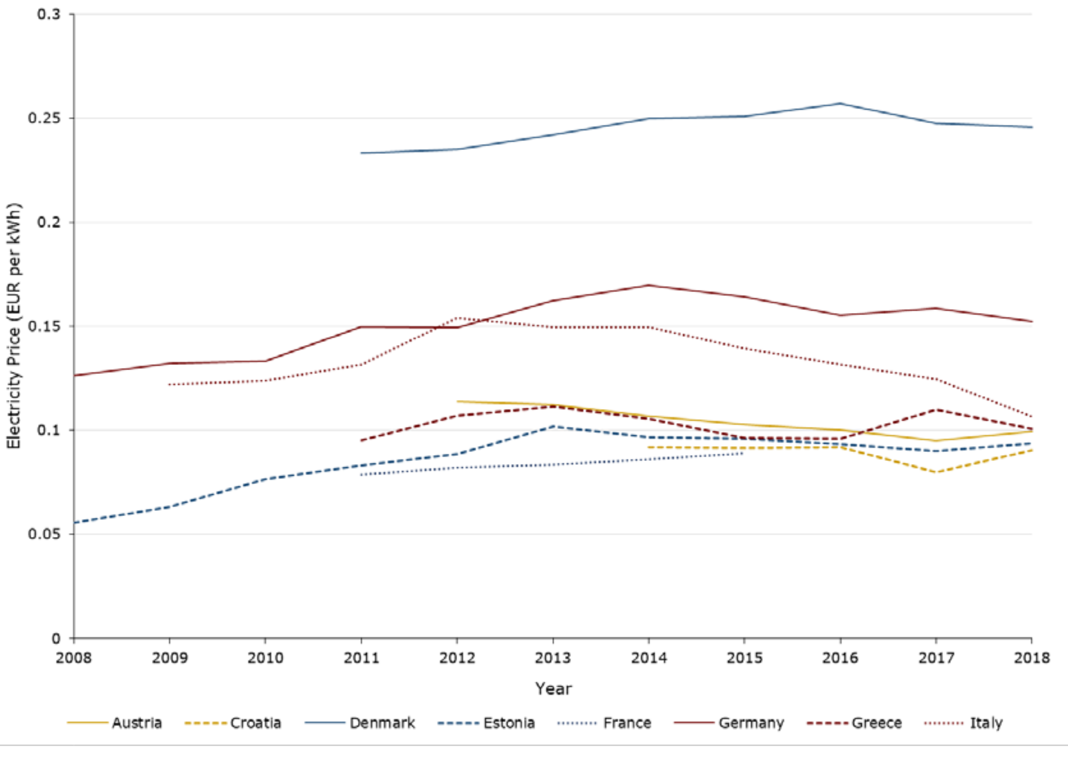
Source: Eurostat

Figure A6.6.11: Electricity prices inclusive of all taxes and charges by sampled Member States over time (averaged across all example household consumers), Latvia to the UK



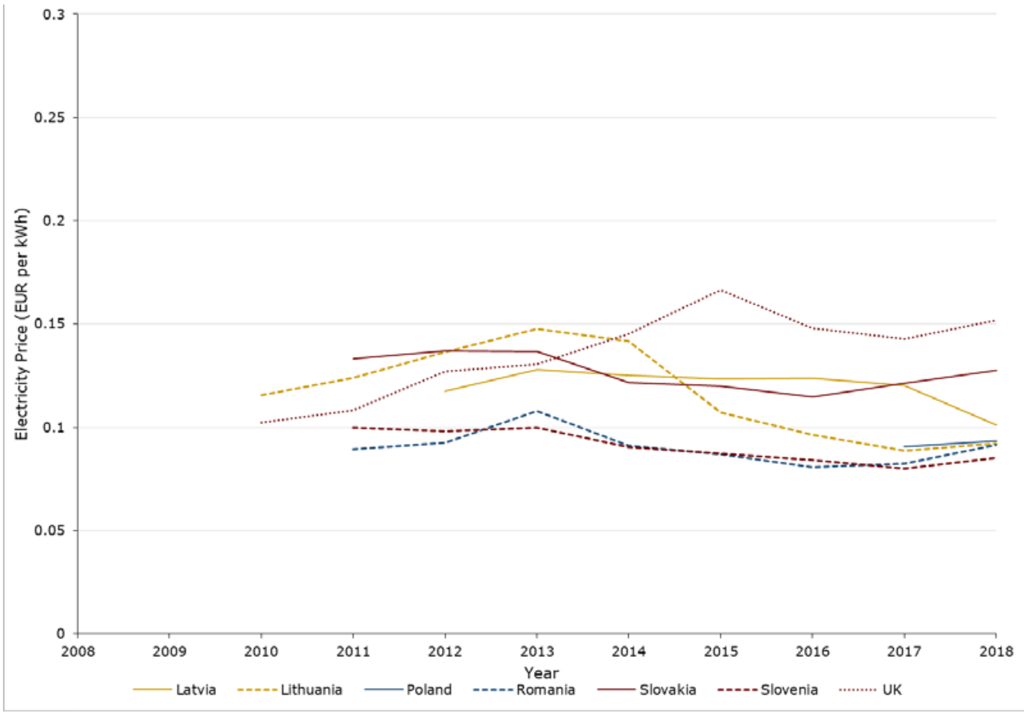
Source: Eurostat

Figure A6.6.12: Electricity prices inclusive of all taxes and charges by sampled Member States over time (averaged across all example commercial users), Austria to Italy



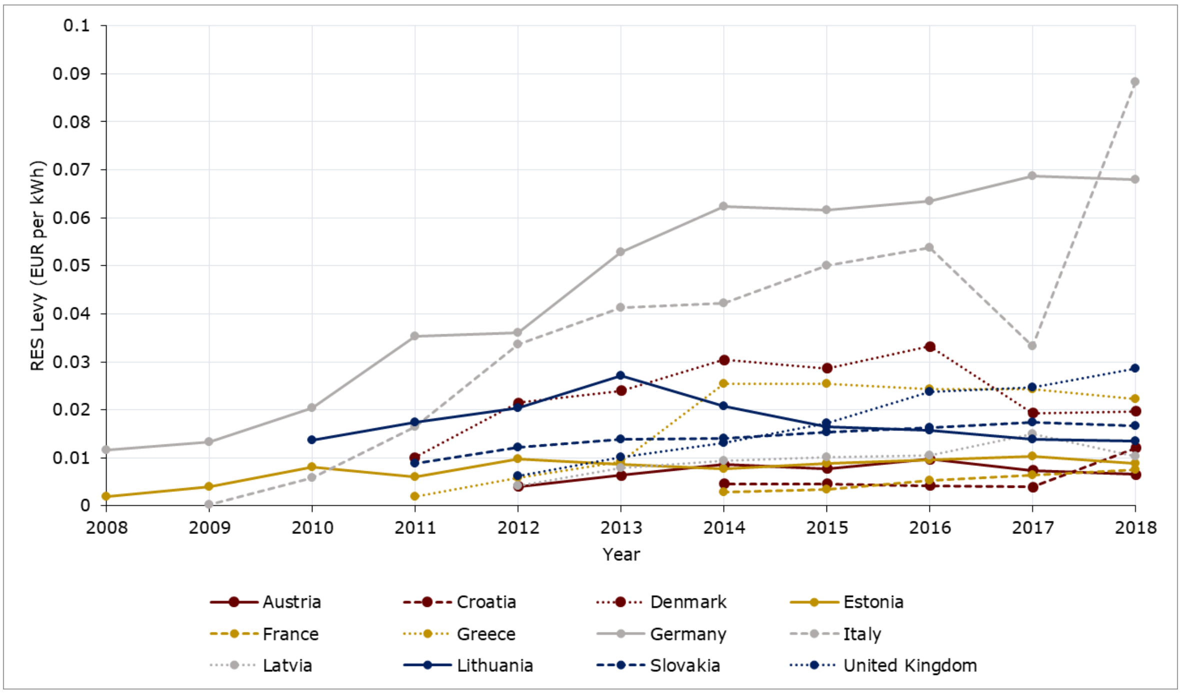
Source: Eurostat

Figure A6.6.13: Electricity prices inclusive of all taxes and charges by sampled Member States over time (averaged across all example commercial users), Austria to Italy



Source: Eurostat

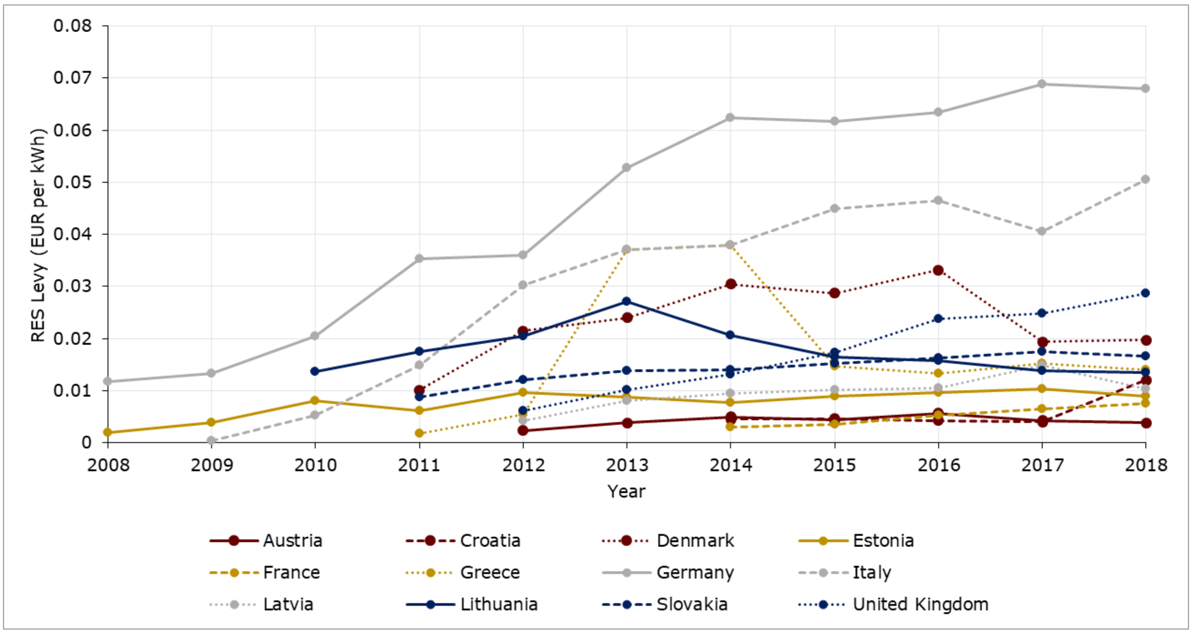
Figure A6.6.14: RES Levy rates by sampled Member States over time (averaged across all example household consumers)[250]



[250] *Excludes the fixed fee elements of charging systems.*

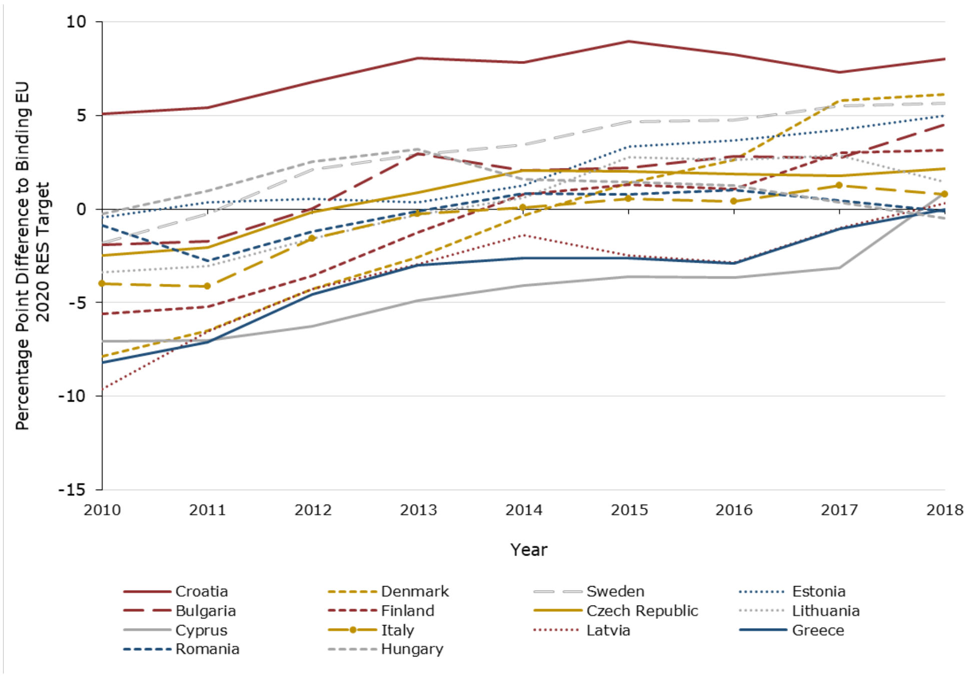
Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

Figure A6.6.15: RES Levy rates by sampled Member States over time (averaged across all example non-energy intensive consumers)[251]



Source: Calculations by Centre for Competition Policy, University of East Anglia utilizing information from national authority websites, national authority documents and European Commission decision documents.

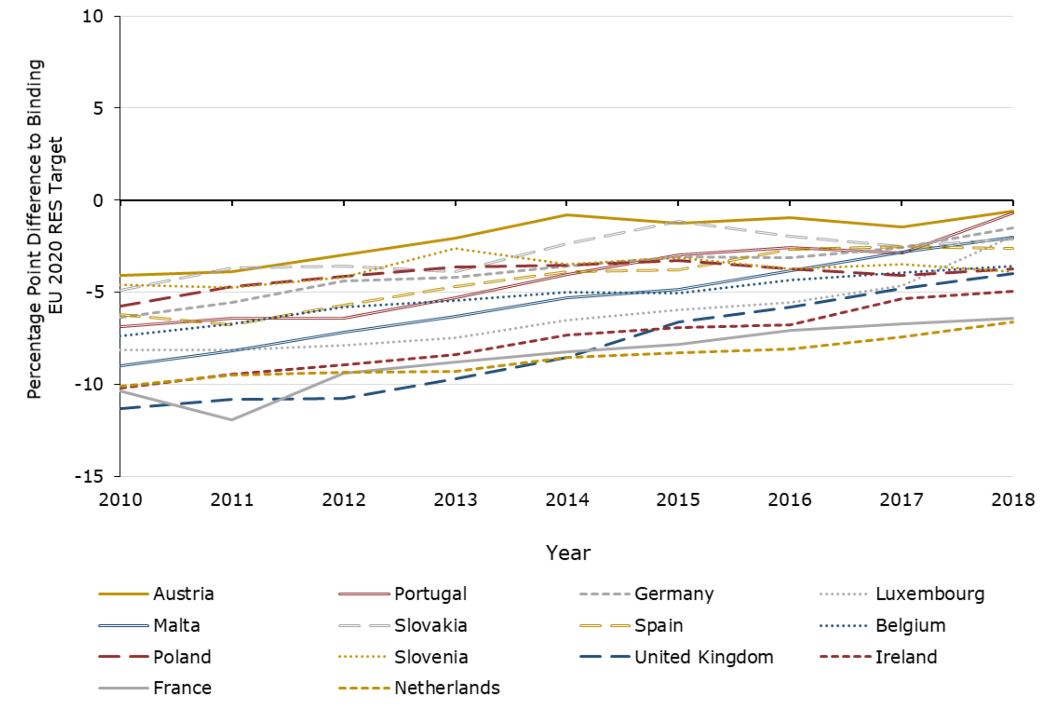
Figure A6.6.16 Difference to EU 2020 RES target for primary energy consumption by Member State (first 14), 2010-2018



[251] *Excludes the fixed fee elements of charging systems.*

Source: Calculations by Centre for Competition Policy, University of East Anglia using Eurostat data

Figure A6.6.17 Difference to EU 2020 RES target for primary energy consumption by Member State (second 14), 2010-2018



Source: Calculations by Centre for Competition Policy, University of East Anglia using Eurostat data

Annex 7.1 – Review of Article 47 GBER schemes

(see accompanying Excel file)

Annex 7.2 – Review of Article 47 GBER schemes containing provisions on waste management

(Confidential Annex)

Annex 7.3 – Waste management projects under scheme SA.49422 and SA.40266

(see accompanying Excel file)

Annex 7.4 – Responses to questionnaires

(Confidential Annex)

Annex 7.5 – Confidential details on German projects having received State aid from KfW

(Confidential Annex)

Annex 8.1 - RES and related levies

The review presented in this appendix covers all countries that introduced a reduction on RES levies over the period of observation individually. These countries are: Denmark, France, Germany, Greece, Italy, Latvia, Poland, Romania, Slovenia and the UK.[252]

Electricity prices, RES levies and reductions to the latter generally depend on the consumption intensity. The following table provides an overview of consumption bands and the consumption range. When calculating total levy rates based on consumption, the midpoint of each consumption range interval is assumed to provide the best estimate for consumption. Only for the lowest consumption band, the upper bound of the interval (1,000 kWh) is assumed as proxy for yearly consumption.

Table 1: Electricity consumption bands and related ranges of consumption

Consumption band	Consumption Range (kWh)	Consumption band	Consumption Range (kWh)
DA	< 1,000	**IA**	< 20
DB	1,000–2,500	**IB**	20–500
DC	2,500–5,000	**IC**	500–2,000
DD	5,000–15,000	**ID**	2,000–20,000
DE	> 15,000	**IE**	20,000–70,000
		IF	70,000–150,000

Source: Eurostat.

The assessment of potential impacts of reductions is based on a discussion of two elements:

- **A graphical depiction of the development of levy rates in Eurocent**[253] **per kWh over time** for different user groups.
- **A graphical depiction of the development of levy rates indexed to the last year before the introduction of a rebate.**
- **A tabular comparison of the level of levies before to after the introduction of rebates** for different user groups. This comparison is based on periods of equal length before and after the introduction of a rebate.[254] The level of levies is quantified in two alternative ways: (i) as total levies in Euro per year paid by user group. (ii) RES or CHP levies as share of the overall electricity bill.

---

[252] *For some countries, data on RES levies or reductions to RES levies have been collected and presented in the answer to Question 6 but these data are cannot be used here. Austria was disregarded for it introduced an exemption for households in 2012 because data are only available from 2012 onwards. Estonia, Lithuania and Slovakia were also disregarded for there were no reductions applied to EIUs.*

[253] *All monetary values have been converted to Euros.*

[254] *These periods are as long as possible given the availability of the data. For example, if there are three years observed before the introduction of a rebate and five years after it, the last three years before the introduction of rebates are compared to the first three years after this introduction.*

The following analyses focus on the development of different levy rates and observed correlations (or co-developments). Where appropriate, it is noted that the observed pattern is consistent with a redistribution effect. However, this should not be misinterpreted as evidence or causality because the development of levies is influenced by multiple factors, including unobserved political decisions. In particular, insofar as levy rates are linked to the price of electricity, then they also depend on unobserved market factors. As a result, even if one rate (e.g. for EIUs) decreases and another rate (e.g. for households) increases, this does not prove that one caused the other. The analyses, based on the data at hand, allows depicting developments and identifying patterns but it does not allow making conclusions on causality.

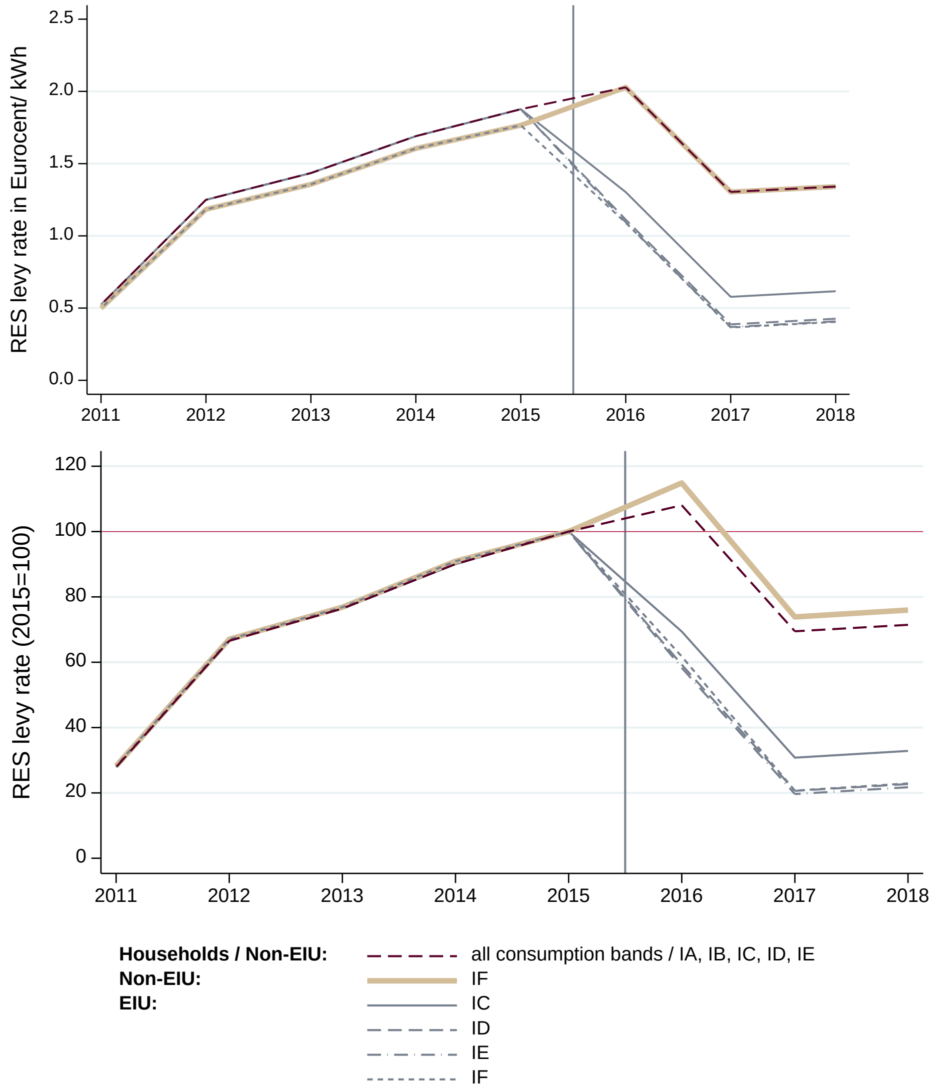
8.1.1 Denmark

Denmark introduced a subsidy for EIUs in September 2015 that is estimated to amount to roughly 0.07 DKK per kWh. The subsidy may not exceed 85% of the total levy amount and will not be paid on an amount less than 20,000 DKK but companies can group together to exceed threshold and benefit from the subsidy (see Question 6ii).

The following figure shows the development of RES levy rates in Eurocent/ kWh[255] in Denmark separately for energy-intensive users (EIUs) and non-EIUs. All customers pay the same RES levy per kWh but the subsidy introduced for energy intensive users (EIS) in 2016 leads to a reduction for the latter. The lower panel shows the levy rates indexed to year 2015, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

[255] *Figure 1 in 11.1 shows the development indexed to 2015, illustrating the percentage changes in the levy relative to the last year before the introduction of the subsidy.*

Figure 1: RES levy rate per consumption band in Denmark. Lower panel indexed to 2015



Source: E.CA Economics based on data collected as answer to Question 6. RES levy rates calculated by the University of East Anglia. Note: Reductions are available for EIU as of Sep 2015.

RES levies in Denmark show a hump-shaped development for all user groups. Rates for EIUs declined significantly after 2015. For all user groups, RES levy rates increased from 2011 to 2014 from about 0.5 to 2 Cent. For households and non-EIUs, they increased from 2015 to 2016 and then decreased so about 1.4 Cent. In relative terms, they more than doubled between 2011 and 2015 and then decreased to about 70% of the level of 2015. For EIUs, they decreased sharply from 2015 to 2017 and then levelled off at slightly less than 0.5 Cent, or between 20 and 40% of the level of 2015. Only for consumption band IF of non-EIUs, levy rates increased to the level of all other non-EIUs and households when rebates for EIUs were introduced. However, this adaptation appears small relative to the massive discount introduced for EIUs.

The following table describes the difference in levels of levies before to after the introduction of the subsidy. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2013-2015 (three years before the introduction of rebates), the level for 2016-2018 (three years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 2: RES levies per user type and consumption band before and after introduction of rebate (Denmark)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2013-2015 (€)	2016-2018 (€)	Difference (€)	Difference (%)	2013-2015 (%)	2016-2018 (%)	Difference (p.p.)	Difference (%)
Households								
DA	16.7	15.6	-1.1	-6.6	4.8	4.1	-0.7	-15.1
DB	29.2	27.3	-1.9	-6.6	5.0	4.7	-0.4	-7.3
DC	62.5	58.4	-4.1	-6.6	5.5	5.1	-0.5	-8.3
DD	166.7	155.8	-11.0	-6.6	7.3	6.4	-0.9	-12.4
DE	250.1	233.7	-16.4	-6.6	7.4	7.0	-0.3	-4.7
Non-EIUs								
IA	333.5	311.5	-21.9	-6.6	5.9	5.3	-0.7	-11.1
IB	4,335.1	4,050.1	-285.0	-6.6	6.3	5.6	-0.7	-10.6
IC	20,842.0	19,471.6	-1,370.4	-6.6	6.5	6.0	-0.5	-8.1
ID	183,409.6	171,350.3	-12,059.3	-6.6	6.5	6.0	-0.5	-7.6
IE	750,311.9	700,978.4	-49,333.6	-6.6	6.9	6.4	-0.5	-7.5
IF	1,733,301.4	1,713,502.6	-19,798.7	-1.1	6.6	6.4	-0.2	-2.8
EIUs								
IC	20,842.0	10,405.9	-10,436.1	-50.1	6.5	3.3	-3.2	-49.6
ID	183,409.6	70,620.5	-112,789.1	-61.5	6.5	2.6	-4.0	-60.8
IE	750,311.9	280,599.3	-469,712.6	-62.6	6.9	2.6	-4.3	-61.8
IF	1,733,301.4	682,029.5	-1,051,271.8	-60.7	6.6	2.6	-4.0	-60.0

Source: E.CA Economics based on data collected as to Question 6.

Between the three years before and after the introduction of the subsidy, the average RES levy paid by households of band DA decreased from 16.7 Euro to 15.6 Euro, which is a reduction by 1.1 Euro or 6.6%. Since all non-EIUs (but band IF) pay the same RES levy rate, their percentage increase was the same. However, the total increase depends on total consumption. For band IE, the decrease by 6.6% meant 49 thousand Euro less expenses for RES levies. For band IF, the decrease was only 19 thousand Euro.

For EIUs benefiting from the subsidy, the reduction meant a decrease of expenses up to 61.8%. For band IF consuming the largest amounts of electricity, total RES levies were on average 1.7 million Euro in 2013-2015 and 682 thousand in 2016-2018, a decrease by 1.05 million Euro, or 60.7%.

The share of RES levies in the electricity bill (shown in the last part of the table) did not change much. For households and non-EIUs, it was between 4% and 8% in 2013-2015 and about half a percentage point lower in 2016-2018. For EIUs, the share decreased by 50 to 60% from 6% to 7% of the electricity bill to 3.3% for band IC and to 2.6% for bands ID, IE and IF.

Overall, RES levies declined for all user groups, but for EIUs, they declined much more that for others because of the reduction.

8.1.2 France

In France, RES and CHP levies were collected through the same channel, i.e. the CSPE.[256] This is capped at 0.5% of the EIUs value added but also in terms of the total CSPE contribution per consumption site. The total cap was introduced in 2011 when it was set to 550,000 € per year and then increased on an annual basis.[257] This cap therefore reduced total charges for consumption band IF from 2011 onwards. From 2013 onwards, total CSPE-charges for the average site of band IE exceeded the cap. Since data is available only from 2011 onwards, the following discussion focuses on the reduction relevant for band IE from 2013 onwards (see Question 6). The levies have been in use until 2015. From 2016 onwards, the system of financing renewable energy sources through levies was replaced by financing via general taxation.

The average share of RES levies in the CSPE for 2003 through 2015 was 39% and the average share of CHP levies was 61%. The following discussion first addresses the development of RES levies and then the development of CHP levies. It then shows the overall effect of both levies on expenses by different consumer groups and on the electricity bill of these.

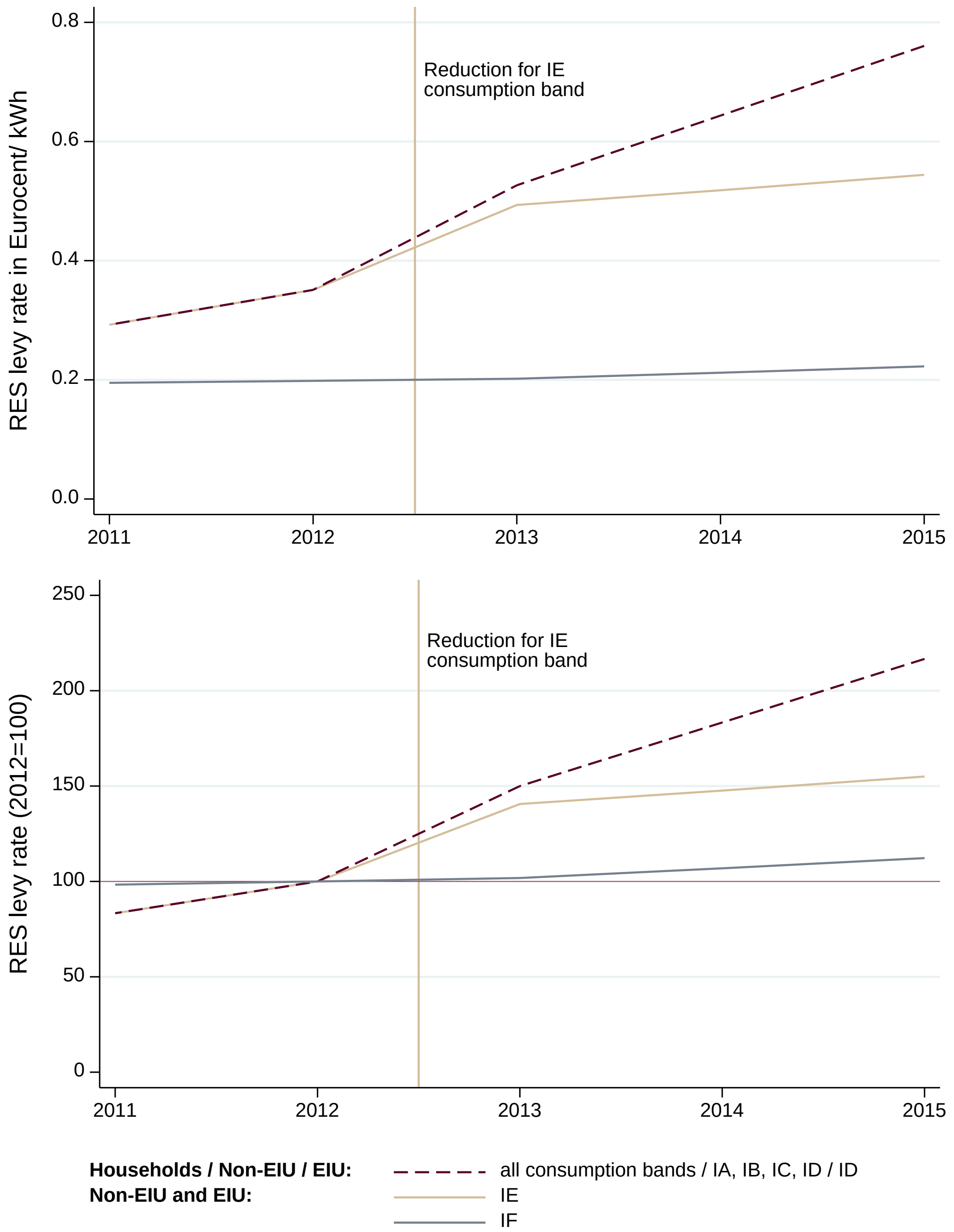
RES levies

The following figure shows the development of RES levy rates in Eurocent/ kWh[258] in France by consumption band. Since 2013, firms belonging to band IE benefit from a reduction due to the cap in total contributions. Households and consumption bands IA, IB, IC and ID pay the same RES levy rate, so there is only one line for all these groups. The lower panel shows the levy rates indexed to year 2012, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

---

[256] *Contribution au service public de l'électricité, or tax contribution to the public service charges for electricity.*
[257] *Annual values are: 550,000 € (2011), 559,350 € (2012), 569,418 € (2013), 597,889 € (2014), and 627,783 € (2015). Source: Question 6.*
[258] *Figure 3 in Annex 11.1 shows the development indexed to 2012, illustrating the percentage changes in the levy relative to the last year before the introduction of the reduction.*

Figure 2: RES levy rate per consumption band in France. Lower panel indexed to 2012



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates adjusted by the University of East Anglia. Note: Reductions are available for EIU (IE) as of Jan 2013. Additional reductions are available for EIU (IF) as of Jan 2011.

RES levies in France follow an almost linear upwards trend for most consumption bands. Only for IF, they have been almost unchanged between 2011 and 2015. For households and consumption IA through ID, RES levies increased from about 0.3 Cent in 2011 to less than 0.8 Cent in 2015. In percentage (lower panel), this means that RES levies more than doubled in this period. For consumption band IE, the increase was more moderate. Levy rates increased by almost 40% between 2012 and 2013. Then, the increase slowed down (as can be seen in the kink) and rates increased to slightly more than 50% above the 2012-level in 2015.

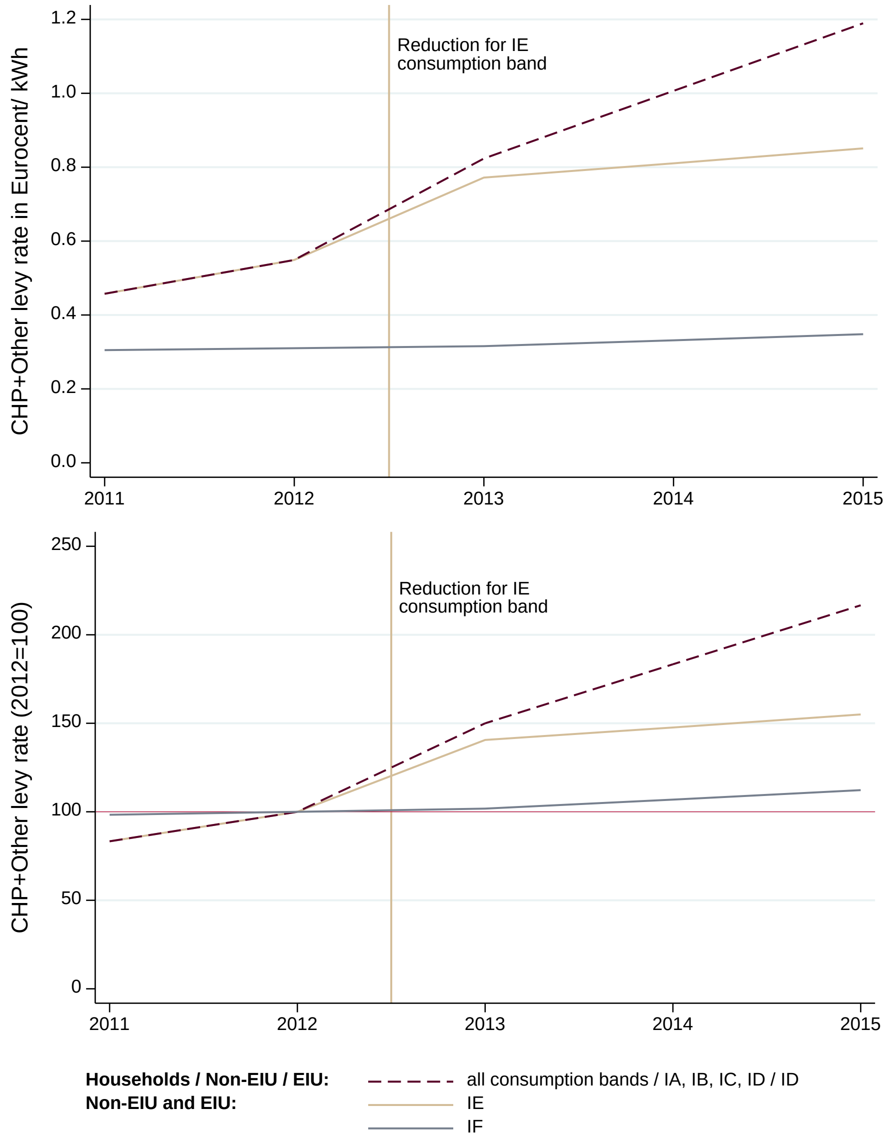
The development for consumption band IF was very moderate. These increased from slightly less than 0.2 Cent in 2011 to slightly more than this in 2015, or from 98% of their 2012-level in 2011 to 112% in 2015.

CHP levies

Since CHP levies and RES levies are derived from the same source (the CSPE) and the data only allow a separation by average share, the overall development is the same but the levels differ. The following figure shows the development of CHP levy rates in Eurocent/ kWh[259] in France by consumption band. As discussed above, households and consumption bands IA, IB, IC and ID pay the same rate, so there is only one line for all these groups. As for RES levies, the lower panel shows the values indexed to 2012.

[259] *Figure 4 in Annex 11.1 shows the development indexed to 2012, illustrating the percentage changes in the levy relative to the last year before the introduction of the reduction.*

Figure 3: CHP + Other levy rate per consumption band in France. Lower panel indexed to 2012



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates adjusted by the University of East Anglia. Note: Reductions are available for EIU (IE) as of Jan 2013. Additional reductions are available for EIU (IF) as of Jan 2011.

Aggregate effect of reductions

The following table shows the aggregate effect of the reduction introduced in 2013 on the sum of both levies (RES + CHP), i.e. the CSPE charge. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. Since reductions depend on the level of consumption only, EIUs and non-EIUs are grouped together. The second part shows the average levies (RES + CHP) in Euro per year and the third part the average levies in percent of the electricity bill. Within each part, the table shows the level for 2011-2012 (two years before the introduction of rebates), the level for 2013-2014 (two years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 3: RES + CHP + Other levy per user type and consumption band before and after introduction of rebate (France)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2011-2012 (€)	2013-2014 (€)	Difference (€)	Difference (%)	2011-2012 (%)	2013-2014 (%)	Difference (p.p.)	Difference (%)
Households								
DA	8.3	15.0	6.8	81.8	3.3	5.4	2.1	62.1
DB	14.4	26.3	11.8	81.8	5.1	8.3	3.2	62.0
DC	30.9	56.3	25.3	81.8	5.8	9.3	3.6	61.6
DD	82.5	150.0	67.5	81.8	6.3	10.2	3.9	61.0
DE	123.8	225.0	101.3	81.8	6.4	11.0	4.5	70.5
Non-EIUs / EIUs								
IA	165.0	300.0	135.0	81.8	5.5	9.3	3.8	68.9
IB	2,145.0	3,900.0	1,755.0	81.8	6.9	11.1	4.1	60.0
IC	10,312.5	18,750.0	8,437.5	81.8	8.2	13.3	5.2	63.2
ID	90,750.0	165,000.0	74,250.0	81.8	9.4	15.5	6.1	64.5
IE	371,250.0	583,653.5	212,403.5	57.2	10.1	16.0	5.9	58.0
IF	554,675.0	583,653.5	28,978.5	5.2	7.4	8.4	1.0	13.8

Source: E.CA Economics based on data collected as answer to Question 6.

Between the two years before and after the introduction of rebates, the average total levy paid by households and consumption bands IA through ID increased by 81.8%. The total amount depends on the level of consumption. For band DA, expenses increased from 8.3 Euro to 15.0 Euro, an increase by 6.8 Euro. For band DE, the increase meant additional expenses of 101 Euro. For band ID, this translates into additional costs of 74,250 Euro, a change from 90,750 Euro to 165,000 Euro. For band IE, the increase was 57.2%, or 212 thousand Euro. For band IF (the band that benefitted from a reduction taking effect in 2011), the difference is very small; expenses for band IF increased by only 5.2%.

The share of RES levies in the electricity bill increased by more than 50% for households and slightly more than that for bands IA through IE. Only for band IF, the relative increase was moderate for the share of its electricity bill that consists of RES levy contributions only increased by 13.8%.

Overall, contributions to RES and CHP levies in France increased for all customer groups but the increase was stronger for non-rebated groups, which are all but those with the highest consumption levels. For band IF, the development after 2011 is very flat compared to other bands.

8.1.3 Germany

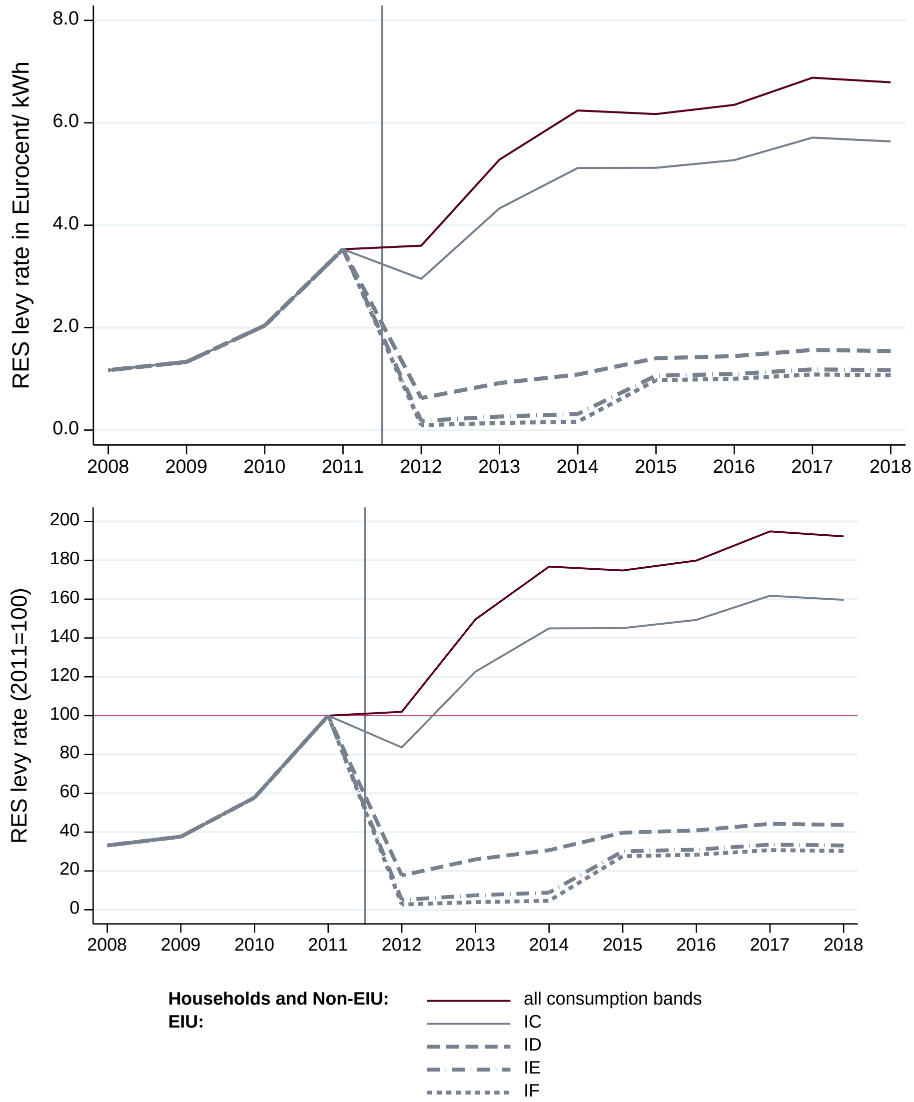
In Germany, both RES and CHP levies have been collected. RES levies were much higher - they amounted to about 3.5 Cent in 2011, while CHP levies make up only between 0.1 and 0.5 Cent per kWh. In 2012, there was a reduction of RES levies for EIUs and in 2017 there was a harmonisation of CHP levies (see Question 6). The before-after comparison of rebates is therefore presented separately for RES and CHP levies.

RES levies

The following figure shows the development of RES levy rates in Eurocent/ kWh[260] in Germany by consumption band and separately for energy-intensive users (EIUs) and non-EIUs. All non-EIUs pay the same RES levy, so there is only one line for all these groups. The lower panel shows the levy rates indexed to year 2011, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

[260] *Figure 5 in Annex 11.1 shows the development indexed to 2011, illustrating the percentage changes in the levy relative to the last year before the introduction of the reduction for EIUs.*

Figure 4: RES levy rate per consumption band in Germany. Lower panel indexed to 2011



Source: E.CA Economics based on data collected as answer to Question 6. RES levy rates based on information from legislation. Notes: Reductions are available for EIU as of January 2012.

RES levies in Germany generally follow an upward trend. In 2008, they were at less than 2 Cent per kWh, grew to 3.5 Cent in 2011, and to almost 7 Cent in 2017. In percentage (lower panel), this means that RES levies more than doubled in the four years leading up to 2011. For households and non-EIUs, they grew by 80% in the three years following the introduction of the rebates. For EIUs, they shifted to a very low level and then increased slowly over time.

The development of RES levies for EIUs that benefitted from the reduction depends on the consumption bands. Since the full levy amount is payable for the first GWh consumed but all consumption above this threshold is reduced, the average reduction is relatively small for the band IC[261] while for most of the electricity consumed by members of band IF, there is a significant reduction to the RES levy.[262] For consumption band IC, RES levies still grow by more than 50 percent to almost 6 Cent per kWh until 2018. For bands ID to IF, they dropped to less than 1 Cent in 2012, or by 2 to 20% of their 2011-level. Over time, they grew to 1 to 2 Cent, or to about 20 to 45% of their 2011-level. The following table describes the difference in levels of levies before to after the introduction of rebates.

[261] For the mid-point of the consumption interval (1.25 GWh), only one 20% of total consumption are reduced while for 80%, the consumer needs to pay the full RES levy.

[262] *This band refers to customers consuming between 70 GWh and 150 GWh. For 70 GWh, the unrebated first GWh amounts to only 1.4%, for 150 GWh it makes up only 0.7%. Since the reduction means that EIUs pay only 10 to 15% (depending on the year) of the levy for consumption beyond 1 GWh, levy rates for EIUs with high consumption are reduced substantially.*

Table 4: RES levies per user type and consumption band before and after introduction of rebate (Germany)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2008-2011 (€)	2012-2015 (€)	Difference (€)	Difference (%)	2008-2011 (%)	2012-2015 (%)	Difference (p.p.)	Difference (%)
Households								
DA	20.2	53.2	33.1	163.8	5.5	12.5	7.0	129.0
DB	35.3	93.1	57.8	163.8	7.6	16.9	9.3	121.9
DC	75.7	199.6	123.9	163.8	8.4	18.4	10.0	118.9
DD	201.8	532.3	330.5	163.8	8.9	19.4	10.4	117.0
DE	302.6	798.4	495.8	163.8	9.2	20.2	10.9	118.2
Non-EIUs								
IA	403.5	1,064.5	661.0	163.8	8.0	18.5	10.5	130.7
IB	5,245.5	13,838.5	8,593.0	163.8	11.2	24.2	13.0	116.6
IC	25,218.8	66,531.3	41,312.5	163.8	12.9	27.7	14.9	115.3
ID	221,925.0	585,475.0	363,550.0	163.8	14.2	31.1	16.9	118.7
IE	907,875.0	2,395,125.0	1,487,250.0	163.8	15.4	35.4	19.9	129.3
IF	2,219,250.0	5,854,750.0	3,635,500.0	163.8	16.1	38.9	22.9	142.0
EIUs								
IC	25,218.8	54,748.4	29,529.7	117.1	12.9	23.7	10.8	84.1
ID	221,925.0	110,760.5	-111,164.5	-50.1	14.2	7.5	-6.7	-47.4
IE	907,875.0	204,593.8	-703,281.3	-77.5	15.4	4.3	-11.1	-71.9
IF	2,219,250.0	377,213.8	-1,842,036.3	-83.0	16.1	4.0	-12.1	-75.4

Source: E.CA Economics based on data collected as answer to Question 6.

The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2008-2011 (four years before the introduction of rebates), the level for 2012-2015 (four years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Between the four years before and after the introduction of rebates, the average RES levy paid by households of band DA increased from 20.2 Euro to 53.2 Euro, i.e. by 33.1 Euro or 163.8%. Since all non-EIUs pay the same RES levy rate, the percentage increase was the same for all of these. However, the total increase depends on total consumption. For band IF of non-EIUs, the annual RES levies paid went from 2.2 million Euro to 5.9 million Euro, which is an increase by 3.6 Mio Euro.

For EIUs that benefit from the reduction, the development depends on the level of consumption and hence the share of this consumption that is reduced (see above). The lowest band of EIUs (band IC) faced an increase in RES levies paid. These went up from 25 to 55 thousand Euro, which means an increase by 29.5 thousand Euro, or 117.1%. For the bands of higher consumption, RES levies decreased significantly. For consumption band IE, they decreased by about 111 thousand Euro (50.1%), for band IE by 703 thousand Euro (77.5%), and for band IF by 1.8 million Euro (83.0%).

The share of RES levies in the electricity bill (shown in the last part of the table) grows with the consumption level. This is because higher consumption leads to lower prices per kWh while the RES levy per kWh is constant, hence the share of the RES levy in the total price increases. For households in band DS, the share went up from 5.5% of the electricity bill to 12.5%, which is an increase by 7 percentage points or 129%. The difference in percentage points between both periods also generally increases with consumption. The percentage difference is more heterogeneous: It ranges from 115.3% for group IC to 142.0% for group IF, meaning that also the share of RES levies in the electricity bill more than doubled between the two periods.

Regarding EIUs, the share of the electricity bill paid for RES levies increased with consumption before the introduction of rebates but decreased after the introduction of rebates (see discussion above). For consumption band IC, RES levies made up 23.7% in the years 2012-2015 while for band IF, they only accounted for 4.0%. In terms of differences, this means that they increased by 10.8 percentage points or 84.1% for band IC but a decrease by 12.1 percentage points or 75.4% for band IF.

The development is consistent with substantial redistribution between consumer groups. RES levies paid – both in Euro per year of as share of the electricity bill – increased significantly for all user groups not benefitting from a rebate and even for those EIUs for which the reduction affected only a small part of their consumption. On the other hand, EIUs with higher electricity consumption (bands ID, IE and IF), saw a significant reduction in the total Euro paid for RES levies or in the share of their electricity bill made up by RES levies.

CHP levies

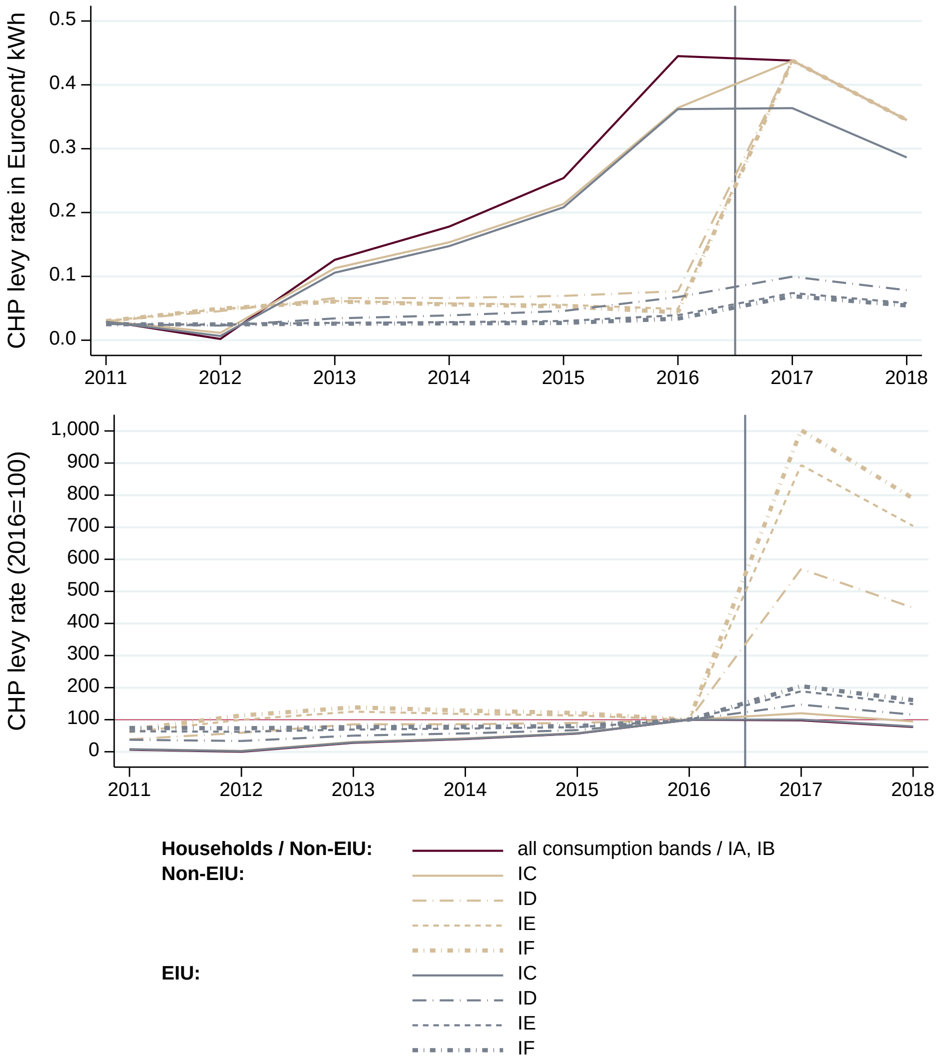
Germany also charges CHP levies. For years 2011 through 2016, there were three different CHP levy rates depending on total consumption. For 2017 and 2018, this system was harmonised. Since then, there is only one CHP levy rate and EIUs benefit from reductions that are applied to consumption above 1 GWh.

The following figure shows the development of CHP levy rates in Eurocent/ kWh[263] in Germany by consumption band and separately for energy-intensive users (EIUs) and non-EIUs. All households and consumption band IA and IB pay the same CHP levy rate. The lower panel shows the levy rates indexed to year 2016, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

---

[263] *Figure 6 in Annex 11.1 shows the development indexed to 2016, illustrating the percentage changes in the levy relative to the last year before the harmonization of rates.*

Figure 5: CHP levy rate per consumption band in Germany. Lower panel indexed to 2016



Source: E.CA Economics based on data collected as answer to Question 6. CHP Levy rates are taken from legislation. Note: Reductions are available for EIU as of January 2017.

The development of CHP levies differs across consumption bands. For households and consumption bands IA and IB, rates increased from less than 0.1 Cent to about 0.45 Cent between 2011 and 2016 and then started to decline. Up to 2016, the rate for bands IC for EIUs and non-EIUs were almost identical. From 2017 onwards, rates for non-EIUs were the same as rates for households, which led to an increase of the rates for non-EIUs. As shown in the lower panel, this increase was massive relative to the level of 2016 for bands ID, IE and IF because rates for these had been on a relatively low level up to then.

Rates for EIUs were lower and remained in a corridor between 0 and about 0.1 Cent per kWh throughout the period of observation (2011 to 2018).

The following table describes the difference in levels of levies before to after the introduction of rebates and the harmonisation in 2017. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average CHP levies in Euro per year and the third part the average CHP levies in percent of the electricity bill. Within each part, the table shows the level for 2015-2016 (two years before the introduction of rebates), the level for 2017-2018 (two years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 5: CHP levies per user type and consumption band before and after introduction of rebate (Germany)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2015-2016 (€)	2017-2018 (€)	Difference (€)	Difference (%)	2015-2016 (%)	2017-2018 (%)	Difference (p.p)	Difference (%)
Households								
DA	3.5	3.9	0.4	12.0	0.8	0.8	0.0	5.7
DB	6.1	6.9	0.7	12.0	1.1	1.2	0.1	8.9
DC	13.1	14.7	1.6	12.0	1.2	1.3	0.1	9.8
DD	35.0	39.2	4.2	12.0	1.2	1.4	0.1	10.8
DE	52.4	58.7	6.3	12.0	1.3	1.5	0.2	12.1
Non-EIUs								
IA	69.9	78.3	8.4	12.0	1.3	1.4	0.1	10.1
IB	908.7	1,017.9	109.2	12.0	1.6	1.7	0.2	10.9
IC	3,608.8	4,893.8	1,285.0	35.6	1.5	2.0	0.5	34.5
ID	8,045.0	43,065.0	35,020.0	435.3	0.4	2.3	1.9	449.5
IE	23,515.0	176,175.0	152,660.0	649.2	0.4	3.1	2.8	758.2
IF	53,090.0	430,650.0	377,560.0	711.2	0.4	3.0	2.6	680.6
EIUs								
IC	3,563.8	4,061.8	498.1	14.0	1.4	1.6	0.2	13.5
ID	6,245.0	9,787.5	3,542.5	56.7	0.3	0.5	0.2	63.6
IE	15,595.0	29,754.0	14,159.0	90.8	0.2	0.5	0.3	122.2
IF	33,470.0	67,925.3	34,455.3	102.9	0.2	0.5	0.2	97.7

Source: E.CA Economics based on data collected as answer to Question 6.

Since levy rates were quite high in 2015-2016 already, the relative increase in expenses was only 12% for households and non-EIUs of band IA and IB. For consumption band DA, this means an increase from 3.5 Euro to 3.9 Euro, or by 40 Cent. For band IC (which was close to the rate of households but then the levy rate was adjusted upwards), expenses for CHP levies increased from on average 3,609 to 4,894 Euro per year, by 1,285 Euro or 35.6%. For bands ID through IF, the increase was massive and amounts to between 435 and 711% relative to the level of 2015-2016. In monetary terms, CHP expenses for band IF went from 53 thousand Euro up to 431 thousand Euro (by 378 thousand Euro).

Expenses also increased for EIUs. For band IC, expenses increased by 498 Euro (14.0%), for band ID by 3,543 Euro (56.7%), for band IE by 14,159 Euro (90.8%). Band IF saw its expenses more than doubled as they went from 33,470 Euro to 67,925 Euro, which is an increase of 34,455 Euro or by 102.9%.

Overall, there is no clear pattern of redistribution regarding CHP levies in Germany. However, the harmonisation in 2017 led to significant increases in rates for non-EIUs with high consumption. At the same time, CHP expenses for EIUs also increased significantly, while expenses for households remained rather stable.

8.1.4 Greece

Greece finances renewable energy through the ETMEAR[264] Levy introduced in 1999. The levy is used to fund both renewable energy and HECHP[265]. It is a flat rate fee that varies by voltage (Low, Medium and High) and consumer type (residential, agricultural, and other). In 2014, Medium Voltage (bands IC, ID and IE) was split by consumption level to reduce the ETMEAR rate for medium voltage users, which consumed more than 13 GWh of electricity. This split is comparable to a reduction of levy for bands IC, ID and IE and will therefore be discussed as such (see Question 6). The major part of ETMEAR are RES levies. Only 2 to 4% of ETMAR levy are used to finance HECHP.

RES levies

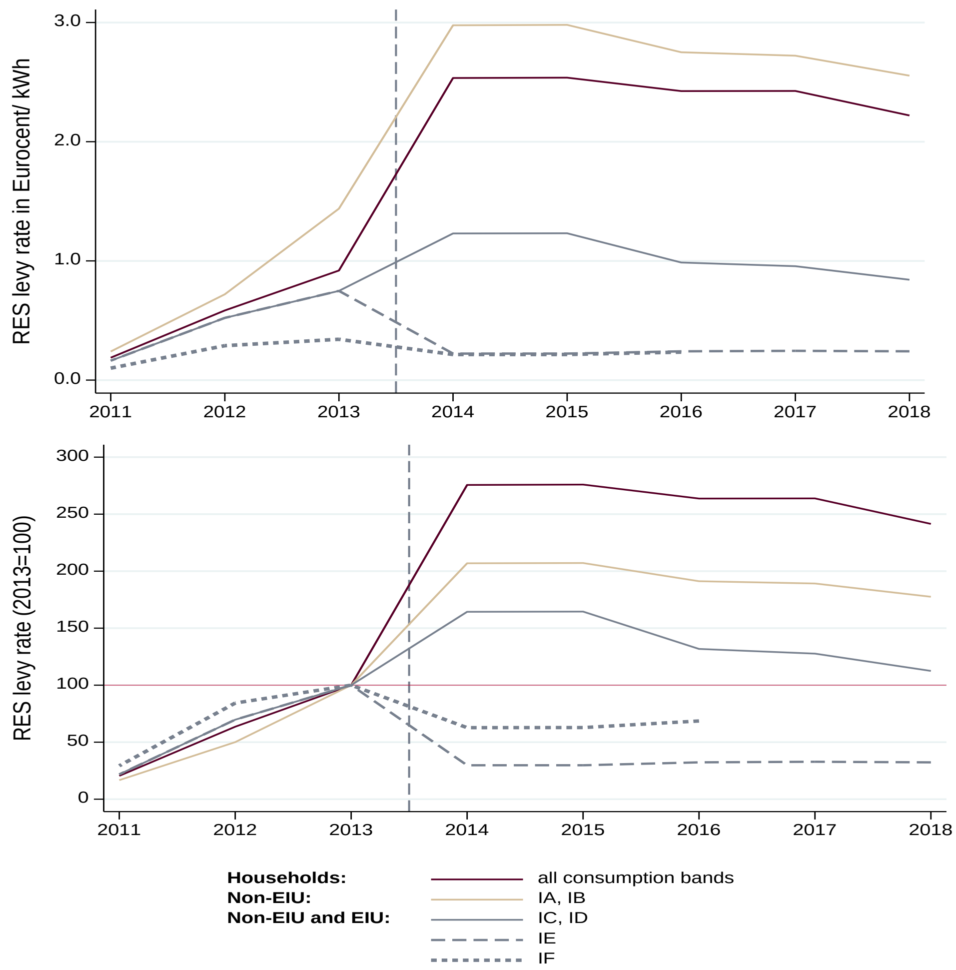
The following figure shows the development of RES levy rates in Eurocent/ kWh[266] in Greece by consumption band and separately for energy-intensive users (EIUs) and non-EIUs.

[264] *Ειδικό Τέλος Μείωσης Εκπομπών Αερίων Ρύπων.*

[265] *High Efficiency Combined Heat and Power production*

[266] *Figure 7 in Annex 11.1 shows the development indexed to 2013, illustrating the percentage changes in the levy relative to the last year before the split of medium voltage consumption bands.*

Figure 6: RES levy rate per consumption band in Greece. Lower panel indexed to 2013



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates are taken from legislation. Note: Reductions are applied as of 2014. There is no data for consumption band IF for 2017 and 2018.

Households pay the same RES levy irrespective of their consumption level, so there is only one line for all these groups. The lower panel shows the levy rates indexed to year 2013, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index. RES levies in Greece generally follow an upwards trend up to 2013 and then diverge. Rates for households and consumption bands IA and IB increase heavily between 2013 and 2014 before they level off and slowly decrease up to 2018. For consumption bands IC and ID, there was also an increase but more moderate while rates for bands IE and IF decreased and, from 2014 onwards, remained relatively stable.

For households, rates increased from about 0.2 Cent in 2011 to around 1 Cent in 2013 and then more than doubled, reaching about 2.5 Cent 2014, an increase by about 150%. Between 2014 and 2018, rates remained relatively stable but slightly declined. The development was similar for bands IA and IB, but the level was slightly higher.

For bands IC and ID, rates in 2013 were about 0.7 Cent per kWh and grew by about 70% between 2013 and 2014. They remained stable for a year, decreased to about 1 Cent in 2016 and remained relatively stable at around this value up 2018, slightly declining over time.

Band IE saw the biggest change. Before the redefinition of groups, rates were at about 0.7 Cent (as for band ID) in 2013 but then declined to about 0.2 Cent in 2014 where it remained up to 2018.

The band with the highest electricity consumption (IF) saw the most moderate change in RES levies. These increased from 0.1 Cent in 2011 to 0.3 Cent in 2013, declined to 0.2 Cent in 2014 and remained relatively stable up to 2016.[267]

Overall, the redefinition of consumption bands in 2014 has the effect similar to a levy reduction for EIUs. There was a strong upwards shift in levy for consumption bands that do not qualify for the lower levy and a downwards shift for bands IE and IF that qualified for a lower levy due to the change.

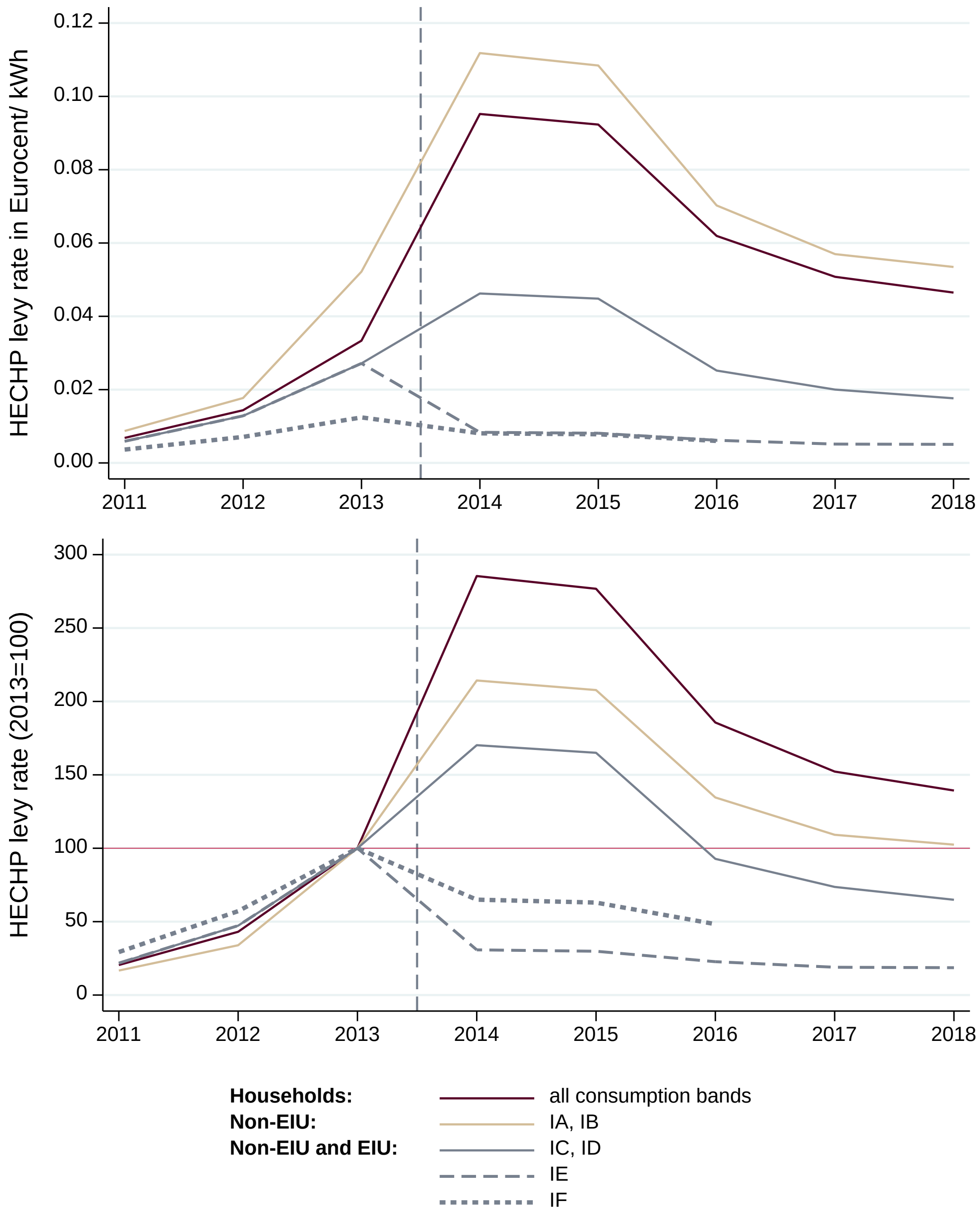
HECHP levies

Since HECHP levies are defined as a share of ETMEA rates and this share is relatively stable over time, the overall development is comparable to the development of RES levies discussed above. The level, however, is very difference because only 2 to 4% of the ETMEA rates are used for HSCHP purposes. The following figure shows the RES HECHP levy rate in Eurocent/ kWh[268] in Greece by consumption band and separately for energy-intensive users (EIUs) and non-EIUs. Households pay the same RES levy irrespective of their consumption level, so there is only one line for all these groups. The lower panel shows the levy rates indexed to year 2013, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

[267] *For 2017 and 2018, Eurostat does not provide price information.*

[268] *Figure 8 in Annex 11.1 shows the development indexed to 2013, illustrating the percentage changes in the levy relative to the last year before the split of medium voltage consumption bands.*

Figure 7: HECHP levy rate per consumption band in Greece. Lower panel indexed to 2013



Source: E.CA Economics based on data collected as answer to Question 6. HECHP Levy rates are taken from legislation. Values in 2018 are calculated by the University of East Anglia. Note: Reductions are applied as of 2014. There is no data for consumption band IF for 2017 and 2018.

Aggregate effect of reductions

The following table describes the difference in levels of levies before to after the split of the medium voltage band. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average total ETMEA levies in percent of the electricity bill. Within each part, the table shows the level for 2011-2013 (three years before the split), the level for 2014-2016 (three years after the split), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 6: RES + CHP levies per user type and consumption band before and after introduction of rebate (Greece)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2011-2013 (€)	2014-2016 (€)	Difference (€)	Difference (%)	2011-2013 (%)	2014-2016 (%)	Difference (p.p)	Difference (%)
Households								
DA	5.8	25.8	20.0	343.4	3.2	11.1	7.9	248.5
DB	10.2	45.2	35.0	343.4	4.3	14.8	10.5	246.9
DC	21.8	96.8	75.0	343.4	3.9	14.7	10.8	277.9
DD	58.2	258.2	200.0	343.4	3.5	13.9	10.4	294.8
DE	87.4	387.4	300.0	343.4	3.6	13.4	9.8	269.1
Non-EIUs								
IA	165.2	599.9	434.7	263.2	4.0	12.6	8.6	216.0
IB	2,147.6	7,799.1	5,651.5	263.2	4.8	16.3	11.5	238.0
EIUs								
IC	6,166.7	14,858.3	8,691.7	140.9	3.6	8.6	4.9	136.6
ID	54,266.7	130,753.3	76,486.7	140.9	4.2	10.8	6.6	156.5
IE	222,000.0	106,500.0	-115,500.0	-52.0	4.8	2.8	-2.0	-42.1
IF	276,833.3	251,900.0	-24,933.3	-9.0	3.4	3.7	0.2	6.8

Source: E.CA Economics based on data collected as answer to Question 6.

Between the three years before and after the splitting of consumption levels in 2014, the average ETMEA levy paid changed a lot depending on the consumption band.

The combined levies increased by 343.3% for all households, from 5.8 Euro to 25.8 Euro for band DA alone.[269] For band DE, this means an increase of 300 Euro in RES + CHP contributions.

For non-EIUs of bands IA and IB, the increase was smaller than for households but still 263.2 % compared to the average level before the introduction. For bands IC and ID (EIUs or non-EIUs), expensed increased by 140.9%, meaning that total costs went from 54 thousand Euro to 130 thousand Euro (plus 76 thousand Euro) for band ID.

[269] *This increase might overstate the general development because as the comparison is based on three years before to after the introduction of rebates, the time after the introduction covers the top of the hump as can be seen from the figures above.*

Band IE saw its total expenses for levies decline. From an average of 222 thousand Euro in 2011-2013, these went down to 106.5 thousand Euro, a decline by 115.5 thousand Euro or 52.0%. For band IF, there was a decline by 25 thousand Euro, or 9.0% relative to the average level of 2011-2013.

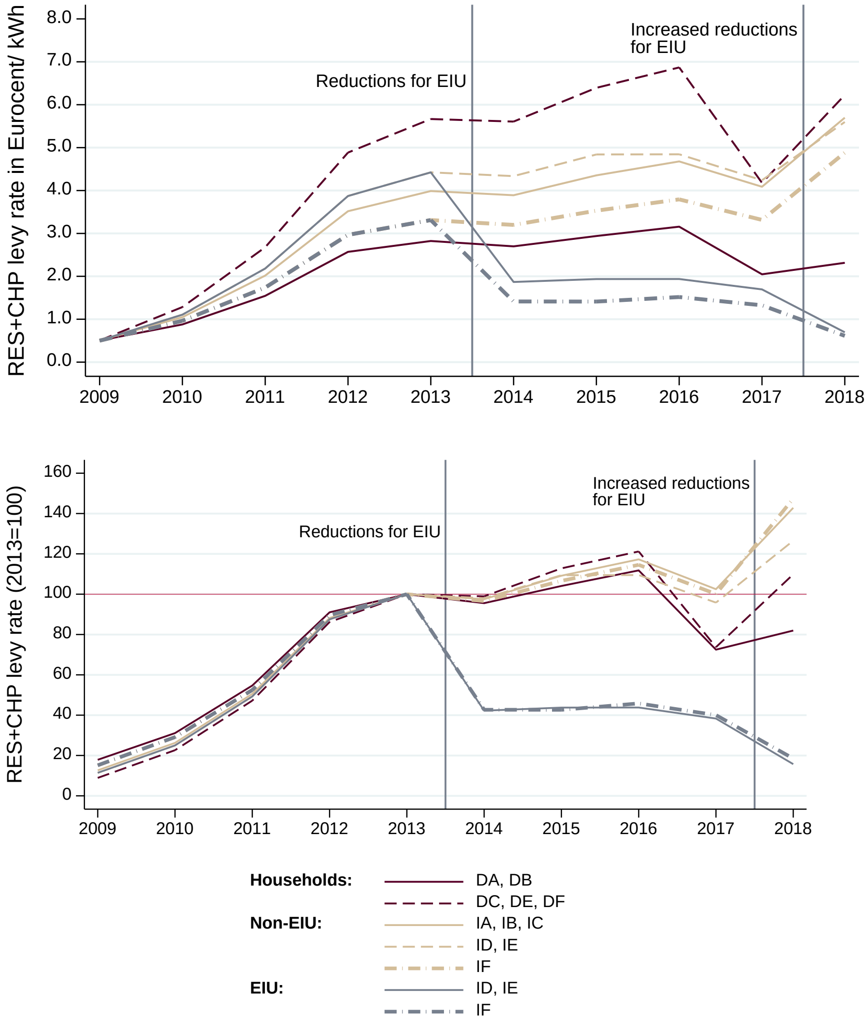
Relative to the electricity bill, the increase for households and non-EIUs was large as well. This share was from 3% to 5% before 2014 and subsequently grew to a range from 11% to 17% in the period 2016-2016, an increase by more than 200%. For bands IC and ID, the share more than doubled and for IE it declined by some 42%. For band IF, the share remained largely unchanged.

Overall, RES and CHP levies in Greece increased a lot between 2011 and 2014, which is when they reached the maximum for non-rebated customer groups, and then declined again. At the same time, they declined for customer groups that benefitted from the reduction, which is consistent with a redistributional effect of the reduction.

8.1.5 Italy

Italy applies two schemes to fund renewable energy sources: RES levies and contributions to green certificates. The contribution to RES levies depends on consumption and on the peak demand of the end user. In 2014, contributions to green certificates faded out and Italy introduced reductions to EIUs. In 2018, these reductions were increased (see Question 6). The following figure shows the development of levies combined, i.e. the RES levies that include contributions to cogeneration (CHP) as well as contributions to green certificates.

Figure 8: RES and other levies per consumption band in Italy. Lower panel indexed to 2013



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates are taken from legislation. Note: Total rate include costs for green certificates. Green certificate rate is calculated by the University of East Anglia. Reductions are available for EIU as of Jul 2013/ Jan 2018. Values for EIU IC are only available for 2018.

Rates are shown in Eurocent/ kWh[270] for groups of different levy costs: domestic bands DA and DB, domestic bands DE, DE and DF, non-EIUs are of bands IA, IB and IC or ID and IE and, finally, IF. EIUs are grouped similarly (ID and IE as well as IF). The lower panel shows the levy rates indexed to year 2013, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.RES and related levies in Italy increase between 2009 and 2013 and then develop differently for different consumption bands. In general, they continue to increase or remain stable for EIUs and households. For the latter, they decrease after 2016 again. For EIUs, they shift to a lower level in 2014 where they remain rather stable up to 2017 before decreasing again in 2018.

For households of bands DA and DB, levies increased from about half a cent in 2009 to below 3 Cent in 2013 and then remained relatively stable through to 2016 before they

---

[270] Figure 9 in Annex 11.1 shows the development indexed to 2013, illustrating the percentage changes in the levy relative to the last year before the introduction of reductions for EIUs and the fading out of green certificates.

dropped to about 2 Cent in 2017 and 2018. For households of bands DC through DF, levies were higher throughout. They started at the same level but increased to more than 5 Cent in 2013. They then remained stable and increased further between 2014 and 2016 to almost 7 Cent per kWh. After that, they dropped sharply to about 4 Cent and rebound to more than 6 Cent in 2018. Relative to 2013, they developed similar to bands DA and DB.

Non-EIUs saw a relatively modest but steady increase in levies. Starting at about 0.5 Cent in 2009, levies increased to 3.5 Cent (band IF), 4 Cent (bands IA, IB and IC) and 4.5 Cent (bands ID and IE) in 2013. These rates remained stable between 2013 and 2017 and then increased in 2018 when reductions of EIUs were introduced.

The following table describes the difference in levels of levies before to after the introduction of rebates to EIUs in 2014. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands.[271] The second part shows the average total levies in Euro per year and the third part the average total levies in percent of the electricity bill. Within each part, the table shows the level for 2009-2013 (five years before the introduction of rebates), the level for 2014-2018 (five years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

[271] *Consumption band IC exists for EIUs only since 2018.*

Table 7: RES and other levies per user type and consumption band before and after introduction of rebate (Italy)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2009-2013 (€)	2014-2018 (€)	Difference (€)	Difference (%)	2009-2013 (%)	2014-2018 (%)	Difference (p.p)	Difference (%)
Households								
DA	16.6	26.3	9.7	58.1	6.2	8.6	2.4	38.8
DB	29.1	46.1	16.9	58.1	9.0	12.3	3.2	35.8
DC	112.6	219.6	106.9	94.9	13.8	25.8	12.0	86.9
DD	300.4	585.5	285.2	94.9	11.1	22.8	11.7	105.8
DE	450.6	878.3	427.7	94.9	10.0	22.4	12.4	124.3
Non-EIUs								
IA	443.1	908.3	465.3	105.0	7.4	15.5	8.1	108.6
IB	5,759.8	11,766.2	6,006.4	104.3	10.0	21.1	11.1	110.9
IC	30,282.6	59,816.4	29,533.8	97.5	12.7	26.8	14.0	110.2
ID	265,989.5	524,926.6	258,937.2	97.3	14.4	30.8	16.4	114.5
IE	1,087,941.6	2,146,849.6	1,058,907.9	97.3	17.2	37.0	19.9	115.6
IF	2,086,129.5	4,118,632.8	2,032,503.4	97.4	15.8	38.3	22.5	142.2
EIUs								
ID	265,989.5	178,970.7	-87,018.7	-32.7	14.4	12.5	-1.9	-13.2
IE	1,087,941.6	732,007.0	-355,934.7	-32.7	17.2	15.5	-1.7	-10.0
IF	2,086,129.5	1,382,234.1	-703,895.4	-33.7	15.8	16.0	0.2	1.1

Source: E.CA Economics based on data collected as answer to Question 6.

Between the five years before and after the introduction of rebates, the average RES and related levies paid by households of band DS increased from 16.6 Euro to 26.3 Euro, which means by 9.7 Euro or 58.1%. For households of band DC through DE, expenses related to RES and related levies increased by 94.9% and hence almost doubled. For Non-EIUs from bands IA and IB, they more than doubled, leading to additional costs of 6 thousand Euro for band IB. For bands IC through IF, the increase was also massive (by 97.3 to 97.5%). Since the total amount depends on consumption, expenses for levies of non-EIUs from band IF increased from 2.09 million Euro to 4.12 million Euro, which means these paid more than 2 million Euro more than before.

For EIUs, the total bill decreased by about a third (32.7% or 33.7%), translating into savings of 87 thousand Euro for band ID, 356 thousand Euro for band IE and almost 704 thousand Euro for band IF. The share of RES and other levies in the electricity bill increased for all households, but most so for bands DD and DE where it grew by more than 100%. For all non-EIUs, it more than doubled. The effect for EIUs was more diverse. For band ID, the share in the electricity bill declined by 1.9 percentage points or 13.2%. For band IE, it declined by 1.7 percentage points or 10.0%, and for IF it increased by 0.2 percentage points or 1.1%.

Overall, levies increased for households and non-EIUs but declined for EIUs after the introduction of levy reductions in 2013. Some levelling-off happened between 2014 and 2018 for all customer groups. Additional reductions for EIUs introduced in 2018 again pushed the levies for households and non-EIUs up and the levies for EIUs down, thus consistent with the redistribution between different consumer groups.

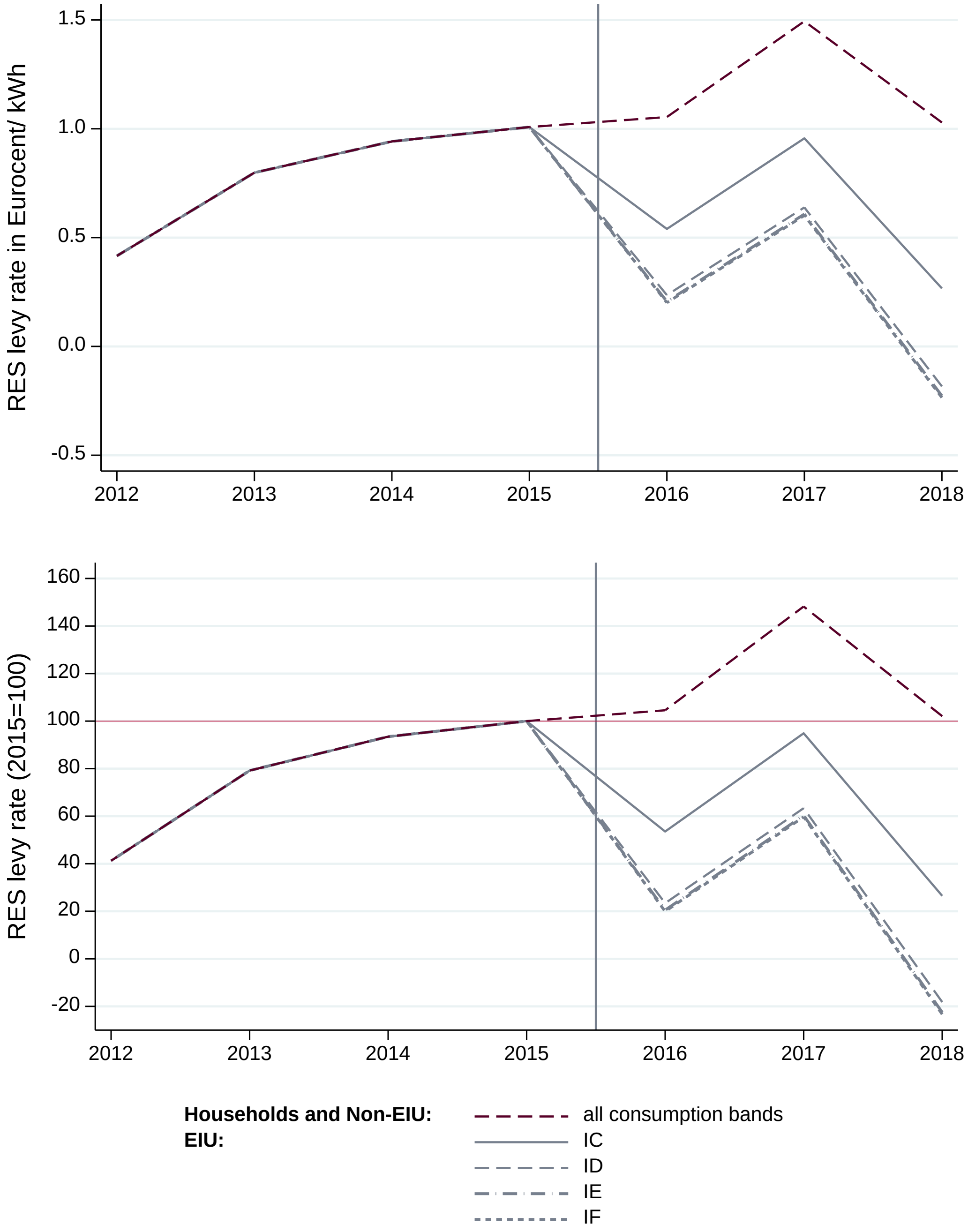
8.1.6 Latvia

Latvia has one levy, which is used to fund Renewable Energy Sources only. In order to be classified as EIUs, undertakings must exceed 0.5 GWh of annual electricity consumption. In 2016, Latvia introduced an EIU exemption, which takes the form of a compensation for 85% of the charge for RES over 0.5 GWh in the previous year (see Question 6).[272]

The following figure shows the development of RES levy rates in Eurocent/ kWh[273] in Latvia by consumption band and separately for energy-intensive users (EIUs) and non-EIUs. All households and non-EIUs pay the same RES levy, so there is only one line for all these groups. The lower panel shows the levy rates indexed to year 2015, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

[272] Due to this calculation, and because the levy rate decreased in 2018, some levy amounts of EIUs in this annual period were negative. Where a negative levy amount was calculated, the levy/electricity bill was assumed equal to zero.
[273] Figure 10 in Annex 11.1 shows the development indexed to 2015, illustrating the percentage changes in the levy relative the last year before the EIU exemption.

Figure 9: RES levy rate per consumption band in Latvia. Lower panel indexed to 2015



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates are taken from legislation. Note: Reductions are available for EIU as of Jul 2015. As the compensation is based on the levy amount of the previous year, negative values exist for EIU in 2018.

RES levies in Latvia generally follow a slight upwards trend. For EIUs, they shifted downwards with the introduction of rebates in 2016. The RES levy was below half a Cent in 2012 and increased to about 1 Cent in 2015. For non-rebated bands, it increased slightly in 2016, went up to about 1.5 Cent in 2017 and back to about 1 Cent in 2018. This up-and-down movement amounts to slightly more than 40% of the level of 2015.

For EIUs, the costs per kWh declined to about a quarter of a Cent in 2016 (20% of the level before), then rebound to between half a Cent and a Cent, depending on the band, and then declined again.

The following table describes the difference in levels of levies before to after the introduction of rebates to EIUs in 2016. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2013-2015 (three years before the introduction of rebates), the level for 2015-2018 (three years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 8: RES and other levies per user type and consumption band before and after introduction of rebate (Latvia)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2013-2015 (€)	2016-2018 (€)	Difference (€)	Difference (%)	2013-2015 (%)	2016-2018 (%)	Difference (p.p)	Difference (%)
Households								
DA	9.2	11.9	2.8	30.2	7.2	6.3	-0.9	-12.6
DB	16.0	20.9	4.8	30.2	6.7	7.3	0.6	9.0
DC	34.4	44.7	10.4	30.2	6.3	7.6	1.2	19.1
DD	91.6	119.2	27.6	30.2	6.2	7.8	1.6	26.5
DE	137.4	178.9	41.4	30.2	6.2	7.7	1.6	25.4
Non-EIUs								
IA	183.2	238.5	55.2	30.2	4.9	5.5	0.5	10.4
IB	2,381.8	3,100.1	718.2	30.2	5.9	7.5	1.5	25.6
IC	11,451.2	14,904.2	3,453.0	30.2	6.5	8.7	2.2	33.1
ID	100,770.3	131,156.7	30,386.4	30.2	7.1	9.9	2.8	38.7
IE	412,242.0	536,550.0	124,308.0	30.2	7.4	10.9	3.5	47.0
IF	1,007,702.7	1,311,566.7	303,864.0	30.2	8.4	12.9	4.5	53.8
EIUs								
IC	11,451.2	7,347.7	-4,103.5	-35.8	6.5	4.4	-2.1	-32.7
ID	100,770.3	25,365.7	-75,404.6	-74.8	7.1	2.5	-4.7	-65.3
IE	412,242.0	88,197.7	-324,044.3	-78.6	7.4	2.5	-5.0	-66.7
IF	1,007,702.7	208,317.7	-799,385.0	-79.3	8.4	3.0	-5.4	-64.1

Source: E.CA Economics based on data collected as answer to Question 6.

Comparing the period before to after the introduction, the table shows that total expenses increased by 30.2% for all bands who did not benefit from the rebates (households and non-EIUs). For households of band DA, it increased from 9.2 Euro to 11.9 Euro, or by 2.8 Euro. For band IF, expenses for RES levies increased from 1 million Euro to 1.3 million Euro by about 303 thousand Euro.

For EIUs that benefit from the reduction, total expenses declined. For band IC, the bill went down by 4 thousand Euro from 11.4 to 7.3 thousand Euro, a relative reduction of 35.8%. For bands ID through IF, the relative reduction was close to 80%, and band IF saw its expenses reduced by 0.8 million Euro.

The share of RES levies in the electricity bill (shown in the last part of the table) amounts to some 5 to 10% before the introduction of rebates. After the introduction, non-rebated but high-volume consumers (bands IE and IF) paid more than 10% of their electricity bill for RES levies while for those benefitting from the rebates, RES levies made up only 2.5 to 3% of the electricity bill.

Overall, the figures and table show that RES levies paid – both in Euro per year of as share of the electricity bill – increased significantly for all user groups not benefitting from a rebate and even for those EIUs for which the reduction affected only a small part of their consumption. On the other hand, EIUs with higher electricity consumption (bands ID, IE and IF), saw a significant reduction in the total Euro paid for RES levies or in the share of their electricity bill made up by RES levies.

8.1.7 Poland

Poland has two schemes, the RES Surcharge (opłata OZE) and Certificate of Origin System. The RES surcharge was set to 0 in 2018 and 2019 due to overfunding in 2017, but the Certificate of Origin System collected positive contributions (see Question 6).[274] The following sections first discuss the reduction for RES levies and then the reduction for CHP levies. Furthermore, Poland has three different reduction rates that depend on the EIUs electro-intensity. Firms only pay 80% of the RES surcharges if their electro-intensity is between 3% and 20%; they pay 60% if their electro-intensity is between 20% and 40%; and they pay 15% of the RES surcharge if their electro-intensity is above 40%.[275]

RES levies

The following figure shows the development of the RES levy rate in Eurocent/ kWh[276] in Poland for EIUs and non-EIUs. The RES levy is understood as a combination of the RES surcharge and the cost of the origin certificates. The lower panel shows the levy rates indexed to year 2013, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

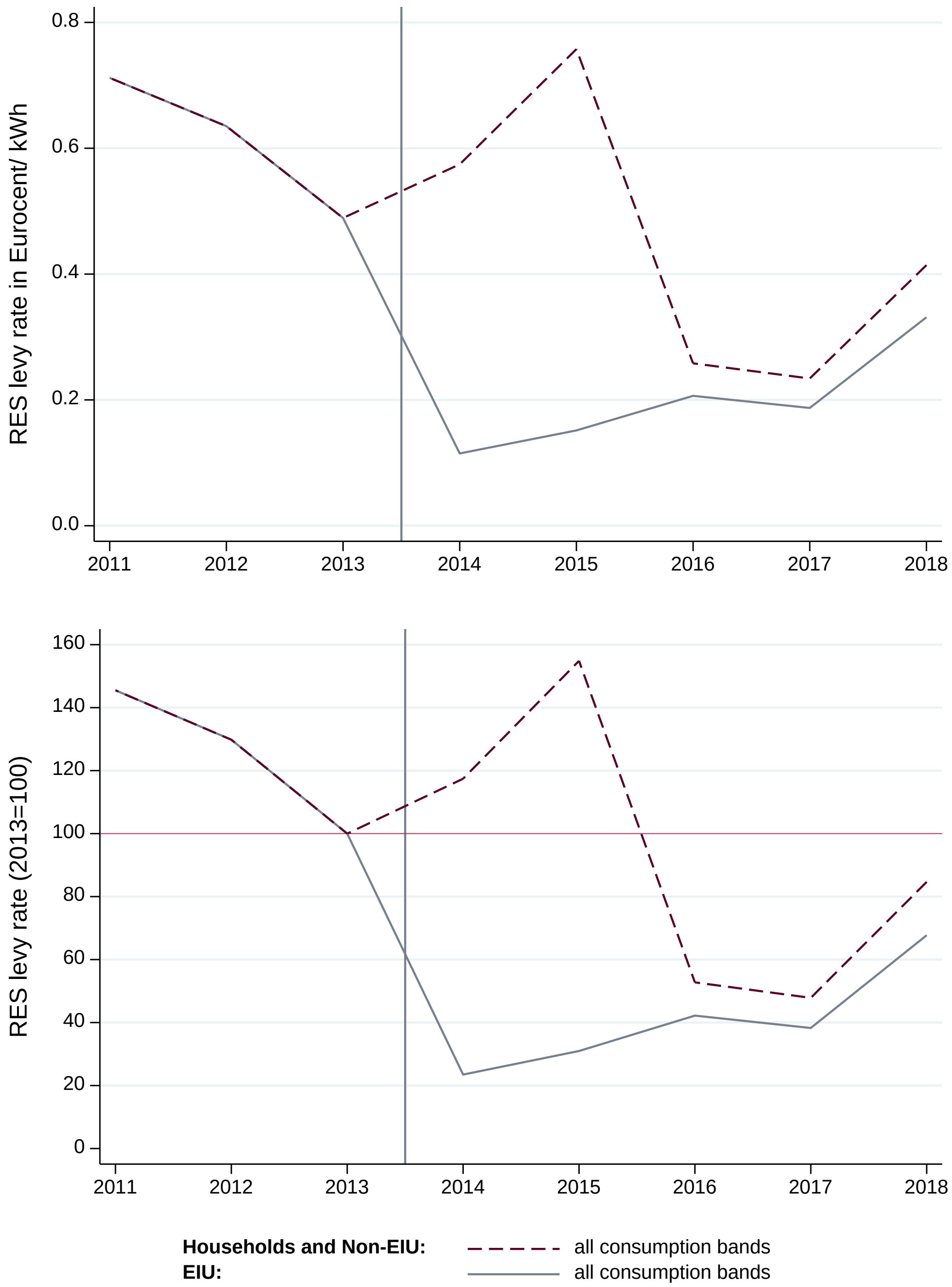
---

[274] *Since there are two levies, total rates as presented below are not zero in 2018.*

[275] *Source: SA.43697, para. 85.*

[276] *Figure 11 in Annex 11.1 shows the development indexed to 2013, illustrating the percentage changes in the levy relative to the last year before the introduction of the rebate for EIUs.*

Figure 10: RES levy rate per consumption band in Poland. Lower panel indexed to 2013



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates are taken from legislation. Green certificate rate is calculated by the University of East Anglia. Note: Reductions are available for EIU as of Jan 2014.

For households and non-EIUs, the RES levy rate decreased between 2011 and 2013 from about 0.7 Cent to 0.5 Cent and then re-increased to the same level over the years 2014 and 2015. After 2015, it sharply dropped to almost the same level of EIUs (about 0.25 Cent) for 2016 and 2017 and then increased to about 0.4 Cent in 2018 again. Relative to the level of 2013, this meant an increase by more than 50% over two years and then a decrease to about 50% of the 2013-level.

Rates for EIUs continued to decline after 2013 to about 0.1 Cent in 2014 (about 25% of the level of 2013) and then slightly increased again to about 0.2 Cent in 2016 and 2017 and above 0.3 Cent in 2018.

The following table describes the difference in levels of levies before to after the introduction of rebates. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2008-2011 (four years before the introduction of rebates), the level for 2012-2015 (four years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 9: RES levies per user type and consumption band before and after introduction of rebate (Poland)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2011-2013 (€)	2014-2016 (€)	Difference (€)	Difference (%)	2011-2013 (%)	2014-2016 (%)	Difference (p.p)	Difference (%)
Households								
DA	6.1	5.3	-0.8	-13.4	3.3	3.0	-0.4	-10.7
DB	10.7	9.3	-1.4	-13.4	4.0	3.6	-0.5	-11.2
DC	23.0	19.9	-3.1	-13.4	4.2	3.8	-0.5	-11.3
DD	61.2	53.0	-8.2	-13.4	4.4	3.9	-0.5	-11.6
DE	91.8	79.5	-12.3	-13.4	4.5	3.9	-0.6	-12.5
Non-EIUs								
IA	122.4	106.0	-16.4	-13.4	3.2	2.9	-0.3	-8.6
IB	1,591.3	1,378.2	-213.2	-13.4	4.2	3.9	-0.4	-9.1
IC	7,650.7	6,625.8	-1,024.9	-13.4	5.3	5.1	-0.2	-3.5
ID	67,326.0	58,307.0	-9,019.0	-13.4	6.1	5.9	-0.2	-4.0
IE	275,424.7	238,528.6	-36,896.0	-13.4	6.5	6.4	-0.1	-1.2
IF	673,260.3	583,070.0	-90,190.3	-13.4	6.8	6.9	0.1	1.6
EIUs								
IC	7,650.7	1,970.4	-5,680.3	-74.2	5.3	1.6	-3.7	-70.6
ID	67,326.0	17,339.8	-49,986.2	-74.2	6.1	1.8	-4.3	-70.9
IE	275,424.7	70,935.6	-204,489.1	-74.2	6.5	2.0	-4.6	-69.9
IF	673,260.3	173,398.0	-499,862.3	-74.2	6.8	2.1	-4.7	-68.9

Source: E.CA Economics based on data collected as answer to Question 6.

Comparing the period before to after the introduction of rebates, all customer groups saw a decline in their expensed for RES levies. This decline was 13.4% for non-rebated groups (households and non-EIUs) and 74.2% for EIUs. In monetary terms, annual expenses for households of band DA decreased by 80 Cent from 6.1 Euro to 5.3 Euro. For band IF of non-EIUs, it was 673 thousand Euro before and 583 thousand Euro after the reduction, a decline by 90 thousand Euro. For EIUs, the savings range from 5,680 for band IC to almost half a million for band IF, where expenses declined from 673 to 173 thousand Euro per year.

The share of RES levies in the electricity bill ranged from about 3% to 7% before the introduction of rebates and slightly declined afterwards for households and non-EIUs. The change in percentage points was between -0.6 and 0.1. For households, the share in the electricity bill declined by slightly more than 10%, for non-EIUs by less.

For EIUs, RES levies made up 2% or less of the electricity bill in 2014-2015. Relative to this, the share of RES levies in the electricity bill declined by about 70%.

Overall, there reduction has led to stronger rebates for EIUs than for non-rebated customer groups. However, this difference did not last. The rates were very similar from 2017 onwards.

CHP levies

Beyond RES levies, Poland also charges CHP levies. These are shown in Eurocent/ kWh[277] below and separately for non-rebated and rebated consumption bands. Since the reduction is very small and has very little effect on the difference between both rates, there is no figure that shows the indexed values.

Figure 11: CHP levy rate per consumption band in Poland

Source: E.CA Economics based on data collected as answer to Question 6.

These rebates take effect as of 2019 and have hardly any effect on total or relative levies. However, they lead to a strong decline in 2019 relative to 2018. The rebate affected all consumption bands in the same or almost the same way.[278]

8.1.8 Romania

Financing of RES in Romania is supported by a green certificates scheme. Electricity suppliers are legally obligated to hold a certain level of green certificates and pass on the costs for these certificates to customers. The passing on is determined based on the number of certificates per unit of electricity produced, the quantity of electricity invoiced,

---

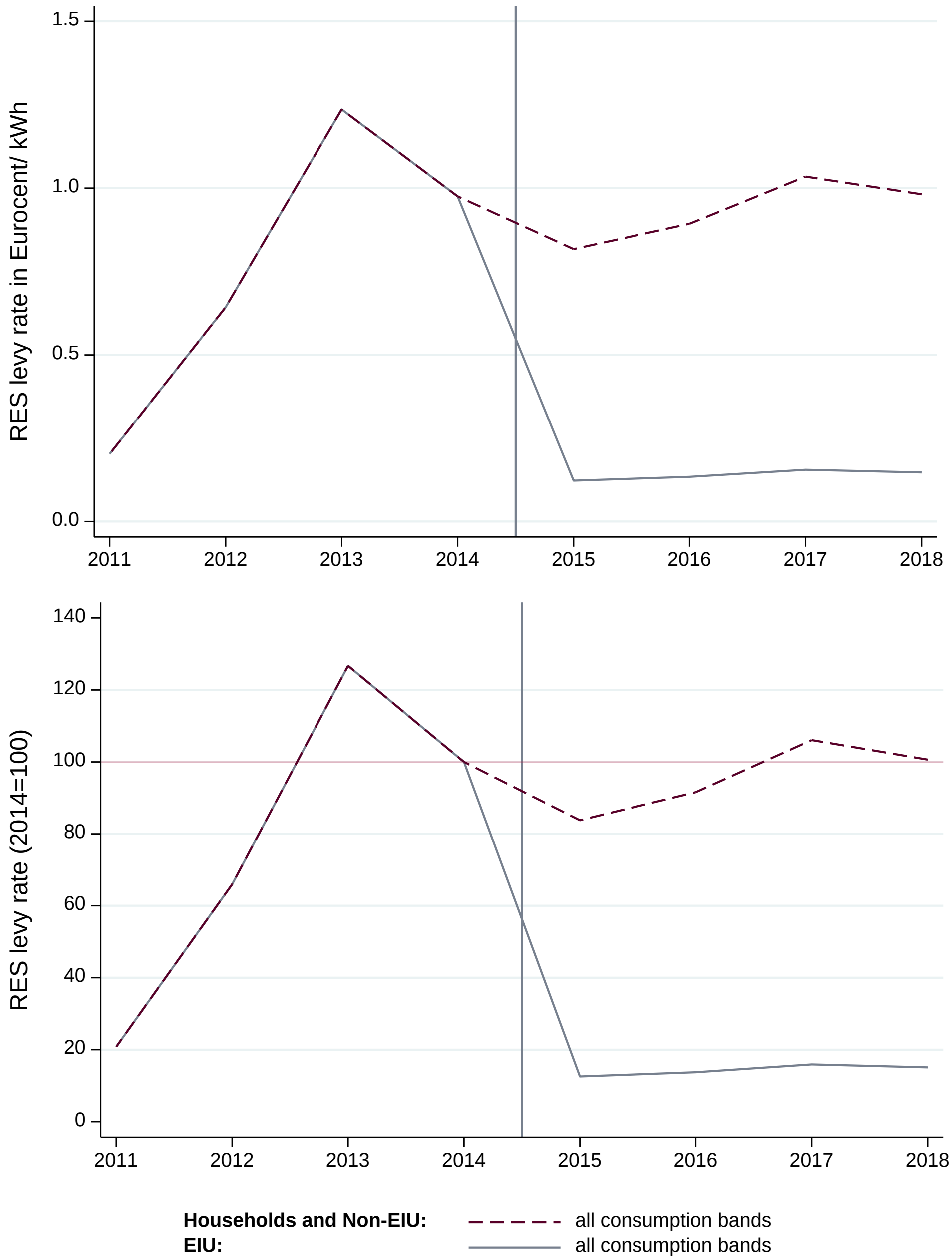
[277] Figure 12 in Annex 11.1 shows the development indexed to 2018, illustrating the percentage changes in the levy relative to the last year before the introduction of rebates for EIUs.
[278] There is no data on consumption for 2019, so it is not possible to compare total expenses.

and the average weighted price for traded certificates (see Question 6). In the following discussion refers to the rates resulting from this pass-on as RES levy rates. Romania introduced a reduction for EIUs, which was binding from the 1st August 2014 and applied in the data from 2015 onwards.

The following figure shows the development of RES levy rates in Eurocent/ kWh[279] in Romania by separately for households and non-EIUs on the one hand and energy-intensive users (EIUs) on the other hand. The lower panel shows the levy rates indexed to year 2014, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

[279] *Figure 13 in Annex 11.1 shows the development indexed to 2014, illustrating the percentage changes in the levy relative to the last year before the introduction of reductions for EIUs.*

Figure 12: RES levy rate per consumption band in Romania. Lower panel indexed to 2014



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates are taken from legislation. Note: Reductions are available for EIU as of Aug 2014.

RES levy rates in Romania started at about a quarter of a Cent in 2011, increased to about five times this value in 2013 and then dropped to slightly below 1 Cent in 2014. After that, EIUs benefitted from a reduction while households and non-EIUs did not.

For non-rebated customer groups, levies remained at about one Cent between 2014 and 2018. For EIUs, they dropped to about 0.2 Cent in 2015 and remained at this level. In relative terms, they dropped to less than 20% of their 2014-level.

The following table describes the difference in levels of levies before to after the introduction of rebates. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2013-2015 (three years before the introduction of rebates), the level for 2016-2018 (three years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 10: RES levies per user type and consumption band before and after introduction of rebate (Romania)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2013-2015 (€)	2016-2018 (€)	Difference (€)	Difference (%)	2013-2015 (%)	2016-2018 (%)	Difference (p.p)	Difference (%)
Households								
DA	10.1	9.7	-0.4	-3.9	7.5	7.6	0.0	0.0
DB	17.7	17.0	-0.7	-3.9	7.6	7.5	-0.1	-1.4
DC	37.9	36.4	-1.5	-3.9	7.8	7.6	-0.2	-2.2
DD	101.0	97.0	-4.0	-3.9	7.9	7.8	-0.1	-1.6
DE	151.4	145.5	-6.0	-3.9	8.1	8.1	-0.1	-0.8
Non-EIUs								
IA	201.9	194.0	-7.9	-3.9	6.9	8.1	1.2	16.8
IB	2,624.7	2,521.5	-103.2	-3.9	7.7	8.8	1.2	15.1
IC	12,618.9	12,122.7	-496.3	-3.9	9.1	10.2	1.1	12.4
ID	111,046.7	106,679.5	-4,367.1	-3.9	10.2	11.0	0.8	7.9
IE	454,281.8	436,416.2	-17,865.5	-3.9	11.4	12.3	0.9	7.7
IF	1,110,466.6	1,066,795.3	-43,671.3	-3.9	11.8	12.5	0.8	6.5
EIUs								
IC	9,724.4	1,818.4	-7,906.0	-81.3	6.8	1.6	-5.2	-76.6
ID	85,574.4	16,001.9	-69,572.5	-81.3	7.7	1.7	-6.0	-77.5
IE	350,077.3	65,462.4	-284,614.8	-81.3	8.5	1.9	-6.6	-77.4
IF	855,744.4	160,019.3	-695,725.1	-81.3	8.8	2.0	-6.8	-77.5

Source: E.CA Economics based on data collected as answer to Question 6.

The table shows that total expenses for RES levies did not change much for non-rebated customer groups. Comparing the three years before to after the introduction of the reduction, expenses declined by 3.9%. For households of band DA, this means that it went from 10.1 Euro to 9.7 Euro, a decline by 40 Cent. For band IF, this means that expenses for RES went from 1.11 million Euro to 1.07 million Euro, a decline by 44 thousand Euro.

The reduction for EIUs led to a decline by 81.3%. For band IF, this translates into expenses declining from 855 to 160 thousand Euro, a decline by 696 thousand Euro.

Relative to the electricity bill, the share of RES levies increases with consumption. While it makes up about 7.5% for band DA, it amounts to 11.8% for band IF in the years 2013-2015 and to 12.5% in 2016-2018. The difference both in percentage points and relative to the average share 2013-2014 was moderate for households with changes of far less than 1 percentage point and less than 3% in relative terms. For non-EIUs, the relative increase was highest for bands IA, IB and IC. These saw the share of their electricity bill grew by 1.1 to 1.2 percentage points, which means an increase of 12.4 to 16.8%. For EIUs, the relative changes were more pronounced as the share of RES levies in the electricity were from 6.8% to 8.8% in 2013-2015 and declined to less than 2% in the period 2016-2018. This implies a decline by more than 75%.

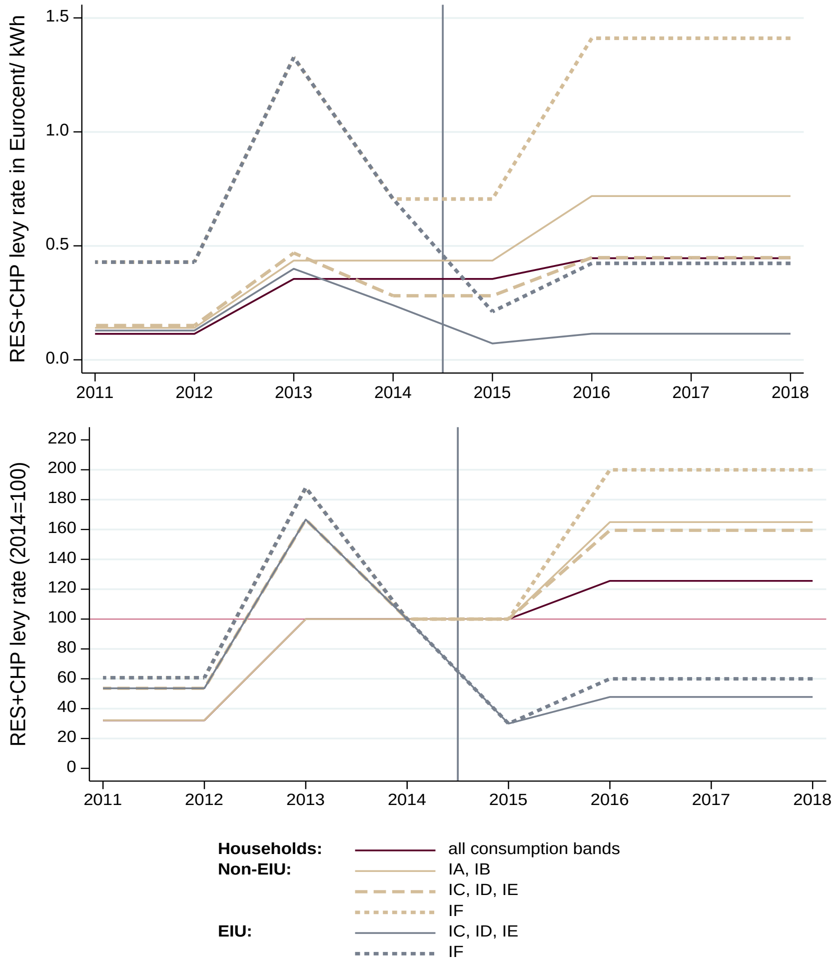
Overall, the reduction in Romania heavily affected EIUs' rates, while expenses and shares in expenses remained stable for non-rebated customer groups.

8.1.9 Slovenia

Slovenia has a levy that is used to fund both RES and CHP. The levy depends on consumers voltage levels, operating hours, and whether they are on a distribution or transmission connection (see Question 6). The following figure shows the development of RES levy rates in Eurocent/ kWh[280] in Slovenia by consumption band and separately for energy-intensive users (EIUs) and non-EIUs.

[280] *Figure 14 in Annex 11.1 shows the development indexed to 2014, illustrating the percentage changes in the levy relative to the last year before the introduction of rebates to EIUs.*

Figure 13: RES + CHP levy rate per consumption band in Slovenia. Lower panel indexed to 2014



Source: E.CA Economics based on data collected as answer to Question 6. Levy rates are taken from legislation. Note: Reductions are available for EIU as of 2015.

Consumption bands are grouped if they pay the same levy rates. The lower panel shows the levy rates indexed to year 2014, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.RES levies in Slovenia are heterogeneous. While all households pay the same levy, there are four different rates applicable to non-EIUs and two different rates for EIUs. There was a peak in 2013 but levels then declined for most consumption bands over the following years. As of 2015, bands IC, ID and IE of EIUs paid the lowest and band non-EIUs from band IF the highest levies. For households, levies were below 0.2 Cent in 2011 and increased to below 0.4 Cent in 2013 where they remained relatively stable. In 2016, they increased by 20% but remained below 0.5 Cent. For non-EIUs of all bands but IF, rates were similar up to 2013 and then slightly diverged. Overall, they remained in a corridor between 0.3 and 0.7 Cent, around the same level as for households. Rates for EIUs vary substantially by electricity consumption bands. For bands IC, ID and IE, they were similar to those of households but declined more after 2013, dropping to the lowest levy of all bands at about 0.2 Cent for the period 2015-2018. Band IF is the most special. Here, rates were high in the early years of observation (0.4 to 0.5 Cent in 2011 and 2012), increased strongly in 2013 and then decreased to below 0.4 Cent for EIUs but remained rather high (at 0.6 to 07 Cent) for non-EIUs. For the latter, levy rates increased to around 1.4 Cent for the period 2016-2018.

The following table describes the difference in levels of levies before to after the introduction of rebates. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2011-2014 (four years before the introduction of rebates), the level for 2015-2018 (four years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 11: RES levies per user type and consumption band before and after introduction of rebate (Slovenia)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2011-2014 (€)	2015-2018 (€)	Difference (€)	Difference (%)	2011-2014 (%)	2015-2018 (%)	Difference (p.p)	Difference (%)
Households								
DA	2.3	4.2	1.9	80.4	1.0	1.8	0.8	78.8
DB	4.1	7.4	3.3	80.4	1.2	2.1	0.9	71.5
DC	8.8	15.9	7.1	80.4	1.5	2.6	1.1	78.2
DD	23.5	42.4	18.9	80.4	1.6	3.0	1.4	83.7
DE	35.2	63.5	28.3	80.4	1.8	3.4	1.5	84.6
Non-EIUs								
IA	57.6	129.6	72.0	124.9	1.6	3.9	2.3	143.8
IB	749.2	1,685.0	935.8	124.9	2.1	5.2	3.1	144.7
IC	3,289.6	5,087.2	1,797.7	54.6	2.3	4.0	1.7	71.3
ID	28,948.1	44,767.7	15,819.6	54.6	2.6	4.7	2.1	78.3
IE	118,424.0	183,140.4	64,716.5	54.6	2.9	5.4	2.5	83.6
IF	794,757.4	1,358,299.3	563,541.9	70.9	8.4	17.4	8.9	106.3
EIUs								
IC	2,802.5	1,300.2	-1,502.3	-53.6	2.0	1.1	-0.9	-47.3
ID	24,662.0	11,441.8	-13,220.2	-53.6	2.2	1.2	-1.0	-44.9
IE	100,890.2	46,807.4	-54,082.7	-53.6	2.5	1.4	-1.1	-43.0
IF	794,757.4	407,489.8	-387,267.6	-48.7	8.4	6.0	-2.4	-28.8

Source: E.CA Economics based on data collected as answer to Question 6.

Between the period before and after the introduction of rebates (in 2015), expenses for RES levies changed differently according to their consumption bands.

For households, average expenses increased by 80.4%, which means an increase from 2.3 Euro to 4.2 Euro (by 1.9 Euro) for band DA and an increase from 35.2 Euro to 63.5 Euro (by 28.3 Euro) for band DE.

For non-EIUs, expenses more than doubled for bands IA and IB (increase by 124.9%) and increased by 54.6% for bands IC, ID, and IE. For band IE, this translates into an increase by 65 thousand Euro, from about 118 thousand Euro to 183 thousand Euro. For band IF, they went from 795 thousand to 1.36 million Euro, which is an increase by 564 thousand Euro or 70.9%.

EIUs saw their expenses roughly cut in half. They declined by 53.6% for bands IC, ID and IE and by 48.7% for band IF. In monetary terms, this means that expensed for band IF wend from 795 thousand Euro to 408 thousand Euro, a decline by 387 thousand Euro.

The share of levies in the electricity bill is lowest for households where it made up between 1 and 2% before 2015, which almost doubled after that. For non-EIUs, the share was slightly higher before the introduction of rebates (in particular for band IF) and the increase was larger. For bands IC, ID and IE, the increase was comparable to that of households but for bands IA and IB, the share increased by almost 150%. For IF, it roughly doubled.

For EIUs, the share was slightly above 2% for bands IC, ID and IE and this roughly halved after the introduction of rebates. For band IF, the reduction in terms of share of the bill was more moderate as it declined from 8.4% to 6.0%, a decrease by 2.4 percentage points, or by 28.8%.

Overall, the development is consistent with redistribution effects. While EIUs saw their expenses decline, these increased for households and non-EIUs. The effect was strongest for consumption band IF of non-EIUs which saw its rates increase strongly. However, rates for all non-rebated consumption bands increased within two years after the introduction of rebates and remained at a higher level.

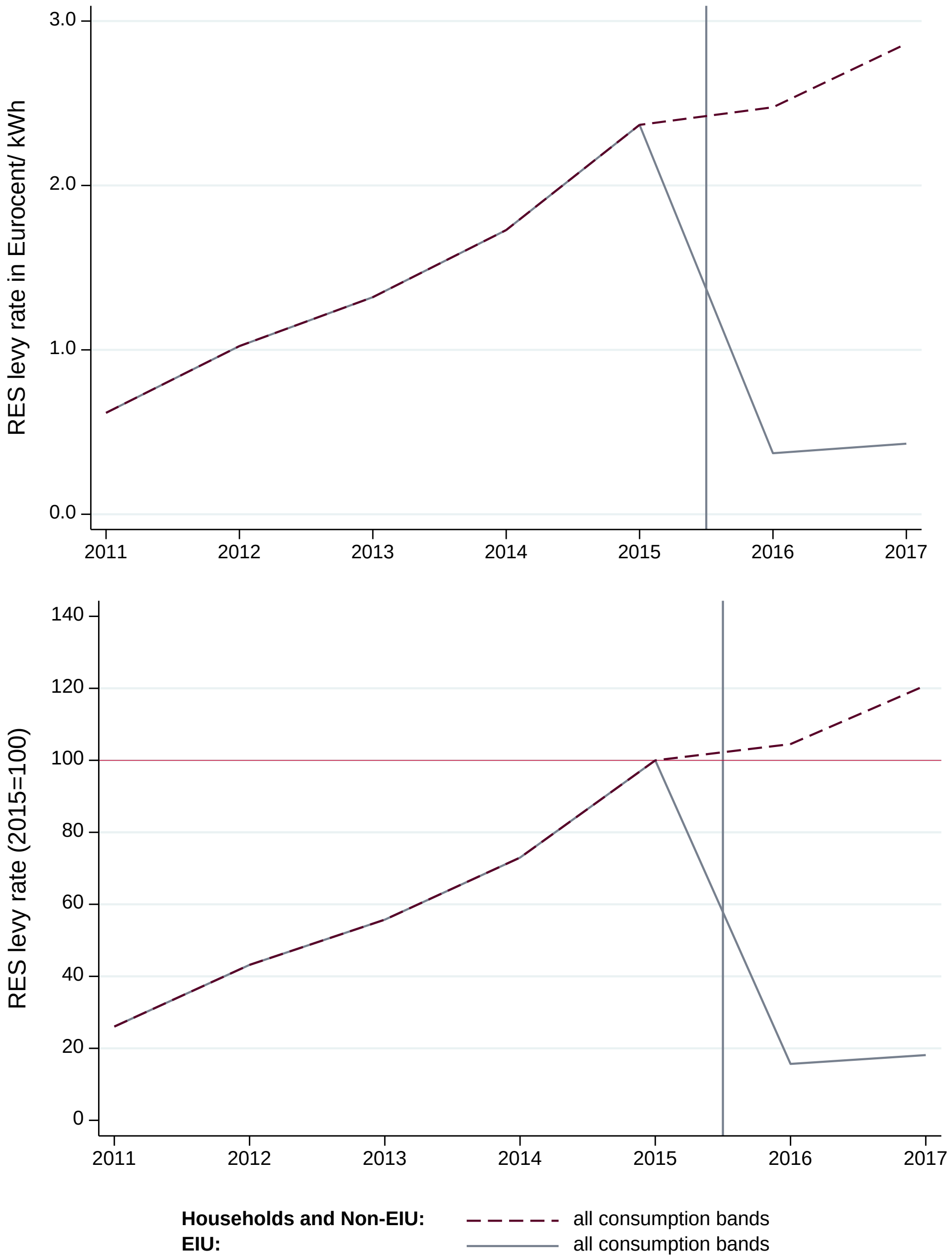
8.1.10 UK

The United Kingdom raises funds for RES via three different schemes: renewable obligations (RO) charged indirectly by a green certificate scheme and passed through to customers, a feed-in tariff scheme (FIT) and a contract for differences (CfD) scheme (see Question 6). In the following discussion refers to the totality of these schemes as RES levies.

The following figure shows the development of RES levy rates in Eurocent/ kWh[281] in the UK separately for energy-intensive users (EIUs) and non-EIUs (including households). The lower panel shows the levy rates indexed to year 2015, the year directly before the introduction of rebates. The horizontal red line marks the 100%-level of this index.

[281] *Figure 15 in Annex 11.1 shows the development indexed to 2015, illustrating the percentage changes in the levy relative to the last year before the introduction of rebates for EIUs.*

Figure 14: RES levy rate per consumption band in the United Kingdom. Lower panel indexed to 2015



Source: E.CA Economics based on data collected as answer to Question 6. CfD Levy rates are adjusted, green certificate and FiT rates are calculated by the University of East Anglia. Note: Reductions are available for EIU as of Jan 2016.

In general, RES levy rates increased almost linearly between 2011 and 2017 for non-rebated customer groups. Between 2011 and 2015, it grew from slightly above half a Cent to more than 2 Cent and then continued to grow up to slightly below 3 Cent in 2017. This is comparable to a 20% increase relative to 2015.

For EIUs who benefited from rebates since 2016, rates went down to less than half a Cent in 2016, or to about 20% of the level of 2015 and remained at this level for 2017.

The following table shows the difference in levels of levies before to after the introduction of rebates. The first two columns show the user type (households, non-EIUs and EIUs) and the consumption bands. The second part shows the average RES levies in Euro per year and the third part the average RES levies in percent of the electricity bill. Within each part, the table shows the level for 2014-2015 (two years before the introduction of rebates), the level for 2016-2017 (two years after the introduction of rebates), the simple difference (in Euro per year or percentage points, depending on the measure) and the difference in percent.

Table 12: RES levies per user type and consumption band before and after introduction of rebate (UK)

Cons. band	Average RES levy in Euro per year				Average RES levy as % of electricity bill			
	2014-2015 (€)	2016-2017 (€)	Difference (€)	Difference (%)	2014-2015 (%)	2016-2017 (%)	Difference (p.p)	Difference (%)
Households								
DA	20.5	26.7	6.2	30.3	8.0	10.1	2.1	26.1
DB	35.9	46.7	10.9	30.3	8.9	12.7	3.8	42.6
DC	76.8	100.1	23.3	30.3	9.9	14.4	4.6	46.0
DD	204.9	266.9	62.0	30.3	10.9	15.8	4.9	45.1
DE	307.3	400.4	93.0	30.3	11.9	16.9	5.1	42.8
Non-EIUs								
IA	409.8	533.8	124.0	30.3	9.6	14.4	4.8	50.5
IB	5,327.0	6,939.5	1,612.6	30.3	10.8	15.3	4.6	42.5
IC	25,610.4	33,363.2	7,752.8	30.3	12.0	17.3	5.3	43.9
ID	225,371.4	293,595.8	68,224.4	30.3	13.2	18.5	5.3	40.3
IE	921,973.7	1,201,073.6	279,099.8	30.3	13.4	18.8	5.4	40.0
IF	2,253,713.6	2,935,957.6	682,244.0	30.3	13.8	19.1	5.3	38.8
EIUs								
IC	25,610.4	5,004.5	-20,605.9	-80.5	12.0	3.1	-9.0	-74.6
ID	225,371.4	44,039.4	-181,332.0	-80.5	13.2	3.3	-9.9	-75.0
IE	921,973.7	180,161.0	-741,812.7	-80.5	13.4	3.4	-10.1	-75.0
IF	2,253,713.6	440,393.6	-1,813,319.9	-80.5	13.8	3.4	-10.3	-75.1

Source: E.CA Economics based on data collected as answer to Question 6.

Between two years before and after the introduction of rebates, the contributions households and non-EIUs increased by 30.3%. In monetary terms, this means that expenses for band DA increased by 6.2 Euro, from 20.5 Euro in 2014-2015 to 26.7 Euro in

2016-2017. For band IF, this means that expenses went up from 2.25 million Euro to 2.94 million Euro, or by 682 thousand Euro. For EIUs, the rebate led to a substantial reduction. The average contribution in 2016-2017 was 80.5% lower than in 2014-2015. For band IF of EIUs, expenses went from 2.25 million Euro to 0.44 million Euro, a decline by 1.81 million Euro. The share of the electricity bill grows with consumption inside the three user type groups (households, non-EIUs and EIUs). For households and non-EIUs, this share increased by about 40 to 50%. Only the share of group DA increased by only 26.1%. For EIUs, it declined from some 12 to 14% of the electricity bill to slightly above 3%, a decline by about 75%.Overall, the development shows an ongoing increase in levies, expenses and share of the electricity bill for non-rebated customers. At the same time, there was a substantial downward shift of the burden on EIUs.

Annex 8.2 - Grandfathering rule

Table 13: Relevance of grandfathered undertakings in NACE sectors in Poland (RES and CHP 2017)

NACE	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
0111	281.29	N/A	1	N/A	N/A	N/A	(One) sales data from 2018; Data for NACE A is not available
0210	265.74	N/A	2	N/A	N/A	N/A	Data for NACE A is not available
2561	54.94	2,388.3	1	4,193	2.3	0.024	
3511	6.12	8,188.4	1	2,989	0.075	0.033	
3811	N/A	2,560.3	1	2,256	N/A	0.044	No sales data available for grandfathered firms
4120	4.12	19,261.4	1	54,438	0.021	0.0018	
4671	*2,500.69	30,287.5	1	4,447	*8.26	0.025	*One firm is producing coal, yet is exempted through its wholesale entity in NACE 4671
4673	79.44	12,494.9	2	11,757	0.636	0.017	
4675	2,315.55	10,987.0	1	3,068	21.1	0.0326	One firm is also grandfathered for CHP

NACE	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathere d under-takings	NACE sector	% of sales	% of no. of under-takings	
4677	2.61	4,481.3	1	3,744	0.058	0.0267	
4690	291.23	42,641.1	2	23,510	0.683	0.0085	One firm is also grandfathered for CHP
6810	*986.79	3,004.6	1	9,102	*32.8	0.011	One firm is also grandfathered for CHP; *One firm is producing coal, yet is exempted through its holding entity in NACE 6810
7022	119.54	5,265.1	1	39,770	2.27	0.0025	

*Source: Bureau van Dijk, Eurostat. . Note: *If the holding entities of the coal producers are assessed against NACE 0510 (Mining of coal and lignite), the proportion of grandfathered undertakings in respect to sales is 56.22% and 3.51% in respect to the number of undertakings.*

Table 14: Relevance of grandfathered undertakings in NACE sectors in Germany

NACE [282]	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
1052	132.91	1,437.0	2	223	9.249	0.897	

[282] ***NACE Codes** – 1052 Manufacture of ice cream; 1060 Manufacture of grain mill products, starches and starch products; 1072 Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes; 1089 Manufacture of other food products n.e.c.; 1330 Finishing of textiles; 1610 Sawmilling and planing of wood; 1729 Manufacture of other articles of paper and paperboard; 1810 Printing and service activities related to printing; 1812 Other printing; 1813 Pre-press and pre-media services; 1820 Reproduction of recorded media; 2229 Manufacture of other plastic products; 2361 Manufacture of concrete products for construction purposes; 2451 Casting of iron; 2561 Treatment and coating of metals; 2562 Machining; 2810 Manufacture of general-purpose machinery; 2932 Manufacture of other parts and accessories for motor vehicles; 3317 Repair and maintenance of other transport equipment; 3511 Production of electricity; 3811 Collection of non-hazardous waste; 4120 Construction of residential and non-residential buildings; 4312 Site preparation; 4671 Wholesale of solid, liquid and gaseous fuels and related products; 4673 Wholesale of wood, construction materials and sanitary equipment; 4675 Wholesale of chemical products; 4677 Wholesale of waste and scrap; 4690 Non-specialised wholesale trade; 4900 Land transport and transport via pipelines; 4920 Freight rail transport; 4931 Urban and suburban passenger land transport; 4940 Freight transport by road and removal services; 5221 Service activities incidental to land*

NACE[282]	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
1071	N/A	20,680.9	1	9,383	N/A	0.011	
1330	2.65	1,220.5	3	1,291	0.217	0.232	Sales data available for 1/3 firms
1810	19.61	19,045.0	3	9,585	0.103	0.03	Sales data available for 2/3 firms; Sales data from 2016 for one firm; 3/3 NACE codes are reassigned by Orbis
1812	1,364.93	14,649.7	20	6,444	9.317	0.31	Sales data available for 15/20 firms
1820	148.99	12,237.1	1	1,615	1.22	0.124	Sales data from 2015 for one firm; Sales data available for 1/2 firms
2361	9.60	8,534.6	1	1,163	0.112	0.086	
2562	7.10	21,115.0	1	16,155	0.034	0.006	
2810	N/A	103,786.8	1	2,171	N/A	0.046	Sales data available for 0/1 firms; 1/1 NACE code is reassigned by Orbis
3317	12.54	2,712.9	1	975	0.462	0.103	1/1 NACE code is reassigned by Orbis

transportation; 5222 Service activities incidental to water transportation; 5229 Other transportation support activities; 6420 Activities of holding companies; 6810 Buying and selling of own real estate; 7022 Business and other management consultancy activities; 7490 Other professional, scientific and technical activities n.e.c.; 8292 Packaging activities; 8299 Other business support service activities n.e.c.; 9609 Other personal service activities n.e.c..

NACE[282]	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
4212	N/A	2,044.5	1	260	N/A	0.385	Sales data available for 0/1 firms; 1/1 NACE codes is reassigned by Orbis
4312	336.38	2,334.9	1	3,142	14.407	0.032	1/1 NACE codes is reassigned by Orbis
4690	N/A	77,043.5	1	4,693	N/A	0.021	1/1 NACE codes is reassigned by Orbis
4900	88.78	95,219.6	3	70,215	0.093	0.003	3/3 NACE codes are reassigned by Orbis; Sales data available for 1/3 firms
4920	6,457.05	N/A	25	N/A	N/A	N/A	NACE code data on Eurostat is confidential
4931	195.40	25,140.0	4	3,887	0.777	0.077	3/4 NACE codes are reassigned by Orbis
4940	3.1	44,824.0	1	38,455	0.007	0.003	1/1 NACE codes is reassigned by Orbis
5221	37.52	10,660.1	2	2,534	0.352	0.079	2/2 NACE codes are reassigned by Orbis
5222	171.57	3,396.7	1	688	5.051	0.145	1/1 NACE codes is reassigned by Orbis

NACE [282]	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
5229	1,294.63	87,489.5	5	15,515	1.480	0.032	5/5 NACE codes are reassigned by Orbis; Sales data available for 3/5 firms
6420	264.86	N/A	2	N/A	N/A	N/A	2/2 NACE codes are reassigned by Orbis; NACE code does not appear on Eurostat
7490	78.19	15,120.9	1	34,600	0.517	0.003	1/1 NACE codes is reassigned by Orbis
8292	N/A	3,651.6	1	1,276	N/A	0.078	1/1 NACE codes is reassigned by Orbis; One firm does not have sales data available
8299	86.62	31,606.7	1	34,768	0.274	0.003	1/1 NACE codes is reassigned by Orbis
9609	6.0	N/A	1	N/A	N/A	N/A	1/1 NACE codes is reassigned by Orbis; NACE code is not available on Eurostat

Source: Bureau van Dijk, Eurostat. Note: There are additional grandfathered undertakings, based on the NACE code provided by BAFA, in the NACE codes 1060,1071 (3x), 1600, 1820, 2200, 2450, and 2562. Due to the conflicting information between BAFA and Orbis in respect to the NACE codes, they are neglected in the table. Additionally, there are three undertakings, which BAFA tags with NACE 4920, while Orbis tags them with NACE 4910. These undertakings are not included in the map of undertakings active in NACE 4910

Table 15: Relevance of grandfathered undertakings in NACE sectors in Italy

NACE [283]	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
0100	14.7		1				NACE code is not available on Eurostat
0110	48.0		1				NACE code is not available on Eurostat
0111	6.4		1				NACE code is not available on Eurostat

[283] ***NACE Codes*** *– 111 Growing of cereals (except rice), leguminous crops and oil seeds, 0161 Support activities for crop production, 0163 Post-harvest crop activities, 0210 Silviculture and other forestry activities, 1052 Manufacture of ice cream, 1071 Manufacture of bread; manufacture of fresh pastry goods and cakes, 1330 Finishing of textiles, 1811 Printing of newspapers, 1812 Other printing, 1814 Binding and related services, 2361 Manufacture of concrete products for construction purposes, 2363 Manufacture of ready-mixed concrete, 2364 Manufacture of mortars, 2550 Forging, pressing, stamping and roll-forming of metal; powder metallurgy, 2561 Treatment and coating of metals, 2562 Machining, 3312 Repair of machinery, 3521 Manufacture of gas, 3821 Treatment and disposal of non-hazardous waste, 4120 Construction of residential and non-residential buildings, 4321 Electrical installation, 4621 Wholesale of grain, unmanufactured tobacco, seeds and animal feeds, 4631 Wholesale of fruit and vegetables, 4632 Wholesale of meat and meat products, 4639 Non-specialised wholesale of food, beverages and tobacco, 4641 Wholesale of textiles, 4662 Wholesale of machine tools, 4669 Wholesale of other machinery and equipment, 4673 Wholesale of wood, construction materials and sanitary equipment, 4674 Wholesale of hardware, plumbing and heating equipment and supplies, 4675 Wholesale of chemical products, 4676 Wholesale of other intermediate products, 4791 Retail sale via mail order houses or via Internet, 4941 Freight transport by road, 5210 Warehousing and storage, 5814 Publishing of journals and periodicals, 6420 Activities of holding companies, 6820 Renting and operating of own or leased real estate, 7010 Activities of head offices, 7219 Other research and experimental development on natural sciences and engineering, 9609 Other personal service activities n.e.c., 0100 Crop and animal production, hunting and related service activities, 0110 Growing of non-perennial crops, 0700 Mining of metal ores, 0810 Quarrying of stone, sand and clay, 0890 Mining and quarrying n.e.c., 1000 Manufacture of food products, 1010 Processing and preserving of meat and production of meat products, 1030 Processing and preserving of fruit and vegetables, 1060 Manufacture of grain mill products, starches and starch products, 1070 Manufacture of bakery and farinaceous products, 1090 Manufacture of prepared animal feeds, 1300 Manufacture of textiles, 1700 Manufacture of paper and paper products, 1710 Manufacture of pulp, paper and paperboard, 1720 Manufacture of articles of paper and paperboard, 1810 Printing and service activities related to printing, 2000 Manufacture of chemicals and chemical products, 2010 Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms, 2100 Manufacture of basic pharmaceutical products and pharmaceutical preparations, 2210 Manufacture of rubber products, 2220 Manufacture of plastics products, 2300 Manufacture of other non-metallic mineral products, 2310 Manufacture of glass and glass products, 2340 Manufacture of other porcelain and ceramic products, 2350 Manufacture of cement, lime and plaster, 2400 Manufacture of basic metals, 2430 Manufacture of other products of first processing of steel, 2440 Manufacture of basic precious and other non-ferrous metals, 2450 Casting of metals, 2500 Manufacture of fabricated metal products, except machinery and equipment, 2510 Manufacture of structural metal products, 2560 Treatment and coating of metals; machining, 2590 Manufacture of other fabricated metal products, 2610 Manufacture of electronic components and boards, 2810 Manufacture of general-purpose machinery, 2820 Manufacture of other general-purpose machinery, 2840 Manufacture of metal forming machinery and machine tools, 2930 Manufacture of parts and accessories for motor vehicles, 3100 Manufacture of furniture, 4600 Wholesale trade, except of motor vehicles and motorcycles, 5810 Publishing of books, periodicals and other publishing activities, 7110 Architectural and engineering activities and related technical consultancy*

NACE 283	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
0161	54.8		2				NACE code is not available on Eurostat
0163	275.2		1				NACE code is not available on Eurostat
0210	69.9		2				NACE code is not available on Eurostat
0700	150.3		1				Eurostat data is partially confidential, thus not representative/neglected
0810	35.3	2007.0	3	1736	1.758	0.173	N/A
0890	83.9	611.4	1	140	13.725	0.714	N/A
1000	192.7	117954.9	5	52542	0.163	0.010	N/A
1010	139.7	24177.7	6	3182	0.578	0.189	N/A
1030	102.0	11565.3	5	1768	0.882	0.283	One sales number is from before 2017
1052	404.5	1063.4	2	354	38.037	0.565	One undertaking is a leading player in the market
1060	40.6	7131.0	2	1146	0.570	0.175	N/A
1070	17.4	19269.8	1	34285	0.090	0.003	N/A
1071	156.7	7736.7	7	29061	2.026	0.024	N/A
1090	175.7	5537.6	5	492	3.172	1.016	N/A
1300	112.9	20796.7	5	13471	0.543	0.037	One sales number is from after 2017
1330	591.1	2082.3	52	2190	28.385	2.374	One sales number is from before 2017; Four undertakings together generate more than 20% of the aggregated

NACE 283	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
							sales of all grandfathered undertakings
1700	735.4	23176.1	2	3637	3.173	0.055	N/A
1710	354.8	5987.9	6	180	5.925	3.333	N/A
1720	351.4	17188.2	8	3457	2.044	0.231	One sales number is not available
1810	44.5	10281.6	3	14901	0.433	0.020	N/A
1811	38.3	339.4	4	35	11.286	11.429	N/A
1812	1281.9	8509.9	37	11652	15.064	0.318	One sales number is not available
1814	111.7	605.2	2	1112	18.453	0.180	One undertaking is a leading player in the market
2000	1153.0	68662.3	7	4250	1.679	0.165	N/A
2010	5412.3	39870.3	13	989	13.575	1.314	N/A
2100	275.9	27146.7	6	405	1.016	1.481	N/A
2210	677.1	12355.2	8	1339	5.480	0.597	One sales number is from before 2017
2220	5274.4	33614.3	188	8330	15.691	2.257	One sales number is from before 2017
2300	40.8	28583.8	1	17978	0.143	0.006	N/A
2310	1032.1	6090.6	14	2933	16.946	0.477	N/A
2340	55.6	979.6	3	2198	5.680	0.136	One sales number is not available
2350	3.6	2057.3	1	146	0.177	0.685	N/A
2361	33.5	2117.0	2	1139	1.582	0.176	One sales number is from before 2017
2363	40.7	2144.4	2	1074	1.898	0.186	N/A
2364	12.7	238.3	1	71	5.343	1.408	N/A

NACE 283	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
2400	580.9	57899.4	1	3257	1.003	0.031	N/A
2430	105.3	6227.5	4	667	1.691	0.600	N/A
2440	611.0	14838.4	3	663	4.118	0.452	N/A
2450	1511.7	6776.1	36	1036	22.309	3.475	Two undertakings together generate more than 40% of the aggregated sales of all grandfathered undertakings
2500	354.3	80720.4	7	62759	0.439	0.011	N/A
2510	235.7	19012.8	6	29506	1.240	0.020	N/A
2550	3464.2	11170.7	92	1317	31.011	6.986	N/A
2560	23.7	19029.7	1	15465	0.124	0.006	N/A
2561	1215.0	5309.6	94	3682	22.883	2.553	One sales number is from after 2017
2562	1144.7	13720.1	46	11783	8.344	0.390	One sales number is not available
2590	293.3	18552.4	8	11158	1.581	0.072	N/A
2610	1598.0	6090.3	1	1940	26.239	0.052	One undertaking is a leading player in the market
2810	15.1	31350.9	1	2712	0.048	0.037	N/A
2820	134.2	40630.4	4	7314	0.330	0.055	One sales number is not available
2840	356.0	9137.1	2	1699	3.896	0.118	N/A
2930	179.7	24504.4	1	1425	0.733	0.070	N/A
3100	633.8	22300.6	8	18200	2.842	0.044	N/A
3312	20.7	6719.9	2	18563	0.308	0.011	N/A
3521	67.9	94.4	2	45	71.911	4.444	One undertaking is a leading player in the market and generates more than 65% of all sales in the NACE

NACE[283]	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
							sector; sector only includes other manufacturer of gas, yet undertaking is also active in related sectors
3821	5.4	4468.3	1	771	0.121	0.130	N/A
4120	21.8	51694.5	2	109670	0.042	0.002	N/A
4321	29.9	20204.4	1	66412	0.148	0.002	N/A
4600	29.4	517968.3	2	379784	0.006	0.001	N/A
4621	84.0	13649.2	3	3436	0.615	0.087	N/A
4631	37.3	24656.6	2	7874	0.151	0.025	N/A
4632	22.7	11553.6	2	3018	0.196	0.066	N/A
4639	146.2	21024.9	2	2349	0.695	0.085	N/A
4641	2.7	4117.5	1	3248	0.065	0.031	N/A
4662	52.7	6242.7	1	3538	0.845	0.028	N/A
4669	35.4	17937.3	1	9149	0.197	0.011	N/A
4673	97.8	18184.3	3	15667	0.538	0.019	N/A
4674	39.5	17142.3	3	6951	0.231	0.043	N/A
4675	466.9	16162.7	3	3981	2.889	0.075	N/A
4676	222.6	7841.2	4	3315	2.839	0.121	One sales number is not available
4791	14.0	9834.4	1	12170	0.143	0.008	N/A
4941	23.1	47308.5	1	62752	0.049	0.002	N/A
5210	15.9	3630.9	1	1660	0.439	0.060	N/A
5810	88.3	7421.9	2	4648	1.190	0.043	N/A
5814	49.2	2287.0	1	1791	2.153	0.056	N/A
6420	79.1		2				One sales number is from after 2017

NACE 283	2017 sales in EUR million		Number of undertakings		Proportion of grandfathered undertakings		Comments
	Grand-fathered under-takings	NACE sector	Grand-fathered under-takings	NACE sector	% of sales	% of no. of under-takings	
6820	151.8	23729.2	4	144539	0.640	0.003	N/A
7010	277.5	6478.6	5	1241	4.283	0.403	N/A
7110	17.7	15887.5	1	196199	0.111	0.001	N/A
7219	16.6	2575.8	1	4489	0.645	0.022	N/A
9609	17.6		1				NACE code is not available on Eurostat

Source: Bureau van Dijk, Eurostat. Note: There are 19 undertakings, which were identified by Orbis, yet do not show a NACE code. Therefore, these undertakings could also potentially be grandfathered undertakings. These undertakings are neglected in the table and therefore their respective share is potentially underestimated. Additionally, there are 54 undertakings on the list of beneficiaries provided by the Italian regulator, which Orbis did not identify based on the tax ID code (Partita IVA). If possible, these were identified on Orbis through their company name. If the manual search did not yield the appropriate undertaking listing on Orbis, the concerned undertaking is being neglected.

Annex 8.3 - Literature review

Impacts of environmental regulations on the affected firms have been extensively debated and analysed in the economic literature. There are two different views in the environmental economics literature on the effects of asymmetric policies on the firms' performance: the *pollution haven (or carbon leakage) hypothesis* and the *Porter hypothesis*.

The pollution haven hypothesis predicts that more stringent environmental policies will increase compliance costs and drive pollution-intensive production to regions with weak environmental policy (e.g., Levinson and Taylor, 2008). Subsequently, there will be a *carbon leakage* from the regions with more stringent environmental policies to regions with weak environmental policy. Imposing RES levies should have thus caused carbon leakage from EU to other regions of the world, insofar as the tightening of environmental policy has been unilateral.

In contrast, the Porter hypothesis (Porter and van der Linde 1995) argues that stringent environmental policies promote cost-cutting efficiency improvements, which reduce or completely offset regulatory costs, and foster innovation in new technologies. This, subsequently, helps firms to achieve international technological leadership and expand market share.

This section, reviews the recent economic literature that has analysed the impacts of asymmetric environmental regulations on competitiveness. Although most of the papers do not discuss RES levies per se, any environmental policy that increases the cost of using non-renewable energy - such as carbon emission price –expectedly has similar effects as RES levies.

The section begins by reviewing the predictions from recent papers that have applied computational general equilibrium (CGE) models. In the second subsection, it moves on to review the recent empirical literature. First, it discusses at papers where the point of departure is more based on the pollution haven hypothesis and which analyse, for example, whether it is observable that more stringent environmental policies would have caused changes in trade flows or firms' location choices. Second, it discusses papers that build more on the Porter hypothesis and focus on the impacts of environmental regulations on various measures of competitiveness, such as productivity, innovation, sales, export share, and investment. Third, it focuses on papers that have assessed the impacts of environmental regulations on employment. The final subsection concludes.

Carbone and Rivers (2017) have recently reviewed the CGE models on this topic, whilst Dechezleprêtre and Sato (2017) have gone through the empirical literature. The section below will build upon these reviews and, for simplicity, refer to the former by CR and to the latter by DS. It summarises the main findings from these reviews, discussing explicitly each paper that has employed data from EU. Alongside it complements the text with the most recent studies published after 2017. Unfortunately, the studies that employ data from EU do not yet cover the period beyond 2013.

8.3.1 CGE models

This section focuses on studies that employ CGE models to predict the impacts of environmental regulation on international trade, productivity, economic performance and employment. CGE models are based on the same foundation as theoretical models, but they are solved numerically rather than algebraically. In addition, CGE models calibrate the system of equations to observed economic data, thus providing a numerical estimate of the magnitude of the effect to be estimated.

According to the pollution haven hypothesis, stringent environmental policies drive pollution-intensive production to regions with weak environmental policy. Subsequently, within a given country, and insofar as the environmental policies are effective, a reduction in greenhouse gas emissions should be associated with a decrease in net exports in energy intensive sectors. When energy intensive sectors move their production abroad, exports of those goods decrease and some of the domestic consumption is replaced by imports. Meanwhile, greenhouse gas emissions in the country decrease.

This hypothesis is also partly supported by the models studied by CR: The average model arrives to a reduction of approximately 7 percent in *exports* for a country that unilaterally reduces its greenhouse gas emissions by 20 percent. However, CR is not able to find discernible relationship across the studies between import volumes and levels of unilateral greenhouse gas reductions.

8.3.1.1 Productivity, innovation and economic performance

The models reviewed by CR also seem to agree that the output in emission intensive sectors decreases when a country unilaterally cuts down greenhouse gas emissions. Moreover, there appears to be some agreement among the studies concerning the magnitude of this effect: for a 20 percent reduction in emission levels from the pre-policy baseline, the models predict a reduction of approximately 5 percent in output. This is slightly lower than the reduction of 8.3% obtained by Pezzey (1992) for EC.

In a fairly recent paper Baccianti and Löschel (2014) develop a dynamic multi-sector CGE model that distinguishes between R&D-based process innovation for all firms, endogenous product innovation in the capital good sector and adoption decisions with respect to the installation of new capital vintages in the rest of the economy. The results of the authors support the previous literature in finding that aggregate innovation declines following an energy tax but whereas process innovation is reduced, product innovation actually rises. The authors further find that demand pull policies are less effective than product-related R&D subsidies to reduce aggregate energy intensity.

8.3.1.2 Employment

According to CR, only a few studies examine the response of employment levels to unilateral reductions in greenhouse gas levels. However, the ones that do suggest a response that is very similar to output: roughly a 5 percent reduction in emission intensive sector employment when there is a 20 percent unilateral reduction in the greenhouse gas emissions.

In a recent paper by Castellanos and Heutel (2019) develop a CGE model of US economy to study the unemployment effects of climate policy and the importance of cross-sectoral labour mobility. The authors consider two alternate extreme assumptions about labour mobility: either perfect mobility, as is assumed in much previous work, or perfect immobility. The effect of a $35 per ton carbon tax on aggregate unemployment is small and similar across the two labour mobility assumptions (0.2–0.3 percentage points). The effect on unemployment in fossil fuel sectors is much larger under the immobility assumption – a 30 percentage-point increase in the coal sector – suggesting that models omitting labour mobility frictions may greatly under-predict sectoral unemployment effects. Returning carbon tax revenue through labour tax cuts can dampen or even reverse negative impacts on unemployment, while command-and-control policies yield larger unemployment effects.

8.3.2 Ex-post studies

8.3.2.1 International trade and location choice

At the most straightforward level, pollution haven hypothesis has been tested simply by examining the overall effect of international trade on the quality of the environment. Based on the reviewed literature, DS find little evidence that would support the hypothesis that international trade would worsen the quality of the environment. In fact, the authors even refer to a study by Antweiler et al. (2001), where international trade is found to decrease the level of sulfur dioxide concentration, because the increase in economic activity (scale effect) is offset by changes in both technology and the composition of output in the economy.

Based on literature that more directly assess whether environmental regulation causes changes in trade flows, DS conclude that environmental regulation does have an impact on trade flows, at least in geographically mobile sectors. Studies that focus on the impacts of carbon pricing policies on trade report modest effects, particularly in more energy-intensive sectors. This is also the conclusion drawn by Branger et al. (2016), who examine the impact of the EU ETS using a time-series analysis for the period 2004–2012. They test whether carbon prices increased net EU imports of cement and steel, but they find limited evidence.

The conclusions by DS are in line with the results of a recent paper by Ederington et al. (2019), in which the authors use industry-level bilateral trade data to study the impacts of the ratification of an international environmental agreement (IEA) on country's exports. The authors find that ratifying an IEA has significant, but small, negative effects on the exports of a country's median (in terms of emission intensity) manufacturing industry in the short run. In addition, ratifying an IEA induces a compositional shift towards exporting cleaner goods and this effect becomes stronger in the long-run as a ratifying country sees a further decline in exports of polluting industries which is more than compensated for by an increase in exports of cleaner industries, with an overall positive but negligible effect on employment. In contrast to the results above, Naegele and Zaklan (2019), who also use industry-level bilateral data, find no evidence that the EU ETS emission costs caused carbon leakage in European manufacturing.

Yet using trade flows as a starting point, Barrows and Ollivier (2018) how production and emissions of manufacturing firms in one country respond to foreign demand shocks in trading partner markets. Using a panel of large Indian manufacturers the authors estimate that foreign demand growth leads to higher exports, domestic sales, production, and CO2emissions, and slightly lower emission intensity. Interpreting their results literally would indicate that environmental regulation that doubles energy prices world-wide (except in India) would only increase CO2 emissions from India by1.5%. Thus, while leakage fears are legitimate, the magnitude appears fairly small.

Besides trade flows, the impacts of environmental regulation also on location choices have been examined. Several researchers have used the variation in environmental standards across U.S. to examine its effect on manufacturing plant location. The papers reviewed by DS suggest that studies with a smaller geographic scope tend to find stronger effects, possibly because smaller areas tend to have less variation in the other determinants of production location. This conclusion is also supported by the findings of Millimet and List

(2004), who say that the effects of environmental standards vary systematically with other location-specific factors.

Within-country variation in environmental standards has also been used to examine its impacts on both inwards and outwards FDI location. Based on analysis conducted using UK firm-level data, Manderson and Kneller (2012) are not able to find evidence that firms with high environmental compliance costs are more likely to establish foreign subsidiaries than those with low environmental compliance costs. Taking into account also the studies from US, DS conclude that the overall evidence from the literature on this topic is inconclusive.

8.3.2.2 Productivity, innovation and economic performance

Environmental regulation may affect firms' decisions concerning the volume, type, or timing of their investments, including their investments on research and development. Subsequently environmental regulation may have an impact on firms' productivity and long-term competitiveness.

Considered in isolation, because investment in pollution control diverts resources away from production, economic theory seems to suggest that environmental regulation will hamper productivity growth. However, the literature reviewed by DS suggests that environmental regulation has both negative, short-term impacts on productivity in some sectors and for some pollutants and positive productivity impacts in others.

DS quote several studies that support the so-called "induced innovation hypothesis", which suggests that when regulated firms face a higher price on polluting emissions relative to other costs of production, these firms have an incentive to develop new emissions-reducing technologies. Among the quoted papers is the one by Calel and Dechezleprêtre (2016) who employ firm-level data to estimate the impacts of EU ETS on innovation. According to the results, EU ETS has increased innovation activity in low-carbon technologies among regulated companies by 30 percent relative to a control group.

In a recent paper Fusillo et al. (2019) use a dataset of European firms over the period 2005-2012 and find that rather than having a direct effect on the development of green technologies, environmental regulation stimulates firms to search for new qualified collaboration. Then the nature and the structure of these collaborations is the factor that potentially encourages firms to generate new green technological knowledge.

Empirical literature supports the view that regulation promotes environmental innovation. Subsequently, from a policy perspective, the next logical step is to assess which regulatory instruments provide the strongest incentives for innovation. DS quote an array of theoretical literature suggesting that market-based instruments provide stronger incentives for innovation than technology mandates and performance standards. However, the few empirical papers reviewed by DS appear to at least partly contradict this hypothesis.

Moving to competitiveness, in a recent paper Gerster and Lamp (2019) investigate the causal impact of an exemption from the renewable energy sources levy in Germany on plant-level electricity consumption, fuel input choices, and competitiveness indicators (sales, export share, and investment). The data ranges from 2010 to 2013. The authors find that exempt plants increase electricity consumption by 5-7.5% in response to the exemption, substitute electricity for gas and reduce own electricity generation capacities. Electricity-intensive plants adjust energy inputs more strongly in response to an exemption, whilst export-oriented firms do it less. The authors do not find evidence that the exemption had an impact on competitiveness indicators.

Employing the same estimation methodology as Gerster and Lamp (2019), Laukkanen et al. (2019) study the causal impact of energy tax exemption on the economic and environmental performance of the manufacturing firms in Finland. The researchers employ a dataset that contains information on establishment level economic outcomes, expenditure and energy use and firm level information on tax refunds for years 2007-2016. To this end, the last two years of the dataset overlap with the EEAG. However, the focus of the analysis is Finland's 2011 energy tax reform and the subsequent expansion of a pre-existing tax exemption for large energy-intensive firms. Laukkanen et al. (2019) find that the exemption has had no statistically significant impact on turnover, value added, wages, number of people employed or electricity consumption and negative impact on gross output and energy efficiency.

Third very recent study by Dechezleprêtre et al. (2018), which also relies on the same methodology as the two aforementioned papers, investigates the joint impact of the European Union Emissions Trading System (EU ETS) on carbon emissions and economic performance of regulated companies. The impact on emissions is analysed using installation-level carbon emissions from national Polluting Emissions Registries from France, Netherlands, Norway and the United Kingdom complemented with data from the European Pollutant Release and Transfer Register (E-PRTR). The impact on firm performance is analysed using firm-level data for all countries covered by the EU ETS. The analysis focuses on the first and the second trading period of the EU ETS and therefore the datasets extent only up until 2013. The authors find that the EU ETS has induced carbon emission reductions in the order of -10% between 2005 and 2012, but it has not have any negative impact on the economic performance of regulated firms. Moreover, Dechezleprêtre et al. (2018) even find that the EU ETS has led to an increase in regulated firms' revenues and fixed assets.

8.3.2.3 Employment

The political acceptability of climate policies is undermined by job-killing arguments, especially for the least-skilled workers. Using a general-equilibrium two-sector search model, Hafstead and Williams (2016) show that in the long run environmental regulations might simply induce a substitution between polluting and non-polluting activities. This implies that the long run impacts of environmental regulations on net employment is impossible to determine a priori.

To this end, DS turn to empirical studies that have been conducted at the microeconomic level and focus on short run effects of environmental regulations on employment. Out of these studies, the only one that uses data from EU is the one by Cole and Elliot (2007): using an industry-level data from in UK the authors carry out an analysis that provides no evidence that environmental regulations reduced employment in the 27 examined industries. Taking into account also the other studies on this topic, DS conclude that the effects of environmental regulations on employment in energy intensive sectors seem to be small but statistically significant. However, the authors point out that all the studies they reviewed were based only on within-country analyses and since relocation barriers are likely higher between countries, then the results from the literature present upper bounds on the likely effects of cross-border difference in environmental stringency.

In a recent paper Marin and Vona (2019) use sectoral-level data to examine the associations between climate policies, proxied by energy prices, and workforce skills for 14 European countries and 15 industrial sectors over the period 1995–2011. The authors find that climate policies have been skill biased against manual workers and have favoured technicians. The long-term change in energy prices accounted for between 9.2% and 17.5% (resp. 4.2% and 8.0%) of the increase (resp. decrease) in the share of technicians (resp. manual workers). Finally, as mentioned above, Ederington et al. (2019), find that ratifying an IEA has an overall positive but negligible effect on employment.

Annex 9.1 – Review of Article 39 GBER schemes

(see accompanying Excel file)

Annex 9.2 – Review of Article 39 GBER schemes containing provisions on the granting of aid

(Confidential Annex)

Annex 9.3 – Responses to questionnaires

(Confidential Annex)

Annex 10 – Subsidy-free projects approved outside and auction system

Country	Technology	Project name and/or location	Capacity (MW)	Reference
Spain	Solar	Torre de Cotillas 1, Murcia	3.9	https://www.foresightgroup.eu/news/foresight-starts-construction-of-torre-de-cotillas-1-a-39-mw-solar-farm-in-murcia-spain/
		Don Rodrigo, Seville	148.8	https://www.baywa-re.com/en/cases/emea/subsidy-free-solar-power/
		El Salobral, Andalucia	45.6	https://www.pv-tech.org/news/hive-energy-bags-approval-for-45.6mw-subsidy-free-solar-farm-in-spain
Germany	Solar	Bavaria	1.5	https://www.pv-tech.org/news/axpo-boosts-german-subsidy-free-scene-with-ppa-debut
		Rostock	85	https://renews.biz/51497/enbw-backs-subsidy-free-solar-in-germany/
		Barth V, Stralsund-Barth	7.5	https://www.baywa-re.de/en/solar/solar-park-barth-v/
		North Western part of Germany	4	https://www.centrica.com/media-centre/news/2019/subsidy-free-solar-ppa-in-germany/
Norway	Onshore wind	Horavind, Nordhordland	1,500	https://renewablesnow.com/news/norways-norsk-vind-plans-building-15-gw-zero-subsidy-wind-farm-646808/
Italy	Solar	Montalto di Castro, Lazio region	63	https://www.pv-magazine.com/2018/12/17/octopus-signs-second-italian-private-ppa-in-a-week/
		Not known	70.5	https://renews.biz/50465/shell-and-octopus-shake-on-italian-deal/
		Assemini, Sardinia	40	https://renewableenergytimes.com/2018/04/09/octopus-secures-5-year-ppa-for-another-40-mw-of-solar-in-italy/
		Naro, Sicily	15	1https://www.pv-magazine.com/2018/12/17/octopus-signs-second-italian-private-ppa-in-a-week/
		Multiple locations	425	https://www.protheagroup.com › 2018_01_31 Limes RE - PR - Limes Italia

Country	Technology	Project name and/or location	Capacity (MW)	Reference
		Basilicata	20	https://renewablesnow.com/news/audax-renovables-bas-fv-italia-shake-hands-on-10-year-solar-ppa-639694/
		Lazio, Molise, Basilicata, Sicily, Sardinia	400	http://www.solareb2b.it/horus-capital-400-mw-italia/
		Multiple locations	250	https://bebeez.it/files/2019/05/RENERGETICA-EOS_accordo-27052019.pdf
		Piemonte, Lazio e Basilicata	100	https://www.milanofinanza.it/news/renergetica-accordo-pluriennale-con-building-energy-ltd-201905161022252722
	Onshore wind	Mazara del Vallo, Sicily Region	18	https://analysis.newenergyupdate.com/wind-energy-update/vestas-tailors-turbine-site-win-first-italy-merchant-deal
		Northern Italy	23	http://www.energysaving.it/eolico-arriva-il-primo-contratto-ppa-in-italia/
Finland	Onshore wind	Viinamäki, Ii	21	https://www.tuulivoimayhdistys.fi/hankelista
		Lakiakangas, Isojoki	50.4	https://www.tuulivoimayhdistys.fi/hankelista
		Kuuronkallio, Kannus	60	https://www.tuulivoimayhdistys.fi/hankelista
		Hedet, Närpiö	81	https://www.tuulivoimayhdistys.fi/hankelista
		Långmossan, Maalahti	30.1	https://www.tuulivoimayhdistys.fi/hankelista
		Ribäcken, Maalahti	23	https://www.tuulivoimayhdistys.fi/hankelista
		Ponsiovuori, Kurikka	31.1	https://www.tuulivoimayhdistys.fi/hankelista
		Verhonkulma, Marttila	27	https://www.tuulivoimayhdistys.fi/hankelista
		Paltusmäki, Pyhäjoki	21.8	https://www.tuulivoimayhdistys.fi/hankelista
		Välikangas, Haapäjärvi	100	https://www.tuulivoimayhdistys.fi/hankelista
		Somero	18	https://www.tuulivoimayhdistys.fi/hankelista

Country	Technology	Project name and/or location	Capacity (MW)	Reference
		Saunamaa, Teuva, Kurikka	33.6	https://www.tuulivoimayhdistys.fi/hankelista
		Suolakangas, Kauhajoki	37.8	https://www.tuulivoimayhdistys.fi/hankelista
		Kajaani, Pyhäntä, Piiparinmäki	211	https://www.tuulivoimayhdistys.fi/hankelista
		Oltava, Pyhäjoki	91	https://www.tuulivoimayhdistys.fi/hankelista
		Kröpuln, Uusikaarlepyy	30.1	https://www.tuulivoimayhdistys.fi/hankelista
		Storbacken, Vöyri	30.1	https://www.tuulivoimayhdistys.fi/hankelista
		Polusjärvi, Pyhäjoki	56	https://www.tuulivoimayhdistys.fi/hankelista
		Kokkola, Kalajoki, Kannus, Mutkalampi	250	https://www.tuulivoimayhdistys.fi/hankelista
		Not known	52.6	https://www.tuulivoimayhdistys.fi/hankelista
Sweden	Onshore wind	Markbygden ETT, Markbygden	650	https://svevind.se/Project/Markbygden%20ETT
		Aldermyrberget, Skellefteå	72	https://www.wpd.de/en/wpd-builds-72-megawatts-project-in-sweden/
		Målarberget, Norberg, Avesta	113	https://www.pne-ag.com/en/newsroom/news/article/pne-ag-another-large-wind-farm-sold-in-sweden/
		Laxå, Örebro	25	http://www.vksvind.se/project/laxaskogen/pressrealease/
UK	Solar	Clayhill, Milton Keynes	10	https://anesco.co.uk/subsidy-free-solar-pv/
		Westhampnett, Sussex	7.4	https://www.solarpowerportal.co.uk/news/uks_second_subsidy_free_solar_farm_completed_by_west_sussex_council_using_b
		York	29.5	https://www.gridserve.com/post/breaking-news

Country	Technology	Project name and/or location	Capacity (MW)	Reference
		Hull	21.8	https://www.gridserve.com/post/breaking-news
		Outwood Solar Park, Essex	6	https://wirsol.co.uk/wirsol-energy-ltd-announces-the-acquisition-of-two-subsidiary-free-solar-parks-in-the-uk-2/
		Trowse-Newton Solar Park, Norfolk	7.7	https://wirsol.co.uk/wirsol-energy-ltd-announces-the-acquisition-of-two-subsidiary-free-solar-parks-in-the-uk-2/
		Low Farm Solar Park, Lincolnshire	17	https://wirsol.co.uk/wirsol-energy-ltd-adds-an-additional-47mwp-to-their-uk-portfolio-of-non-subsidised-solar/
		Sweeting Thorns Solar Park, Lincolnshire	23	https://wirsol.co.uk/wirsol-energy-ltd-adds-an-additional-47mwp-to-their-uk-portfolio-of-non-subsidised-solar/
		Westcott Venture Park, Wescott	15	https://www.westcottvp.com/news-and-insights/news/uks-first-unsubsidised-on-site-solar-park-at-westcott
		Woodington Farm, Romsey	40	http://www.hiveenergy.co.uk/hive-energy-granted-planning-permission-develop-40mw-subsidy-free-hampshire-solar-park/
	Onshore Wind	Withernwick Wind Farm, Yorkshire	8.2	https://www.naturalpower.com/natural-power-delivers-on-uks-first-subsidy-free-wind-farm/
		Craiggore Wind Farm, Northern Ireland	25	http://res-group.mediaroom.com/press-releases?item=122591
		Douglas West, Scotland	45	https://realassets.ipe.com/news/greencoat-uk-wind-buys-45mw-douglas-west-wind-farm-in-45m-deal/realassets.ipe.com/news/greencoat-uk-wind-buys-45mw-douglas-west-wind-farm-in-45m-deal/10028755.fullarticle
		Crossdykes, Dumfries and Galloway	46	https://www.energylivenews.com/2019/09/02/scottish-developer-breaks-ground-on-subsidy-free-onshore-wind-farm/
		Glen Kyllachy, Highlands	48.5	https://www.morningstar.co.uk/uk/news/AN_1570714561310880300/greencoat-uk-wins-acquires-glen-kyllachy-in-scotland-for-gbp58-million.aspx

Country	Technology	Project name and/or location	Capacity (MW)	Reference
Portugal	Solar	Ourika, Ourique	39.1	https://welink.eu/welink-energy-poised-to-grow-its-collaboration-with-allianz-capital-partners-following-its-sale-to-them-of-europes-largest-unsubsidised-pv-project/
		Vale Matancas, Alcácer do Sol	7	https://www.foresightgroup.it/user_uploads/foresight-group-intro-brochure-spring-2019.pdf
		Iberian Peninsula	28	https://www.photon.info/en/news/dynavolt-build-28-mw-pv-plant-portugal
		Solara4, Alcoutim	220	https://welink.eu/better-planet-now-solara4/
		Planta Solar da Gloria, Salvaterra de Magos	24	https://elperiodicodelaenergia.com/axpo-firma-un-ppa-con-blackrock-para-una-planta-solar-de-24-mw-en-portugal/
Ireland	Onshore wind	Donegal	91.2	https://www.aboutamazon.eu/press-release/amazon-announces-new-renewable-energy-project-in-ireland-to-support-aws-global-infrastructure
Denmark	Onshore wind	Hirtshals Havn, North Denmark	17	https://www.aa.com.tr/en/energy/general/vestas-to-supply-denmarks-first-subsidy-free-wind-park-/24975

Annex 12 – References

Altozano H. (2019). *The Renewable Energy Law Review – Edition 2: Spain.* Retrieved from: https://thelawreviews.co.uk/edition/the-renewable-energy-law-review-edition-2/1196447/spain

Antweiler, W., Copeland, B. R., and Taylor, M. S. (2001). Is Free Trade Good for the Environment?. *American Economic Review*, 91(4), 877-908.

Auroral (2018). *Subsidy-free renewables set to revolutionise energy market, with €180 billion renewables investment opportunity across NW Europe*. Retrieved from: https://www.auroraer.com/wp-content/uploads/2018/03/Aurora-Press-Subsidy-free-renewables-revolution-huge-prize-for-investors-200318.pdf

Baccianti, C., and Löschel, A. (2014). *The Role of Product and Process Innovation in CGE Models of Environmental Policy*. WWWforEurope Working Papers Issue 68, Wien.

Barrows, G., and Ollivier, H. (2018). *Foreign Demand and Greenhouse Gas Emissions: Empirical Evidence with Implications for Leakage.* Working Papers 2018.16, FAERE - French Association of Environmental and Resource Economists.

Branger, F., Ponssard, J. P., Sartor, O., and Sato, M. 2015. "EU ETS, Free Allocations, and Activity Level Thresholds: The Devil Lies in the Details," Journal of the Association of Environmental and Resource Economists, University of Chicago Press, 2(3), 401-437.

Calel, R., and Dechezleprêtre, A. (2016). Environmental Policy and Directed Technological Change: Evidence from the European Carbon Market. *The Review of Economics and Statistics*, 98(1), 173-191.

Carbone, J. C., and Rivers, N. (2017). The impacts of unilateral climate policy on competitiveness: evidence from computable general equilibrium models. *Review of Environmental Economics and Policy,* 11(1): 24–42.

Castellanos, K. A., and Heutel, G. (2019). *Unemployment, Labor Mobility, and Climate Policy*. NBER Working Papers 25797, National Bureau of Economic Research, Inc.

Clarke, L. (2017). Zero-subsidy bids in the Netherlands offshore wind tender, Retrieved from: https://thinkrcg.com/zero-subsidy-bids-netherlands-offshore-wind-tender/

Cole, M. A., and Elliott, R. J. (2007). Do Environmental Regulations Cost Jobs? An Industry-Level Analysis of the UK. *The B.E. Journal of Economic Analysis & Policy*, 7(1), 1-27.

Dechezleprêtre, A., Nachtigall, D., and Venmans, F. (2018). *The joint impact of the European Union emissions trading system on carbon emissions and economic performance*. OECD Economics Department Working Papers, No. 1515, OECD Publishing, Paris.

Dechezleprêtre, A., and Sato, M. (2017). The impacts of environmental regulations on competitiveness. *Review of Environmental Economics and Policy,* 11(2), 183–206.

Deutsche Windguard, Status des Offshore-Windenergieausbaus in Deutschland, Jahr 2018. Retrieved from: https://www.wind-energie.de/fileadmin/redaktion/dokumente/pressemitteilungen/2019/Factsheet_Status_des_Offshore-Windenergieausbaus_in_Deutschland_2018.pdf

Ederington, J., Paraschiv, M., and Zanardi, M. (2019). *The Short and Long-Run Effects of International Environmental Agreements on Trade*. Working Papers 242514732, Lancaster University Management School, Economics Department.

Evans, S. (2018). Q&A: What does 'subsidy-free' renewables actually mean? *CarbonBrief*. Retrieved from: https://www.carbonbrief.org/what-does-subsidy-free-renewables-actually-mean

Flues, F., and Lutz, B. J. (2015). *The Effect of Electricity Taxation on the German Manufacturing Sector: A Regression Discontinuity Approach.* ZEW - Centre for European Economic Research Discussion Paper No. 15-013.

Fusillo, F., Quatraro, F., and Usai, S. (2019). *Going Green: Environmental Regulation, eco-innovation and technological alliances*. Working Paper CRENoS 201907, Centre for North South Economic Research, University of Cagliari and Sassari, Sardinia.

Gerster, A., and Lamp, S. (2019). *Electricity Taxation, Firm Production and Competitiveness: Evidence from German Manufacturing.* Working Paper.

Gipe, P. (2009). *Solar PV DC Conversion Factor for AC kW*. Retrieved from: http://www.wind-works.org/cms/index.php?id=38&tx_ttnews%5Btt_news%5D=208&cHash=bebbcb4dacd986e38d771a9bd496bdfb

Hafstead, M. A.C., and Williams, R. C. (2018). Unemployment and environmental regulation in general equilibrium. *Journal of Public Economics,* 160(C), 50-65.

Harman, J. (2018). *Will Offshore Wind Zero-Subsidy Bids Become the 'Norm'?* Retrieved from: https://www.offshorewind.biz/2018/11/05/will-offshore-wind-zero-subsidy-bids-become-the-norm/

Henderson, D. J., and Millimet, D. L. (2005). Environmental regulation and US state-level production. *Economics Letters*, 87(1), 47–53.

Hill, J. S. (2019). Vattenfall Wins 760 Megawatt Subsidy-Free Dutch Offshore Wind Tender. *Clean Technica*. Retrieved from: https://cleantechnica.com/2019/07/11/vattenfall-wins-760-megawatt-subsidy-free-dutch-offshore-wind-tender/

Huebler, D., Radov, D., and L. Wieshammer. (2017). Method or Madness: Insights from Germany's Record-Breaking Offshore Wind Auction and Its Implications for Future Auctions. Retrieved from: https://www.nera.com/content/dam/nera/publications/2017/PUB_Offshore_EMI_A4_0417.pdf

ICIS. (2018a). *Vattenfall to build Europe's first subsidy-free offshore wind farm in Netherlands* Retrieved from: https://www.icis.com/explore/resources/news/2018/03/19/10203758/vattenfall-to-build-europe-s-first-subsidy-free-offshore-wind-farm-in-netherlands/

ICIS. (2018b). *Webinar: Trends in renewable energy support - Is the Spanish case a forerunner for the rest of the EU?* Retrieved from: https://s3-eu-west-1.amazonaws.com/cjp-rbi-icis/wp-content/uploads/sites/7/2018/08/30042446/webinar.pdf

ICIS. (2019). *Power Perspective: Subsidy-free renewables in Europe: Market data and outlook.* Retrieved from: https://www.icis.com/explore/resources/news/2019/09/09/10415456/power-perspective-subsidy-free-renewables-in-europe-market-data-and-outlook

Klessmann, C. (2017). Explaining recent renewable energy auction outcomes in Europe. Retrieved from: https://www.slideshare.net/sustenergy/explaining-recent-renewable-energy-auction-outcomes-in-europe

Knight, S. (2018). Price increase in second German auction. *Windpower Offshore.* Retreived from: https://www.windpoweroffshore.com/article/1463252/price-increase-second-german-auction

Kruger, W., Eberhard, A., and K. Swartz. (2018). *Renewable Energy Auctions: A Global Overview.* Report 1: Energy and Economic Growth Research Programme (W01 and W05) PO Number: PO00022908, Retrieved from: http://www.gsb.uct.ac.za/files/EEG_GlobalAuctionsReport.pdf

Kyberg, L., and M. de Rijke. (2016). What you need to know about the Dutch offshore wind tenders (in five steps). Retrieved from: https://www.twobirds.com/en/news/articles/2016/netherlands/what-you-need-to-know-about-the-dutch-offshore-wind-tenders

Laukkanen, M., Ollikka, K., and Tamminen, S. (2019). *The impact of energy tax refunds on manufacturing firm performance: evidence from Finland's 2011 energy tax reform*. Publications of the Government´s analysis, assessment and research activities 2019:32.

Levinson, A., and Taylor, M. S. (2008). Unmasking The Pollution Haven Effect. *International Economic Review*, 49(1), 223-254.

Losana, A. I. M. (2017). *Remuneration scheme for renewable energy facilities following the last three renewable capacity auctions in Spain.* Retrieved from: https://www.ga-p.com/en/publicaciones/remuneration-scheme-for-renewable-energy-facilities-following-the-last-three-renewable-capacity-auctions-in-spain/

Manderson, E., and Kneller, R. (2012). Environmental regulations, outward FDI and heterogeneous firms: Are countries used as pollution havens? *Environmental and Resource Economics,* 51(3), 317–52.

Mardsen, R., Sorensen, S., Radov, D., Carmel, A., and S. Jindani. (2018). *Auction design for offshore wind site licence auctions A report for the Netherlands Ministry of Economic Affairs and Climate Policy*. Retrieved from: https://www.rijksoverheid.nl/documenten/rapporten/2018/05/14/auction-design-for-offshore-wind-site-licence-auctions

Marin, G., and Vona, F. (2019). Climate Policies and Skill-Biased Employment Dynamics: evidence from EU countries. *Journal of Environmental Economics and Management, 98.*

Millimet, D. L., and List, J. A. (2004). The case of the missing pollution haven hypothesis. *Journal of Regulatory Economics,* 26(3), 239–62.

Musgens, F., and I. Riepin. (2018). *Is Offshore Already Competitive? Analyzing German Offshore Wind Auctions.* 1-6. 10.1109/EEM.2018.8469851.

Naegele, H., and Zaklan, A. (2019). Does the EU ETS cause carbon leakage in European manufacturing? *Journal of Environmental Economics and Management*, 93(C), 125-147.

Nasner, G. (2019). *Power purchase agreements, PPAs, are a growing focus for renewable power producers industry. But what is a PPA and what are the opportunities? Hanno Mieth from Vattenfall Trading gives an overview.* Retrieved from: https://group.vattenfall.com/press-and-media/news--press-releases/newsroom/2019/growing-market-for-power-purchase-agreements

Netherlands Enterprise Agency (n.d.) *Offshore Wind Energy*. Retrieved from: https://english.rvo.nl/subsidies-programmes/offshore-wind-energy

Norton Rose Fulbright. (2017). German Renewable Energy Act 2017 (EEG 2017) - what you should know. Retrieved from: https://www.nortonrosefulbright.com/en/knowledge/publications/85ea2d80/german-renewable-energy-act-2017-eeg-2017---what-you-should-know

Offshore Wind. (2018). *Germany selects Six Offshore Wind Projects, Zero Subsidy Bids Reappear.* Retrieved from: https://www.offshorewind.biz/2018/04/27/germany-selects-six-offshore-wind-projects-zero-subsidy-bids-reappear/

Pezzey, J. (1992). Analysis of Unilateral CO2 Control in the European Community and OECD. *The Energy Journal*, 0(3), 159-172.

Porter, M., and Van der Linde, C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. *The Journal of Economic Perspectives,* 9(4), 97-118.

Del Río, P. (2016). *Implementation of Auctions for Renewable Energy Support in Spain: a Case Study.* Report D7.1-ES. Retrieved from: http://auresproject.eu/sites/aures.eu/files/media/documents/wp7_-_case_study_report_spain_1.pdf

Shumkov, I. (2018). Germany's 2nd offshore wind tender draws bids of up to EUR 98.3/MWh. *Renewables Now.* Retrieved from: https://renewablesnow.com/news/germanys-2nd-offshore-wind-tender-draws-bids-of-up-to-eur-983mwh-610578/

Suomen Tuulivoimalayhdistys. (n.d.). *Tuulivoimalahankkeet Suomessa*. Retrieved from: https://www.tuulivoimayhdistys.fi/hankelista

Volz, E., and A. S. Waldmann. (2019). *Germany: The German Offshore Wind Act – What's New.* Retrieved from: http://www.mondaq.com/germany/x/802710/Renewables/The+German+Offshore+Wind+Act+whats+new

other publications and subscriptions

http://ec.europa.eu/competition/publications

Publications Office

KD-02-20-327-EN-N
doi: 10.2763/414004