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Identifying and Promoting Missing EU Power  
Interconnectors

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European University Institute

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## **Abstract**

The level of interconnector investment undertaken by countries individually are less than optimal, because of the interaction of three key elements, namely a) larger risks than other infrastructure projects, b) little information across countries about a project's costs and benefits, and c) asymmetric distribution of costs and benefits within a country. Therefore, EU mechanisms for pushing the level of interconnector investment toward optimal ones are advisable. Robust, sound and transparent EU electricity interconnection targets are needed, in order to identify the gap between the optimal and actual interconnection portfolio, and, at the same time, gather the necessary political and social support. These interconnection targets should be based on five methodological pillars, that can be summarised as follows: i) interconnection targets should have a triple dimension, measuring the degree of market integration, the capacity of interconnectors for importing electricity, and the capacity of interconnectors for exporting renewable electricity, ii) in order to avoid and reduce the incentive to propose inefficient interconnector projects, the detailed, all encompassing, cost-benefit analysis should be a necessary ("sine qua non") condition for implementing new interconnectors, iii) attention to the efficiency of the functioning of the European electricity market should be a priority, in particular by recognising and rectifying the situation that "energy only" markets are not coherent with the EU's prime goal of drastically reducing carbon emissions, iv) the EU network should be planned and operated in an integrated way, by harmonising the relevant rules, codes and regulations, but also through a different vision of responsibilities on the security of supply, v) to facilitate interconnector development, citizens and relevant stakeholders should be involved in the identification and balancing of costs and benefits at an early stage.

## **Keywords**

Power interconnectors; Electricity networks; EU electricity interconnection targets; Grid rules and regulations; European electricity market integration





## 1. Introduction

The European Commission set up in mid-2016 an Expert Group to provide technical advice on the relevant elements for the effective and efficient development of electricity interconnectors. In November 2017, the Expert Group presented a Report entitled “Towards a sustainable and integrated Europe” (CEG (2017), the *Report*).

The purpose of this paper is to analyse and assess the proposals and recommendations of the above Report.<sup>1</sup> To this end, Section 2 below analyses the need for specific mechanisms to promote an optimal level of interconnectors. Features of these projects make actual interconnector investments below optimal ones. Section 3 presents the vision of the Expert Group and its key recommendations; the core of this vision can be summarised in the following sentence: “Interconnection targets are necessary and useful, but more is actually needed”. Section 4 organises the recommendations of the Expert Group on the basis of five (5) pillars and describes them in reference to their role in promoting optimal interconnector investment. Finally, Section 5 concludes by indicating some pending issues for improving interconnectors’ development.

## 2. Interconnector Investments Below Optimal Levels

Power interconnectors belong to the category of transnational infrastructure that incur large sunk costs and yield benefits in several countries, benefits that are mostly related to trade. Two groups of issues (or problems) are usually associated with power interconnectors. The first derives from the fact that these interconnectors are only useful for the trade of one single good, namely electricity. The second is associated with the distribution of the costs and benefits of an interconnector across the countries involved. Power interconnectors whose costs and benefits are distributed symmetrically across countries do not give rise to problems greater than those expected from pure national grid projects. However, additional problems do arise when one country bears a disproportionate share of the costs, or enjoys the largest share of the benefits. The interaction of these two groups of issues often leads to situations where a project may be *regionally* desirable, but may be undesirable from the point of view of an individual country.<sup>2</sup>

The following elements lead countries to make individual decisions that ignore or abandon efficient interconnector projects:

- First, the benefits of interconnectors are less diversified than those from other transnational infrastructures, such as roads and ports. Power interconnectors, as well as gas pipelines, are used for trading a single good, while other infrastructures are used for trading a great variety of goods and services. Such concentration of trade makes power interconnectors riskier than other transnational infrastructures.
- Second, power interconnectors suffer more political and regulatory risks than other transnational infrastructures. Most markets of goods and services are well established and subject to general competition rules, while electricity markets and interconnectors are subject to regulations from many different authorities.
- Third, there is, in general, a lack of sufficient information about the benefits of power interconnectors for each individual country involved. Even when a country is able to identify the benefits that it would accrue, it lacks information on how its own investments may reduce costs

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<sup>1</sup> The views expressed in this paper do not necessarily represent the views of the EU Expert Group on Electricity Interconnection Targets. The paper presents our own views of the Expert Group’s Report.

<sup>2</sup> For further discussion on Transnational Infrastructure Projects, see P. Beato (2008), and Laffont, J.J. & D. Martimort (2003).

or yield benefits in another country. In addition, countries lack incentives to attempt to identify third country benefits, since doing so involves extra costs. Precise information on the benefits that a country would derive from an infrastructure project will increase the incentive for closer cooperation and mutually beneficial agreements between neighbouring countries.

- Fourth, power interconnectors generally present asymmetric costs and benefits across countries, something that makes their implementation difficult. The costs of interconnectors are supported by the countries where they are located, while benefits could spread to other countries.
- Fifth, there is a lack of socially acceptable mechanisms to balance costs and benefits within a country. Each country usually supports the costs of the infrastructure located within its own border. But even when countries agree on some sort of cost-benefit sharing, the process is long, complex and cumbersome. However, asymmetry is common even in the most efficient transnational projects.

Although an agreement between two countries is an open option for interconnectors, reaching such an agreement is a difficult process. Notice that it takes a great deal of time for two countries to enter into a dialogue about a project with costs and/or benefits in both nations, if they lack rules for cooperation and/or incentives to communicate with each other about the project's costs and benefits. For instance, after identifying the benefits to a second country, the government of the first country must persuade the government of the other country to contribute to the costs of infrastructure located in the first country. Once the second country accepts the notion of contributing to the cost of the infrastructure, the two countries must agree on the actual amount that the second country must pay the first. The length and complexity of the process usually makes the implementation of power interconnectors a frustrating task. Therefore, increasing interconnectors in a region calls for the establishment of well-defined mechanisms to solve or mitigate the problems that lead to less-than optimal levels of interconnection investment.

### **3. The Expert Group's Vision: EU Interconnection Targets are good, but more is actually needed**

As discussed before, the need for mechanisms to promote electricity interconnection investments stems from important economic and strategic reasons. However, implementing such mechanisms requires strong political support both from the European Commission and the Member States. A first prerequisite for such a support is the setting up of robust, sound and transparent targets, in order to identify the gap between the optimal and actual interconnection portfolio. Targets have three main purposes: First, to guide the overall development of trans-European electricity infrastructure. Second, to provide electricity infrastructure developers, technology providers, manufacturers and financiers, whose collective role is to deliver the additional transmission capacity needed, with a clear and measurable investment signal. Third, to give a strong political message and a solid direction of strategic choice for boosting the European integration of fragmented national electricity markets, while continuously monitoring the efforts and progress of individual Member States in this direction.

The European Council of October 2014 called for all Member States to achieve an interconnection level of at least 10% of their installed electricity production capacity by 2020. This interconnection target of 10% had already been established in 2002 by the Barcelona Council, but that was in a radically different energy era, where only around 2% of total energy was generated from variable, non-dispatchable sources and where the discrepancy between installed generation capacity and peak load was negligible across Europe.

Maintaining the current formulation of the target, as the ratio of net transfer capacity to installed generation capacity, would offer certain continuity and consistency in measuring interconnection levels as initially defined. However, such a target would not be suited to the reality after 2020 and would not adequately account for the multiple benefits of, and complex prerequisites for, the

development of new interconnectors. In particular, such a target would not fit the long-term EU goal of cutting greenhouse gas emissions by 80-95% below 1990 levels, with milestones of 40% cuts by 2030 and 60% by 2040.

The EU Expert Group on Electricity Interconnection Targets recognised that a uniform new interconnection target for 2030 would obviously be good, but not sufficient. Therefore, their vision conveys three (3) additional target-building blocks:

- **Interconnectors should be able to attend export and import needs, while reducing carbon dioxide emissions:** Member States, as well as regions, demonstrate considerable differences in terms of their energy mix, as well as their corresponding export and import capacities. Therefore, it is important to take their inherently different energy profiles into account when planning electricity infrastructure and setting interconnection targets. At the same time, however, emphasis should be placed on the need for cooperation between Member States in energy infrastructure and renewables deployment, especially between areas of renewable abundance and renewable scarcity. Therefore, the capacity of EU Member States to supply renewable electricity to the EU market should be taken into account when setting interconnection targets.
- **Improving the operation and functioning of European markets and networks is key to increasing the benefits of interconnectors.** The benefits of interconnectors are strongly dependent upon the functioning of the EU electricity market and the institutional arrangements for designing and operating the entire EU power network, not only the interconnectors. Usually, the calculation of the expected benefits and costs of interconnectors assumes an optimal working market and an optimal operating system, without actually having sufficient mechanisms for enforcing such optimality. Therefore, the target-setting approach should introduce tools guiding towards an optimally integrated EU market and power network.
- **Promoting efficient interconnectors and avoiding inefficient ones.** Efficient interconnectors should receive support for mitigating the obstacles that prevent their development. However, when substantial (financial) support is given to the construction of interconnectors, the risk of selecting inefficient ones increases. This is because the incentive of country authorities is then to submit as many projects as possible, resulting in a very large portfolio that becomes impossible to implement. The risk of thus creating an unrealistic portfolio may be mitigated by advising stakeholders that declared benefits will be used for two purposes: a) to determine project efficiency and b) to perform cost/benefit distributions. Once countries know that project costs will be assigned as a portion of actual benefits, the incentive to overestimate benefits disappears. However, while reducing the risks of inefficient projects, the problem of underinvestment may appear. The Expert Group's vision relies on requiring a thorough, all encompassing, cost-benefit analysis to ensure efficient interconnectors.

#### **4. The five (5) Pillars of the Expert Group's Proposal**

The Expert Group Report makes specific recommendations for effectively implementing the above vision. These recommendations can be organised on the basis of five (5) key pillars. These pillars identify the gaps between optimal and actual interconnection investments and address most factors causing these gaps. The Report also advises that, in order to take into account the rapid technological developments, continuously being produced in grid and generation, the preparation of an interconnection target portfolio should be reviewed and adjusted at least once every five years.

##### ***Pillar 1. Using three (3) new targets to identify interconnection portfolio gaps***

The vision of the Report for well defined, focused and synergistically acting interconnection targets, materialises through the establishment of three (3) new indicators, serving as quantitative thresholds/triggers for action: (i) one measuring the degree of market integration; (ii) another,

reflecting the potential electricity-import needs of a Member State; and (iii) one indicating its interconnector needs for exporting renewable electricity. The development of additional interconnections should be promptly investigated by Member States, Transmission System Operators (TSOs), promoters, regulators and European institutions, if any of the following three thresholds is triggered:

- **Average price differentials above 2 Euro/MWh:** EU market integration aims to achieve yearly averages of price differentials that are as low as possible, with the €2/MWh between relevant countries, regions or bidding zones as a threshold; above this threshold, the development of additional interconnectors must be considered.
- **Nominal transmission capacity of interconnectors below 30% of their peak load.** This indicator/threshold aims to ensure that electricity demand of any Member State can be met, if needed, by at least 30% through imports.
- **Nominal transmission capacity of interconnectors below 30% of their renewable installed generation capacity.** This indicator/threshold aims at enabling exports of renewable electricity production. If the nominal transmission capacity of interconnectors is below 30% of their renewable installed generation capacity, this last capacity may not be fully and efficiently utilised.

The above triggers serve as indicators of the urgency of action needed and, at the same time, reflect the three headline goals of European energy policy, namely: i) increasing competitiveness through market integration, ii) guaranteeing security of supply; and iii) achieving the climate targets through increased use of renewable sources.

Countries above €2/MWh in price differential, or below 30% on any of the other two indexes, should urgently investigate options of further interconnectors. Any interconnector project helping a Member State to reach any one of the above three thresholds, must be considered as priority candidate for inclusion in the Ten-Year Network Development Plan (TYNDP) and in the Projects of Common Interest (PCI) list. Two remarks on the benefits attached are appropriate:

- TYNDP is a biennial package developed by the European Network of Transmission System Operators (ENTSO-E), which presents an overview of the transmission development plans that are identified as necessary, in order for the transmission grid to effectively accommodate EU energy policy goals. Moreover, only a project that is part of the TYNDP is eligible to apply for inclusion in the PCI list for a given year.
- A project included in the PCI list may benefit from: i) accelerated planning and permit granting, ii) a single national authority for obtaining permits, iii) improved regulatory conditions, iv) lower administrative costs due to streamlined environmental assessment processes, v) increased public participation via consultations, and vi) increased visibility to investors. It also has the right to apply for funding from the Connecting European Facility (CEF). In addition to grants, the CEF offers financial support to projects through innovative financial instruments, such as guarantees and project bonds. Therefore, the inclusion of new interconnectors in the PCI list increases the incentive for investing in them and mitigates the causes of suboptimal level of interconnection investment.

Therefore, the first pillar sets targets, as well as mechanisms and tools, in order to address the causes that make interconnector investment below optimal. Thus, they also push for filling the interconnector gap and reaching the targets in concordance with the vision “*EU Interconnection Targets are good, but more is actually needed*”.

### ***Pillar 2. The Cost-Benefit Analysis is a necessary condition for new interconnectors***

If interconnector projects of countries below the corresponding thresholds had automatic access to special financing as a function of the country’s internal costs, the risk would be an overestimation of

the costs of interconnectors. To deal with such a risk, each new interconnector must be subject to a detailed socio-economic and environmental cost-benefit analysis, and only interconnectors that can demonstrate that potential benefits outweigh costs should be developed.

Interconnectors should be built only if they contribute to the energy and climate goals Europe has committed to, and if their contribution to welfare outweighs their costs. This means that they lead to lower costs for end-consumers, enhance the system's stability, reduce price volatility and ensure that the electricity produced may be transported from areas with low electricity prices to areas with higher prices. However, better quantification of certain costs and benefits is recommended, such as those associated a) with specific environmental impacts (biodiversity, view, etc.), b) with the benefits of enhancing integration of renewable electricity and contributing to technological innovation, and c) with the benefits of exchanges in reserves and ancillary services.

Notice again that the benefits of interconnectors are dependent upon the functioning of the EU electricity market and the institutional arrangements for designing and operating the entire EU power network, not only interconnectors. A rewarding approach is to compare benefits of interconnectors under different scenarios and explain such values to relevant actors. One scenario should be to reflect the actual organisation of the EU markets and networks. Other scenarios, with more efficient and integrated organisation of the power market and networks, should also be considered. However, the benefits on these other scenarios should be taken into account in conjunction with the existence of mechanisms to enforce them. This brings us to Pillars 3 and 4.

***Pillar 3. The efficiency of the current functioning of the European electricity market should be substantially improved***

As mentioned before, the benefits of interconnectors are dependent upon the functioning of the EU electricity market. The European electricity market requires clear, non-discriminatory rules and a stable regulatory framework that will give consistent signals both to grid investors, as well as to users of the infrastructure.

The effective and rapid implementation of the network codes and guidelines adopted in the framework of the Third Energy Package is a top priority in this direction. In particular, the following aspects should be recognized and given due attention in the new framework: i) the insufficiency and inefficiency of “energy only” markets, and the need to put in place other options that stimulate low-cost and low-emission new generation capacity, ii) the convenience of separating bidding zones from national borders, making regional bidding zones, and iii) the key role of the EU authority on capacity adequacy. Moreover, retailers should be able to cover capacity requirements with capacity established and operating outside their borders.

***Pillar 4. The existing interconnectors should be used much more efficiently***

An EU market working along the above guidelines would enhance the benefits of interconnectors, but for their achievement, new rules for developing and operating the EU power network, not only interconnectors, are needed. According to ACER, only a fraction of the existing interconnector capacity is actually made available to the market, thus limiting electricity trade between Member States and making it difficult to reap the full interconnectors' benefits. Many causes may explain such a low use of interconnectors, but two of them deserve special attention:

One, is that the features of the electricity network in some Member States do not safely allow the use of existing interconnector capacity. Adding new internal transmission lines would often result in a better use of interconnections. However, the problem is that in some cases, particularly in small countries, the incentive to complete the network is not sufficient, because the internal benefits are small in relation to the costs, even though the new lines would produce strong benefits for the wider region, via an appropriate and efficient use of the already existing interconnectors.

The other relevant cause is a tendency of some TSOs to give priority access to internal power exchanges. Notice that as long as the security of supply of each Member State lies primarily on itself, the country's TSO would give priority to national resources for ensuring supply and would leave power imports and interconnectors chiefly for unexpected events. Therefore, regulations for enhancing the efficient use of interconnectors should be put in place. In particular, congestion management rules should be non-discriminatory and should maximise the European socio-economic welfare. Moreover, EU regulators should investigate cases of poor use of interconnectors. Finally, the current distribution of security of supply responsibilities among TSOs should be reviewed and updated.

***Pillar 5. Active involvement of citizens, civil society groups and relevant stakeholder groups is necessary from an early stage of interconnector development***

Benefits of interconnectors are difficult to perceive by civil society, which, on the other hand, is easily aware of its costs - economic, social, environmental, etc. As mentioned before, even when a country is able to identify the benefits that it would accrue, it lacks information on how its own investment may reduce costs or yield benefits in another country. Moreover, countries lack incentives to attempt to identify third country benefits, since this involves extra costs. Precise information on the benefits that an infrastructure project would have on a country would increase the incentive for cooperation and the country's social acceptance of the project.

Interconnectors may also generate local negative externalities that are rejected by local communities. Experience shows that lack of public acceptance is one of the main reasons for the delays in interconnector development. However, public acceptance presupposes transparent and good information on the benefits of interconnectors, as well as substantial public involvement of relevant stakeholders at an early stage. An EU analysis on costs and benefits of interconnectors would increase social acceptance. This would be reinforced if socially acceptable methods for balancing local costs and benefits are in place.

## **5. Summary and Final Remarks**

First, the level of interconnector investment undertaken by countries individually are less than optimal, because of the interaction of three (3) key elements: i) larger risks than other infrastructure projects, ii) little information across countries about a project's costs and benefits, and iii) asymmetric distribution of costs and benefits within a country. Therefore, EU mechanisms for pushing the level of interconnector investment toward optimal ones are advisable.

Second, sound and transparent targets, needed to identify the gap between the optimal and actual interconnection portfolio, are necessary for political and social support. Targets have three main purposes: (i) to guide the overall development of trans-European electricity infrastructure, (ii) to provide a clear and measurable investment signal to developers, technology providers, manufacturers, financiers, etc., and (iii) to give a strong political message and a solid direction of strategic choice for boosting the European power market integration.

Third, the Expert Group Report articulates its recommendations on the basis of five (5) complementary pillars that address the obstacles for developing interconnectors. These pillars can be summarised as follows:

- Interconnection targets should have a triple dimension, measuring: a) the degree of market integration, b) the capacity of interconnectors for importing electricity, and c) the capacity of interconnectors for exporting renewable electricity.
- In order to avoid and reduce the incentive to propose inefficient interconnector projects, the detailed, all encompassing, cost-benefit analysis should be a necessary ("sine qua non") condition for implementing new interconnectors.

- Attention to the efficiency of the functioning of the European electricity market should be a priority. In particular, by recognising and rectifying the situation that “energy only” markets are not coherent with the EU’s prime goal of drastically reducing carbon emissions.
- The EU network should be planned and operated in an integrated way. This means harmonising the rules for operating the EU network, but also a different vision of responsibilities on the security of supply.
- To facilitate interconnector development, citizens and relevant stakeholders should be involved in the identification and balancing of costs and benefits at an early stage.

Fourth, interconnectors helping to reach the above-set targets should be included in the list of PCIs, which implies for them accelerated planning and permit granting, lower administrative costs, increased public participation via consultations, and increased visibility to investors. They also have the right to apply for funding from CEF, which offers grants and other types of financial support to mitigate interconnector risks.

Finally, in our opinion, the proposal of the Expert Group addresses most causes that make the current portfolio of interconnectors a suboptimal one. However, a major reason for interconnector underinvestment is the asymmetric distribution of costs and benefits within a country. This is a problem especially relevant in small countries, where interconnector costs have a large impact on final consumers. This is so, because cost asymmetries in small countries are distributed among a relatively small number of consumers and the impact is large, while in large countries they are distributed among many consumers and the impact is smaller. A useful balancing tool in this direction is the TEN-E Regulation, which offers the possibility to go for the so-called cross-border cost allocation (CBCA), if one of the promoters/TSOs deem it useful. Such CBCA becomes mandatory if the promoters/TSOs apply for EU grants under the Connecting Europe Facility. We recommend additional work for designing and implementing mechanisms for balancing costs and benefits of interconnectors within each country.

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