Analysing RES support mechanisms in the EU post-2020

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Highlights

- Policies in the sectors of heating and cooling, and transport need a stronger focus to achieve the EU 2020 and 2030 renewable share targets.
- There is scope to introduce policy measures supporting Renewable Energy Sources (RES) in the transport sector (RES-T) such as a single binding legislative framework at the EU level while allowing differentiated support for efficient biofuels, green certificates as well as the uptake of electric and hydrogen mobility
- In addition to setting overall targets the EC can play a role in monitoring retroactive measures at the Member States (MS) level, develop clear sustainability criteria to support bioenergy, and ensure that MS RES policy packages are consistent with the internal energy market
- Costs of ancillary services such as balancing reserves will need to be distributed fairly between network operators and end-users across national borders as the EU moves towards an common internal energy market

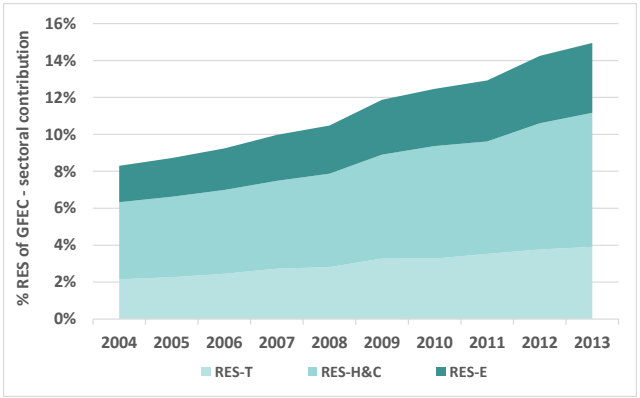
RES driving factors

This section analyses the recent growth in Renewable Energy Sources. It includes the implications of cost, financing, and policies in supporting the development of RES to meet the EU's 2020 and 2030 energy targets.

Overview of RES capacity and shares in generation by sector

Renewable energy, as a percentage of final energy (in terms of gross final energy consumption), has increased by over 80% between 2004 and 2013 (Figure 1). Of this 80% increase, almost half has been delivered by RES-H/C[1], with a quarter each from RES-E[2] and RES-T[3].

Figure 1: Sectoral contributions to RES by sector, 2004 - 2013[4]



Growth in RES-T is largely driven by the increase in biofuel consumption, while RES-

[1] RES Heating and Cooling
[2] RES Electricity
[3] RES Transport
[4] SHARES (renewables) data, Eurostat. http://ec.europa.eu/eurostat/web/energy/data/shares

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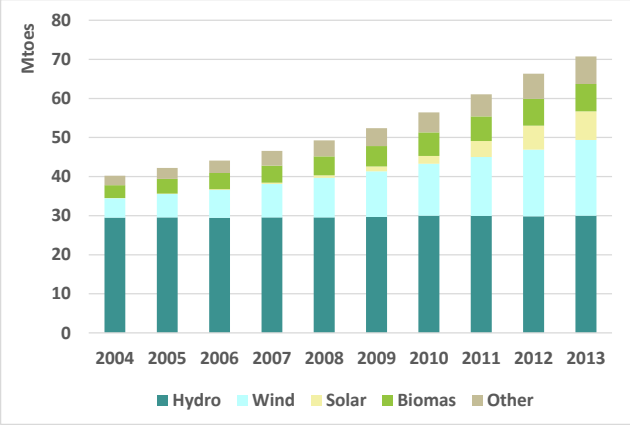
H/C reflects increases in renewables-based district heating, heat pumps, and bioenergy consumption.

Figure 2: Renewable electricity production by technology, 2004 - 2013[5]



The EU Tracking Roadmap and a recent INSIGHT_E report[25] suggest that if growth rates observed in the last 3 years can be maintained for RES-E and RES-H&C, they would achieve their contribution to the RES targets, as per Member State (MS) National Renewable Energy Action Plans (NREAPs). However, RES-T is lagging behind with respect to the necessary action. Based on model analysis, a projected RES share of only 18.4% would be feasible without additional action. Therefore, strong action to remove barriers and enhance existing policy is required.[6]

An assessment of selected past and present EU support schemes for renewables is presented in Appendix A: Assessment of selected past and present EU support schemes for renewables.

Technology costs and financing in the power sector

While renewables are still more expensive in general than conventional power generating technologies, the gap has narrowed significantly. Solar PV prices in particular have been falling dramatically with a growing installed capacity. With every doubling in cumulative capacity of a renewable technology, costs have come down by as much as 18% to 22% for solar PV and 10% for wind[7,8]. China has played a key role in this, accounting for nearly one-third of global capacity added, followed by Japan and the United States[9]. With production costs projected to fall further and solar cell efficiencies increasing steadily, the number and size of utility-scale systems will continue to increase[9].

Growth in both residential and commercial distributed solar PV sectors is robust in countries where the levelised cost of energy (LCOE) of systems are below the variable portion of retail electricity prices. In Germany, Italy and the Netherlands, where retail electricity prices are high, some projects with good financing are already profitable without feed in tariffs (FiT), depending on the share of self-consumption. In addition to - and in part as a consequence of - falling costs, financing for EU renewable energy projects has improved since the 2011-2013 period, and continued through 2014[10].

[5] SHARES (renewables) data, Eurostat. http://ec.europa.eu/eurostat/web/energy/data/shares
[6] EU Tracking Roadmap 2015, EUFORES. http://www.keepontrack.eu/contents/publicationseutrackingroadmap/eu_roadmap_2015.pdf

[7] This is often measured by "learning rates", a percentage reduction in costs for every doubling of cumulative installed capacity. These learning rates are high for renewables, as although they are commercially mature, they still have significant cost reduction potential unlike fossil fuels and nuclear
[8] Renewable Power Generation Costs in 2014, IRENA http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf
[9] Renewables 2014 - Global Status Report, REN21
[10] Low Carbon Finance Group, EU Renewables Financing Market – Status & 2015 Outlook, First Quarter, 2015

Policy framework

For continued investor confidence and stable growth of renewable deployment in the post-2020 period, policy certainty is essential[11]. As one of the three pillars of its Energy Package 2020, the EU aims to fulfil at least 20% of its total energy needs with RES by 2020 and each Member State (MS) must achieve 10% of its transport fuel from renewables. This renewable energy can be from biofuels or the renewable portion of electricity used for transport. The Directive 2009/28/EC also establishes the sustainability criteria for biofuels and bioliquids. Transport energy from wastes, second generation biofuels and electric vehicles (EVs) is given a higher weighting than first generation biofuels for the EU RES-T target. While most MS have chosen to implement a mandatory quota for biofuels to achieve the respective target, a large panel of support schemes have also been deployed in the RES-E and RES-H/C sectors

The Keep-on-Track! Project identifies and analyses the barriers hindering the development of RES across all three energy sectors in the European Union. Across all three sectors, most barriers are related to the "political and economic framework", with a share of 38% of all reported barriers in the RES-E sector, 45% in the heating and cooling sector and 55% in the RES-T sector. More specifically, the project lists flaws in the "existence and reliability of a general RES strategy and support scheme" as a key barrier across all three sectors[12] - there is a need for clearer RES strategies at the MS-level. This is confirmed by the INSIGHT_E report on Europe's renewable energy policies[25].

For example over the past year, some Member States introduced retroactive measures harming renewable deployment. Spain concluded a new retroactive remuneration scheme that ended feed-in tariff payments for RES-E. This is replaced by annual payments based on a calculation of a fixed "reasonable annual return" of 7.4%. In Bulgaria, solar PV feed-in tariffs have been cut retroactively, assuming that the country has already met its 2020 renewable energy target. The government of Romania passed legislation to halve the number of certificates provided to both wind and solar PV. Italy also introduced retroactive policy changes for solar PV installations larger than 200 kW. For continued investor confidence post-2020, retroactive measures in Member States may need to be carefully monitored.

Shaping the post-2020 policy regime

At the October 2014 European Council Meeting, EU leaders agreed to a 2030 GHG emission reduction target of 40% below 1990 levels, and a target of 27% for the share of renewable energy[13]. The delivery of this more ambitious RES target is not prescriptive at the Member State level nor is it sector-specific; this supports the view that the delivery of targets will be achieved on the basis of cost-effective action. Binding national targets may be seen as a key mechanism to achieving the EU's 2020 targets. However, it can also be argued that being too prescriptive at the Member State level does not allow for cost-effectively meeting GHG reduction targets at the EU level. Under this reformulated approach, there will need to be a strong effort to ensure ambitious Member State RES policy packages that are consistent with the internal market, potentially increasing harmonisation

[11] As acknowledged in the EC's 2030 Climate and Energy package.
[12] Analysis of deviations and barriers 2014/2015, Keep-on-Track! Project, http://www.keepontrack.eu/contents/publicationsanalysisdeviationsbarriers/kot_deviations-and-barriers-report-2015.pdf

[13] October 2014 European Council conclusions, http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/145397.pdf

between support schemes, and the clear establishment of a bioenergy framework.

It is understood that the Commission will consult EU Member States on a 'New Governance Framework' in the second half of 2015, which will be critical in ensuring delivery of the post-2020 target in the absence of Member State targets. The EC is also likely to revise the Renewable Energy Directive in the next couple of years that will 'seek to enhance convergence and cooperation amongst renewable energy support schemes'[14]. EU MS are not equally developed in terms of industry, employment, GDP etc. Therefore, it is clear that RES projects have different "values" for a state that produces the technology (and employs people for this production) and finances the project from its own capital compared to a state that imports foreign technology and finances projects using loans from foreign banks. At the same time, the Emissions Trading Scheme (ETS) will be reformed, presumably having an impact on electricity production costs from conventional sources. In MS experiencing rapid deployment of variable renewables in the power sector the question of how to ensure adequate investment signals on generation guaranteeing capacity and balancing power at the lowest possible costs is raised[15,16].

RES in the electricity sector

The EC framework for climate and energy policy post-2020 states that the *"EU level target will drive continued investment in renewable energy meaning, for example, that the share of renewable energy in the electricity sector would increase from 21% today to at least 45% in 2030[16]."*

A power system with such high shares of variable and distributed RES means that requirements to the overall grid as well as to power generators change dramatically. Costs for integration in terms of balancing and grid extension costs will rise, while wholesale market prices of electricity will further go down[15]. To lower the stress on the grid and to the wholesale market, future renewable support schemes should support more flexible production of electricity.

The integration of European electricity markets and the expansion of interconnections between MS can help balance the production in different countries due to stochastic/correlation effects of feeding in RES production. This can help to integrate RES to wholesale markets. Additionally, the emergence of the internal electricity market makes Europe-wide support schemes achievable. The cooperation mechanisms in the EU directives facilitate cross-border projects to support RES.

However, it is difficult for RES production to cover its upfront investment costs in the wholesale market. To resolve both problems, capacity payments in addition to the unit market price are a possibility to reach a higher degree of market integration while keeping investments in RES viable[17]. In a different paper, INSIGHT_E examined different market design options for low carbon technologies and concludes that most probably Member States will continue with energy-only markets in

[14] Keep on Track 2015 Policy Recommendations Report, http://www.keepontrack.eu/publications/
[15] Deane, P. (2015): Quantifying the "merit-order" effect in European electricity markets, INSIGHT_E RREB
[16] European Commission (2014): A policy framework for climate and energy in the period from 2020 to 2030.
[17] EURELECTRIC (2014): Renewable Energy and Security of Supply: Finding Market Solutions. http://www.eurelectric.org/media/154655/res_report_140919_lr-2014-030-0569-01-e.pdf

combination with specific add-ons for RES support[18].

There are already options available that are easy to implement and help make RES production more manageable. Different technical settings of generation units (such as *Generation Levelling Control for Wind Farms*[19]) can stabilise infeed but will produce less energy. This may lead to weaker financial viability, but might mitigate grid extensions or a higher demand in flexible fossil power production. To foster the orientation to system issues, such units could be supported by a dedicated capacity premium[20]. Another method to avoid peak loads in RES production and reduce costs is curtailing chosen units[21].

In some Member States, PV and wind energy production are able to compete with the retail price of electricity due to a large number of taxes and levies (e.g., Germany, Belgium). In other Member States this trend is foreseen for the near future. Thus self-consumption of electricity may make a viable business case for households and SMEs. This way, FiTs could be reduced or phased out for smaller units, while support is delivered in form of tax/levy avoidances. Experts also project that net metering schemes will proliferate further in this context[22]. To harvest potential benefits of batteries and flexibility of demand, support mechanisms could incentivise the use of control mechanisms of feed-in from PV-battery systems.[23] Direct selling of produced RES electricity to end users could be allowed or simplified and may benefit from economies of scale in storage solutions, e.g., through community storages that stores electricity from neighbouring decentralized production units (e.g. "electricity banks"[24]).

In conclusion, the integration of large shares of variable RES production calls for flexibility in storage and production that might need support on different levels. This flexibility can be delivered by increased EU integration (through an internal energy market). It is also likely that the "missing-money" problem for RES prevails, which makes further support necessary in order to achieve the 2030 targets[18].

RES Heating and Cooling

EU renewables policies in the sectors of heating and cooling need a stronger focus to realise their potential, and help deliver Europe's 2020 and 2030 targets.[25] Given that heating and cooling accounts for over 50% of total energy demand, the potential growth in RES-H/C is significant.

The majority of RES in heating and cooling is delivered by bioenergy, but with growing contributions from district heating and heat pumps. Any post-2020 regime will need to promote these three types of energy sources, in addition to energy efficiency measures that reduce overall consumption. This will be critical given the size of energy demand in this sector, accounting for half of the total.

[18] Hartel, R. et al. (2015): Electricity market design options for promoting low carbon technologies, INSIGHT_E RREB
[19] Imaie, K., Kondo, S., Power Stabilization Technologies for Next-generation Transmission and Distribution Networks, Hitachi, 2010
[20] Ökoinstitut (2014): Erneuerbare-Energien-Gesetz 3.0 (Kurzfassung). Study commissioned by Agora Energiewende.
[21] Steurer, M. et al (2015): Curtailment: an option for cost-efficient integration of variable renewable generation? INSIGHT_E HET.
[22] REN21 (2013): Renewables Global Futures Report. http://www.ren21.net/future-of-renewables/global-futures-report/
[23] Dehler, J. et al. (2015): Self-consumption of electricity from renewable sources. INSIGHT_E RREB.
[24] https://www.mvv-energie.de/de/mvv_energie_gruppe/nachhaltigkeit_2/innovationen_1/strombank/strombank_1.jsp
[25] Pye, S. et al. (2014): Europe's renewable energy policies: Too much focus on renewable electricity? INSIGHT_E HET.

A heating and cooling strategy for Europe would go some way in understanding how best to foster increases in RES-H/C[26]. One important area will relate to bioenergy, which is the largest provider of RES in the EU and set to grow further leading up to 2030[27]. Clear sustainability criteria will be critical to ensuring that this continues to be an important source of RES post-2020. A key conclusion of a recent working document is that greater understanding is needed of: the EU's future supply; the life cycle emissions of different sources; and effective sustainability criteria that can be harmonised across Member States.

Integrating distributed generation of renewable heat/cold into smart district energy networks can foster the development to a renewable heating/cooling system. Conventional thermal networks consist of few large production units from fossil fuels, CHP or biomass, hindering the integration of solar hot water or advanced heat pumps[28]. In order to achieve such a system integrating distributed generation, tariff policies, interconnections and incentives have to evolve. The IEA also draws similar conclusions proposing the support of CHP, district heating and cooling networks and locally adapted solutions[29].

RES in the transport sector

Projected to account for 26% of gross final energy consumption (GFEC) by 2020, the transport sector has a critical role to play in GHG reduction. In the post-2020 framework,[30] there is no prescribed role for the transport sector in relation to RES. Rather the policy emphasis is to consider a range of options to reduce GHG emissions including efficiency improvements, electric and other low emission vehicle deployment, and second and third generation biofuels.

Due to the diverse nature of the transport sector, a range of options will be required. As shown in Figure 3 below, different fuel options can play a role across different modes, although their use (and its timing) will be dependent on a range of technology and cost factors.

Post-2020, the focus on supporting alternative fuels for transport should allow for differentiation across different technologies. Subject to sustainability criteria since 2011[31], biofuels are currently the most widespread of alternative fuels, accounting for 4.4% in EU transport. However, removal of support for 1st generation biofuels under a post-2020 regime will result in no growth or a decline in overall usage without strong development of 2nd or 3rd generation biofuels[32].

Figure 3: Coverage of transport modes and travel range by the main alternative fuels[33]

Fuel \ Mode	Road-passenger			Road-freight			Air	Rail	Water		
Range	short	medium	long	short	medium	long			inland	short-sea	maritime
LPG											
Natural Gas LNG											
Natural Gas CNG											
Electricity											
Biofuels (liquid)											
Hydrogen											

It should be ensured that only biofuels are used that actually reduce GHG and do not

[26] Keep on Track 2015 Policy Recommendations Report, http://www.keepontrack.eu/publications/
[27] State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU, SWD (2014) 259
[28] REN21 (2015): Renewables 2015 Global Status Report.
[29] IEA (2014): Linking Heat and Electricity Systems - Co-generation and District Heating and Cooling Solutions for a Clean Energy Future.
[30] European Commission (2014): A policy framework for climate and energy in the period from 2020 to 2030.
[31] Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels
[32] IEEP et al. (2015): Low Carbon Transport Fuel Policy for Europe Post 2020. http://www.ieep.eu/assets/1789/IEEP_TEPR_ICCT_2015_Low_Carbon_Transport_Fuel_Policy_for_Europe_Post_2020.pdf
[33] European Commission (2013): Clean Power for Transport: A European alternative fuels strategy.

alter land use in an unacceptable manner, via clear sustainability criteria. For fostering the diffusion of electric vehicles, EU can support the availability of charging points. The same holds for hydrogen usage: the distribution of fuelling infrastructure is important for the wider penetration of hydrogen vehicles.

Possible policy options at an EU level include a single binding legislative framework, for example on the GHG intensity of transport fuels, while allowing differentiated support for efficient biofuels, green certificates or policy supporting the uptake of electric and hydrogen mobility[32]. However the policy framework develops, it is critical that it can ensure sustainability of biofuels in particular, which has been a major issue with the biofuels to date. It should also ensure that it fits with the longer term framework set out in the EC's Transport White Paper.[34] This sets out the objective to reduce GHGs from transport by at least 60% by 2050 (relative to 1990). In 2030, this means reducing GHG emissions to around 20% below their 2008 level.

Conclusions

- Current policies in RES-E may transition from providing direct support to renewable technologies to indirect support (e.g. self-consumption at a neighbourhood level). This will serve the dual purpose of alleviating grid balancing issues related to the integration of variable renewables in the grid and promoting distributed renewable installations on the end-user side.
- The introduction of retroactive measures in Member States can harm investor confidence and may need to be monitored.
- Ancillary services such as balancing reserves will need to be priced fairly as the EU moves towards and common internal energy market with varied balancing processes in place in different Member States
- EU renewables policies in the sectors of heating and cooling, and transport, need a stronger focus to realise their potential, and help deliver Europe's 2020 and 2030 targets[35]. Given their share of total energy demand, whilst already accounting for over 70%, the potential growth in RES is significant.
- One important area for RES-H/C relates to bioenergy, which is the largest provider of RES in the EU and set to grow further leading up to 2030[36]. Clear sustainability criteria will be critical to ensuring that this continues to be an important source of RES post-2020.
- Strong effort is required to ensure ambitious Member State RES policy packages that are consistent with the internal market, potentially increasing harmonisation between support schemes, and the clear establishment of a bioenergy framework. Efforts will also be needed to ensure support from communities to allow for increasing RES uptake, and strong efforts to remove existing barriers.
- At the EU level, RES-T can be supported through mechanisms such as green certificates or policies favouring the uptake of electric and hydrogen mobility and a single binding legislative framework on the GHG intensity of transport fuels, while allowing differentiated support for efficient biofuels.

[34] EC Transport White Paper 2011 http://ec.europa.eu/transport/themes/strategies/2011_white_paper_en.htm

[35] Pye, S. et al. (2014): Europe's renewable energy policies: Too much focus on renewable electricity? INSIGHT_E HET.

[36] State of play on the sustainability of solid and gaseous biomass used for electricity, heating and cooling in the EU, SWD (2014) 259

Appendix A: Assessment of selected past and present EU support schemes for renewables[37]

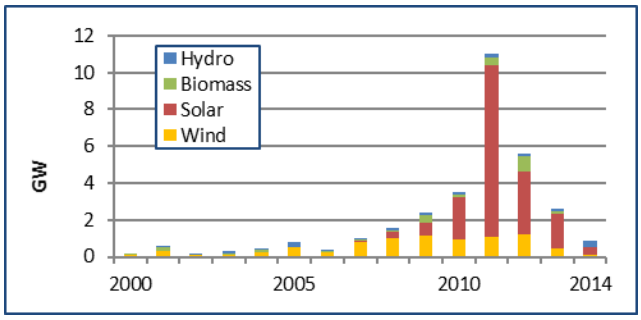
Quantity-based support schemes

To incorporate biofuels in the transport sector the biofuel blend mandates have been largely adopted. Mandatory quotas are also imposed on fuel producers and importers. The debate has now been extended to the application of mandates for new generation biofuels, so far only adopted by Italy (0.6% by 2018).

In the power sector the Renewable Portfolio Standard (RPS) system imposes producers and importers of electricity to introduce a minimum share of RES within the national power mix, either by generating RES power or by trading of green certificates (GC). Italy implemented such scheme in 1999: the price of GCs, initially set on the market through the match of the offer and demand, was successively oriented by the introduction of cap (2005) and floor (2008) prices, in order to improve the investment incentives. The RPS system was progressively replaced by a feed-in tariff (FiT) scheme as of 2005 and definitely closed at end-2012. In terms of addition of RES installed capacity, the scheme appears not having been successful, especially in the view of surge of new installations with the FiT system as from 2005 (cf. Figure 4). This conclusion is backed by the British and Polish move to switch from the RPS system towards other tools (FiT, CfD).

For RES H&C systems so far 7 MS have established mandates. As the attention is towards the residential sector the mandates are an important tool to satisfy the EU Energy Performance of Buildings Directive. Being mostly technology-neutral, mandates help promote different technologies such as geothermal, solar, heat pumps and biomass. Only Greece has an exclusive mandate for solar water heating systems.

Figure 4: Annual additional RES installed capacity in Italy (GW)



(Source: Enerdata)

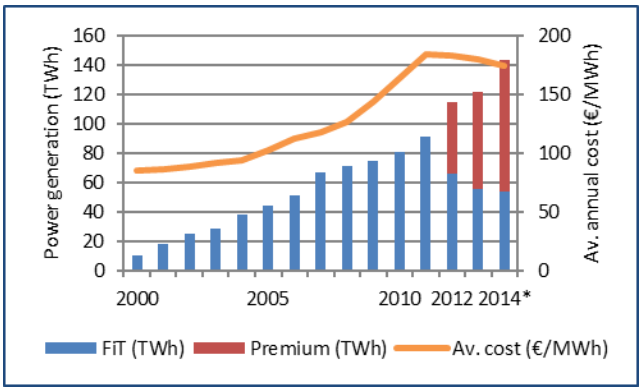
Price-based support schemes

This type of incentive includes price-based schemes such as feed-in tariffs (FiT) and feed-in premium (FiP). Over the time, the price-based support schemes have been so successful to expand the RES that States budgets became uncontrolled. To cope with this issue several MS stopped the scheme such as Latvia in 2011, Spain in 2012 and Greece in 2013. Italy continued to provide FiT and FiP until the dedicated budget, set ex-ante, was consumed. Other MS kept the scheme ongoing by amending them such as Germany that adapted its policies to face the costs reduction trend in several technologies (PV, wind onshore) and the increasing cost supported by end-consumers through levies that finance the RES policies. The major FiT/FiP policy amendments were, firstly, the introduction of a 3-months volume-based corridor that drives the FiT level for the fast expanding PV technology. Secondly, in a pilot program, Germany limited the access to FiT for mature technologies and capital intensive projects that must now elect for the FiP system or compete through an auction mechanism. Thanks to these adjustments, Germany achieved to continue supporting the RES expansion while controlling the related budget (cf. Figure 5).

[37] See "European Commission guidance for the design of renewables support schemes (Appendix I)" for a comprehensive overview of RES-E support schemes

This type of scheme also started to be applied to RES H&C systems. In 2012 the UK stated a 1 cent per kWh of heat generated incentive applied to new and existing buildings. Eligible beneficiaries need to comply with minimum threshold of production stated by law.

Figure 5: Supported RES electricity generation and costs (TWh, €/MWh) in Germany



Source: BMWi

Budget support schemes

The third type of policy developed consists in providing financial incentives for new projects. Most of the MS have put in place front project subventions until a dedicated and redefined budget of the project is over, in addition to others incentives to boost the expansion of specific energies. Financial incentives are widely enacted for RES H&C systems. Subsidies, soft loans and tax incentives are key to the expansion of those systems, especially when focused on the construction sector.

Hybrid support schemes

At the crossroad of these different types of support schemes, two MS have developed interesting hybrid systems. The UK is developing Contract for Difference (CfD) that pays a power producer a variable top-up between the market price and a fixed price level, known as the "strike price". This new tool mixed power market-base price payment and long term minimum guaranteed support, whilst protecting consumers from paying for higher support costs when electricity prices are high. The Netherlands has implemented a tender-based system called SDE+ in which all technologies compete between each other through six rounds. FiT are provided to the winners of the tenders until the ex-ante budget is over. The Dutch system then favours mature technologies within a predefined budget.

In a move to bring the RES technologies closer to the power market prices and costs, the European Commission has decided to *abolish the guaranteed purchase of renewable energy at fixed prices and* introduce competitive bidding for large RES projects as of 2017 (with a pilot phase in 2015 and 2016). Power producers from renewable energy will then have to sell their production on the market and receive aid in the form of a premium in addition to the market price.

For further reading or information, please visit www.insightenergy.org