eurelectric
ELECTRICITY FOR EUROPE

ELECTRICITY MARKET DESIGN:
FIT FOR THE LOW-CARBON TRANSITION

EURELECTRIC IN BRIEF

EURELECTRIC represents the common interests of the electricity industry at pan-European level. Our current members represent the electricity industry in over 30 European countries. We also have affiliates and associates on several other continents.

Our well-defined structure of expertise ensures that input to our policy positions, statements and in-depth reports comes from several hundred active experts working for power generators, supply companies or distribution network operators (DSOs).

We have a permanent secretariat based in Brussels, which is responsible for the overall organisation and coordination of EURELECTRIC's activities.

EURELECTRIC pursues in all its activities the application of the following sustainable development values:

ECONOMIC DEVELOPMENT

- GROWTH, ADDED-VALUE, EFFICIENCY

ENVIRONMENTAL LEADERSHIP

- COMMITMENT, INNOVATION, PRO-ACTIVENESS

SOCIAL RESPONSIBILITY

- TRANSPARENCY, ETHICS, ACCOUNTABILITY

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Cover note

The European electricity industry is fully committed to the European decarbonisation agenda and wants to take an active part in the upcoming discussions to ensure that the low-carbon transition is done in the most cost-efficient and market-based way.

EURELECTRIC – the sector association representing the electricity industry at European level – is pleased to share with you its views on how to make the electricity market design fit for the low-carbon transition.

The European energy panorama is still fragmented and our sector thus faces different underlying fundamentals and regulatory frameworks across countries and regions. EURELECTRIC therefore proposes in this report a number of overarching recommendations and principles to underpin the paths towards a decarbonized power sector. We nevertheless believe that market designs are not carved in stone and should evolve with the energy transition; this report should therefore be considered as a living document.

EURELECTRIC believes that the upcoming European Commission's new energy market design initiative should ensure that consumers reap the benefits of linking wholesale and retail markets, ensure that RES are fit for the market and improve the energy market to attract flexible resources and achieve renewables integration.

A central element of the proposal is the introduction of a scheme of regional adequacy assessments, which should be taken into account when introducing changes in market design such as the introduction of market-based capacity mechanisms. Such a system of regional adequacy assessments poses a number of challenges that are detailed in the report. This analysis could lead some member states to introduce new elements in the market design, such as market-based capacity mechanisms. Regions that do not consider that such developments are needed should obviously not be forced to do so. On the other hand the existing initiatives for well-designed capacity markets with cross-border participation should be considered as building blocks for an efficient regional and European approach.

To minimise the impact on the energy market, these mechanisms should be sufficiently harmonised in their basic design criteria: they should be technology neutral, open to cross-border participation, open to new and existing generation, storage and demand, and produce as outcome contracts with the suppliers of capacity, with a lead time and duration that is consistent with the needs of investment decisions. When such a mechanism is introduced, it becomes a valuable tool for future adequacy analysis, since it provides a market-based assessment of the need for new capacity.

Electricity market design:
fit for the low-carbon transition

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RECOMMENDATIONS

1 ENSURE THAT CONSUMERS REAP THE BENEFITS OF LINKING WHOLESALE AND RETAIL MARKETS

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- "Free up the bill": policymakers should explore how support for power sector-related policies can be made more cost-efficient and less burdensome on the energy bill, thus ensuring that electricity is competitive against other energy sources. Electrification will be the fundamental way to decarbonise the European economy.
- Allow for an efficient development of demand-side flexibility, storage and self-generation to ensure a level playing field between all market players. Network access charges should be progressively adjusted to better reflect the cost structure of networks and excess energy injected in the network should be priced at its true value.

2 ENSURE THAT RENEWABLES ARE FIT FOR THE MARKET AND THE MARKET FIT FOR RENEWABLES

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- Ensure that the EU ETS becomes the main driver for renewables investments: strengthening it is a no-regret option. As it is an established, technology-neutral and European-wide instrument, the EU ETS can boost the EU dimension of low-carbon technologies' development and investment. With a reinforced carbon price signal and an accelerated cap reduction, additional measures to promote renewables can be minimised within the ETS sectors.
- Should member states choose to continue support for mature renewables after 2020, it should be done in the most cost-efficient and market-based way, minimising distortions, including those affecting the merit order.
- Member states should address the barriers to regional support and take into account the future electricity demand when deciding on supported volumes and on their geographical scope.
- Fully integrate renewables in the market: balancing responsibility should apply to all technologies to foster a level playing field and to maximise cost-efficiency.
- The member states and the Commission should guarantee consistency between the 2030 climate and energy targets. They should be required to assess the interlinkages between the EU ETS and renewables support and consider ways to address them. The impact of renewables support on the power market, security of supply and competitiveness of electricity for end-consumers should also be evaluated, and the resulting distortions minimised.

3 IMPROVE THE ENERGY MARKET TO ATTRACT FLEXIBLE RESOURCES AND ACHIEVE RENEWABLES INTEGRATION

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- Swiftly complete the internal energy market and end all regulated prices.
- Fully integrate day-ahead, intraday and balancing markets, implementing shorter gate closure to effectively make the market fit for renewables and ensure that wholesale prices adequately reflect scarcity situations.
- Make the best out of available cross-border capacity to enhance market integration.
- Ensure that transmission tariffs do not distort the market and the merit order.

4 DEVELOP A REGIONAL APPROACH TO SYSTEM OPERATION AND SYSTEM ADEQUACY

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- Coordinate and ultimately integrate system operation and planning tasks relevant to cross-border trade at regional level.
- Ensure that member states and ultimately regions define system adequacy targets using homogeneous metrics.
- Implement regional adequacy assessments involving all relevant stakeholders and jointly analyse potential solutions at regional level. Develop a transparent and contestable methodology, taking into account the market perspectives and the economic viability of existing assets.
- Regional adequacy assessments should be taken into account when introducing market-based capacity mechanisms. Where these exist, they are also a tool in themselves for the regional adequacy assessment.

5 CAPACITY MARKETS SHOULD BE WELL-DESIGNED AND HAVE A REGIONAL PERSPECTIVE TO ENSURE SECURITY OF SUPPLY IN A COST-EFFICIENT WAY

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- Capacity markets should be technology-neutral, open to new and existing assets, and provide capacity contracts with a time-horizon that is relevant for investments.
- Cross-border participation in capacity markets is a must in order to avoid pure national approaches.

INTRODUCTION

The economic environment of the electricity sector is driven by the low-carbon transition. Its objective is to fully restructure the electricity system towards a more diverse mix of assets, with an increasing share of renewable generation. In this context, the need for flexibility and firm capacity will increase, as well as the need for other system services. Customers will also become more active as many of them will be prosumers and provide flexibility with demand response and storage.

This transition is unprecedented and its pace is difficult to foresee. It will bring about innovation and exciting opportunities; as well as challenges. Lots of questions still remain open today: how much flexibility will consumers provide? When will storage solutions be broadly implemented? When will existing power plants close and new investments happen?

As Europe strives to decarbonise its economy and to promote renewable sources of energy, and in the midst of these uncertainties, European citizens and businesses should have access to the reliable and competitive electricity supplies they need.

EURELECTRIC is strongly committed to decarbonise the power system. The share of electricity produced by fossil-fuelled power plants will continue to shrink, thus opening a brand new range of opportunities to innovate, develop new services and invent new business models.

In the current environment where large amounts of subsidised generation together with other market interventions distort price formation, the electricity system lacks signals both for short-term operations and longer term system adequacy and decarbonisation. The market environment has indeed become increasingly volatile and the risk exposure of investors has therefore increased. In this context, the issues faced by market participants and investors are similar for all assets, be it thermal or renewable generation, storage or demand response.

The EU has set a clear direction with the 2030 targets for carbon emissions reduction, renewables and energy efficiency. In an energy-only electricity system with no support schemes or capacity mechanisms, the amount of renewables and the system adequacy level are the outcome of the market.

Given the binding EU objective to achieve at least 27% of renewables by 2030, some member states may continue support schemes in the electricity sector after 2020. Many countries are also complementing their energy markets with a patchwork of capacity mechanisms to guarantee the desired level of security of supply. Unfortunately, non-market-based interventions have flourished, such as forbidding plant closures or targeted subsidies to certain technologies or categories of assets, as ill-designed and unsustainable ways of managing security of supply.

For the sake of European consumers and the European economy, cost-efficiency should be a leading principle when working towards the achievement of the 27% renewables target in the EU and adequacy targets set by member states. System adequacy targets should thus be met with market-based, non-discriminatory measures, and a regional approach to security of supply should be ensured. Both the EU ETS and the non-ETS sectors should contribute in the most cost-effective way to achieve the agreed EU-wide target for renewables.

Market designs are not carved in stone and should evolve with the energy transition. In the short to medium term the critical challenges are to foster the competitiveness of low-carbon technologies, to allow for the development of flexible solutions, to ensure that the market provides price signals adequate for existing assets and investments, and to avoid structural over or undercapacity thus ensuring security of supply in a cost-efficient way. EURELECTRIC believes that non-market measures should be avoided and hence proposes its recommendations for an electricity market design that is fit for a customer-centric and cost-efficient low-carbon transition.

1 ENSURE THAT CONSUMERS REAP THE BENEFITS OF LINKING WHOLESALE AND RETAIL MARKETS

Consumers expect a reliable, affordable and decarbonised electricity supply. Innovative solutions provide them with better information than ever before and open up new opportunities to play an active part in the market. Consumers are increasingly opting for distributed generation, driven by policy support and regulatory intervention in many countries. According to the International Energy Agency one third of the global PV capacity was installed at residential level in 2014.[1] Consumers are also expected to increasingly invest in technological solutions such as heat pumps, electric vehicles, home management systems, home energy devices and connected objects. All these developments will give them unprecedented control of their energy use at the touch of a button – or, increasingly, the swipe of a screen.

Empowered customers are expected to have a crucial role to play in addressing the challenges of the power system transition. The need to integrate increasing shares of variable renewable energy sources (RES) into the system makes demand response more and more relevant. Final consumers – households or businesses – could increasingly provide flexibility to the electricity system by voluntarily changing their usual electricity consumption in reaction to price signals or to specific requests, while at the same time benefiting from doing so.

Nevertheless customers' flexibility potential has still not been fully unlocked. Retailers[2], service providers and start-ups are developing new products and services but their uptake has been rather sporadic to date.

ENABLE DEMAND-SIDE PARTICIPATION

To enhance the operation of retail markets in general as well as demand response, a number of no-regret options must be implemented:

- rules that enable customers to participate in the market and ensure that competition between all resources (generation, demand response, storage) takes place on a level playing field;
- clear roles and responsibilities for all market players, including balancing responsibility;
- phasing out regulated prices to enhance competition, allow retailers to develop more innovative products and customers to reap the benefits of liberalised markets with competitive pressure;
- and the timely roll-out of smart meters and smart grids.

BETTER LINK WHOLESALE AND RETAIL MARKETS: END DISTORTED PRICE SIGNALS

Whilst setting rules for the development of these resources and their access to markets is important, it is not sufficient to ensure a better link between wholesale and retail markets because other factors have major detrimental impacts.

As highlighted by the European Commission in its New Deal for Energy Customers communication, "a key enabler of demand response is consumers' access to price signals that reward flexible consumption."[3] But today, the link between wholesale and retail prices is weak due to a high "wedge" of policy costs and taxes in the bill, holding customers back from actively participating. In 2014, rising taxes and policy support charges represented as much as the energy element on the average European

1 *Residential Prosumers – Drivers and Policy Options (Re-prosumers), IEA-RETD (2014).*
2 *Visit http://www.eurelectric.org/innovation/*
3 *Delivering a New Deal for Energy Customers, COM(2015)339 final.*

household customer bill[4]. This energy element keeps on decreasing due to falling wholesale prices (Figure 1)[5] while the total bill keeps on increasing.

The benefits that well-functioning retail markets can bring to consumers are therefore dramatically reduced. Retailers are competing on an ever smaller part of the bill to deliver electricity at the lowest cost and in the most innovative ways. The development of products based on more dynamic pricing to trigger demand response is also slowed down. Electricity's competitiveness as a key energy carrier that will allow for decarbonisation of the economy against other fuels is hampered. Finally, this evolution deters transparency and is a source of confusion for end consumers.

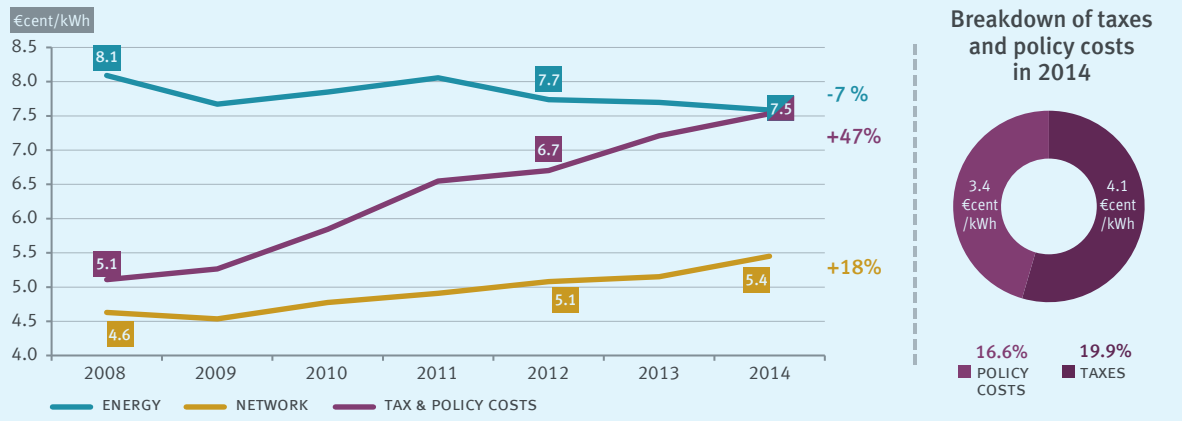
At the time when customers did not have realistic alternatives to the electricity system, policy makers decided to use electricity bills to bolster public budgets and finance other – sometimes unrelated – policy decisions. But in the context of the energy transition, with options like distributed generation, storage, electro-mobility, micro-grids or CHP, customers can choose a tailor-made energy supply system that suits their individual needs, bring down their consumption from the grid and potentially leave the electricity supply system altogether.

One should however be mindful that (i) such options often seem more competitive than they really are in comparison to the real costs of the electricity system and that (ii) some taxes, policy costs and often network costs are today recovered from those customers that are either not interested or not able to invest in similar solutions. Although policy support costs form a large share of the final consumers' bills and tend to be fixed costs, they are billed as volumetric charges. The same holds for network costs. As prosumers consume less electricity, the costs they avoid are shifted to other customers, thus creating a "consumer divide".

It is necessary to develop a supply chain that improves price incentives to facilitate active consumer behaviour in the market and reveal the true value of local power generation and storage:

- Policymakers should explore how support for power sector-related policies can be minimised to be less burdensome on the energy bill.
- In order to ensure that the retail price is the appropriate reference for investment and behavioural decisions, the different elements of the final bill (commodity, network, taxes/levies) have to be designed cost-reflectively in terms of volumetric/capacity-related and standing charges. An evolution towards more capacity-based network tariffs could help to ensure that customers pay for the grid services they actually use and avoid the creation of a "consumer divide".
- On a level playing field, prosumers sell the excess electricity at a price that reflects its value in the market. Indirect subsidies, such as non-market-based net-metering schemes and socialising of prosumers balancing costs should be avoided. Possible RES support should be cost-efficient, transparent and minimise distortions.

FIGURE 1 – EVOLUTION OF HOUSEHOLDS BILL COMPONENTS 2008-2014



Source: EURELECTRIC infographic "Making sense of your electricity bill", February 2016

4 *EU28+Norway.*

5 *Making sense of your electricity bill, EURELECTRIC 2016.*

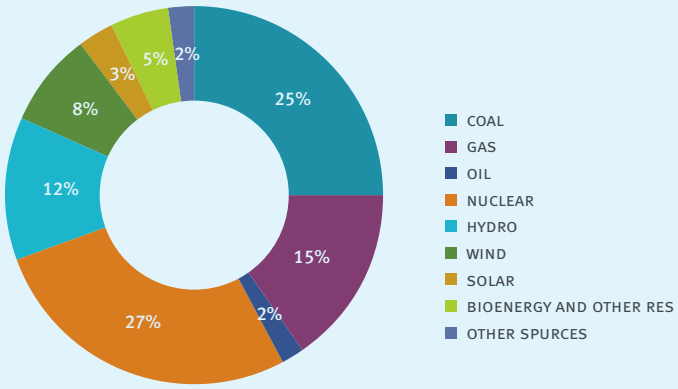
2 ENSURE THAT RENEWABLES ARE FIT FOR THE MARKET AND THE MARKET FIT FOR RENEWABLES

The European power generation mix is becoming increasingly low-carbon with a growing share of renewables. In 2014, 56% of the electricity generated in the EU came from low-carbon sources and 28% from renewable energy sources.

Nine out of the eleven biggest investors in variable renewables are European utilities with over 40 GW of installed capacity[6]. Based on this broad experience, recent technological developments and market experiences, the power industry is confident that renewables will become competitive with other power generation technologies. Onshore wind, and in some cases solar PV, are now considered as commercially competitive in terms of LCOE[7] in a number of markets. This will require that future renewables deployment is sustainable, cost-efficient and based on market fundamentals.

As we progress towards an integrated European electricity market, renewables must be increasingly exposed to competition and be placed on a level playing field with other technologies.

FIGURE 2 – EU GENERATION MIX IN 2014



Source: EURELECTRIC report "Power statistics and trends: the five dimensions of the Energy Union", December 2015

6 *Bloomberg New Energy Finance, 15 February 2016 (1. Iberdrola SA, 3. Enel SpA, 5. E.ON SE, 6. Engie SA, 7. RWE AG, 8 EDP – Energias de Portugal SA, 9. EDF SA, 10. Vattenfall SA, 11. SSE PLC.*

7 *LCOE (levelized cost of energy) is one of the utility industry's primary metrics for the cost of electricity produced by a generator. It is calculated by accounting for all of a system's expected lifetime costs (including construction, financing, fuel, maintenance, taxes, insurance and incentives), which are then divided by the system's lifetime expected power output (kWh).*

STRENGTHEN THE EU ETS

The post-2020 framework for renewables must ensure a coherent approach that takes into account the contribution of all sectors – heating, cooling, electricity and transport. In the transition phase towards a fully decarbonised system, the EU ETS should be the main driver for RES investments in the electricity sector. It is indeed an established, technology-neutral instrument that can bring an increasingly EU-wide approach to low-carbon technologies. Strengthening the EU ETS is therefore a no-regret option to increase the competitiveness of renewable energy technologies and encourage future fuel-switching to low-carbon sources. Additional measures to promote RES can be minimised within the ETS sectors by a reinforced carbon price signal and an accelerated cap reduction in the number of emission allowances.

REDIRECT ENERGY POLICIES TOWARDS GREATER MARKET INTEGRATION, COMPETITIVENESS AND AFFORDABILITY

If member states choose to maintain support for mature technologies after 2020, it should be done in the most cost-efficient and market-based way to maximise market integration and minimise distortions. Beyond research, demonstration and early deployment, policy measures should not seek to promote specific technologies or projects, but rather support RES development in the most cost-efficient way. When deciding to support certain volumes, it is important to take into consideration system costs as well as the evolution of demand for electricity to further avoid energy oversupply. Distortions of the merit order should especially be reduced as they lead to inefficiencies and increased costs that are ultimately borne by consumers through policy support charges. They also distort investment signals provided by wholesale market prices which become lower than they would be without such distortions.

EURELECTRIC does not see any obstacles to full operational integration of all renewable electricity generators into the market as of today. It is for instance necessary to move towards putting operational market responsibilities on all participants, either directly or indirectly through a service provider, including balancing responsibility. It is also key to enable commercial parties to offer balancing and commercialisation services to RES generators.

As for existing generation, it should be left to the discretion of member states to decide whether balancing responsibility should be applied on a voluntary basis or made mandatory, subject to adequate compensation, taking into account the costs derived from these obligations as well as the possible revenues of RES in the balancing market. Either way, full market integration should be ensured as soon as possible.

Further alignment of support schemes' key characteristics through common EU rules should take place. Partial opening across borders and regional support programmes also increase cost-efficiency. Member states should address the barriers to regional support (taxes, levies, permitting etc) and take into account the future electricity demand when deciding on the geographical scope of the schemes. Experience shows that it is challenging to find the political will to establish common schemes, and that their execution involves challenges as well.

DESIGN EFFECTIVE AND COST-EFFICIENT SUPPORT SCHEMES

Member states have adopted a variety of national RES support schemes which will continue to apply to new investments at least until 2020. The plants which entered in operation before 2020 will be supported in some cases even until 2040. Recently, some schemes have evolved from FiTs (feed-in tariffs) to FiPs (feed-in premiums) or CfD (contracts for difference) and elements of tendering are also being introduced for larger units, in line with the state aid guidelines.

If implemented, support schemes should be cost-efficient, minimise distortions in the wholesale market and be technology-neutral. Feed-in tariffs should be phased out, because they do not allow market integration. These principles should apply to all RES support, including for prosumers. However, retroactively changing support schemes should be avoided as they deteriorate the investment climate.

Auctioning mechanisms improve competition between projects and set the levels of support in a competitive way, which is also the case for green certificates market schemes. The projects selected through an auction can be granted energy-based support or capacity-based support, including investment aid[8].

On the one hand, energy-based support incentivises investors to maximise assets' generation output and develop the sites with the largest generation potential, but on the other hand it distorts the merit order. Solutions to minimise these distortions should be implemented, such as introducing partly capacity-based support, capping the annual or monthly amount of electricity that gets support or limiting the support to those hours when wholesale prices are above variable costs[9], as required by the state aid guidelines.

Capacity-based support ensures that dispatching decisions are independent from the support scheme, therefore minimising distortions of the merit order and wholesale price signals. This type of support contributes to reducing the cost of capital and the LCOE. This is particularly relevant for technologies with high investment costs and low operating costs (e.g. wind and solar). Capacity-based support as such does not directly incentivise the development of sites with the largest generation potential nor does it incentivise generators to maximise the output. For this purpose, specific market mechanisms need to be developed. However, logically, RES producers would strive in any case to maximise their revenues from the wholesale market. Finally, capacity-based support can be inadequate for technologies with relatively high variable costs, such as biomass.

Member states and the Commission should guarantee consistency between the 2030 climate and energy targets, and should be required to take into account the interlinkages between the EU ETS and support to renewables, while considering ways to address them. The impacts of RES support on the power market, security of supply and competitiveness should be evaluated and potential distortions minimised. EURELECTRIC supports the development of a holistic Energy Union governance system that contributes to ensuring consistency between policy targets.

8 In the energy based support investors' revenue takes the form of premiums that are paid as €/MWh on top of the wholesale energy price (there can be a cap for the supported volume per project and/or per year) or as a strike price based support that sets the total €/MWh income. With capacity based support the investor's revenue takes the form of e.g. annual/monthly capacity based compensation in €/MW or investment aid. "Investment aid" usually represents a one-off compensation that is granted to the investor when the generation unit is built. In addition to this investors sell their production at market price.

9 The distortion of the merit order is not only related to negative prices as stated in the State Aid Guidelines, but to the fact that generators are encouraged to produce when market prices are below their variable costs.

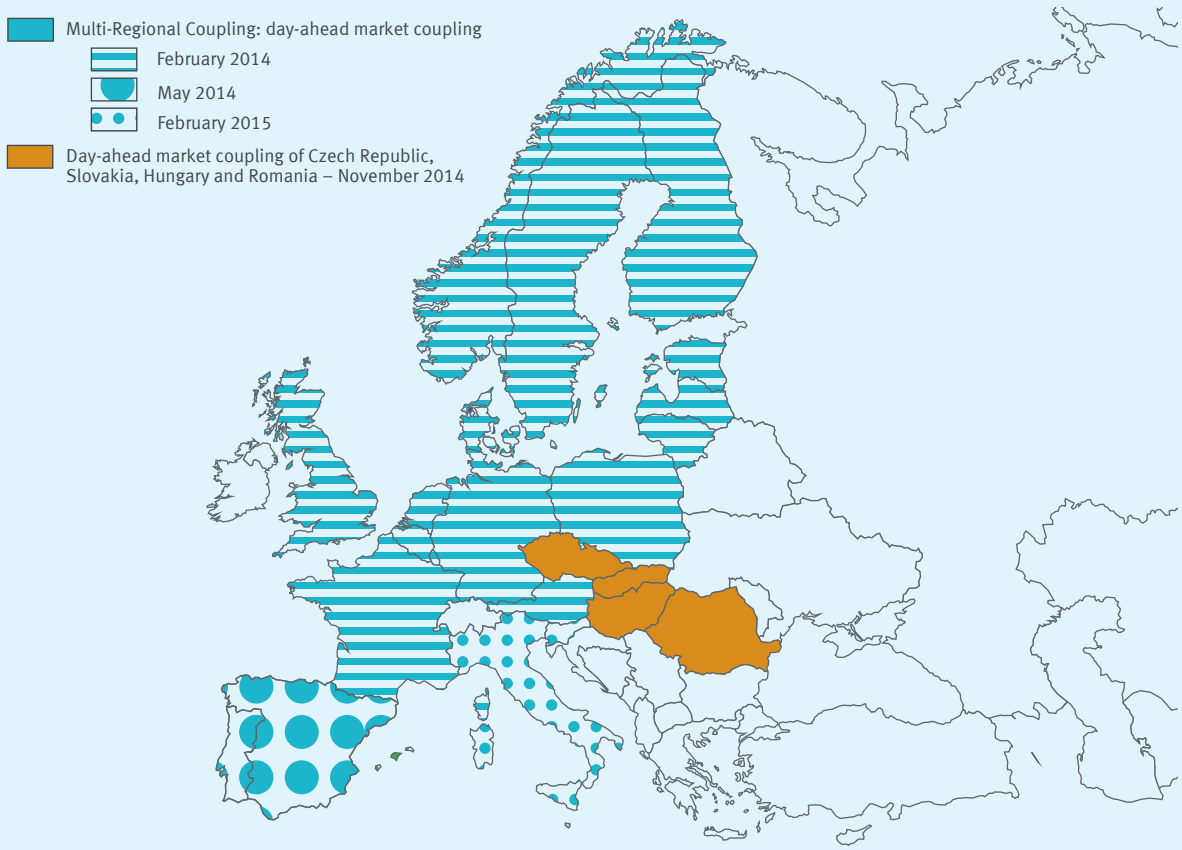
3 IMPROVE THE ENERGY MARKET TO ATTRACT FLEXIBLE RESOURCES AND ACHIEVE RENEWABLES INTEGRATION

The internal electricity market (IEM) must be completed. The third energy package and the integration of European wholesale markets across all timeframes through network codes is the cornerstone of the electricity market design.

Significant progress has been achieved with day-ahead market coupling, but a fully integrated internal electricity market is yet to be reached. Further progress is needed to develop cross-border intraday and balancing markets.

An efficient use and a cost-efficient expansion of interconnections and networks is indispensable to complete the internal market with a growing share of RES. The projects of common interest (PCIs) selection process, relying on the ten year network development plan (TYNDP), is a good approach for a consistent development of new infrastructures.

FIGURE 3 – PROGRESS IN MARKET COUPLING IN 2014 AND 2015



Source: ACER and ENTSOe; see EURELECTRIC report "Power statistics and trends: the five dimensions of the Energy Union", December 2015

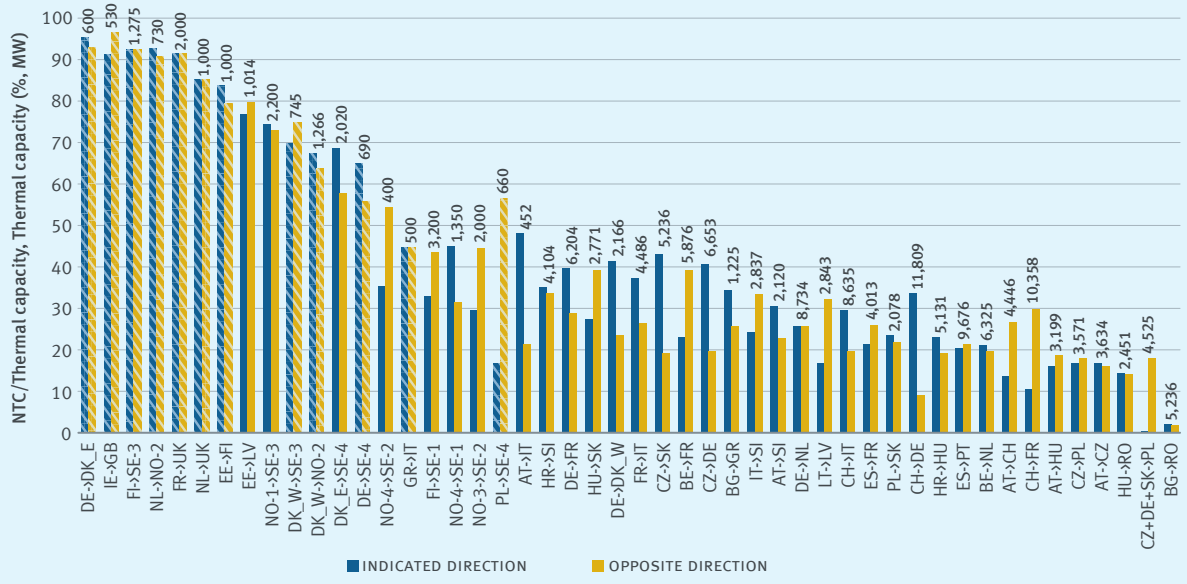
MAKE THE BEST OUT OF AVAILABLE CROSS-BORDER CAPACITY TO ENHANCE MARKET INTEGRATION

There is significant scope for electricity transmission networks to be used in a more efficient way and hence make more cross-zonal tradable capacities available to the market in different time frames. ACER's market monitoring report 2015 indeed shows that in nearly 70% of all assessed borders, the physical capacities are at least twice as high as the tradable capacity.

In order to update the available grid capacity for trade, efficient capacity calculation methods coordinated among TSOs should be implemented, including in the intraday timeframe. To this end, the implementation of the capacity allocation and congestion management (CACM) guideline as well as the step-wise extension of flow- based market coupling across Europe is necessary. In particular, cross-border capacity should not be unduly curtailed or limited and internal congestion should not be moved to borders. In general, market-based solutions for curtailment should be implemented.

EURELECTRIC welcomes the progress reached so far regarding the performance of the day-ahead market coupling algorithm. To solve the remaining issues, we believe that before implementing inefficient changes to the design of the algorithm, we should rather harmonise existing market design rules (e.g. switch to portfolio bidding in day-ahead markets, harmonise products, abandon other interventions preventing free bidding and freedom of dispatch, etc).

FIGURE 4 – PHYSICAL CAPACITY IS MUCH HIGHER THAN THE TRADABLE CAPACITY ON MOST BORDERS (2014)



Source: Data provided by NRAs through the ERI (2015), EMOS, ENTSP-e (2015) and ACER calculations. See ACER "Market monitoring report 2015", p. 154 (paragraph 384).

FUTURE-PROOF INTRADAY AND BALANCING MARKETS TO INTEGRATE A GROWING SHARE OF RENEWABLES

The development of robust cross-border intraday and balancing markets will be crucial to ensure that the system remains balanced as the share of renewables continues to grow.

It is therefore necessary to promote a liquid continuous implicit cross-border intraday market with harmonised products in all member states, while capacity pricing shall not drain liquidity nor reduce the speed of market processes. The market shall be enabled to determine the most economic dispatch until a gate closure set as close to real-time as possible (e.g. 15 minutes). TSOs shall only perform the residual balancing of the system.

The approach to European balancing markets must be ambitious with a clear end-goal, in particular regarding TSOs' balancing philosophy. The current approach based on various pilot projects (see Figure 5) allowing the co-existence of different balancing models in terms of products, pricing, settlement, etc. will not lead to ultimate integration. The balancing guideline, and especially the future legislative proposals on coordinated sizing and cross-border sharing of reserve capacity to be presented by the European Commission, should ensure the future convergence of the coordinated balancing areas and progress towards a limited number of standard products. In addition, balancing should be a fully market-based process and the code should not require mandatory participation in balancing markets.

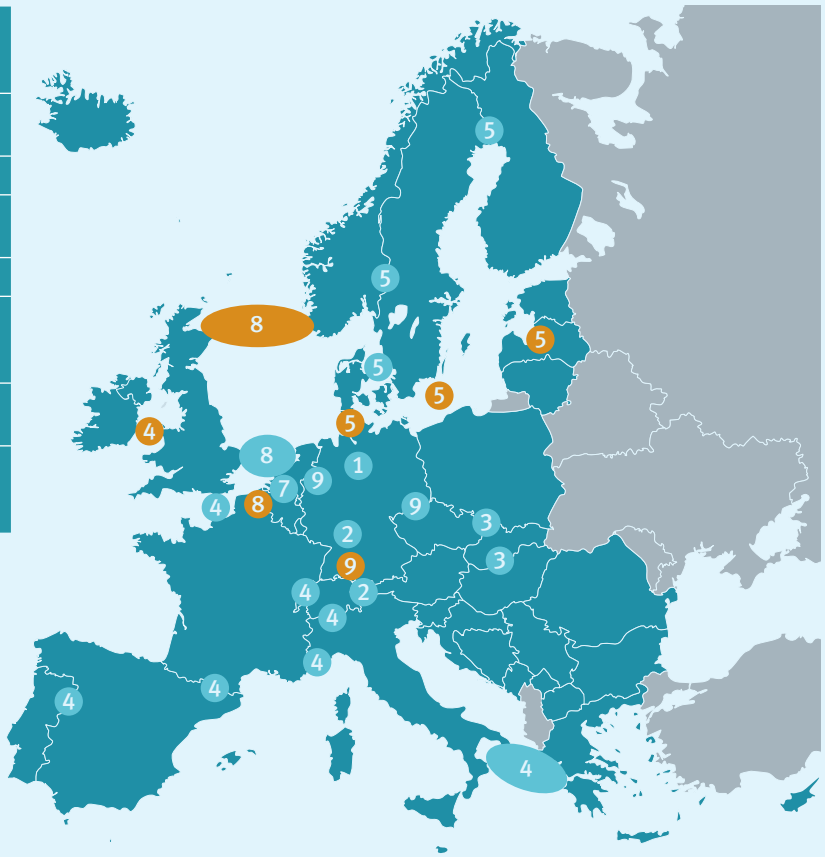
Finally, markets, or when this is not possible market-based solutions, should be developed for the provision of other system services, which are critical to provide flexibility and stability to the grid, such as reactive power balance.

FIGURE 5 – OVERVIEW OF REGIONAL BALANCING PILOT PROJECTS

1	Common Merit Order (CMO) for mFRR and aFRR with real time flow based congestion management
2	Cross-border market for FCR based on TSO-TSO model
3	E-GCC (project on hold)
4	TERRE: Trans-European Replacement Reserves Exchange
5	Development of the Nordic RPM
7	Design and evaluation of a harmonised reactive balancing market with XB optimisation of Frequency Restoration
8	BritNed / TenneT / National Grid Balancing Services (project on hold)
9	IGCC Imbalance Netting, aFRR-Assistance and Flow-Based Congestion Management

TSOs involved

TSO possible future involvement



mFRR: manual Frequency Restoration Reserves – **aFRR:** automatic Frequency Restoration Reserves – **RPM:** Regulating Power Market – **IGCC:** International Grid Control Cooperation – **E-GCC:** Grid Control Cooperation in CZ, SK and HU

entsoe
Reliable Sustainable Connected

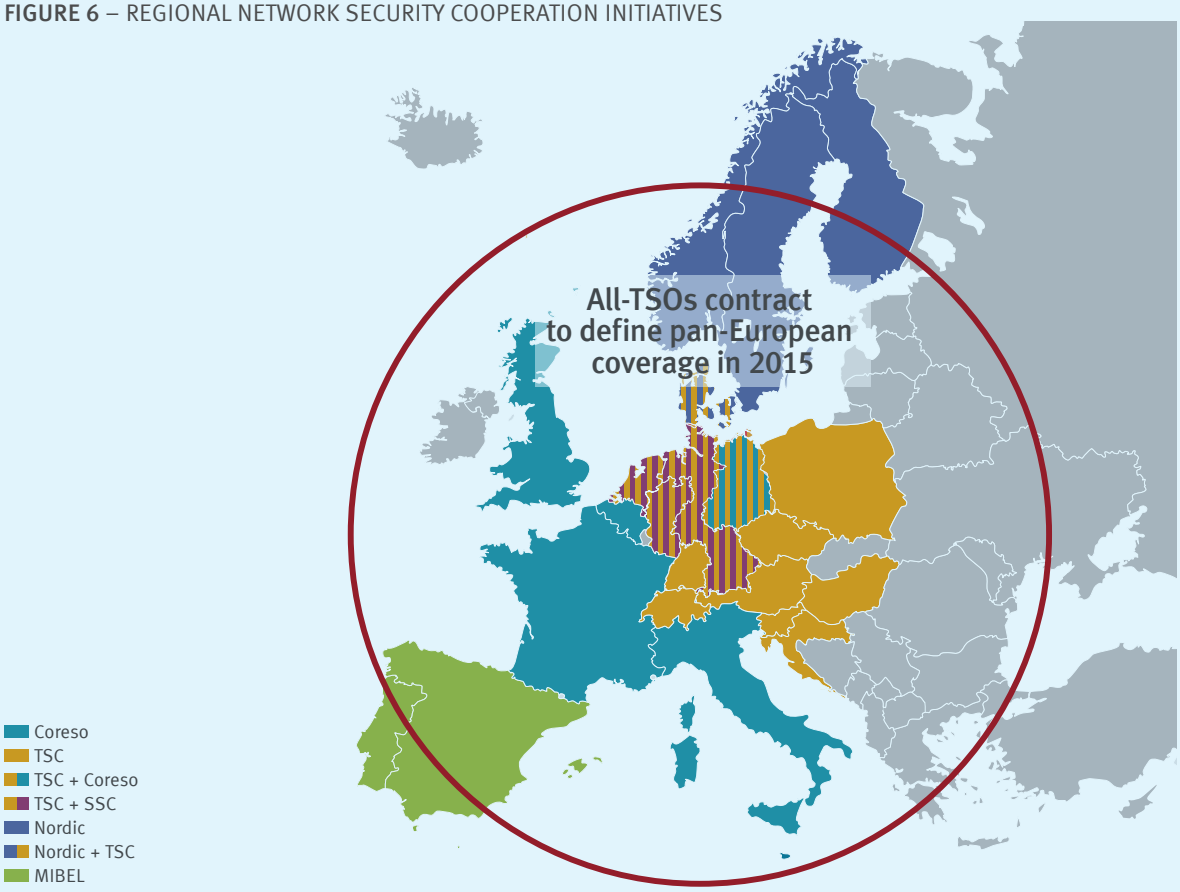
Source: ENTSO-e website

4 DEVELOP A REGIONAL APPROACH TO SYSTEM OPERATION AND SYSTEM ADEQUACY

COORDINATE AND ULTIMATELY INTEGRATE SYSTEM OPERATION FUNCTIONS AT REGIONAL LEVEL

The transition towards a truly integrated internal electricity market will be more efficient if the electricity system is optimised on a regional and ultimately European basis (e.g. TSOs should act as "one"). This will require a high degree of cooperation between system operators and harmonisation of system operation rules. In this context, the European Commission's recent call for more system operation integration, and in particular its proposal to establish regional operational centers (ROCs), is a good starting point.

FIGURE 6 – REGIONAL NETWORK SECURITY COOPERATION INITIATIVES



Source: ENTSO-e "Future TSO coordination for Europe policy paper", November 2014

Current TSO coordination initiatives are steps in the right direction. The harmonisation and integration requirements developed in the system operation guideline are nevertheless not ambitious enough. Indeed, these approaches remain mostly national with the aim of protecting the autonomy of individual system operators.

A step-wise regional integration of system operation and planning tasks relevant to cross-border trade therefore needs to happen. Such process should build upon the ongoing establishment of regional security coordination initiatives (RSCI) service providers (see Figure 6), which are executing a certain number of system operation tasks on behalf of national TSOs and could be a step towards gradually allocating the responsibility for these tasks to regional entities.

A truly regional system operation can however only be based on a regional decision-making structure and a single operational framework. Establishing regional integrated system operators performing system operation and planning tasks in all regions should therefore be the end goal to allow for more operational coordination of TSOs.

They should aim at ensuring at least:

- an integrated congestion management based on a regional capacity calculation methodology allowing for frequent updates of available grid capacity;
- an integrated balancing market with common rules and market solutions for operational tools such as ancillary services;
- regional system adequacy assessments;
- regional network investment planning and coordination of network investment decisions.

Such transition will require legislative changes and should ensure a clear delineation of responsibilities between national TSOs and the regional integrated system operators.

Regarding transmission tariffs applied to generators, their structure and methodologies to compute the costs need to be harmonised. Furthermore, their levels should be set as low as possible, in particular the power based charges (€/MW) which act as a fixed cost for generation and therefore distort investment decisions.

DEVELOP REGIONAL ADEQUACY ASSESSMENTS

A regional approach to security of supply should be developed to supplement national assessments, involving all relevant stakeholders (TSOs, regulators, market participants, etc.) and including the coordinated analysis of solutions.

Adequacy targets for security of supply are usually defined using different metrics (LOLE, energy not served, etc.). These metrics should be:

- harmonised at regional level, indeed, using the same metrics will allow for a straightforward comparison of targets in different countries;
- homogeneous and transparent to let the market understand the outcome.

While the choice of adequacy metrics should be harmonised, each country should be free to set its desired level of adequacy. However, in integrated markets, these target values should naturally converge to prevent the side-effects of significantly different target levels across member states, such as free-riding.

A clear methodology should be defined for regional system adequacy assessments. This methodology should inform member states on whether their chosen adequacy target can be met. It should be followed by a joint analysis of the potential solutions necessary to achieve security of supply in the region. This methodology should be transparent and contestable. It should be developed by expert groups involving all relevant stakeholders, including market parties. EURELECTRIC calls on the European Commission to engage in an open consultation with stakeholders on the methodology and the results.

These assessments require:

- an integrated approach among involved TSOs, NRAs and governments;
- an analysis of the location of "firm capacity", because grid capacity across Europe, and in particular transmission capacities, are finite;
- a thorough analysis of the firm capacity provided by all assets on the supply side and on the demand side, including renewables, demand response and storage;
- an analysis of the economic situation of existing assets in the short and long term: if some assets do not cover their fixed costs, the adequacy assessment should anticipate the corresponding closures.

Member states should decide how to ensure regional security of supply in cooperation with their neighbours, while ensuring the availability of contracted cross-border capacity. In case of common scarcity events, TSOs' actions should be clarified and factored in the adequacy assessment.

Additional grid development to address a system adequacy issue should also be considered, subject to a positive cost benefit analysis and taking into account the time needed to reinforce the network or interconnections.

The deployment of well-designed market-based capacity mechanisms should take into account the outcome of these regional adequacy assessments and provide a sustainable solution to ensure that adequacy targets are met.

Where well-designed market-based capacity mechanisms are in place, they are also a tool in themselves for the regional adequacy assessment. Indeed, they contribute to revealing the adequacy situation by explicitly valuing the available capacity that is needed to ensure the adequacy target and by identifying the available capacity that is not needed.

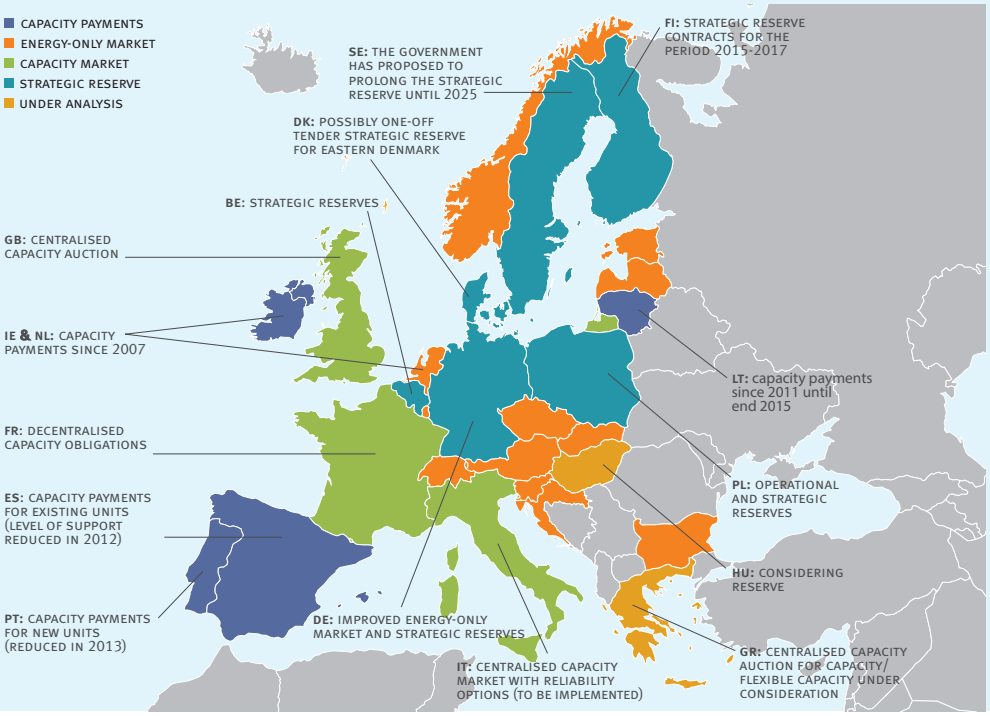
Well-designed market-based capacity mechanisms should ensure that the most competitive generation, demand response and storage assets are selected and properly valued. Conversely, such market-based mechanisms will help identifying the excess of generation capacity, demand response and storage.

5 CAPACITY MARKETS SHOULD BE WELL-DESIGNED AND HAVE A REGIONAL PERSPECTIVE TO ENSURE SECURITY OF SUPPLY IN A COST-EFFICIENT WAY

Capacity markets should be well-designed to ensure security of supply in a cost-efficient and sustainable way, hence becoming an integral part of a future-proof market design.

Governments tend to consider security of supply as a public good. They hence set clear system adequacy standards and implement mechanisms to achieve them. Governments should avoid non market-based measures, such as not allowing plants closure or subsidising specific types of assets. As a matter of fact, many member states have moved ahead with a range of capacity mechanisms. EURELECTRIC believes that a regional approach to system adequacy would secure a coordination of efforts that would bring significant benefits in terms of effectiveness and optimisation of resources. The current piecemeal approach should therefore evolve into a more regional approach, which can be obtained through cross-border participation.

FIGURE 7 – CAPACITY MECHANISMS IN EUROPE – STATUS IN JANUARY 2016



Source: EURELECTRIC, 2016

Capacity markets deliver system adequacy in a sustainable way by valuing reliable and firm capacity and thereby providing signals for competitive existing capacity to stay online or new capacity to be developed in order to reach system adequacy targets.

The overarching goal of any capacity market must be to ensure system adequacy, i.e. firm capacity provided by conventional and renewable generation, demand response and storage assets. Other political objectives such as decarbonisation should be met through instruments like the EU ETS and should therefore be left out of the capacity market debate. Consequently, the capacity market should only value the assets' availability based on their firm contribution to system adequacy. In order to maximise cost-efficiency and market orientation, any capacity market should follow a set of fundamental design features. Having a market-based capacity mechanism that is open to all technologies throughout the whole value chain and that does not discriminate between new and existing plants is the most cost-efficient way to reveal which capacity providers should be remunerated to ensure system adequacy.

Well-designed market-based capacity mechanisms should have the following features[10]:

- **Market-based** – Capacity should always be valued in a competitive market. Capacity prices should be allowed to move freely without distortive price regulation;
- **Technology-neutral** – All technologies that provide firm capacity should be able to participate in the market without discrimination;
- **Open to new and existing assets** – Market access should be based on a level playing field between both new and existing firm capacity providers;
- **Cross-border participation** – Capacity mechanisms must be open to cross-border participation to drive regional cooperation and take into account regional interdependencies;
- **Open to generation, demand response and storage** – All forms of capacity throughout the value chain should be able to participate in the market;
- **Contracts** – the outcome of capacity mechanisms should be capacity contracts and not only a regulatory commitment.

There are two critical time variables for capacity mechanisms: the lead time and the contract duration.

- Lead time: capacity mechanisms should coordinate system capacity needs in the medium and long term. To optimise existing capacity and manage possible oversupply, a lead time of 3 to 4 years should be sufficient. This amount of time also makes it feasible for most new capacity providers to be available at the start of the capacity contract, as it is consistent with the time associated with investment decisions.
- Contract duration: investment decisions would benefit from price signals through the capacity market taking into account the assets' useful lifetime. So far, energy markets have failed to develop contracts in the time horizon relevant for investments; a capacity market can complement this. Indeed, investments in new generation capacity with a lifetime of several decades would benefit from long-term and stable investment signals.

FIGURE 8 – KEY FEATURES OF WELL-DESIGNED CAPACITY MECHANISMS

Objective	Product	How?	Geography
‣ Security of supply	‣ Availability	‣ Market-based ‣ Technology neutral: generation, demand response, storage ‣ Open to new and existing plants	‣ Open to cross-border participation, and ideally common sourcing at regional level

Source: EURELECTRIC, 2016

10 A reference model for European capacity markets, EURELECTRIC, 2015.

ANNEX 1: METHODOLOGY TO PERFORM REGIONAL ADEQUACY ASSESSMENTS

In order to proceed with regional adequacy assessments, commonly agreed assumptions on situations in every area are needed to set up a number of scenarios. They should be discussed and agreed with the relevant stakeholders (regulators, TSOs, market participants, etc.):

- peak demand and simultaneity of peaks (e.g.: do winter peaks fall together or are there some seasonal differences? Are both bidding zones in the same time zone or not?);
- demand-side participation in the market (volumes, prices);
- existing and planned installed capacity and availability of conventional generation;
- existing and future intermittent generation capacity (wind, PV) based on targets set by the member states/ European Commission;
- existing and future embedded generation and self-consumption;
- availability of natural gas and other fuels;
- weather scenarios, including rare winter/summer events;
- weather assumptions to derive wind, solar, hydro generation, including hydro assumptions;
- storage capacity (both centralized/decentralized);
- likelihood of "overhaul" and "forced outages";
- fuel prices, CO_2 prices (determining conventional dispatch with given plant efficiencies);
- transmission grid in the region (internal and cross-border lines), including new developments;
- import/export assumptions and interconnection capacity to neighboring regions. Should the process be built on an EU scale, the uncertainty on this would be reduced;
- system balancing rules and the amount of contracted ancillary reserves (FCR, FRR; RR to the extent that it is contracted);
- etc.

The involved stakeholders should agree on a range of relevant scenarios, including worst-case or stress scenarios for security of supply. The scenarios are set up by combining the various risk factors according to the scenario storylines.

Based on this shared set of assumptions and scenarios for the medium to long term, the optimal dispatching of the power system should be simulated in a stochastic way on an "hourly" basis, using the above-mentioned assumptions across scenarios, and including operational constraints.

Additional simulations are then necessary to take into account the anticipated plant closures, possibly also taking into account the impact on other markets of the same region and on other regions. It should be noted that plant closures would also affect the cross-border capacity available during scarcity events.

ANNEX 1: METHODOLOGY TO PERFORM REGIONAL ADEQUACY ASSESSMENTS

A detailed economic assessment, including price forecasts to analyse the likelihood of existing plants remaining operational should thus be performed.

The frequency and location of customer curtailments (i.e. member state or the zone in a member state) should be checked for each scenario against the chosen metrics (LOLE, energy non-served, etc.). The simulation could also reveal i) "local" domestic (intra-national) congestions leading to congestions between zones and ii) locations where the curtailments could possibly happen.

This regional adequacy assessment process could also allow defining detailed "de-rating" factors that estimate the cross-border contribution that member states can expect during a scarcity situation. This would result in a more efficient assessment than the current existing methodologies (mainly based on national assessments).

The study on generation adequacy from the Pentalateral Energy Forum (2015) is a good example of a regional initiative and how it could work in practice, though some shortcomings in the methodology used in this study should certainly be relieved.

The ENTSO-E report on system outlook and adequacy forecast should progressively leverage on this kind of regional initiatives to provide the relevant information on system adequacy over the medium to long term.

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