



European  
University  
Institute

ROBERT  
SCHUMAN  
CENTRE FOR  
ADVANCED  
STUDIES

Issue 2014/04  
September 2014

POLICY

BRIEF

FLORENCE  
SCHOOL OF  
REGULATION

## *Beyond national generation adequacy: Europeanizing the building of capacity mechanisms?*

*Authors: Arthur HENRIOT & Jean-Michel GLACHANT*

### *Highlights*

- Revenues of “standard” power generation assets in the EU are strongly impacted by massive renewables. Due concerns have emerged on the ability of “energy only” markets to ensure generation adequacy over the next decade. Some Member States are considering “national only” generation adequacy mechanisms, conceived to address issues that are specific to each Member State. Therefore it is not obvious that a common “regional” mechanism will spontaneously reach a consensus.
- “National autarkical generation adequacy policies” - if not contradictory - are inevitably expensive. Significant benefits can be achieved when sharing resources and managing the stress events at a multilateral scale. To be efficient all national adequacy policies should acknowledge the multi-lateral dimension of the adequacy issue in the EU, and take into account (either ‘explicitly’ or ‘implicitly’) the actual contribution of cross-border resources.
- However Europeans do not seem ready for this demanding Europeanization. Today the set of tools that we need is still to be defined before thinking about any implementation. We still have to deliver a proper Europeanization of the national adequacy mechanisms.
- How to do any coherent assessment of the EU and each Member State actual generation adequacy without an EU harmonisation of methodology, data base and scenarios? How should we allocate among various players the responsibilities for energy delivery, while the true contribution of interconnections can only be known in real-time, and results from a conjunction of conditions in different systems? And how to allocate energy at times of scarcity, considering efforts made through heterogeneous adequacy mechanisms? Can we combine any set of compatible economic incentives with the needed spirit of solidarity embodied in our EU treaty?



## 1. Background: the emergence of national generation adequacy policies

The ability of energy-only markets to provide an adequate revenue stream to investors in generation assets has recently been questioned in Europe. The “missing money” issue is an old debate, which led - for instance - to the implementation of several capacity remuneration mechanisms in the United States and Latin America<sup>1</sup>. In Europe, this debate is renewed by the large-scale development of intermittent renewable energy sources (RES), such as wind turbines and solar panels.

Actually the current wave of investment in RES capacities is driven by support schemes. Only the “outside of the energy market” revenues make RES investment attractive and always profitable... even in case of gigantic generation overcapacity and historically low wholesale energy prices. Furthermore very significant amount of flexible and dispatchable generation (or consumption or storage) assets is needed to ensure the system security vis-à-vis the high RES intermittency. In the meantime all the “classical” flexible generation assets are used less often than before (on average). Several concerns have consequently been raised regarding the attractiveness for investment in capacity of a “wholesale energy only market” remuneration based on highly volatile and actually lower wholesale energy prices.

The today “missing money” issue that EU faces has an historical dimension (a RES public push despite a low demand) that could be addressed if the excess capacity of generation was decommissioned. However it is not clear if and how we might reach a sustainable “plateau” of flexible and dispatchable assets after such a bloody “assets cleaning”.

What the European systems need is that the right amount of back-up resources will also be able to provide the right amount and profile of flexibility, to cope with the system variability of intermittent RES. Concerns have therefore emerged over the ability of the existing sequence of wholesale markets (from Day Ahead to balancing via intraday) to drive the system required investment in flexibility. In the today’s EU already “generation adequacy” is not only ensuring an abstract right volume of dispatchable resources; it has clearly become ensuring the right “flexibility mix” for the system.

Of course the needs and the resources of Member States differ substantially. France aims at dealing with a high peak demand and electrical heating when temperatures are low. The Spanish CCGT fleet bleeds and the corresponding LNG terminals sleep... in a peninsula... as long as wind blows or sun shines. Such countries differences are resulting in a wave of hetero-

geneous proposals for capacity remuneration mechanisms. With centralised, targeted “strategic reserves” in Belgium, or “decentralised”, market-wide capacity obligations on suppliers in France. It is therefore unlikely that a harmonised European capacity remuneration mechanism will ever spontaneously emerge. How then to avoid too many and too strong national “lock-in/s” derailing our historic move towards an integrated European market? On the one hand, it should be more clever than ever to pool scarcely-used back-up resources at a multi-lateral scale. While reducing the total flexibility needs by aggregating regionally the variable production of intermittent RES (all RES do not fluctuate the same way at the same time). On the other hand, some national generation adequacy mechanisms are currently being implemented. It is not clear yet how these schemes will impact the actual integration of our internal energy market; or prevent (pre-empt?) the activation of non-generation adequacy resources (as demand response, storage or interconnectors).

We do have to analyse the scope and to understand the functioning of national generation adequacy policies in our EU integrated electricity market.

Our policy brief first explains why handling security of supply on a purely national way will be prohibitively expensive if not purely counter-productive (with countries harming each other). EU and Member States do not need and cannot afford a new type of over-capacity: an over-capacity of “adequacy redundancies” which can only distort more and more energy exchanges and investments in the internal energy market. The Commission repeats being determined not to allow a generalised split of the internal market by autarkical capacity remuneration mechanisms. Of course security of supply has been legitimately and traditionally addressed only country by country before the building of the internal EU market. Of course our EU Member States still have different SoS needs and different SoS tool boxes as reflected by the heterogeneity of reliability standards and balancing arrangements. However a Europeanization of national capacity remuneration mechanisms is needed: it cannot be avoided and has to start. In the second part of this policy brief, we identify several key challenges on our journey to the coming Europeanization of national capacity remuneration mechanisms.

## 2. A Europeanization of national generation adequacy tool kits is unavoidable

A fully unique and fully harmonised adequacy policy cannot be developed “in Brussels”(or Ljubljana) and implemented all over Europe, as Member States face too different needs, based

1. See for instance Joskow (2013) “Symposium on ‘Capacity Markets’” Economics of Energy and Environmental Policy 2.2



on too different systems and resources and address legitimately different security objectives or energy policies (the former “2020 policy” is ending: toward 2030 “fais ce qui te plaît” / “Honny soit qui mal y pense”). It is certainly not a reason to not look after coherence and consistency across nationally specific schemes: think only one minute about how to measure the adequacy contribution of cross-border resources. In this section, we will also look at the Commission approach as it already has (Member States liking it or not) strong legal tools to oppose autarkical approaches in the name of “free movement of goods” and of “state aid control”.

### *2.1 Autarkical generation adequacy policies are inevitably more expensive*

The benefits of a multi-lateral (or regional) approach towards security of supply are obvious by comparison to a national autarkical approach. First, current level of reserve margin and future needs vary across different Member States. Some of these states experience large amount of surplus capacity, while the reserve margins are shrinking in some neighbouring countries. A multi-lateral reserve margin will therefore be better than the smallest national reserve margins, even with constraints coming of limited interconnections. Second, stress events across neighbouring countries are not perfectly correlated, which means that the surplus capacities will not generally be needed at the same time by the different national systems. Of course the stressing events are also partially correlated: weather correlations between neighbouring countries can result in similar hourly load among different systems; as well as a correlation of weather-driven output from intermittent RES among these systems. However, even when stress events with low capacity margins occur within the same period (e.g. during the winter in Northern Europe), they are rarely coincident.<sup>2</sup>

Excluding the activation of cross-border resources from generation adequacy policies will therefore lead to higher overall costs, as the potential to share capacity resources available at a multi-lateral scale is lost. The costs of provision aiming at ensuring national self-security were estimated to 3.0 to 7.5 billion euros per year from 2015 to 2030, reducing the benefits of an integrated energy market by more than 20%.<sup>3</sup>

### *2.2 Generation adequacy policies will impact energy prices*

Generation adequacy (the availability of sufficient resources capacity when needed – incl. activation of demand switching)

2. Pöyry (2013). “Analysis of the correlation of stress periods in the electricity markets in GB and its interconnected systems.” Report to Ofgem.
3. Booz & Company, Newbery et al. (2013). “Benefits of an Integrated European Energy Market.” Report for the Directorate-General Energy of the European Commission.

and flexibility (the ability to adapt production or consumption to the system needs within a given timeframe) are two cornerstones of a reliable power system hosting a high share of intermittent RES. However the issue of flexibility is sometimes decoupled from the generation adequacy issue. One assumes some long-term mechanisms would be implemented to ensure generation adequacy on the one hand, while looking at other short-term signals from day-ahead to balancing horizon to ensure an optimal dispatch of generation and activation of flexible system components (either generation, demand or storage).

Such a partition between long term adequacy building and short term flexibility activation seems however misleading. The ability of system resources to start-up and ramp-up quickly, to cycle frequently, and to operate at low minimum loads becomes inevitably critical in a system hosting a high share of intermittent RES. For a thermal unit with significant variable costs, it may imply generating at a loss so as to be available when needed. Generation adequacy incentives end inevitably impacting prices and flexibility remuneration in the “short term” markets. If the generation adequacy policy is biased ex ante towards a given set of resources (by technology and location) further distorted conditions are introduced in the short term markets acting ex post.

### *2.3 The European Commission has the legal weaponry for a minimal Europeanization of generation adequacy*

Member States have a unilateral right to influence the general structure of their energy supply (= their systems’ energy mix + the private / public mix of industry ownership). They also have a legitimate right to define the conditions and operation of security of supply within their boundaries. They also bear the complementary national regulatory frames and authorities (the NRAs). These strongly national foundations of the EU power systems are reflected in the diversity of national balancing arrangements and reliability standards. The Electricity Directive 2000/9/72/EC (article 7) allows Member States to implement “a tendering procedure or any procedure equivalent in terms of transparency and non-discrimination”, in the interests of security of supply.

All of this said, the European Commission also has a solid weaponry coming from internal market’s freedom for trade or competition policy for state aid. That is why the Commission will not let national schemes tearing into pieces the integration of internal energy market. In the Commission’s guidance on public interventions, it is clearly stated that “mechanisms to ensure generation adequacy should be open to all capacity which



*can effectively contribute to meeting the required generation adequacy standard, including from other Member States”.*

In order to prevent distortion of competition and trade, the Commission has two powerful weapons. First energy is legally a good and as such, the dispositions of the Lisbon treaty regarding free movement of goods apply. It prevents unilateral restrictions of energy imports and exports. Second even for a legitimate state intervention the guidance states that “*Member States, when intervening to ensure generation adequacy, should choose the intervention which least distorts cross border trade and the effective functioning of the internal electricity market*”. The Commission will use its State Aid strong powers to prevent or cure any public intervention that would unilaterally harm or discriminate cross-border trade. However this Europeanization process will be quite demanding as the “technology neutrality” been required covers all “generation + storage + demand response” alternative technologies and assets.

### 3. A frame for a workable Europeanization of national generation adequacy mechanisms

It is now clear that national generation adequacy mechanisms must take into account the contribution of cross-border resources. Either to avoid the extra costs of autarky or to ensure compatibility with the guidance of European Commission. However no one so far has defined a ready-to-use tool-kit of practical and workable efficient solutions. We propose in this section what could be the main tools ensuring a minimal Europeanization of national generation adequacy mechanisms. A first tool is a methodology allowing an assessment of the adequacy needs and a measurement of the contribution of cross-border resources. A second is a frame of legitimate remuneration and allocation of responsibilities for services delivery at activation. A third and last tool is a multi-lateral frame to coordinate this activation of services at times of general and multi-lateral scarcity. Such a frame must deliver compatible economic incentives while respecting the solidarity principles embodied in the EU treaties.

#### 3.1 A consistent assessment of adequacy needs and measurement of cross-border resources

ACER, in its report on capacity remuneration and the internal market, underlines that “*the contribution from cross-border capacity to security of supply is often not taken into account sufficiently well when addressing national or local adequacy concerns*”. CEER in its own 2014 report “Assessment of electricity generation adequacy in European countries” reminds the remaining difficulties to assess regional security of supply.

It states that national generation adequacy outlooks are established with no consistent definitions, methods or scenarios, and in most cases with no identification of the impact of correlated events at regional level on security of supply. It highlights an urgent need for harmonisation of methodologies within Europe. It calls for a more robust and comprehensive methodology to assess security of supply at a regional scale, as the direction and the volume of flows through interconnectors are the result of partially correlated conditions such as load and output of intermittent RES in the different Member States.

We see two ways of including the contribution of cross-border resources in national generation adequacy policies. A first “explicit” approach is to allow cross-border resources to participate by themselves (hence “explicitly”) in the process, in conditions objectively non-discriminant vis-à-vis domestic resources. A second approach is “implicit” because it bases the procurement process on the domestic resources, while taking into account the statistical contribution (hence “implicit” contribution) of all the cross-border resources to national generation adequacy.

The explicit approach is of course demanding - hence difficult to implement. It is not used in France, Italy, or the UK. The new Irish “*Single Electricity Market*” has developed an explicit approach based on a mark-up on imports, and a mark-down on exports. On the continent the widespread “market coupling” makes difficult to identify the resources imported and the ones exported. Moreover, the mark-ups currently include a component calculated ex-post, which is in contradiction with the implicit allocation of transmission capacity. The implicit approach is therefore the only easy option currently available in coupled electricity markets.

The implicit approach is not flawless either. Even a basic assessment of the overall contribution of cross-border resources remains challenging. Indeed, despite high availability factors of interconnector, the availability of flows through interconnectors cannot be easily guaranteed until real-time. The contribution of interconnectors is actually highly variable and influenced by concomitant conditions across several European systems, making it difficult to foresee what to get from the interconnectors at times of stress.

In the absence of a sophisticated probabilistic methodology, Member States might have to exclude the participation of resources committed in another generation adequacy mechanism, which is referred to as ‘*No double-counting*’. However, even in neighbouring systems, scarcity events are rarely concomitant. Some resources will actually contribute to generation adequacy in several systems, and at different times. The ‘no double-counting’ policy therefore overestimates the probability of concomitant stress events in different systems, leading to multi-lateral overcapacity and extra costs. Mitigating double-



counting might come from refining the adequacy products, allowing the time-periods of commitments to match more accurately the needs of different systems.

### First tool needed: assessment of generation adequacy at the regional level

How to establish a robust methodology to estimate the contribution of cross-border resources? Is ensuring the consistency of national scenarios sufficient?

Should some “ability” of resources to actually contribute to generation adequacy in several systems be considered? How then to refine national generation adequacy policies so as to avoid discrimination of cross-border resources?

## 3.2 Risk allocation and remuneration of cross-border resources

Someone has to be responsible for the actual delivery of committed cross-border resources. But who really wants to handle this “hot potato”? The actual contribution of committed cross-border resources entails three prerequisites: 1) the resource itself must be available, 2) the interconnector must be physically available, and 3) energy must flow through the interconnector. Should the risks related to physical availability of interconnector and resources be allocated respectively to the interconnector operator and the resources owner? Both being on the best side to manage each of these risks? But we also know that the direction of the flows and the maximum available capacity of the interconnectors are influenced by Foreign concomitant conditions born in different Member States. Predicting these conditions over the long-term is problematic. And who could handle the associated uncertainty in absence of a regional (multi-lateral) system operator? Allocating “too much” risks to interconnectors and/or cross-border resources, with actors being unable to really handle the associated risks might result in a very reduced commitment from cross-border resources.

Another issue is the remuneration of cross-border resources. How to remunerate the overall contribution of cross-border resources in case of an “implicit” approach of their contribution? How should these revenues be shared between the proper cross-border resources and the owner of the interconnector capacity? Should cross-border resources be responsible for explicitly booking transmission and interconnector capacity? Should interconnectors receive a significant “capacity congestion rent”? Or would it be sufficient to take into account their contribution to security of supply when performing a cost-benefit analysis at times of investment?



### Second tool needed: allocation of risks and remuneration for the contribution of cross-border resources

No player can efficiently manage alone all the risks of failed delivery of energy from cross-border resources. How should this risk then be allocated? And to whom: resource owners? Interconnectors? System Operators?

And how to remunerate the cross-border resources and the interconnectors?

## 3.3 Definition of rights over the system resources at times of extreme scarcity

Generation adequacy policies aim at coordinating the different actors of the system vis-à-vis extreme scarcity cases. The emergence of national CRMs aiming at insuring consumers within a certain system against extreme scarcity can become a source of conflict as Member States do not live in isolation. The many interdependencies between European power systems make it difficult for a single system – or certain consumers – to ensure their “own” adequacy. This will become an issue at times of extreme scarcity, when energy prices might be unable to keep energy flowing towards the “better” insured consumers or towards highest social value uses. Current rules in the market coupling algorithm Euphemia for instance impose identical curtailment ratios in all bidding areas, independently of any efforts made to avoid scarcity situations.

It is clear that solidarity in the electricity sector at times of scarcity matters as much as it matters in the gas sector. Economic incentives to insure against scarcity should not be implemented to the detriment of solidarity at times of emergency situations and extreme scarcity. This is all the more important as market mechanisms cannot in any case deal with some “black swan events” that are too high-profile and too hard-to-predict. This is why it is so important to define ex-ante the scope of market mechanisms, and the situations in which solidarity and other arrangements should apply. Generation adequacy is partly a transnational public good. But in an interdependent system, everybody has to take responsibility to ensure a minimum reliability level. As some Member States are willing to insure more (at a higher level) their constituency against extreme scarcity than the neighbouring countries, it becomes crucial to measure the efforts made by some consumers under heterogeneous generation adequacy policies and the quantity of energy that these consumers are entitled to at times of scarcity. If a common frame cannot be found to allocate fairly the rights to consume energy at times of scarcity, there is a danger that Member States will turn towards autarky so as to avoid cross-border socialisa-



tion. Solidarity principles should not prevent those who paid for a higher level of insurance from enjoying the higher level of adequacy they contracted for.

The contribution of cross-border resources will only be reliable if the priority of foreign demand with contracted system adequacy is ensured over domestic demand without similar adequacy commitment. This implies that national adequacy policies should be coordinated at a larger geographical scale (through bilateral or multi-lateral agreements). A first option is to make sure that the actual level of physical rationing of systems (or of their consumers) reflects the efforts made ex ante to be insured against curtailment. An alternative option is to put into place a financial compensation from systems – or consumers- (being de facto benefiting “ex post” from the activation of the generation adequacy policy - but having not contracted for it ex ante) to systems – or consumers - (having contracted ex ante for such a policy but being not benefiting ex post of the activation). In any case, there is a need for consistent agreements on both the volume of resources that the systems – the consumers - in each Member State are entitled to in the various possible cases and the value scale of the necessary financial

compensation. It comes back to valuing - at time of high scarcity - the efforts made by some systems – some consumers - to ensure their “own” adequacy.

All this Policy Brief suggests that the EU debate on the Europeanization of generation adequacy policy is not going to end abruptly or too soon... It looks like a typical decade-long EU debate...

### Third tool needed: allocation of rights to consume energy at times of scarcity

Can free-riding be avoided in case when different reliability standards and different generation adequacy policies are implemented in Member States?

How to measure the efforts made by consumers under heterogeneous generation adequacy policies? How to determine the quantity of energy that consumers are entitled to at times of scarcity and what should be the value of financial compensation when necessary? Finally, how to ensure compatibility with a spirit of solidarity?

Florence School of Regulation  
Robert Schuman Centre  
for Advanced Studies

European University Institute  
Via delle Fontanelle 19  
I-50014 San Domenico di Fiesole (FI)  
Italy

Contact FSR coordinator:  
[Annika.Zorn@eui.eu](mailto:Annika.Zorn@eui.eu)

## The Florence School of Regulation

*The Florence School of Regulation (FSR) was founded in 2004 as a partnership between the Council of the European Energy Regulators (CEER) and the European University Institute (EUI), and it works closely with the European Commission. The Florence School of Regulation, dealing with the main network industries, has developed a strong core of general regulatory topics and concepts as well as inter-sectoral discussion of regulatory practices and policies.*

*Complete information on our activities can be found online at: [fsr.eui.eu](http://fsr.eui.eu)*