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SCHUMAN
CENTRE FOR
ADVANCED
STUDIES

Issue 2015/04
December 2015

POLICY BRIEF

ISSN: 1977-3919
ISBN: 978-92-9084-251-4
doi: 10.2870/129866

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SCHOOL OF
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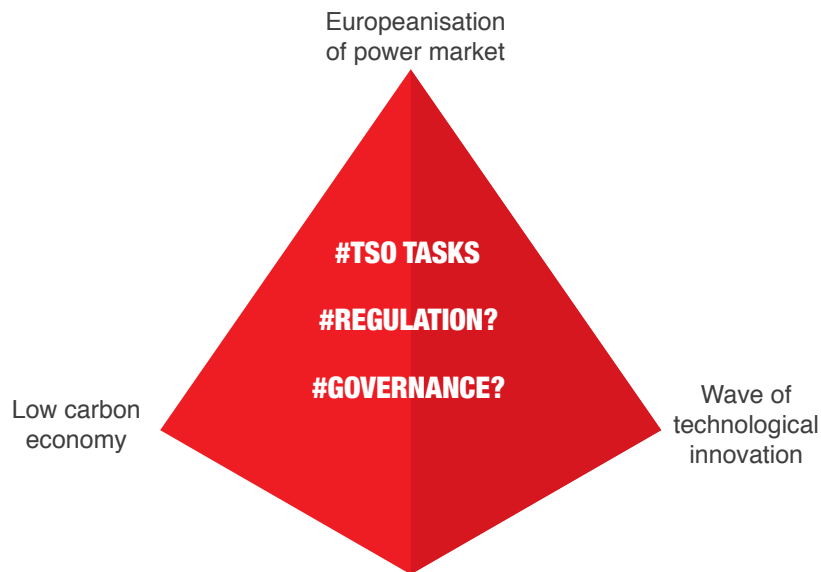
“What future(s) for the EU power transmission industry?”¹

*Authors: Jean-Michel Glachant, Vincent Rious and
Jorge Vasconcelos*

Highlights

- The EU power system and transmission business are entering an era of radical changes. Why? A driving force is the Europeanisation of the markets and of the system. It is complemented by the strength of distributed generation and “prosumers”; as well as the speed of technological change. Each of these three powerful forces combine to create a genuine wave of innovation and disruption.
- In ten years time, both the power system and the transmission business will be “new beasts”. But, which ones? Three big alternative futures pop up. First, Europeanisation of the system and business is a logical end. But second, renationalisation of the MS energy policy and 2030 trajectories can also be the opposite driving force. Indeed and third, even a disaggregation of both the system and the business into “local only” interactions also looks logical.
- The Florence School gives you a framework to re-think the future(s) of EU TSOs and to identify the constraints you will face when building your own favourite scenario.

1. See our full Florence School of Regulation research report: J-M Glachant, V. Rious & J. Vasconcelos “*A conceptual framework for the evolution of the operation and regulation of electricity transmission systems towards a decarbonised and increasingly integrated electricity system in the EU*” (October 2015).



The EU electricity industry is undergoing major changes, mainly dictated by the need to simultaneously accomplish the integration of the European energy markets and build a low-carbon economy. This process was facilitated - if not initiated - by a wave of technological innovation. The EU power transmission enters a brand new world, which had not been foreseen by the former three “Single Energy Market” packages. To understand where the EU power system and transmission networks are headed, the Florence School offers you a conceptual framework. We identify: the forces of transformation at work; three alternative future power systems; the transmission tasks being most impacted; the corresponding regulatory gaps, and the biggest challenges for EU power regulation and governance.

The Florence School is not pushing any roadmap or blueprint. We are offering you “food for thought”: our own knowledge framework to understand the shifting power landscape. But, it is up to you, decision makers and stakeholders, to draw your own conclusions and prepare the actual future that the EU, its economy and society deserve, and will get from you.

1. An analysis of how “European integration”, a “Low-Carbon Target”, and a “Wave of innovation” shake up the EU power system and transmission industry.

The EU power system and transmission industry are unsettled by three different processes which, by occurring at the same time, trigger an enormous shake up, or even a revolution. First; the continental wide opening of the wholesale market, with market based pricing mechanisms, cross-border flows and trade coupling, puts all transmission grids investments, technologies and operation in an accelerating Europeanisation process well exemplified by the push/pull effect brought on by the TYNDP, the Grid Codes, or the ENTOS-E Security Initiatives. Second; the RES push embedded in the EU 20-20-20 energy policy strategy has liberated thousands of wind mills and millions of PV panels, which make “distributed generation” and “pro-active prosumers” the very core of all the new EU generation set. As a result, the distribution grids become the primary recipients of all the new interactions initiated by these numerous distributed units. Third; an enormous wave of innovation is transforming the grid assets and operation technologies (think of; HV-DC and Phase shifters; or sensors and Big Data) as well as the infrastructures of market interactions (new market platforms; new intermediaries; new customer services). The likelihood of a close bridging between the wholesale sequence of markets and the many areas of retail interactions/aggregations increases.



2. Three conceptual scenarios of evolution being: #1# Full European market integration; #2# National only Low-Carbon system and policy; #3# Local only Low-Carbon system and policy

We therefore end up with three conceptual scenarios that we should investigate one by one to better understand what novel logic is to be faced by our existing EU power system and transmission.

First, of course, # *Full European market integration*. The Third Package opened the final stage of the “Europeanisation” of the power system and transmission. It is not finished yet; but we are closer than ever. In a scenario of full Europeanisation, we would see the wholesale markets sequence (from Day-Ahead to balancing), as the transmission planning and system operation would be without national borders or national control zones veto. However, while Europeanisation of the market, system and transmission are achieved, full transition to Low-Carbon cannot be realised because it has not been prepared by the Third Package, and would require a complete reshuffle of the EU market, system and transmission: a new and particularly strong and demanding “4th Package”.

Second, # *A national only Low-Carbon system and policy*. It means that if no full Europeanisation of Low-Carbon trajectory is allowed by Member States, all of the MS push to 2030 –will become “national target only” – a significant shift from the formerly agreed 20-20-20 strategy. Hence all Low-Carbon targets, tools, steps, and milestones are national. It implies an important degree of national centralisation and of coordination. A strongly national push for RES and other very low GHG technologies keeps the national power system and transmission grid at the core of the policy. A flavour of this is actually given by the current British “Low Carbon & lonely Security of Supply” energy policy.

Third, # *Local only Low-Carbon system and policy*. Assuming that the wave of innovation for generation, grids, prosumers, market platforms, demand and intermediaries will accelerate and become irreversible; the “old” centralised power system (that has been built in Western EU since the 1930s) will break down into many local power systems. Low-carbon generation, grid, consumption, and intermediaries will heavily interact, but on a small scale. Transmission might remain as a national or cross-local zones “last resort” device. But, the bulk of all system and grid interactions will be played at the local level: in the many distribution zones or even numerous micro-grid autonomous areas.

3. A detailed application of these scenarios to the core tasks performed by a typical EU TSO. These are either Hardware tasks (as network planning, investment, connection to the grid...) or Software tasks (as balancing, congestion, cross-border exchange, market facilitation, relationship with DSOs & NRAs...)

First, with # *Full European market integration*, the more strongly questioned TSO tasks are:

- *grid connections and network investments* for the Hardware (should an ISO take them, with asset owners becoming solely TOs implementing the ISOs rules and plans?);
- *system operation, rules design and TSO coordination* for the Software (are enhanced ISO bodies needed while TOs could remain national? How harmonisation of balancing and reserve markets would go up to much finer “time and space” products?).

Second, in a # *National only Low-Carbon system and policy*, the more strongly questioned TSO tasks also the same but for different reasons:

- *grids connections and network investments* for the Hardware (because greater coherence and coordination between DSOs and the national TSO is needed);
- *system operation, rules design and TSO coordination* for the Software (the national TSO will remain the leader, but the efficiency of rules and coordination requires the deep involvement of DSOs; plus balancing and reserves will become “mixed” items, playing both at distribution and at transmission system levels).

Third, in a # *Local only Low-Carbon system and policy*, again the more strongly questioned TSO tasks are the same but again for very different reasons:

- *grid connection and network investments* for the Hardware (as the transmission network will stop being the core of the power system architecture, while local grids will take it over);
- *system operation, rules design and DSO coordination* for the Software (all key actions will be conceived and performed at local level; transmission will only become a “last resort”



security option which is difficult to finance; balancing and reserves will become fragmented “pocket products” which will be hard to value and access across all local systems).

4. A fourth scenario, a “Hybrid”: a scenario where a Low-Carbon Target and the wave of Innovation co-exist at all three previous levels (European, National, and Local), but with a substantial regulatory gap – if the current framework is not seriously updated.

It is unlikely that all EU power transmission will become fully Europeanised, or fully renationalised, or fully local in the coming decade.

Each of the previous three conceptual scenarios is rational and has a strong internal logic (a logic easing the analysis of changes faced by our existing EU power system and transmission in each of them). But another scenario, a fourth, is still likely in the near future: the *Hybrid*.

It will combine fragments of the fully European, the fully renationalised and the fully local plan. Will any mix of these alternative conceptual systems make things easier for the evolution and the operation of the current EU power system? Alas, no! Such a mix will only exacerbate the contradictions and inconsistencies already revealed by the gaps and black holes that need to be patched up. In any type of “system mix”, the EU will need:

- a more consistent EU wide regulation with more coherence among NRAs and more coordination among TSOs;
- a really robust arrangement between TSOs and DSOs both for grids Hardware and system Software;
- a fair and reliable framework for access to and operation of local systems, both as “pocket systems” and as “lower foundations of the national and EU power systems dynamics”.

Any system mix will be very challenging because, in the currently existing EU grid and market framework, most of these critical coherence needs are still unaddressed.

5. A set of check-points to build an EU multi-layer coordination framework, and make our power system transition to a European Low-Carbon system coherent, efficient and resilient enough to succeed

1. the EU power system will keep changing and evolving throughout the coming decade. Nothing that we know from the past might be taken as granted. Technologies, system and market parties’ behaviours and strategies, hence business models, will come to change and surprise us.
2. critical TSOs system functions are becoming performed by other players (local or supranational).
3. the legal and regulatory framework should start defining each operational function, assigning responsibility for performance, and establishing coordination mechanisms.
4. in our “evolving system mix”, we already face and will face more legal, regulatory, and organisational “black holes”, challenging the effectiveness and efficiency of power systems and the markets.
5. assuming a perfect implementation of the Third Package, but no new legislative and regulatory framework, both the EU/national interactions and the national/local interactions will require an increase in transparency, consistency and reliability.
6. key points are:
 - the regionalisation of grid planning, system and market operation;
 - Euro-compatibility of MS security of supply, capacity adequacy and energy mix;
 - regional consistency of MS 2030 NAPs with the actual evolution of grids, systems and markets;
 - articulation between local/national/European layers of grids, systems and markets in a multilayer coordination framework assembling DSOs/TSOs/ NRAs and MS
7. Since the Third Package adoption, a voluntary and informal cooperation among many EU players and stakeholders has been crucial for the development of the internal market. Can this lucky strike still deliver in the demanding EU journey of an energy transition to high decarbonisation? How will the Energy Union succeed in combining initiatives in self-positioning and a willingness to play with a deep and solid re-design of power governance and regulation?



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

FSR Research Coordinator:
Ilaria.Conti@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