Europe lacks a vision for its future power grid

The view of Environmental NGOs on grid development in Europe

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1. Introduction

Europe's electricity grid is characterised by large and centralized power stations (geographically but also regarding ownership structure), mostly based on polluting fossil fuels, which produce energy constantly regardless of consumer needs; along a wasteful and inefficient[1] aging network. The patchwork of national grids stitched together over the years is an inconvenient and uneconomical system.

Climate change policy and the increasing dependency on energy imports, together with citizens' desire to consume clean energy, are driving Europe to transform towards a smarter, more efficient Europe-wide grid. Such a grid should be able to integrate vast amounts of clean and cheap renewable energy while guaranteeing continuous supply, and would provide huge technological and business opportunities to a sector which is as well affected by the economic downturn. It will also support the interconnection of isolated electrical regions and markets, fostering market and price coupling and thus reducing electricity prices across Europe. Public support for the major investments is essential. This means plans must be based on a coherent and ambitious 'green' vision, and be implemented sensitively to minimize the direct impacts additional generation and grid infrastructure can have on nature and the environment.

2. Building the grid for tomorrow's energy system

Renewables integration

Despite wide public support for renewable technologies such as wind, solar geothermal and ocean power, and their impressive cost reduction trajectories we have witnessed in the past few years, there is an increasing political opposition to their deployment. This opposition is in part due to the technical challenge of integrating decentralized and variable energy sources in a i) **system designed for inflexible centralized production** (baseload generation concept) and ii) in **an energy market based on an outdated model**, whose price is set by high fuel and operational cost (in contrast to renewable energy plants, that are capital intensive but have close-to-zero running costs) and does not incentive the consumer to actively participate. Opposition also comes from the large electricity companies, due to the increasing displacement of their gas-fired power plants portfolio as renewables penetrate the market

[1] The current network is oversize and non optimized, hence becoming inefficient

significantly (merit-order effect).

In countries with a significant penetration of wind power, such as Spain, we have already experienced the curtailment of hundreds of cost-free and clean GWh (constrained power), in part because the underdeveloped grid cannot absorb all energy generated, but mainly because the system is inflexible, maintaining a constant production of heavily subsidised nuclear and coal plants, thus carrying on business as usual.

A trans-European network for a fully optimized energy system

If Europe is serious about its pledges and long-term objectives to fight climate change and to preserve our ecosystems and if it wants to become energy independent, the transformation of the current dirty energy system to one based fully on renewables is a matter of urgency.

Trans-European networks should be reformed and reinforced to connect and upgrade national networks, combining them with balancing solutions at the local level. New and reinforced networks are also necessary to bring large amount of wind power from the windiest regions, such as the North Sea, to consumption centers. And Europe needs to reinforce its distribution networks to allow consumers to produce and consume large amounts of solar and geothermal energy at the local level without unbalancing the system. Furthermore, surpluses of locally produced solar energy may need to be transported into the transmission lines, thus requiring the grid to be a bi-directional system.

3. Overcoming existing barriers to grid development

Public participation and transparency

New electricity infrastructure projects, in many cases, besides facing long permitting procedures, face public, local opposition. The resistance is often triggered by concerns about landscape and visual impacts, effects on property prices, and/or due to health concerns linked to overhead high-voltage power lines. Objections in certain locations may also relate to possible impacts on nature and biodiversity. In many cases, local groups' opposition is further provoked because they feel they have not been informed on the motivations to build those lines, they have not been involved (or consulted) on the planning of the project, and do not perceive the potential benefits.

Minimizing environmental impacts, transparency and the participation of citizens in the grid planning, development and implementation are important conditions for public acceptance. The energy transformation will succeed only if it is a 'green' people's project as much as it is a political and technical project.

It is important that the public understands which projects or lines need to be built, and on which assumptions, in order to increase acceptance. This is why public participation should be

implemented at the earliest possible point in the process- the planning stage. Public participation is also crucial in the spatial planning process in order to bring alternative corridors or technologies into the discussion. Benefit-sharing schemes for local stakeholders can increase the level of public acceptance and could be developed in a EU-wide scale.

The need of a long-term vision and strategy

The larger penetration of renewable energy is one of the reasons for building new power lines, but not they only one[2]. The public may be more open to accept projects that pursue this objective, as long as these projects are based on a clear, positive vision and strategy, and the environmental and social benefits are clear and tangible.

Europe needs therefore a long-term vision for its energy system, and a common strategy to develop the grid that can support such a system. For the moment, Europe has been able to develop and communicate on a strategy to bring about 33% of renewable energy into the power system before 2020 (as a results of its 20% renewable energy share objective).

A clear roadmap and strategy are essential for grid planning, which has long lead times of up to ten or more years. There must therefore be a robust indication of the power mix and (roughly) the location of large-scale renewable energy infrastructure ten to twenty years in advance to ensure that investor risk can be calculated and grid planning optimized. Additionally, implementing energy efficiency measures and reducing and/or controlling demand (demand side management- DSM) can avoid the need for new power lines. A robust indication of energy and electricity demand by 2030 would support the same goals of predictability and optimization.

Ambitious, binding renewable energy and energy savings targets for 2030 thus help ensure optimal planning, avoiding unnecessary investments, and minimizes the risk for investors. Clear targets will help grid developers and policy makers to bring citizens on board of this European project.

Grid development put into perspective

Climate change impacts posses a level of urgency onto European citizens in order to transform our energy system into a sustainable one, based on renewable energies. This transformation, as already explained, will require a certain level of grid infrastructure. Getting this infrastructure up and ready will require a wide-public support, based on the understanding of climate change and its environmental impacts. But environmental protection is also necessary at the local and regional level, ensuring the conservation of nature and biodiversity. Therefore, legal provisions for nature protection should not be undermined with the pretext of climate change urgency. Similarly, short cuts in the participatory process of public and other

[2] Some projects will serve to reach a lower energy cost (between to control zones or market) by allowing market/price coupling but this is not ultimately reflected in the energy bill, and therefore the benefits are not directly impacting the public.

stakeholders will proof counterproductive, as the acceptability of projects and the credibility of the energy transition will be put in question.

4. Optimizing our energy system

Energy efficiency and demand side management as the priority

The most effective solution to reduce the cost of the system and ensure the highest environmental protection and public acceptance will be to develop energy efficiency measures across the whole system, and ensure that consumers make significant energy savings. **The cheapest investments in improving the performance of our grid is by ensuring we reduce the amount of electricity produced and consumed at any given moment**, and therefore we reduce the need for new power lines. In that context, demand side management will be also important in order to optimize the size of the existing network, and to accommodate variable renewable energy sources.

A *one-size fits all approach* is not possible

CAN Europe supports the transformation of our power grid system, as investments are necessary, as justified above. The challenge is to find the **optimal balance between investments in power grids and other flexibility solutions**. For instance, a high percentage of cogeneration and district heating like in Denmark can favor the local integration of electricity, while in other cases, transmission of centrally-generated electricity will be more economical. This transmission can take place on either national or an international basis; in some regions in Europe, cross-border transmission will be shorter than the use of national lines and more cost-effective than other options.

Considering the physics of energy transmission and the variety of system architectures and local conditions, it is not possible to make generalizations for any one flexible solution. The optimal mix has to be investigated on a case-by-case basis.

The current focus of European policy makers in relation to the construction of a trans-European electricity grid has to be complemented by a stronger focus on local distribution networks, improved communication technologies and other flexible resources.

Flexibility is key for the future power grid

Energy savings, together with other flexible solutions such as storage capacity, demand-side management and the optimisation of local distribution will reduce the need to build new transmission lines and back-up generation capacity and would further speed up the transformation of our energy system (see figure 1). Storage capacity will have an important role to play in the future energy system with very large shares of variable renewables. For the time being, however, the principle technology available today – hydro pumped storage – often faces strong opposition on environmental grounds, and other flexibility solutions are often more feasible and competitive options to balance the grid. Electricity generating units,

such as wind turbines and photovoltaic systems could play a more active role in the operation and balancing of the grid. Those supporting functions and services however, need to be developed through research and demonstration and come, in most of the cases, with an additional technological cost. System operators should assess the value of those services and should design a market that acknowledge and incentivise producers to provide them (e.g. ancillary services market). **An integrated and continuous assessment of the different flexibility options to provide a power system largely based on variable generation is needed. An immediate push for research and demonstration projects in this field, together with a re-design of the energy market is also urgently needed.**

Level of DER penetration ↓

Grid reinforcement measures	"Smart" solutions	DER participation in system operation
Adjustment of the transformer output voltage	MV and LV grid monitoring	Passive feed-in
Reinforcement or additional cables	Intelligent transformers	Response in case of "over/under" voltages
Reinforcement or additional MV/LV transformers	Decentralised storage solutions	Control of DER in case of extreme networks conditions
Reinforcement or additional HV/MV transformers	Demand side management	Active support to system operation

source: Based on E.ON Bavaria analysis, 2011 and EPIA, 2012

Figure 1. Measures to address grid bottlenecks besides grid expansion

5. A vision for 2030

As explained in the previous sections, one of the barriers to accelerate the upgrade of our power grid system is the lack of a European-wide long-term energy strategy. The lack of a common vision results in a high level of uncertainty with relation to the time and level of deployment of technologies, especially renewable energy technologies. This situation slows down the work of organizations such as ENTSO-e (European Network of Transmission System Operators for electricity), which is in charge of presenting regularly a long-term EU grid development plan (so called Ten Year Network Development Plan). Due to the lack of a common position at EU level and the lack of a post-2020 climate and energy framework (with binding targets for renewables penetration and energy savings), those plans systematically underestimate the growth of variable renewable energy technologies beyond 2020, and the potential to reduce energy demand at the consumer and the supply side.

Those plans result is a costly grid system that tries to accommodate an increasing penetration of variable renewables but that still relies highly on conventional, inflexible technologies (base load generation). The presented future centralized grid architecture is very expensive because it does not consider optimization solutions for the penetration of renewables, flexibility and

efficiency at the demand side, and the benefits of locally managed grids.

European policy makers should urgently set 2030 ambitious binding targets for renewables and energy savings to provide a long-term certainty to grid planners and investors. They should also enable a policy framework for the rollout of technological solutions that increase the flexibility of the system, together with an increase of demand-side participation (i.e. through innovative market instruments that encourage investments on both flexible supply and demand solutions). Considering this is done, the expansion of the grid would be less costly, more efficient and would encounter a more favorable public support. Otherwise, Europe will be planning for failure, investing in unnecessary projects, delaying the swift to a low-carbon economy and blocking European citizens from energy independence.

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