



Perception of barriers for expansion of electricity grids in the European Union

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HIGHLIGHTS

- Estimations of perceptions on barriers for expansion of electricity grids in Europe.
- Recommendations on political process and level of acceptance among European population.
- Needs for better, simplified and standardized regulations.
- Strong and transparent consultation process in all stages.

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ABSTRACT

Many of the scenarios for decarbonising the European energy system involve the integration of large-scale and decentralised renewable energy sources, such as wind and solar power. However, such integration requires substantial and rapid improvements to the existing transmission grids. Using a mix of qualitative and quantitative methods, we analysed the opinions and views of stakeholders concerning the main barriers and solutions to this problem. The results suggest two conclusions. The first is that primary barriers to the currently needed level of grid expansion are not technical or financial, but the lack of appropriate regulatory frameworks and public acceptance. The second is that major changes are needed in the overall regulatory process, rather than simply minor modifications or improved implementation of existing regulations.

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1. Introduction

As in other industrialised regions of the world, the existing European electric grid infrastructure was designed half a century ago to satisfy national electricity needs, which were largely based on fossil and nuclear generating plants located near important load areas. Today, concerns about climate change and energy security have dramatically changed the landscape of energy generation and the requirements placed upon the transmission grid. First, European climate policy goals require a reduction of at least 80% of all CO₂ emissions by 2050, eventually leading to the full decarbonisation of the power sector (European Commission, 2010). Second, price volatility and competition on global markets for energy sources are creating additional incentives for national governments to develop available renewable energy resources. The diversification of the electric power system away from fossil fuels and towards a greater use of renewable energy sources (RES)

could contribute to the alleviation of energy security concerns in Europe.

A series of studies has examined whether it is possible to overcome the technical and economic barriers to such a transformation of the power system by 2050, considering issues such as economic potentials of various supply options, the financial flows needed for new generation infrastructure, and the challenge of matching power supply with demand at all times. Several of these studies have concluded that this is possible and affordable (ECF, 2010; IEA, 2009; Schellekens et al., 2010; Williges et al. 2010). However, all such scenarios require a grid architecture that differs substantially from the existing one. Indeed, the current high voltage transmission grid architecture is already constraining the expansion of renewables (ECF, 2010; Nature, Editorial 2008). The European Union (EU) Directive 2009/28/EC (2009), amending EU Directive 2003/87/EC, foresees 20% of the primary energy consumption to be generated by RES by 2020, which will require a strong upgrade and expansion of the electricity grids in Europe. Without substantial changes in the power grid architecture, it will be difficult to incorporate even these shares of renewable power, even before one begins to consider much more ambitious quantities required to meet the 2050 decarbonisation targets

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(Battaglini et al., 2009; Schellekens et al., 2010; Patt et al., 2011; Lilliestam et al., 2012).

If the challenge of changing the transmission grid was simply a technical one, then it would not be difficult to solve. However, one important problem is that grid expansion is constrained, rightly so, by national regulatory frameworks that have been designed at national and sub-national levels, in order to satisfy multiple objectives. These include local environmental concerns, property owners' rights, and in particular the economic interests of market players at a range of scales. Changes in such regulatory frameworks may be necessary, and if so would have to take into account the perceptions and desires of stakeholders, drawing off their collective expertise and insight to identify successful solutions. In this paper we present the results of a stakeholder survey designed to identify stakeholders' perceptions of barriers for electricity grid expansion in Europe, the barriers they perceive as most important, and their suggestions as to how to overcome them. In particular, we address the question of whether the pace of grid development can accelerate given the current regulatory landscape, or if basic changes to that landscape are required before substantial additions to infrastructure are possible.

2. Background

2.1. Technical requirements for change

There are numerous studies pointing to the fact that the existing European electricity grid is inadequate to cope with increasing volumes of renewable electricity (IEA, 2002). Indeed, the generation of renewable power is generally concentrated in European regions with relatively low load, and then needs to be transmitted to high load and storage sites, sometimes over distances of several hundred kilometres (km). The majority of the European transmission systems is 30–40 years old, and needs to be replaced, upgraded and even expanded (Ecofys, 2008). In some regions, grids are already pushed to the limits of their capacities due to rapid expansion of electricity from wind generation (EWEA, 2005), especially in the case of cross-border interconnectors (Battaglini et al., 2009). According to ENTSO-E (2010) 42,000 km of transmissions lines need to be upgraded or constructed in Europe to secure market integration, security of supply and to accommodate the renewable expansion planned for 2020.

However, the construction of new power lines is extremely slow. In some countries not a single overhead power line at voltages higher than 200 kV exceeding 5 km has been built in the last 10 years (ETSO, 2006). Several interconnection projects became stuck in the planning phase and were never realised (European Commission, 2007). Delays are rarely related to technology, but rather to the insufficient regulatory framework, which cannot prevent or limit delays and interruptions during each phase of the permitting process. In the majority of Member States public opposition is considered to be the main cause preventing the expansion of the high voltage electricity grid.

It is not just the volume of power lines that is required, but also the design of the system within which they are constructed that needs changing. In order to better integrate Europe's geographically dispersed renewable energy resources, the coordination in grid planning among Member States will need to increase. A European approach to grid planning could enable the build up of interconnectors across Europe to include solar and offshore wind farms, as well as distributed generation and electricity generated beyond the European borders (Battaglini et al., 2009). Similarly, compatible if not harmonised policies and support mechanisms (ECF, 2010) across Europe and the

Mediterranean region could facilitate the build up of transmission capacity. At the level of capacity planning, this is starting to occur; the Third Energy Package of the European Commission places a strategic priority on creating a single European electricity market (European Commission, 2007). Less clear, however, is whether the grid developments could keep up with this vision and if support for grid expansion can be achieved across society.

2.2. Assessed barriers to grid expansion

There is a wide literature examining the factors that constrain the development of infrastructure, looking at technologies for carbon capture and storage, hydropower and infrastructure for non-renewable energy sources (Benalcazar, 2008) as well as renewable energy sources (Komendantova et al., 2011). They have consistently identified both public acceptance and insufficient regulation as important barriers. In the context of grid development to support renewable energy infrastructure in Europe, there have been seven prominent studies. We summarise their results here, as they provide the context for our own work.

2.2.1. ENTSO-E

In 2006, the European Network of Transmission Service Operators-Electricity (ENTSO-E) analysed the legal and administrative procedures for constructing 110–400 kV overhead lines in the EU, and carried out interviews with the majority of the European transmission system operators (TSOs). The results showed that legal procedures are comparable in all member states, but the planning and implementation processes can differ significantly. Moreover, the analysis pointed to the fact that administrative procedures for building interconnectors tend to be very complicated. The study identified the main barrier to grid expansion to be the length of the administrative process; this can take, depending on the jurisdiction, up to 20 years, and can be stopped by administrative authorities at any point in time. They concluded that the overruling power of local authorities is the main reason for unpredictable delays, together with the increasing complexity of procedures, which tends to increase with the number of involved entities (ENTSO-E, 2010).

2.2.2. PIP

In 2007, the European Commission developed and communicated to the European Council and the European Parliament the Priority Interconnection Plan, or PIP (European Commission, 2007). The PIP aimed at identifying barriers for cross-border transmission projects, and analysed the 42 projects listed in the Guidelines for Trans-European Energy Networks (TEN-E). More than half of these projects were behind schedule due to the complexity and the lack of harmonisation in planning and authorisation procedures. PIP listed a set of obstacles hindering their development. Twelve projects suffered delays due to inadequate authorisation procedures and legal frameworks, while eleven were held up due to concerns of local communities about the health impacts of electromagnetic fields. Other environmental issues accounted for delays in nine of the projects, while visual impacts and the vicinity of densely populated urban and rural areas held up seven of them. Other factors constraining development were difficult terrain, weather, identification of cross-border points, commercial problems, and the absence of the European approach in electricity network planning. The PIP recommended five areas for priority action: (1) to closely monitor the projects of European interest in order to ensure that they are completed in time; (2) to appoint coordinators to support the realisations of these projects; (3) to adopt a regional (supra-national) approach instead of national ones for networks planning; (4) to simplify

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