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Electricity security in the European Union—The conflict between national Capacity Mechanisms and the Single Market

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ABSTRACT

The European Internal Energy Market aims to promote trade and competition in electricity generation across the EU, with investment signals for new generation capacity and interconnection coming from zonal electricity prices reflecting scarcity value. However, a growing number of EU Member States have implemented national Capacity Mechanisms in order to ensure future security of supply within their own borders, which may distort the cross-border trade of energy. This local view of energy security is in response to internal technical and economic constraints and a perceived inability of cross-border electricity flows to be a reliable source of capacity at times of maximum stress, in favour of self-sufficiency. A number of routes are available to resolve this conflict through permitting cross-border participation of generators in local Capacity Mechanisms, but this requires resolution of a number of complicating factors, not least a means for properly allocating transmission capacity without introducing further distortions to the energy market. Alternative solutions could be enacted at an EU-level, such as through the alignment of Capacity Mechanisms to a common model, or the introduction of an EU-wide single Capacity Mechanism, but the current regulatory focus appears to remain on resolution of such issues at a national level.

1. Introduction

The creation of a secure electricity system creates a distinct set of planning constraints for governments and their agencies. The overriding political goal is, primarily, to create – through appropriate investment at sufficiently advanced timescales – a market and network capable of serving the future demands for electricity (whatever that may turn out to be) across all sectors. As secondary concerns, this must also be done at reasonable cost to the end consumer and, in keeping with constraints on greenhouse gases and other atmospheric pollutants, be achieved within decreasing emissions limits. These three objectives comprise what is classically termed the 'energy trilemma' [1], to which may be added the requirement for the social impacts of electricity investment to be fairly allocated, and for associated commercial structures to enable investment to be secured in a manner compatible with standard financial instruments.

Jervis [2] presents the classical security dilemma of international politics: that many of the means by which a state tries to increase its security decrease the security of others. While the dilemma is originally posited in the context of Defence, the concept of the requirement for a collective security arrangement to be perceived as well-functioning by its member states (and even perhaps as a precondition to seeking membership of the arrangement) applies equally well to energy security. In the context of energy, states are highly interdependent; energy is vital to state survival, and can be used to harm other states leading to a complex intertwining of energy supply with geopolitics [3]. Within the European Union, there has been a growing move towards energy interdependence within a framework of Market Liberalism, based on cooperation through non-discriminatory open markets available to foreign investment, enacted within the 'Single Market for Energy'. However, each individual Member State must balance its degree of cooperation against its own sovereignty in energy [4].

As opposed to the general situation for energy, electricity is particular in that almost all countries possess the ability to be self-sufficient in terms of generation capacity, and to not be dependent on external imports (although conventional generation may be reliant on fuel imports). This means that each country broadly has the ability to determine its own electricity future according to its own technical and political situation, and to determine the extent to which it relies on cross-border trades in electricity to establish appropriate levels of electricity security. In recent years, the closure of conventional generators due to environmental reg-

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ulations and the increasing penetration of renewable energy has led to increased concern over domestic levels of electricity security in European Union Member States [5]. Additionally, many Member States have moved to support increasing localisation of energy systems in order to support diversity and security [6]. This has led many Member States to implement Capacity Mechanisms in addition to their core energy wholesale markets in order to ensure ongoing security of supply and fill an expected capacity gap.

In turn, the decisions of one Member State in how it treats electricity security will affect the extent to which its neighbours may be reliant on it for imports at key times of system stress. This leads to a situation where the Single Market may not yet be trusted by all Member States to provide mutual electricity security, leading to the implementation of national Capacity Mechanisms, which in turn reduces the effectiveness of the Single Market in ensuring security. This maps back to the central idea of the security dilemma whereby a State's means of self-help – trying to escape from the dilemma by accumulating more and more local power – generates a cycle of power competition [7].

In this paper, we survey the evolution of cross-border trades in electricity in the EU; the current status of Capacity Mechanisms: where they have been implemented to date; the drivers for their implementation, and how this relates to the reality and perception of energy security; how Capacity Mechanisms have been incorporated into EU electricity regulation to date; the ongoing and future possible impacts on the efficient use of cross-border signals for generation investment; and, finally, how in the future these issues may be resolved at the European level.

2. Development of EU electricity markets and cross-border exchanges

The reform and deregulation of western electricity markets through the 1980s and 90s included a restructuring of the generation sector to enable wholesale competition. Generation owners and operators would respond to price signals from centralised spot markets and/or bilateral trading with retailers, rather than investment in new generation being centrally planned and controlled.

This shift from central planning, however, also removed the ability of governments to ensure through direct means that sufficient generation would be in place to meet demand. A market-based mechanism for electricity removes the 'command and control' of monopoly generators which can ensure adequate capacity margins. However, this centralised planning can also lead to 'gold plating' of secure supplies by creating a greater capacity margin than is necessary [8].

Under the market-led paradigm, spot markets for electricity should provide a complete price signal for sufficient investment in new generation capacity. If there is a perceived shortfall in capacity at some future horizon, it should also be evident to investors that there is a matched benefit in owning operating capacity at that point in time due to raised electricity prices reflecting that shortfall – in other words, scarcity pricing should stimulate new investment.

The 'missing money' problem, occurs, however, when conditions arise in markets which mean that the energy market alone does not provide sufficient (or sufficiently reliable) revenue for investment to occur. This may arise due to a number of factors, including [9]: low wholesale energy prices (which may be driven by high penetrations of renewable generation with negligible marginal costs); price caps below the Value of Lost Load (the economic cost impact of not supplying a consumer with their desired power demand); inefficiently high transmission charging; or inadequate remuneration for ancillary services. Similarly, there may be the 'missing market' problem where the revenue is in reality adequate but is not perceived to be so [10].

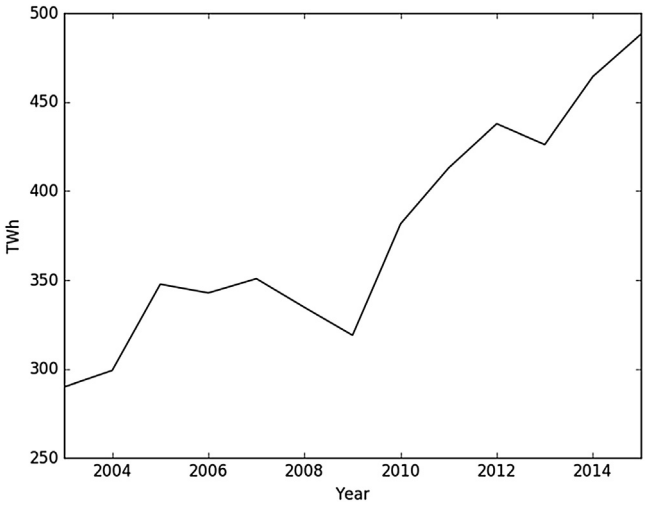

Fig. 1. Increasing volumes of cross-border trades in energy between EU Member States since the Second Energy Package of 2003 [16].

Historically across Europe, transmission interconnections between national systems have been developed to promote security of supply, but increasingly have taken on a wider role in order to promote competition, trade and an increase in overall welfare across EU Member States [11]. A shortage of interconnection capacity creates barriers to trade, and so the European Commission has been taking steps – most significantly through the Third Energy Package of 2009 [12] – to promote investment in new cross-border connections. The Energy Union package of 2015 refers to desirable levels of interconnection of 10% and 15% by 2020 and 2030 respectively, although there is no proposal for these targets to be mandatory [13]. This underpins the European Internal Electricity Market (also known as the Single Market), which requires sufficient physical transmission links between member states to transmit demand, and enough efficient market-based mechanisms to make the most of the transmission capacity. In pursuit of this aim, the Commission has been promoting a Target Model for electricity markets to facilitate border-free trading across Europe. The Target Model is based on two broad principles: energy-only regional markets, preferably organised on a zonal basis, in which generators' revenues depend primarily on the price for each marginal unit of energy supplied; and market coupling, which is a way of linking zonal day-ahead spot markets into a virtual market, so that the lowest priced bids are accepted up to the point where congestion constraints limit further trade [14]. However, interconnector growth may be constrained by long lead times and capital investment costs in transmission infrastructure, as well as uncertainty on the part of investors that energy arbitrage will be sufficient in future to ensure long-term profitability [15].

Fig. 1 shows the increasing volumes of energy traded across Member State borders since the implementation of the Second Energy Package of 2003 which established the basic framework for market alignment (though it should be noted that not insignificant levels of energy have been traded across those borders for far longer through bilateral arrangements, and that the EU-wide framework has not been a pre-requisite for such trade).

In some EU Member States, there have been Capacity Mechanisms established – whereby electricity generators, interconnectors or demand-side response providers receive some form of remuneration for being *available* to meet electricity demand irrespective of whether they actually are dispatched (either by the market or a central operator) to do so. These Mechanisms have been created in response to a perceived (or in some cases, actual) failure of the energy-only markets within those nations, and oper-