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The Finnish power market: Are imports from Russia low-cost?

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HIGHLIGHTS

- We model the likely long-term dynamics of the interconnection Finland–Russia.
- Different cross-border arrangements and capacity adequacy policies are considered.
- Discriminatory access to the interconnector undermines the benefits of integration.
- Market coupling reduces supply costs but creates reliability concerns.
- Keeping a strategic reserve reduces the benefits of market coupling.

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ABSTRACT

Electricity market integration of high- and low-price areas is expected to bring benefits to the consumers in a high-price area. However, these potential benefits are highly dependent on the market characteristics and the policy interventions. We use simulation to study the effects of different alternatives for the expansion and operation of the interconnector Finland–Russia on the Finnish market (a high-price area). Our results show that the current trading arrangement, where a single trader owns the transmission rights, and limits the trade during peak hours to avoid capacity charges in Russia, is beneficial for Finland at the current interconnection capacity. However, if the interconnector is expanded, the behaviour of the trader would create significant distortions in the Finnish market. We also analyse the pros and cons of maintaining a strategic reserve in Finland in combination with the different scenarios of interconnection expansion and trading arrangements. We conclude that in the absence of trust in imports, the need for a strategic reserve is undeniable. This will slightly reduce the economic benefits of integration for Finnish consumers, but it will significantly improve reliability.

1. Introduction

Electricity market integration has been widely promoted over recent years and represents a key part of the EU 2020 strategy. It is strongly believed that market integration can bring benefits by improving efficiency in the use of resources, reducing supply costs and carbon emissions, and strengthening the security of supply (Creti et al., 2010; Jamasb and Pollitt, 2005). However, the achievement of these benefits may be hindered by inefficient cross-border trade and uncoordinated national capacity expansion and security of supply policies (Cepeda and Finon, 2011; Ochoa et al., 2013).

Efficient trade can be facilitated by implementing non-discriminatory and market-based interconnection capacity allocation methods. Implicit auction (or market coupling) has proven to be the best mechanism to allocate transmission capacities and ensure the most efficient use of resources (Neuhoff et al., 2011). Yet, many interconnections currently operate under other trading arrangements. This is the case of Russia and Finland, where a single trader owns the physical transmission rights (PTRs) and is free to decide the flows and collect the resulting rents.[1] PTRs allow the owners to withhold the transmission rights from the market to increase their profits, which can lead to under-usage of the interconnection capacity and inefficient production. An alternative would be to implement financial transmission rights (FTRs), which are designed to hedge against the market price difference without affecting the dispatch (Joskow and Tirole, 2000).

[1] In Russia, the cross-border electricity trade is assigned to a single company, Inter RAO. In Finland, a daughter company of the Russian exporter RAO Nordic Oy acts as the sole importer of the Russian electricity. This trading arrangement enables a single company to decide the amount of electricity that is made available for the cross-border trade over the Finnish-Russian interconnector.

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In terms of strengthening the security of supply, there is a concern that market integration creates challenges to ensure it. Investment decisions in generation depend, among others, on the prospects of importing or exporting; therefore, net importer countries may be more prone to risks of insufficient local capacity to meet the peak demand. The development of regional rather than individual criteria of generation adequacy and high reliance on neighbouring countries may reduce capacity requirements in integrated markets. However, low confidence in integrated markets to deliver security of supply and the self-sufficiency mind-set that most countries still retain may lead to an explicit consideration of resource adequacy policies at a national level to guarantee independence, which may reduce or eliminate the benefits of market integration (Ochoa and van Ackere, 2014a).

Understanding the impacts of different trading arrangements and national policies on the evolution of interconnected electricity markets is vital in order to obtain the benefits and minimise the risks of integration, thus ensuring low-cost, reliable and clean power supply. In order to contribute to this understanding, we use a simulation model to assess the effects on the Finnish electricity market of different trading arrangements with Russia.

The long-term dynamics of the Finnish electricity market have received little attention in the literature so far. However, it is an interesting and particular case given its powerful neighbours. Nord Pool and Russia offer large amounts of cheap electricity (and energy in general) to Finland; nevertheless, although Nord Pool can be considered an example of integration success, imports from Russia raise questions. There are no intentions to coordinate energy policies between Finland and Russia, and the interconnection is currently operated by a single trader, who has no interest in maximising social welfare or providing security of supply to Finland.

Finland has implemented a self-sufficiency policy in order to mitigate the risks of import dependency. The reliability concern would not be eliminated by replacing the current cross-border trade with market coupling, since the country would be even more vulnerable to the dynamics and decisions of its neighbour. Changes in the demand-supply situation or of the policies in any of the interconnected countries may influence the availability of imports and threaten the security of supply. Thus, confidence in neighbouring countries is essential in market coupling. This can be facilitated by coordinated policies and cross-border agreements establishing clear and transparent rules to operate the market in situations of stress or scarcity, as is the case in the EU (European Commission, 2006). However, as Finland and Russia do not intend to create a single market or coordinate their national policies, the reliability of imports is questionable.

The paper is structured as follows: Section 2 provides an overview of the Finnish electricity market. In Section 3 we discuss the methodology choice to analyse the long-term dynamics of this market. Section 4 presents a description of the model, followed by an analysis of the simulation results in Section 5. Finally, conclusions are given in Section 6.

2. Finnish electricity market

Finland represents one price zone of the Nordic electricity market, which covers Denmark, Finland, Sweden, Norway, Estonia, Lithuania and Latvia (Nord Pool, 2014). It is directly interconnected to Sweden, where hydro and nuclear power together account for more than 86% of the total electricity production, through a 2850 MW transmission link. The formation of area prices and the allocation of cross-border capacities between the Nordic countries are managed by implicit auctions in the day-ahead market of the Nordic power exchange. In the absence of inter-zonal transmission congestion, a uniform market clearing price is formed. However, in case of transmission congestion, the Nordic electricity market may be divided in up to 14 price zones, with separate area prices for each zone. In 2010–2012, market uniformity (the same price in all zones) was achieved about 20% of the time, which is well below the targeted 65% (Viljainen et al., 2012). 80% of the time Finland decouples from the Nordic market, with prices significantly higher than the Nord Pool system price.

Finland is also interconnected to Russia by a 1400 MW link, for which the transmission rights are assigned to one trader who buys electricity in the low-price area (generally Russia) and sells it in the high-price area (generally Finland). The Russian electricity market is gas dominated, with 65% of gas generation. The domestic gas prices in Russia have been regulated by the government and are a quarter of gas prices in Finland, thereby making the Russian electricity import cheaper than the gas- and even coal-produced electricity in Finland (Gazprom, 2014; Statistics Finland, 2014). In 2006, the Russian government introduced the target of domestic gas prices reaching parity with the European export netback price by 2011. However, this target has not been achieved, and domestic gas prices in Russia remain far below the European levels (Vasileva et al., 2015).

The total installed capacity in Finland is 16,600 MW, while the peak demand is 15,300 MW. However, only 13,300 MW of domestic capacity is available during peak hours (Statistics Finland, 2013). This deficit, together with the retirement of old thermal and nuclear power plants, puts pressure on the security of electricity supply in Finland. According to Syri et al. (2013), 6000 MW of additional capacity will be needed by 2030, despite the slow demand growth of less than 1% a year.

Until recently, imports played a crucial role in fulfilling the peak demand. Before 2011, Finland steadily imported electricity from Russia at the full volume of the transmission link. Nevertheless, the situation has changed as a result of the restructuring of the electricity sector in Russia. Since the introduction of a capacity remuneration mechanism (CRM) in Russia, designed to support the development of new generation, the cross-border trade has significantly decreased (the utilisation rate dropped from 100% in 2010 to 30% in 2013). The reason is that during predefined peak hours (there are 8–9 peak hours per working day), the cross-border trader faces a capacity charge in the Russian market based on its maximum export in any of the peak hours of the month. This incentivises the trader to reduce exports to Finland in peak hours, which have to be substituted by increased generation in Finland from gas and oil, also imported from Russia.

As electricity imports thus depend on decisions outside the Finnish control, the Finnish Energy Market Authority decided to keep a strategic reserve. This reserve is not available to the market, and is only dispatched by the Transmission System Operator in case supply-demand balance is not achieved in Nord Pool Spot. Currently, the strategic reserve accounts for 1556 MW. The generators in the strategic reserve are provided with fixed payments, which are collected from the Finnish end-users through transmission tariffs (Energy Market Authority, 2013).

The Finnish electricity sector is one of the most diversified in the world, as observed in Fig. 1. In 2013, 27% of electricity was produced by the four nuclear plants (2752 MW of installed capacity). These plants were built between 1977 and 1982 and are expected to be decommissioned in the period of 2020–2030. In addition, one nuclear plant of 1600 MW is under construction and will be online in 2018. The public attitude toward nuclear power in Finland is generally positive owing to the view that nuclear power contributes to the competitiveness of the national economy by providing stable, low-cost supply for the industry, and because of the advanced final disposal of the high-level waste (Syri et al., 2013). The annual hydropower production varies between 9 and