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Renewables and the EU Internal Electricity Market

The case for an arranged marriage

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Summary

This Policy Brief argues that pursuing the renewables objective could contribute to the completion of the internal electricity market, help to overcome opposition to transmission projects and decrease the market power of incumbents. Conversely, an integrated internal electricity market means less price volatility in specific regional markets, which allows for more efficient deployment and grid integration of renewables.

It is also shown that these benefits will not materialise automatically, however: citizens' support for both policy goals may decrease as a result of rising retail prices; the current electricity market arrangements may not be able to deliver sufficient flexible capacity; and infrastructure deployment, which could benefit both objectives simultaneously, is currently hampered by a number of obstacles.

Three sets of recommendations are proposed. First, European solutions will be needed to avoid suboptimal national policies, especially with a view to capacity mechanisms, ancillary services, renewable support schemes, and infrastructures. Second, the paper calls for increased efforts to improve locational signals for generation investments, in order to reduce the total costs of the electricity system. Finally, we emphasise the crucial contribution a well-designed electricity market can make to dealing with the uncertainty associated with the EU's transition to a low-carbon economy.

Introduction

Integrating electricity from renewable energy sources (RES-E) and achieving the single market for electricity are key components of the EU 2020 strategy for smart, sustainable and inclusive growth in the EU. However, in practice the two objectives are not aligned.

Areas of conflict arising from the complex interplay between the renewables and the internal electricity market include issues such as renewable support schemes, uncoordinated national energy policy choices and an unequal burden-sharing between large- and small-scale customers.

In fact, even though the official deadline for the completion of the Internal Energy Market is right

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around the corner – in February 2011 the EU's Heads of State and Government set the target to 2014 – some market players conclude that Europe is further away from an integrated electricity market than ever.[1]

This CEPS Policy Brief demonstrates that the two goals are not irreconcilable, however. Quite by contrast, the paper points to the great potential for synergies between the renewable and the internal electricity market goal. However, present and prospective conflicts are also analysed, explaining why the two objectives are not often on the same page in practice. The conclusion presents a set of policy recommendations on how a marriage could be arranged.

Why they could make a great couple

Investing in cross-border and internal grid infrastructure can contribute to achieving both the internal market goal and the cost-effective integration of RES-E in the power system. On the one hand, transmission infrastructure could benefit RES-E integration as destination markets for variable RES-E are enlarged. This can reduce storage requirements and backup capacity needs, thereby reducing the costs of integrating variable renewables into the electricity grid.

At the same time, increasing transmission capacity could reduce congestion and allow for more electricity trading. This may lead to a substitution effect – more efficient generators replace less efficient ones – and/or a strategic effect, if market competitiveness increases as opportunities for market power abuse decrease (Migliavacca, 2011). In short, it can contribute to the very essence of what the internal energy market seeks to accomplish.

Facilitating interconnectors

In the past, many interconnector projects – which would have brought overall social welfare benefits – were not realised because they were in conflict with important national and company interests (Supponen, 2011). Put simply, if a high and a low price zone are interconnected, producers in the low-price zone gain as they can sell electricity in the high-price zone. Consumers in the high-price zone benefit from lower prices, while consumers in the low-price zone will face higher prices. On the other hand, producers in the low price zone gain as prices go up, whereas producers in the high-price zone would have to cope with lower prices. In short, producers in high-price zones as well as consumers/regulators in the low-price zone may oppose interconnection projects.

But energy mixes in different countries may be complementary, leading to dynamic price differences. Traditionally, such complementarities can be observed for interconnectors linking thermal and hydro-based systems. The former type of system sees large price differences between day and night, but is not so volatile across seasons. Hydro-based systems, by contrast, have more stable prices during day and night but seasonal and annual prices hinge upon precipitation levels. In these cases, long-term net trade between two countries may well be balanced, while the value of the interconnector arises from gross trade.

A paradigm example for such an effect is the NorNed cable, linking Norway and the Netherlands. Depending on precipitation levels, the main direction of the commercial flow changes. According to ENTSO-E's electricity exchange statistics, the Netherlands was a net importer from Norway in both 2008 (2.8 TWh) and 2009 (1.6 TWh). However, in 2010, a dry year in the Nordic countries, the Netherlands became a net exporter to Norway (1 TWh). To simplify: in dry years Norwegian consumers benefit, in wet years Dutch consumers do so. In a multiannual perspective, both countries' consumers benefit, as they have lower average prices and less price fluctuation.

Renewable deployment can help to mitigate the sometimes problematic distributional effects of interconnectors and lead to similarly complementary energy mixes. Due to the weather-induced variability of many RES-E, price differences should be more dynamic in the future. In other words, depending on the weather conditions, prices will be lower in one price zone or the other, leading to a shift from rather static to more dynamic price differences.

[1] Comment by Johannes Teyssen, CEO of E.ON and vice-President of Eurelectric at the Energy Roadmap 2050 high-level stakeholder conference, organised on behalf of the European Commission, Brussels, 7 February 2012.

Impetus for new power lines within member states

In addition to facilitating cross-border projects, renewable deployment may also give impetus to transmission expansion within member states. The weak north-south link in Germany is one of the best-known examples. In order to bring wind production from the north to the centres of consumption in the south, internal grid reinforcements are necessary. In principle, these links could also be used, for example, to transport electricity from the Nordic countries to southern Germany and beyond when the wind is not blowing in northern Germany (Teusch et al., 2012).

Paint it green

RES deployment can facilitate the deployment of infrastructures that benefit the internal market as well. In some member states, convincing locally affected populations of the need to build lines for the sake of integrating renewables may be easier than telling them that the infrastructure is needed to promote the internal market. This should particularly apply to countries where nuclear energy is regarded with scepticism.

To give a concrete example, building a North Seas offshore grid intelligently would imply making sure that spare transmission capacity could be used for 'ordinary' power trading whenever the wind is not blowing (OffshoreGrid, 2011). As both the UK and Sweden have nuclear capacity, such a grid could also mean that countries which opted out of nuclear energy may import more nuclear power from other countries. In addition, the more transfer capacity is available, the more profitable nuclear capacity additions in the aforementioned countries may be. In other words, the 'renewable rationale' for building interconnectors may in some instances be able to brush over the lack of consensus on the energy mix across member states.

Triggering greater coordination

The Lisbon Treaty clearly states that the energy mix is the competence of the member states. At the same time, it should be clear that national energy mixes cannot be truly independent in an interconnected European market. Decisions taken in one country potentially have an impact on prices and security of supply in others, as became evident in the aftermath of Fukushima. In reaction to the lack of coordination post-Fukushima an electricity coordination group was set up, which held its inaugural meeting in December 2011. It comprises member state representatives and other relevant stakeholders, such as TSOs and industry associations.

Renewable deployment may be helpful in terms of triggering greater coordination as the characteristics of variable renewables illustrate the benefits of coordination: wind, solar or other variable renewable power plants are more efficient in some locations than others; larger markets reduce storage requirements and backup capacity needs; and the costs of RES-E integration can be further reduced by harmonised balancing markets (as discussed below).

Competition

As renewable support schemes have transformed many former consumers into entrepreneurs, they are also leading to a more diversified energy supply structure, thereby decreasing the market concentration of incumbents in some measure.

Demand response

In addition, the fact that increased attention is now being paid to improving demand response by electricity consumers, in order to better accommodate variable renewables, could contribute to the functioning of the internal electricity market as greater price elasticity can be an effective means of preventing market power abuse and decreasing the need for expensive peaking capacity.

Regulatory synergies

The development of European network codes is another example of how the internal market and the renewable objective can be achieved at the same time. Network codes are relevant for both cross-border trade and the cost-effective integration of offshore wind farms into the European electricity network.

Last but not least, other important aspects of electricity market integration, such as intraday trading possibilities and short gate closure times are also crucial to ensure the cost-effective integration of variable RES-E into the electricity grid.

Present and prospective conflicts

A major promise of the internal energy market is to deliver affordable energy to consumers. Yet, as outlined in the Commission's (2011b) Energy Roadmap 2050, electricity prices will most likely rise until 2030. While there are many reasons for this – Europe is also on the verge of a new investment cycle as a large amount of infrastructure is outdated and has to be replaced in the next few years – citizens may (and some have already started to) blame market liberalisation and renewable deployment for their rising electricity bills.

Unequal burden-sharing

Citizens' support for the EU's transition to a competitive low-carbon economy may also decrease as a result of various government actions aimed at preserving industrial competitiveness at home. Being concerned about their industries' ability to compete in global markets, governments are inclined to protect their industry from rising electricity prices by cross-subsidising large and medium-scale industry at the expense of small-scale customers. This can take the form of discounted grid charges or limiting the extent to which large- and medium-scale customers have to share the costs of feed-in tariffs. Ordinary customers without political clout are left to bear the costs alone. Germany is a particularly striking case in point.

Breeding ground for protectionism

In addition, such government interventions may lead to some unhealthy intra-European competition as to who is best at shielding its own industry from rising electricity prices. Since European enterprises often face stiff competition from other companies within Europe, effective cross-subsidisation may bring significant competitive advantages for domestic industry. The consequences are potentially severe as new market distortions are created outside the wholesale electricity market, where European oversight in difficult.

At present, the internal electricity market is still/already suffering from a wide variety of market distortions related to limited transport capacity, non-harmonised market rules, weak regulators, and high degrees of market concentration. As of 27 February 2012, seven member states have not yet communicated any transposition measures with regard to the Electricity Directive of the Third Energy Package – which should have been implemented by 3 March 2011. Other member states have only partially transposed the Directive.

The flexibility challenge

Notably, the expansion of variable RES-E has an impact on thermal-based power generation that requires more starts and stops. As a result,

> "the large amount of thermal capacity that essentially operates as a backup ... becomes more valuable for its capacity than its energy output" (Pöyry, 2011).

In other words, due to the preference given to renewables, fossil fuel-based thermal capacity can be expected to have a relatively low load factor.

The problem is that, while scenario analyses suggest that in the long term even a 100% RES-E scenario is possible (e.g. ECF, 2010), conventional capacity will still be needed for a transitional period to ensure that supply meets demand at all times – even on the notorious cloudy, windless winter days.

In theory, energy-only markets (where investments are solely driven by electricity prices) would be able to deal with low load factors for conventional generation capacity and highly volatile revenue streams – as long as no price caps exist – since the costs for backup plants could be recovered through very high scarcity prices at times when RES-E are not able to meet demand. Yet, an interaction of various market rules may lead to implicit price caps, even when prices are no longer explicitly regulated.[2] In addition, the uncertainty that comes along with transitions aggravates the situation, as investors are not sure how long

[2] For an explanation of this complex phenomenon, see Hogan (2008).

their conventional power plants will still be needed.

Capacity mechanisms

The fact that several member states are discussing the introduction of capacity mechanisms (e.g. the UK Department of Energy & Climate Change, 2011) shows that there are serious doubts about whether sufficient conventional generation capacity investment will take place. When a capacity mechanism is in place, power plants are remunerated for being available for system balancing or peak demand. However, capacity mechanisms may lead to more market distortions and further delay the completion of the internal electricity market (Zachmann, 2011). Potential risks related to the introduction of poorly designed capacity mechanisms include increasing the market power of incumbents and causing unfair cross-payments between customers and/or generators of different member states.[3]

While capacity mechanisms are meant to reduce uncertainty, the uncertainty arising from discussing capacity mechanisms and other market interventions (radical proposals go as far as a suggestion to replace the energy-only market with a central purchaser model), may actually induce potential investors to further delay investment decisions. This could result in a self-fulfilling prophecy.

Storage

Storage facilities can help to deal with the fact that many renewables are variable. Yet, most forms of storage are still very expensive and not commercially viable. The commercial viability of storage crucially depends on both temporal price differences and the cost of storage. The more dynamic price differences that come along the deployment of variable renewables increases the profitability of storage. Needless to say, price caps of any kind will decrease the commercial viability of storage. Allowing for proper scarcity pricing is thus not only important to incentivise the market to provide for sufficient flexible capacity, but also to attract market-based investments in storage.

New flow patterns

Dealing with new variable flow patterns is complex and may cause loop flows. This represents both a technical and a regulatory challenge. Technical solutions comprise optimising transmission switching and making use of phase shifters. In addition, until better forecasting tools are available, variable RES-E imply greater uncertainty regarding the exact location and timing of power generation. As a result, TSOs may decide to use a higher security margin to ensure secure network operation.

Integrating balancing markets

Another regulatory challenge lies in the integration of electricity balancing markets, as the traditional approach – i.e. performing balancing at the control-area level without sharing balancing resources – is not ideal in terms of either variable RES-E integration or the efficient use of available generation capacities. Nevertheless, given the highly complex nature of the subject (the practices of TSOs differ widely across Europe) this process will take time. The Agency for the Cooperation of Energy Regulators (ACER) is currently drafting framework guidelines for an EU code on balancing (expected in the third quarter of 2012). Such a code should result in harmonised and integrated balancing markets throughout the EU.

In fact, this is a crucial prerequisite for fully reaping the benefits of increased transmission capacity. Still, while cross-border balancing can in principle benefit both objectives, it potentially involves a trade-off with commercial exchanges of electricity. This is supported by the ongoing debate, mainly taking place between TSOs and regulators, on whether and under what conditions transmission capacity should be reserved to allow for cross-border exchanges of power reserves.

How to arrange the marriage

The analysis presented so far has shown that pursuing the renewable objective can

[3] For example, if member state A has a capacity mechanism that is paid for by domestic consumers (e.g. through higher network tariffs) and that guarantees a high level of supply security, member state B – if interconnected with A – may also benefit from this capacity mechanism in the internal electricity market.

complement the internal market as it may trigger more coordination among member states, and, more generally, create a constituency for reform. At the same time, an integrated European electricity system allows for a more efficient integration of renewable energy.

But several threats are looming on the horizon before the benefits of these synergies can be reaped: citizens' support for both policy goals is jeopardised by rising retail prices and unequal burden-sharing across different consumer groups; renewable policies as well as security of supply-oriented policies (e.g. capacity mechanisms) may be 'hijacked' by governments to pursue protectionist policies; and a number of obstacles are preventing the infrastructure roll-out from taking place in time.

Recommendation I: Avoid isolated national responses to challenges arising from the transition to a competitive low-carbon economy.

Policy-makers should opt for a coordinated European approach to avoid suboptimal and potentially market-distorting national measures with a view to (a) capacity mechanisms, (b) ancillary services, (c) renewables support, and (d) infrastructures.

a) The fact that some member states fear electricity shortages in the future should be taken seriously. But there are at least three more ways to deal with the challenge of integrating large amounts of variable generation into the grid than introducing capacity mechanisms: grid expansion (both within and between member states), demand response, and storage. In addition, variability represents only one part of the challenge; the bigger underlying issue is the increased uncertainty for investors due to the many unknown implications of the energy transition (see also: Recommendation III).

Member states should be encouraged to at least consider other flexibility options before introducing capacity mechanisms. Grid expansion is a particularly promising measure that could make a significant contribution to both the internal market objective as well as the integration of RES-E. In the case where member state governments are determined to push the issue of capacity mechanisms further, the EU should be involved by encouraging best practice exchange (some member states already have capacity mechanisms in place) and by developing framework guidelines. Designing an intelligent capacity mechanism that sends the right qualitative and locational signals is challenging. Existing designs of capacity mechanisms favour fossil-fuelled powered plants over low carbon sources, and would therefore need to be adapted (Hood, 2011).

b) When the costs of balancing and other ancillary services increase with a rising share of variable generation, wholesale electricity prices become, relatively speaking, less important for retail price formation (Zachmann, 2011). As ancillary services are often not organised in a transparent, market-based way, it may lead to distortions of the internal electricity market.

The provision of ancillary services requires European-level attention and will hopefully be tackled by the forthcoming Commission communication with proposals on refinements to ensure the completion of the internal energy market. As a guiding principle, market mechanisms should be at the heart of as many parts of the electricity value chain as possible (see also: Recommendation III).

c) In this regard, it is important to point to the need for a European approach to integrating RES-E. According to the national renewable energy action plans, electricity will already represent 35% of electricity generated in 2020. It should be self-evident that one cannot design an efficient market around renewables. Renewables have to become part of the market themselves (see also: Recommendation III).

But making renewables part of the market requires, first of all, that there is a functioning electricity market that renewables can become a part of. It is noteworthy that in a well-functioning electricity market, there would no longer be a need to grant priority access to variable renewables. As variable renewables such as wind, solar, or geothermal energy have zero fuel costs, they are highly competitive in the merit order. This is because power plants are ranked according to their short-run marginal costs of production. Put differently, the fact that the levelised costs of electricity (a measure illustrating the overall competiveness of different generation technologies) is still higher for most RES-E (IEA 2010), does not matter for their position in the merit order.

This last point also implies that integrating renewables into the market does not mean that subsidies for renewables should be removed for all technologies. It would rather be important to create a level playing field across Europe, making sure that renewables are developed where they are most efficient – both in terms of natural conditions as well as from an electricity system integration perspective (see also Recommendations II and III).

However, a fully harmonised European support scheme for renewables seems highly unlikely for political reasons. Notably, one important argument of RES supporters is that renewables deployment promotes technological innovation and employment at home. And as the euro crisis demonstrates, member state governments and citizens alike do not necessarily think European. The fact that member states' forecast documents show that cooperation mechanisms, as established by the 2009 Renewables Directive, are expected to make only a marginal contribution to achieving the renewable targets may serve as anecdotal evidence for such national perspectives.

d) Isolated national perspectives are also at the heart of the cross-border infrastructure dilemma. While a transmission infrastructure that is optimised from a European perspective would increase overall welfare, doing so in practice is difficult as national regulators are still legally obliged to honour national objectives such as ensuring national security of supply and keeping national network tariffs as low as possible.

The Energy Infrastructure Regulation proposed by the European Commission (2011a) is a pragmatic answer to these challenges. While it would benefit from some fine-tuning (Teusch et al., 2012), it is important that the common European approach to the infrastructure challenge is not watered down in the negotiations between Parliament and Council. Cost-benefit analyses dominated by national preferences cannot deliver the infrastructures needed to make Europe's transition to a competitive low-carbon economy a success. The lengthy authorisation process has to be streamlined as well.

Recommendation II: Improve locational signals for generation investments.

In order to increase the efficiency of Europe's power sector, efforts should be made to improve locational signals for generation investments.

The effective unbundling requirements of the third energy market liberalisation package imply that in many member states connection costs are no longer relevant for power generators. But locational signals need to be provided to avoid excessive connection costs and reduce total systems costs. Electricity is not like any other commodity; it actually matters where power is produced. Providing effective locational signals without intervening in the market is challenging.

One interesting option to attract generation investment in places where it is needed and/or to create a constituency for grid expansion is to redesign price zones

> "so that the congested parts of the network are at their outer borders and that inside the zones transmission from any generator to any load can be guaranteed with reasonable certainty" (Supponen, 2011).

Still, the issue of price zone redesign, which would in some cases imply smaller price zones as well as price zones crossing national boundaries, is not clear-cut. A recent study commissioned by the German regulatory authority (Frontier Economics and Consentec, 2011) points to possible negative consequences associated with smaller price zones, as they might, for example, lead to reduced market liquidity, the increased market power of large electricity generators and reduced retail competition. A careful assessment on a case by case basis is therefore needed.

In the case of variable RES-E in particular, there is often a trade-off between the location and the efficiency of the power plant. From an overall welfare point of view, it may for example make sense to build a solar or wind power plant somewhere rather less sunny or windy than another location, if this 'less efficient location' is easier to connect to centres of consumption. Smart renewable support schemes would provide these kinds of locational signals (e.g prefer premiums over fixed feed-in tariffs) and, at least to a certain extent, internalise connection and other electricity system costs.

Recommendation III: Minimise the political uncertainty associated with the transition of the power sector.

The uncertainty arising from the many challenges of the ongoing decarbonisation of the power sector makes it difficult to attract private sector investment. Sustainable market-based policies targeting the electricity sector are therefore all the more important to keep political uncertainty at bay.

First of all, it is important to stress that one should not try to do away with the normal uncertainty associated with unknown future developments. In fact, there is little one can do about this kind of uncertainty: we will always be surprised by technological developments; and history tells us that any attempt to predict the future is doomed to fail. Here, the best one can do is to preserve flexibility to be able to respond dynamically to future events.

The Commission's (2011b) Energy Roadmap 2050 deserves credit for making a case for accepting this kind of uncertainty. The Roadmap is technology-neutral and demonstrates that there are at least five feasible decarbonisation pathways. Importantly, it does not indicate a preference for any of them. Instead, it identifies the development of a new, flexible infrastructure as a no-regret option.

But how well does existing RES-E and internal electricity market legislation fare in terms of minimising political uncertainty that determines investors' willingness to invest? Here, political uncertainty is defined as the likelihood that policy-makers will opt for fundamentally different policies in the future. It is this kind of uncertainty that investors fear most when assessing the risk of stranded investments, as it includes policy options such as nationalisation and the replacement of an economic model (e.g. a single purchaser model instead of the energy-only market model).

Such radical political choices are more likely to be pursued when the status quo is in severe disequilibrium. By agreeing on sustainable policies (broadly understood), policy-makers can minimise this kind of uncertainty. Put differently, if existing policies are economically sound and do not have troublesome distributional effects, there will be few incentives to overthrow these policies in the future.

Applied to this paper's topic, the distributional effects resulting from member states' responses to the rising costs of electricity are challenging. A closer look at the Roadmap underlines this. At first glance, it seems reassuring that the Roadmap acknowledges that there may be a need for "safeguards against carbon leakage" to preserve industry competiveness and that "the social aspects of energy pricing should be reflected in the energy policy of Member States".

Yet, one should not forget that this implies that sectors believed to be unaffected by carbon leakage, as well as ordinary customers, will have to shoulder an even greater share of the costs associated with the energy transition.

The fact that more and more exemptions and redistributional policies may be needed in the future represents a serious caveat with a view to decreasing political uncertainty. In other words, investors may conclude that the market will only play a minor (if any) role in the energy transition.

As this Policy Brief has argued, at least with regard to the internal electricity market and the renewable objective, there is great potential for synergies. In order to exploit this potential, a strong commitment to the market is essential, as the market is best at dealing with the normal uncertainty associated with future developments. To serve as an example and reassure market participants, the marriage between renewable and internal electricity market policy goals should henceforth be arranged.

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