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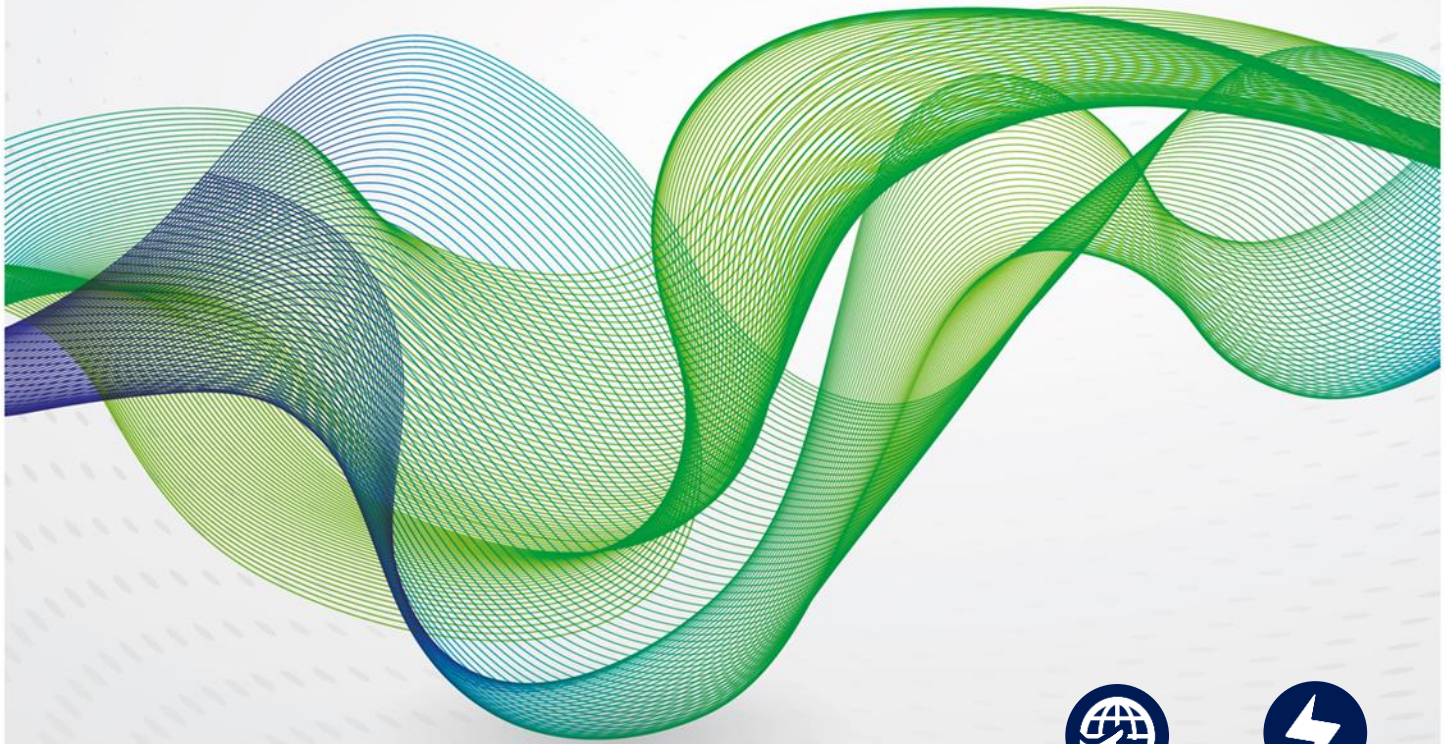
Current Energy Crises, the Energy Transition and the Design of Electricity Markets



ENERGY TRANSITION ELECTRICITY

OIES ENERGY COMMENT

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The European[1] energy **price** crisis that began with rising gas and electricity prices in 2021 turned into a **security of fossil-fuel supply** crisis following the Russian invasion of Ukraine. The combined price and security crises add urgency to the **climate crisis** that has to date been the primary motivator for the energy transition. The European Union (EU) and the United Kingdom (UK) are scrambling to respond to these new crises, while using them as a sound further reason to accelerate the energy transition.

Fossil fuels will continue to be part of the European energy mix for many years. However, the energy transition means that vastly expanded amounts of green electric power generation and consumption will replace current fossil-fuel production and consumption. Energy security will increasingly depend on the central role that electricity will play in the decarbonized energy system. To avoid or mitigate potential future problems concerning the reliability of electric power supply will require in-depth thinking on a redesign of current electricity markets. This will be needed to elicit necessary private sector investment in renewables generation capacity, power storage technology, electrification, smart grids, and various other technologies, including those that increase the potential for energy demand-side management. In the meantime, it is important to avoid policy decisions that will slow the energy transition or increase its costs, and equally important to secure the support of consumers for the energy transition and their active participation in it.

The crises

Since the first quarter of 2021, global energy prices have been rising, especially in Europe. In particular, natural gas spot prices in Europe increased sixfold. This led to a similar sixfold increase in wholesale electricity prices, mainly because natural gas is the marginal source of electricity generation in many countries and sets wholesale power prices through “pay as clear” energy markets. These widespread gas and electricity price increases were unprecedented in Europe.

The Russian invasion of the Ukraine introduced a new crisis, namely that of geopolitical insecurity of fossil fuel supply, in particular natural gas. The EU declared its intention to end its dependence on Russian fossil fuels and began looking for alternatives. And Russia began to cut supplies of natural gas to EU countries, exacerbating concerns over security of supply.

Energy policy and transition

On the one hand, these crises have changed EU's energy policy. Of the objectives of the energy trilemma (environment sustainability, security of supply and affordability of energy), the two crises have led to more attention to security and affordability and less to sustainability. This implies a detour on the path to net zero as emissions rise (with coal temporarily replacing gas in the power sector of many European countries) and governments struggle financially to deal with the other two objectives and the wider macroeconomic consequences.

On the other hand, the new emphasis on security confirms an under-appreciated benefit of the energy transition in Europe—greater energy independence stemming from a reduced reliance on imported fossil fuels—and offers an opportunity to underscore and support its acceleration. Climate change has always been a concern to the security establishment, especially due to its impact on geopolitical instability. However, the energy security challenge now posed by Russia strengthens the appeal of the energy transition to the security lobby in Europe.

REPowerEU is the EU´s strategic response to the crises. It proposes several measures to reduce dependence on Russia and fossil fuels in general, and to accelerate the energy transition. The most important measures from the perspective of decarbonizing the energy system have to do with the penetration of renewable energy generation in the electricity sector, the electrification of demand and the development of decarbonized gas, in particular green hydrogen. Electricity is certainly central to the transition. Today it accounts for 20-25% of energy demand in EU countries; by 2050, it will be responsible for more than 50% of demand, and in some scenarios significantly more, especially where green hydrogen becomes an important part of the energy mix. The challenge will be to adopt policies

[1] The reference to Europe in this paper includes the European Union (EU), the United Kingdom (UK), the European Free Trade Association (Iceland, Liechtenstein, Norway) and Switzerland.

that facilitate and can accelerate the transition through a massive transformation of the energy system, while ensuring security of energy supply.

Market design, government intervention and consumer participation

To facilitate the transition to the energy and electricity system of the future, there are three issues that deserve more attention from governments than they have received to date:

- Agreeing a new market design that will ensure security of decarbonized electricity supply;
- Avoiding government interventions in the power sector that will slow the transition and raise its costs; and
- Promoting active consumer support for and participation in electricity markets.

We need to rethink electricity market design for the new era of decarbonization. It is important to recognize that we are replacing security of fossil fuel energy supply with energy security based on renewable electricity supply. This of course requires massive investments in renewable power, mainly solar and wind. However, because these renewables are intermittent, the system also requires investments in flexible energy resources to:

- Supply energy or reduce demand when renewables are not generating;
- Store energy or increase demand when renewables are surplus to demand; and
- Manage network operations.

To take an example, in Spain's current electricity system, fossil-fired and hydro generation provide almost all of the flexibility needed. This flexibility includes rapid response for very short periods, slower response for much longer durations (weeks or even seasons), pumped storage to absorb electricity when it is economic to do so, and flexibility to maintain system stability and manage network congestion. In the new decarbonized electricity system in Spain, flexibility will come in part from traditional resources[2], notably hydro, but increasingly from new resources, including battery storage, concentrated solar power, smart grids and demand flexibility. A key feature of the new system in Spain and in most countries will be the high level of decentralization of these resources, many of which will be behind consumer meters, including distributed generation with batteries, electric vehicles, heat pumps, smart thermostats and other electrical devices that support demand-side flexibility. Together, these behind-the-meter resources will make consumers, and their agents, increasingly important players in the new system.

Designing markets that will elicit efficient investment and operations in this new system is critical and complex. One thing, however, is clear to most experts, namely that the current wholesale electricity market design is inadequate. At the very least, it will need incremental reforms, but more likely very substantial ones, to address at least the following challenges:

- Recovering fixed investment costs for renewables generation (and other assets) when the short run marginal cost of most generation on the system is close to zero, leading to very low average wholesale energy market prices;
- Motivating new investment in flexible technologies to assure security of supply when most generation is by renewable sources and thus inherently intermittent;
- Providing spatial price signals to reflect the different costs associated with the location of consumption and production of electricity; and
- Supporting the growing participation of consumers and their representatives in providing energy and flexibility using their distributed energy resources.

[2] For instance, Carbon Capture Use and Storage (CCUS) technology may develop to the point that gas-fired generation with CCUS can provide firm, flexible and long-duration flexibility until zero carbon alternatives are economic.

Building the markets of the future must begin soon because investors today want clarity with respect to what will determine their revenues for the next 15-25 years. We are beginning to see serious consideration of different market designs in the UK, with the publication of The Review of Electricity Market Arrangements (REMA)[3]. This is a public consultation that identifies options for delivering a net zero wholesale electricity market. It sets out a range of new arrangements, including splitting the electricity market (into "As Available" renewable energy and "On Demand" firm energy)[4], introducing locational pricing, establishing distribution-level markets, and changing the parameters of the *status quo*. The intention of the REMA document is to determine what reform is needed to achieve a net zero wholesale electricity market in 2035 (and beyond), while ensuring that existing commitments to investors are maintained during the transition to the reformed market arrangement.

By contrast, some EU countries, notably Spain, have been focusing on temporary market interventions aimed at capping wholesale electricity prices. However, the President of the European Commission has recently said that the current electricity market design is no longer adequate and that the Commission is working on alternatives. With 27 Member States, reaching a consensus on longer-term reforms will be difficult. Many southern European countries favour government intervention and the end of the current wholesale market design based on "pay as clear" pricing, whereby wholesale prices for all electricity that operates in the market are set by the price of the marginal resource needed to meet demand, which is often natural gas.

But most northern European countries, and ACER (the EU Agency for the Cooperation of Energy Regulators), generally support competitive markets and recommend incremental improvements to the current model, in particular more granular price signals and the promotion of demand-side flexibility. Although these supporters of the current model recognize the need to respond to crises, they are concerned about losing the benefits of an integrated electricity market where all countries follow the same ("pay as clear") electricity market principles. In particular, in its final assessment of EU electricity market design, ACER suggested that "the need for interventions in market functioning should be considered prudently and carefully in situations of extreme duress and if pursued should, ideally, seek to tackle 'the root causes' of the problem (currently gas prices)" [5]. This is not a matter that should be fudged by political bargaining; it requires the sort of expert group that the UK has established in order to assess the alternatives and make recommendations; and it will require the political wisdom to agree on a market design that is fit for purpose for the next fifteen years and beyond.

Meanwhile, it is very important not to introduce policies that slow down the transition or raise long term costs. Governments will of course play a critical part in the energy transition, especially through energy system and network planning, support for new technologies, competition policy, protection of vulnerable consumers and ensuring a just transition. However, some policies are barriers to the transition. Two examples serve to make the point: one related to consumers and the other to investors.

First, it is widely accepted in the EU and the UK that governments should intervene to protect the most vulnerable consumers. However, intervention is unhelpful where it distorts price signals. Electricity markets in most countries currently send information that may be unwelcome but is important. High wholesale and retail prices convey the message that consumers should reduce demand, which will lead to lower prices for everyone, lower CO2 emissions and provide less revenue for Russia and other gas suppliers. Expectation of continued prices also justifies investment in renewables whose fixed costs can be amortized very quickly. Governments have many tools other than price caps at their disposal to assist the most vulnerable consumers, for instance financial transfers that do not distort price signals. They should be especially careful not to extend relief to consumers that are not vulnerable, for instance by reducing VAT on electricity sales. The IMF recently reinforced this point[6]:

[3] Review of electricity market arrangements, Department of Busines, Energy and Industrial Strategy, UK Government, 18 July 2022.
[4] The REMA document analyzes the "split market" approach proposed by Malcolm Keay and David Robinson in *The Decarbonised Electricity System of the Future: The "Two Market" Approach,* Oxford Institute for Energy Studies, June 2017.
[5] ACER is the EU Agency for the Cooperation of Energy Regulators. See ACER´s Final Assessment of the EU Wholesale Electricity Market Design, April 2022.
[6] See the IMF Blog: How Europe Can Protect the Poor From Surging Energy Prices, 3 August 2022.

> "Soaring energy prices have sharply increased living costs for Europeans. Since early last year, global oil prices doubled, coal prices nearly quadrupled and European natural gas prices increased almost seven-fold. With energy prices likely to remain above pre-crisis levels for some time, Europe must adapt to higher import bills for fossil fuels.
>
> Governments cannot prevent the loss in real national income arising from the terms-of-trade shock. They should allow the full increase in fuels costs to pass to end-users to encourage energy saving and switching out of fossil fuels. Policy should shift from broad-based support such as price controls to targeted relief such as transfers to lower-income households who suffer the most from higher energy bills."

A second example is related to investment. Another widely accepted view in the UK and the EU is that governments must intervene to support investment for promising technologies that are not yet economic. However, governments should ensure that markets are designed to encourage competition by private investors in economically viable technologies (and those that could be soon), thereby reducing system costs and final prices for consumers. That objective is undermined when governments intervene in ways that create or reinforce the investor perception of political risk. For instance, capping wholesale prices not only distorts current price signals, discourages energy saving and investment in renewables; it also makes investors nervous about future revenue streams, leading them to require a higher return on investment to compensate for political risk. That raises the cost of the transition.

Consumer participation is critical to the energy transition. This is evident on three dimensions:

- The need for consumer and citizen support for the transition;
- The need to assist consumers to reduce their vulnerability to high prices; and
- The importance of empowering consumers so that they can benefit from participating in energy markets.

First, it is evident that citizen support is required for a successful transition. It is extremely difficult to maintain that support if consumers see the energy transition as the reason for high electricity prices. Governments have a responsibility to be transparent with consumers about the reasons for high prices. Rather than blaming electricity markets, the focus of discourse should be on the policies that led to excessive reliance on imported fossil fuels, especially natural gas from Russia. A recognition of the security and cost implications of relying so heavily on imported gas, especially from Russia, will strengthen the case for making the transition, provided the latter has been designed to ensure energy security and eventually lower costs.

Second, governments should assist consumers to reduce their vulnerability to high prices, and to contribute to the energy transition. One means of doing so is to support demand-side flexibility, encouraging consumption when electricity prices are lower and avoiding consumption when prices are higher; and creating opportunities for consumers to sell their energy and flexibility in all electricity markets. This allows consumers to lower their energy costs and reduce overall system cost, facilitating the transition. Governments should remove the barriers impeding demand-side flexibility, including restrictions on consumer participation in energy and capacity markets, insufficient information provided by system operators, and barriers to entry for aggregators that act as intermediaries that sell consumer flexibility into energy and flexibility markets.

Another means of supporting consumers while promoting the transition is to support improved energy efficiency. Lower energy demand reduces damaging emissions, limits vulnerability to the volatility of imported fossil fuels and reduces Russian revenues. One of the main sources of energy efficiency is electrification of transport and buildings. Governments should consider introducing declining carbon intensity mandates so that energy producers, suppliers and consumers have incentives to electrify or to adopt alternative sources of decarbonized energy. In the interest of supporting demand-side flexibility and energy efficiency, governments should also consider promoting electrification by ending fiscal subsidies for fossil fuels, subsidizing electromobility in public transport, and offering tax credits for investment in EVs, EV charging networks, heat pumps, batteries and other electrical devices that enable consumers to be flexible and to transition their consumption from fossil fuels to electricity. This financial support should be targeted to those that really need it; this becomes increasingly obvious as the fiscal cost of subsidizing all consumers becomes unbearable.

A further means of helping consumers to mitigate the consequences of high wholesale prices is to adopt policies that decouple electricity prices from the price of gas. One such policy is support for renewable self-generation by individuals or collectively, for instance through energy communities[7]. To the extent that consumers use their own renewable electricity when wholesale market prices reflect the cost of natural gas, they are effectively decoupling from high electricity prices. Another means of achieving this decoupling is for governments to adopt the split-market design that provides incentives for consumers to contract for "As Available" renewable energy and to consume or store the electricity when renewables are operating, as explained in the REMA document and the original paper by Keay and Robinson[8].

Third, governments should promote the development of markets, business models and technologies that facilitate and encourage consumer empowerment. For instance, rising electricity demand and the development of distributed generation will increase the complexity of electric power distribution. This complexity places new demands on the distribution network, including frequent and unpredictable congestion. One way to manage this is through the creation of local markets in which third parties compete to sell flexibility to the distribution system operator. Most small consumers will not have the scale, information or interest in participating in these or other markets. However, commercial aggregators and energy communities can provide digital platforms that optimize the use of these resources at scale. Policies, for instance regulatory sandboxes that relax regulatory barriers, should be used to encourage innovation and the development of new business models and technologies that assist consumers to become more active, furthering their own interests while lowering the costs of the transition.

Conclusion

The current energy crisis has reinforced the case in Europe for an energy transition away from fossil fuels and towards electrification. However, the new decarbonized and decentralized electricity system raises its own security of supply challenges. New market designs are needed to address those challenges and to incentivize the appropriate mix of investments.

Furthermore, while protecting the most vulnerable consumers, governments should avoid interventions in the short term that weaken the incentive for consumers to reduce energy demand and that increase investor perceptions of political risk. The energy system of the future will be increasingly electric. Electrification and the integration of intermittent renewables will be central to ensuring that the new energy system provides security of supply. Active consumer participation will be essential to both.

Finally, citizen support and consumer participation are essential for the energy transition. Governments should offer targeted relief such as transfers to lower-income households who suffer the most from higher energy bills. However, they should not shield most consumers from those prices. Rather, they should encourage energy saving and assist citizens to mitigate the impact of high energy prices while at the same time contributing to the energy transition.

[7] See the following book edited by Sabine Löbbe, Fereidoon Sioshansi and David Robinson. *Energy Communities: Consumer-Centered, Market-Driven, Welfare-Enhancing?*, Elsevier, Academic Press, 2022.

[8] Malcolm Keay and David Robinson, *The Decarbonised Electricity System of the Future: The "Two Market" Approach*, Oxford Institute for Energy Studies, June 2017.