

Europe's long road to Energy Union



A report from the UK's Department for International Trade



Written by The Economist Intelligence Unit



Department for
International Trade

Department for International Trade

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Executive Summary

Department for International Trade

For over two decades, the European Union (EU) has pursued three main energy goals for member states: affordable prices through competition, environmentally sustainable energy generation, and secure supplies from diverse sources. With these goals in mind, the European Commission (EC) said in February 2015 that it aims to create an EU Energy Union—an integrated electricity market in which member states and neighbouring nations collectively unify energy markets, reduce emissions and boost efficiency.

The statement was a long-awaited step in integrating the EU economies, but also an ambitious one. The EU, and Europe in general, is home to a patchwork of national approaches to energy security and regulation. That difficulty is compounded by legacy systems that must be brought into harmony, as well as political mistrust among some of the states involved. A further complication is the different pace at which countries are impacted by trends in energy demand and power generation. Europe's journey to energy union, while clearly leading to a more efficient and secure power market, will be neither smooth nor fast.

This research looks at the goal of energy union in Europe, and what it might take to reach that goal. Here are some of the key findings of this research:



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**ACT Blade are the masters of wind. The same
technology that powered the world's fastest sailing
yachts now powers the most efficient wind turbines.
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encourages imagination.**



- Many European countries are inefficient 'energy islands' isolated even from their nearest neighbours. In many countries, too, households have little choice of supplier and face hefty bills, despite decades of EU-level efforts to open national energy markets to competition.
- An integrated European electricity market would help to address this problem by boosting market competition and aiding price convergence across the continent, but Europe is only at the start of creating such a market.
- Market coupling - a variant of energy union that brings all bids and offers from national power exchanges into one 'basket' for cross-border trading, along with the necessary transmission capacity to convey it from point to point - could save consumers €2.5-€4 billion a year in the EU alone, according to the European Commission.
- While the EU sets energy rules at a supranational level, in practice it must grapple with 28 national regulatory systems, each heavily influenced by domestic political concerns, foreign policy stances, legacy energy investments and projected energy requirements.
- Vital energy infrastructure is ageing in much of Europe and requires substantial investment. In addition, new and specialised infrastructure will be needed to accommodate increased production and trading of energy from renewable sources. Creative financing mechanisms will be needed to meet these requirements.





About This Research

Department for International Trade

'Europe's long road to energy union' is a report from the UK Department for International Trade, written by The Economist Intelligence Unit (EIU). It discusses the reasons for the EU's goal of unifying energy markets, details the obstacles to this union, and assesses the outlook for achieving it.

The Economist Intelligence Unit bears sole responsibility for the content of this report. The findings and views expressed in the report do not necessarily reflect the views of the sponsor. Jessica Twentyman, an independent journalist, was the author of the report, and Aviva Freudmann, research director, EMEA Thought Leadership for The Economist Intelligence Unit, was the editor.

The report is based on extensive desk research and in-depth interviews with seven experts in the topic, conducted in April and May 2017. Our sincerest thanks to the following participants (listed alphabetically by surname) for their time and insights:



Europe's long road to Energy Union





*Tidal power turbine,
Atlantis Resources Ltd.*

- Manuel Baritaud, Senior analyst, International Energy Agency
- Andrew Claxton, Chairman, Nominated Electricity Market Operators (NEMO) Committee
- Paul Hallas, Director of regulation and strategy, Centrica
- Jerome Le Page, Manager for European electricity markets,
- European Federation of Energy Traders
- Thorsten Lenck, Senior associate, Agora Energiewende
- Ronan O'Regan, Director, renewables, PricewaterhouseCoopers
- Wolfram Vogel, Director of public and regulatory affairs,
- European Power Exchange (EPEX SPOT).



Introduction

This report examines the reasons and the plans for developing a Europe-wide energy market over the next 10 to 20 years, how the shift to generating power from renewable fuel sources influences those plans, and some of the barriers to realising the objective of energy union.

The name may be unwieldy, but the aim is clear. The Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy was announced by the European Commission (EC) in February, 2015. The policy statement outlined a future 'Energy Union', in which EU member states trade electricity seamlessly across borders, moving it from areas of oversupply to areas of demand.

"Today, we launch the most ambitious European energy project since the Coal and Steel Community," Maros Sefcovic, the EC's vice president responsible for the Energy Union, said at the time. The project would integrate all 28 markets, making Europe less dependent on energy imports and improving supply predictability.

Two years on, the project has seen some successes, as well as encountering serious barriers. The proposed Energy Union faces significant financial, political, technological, and





Agrivert anaerobic digestion facility

regulatory hurdles. Much ambition and determination are still needed.

A major obstacle is the need to accommodate the interests of a broad array of market and policy players, including:

- Electricity suppliers, who buy electricity from generators and sell it to consumers;
- Consumers, who use electricity and pay suppliers via their bills;
- Transmission system operators (TSOs), who are paid for the long-distance transport of electricity and for ensuring market stability;
- Distribution system operators (DSOs), who are paid for delivering electricity to consumers;
- Regulators, who set rules and oversee the functioning of the market;
- Power exchanges, which already provide the platforms where electricity is bought and sold, albeit on a fragmented, regional level; and
- National governments.

I. Setting a Course for Energy Union

In January 2017, a severe cold snap triggered energy shortages across southeast Europe, leaving many countries hoarding power. Bulgaria, which normally exports more than 10% of its electricity, halted all power exports for almost a month. Greece cut power exports for two days, and Romania restricted export flows when a high-voltage line was damaged by a blizzard.

In this region, ageing infrastructure is a concern, but a greater hurdle is the priority placed on national energy security rather than the security of the bloc as a whole. Political distrust between neighbouring countries can compound the problem. As Andras Totth, deputy head of strategy at Hungarian state-controlled utility MVM told Bloomberg News, “What I see in the Balkans is clear evidence that everybody first secures its own consumption



*Hydroplan, Corrou Estate,
Scotland, UK*

and only then, if they're in a position to do so, they'll help the others."

An integrated European market would, in theory, bind countries through a system of cross-border interconnections, fostering greater competition and price convergence. According to the EC, market coupling - a variant of energy union that brings all bids and offers from national power exchanges into one 'basket' for cross-border trading - could save EU consumers €2.5-€4 billion a year.

A few weeks after the January 2017 cold snap, in a counterpoint to this parlous state of affairs, the European Commission (EC) published its second State of the Energy Union report, looking at progress made since the first report in November 2015. Despite the clampdown on energy trading in parts of the EU in January 2017, the February 2017 report contained some good news.

Most of the good news related to progress on reducing energy use and introducing renewable fuels. The report found that final EU energy consumption had already reached its 2020 target. In 2014, the EU consumed 1062

Mtoe¹, a level already 2.2% below the 2020 target of 1086 Mtoe. Final energy consumption dropped by 11% between 2005 and 2014, said the EC².

Similarly, the report found that the EU was moving resolutely toward ramping up the use of renewable fuels. The EU had achieved an estimated share of 16.4% renewables in its final energy consumption in 2015, and was well on track to reach its 20% target by 2020.

1. million tonnes of oil equivalent, a measure used to quantify the amount of energy released by the burning of a million tonnes of crude oil

2. http://europa.eu/rapid/press-release_MEMO-17-162_en.htm

Beginnings of a cross-border energy market

Beyond such signs of progress, Europeans can find additional encouragement in the specific area of cross-border energy trading. Parts of Europe already have an active wholesale electricity market, whose participants are generators, electricity suppliers, municipalities, large industrial consumers, and transmission system operators. Electricity can be traded privately, as happens in the over-the-counter market.

Moreover, in energy-integrated parts of Europe, deals can also be made via energy exchanges that bring together buyers and sellers from different countries on a single platform. Deals can be made via 'market coupling' arrangements. Market coupling integrates the electricity markets of two or more regions by making cross-border transmission capacity implicitly available on the power exchanges of the regions involved. The exchanges then use the available transmission capacity to enable trading that minimises the energy price difference between different suppliers.

"Market coupling is one of the most concrete implementations of the Energy Union to date," says Wolfram Vogel, director of public and regulatory affairs and communications at Epex Spot, an exchange which operates short-term electricity markets in Central Western Europe and the UK. In 2016, its 278 members traded 529 terawatt-hours of energy, a third of the domestic consumption in the eight countries covered.³

*3. Germany, France, United Kingdom, the Netherlands, Belgium, Austria, Switzerland and Luxembourg;
Source: https://www.epexspot.com/en/company-info/about_epex_spot*

Network codes

For such projects to expand to the whole of Europe, however, the continent will need to adopt common network codes. These are rules that govern the operators in cross-border electricity networks, particularly energy generators and transmission system operators, and determine how access is allocated to users. In the past, these rules were drawn up nationally or even in regions within nations. But with increased interconnections across borders, differing rules can create difficulties. The EC has stepped in to try to harmonise the system, with input from the Agency for the Cooperation of Energy Regulators (ACER) and the European Network of Transmission System Operators for Electricity (ENTSO-E).

Here, too, there has been tangible progress. In August 2015, the first of eight European network codes came into force: a rule on Capacity Allocation and Congestion Management. A rule on Forward Capacity Allocation came into force in October 2016.

In mid-March 2017, member states approved the last of the eight network codes, the so-called 'Balancing Guideline'. Electricity balancing is a key role of transmission system operators, involving ensuring that generation matches demand in real time. Cross-border balancing markets, in which countries share the burden of balancing resources, will be vital to ensuring security of supply in an integrated energy market. A further aim of electricity balancing rules is to accommodate integration of energy from renewable sources.

Transmission capacity and access

While progress has been made at the bureaucratic level, the physical market has yet to catch up. The European Commission has set a target for member states to allocate at least 10% of installed capacity for cross-border trading by 2020, increasing to 15% by 2030. When this goal was set in 2015, 12 member states fell short of the 10% minimum interconnection target. By February 2017, the number had only fallen to 11.

While focusing on increasing transmission access, European governments are also working toward expanding the amount of capacity available. In February 2017, for example, work began on ElecLink, an interconnector between the UK and France, which will run through the Channel Tunnel. Work is also proceeding on Europe's longest interconnector, NordLink, which will run between Tonstad in Norway and Wilster in Germany, supporting the exchange of Norwegian hydropower and German solar and wind energy.

Limited access to transmission capacity is but one of a host of technical, financial, institutional and political barriers to cross-border trading in Europe—as the next chapter discusses.

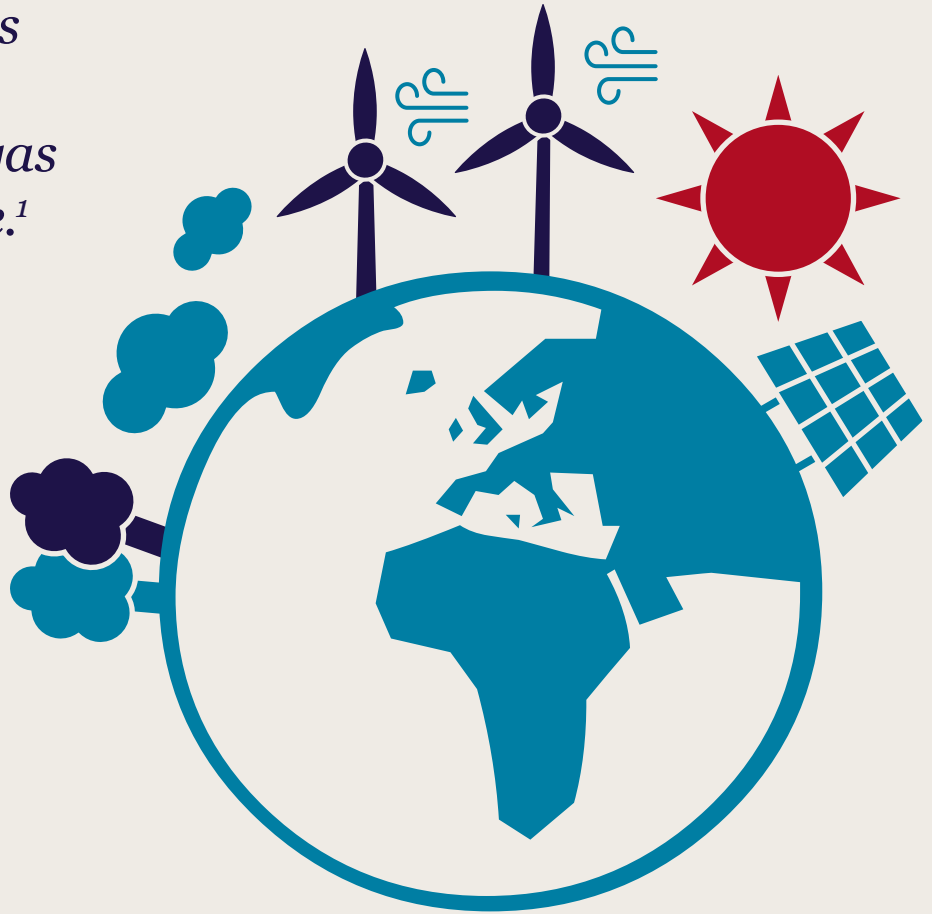


*Offshore wind farm,
England, UK*



In 2017, renewable sources of energy generated more electricity than coal and gas in the UK for the first time.¹

What clean energy technologies will power our future world?

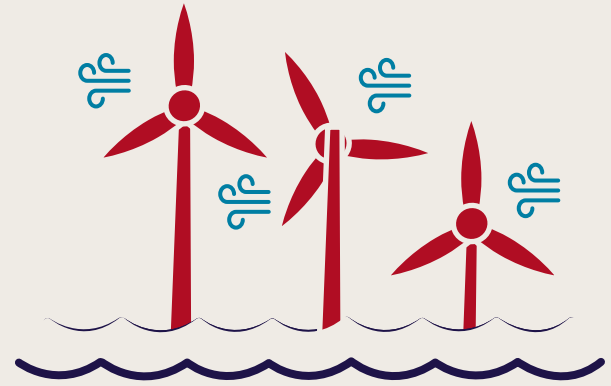
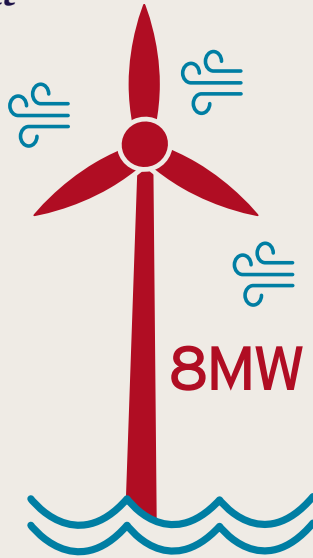


The UK is the world leader in offshore wind, with more installed capacity than any other country²

⚡ 5.1GW installed

⚡ 4.5GW under construction

⚡ 9GW under development



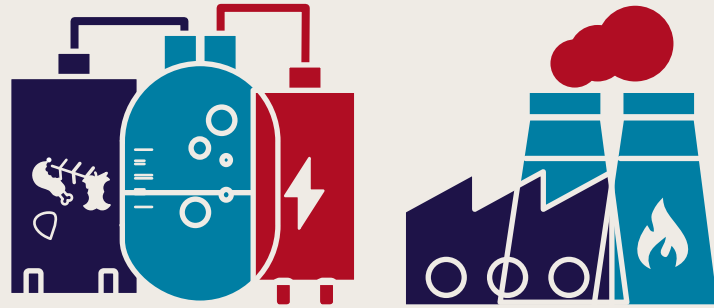
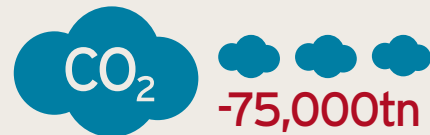
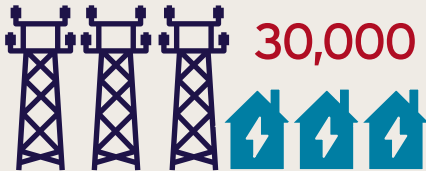
Opened in May 2017, Burbo Bank Extension off the Liverpool coast is the first offshore wind farm in the world to make commercial use of 8MW wind turbines³

- ⚡ Each turbine is taller than the Gherkin building in London
- ⚡ One rotation of an 8MW turbine can power an average house for 29 hours
- ⚡ Increasing capacity is driving down costs

Energy from Waste

Types of EfW technologies:

- ⚡ Anaerobic digestion
- ⚡ Incineration
- ⚡ Pyrolysis/gasification



There is a £180 million state-of-the-art EfW facility in Suffolk⁴

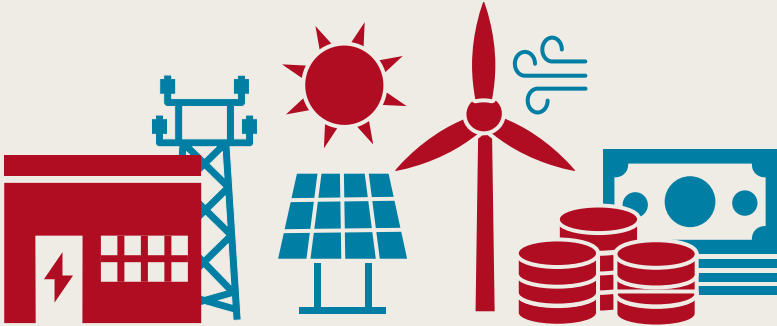
- ⚡ processes 269,000 tonnes of waste per year
- ⚡ generates up to 30MW of electricity, enough for 30,000 households
- ⚡ costs at least £350 million less than continuing to landfill
- ⚡ reduces greenhouse gases by 75,000 tonnes per year

“It’s a scandal that as much as a third of all food in the world is lost or wasted. Separate food waste collections and AD offer a huge opportunity to reduce the amount of food wasted.”

– Charlotte Morton, chief executive, Anaerobic Digestion and Bioresources Association (ADBA)

Smart Grids

An interconnected network of smart equipment, sensors and devices that allow a grid to be more flexible and stable – could save consumers billions⁵



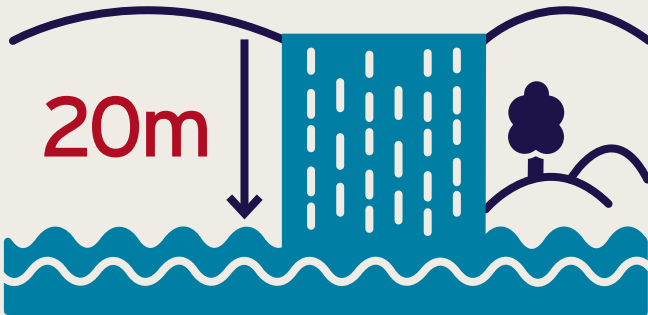
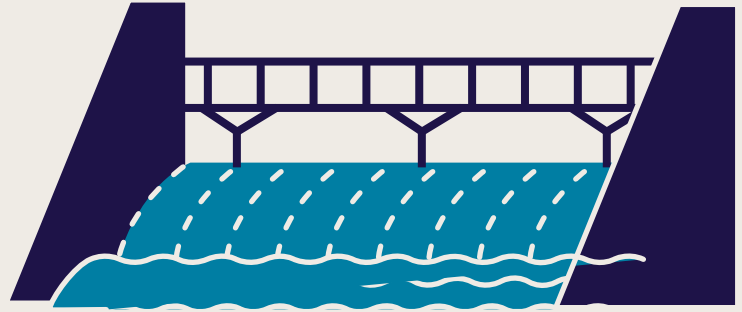
Microgrid (n.) a local grid that can integrate with clean energy sources such as solar and disconnect from the traditional grid to operate autonomously – providing cost savings, emergency backup and energy independence, along with sustainability

Energy storage solutions enable electrical energy to be converted and stored when there is oversupply and then re-deployed on demand.

The technology supports grid flexibility, reduces generation curtailment and helps to stabilise electrical networks that have intermittent renewable generation inputs

Hydropower

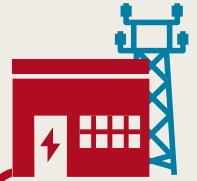
Hydropower comes in different forms: micro; small run-of-river; large; pumped; and tidal lagoon or offshore hydro



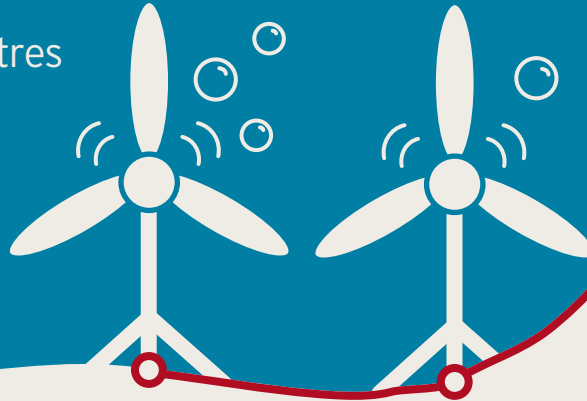
Comparatively low-cost and dependent on geographical features, small-scale hydro is ideal for community ownership⁶

'Run-of-river' installation doesn't interfere significantly with river flows⁷

Small-scale hydro requires a fast-running stream that drops over 20m⁸



- ⚡ 15 metres tall
- ⚡ blades 16 metres in diameter
- ⚡ nearly 200 tonnes⁹



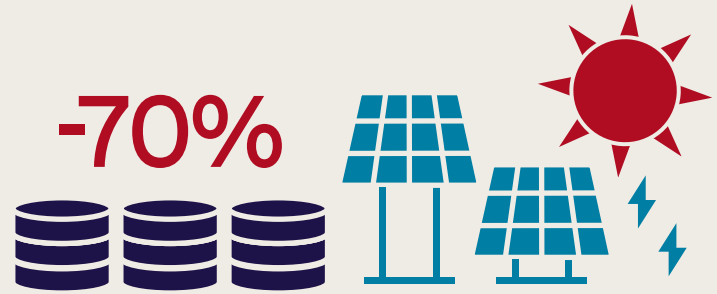
MeyGen tidal energy project in Pentland Firth, Scotland, is the world's first large-scale tidal energy scheme¹⁰

A tidal barrage has a long expected lifespan – more than 100 years

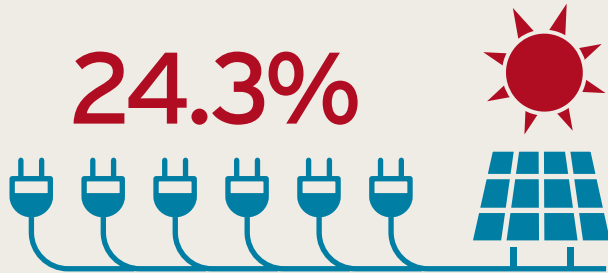


Solar Energy

The cost of solar power has come down by over 70% in less than a decade¹¹



In May 2017, the UK broke its solar power record, providing 8.7GW in half an hour, or 24.3% of demand¹²



24.3%

London-based solar energy leader Solarcentury's largest project in Latin America is in Valparaiso, Chile¹³

- ⚡ 40MWp
- ⚡ Over 120,000 solar modules
- ⚡ Could power approximately 21,600 homes

“Every day people recognise the overwhelming benefits solar offers, from cheap power to very real control over energy bills.”

- Paul Barwell, chief executive of the Solar Trade Association¹⁴



If just 1% of Earth's land mass were covered with wind turbines, they would generate the same amount of energy as all electricity plants in the world today¹⁵

¹ National Grid

² DONG Energy

³ Dong Energy

⁴ Suez Environnement and Suffolk County Council

⁵ GOV.UK

⁶ The Guardian

⁷ IEA Hydropower

⁸ TGV Hydro

^{9&10} The Guardian

¹¹ Solar Trade Association

¹² National Grid

¹³ EQ International

¹⁴ Solar Trade Association

¹⁵ World Energy Council



II. Barriers to Energy Union

Integrating diverse electricity markets would be a challenging objective from the technological, financial and market-regulation standpoints in any large region. In Europe, several additional factors unique to this region make the effort particularly difficult. This chapter discusses those obstacles.

Intra-EU political wrangling

Some of the biggest barriers are rooted in the nature of the European project itself. While the European Union sets energy rules at a supranational level, it must also deal with 28 national regulatory systems. These are heavily influenced by the different political concerns, previous energy investments and future energy requirements of each state.

One current example is the effort to find agreement among the key EU institutions—the Commission, the Parliament, and the Council of Energy Ministers—on a clean energy package. The proposal for this package, sometimes called the ‘Winter Package’, was released in November 2016, with a goal of reaching a final draft by the end of 2017. The package covers energy efficiency,



*Turbine Blade testing,
Offshore Renewable Energy Catapult*

energy governance, and design of electricity markets. The plan, however, has been delayed by politics—in particular, elections in the Netherlands, France, Germany and the UK, which have slowed down the legislative work, and raised questions about future transposition of the legislation into national laws.

Even existing EU legislation calling for competitive energy markets is only partially integrated into national laws. The result is that many European households still have little choice of energy supplier and face hefty bills. Around 9% of the expenditure of low-income European households goes towards energy costs. Not only has this proportion increased in most member states since 2005, but a growing percentage of these households (23% in 2015) do not have sufficient funds to heat their homes adequately.

Costly infrastructure upgrades

A further difficulty is that vital energy infrastructure is ageing in much of Europe. Upgrading those generating and transmission systems is a costly effort; the cost is

compounded by the need to connect with, and make optimal use of, “legacy” systems that differ from country to country in Europe. The cost is further increased by the need to build new facilities to accommodate introduction of more power from renewable energy sources.

An operator that wants to move electricity to a neighbouring but higher-price market often faces limits in the capacity of transmission system operators, says Manuel Baritaud, a senior analyst at the International Energy Agency (IEA) in Paris. “National transmission system operators... tend to focus on their own domestic footprint and on the integration of renewables in their own countries over optimising cross-border capacity for trading.”

Beyond encouraging TSOs to change their priorities, EU policy makers need to organise financing of transmission capacity upgrades. The costs involved are significant. For example, the cost of the proposed Biscay Gulf plan, which would link France and Spain by a subsea cable by 2020, is estimated at €1.9 billion. Similarly, NordLink is expected to cost between €1.5 and €2 billion.

The initial cost is not the only problem; calculating the time required for a return on investment is also a complex issue. That calculation depends in part on assumptions about future energy prices. “If you want to get the full picture regarding the economics of these projects, you have to bear in mind the price differentials between different countries in the market, and make reasonable assumptions regarding the evolution of gas prices and the likely future share of renewables in those countries. It’s the only way you can accurately weigh up the economic benefits of interconnectors versus the cost of building them,” says Mr Baritaud.

The nature of upgrades needed to transmission capacity differs across Europe. Large countries at the centre of Western Europe—France, Germany, and the Benelux countries—are already highly meshed and need to focus on more efficient use of existing interconnections.

Other nations have a more fundamental problem: limited interconnection capacity in southwest Europe, for example, prevents energy companies in Spain and Portugal from participating fully in the EU internal electricity market.



*'Doña Carmen' solar project,
La Ligua, Chile. Solarcentury*



Price fluctuations and renewables

The influx of power from renewable energy sources—a result of policies favouring renewable fuel sources—raises its own set of issues for cross-border energy trading. One of those issues was noted above: the additional specialised infrastructure needed to connect producers of such power—often operating multiple dispersed facilities rather than large central plants—to the grid. According to a July 2016 report prepared for the European Commission, “The entry of new variable energy sources and high-load consumption units in the distribution grid is likely to result in substantial new investments in grid infrastructure. Estimates suggest that...EU distribution system operators will face an additional cost of reinforcing distribution grids of approximately €11 billion yearly towards 2030.”⁴

Renewable fuels also contribute to gyrations in wholesale power prices, since supply of power from solar and wind sources is not as predictable as supply from, say gas- or coal-fired plants. Intermittent supply and resulting large

price fluctuations can work to the disadvantage of all market participants.

Moreover, once wind turbines and solar power arrays are paid for and in place, the power they produce is relatively inexpensive. As the proportion of power from renewables has risen, wholesale electricity prices in Europe have tumbled. At times, prices have even strayed into negative figures; for example, when a high level of generation from renewable sources coincides with low energy demand. “The clear aim over time is that renewable energy takes over responsibility for setting the price signal, a responsibility that is held by conventional power plants today,” says Mr Vogel.

Producers of power from renewable fuels argue that, in the long term, their presence in the market—together with better interconnections and a larger number of market participants—will help to stabilise production and consumption, and therefore stabilise prices.

4. https://ec.europa.eu/energy/sites/ener/files/documents/ce_vva_dso_final_report_vf.pdf

“The more participants there are and the bigger the deal volumes, the more we all experience the advantages,” says Thorsten Lenck, a senior associate at think tank Agora Energiewende (the latter word being the German for ‘energy transition’). But in the short term, large price fluctuations and a lower wholesale price related to introduction of renewables can hurt the business of traditional suppliers.

The Russian factor

Quite apart from the EU's internal issues, there is the matter of different national attitudes towards reliance on Russian natural gas for generating electricity. A major reason for announcing plans for an EU Energy Union in 2015 was to reduce Europe's dependence on Russian gas. Fears that Russia would use gas supply as a political weapon were heightened when Russia did exactly that during its conflict with Ukraine.

However, many European utilities are happy buyers of low-cost gas from Russian state-owned monopoly Gazprom, particularly for use in older plants. In 2016, Gazprom Export supplied 178.3 million cubic metres of gas to European countries, up 12% on 2015's 158.6 million cubic metres, according to company figures. This makes Russian gas a sensitive subject for the EU. Gazprom's Nord Stream 2 pipeline, which will connect Russia with Germany and help to lock-in the company's 50% share in the German gas market, did not even get a mention in the EU's second State of the Energy Union report, despite the potential of Russian gas to disrupt key Energy Union goals.



Brexit

It is still far from clear what the UK's departure from the EU will mean for its participation in the Energy Union. And it may take a while before the issue is clarified, as energy markets are not necessarily at the top of the priority lists of negotiators on both sides.

"The question for me on Brexit is really where does energy sit as a priority on the very long list of important issues that need to be negotiated," says Ronan O'Regan, a specialist in electricity market reform at management consultancy PricewaterhouseCoopers. "I'm not really sure that's been fully considered at this point."

At UK utilities company Centrica, director of regulation and strategy Paul Hallas says the UK should try to preserve as much as possible of the existing institutional arrangements for energy trading. He concedes, however, that once the UK leaves the EU, it will likely lose its place in the "inner circle" of policy making on future market development. The UK energy regulator OFGEM, he points out, is unlikely

to remain a full voting member of ACER, for example. The same applies to the National Grid's role in ENTSO-E. Both are key players in the energy union drive. "I guess we'd hope they'd still have some kind of observer status, that they'd still be in the room when Energy Union is discussed," says Mr Hallas.

The impact of Brexit on the Energy Union project itself involves too many unknowns to assess. The uncertainty it creates, however, must count as one of the obstacles to completion of the project.

III. The Outlook for Energy Union

Despite the many obstacles it faces on the route to Energy Union, Europe has a good chance to reach its integration objectives in the next two decades. Experts interviewed for this report point to several advantages pointing to a successful outcome, notably a political commitment to an efficient internal market and, more importantly, the fact that central Western Europe is already a de facto mini Energy Union. Indeed, Europe is well along the road to energy union—at least when compared to other regions. “In almost every respect, Europe has already gone much further in integrating its energy market than anywhere else I can think of,” says the IEA’s Manuel Baritaud.

In North America, for example, the US has successfully traded energy for years with Canada, its largest energy trading partner. US imports of Canadian electricity

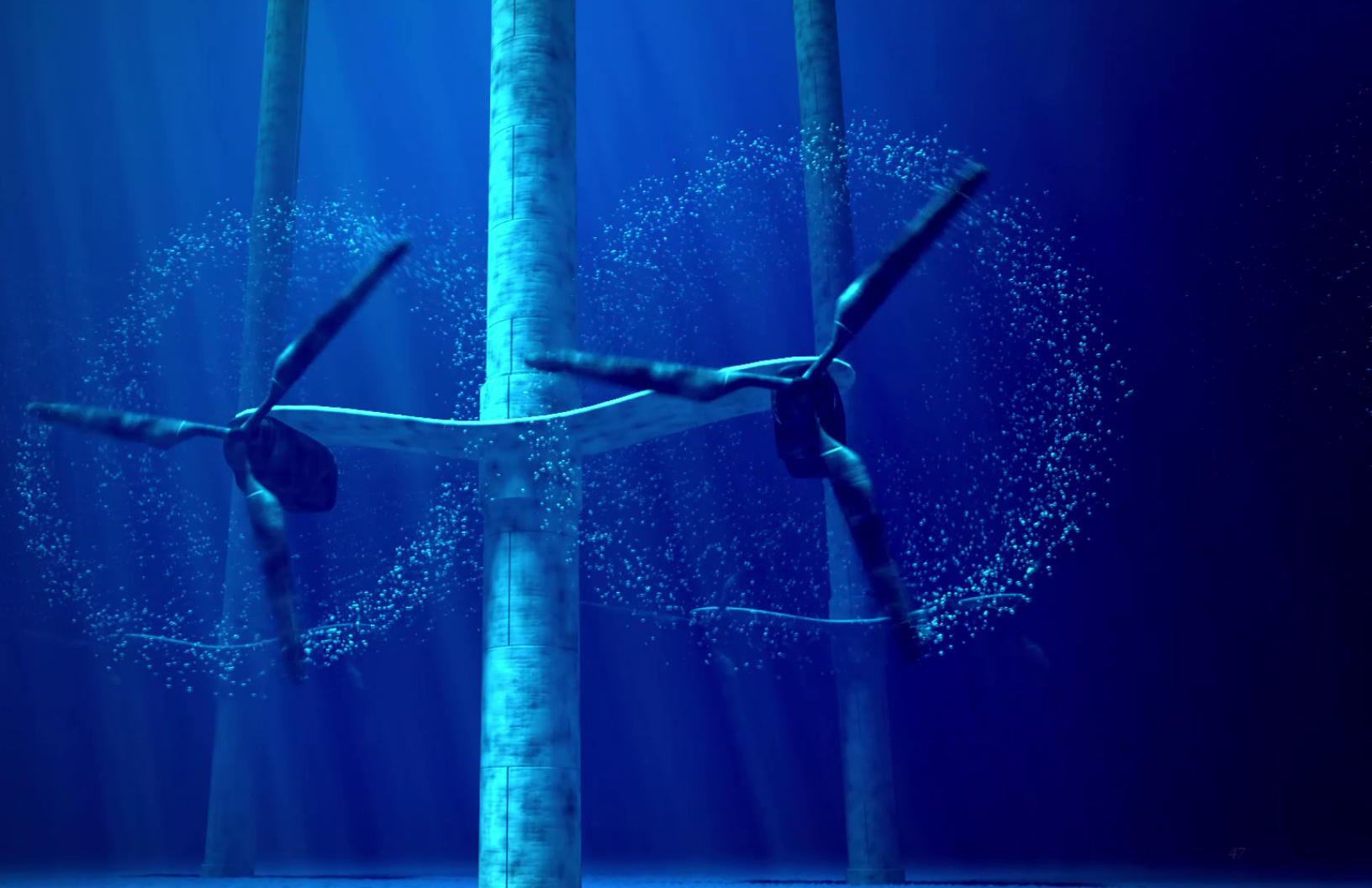
averaged around \$2.2 billion in 2015 and 2016, slightly down on previous years, according to the US Energy Information Authority (EIA). The transmission connections that link the two countries also play an important role in “electric system reliability” - but, by its very nature, this bilateral arrangement lacks a good deal of the multi-party complexity seen in Europe.

In Latin America, interconnections exist between Brazil, Argentina and Uruguay, but cross-border trade tends to take place in an ad hoc manner, in response to shortages and emergency situations, as dictated by governments that remain in control of utilities.

Europe is ahead of other regions attempting cross-border energy union in part due to EU-level efforts. Under EU prodding, some member states have already undertaken

a broad liberalisation of energy markets, although implementation is far from uniform. The internal energy market is, of course, only one part of the integration of EU markets in general, and that integration effort has not been matched on the same scale in other regions. “The European Commission has made it a mission to create a very closely integrated energy market and has taken a strong lead in terms of taking all the participants along with it in that direction,” Mr Baritaud says.

It also helps that Europe has a broad palette of energy generation sources, from solar in the south to hydropower in the north. “Unlike other parts of the world, different European countries have very different energy-generation mixes, so it makes a lot of sense to trade electricity between them,” Mr Baritaud adds.



To capitalise on these advantages, and improve chances of successful completion of the Energy Union, European policy makers should focus on some fundamental changes. These include:

- **Make supply security a supranational responsibility**

Security of electricity supply remains the responsibility of national governments, which in turn can lead to a proliferation of national strategies to ensure supply security. This does not promote closer integration, as different governments have differing interests related to energy—as noted above in the discussion of varying interest in willingness to continue relying on Russian gas. “After all, in an energy crisis, who’s going to get the blame from citizens for a major blackout? The government,” says Mr Baritaud, adding that this feature should be reconsidered.



Kilroot Advancion Energy Storage Array



- **Ensure equitable access**

An implicit part of energy union is a willingness to share scarce resources, such as transmission capacity, and implement mechanisms to ensure that this happens in a fair and equitable manner. This is a perennial challenge in Europe, and not one that is unique to energy markets. Nonetheless, “it will be very hard to reach agreement,” according to the IEA analyst.

- **Reduce network congestion**

Currently, much of the renewable energy collected in particularly windy or sunny conditions simply goes to waste. Better provision for storage of such power would help to ease the congestion that occurs on networks when wind turbines or solar panels are working at full tilt. Reducing congestion, in turn, would improve the functioning of the market for traded electricity.

Fortunately, storage facilities are becoming cheaper; used effectively, storage might reduce the need for costly new network infrastructure. Several storage

methods are under review. Pump hydro storage is one example. Another is chemical storage in batteries, although this option is currently too expensive in most situations and raises the final price of energy. However, that could change in the coming years, if new breakthroughs are achieved in Lithium-ion technologies or if new storage materials emerge.

- **Curtail demand**

Demand management can improve market efficiency by reducing large fluctuations in price. This involves reducing electricity demand by pricing energy higher during periods of high demand. This approach typically relies on smart grids and smart meters, in which Internet-connected sensors report on usage and demand patterns.

While the overall approach involved in time-variant pricing is relatively uncontroversial, some provisions of the draft Clean Energy Package related to demand management are contested by key industry players. Several sector membership bodies—including the European Federation of

Energy Traders (EFET), the Union of the Electricity Industry (EURELECTRIC), and the Association of European Energy Exchanges (Europex)—complain about provisions favouring aggregators (companies that bring retail energy customers together to obtain better prices, service or other benefits). “We welcome demand response, absolutely, but not necessarily demand response that promotes a particular kind of business—in this case, aggregators,” says Jerome Le Page, manager for European electricity markets at EFET. Such controversies cloud the outlook for swift adoption of demand-management provisions that could aid development of an efficient market in traded energy.

- **Update network codes**

Continued development of network codes—rules governing cross-border electricity market transactions and system operations—is clearly crucial for a unified, well-functioning Energy Union. Much of this development work is being done by the NEMO (‘Nominated Electricity Market Operators’) Committee, comprising representatives of



Solar panel installation

Europe's spot exchanges. The committee is working on rules and technical standards to support efficient intra-day and day-ahead market coupling in Europe. The committee's work is crucial because, without updates, "there's a risk we're locking ourselves into a legacy arrangement that is not readily adaptable to future developments, be they new technologies, more distributed energy resources or renewables," says its chairman, Andrew Claxton.

In particular, the existing codes were designed at a time when power generation was focused on fossil fuels, and was "much more predictable and located in different locations from where the new [plants are] located," Mr Claxton explains. The new network codes need to institutionalise greater flexibility regarding price fluctuations, supply intermittency, and new market players. However, while updated network codes may provide a more hospitable environment for new players dealing in renewable fuel sources, they may prove controversial for more established market players.

- **Integrate new market players**

The institutions and rules governing a Europe-wide electricity market will also need to adapt to and integrate new direct participants in electricity markets. One of the relatively new types of participant was discussed above: aggregators, who attempt to secure better deals for groups of energy users than the users could secure for themselves individually. Another type of new market player is 'prosumers', entities that produce and consume their own electricity. Prosumers can be large-scale industrial producers of energy used in their own factories, or individuals with rooftop solar panels. In both cases, the result is less demand for energy from the grid. That, in turn, reduces the revenues of grid operators—who nonetheless are called upon to invest in transmission infrastructure to meet future requirements.

The risk for development of a Europe-wide energy market is that infrastructure investments could be held back by grid operators who are uncertain about future demand

for their services. Traditional consumers who do not produce their own power could end up footing more of the bill as other consumers leave the grid to produce their own power. Correctly assessing the demand impact of 'prosumers' and planning infrastructure capacity accordingly, to avoid overburdening the customers remaining on the grid, will prove an ever more complex problem as more users leave the grid.

- **Figure in new forms of electrification**

Planners and grid managers trying to forecast future demand must include new uses of electricity in their calculations—making the exercise that much more complex. For example, the growing use of electric vehicles in parts of Europe—particularly where such use is subsidised by governments—will add to demands on power generation and transmission infrastructure. The use of heat pumps to provide space heating, cooling and hot water will do the same. Even the smart, connected devices associated with regulating consumption, such as smart meters, use electricity. All these new consumption sources will need to be taken into account in assessing infrastructure needs and devising rules to govern the marketplace fairly.

“The whole electricity system in Europe has changed enormously in the past 15 years, really dramatically, and I expect it to change enormously over the next 15 years, too,” says Mr. Claxton. The impact of new market participants, new technologies and new consumption patterns will be difficult to quantify. Getting those

calculation right, however, is necessary to support accurate infrastructure planning—an essential element of a well-functioning unified electricity market.

Conclusion

As this report shows, a great deal remains to be done to turn the vision of Energy Union into reality. The EU has set out a blueprint and announced a commitment, but the road ahead is a long one. When Mr Sefcovic described 2017 as a “year of implementation” in February 2017, he was referring to a regulatory and legislative “to do” list, not necessarily to the building of physical infrastructure to ensure a well-functioning market.

Upgrading the physical infrastructure, however, poses a large barrier, as the costs involved are enormous. Agreeing on regulatory codes and standards will also require a major effort. Adapting both the physical infrastructure and the market rules to accommodate the influx of power from renewable sources is a further challenge, as is accommodating the emergence of new types of market players. All these efforts are being made against

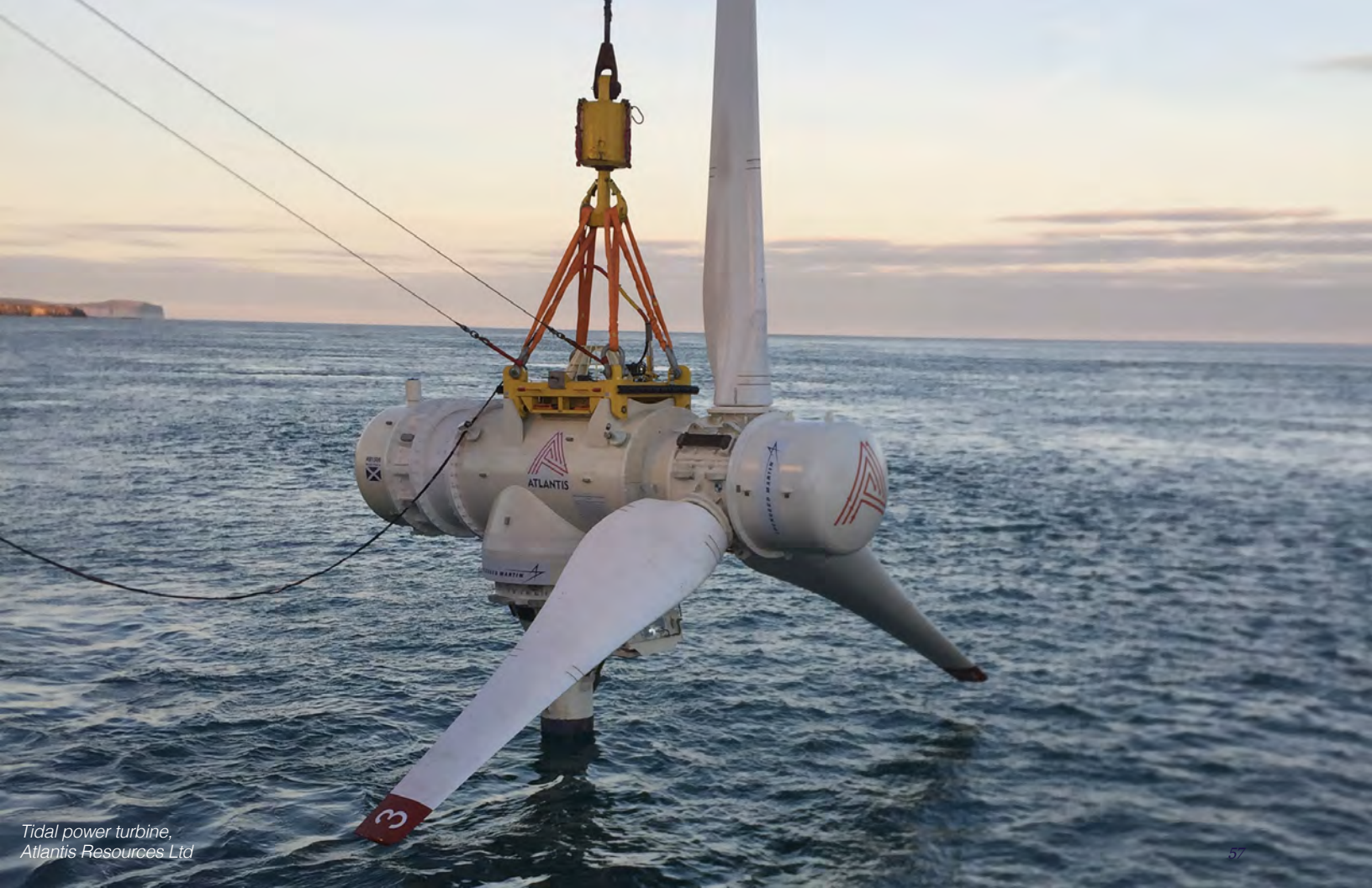
a background of political disagreements—both within the EU and involving relations with non-EU powers—which complicate the process of reaching agreement on the many elements of Energy Union.

Within the EU, progress toward integrating energy markets has been uneven. Energy buyers and sellers in France, Germany and the Benelux countries already benefit from a relatively high degree of energy market integration. Market participants in Italy, Portugal and the Balkans are considerably more isolated in national or sub-national electricity-trading 'islands'. A truly integrated market would build on the existing core of cross-border integration to include countries currently living in energy isolation. That integration will likely require considerable investment, for which financing will need to be found. Investments in energy storage, smart grids and smart meters will likely add to the expense; the task is to ensure that the investments bring positive returns within a reasonable period.

In Europe's democracies, consumers will be particularly

focused on what energy union means for them financially. They have reason to be sceptical: According to the European Commission, once network charges and various taxes and levies are figured in, EU electricity retail prices have risen by about 3% per year since 2008, despite a fall in wholesale prices.⁵ In part this is because households are paying for energy company investments in renewables though various taxes and levies. Yet the promise of energy union is that it will enable greater competition, so that the most efficient power supplier will win markets. For this project to gain the popular support it needs, it will have to deliver on that promise.

It is still too early to say whether policy makers and market participants will be able to design a continent-wide electricity market that benefits consumers and industrial users. The encouraging signs are there: a political will at EU and national level, development of institutions to work on common rules and standards, and a core of countries in central West Europe which have already effectively integrated their energy markets. On the other hand, the



Tidal power turbine,
Atlantis Resources Ltd

challenges related to unifying electricity markets continent-wide remain considerable. If European leaders can build on successes achieved so far, the rewards for energy users across the continent could be substantial. Given its head-start in Energy Union compared to other regions, and its commitment to the project, Europe has a good chance to reach its energy integration objectives over the next decades. period.

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5. <https://ec.europa.eu/energy/en/data-analysis/market-analys>

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