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ELECTRICITY FOR EUROPE

FORGING A JOINT COMMITMENT TO SUSTAINABLE AND COST-EFFICIENT ENERGY TRANSITION IN EUROPE

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Foreword: a brighter energy future for Europe

European electricity prices are rising fast. As a result, the overall increase in energy expenditure is putting mounting pressure on residential end-users and undermining the competitiveness of European industry. The implementation of the energy transition has so far lacked optimisation on a pan-European scale. Without a concerted effort to more effectively manage the costs of the energy transition, expenditure on electricity and gas in 2030 could be 50 percent higher than it is today.

A step-change in the reshaping of the European energy system is urgently needed— by reconfirming the European power sector's support for Europe's sustainability agenda through an optimised approach that avoids unnecessary costs. Doing so would put significant benefits within reach: our analysis shows that implementing an integrated set of levers could generate net savings of €27 to €81 billion per year by 2030. Such savings could be achieved by further integrating energy markets and the supporting regulatory framework at a European level and by leveraging flexibility throughout the electricity value chain — provided utilities, governments, regulators and consumers can forge a joint commitment to work together.

"The restructuring of the European electricity system will have to be carried out cost-effectively if we are to gain the support and trust of energy consumers. This study shows that, with the right policies in place, the energy transition could cost each European citizen over €100 less a year than if we continue with business as usual."

Hans ten BERGE
Secretary General. Union of the Electricity Industry – EURELECTRIC

This report summarises our analysis and points the way forward.

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A new EU energy landscape takes shape

The European energy landscape is being transformed through a combination of decarbonisation, liberalisation and security of supply policies. The EU has made a unilateral commitment for 2020 that should see greenhouse gas emissions reduced by 20 percent compared to 1990 levels. The drive for economic competitiveness is well advanced, with the first and second liberalisation directives now transposed into national law by all Member States, and the 3rd Energy Package currently being implemented. And since 2000, security of supply has significantly improved, with the EU now aiming to reduce fossil energy imports by 26 percent by 2020, as well as cutting energy consumption by almost 15 percent. The Commission's proposal for the 2030 Energy and Climate goals show that the 2020 agenda is only a first step in a long-term transition process.

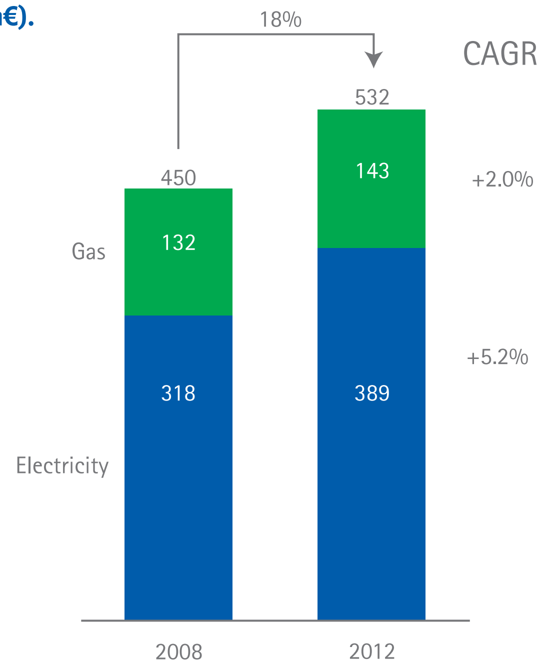
The link between policymaking and rising energy expenditure

However, against this backdrop, there has been an escalation in expenditure on electricity and gas across Europe[1]. Energy expenditure[2] has surged more than 18 percent since 2008 (from €450bn to €532bn), with electricity accounting for most of this increase (see Figure 1).

Rising prices were responsible for 96 percent of the €71bn increase in electricity expenditure between 2008 and 2012, while the volumes consumed were largely stable. And our analysis confirms that these price rises are being increasingly driven by charges for renewables support (Figure 2).[3] In contrast, the costs of supplying electricity have remained relatively stable since 2009.

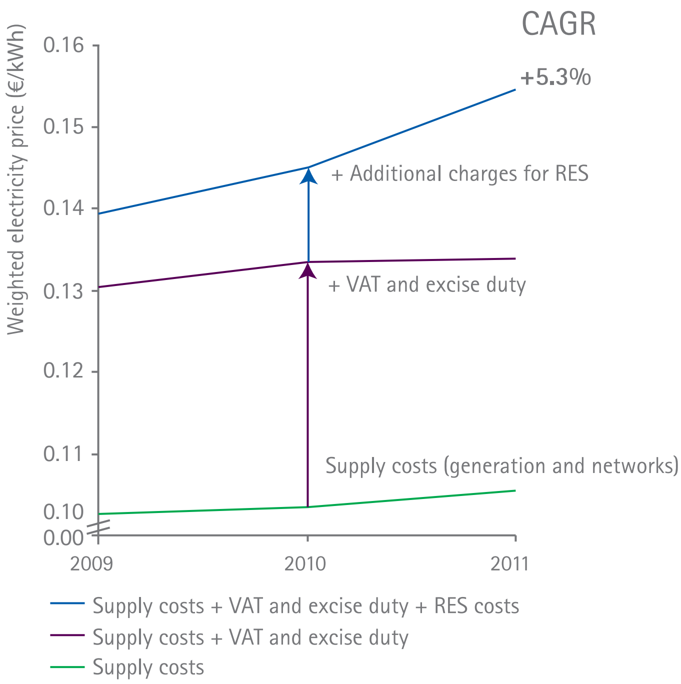
1 Our research covered France, Germany, Italy, the Netherlands, Poland, Spain, Sweden and the United Kingdom.
2 In the context of our research, energy expenditure = energy prices x volume consumed.
3 Although these charges currently may be a relatively small part of the total price, they are the fastest growing component.

Figure 1. Electricity and gas expenditure 2008-2012 (bn€).



Sources: "Energy statistics - quantities, annual data," © Eurostat, European Commission, June 2013, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/nrg_quant_esms.htm; Accenture analysis.

Figure 2. Weighted average electricity prices by component (2009-2011)*.

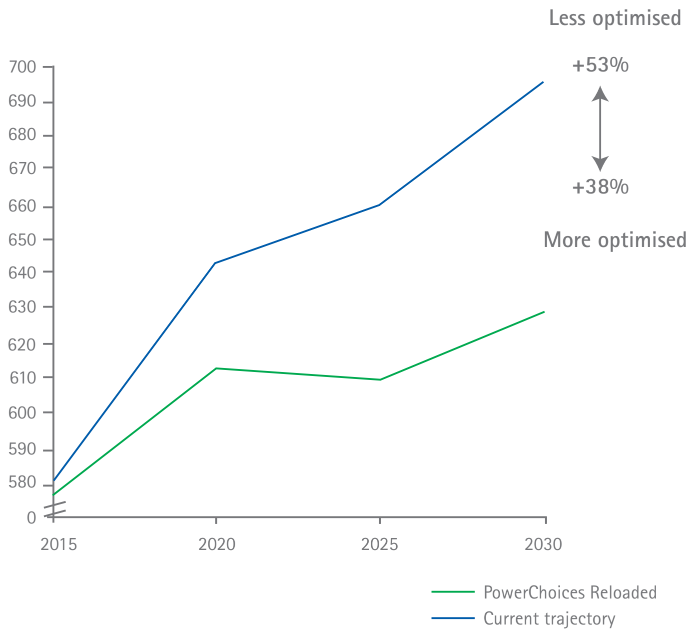


*The weighted price represents the average costs over different user categories, weighted by their relative consumption. The renewable energy costs represent the total costs for supporting renewables in the country distributed evenly over total consumption.

Sources: "Energy statistics - quantities, annual data," © Eurostat, European Commission, June 2013, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/nrg_quant_esms.htm; "Status Review of Renewable and Energy Efficiency Support Schemes in Europe", 25 June 2013, Council of European Energy Regulators, http://www.ceer.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_PAPERS/Electricity/Tab2/C12-SDE-33-03_RES%20SR_25%20June%202013%20revised%20publication.pdf; Accenture analysis.

The rises in electricity and gas expenditure in recent years have exceeded those in optimised scenarios, such as EURELECTRIC's 2013 analysis, *PowerChoices Reloaded*[4]. And this is just the beginning. Without addressing the barriers to meet the agreed decarbonisation objective in a cost-effective manner, our analysis shows that expenditure on electricity and gas in 2030 could be approximately 38 to 53 percent higher in Europe than it is today[5], depending on the level of optimisation achieved (see Figure 3).

Figure 3. Electricity and gas expenditure 2010-2030 (bn€ in 2005 monetary value) projection – optimisation scenario.



Sources: "Energy statistics - quantities, annual data," © Eurostat, European Commission, June 2013, http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/EN/nrg_quant_esms.htm; "Power Choices Reloaded: Europe's Lost Decade," © EURELECTRIC, May 2013, http://www.eurelectric.org/media/79057/power_choices_2013_final-2013-030-0353-01-e.pdf; Accenture analysis.

Households: increasing affordability issues

Without action to ensure policies are more cost-effective, the already considerable effect of these price rises on consumers is set to escalate. For European households, the average share of disposable income spent on electricity rose to 3.3 percent in 2012[6] (up from 1.4 percent in 2008), and our projections indicate this could go as high as 4.7 percent by 2030.

There is no mistaking the evidence that market liberalisation has helped limit price increases by introducing greater competition in generation and retail, and through market coupling and cross-border interconnection. However, because residential energy prices have been increasing against a backdrop of falling disposable incomes, the share of customers said to have difficulty paying their energy bill continues to rise in many countries (currently ranging from 2 percent in the Netherlands to up to 15 percent in Germany[7]). With the projected rises in prices, this pressure on consumers is likely to increase.

4 "Power Choices Reloaded: Europe's Lost Decade," © EURELECTRIC, May 2013, http://www.eurelectric.org/media/79057/power_choices_2013_final-2013-030-0353-01-e.pdf.

5 This scenario is based on the 'Lost-decade' scenario of the *PowerChoices Reloaded* study, characterised by a difficult financial climate and an absence of strong climate action, policy or targets, resulting in a loss of momentum in the period to 2030.

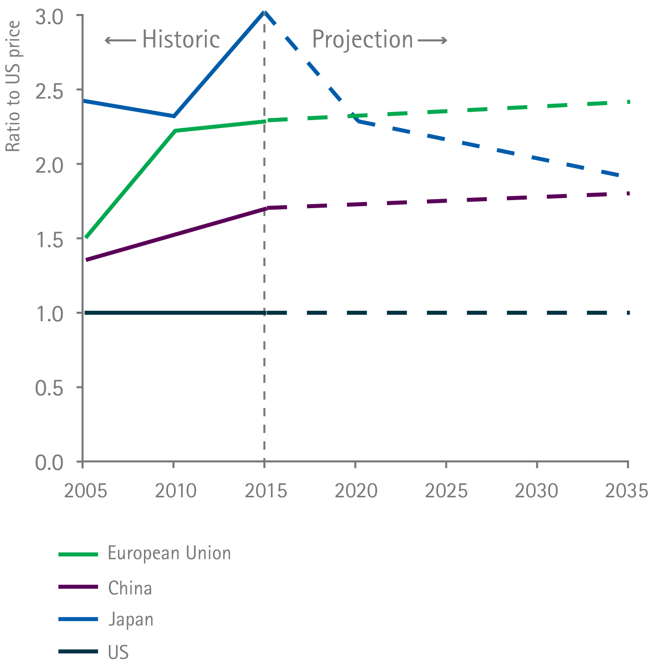
6 There are significant differences between countries. Italian households spent 2.7% of disposable income on energy in 2012, on average, while for households in Spain this was as much as 4.4%.

7 Directive 2009/72 mandates Member States to define the concept of vulnerable customers, which may refer to energy poverty. Therefore, the definitions of consumers with difficulty to meet energy bills or living in energy poverty differ by country.

Industry: increasing competitive pressure

Meanwhile, as the gap in electricity and gas prices between Europe and the United States keeps growing (see Figure 4), European industry is coming under increasing competitive pressure. In 2012, industrial users in Europe were paying more than twice as much for their electricity as their counterparts in the United States. The differences in gas prices were mainly the result of the plunge in wholesale gas prices in the United States due to soaring shale gas production, but differences in taxation also affect the relative price levels[8]. And according to current projections, by 2035 they will be paying closer to 2.5 times more. This could have significant long-term implications for industry in Europe.

Figure 4. Ratio of European Union, Japanese and Chinese to US industrial electricity prices, including taxes.



Sources: "Energy Prices and Taxes - Second Quarter 2013", © OECD/IEA, 2013, http://www.oecd-ilibrary.org/energy/energy-prices-and-taxes/volume-2013/issue-2_energy_tax-v2013-2-en;jsessionid=56214oslanmd9.x-oecd-live-01; "World Energy Outlook 2013", © OECD/IEA, 2013, http://www.worldenergyoutlook.org/.

8 By mid-2012, pre-tax gas prices in Europe were close to five times higher than in the United States and prices in Japan were over seven times higher. This trend is explained primarily by the surge in US shale gas coupled with a historically mild winter, which has boosted overall gas availability and driven prices down to historically low levels.("World Energy Outlook 2013", © OECD/IEA, 2013, http://www.worldenergyoutlook.org/).

Core issue: reaching a tipping point

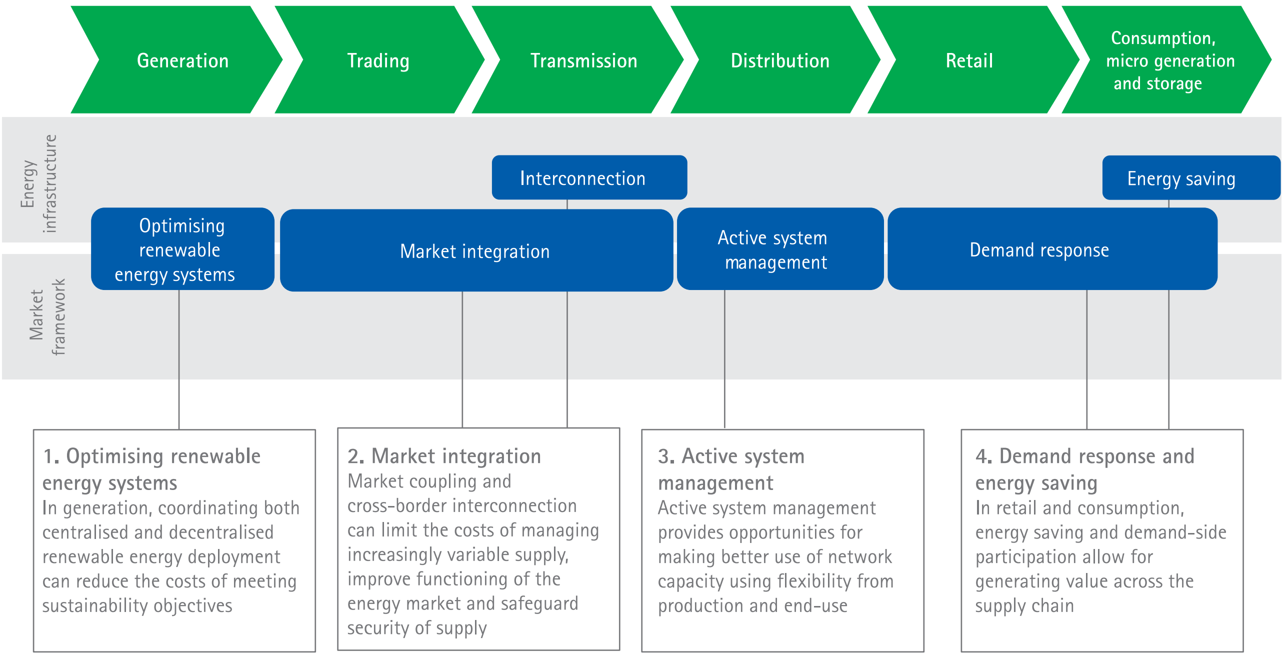
How did we get to this point? First and foremost among the causes is the **patchwork of national regulation** that has led to limited optimisation across Europe. Other reasons include slower cost reductions of some new energy technologies than originally predicted, and energy efficiency being less rapidly and less widely implemented than expected.

As the regulatory patchwork unnecessarily adds to the costs of the transition, a critical evaluation of the energy transition is required; not to question the ambitious objective, but to identify options for a more cost-effective transition pathway to reach the objective. Our research shows that energy expenditure could be stabilised from 2020 onwards (as shown in Figure 3), if we move towards pan-European optimisation of the energy system. This would be hugely beneficial for Europe's households and industry: total expenditure on electricity and gas would reach €629bn in 2030 – 10 percent lower than without such action.

European-wide integration: the key to an energy-efficient transition

What can be done to optimise the energy system? Our analysis shows that the solution to achieving a more cost-efficient energy transition lies in implementing an integrated set of levers across the electricity value chain — from generation, trading, transmission and distribution through to retail and consumption (see Figure 5).

Figure 5. An integrated set of levers across the electricity value chain.



Source: Accenture analysis.

Methodology

The quantitative analysis was based on three components. First, the baseline was taken from the *PowerChoices Reloaded* scenario undertaken by EURELECTRIC in 2013. From this work, the analysis was confined to eight countries: France, Germany, Italy, the Netherlands, Poland, Spain, Sweden and the United Kingdom. The baseline scenario already includes a significant amount of cost control and optimisation in its assumptions and remains a challenging target.

For the building blocks used in this study (see Figure 5), we focused on the electricity system, as rising electricity prices are the major driver of the increase in European energy expenditure. However, many of the measures are equally relevant for the European gas market. These building blocks are all considered to be solutions that could provide optimisation of the European electricity system beyond that envisaged in *PowerChoices Reloaded*. The sources for the value of the building blocks were a combination of published studies; primarily, though not exclusively, EU Commission-funded studies, plus additional analysis by Accenture.

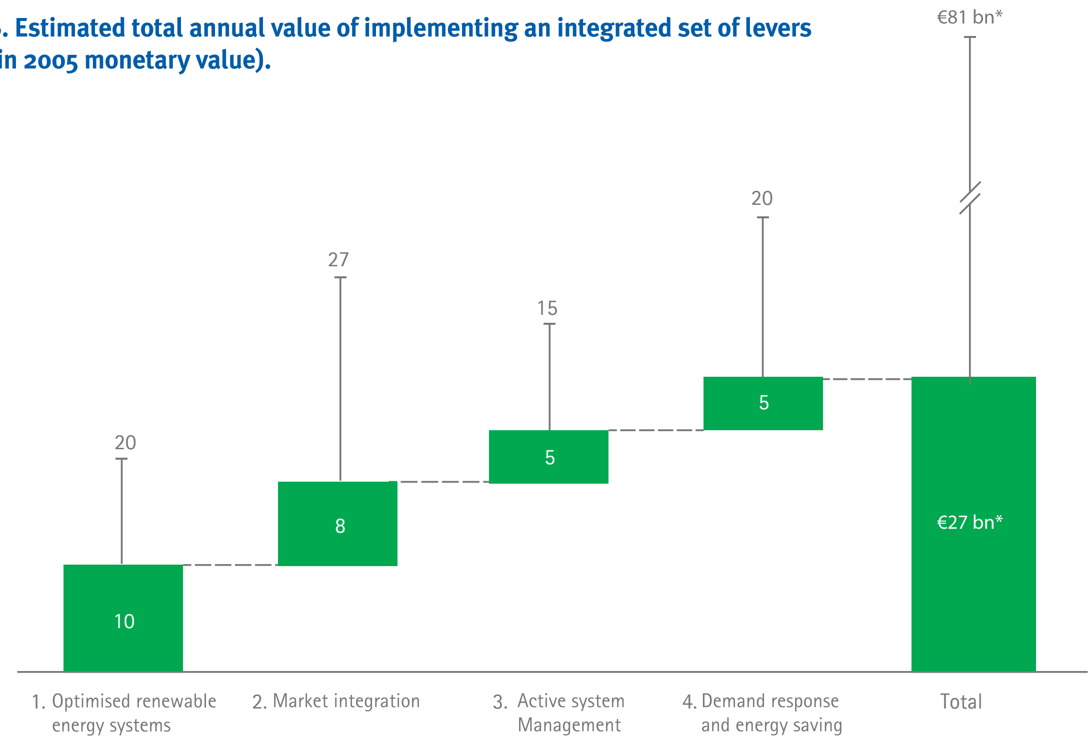
Given the wide breadth of the analysis with many source studies and the significant interaction between different components of the system, there is a large degree of uncertainty in the costs and benefits of the building blocks. High and low cases were developed for building blocks wherever possible, using ranges from published studies plus Accenture analysis. A significant number of newly enabled value areas from system optimisation have not been assessed, such as new business models and further operational cost control from increased system data and from greater competitive pressures across a more integrated European electricity system. As such, the analysis as a whole is expected to err on the conservative side.

Comprehensive implementation of all levers would first of all reduce the costs of energy transition. Moreover, with a coordinated, and collaborative commitment from utilities, governments and regulators, as well as engagement from consumers, it would help Europe achieve a better balance between its energy policy objectives of competitiveness, sustainability and security of supply.

Shown in Figure 5, these levers can be summarised as follows:

1. **Optimising renewable energy systems:** In generation, the coordination of renewable energy deployments could significantly reduce the costs by ensuring that new capacity is in the optimal location and most appropriate mix to optimise load factors and integration costs, irrespective of national boundaries. This coordination could be achieved through a stable and meaningful value for CO_2, gradually taking over from national renewables support schemes.
2. **Market integration:** Across trading and transmission, market integration and increased cross-border interconnection could limit the costs of managing increasingly variable supply, improve the functioning of the energy market, and better safeguard security of supply.
3. **Active system management:** In distribution, active system management—using flexibility from production and end use—provides new opportunities for making better use of generation and network capacity and reducing the costs of integration of distributed generation.
4. **Demand response and energy saving:** Across retail and consumption, energy saving and demand-side participation to reduce peak demand could enable value to be generated throughout the supply chain.

Figure 6. Estimated total annual value of implementing an integrated set of levers (bn€05 in 2005 monetary value).



* The green bars are the bottom of the range, and therefore represent a conservative estimate. In total, the set of value levers could generate a value of €27 to €81 billion relative to the PowerChoices Reloaded scenario. All blocks refer to electricity only.

Sources: "Power Choices Reloaded: Europe's Lost Decade," © EURELECTRIC, May 2013, http://www.eurelectric.org/media/79057/power_choices_2013_final-2013-030-0353-01-e.pdf; Accenture analysis.

Opportunities exist for generating additional cost savings from existing measures (such as end-use efficiency), as well as from potential new value pockets and new retail business models. Recognising the interdependency of these levers and implementing them in an integrated, comprehensive manner is essential. Taking this approach, we estimate that this could generate net savings of €27- €81bn per annum (see Figure 6). As shown, better-integrated markets and optimisation of renewables deployment constitute the largest opportunities for reducing the costs of energy transition in Europe. Without an integrated approach to implementation, however, the level of optimisation that could be achieved would be significantly reduced.

Focusing on sources of value in key areas of the value chain

1. Optimising renewable energy systems

The growth of national renewables targets and support mechanisms has helped drive renewables growth. But this has come at a significant cost to consumers. The costs of the new renewables capacity have been higher than they might have been, as this national approach has created some skewed investment signals. There are two main reasons for this: (i) limited, or no, responsibility on the part of renewables generators for integration costs, and (ii) poor locational signals across countries, which have resulted in reduced generation load factors. The solution lies in the coordination of the location and mix of renewables and their integration into efficient European electricity markets. This could be achieved by aligning national support systems in the short term while **gradually exposing renewables to the electricity market**, increasing the effectiveness of the EU Emissions Trading System in supporting renewables through **a meaningful, and stable carbon price**; exposing renewables generators to the costs of operational integration; and allowing **full target sharing for renewables** across the EU to ensure that investment moves to the optimal location and deployment reflects the local availability of sun, wind and other renewable resources. Regulators and policymakers should consider these elements in shaping the policy and regulation supporting the energy transition, through dialogue with the energy industry and other stakeholders, with a reliable, long-term carbon price gradually replacing national renewables support schemes.

2. Market integration

Efficient optimisation of the European electricity system is currently hampered by national boundaries to markets and transmission systems. Although considerable progress has been achieved through market coupling, this falls short of the potential cost savings that could be realised from full **market integration**. Recognising that progress is already being made at the EU level, the increasing expenditure on energy calls for faster progress. The solution lies in keeping the momentum, and accelerating the development of fully integrated electricity markets to enable optimisation of short- and long-term trading of energy and ancillary services, as well as providing stronger locational signals for new capacity investment. To achieve this outcome, significant barriers will need to be overcome, with Government leaders being reassured that these integrated markets would be effective in delivering security of supply. To support this move towards integrated markets, it will be necessary to increase the level of interconnection across current markets, particularly through timely implementation of the roughly 52,300 km of extra high voltage power lines needed to address grid bottlenecks, as identified in the 2012 Ten Year Network Development Plan produced by ENTSO-E[9].

9 "Ten Year Network Development Plan 2012 © ENTSO-E, 2012. https://www.entsoe.eu/major-projects/ten-year-network-development-plan/tyndp-2012/

3. Active system management

Distribution systems, while decisive for the efficient integration of renewable energy sources, will face significant challenges over the next 20 years, from ageing assets, new distributed generation capacity and increasing consumer expectations. The growth of distributed generation (DG), in particular, places significant financial and technical stresses on distribution networks. Already, DG projects are being delayed by the unavailability of firm capacity caused by a lack of hosting capacity on the grid. The solution lies in the move to an active system management approach for distribution networks with investments required in areas such as smart metering, network monitoring, improved grid operational controls and enhanced analytics, representing an important part of the €400 billion investment needed in Europe's distribution networks to 2020[10]. Active system management acts as a key enabler of other measures, allowing a move away from the traditional *fit-and-forget* approach of addressing congestion by investing in more copper, towards an optimised and cost-effective network in which capacity is managed closer to real time, making better use of existing assets. There are a number of important capabilities within active system management, including increasing flexibility to improve DG integration, improving locational signals for new DG, enhancing asset management, and creating a more active distribution system management. More intelligence in network assets is a key enabler to accomplish this. Examples include the use of power electronics in the form of distribution STATCOMs and current fault limiters to provide the rapid voltage response required to manage a greater proportion of distributed resources.

Leveraging DG operational flexibility and consumer demand flexibility to enhance the carrying capacity of distribution networks could significantly reduce integration costs and speed up DG deployments. There are a number of ways this could be achieved. Remote operation of DG output would defer reinforcement and allow optimal use of existing grid capacity. Similarly, customer demand flexibility could be used to lower the total cost of integrating new DG, and distributed storage could be used to provide energy that would also lower the cost of DG integration, and provide local ancillary services such as voltage control through DG power electronics configuration.

10 "Power Distribution in Europe. Facts & Figures," © EURELECTRIC, 2013. http://www.eurelectric.org/media/113155/dso_report-web_final-2013-030-0764-01-e.pdf

Additional challenges remain. Within certain limits, most distribution companies are currently obliged to accept any new DG onto the network and guarantee sufficient network capacity to accommodate the loads of end users. This can place a significant burden on consumers, in terms of reinforcement or additional distribution losses. The solution lies in optimising new DG locations, by **providing locational and time-based signals for new DG and loads** that take account of the implications for reinforcement and operating costs across all voltage levels of the distribution network.

Improved asset management is another high-priority objective for active system management. At present, ageing assets and increasing network complexity from distributed resources demand a renewed surge of investment by distribution companies, as well as put pressure on the reliability and quality of supply. By introducing sophisticated analytics capabilities, remote monitoring of equipment condition and real-time load measurement, companies could realise a step-change in their understanding of loads and stresses on components throughout the distribution system. By increasing asset life and utilisation, this would defer the need for replacement and/or reinforcement, as well as reduce the need for field personnel to check asset status.

Improved distribution network operations, a key element in active system management, would address two existing problems. First, field operations in distribution businesses are constrained by a lack of real-time information and reliance on paper-based solutions. Combined with existing datasets, the use of smart technology could help field operations. For example, the process to identify, isolate, repair and re-energise faulted circuits can be speeded up considerably, resulting in fewer truck rolls and faster supply restoration for customers. Second, by leveraging vastly improved network data and targeted network control capabilities, smart network operations could significantly improve network utilisation, reliability and quality of supply.

To realise the value of these levers, regulators would need to create a framework that allows for a more active way of managing the grid. In coordination, network operators could continue their efforts to improve existing assets and operations and explore new approaches of leveraging the flexibility of supply and demand.

4. Demand response and energy saving

In the built environment, progress on energy savings through efficiency and conservation is currently lagging due to factors such as lack of awareness or information, limited options for accessing the upfront investment needed and various market barriers. The commercial (tertiary)—services sector faces additional challenges. Because energy is a relatively small component of the total price of products, there is lower incentive to achieve energy efficiency. The progressive removal of barriers to energy efficiency could provide consumers with easier, cheaper ways to reduce energy usage[11]. Options here include improving usage data through smart metering and in-home devices, as well as providing support for **new business models** that could increase incentives for energy management and enhance customer experience, along with new financing mechanisms that would enable energy-efficiency investment and new ecosystems of different market participants (e.g. building insulation, appliance improvements and fuel substitution).

The electricity system has traditionally been designed to meet capacity requirements. As a result, peak demand is a major driver of overall costs. The European Commission estimates that peak load in Europe could be reduced by approximately 10% through demand response[12]. Achieving this flattening of the load shape by moving some peak demand could significantly reduce costs and improve system reliability, for instance through conventional batteries, plug-in electric vehicles, flow batteries and compressed energy storage.

New sources of demand response could provide a range of services – from ancillary services such as load regulation (secondary frequency response) to load-following services and unit commitment and capacity services, as well as services for providing capacity and energy. Utility companies – with a supportive policy framework – could spur a wave of innovative offers centred on **demand flexibility**, which could be used to enhance the most appropriate parts of the system, whether distribution, transmission, DG or grid-connected generation. And, when economically attractive to do so, these solutions could be extended to incorporate extra flexibility of storage, for instance through conventional batteries, plug-in electric vehicles, flow batteries and compressed energy storage.

Even though they do not change the load shape, investments made to improve the general efficiency of buildings and appliances reduce both total electricity demand and peak capacity requirements. However, end users currently only benefit from paying less for energy, while the system-wide benefits are socialised over all energy users. Innovative demand-response mechanisms would enable verified efficiency improvements to apply for **capacity payments**, as well as calculate the demand reduction for appliance upgrades such as heating, ventilation and air-conditioning (HVAC) units. This way, consumers would see more of the value of their actions to the overall energy system. Such mechanisms could be bundled with support for investing in energy efficiency, netting off the longer-term capacity value from upfront investment.

There is much that the energy industry could do to realise the value of these levers, especially by developing new business models beyond the traditional commodity offering. This means potential new products and services, as well as giving customers more choice through flexible arrangements, using different ways of interacting to connect to clients in the way they expect. New entrants from outside the industry could also pick up this role.

11 The European Data Base on Energy Saving Potentials indicates that the economic potential for reducing electricity use in European households could be 8%-13% to total consumption in 2020. ("Data Base on Energy Saving Potentials," © Enerdata et al., 2014. http://www.eepotential.eu/esd.php)

12 "Incorporating demand side flexibility, in particular demand response, in electricity markets," © European Commission, 2013. http://ec.europa.eu/energy/gas_electricity/doc/com_2013_public_intervention_swd07_en.pdf

Call for action: an urgent need for a joint agenda to optimise the energy system across Europe

Stakeholders from all sides, including policymakers, consumer organisations, industry and the energy sector, have recognised the major impact of the rising energy expenditure on Europe's households and industry, and all share a sense of urgency about the issue. Still, we see a considerable gap between awareness and action.

Going beyond shared recognition, all partners need to work together towards the common goal and on a pan-European basis, reaching across country boundaries. The energy sector, policymakers and regulators, consumer representatives, industrial players, and environmental groups need to bridge their differences.

With this cooperative mindset, utilities can underline their commitment to securing an effective, efficient energy transition by focusing greater effort on the distribution, retail and consumption end of the value chain—whether through partnerships with each other, policymakers and regulators or with end users, as well as through innovative forms of collaboration with other sectors.

Although there has been considerable progress in addressing interconnectivity through the regulatory framework, the optimisation of generation, trading and transmission will be accelerated if there is constructive dialogue between utilities and regulators around European-wide market integration.

The success of our approach hinges on a genuine commitment to move forward together to develop a joint agenda for change, with efforts focused on key value levers across the full electricity value chain. The electricity industry will benefit – and so will Europe.

This document is produced by consultants at Accenture and by EURELECTRIC as general guidance. It is not intended to provide specific advice on your circumstances. If you require advice or further details on any matters referred to, please contact your Accenture or EURELECTRIC representatives.

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