Energy Journal

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Europe: what energy future?

A magazine about energy and more by CESI

Energy Journal
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Editorial coordination
Paolo Chighine / *Cesi*
Agnese Bertello / *Allea*

Art direction
Gianluca Barbero / *AlleaDesign*

Translations
Aaron Maines

CESI
Shaping a Better Energy Future

via Rubattino, 54
I-20134 milan – Italy
info@cesi.It
www.cesi.It

Editorial

Salvatore Machì / *Chairman, CESI*
Matteo Codazzi / *CEO, CESI*

> “Two decades have passed since the Kyoto Protocol was ratified. Since then, the theme of sustainability has become an even stronger policymaking priority for most countries in the world. It is a global challenge but Europe took the lead in this transition, attempting to transform it into an opportunity as the engine for a new development model.”

Two decades have passed since the Kyoto Protocol was ratified, a historic accord that focused the world's attention on global warming and helped transform economic, social and environmental paradigms. Since then, the theme of sustainability has become an even stronger policymaking priority for most countries in the world.

The energy sector was the one most directly affected by this transformation. Radical cuts in CO_2 emissions, necessary to rein in climate change, are objectives achievable only through a strategy that operates on more than one front at the same time: reducing emissions means reducing consumption, increasing efficiency, developing renewable energy sources, using distributed production and more. In turn, these changes imply the development of a smart energy transmission and distribution network, with interconnections that extend across national borders, as well as new market regulations.
It is a global challenge. Twenty years ago Europe took the lead in this transition, attempting to transform it into an opportunity as the engine for a new development model. For this reason, with the aim of sharing what's taking place today within this sector on a global level, we decided to start with a magazine issue dedicated entirely to Europe and the continent's energy transition.
The Second State of the Energy Union, the European Union's annual report addressing progress and delays among individual states in the union as they attempt to pursue diverse objectives, was the starting point from which to explore all aspects of this transition. Today, where do we stand?

The German case is paradigmatic. If Europe is leading this energy revolution, then Germany is unquestionably the country that has moved most determinedly in that direction, delineating a strategy – Energiewende – that substitutes nuclear energy production with renewable sources and, in order to help people take best advantage of all their potential, has invested heavily in infrastructure, creating new HVDC corridors that bring energy produced in a safe, efficient manner to the country's primary industrial production centers. Nevertheless, Energiewende displays some weaknesses: the objectives it has achieved in terms of reduction of emissions have yet to live up to expectations. Equally radical policies for energy consumption in buildings and transportation are required in order to make more progress on that front.

The theme of rendering Europe's real estate more energy efficient introduces another delicate aspect: energy poverty. For far too long we've talked about this issue as something faced by distant continents like Africa, Latin America and Asia. Today we're discovering it affects European citizens too: 10% of Europe's population lives in energy poverty conditions, creating a cascading chain of social and health problems. Today, thanks to the creation of a dedicated observatory, the EU is getting ready to deal with the problem.

Energy generation, mobility, energy efficiency in buildings… These are crucial sectors for environmental sustainability, and deal first and foremost with the urban context. In 2050 it's estimated that 70% of the world's population will be living in cities. Rethinking city models, including from an energy point of view, is key. Today cities are the place where, in both Europe and around the world, people are experimenting the most. In this issue we begin a voyage among the world's avant-garde cities, starting in Vienna, a capital that is driving toward a zero-impact energy future without giving up any of its Mitteleuropean attractiveness.

Last but not least, as you may have noticed we have conducted an editorial and graphic restyling of our Energy Journal. During a period of transformation like the one we're currently experiencing, we thought it was important to make our magazine as up-to-date, involving and functional for our readers as possible. This is our attempt to offer you a tool useful for gaining a deeper understanding of development, present and future, in the energy sector.

Enjoy your read!

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We hope to see a Europe where man of every country will think of being a European as of belonging to their native land… and wherever they go in this wide domain will truly feel "Here I am at home"

Winston Churchill





Top stories

Implementing the Energy Union

Targets set for 2020 have either already been achieved, or are within reach, but the European Union isn't resting on its laurels. Today the EU is launching a new Energy Union Framework Strategy that will raise the bar even higher, aiming to modernize its entire production system, including energy.

While 2016 was the year the Energy Union Framework Strategy was launched, during which initiatives, actions, partnerships and laws were set out on the table one after the other, 2017 will be the year of its effective implementation. Published last February, the Second State of the Energy Union report is monitoring the EU's progress, verifying achievement of intermediary targets and keeping its sights on the ambitious end goal which, in addition to the creation of a single, shared European market, intends to modernize the EU's entire production and economic axis.

The document synthesizes the strategic mission as follows: "The Energy Union is about more than energy and climate alone: it is about accelerating the modernization of Europe's entire economy, making it low carbon and efficient in energy and resources, in a socially fair manner. Its ultimate goal is to make sure that Europe's consumers, workers and businesses benefit from it. European companies should be at the forefront of the necessary investments, since this would create an early mover advantage for new technologies and business models. There is, in other words, a strong business case for the transition to a more modern, low carbon economy."

The Europe currently taking shape is an internationally authoritative and competitive continent , as Maroš Šefčovič, vice-president and director of the Energy Union underlined in the press conference held to present the report. Today Europe is reinforcing its leadership in new energy technologies, leading the global transition to green models. The continent satisfies its energy needs in an efficient manner through renewable sources and low carbon technologies, and can guarantee safety, solidarity and quality of life for Europe's citizens and workers, the ultimate beneficiaries of this revolution.
But the energy transition is necessarily interwoven with other strategic initiatives, and two specific packages in particular: the first is the Circular Economy, which plans to recover up to 29% of energy needs from waste energy; the second is the Paris Agreement on Climate Change, ratified in 2016 and immediately adopted by the EU. From a governance point of view, the effort must be coherent, efficient, global and local; a drive at once multilevel and multinational that is titanic in scope.
Over the course of 2017, Šefčovič will tour all the countries in the union, traveling from State to State to attend encounters organized with governments and business entrepreneurs during which he will detail the characteristics of the Energy Union Framework Strategy, including its specific and global objectives, as well as the positive effects expected for each member state. When it comes to energy integration, a multi-speed union simply will not work.

Where do we stand today?

According to the report, Europe is already well on its way when it comes to consumption, emissions and the development of alternative power sources. The most recent data shows that emissions in 2015 were 22% lower than they were in 1990, confirming a multiyear trend. Of course, the path to greener transportation remains an uphill battle, considering that the long-term (2050) objective calls for a reduction of at least 60% compared to 1990.

Percentage of emissions in Europe

In 2014, 16% of energy end consumption was supplied through renewable sources, and that percentage is expected to rise to 16.4% in 2015. The target for 2020 (20%) is unquestionably within reach, confirmed by the progress registered over recent years: in 2011, 21.7% of electric energy was produced by renewable sources; in 2014 that number rose to 27.5%; and experts believe it will reach 50% by 2030. According to studies, once Europe achieves this objective the continent will see important effects in terms of economic savings on the importation of fossil fuels. In 2030, this should total roughly -58 billion euro on payment balances.

Of course not all member states stand at the same level. In 2015, 25 nations had reached the intermediary target, while today some of them have already achieved the targets set for 2020.

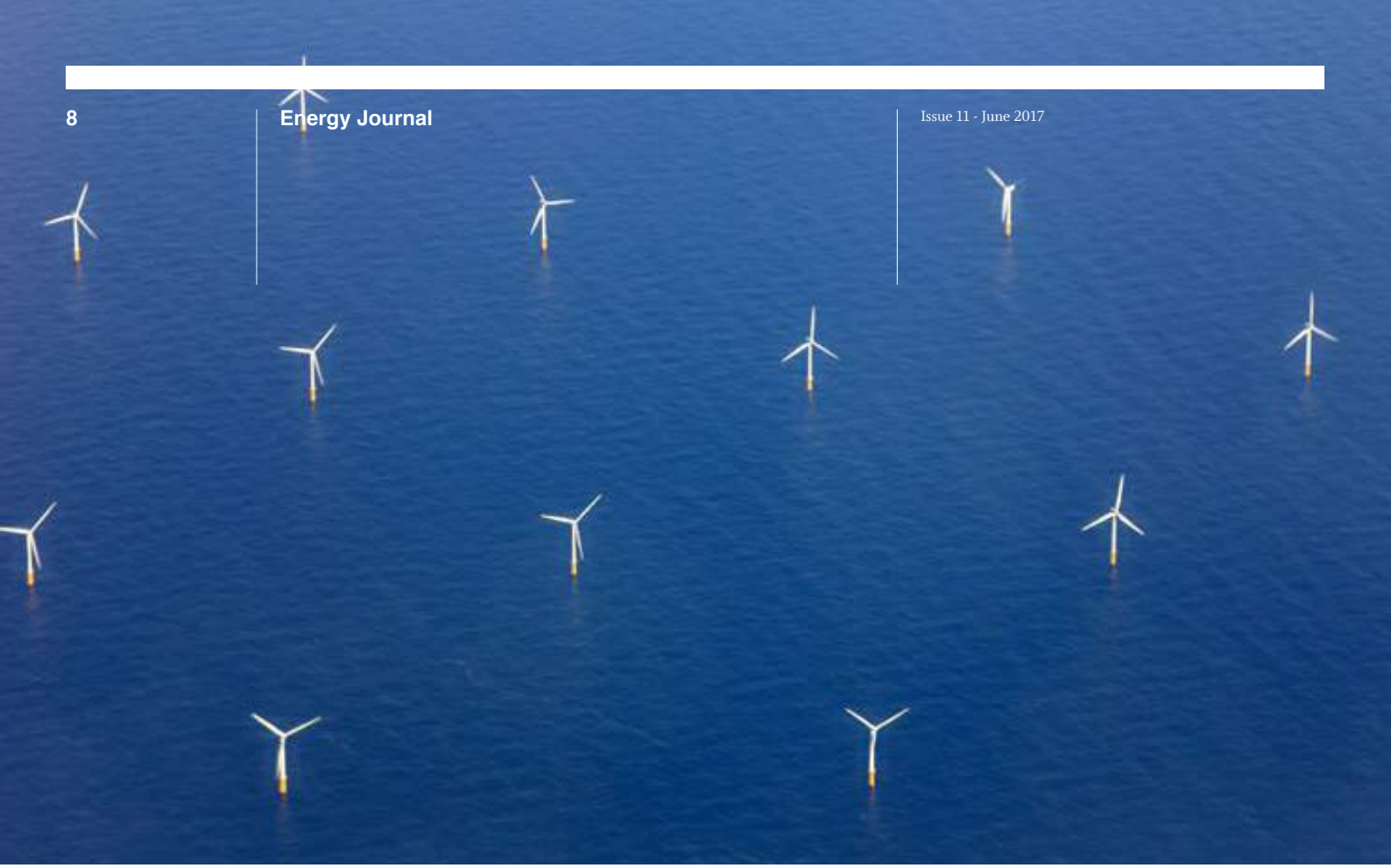
Energy efficiency is considered an energy source in its own right for the European Union. While the target for this area (20% by 2020) has already been achieved, the energy union strategy continues to place considerable emphasis on this goal. Today the target has become even more stringent: a 30% increase in efficiency compared with 1990, to be achieved by 2030. The residential sector is a priority area for this intervention, with important initiatives connected to building requalification, given that heating and cooling accounts for 50% of urban energy consumption.

> “Energy efficiency is considered an energy source in its own right for the European Union”

Another interesting piece of data regards decoupling growth and emissions data: emissions have dropped, but the GDP has continued to increase.

Interconnections between member states will play a key role in achieving these objectives. Attention the EU is paying both to pipelines (new connections like the TransAdriatic Pipeline, the Balticonnector and Brua), as well as GNL terminals and electric network interconnections is indicative of just how fundamental these are for guaranteeing full utilization of the energy produced by offshore wind farms located in the northern seas.

The report also addresses a new theme of key importance for the entire sector: “Digitalization of the energy sector increases its exposure to cyber-attack and the need for strong data protection rules. In order to implement the Network and Information Security (NIS) Directive and to promote synergies between the Energy Union and the Digital Single Market, an expert group is analyzing the specific cyber security needs of the energy sector. This is also crucial from a consumers’ perspective.”



Financing the transition

Realization of this strategic plan requires financing to the tune of roughly 379 billion euro a year from 2020 to 2030. Today, 20% of financing for the European Fund for Strategic Investments is destined for projects in the energy sector, and the European Commission has formally requested that this percentage be doubled within the year, increasing to 40% of strategic funding in order to fully cover the European energy transition. Additional support will come from European Structural and Investment Funds, which between 2014 and 2020 will provide an overall 98 billion euro for projects in the sector, through innovation as well as other financial tools currently under consideration, starting from a revision of the Emission Trading System and extending to the Smart Finance for Smart Buildings initiative, aimed at accelerating the requalification and efficiency-increasing phase for preexisting buildings.

Over the course of 2017, the High-Level Expert Group on Sustainable Finance is also expected to provide the commission with advice on the entire project's financial sustainability, minimizing risks connected with the current high level of financial exposure on the fossil fuel front.

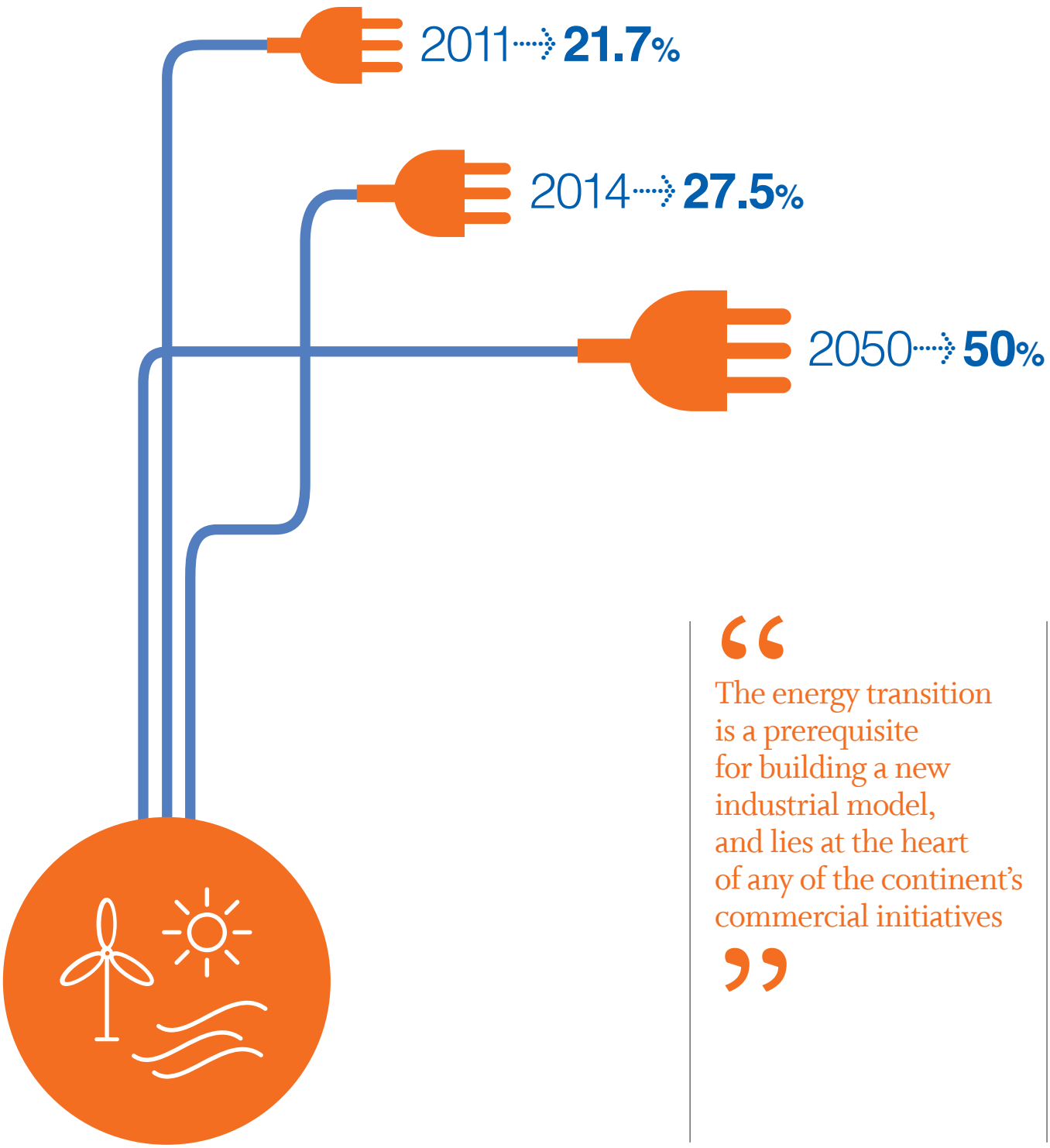
> “Digitalization of the energy sector increases its exposure to cyber-attacks and prompts a need for strong data protection rules”

A leadership role

Europe intends to maintain its leadership role during this global phase of energy transition, both in terms of policy and in terms of green technology, a market that is expanding more powerfully today than ever. The report clearly highlights the EU's position, emphasizing how the energy transition is a prerequisite for building a new industrial model, and lies at the heart of any of the continent's commercial initiatives: “Global leadership of the European Union on the clean energy transition is required. As a global marketplace for clean technologies is being unlocked at an unprecedented scale, the European Union is using its external policies to share its experiences in this area and to mainstream the shift to a low-carbon global economy, first and foremost by developing strong partnerships with countries and regions.”

Addressing climate policies, the report also emphasizes the need to intensify diplomatic activities and collaboration with China, supporting implementation of an Emission Trading Scheme that should become operational in 2017; as well as interacting closely with Africa for technological development and de-carbonization of the continent.

Electric energy produced by renewables



> “The energy transition is a prerequisite for building a new industrial model, and lies at the heart of any of the continent’s commercial initiatives”

Opinions

What Will the Brexit Look Like?

In June 2016 Great Britain voted to exit the European Union. A letter signed by British Premier Theresa May on 29 March 2017 made the breakup official. Identity crises aside, what effects will the Brexit have on Europe and Great Britain in terms of energy policy? We discussed this issue with three different energy experts: Kristian Ruby, Secretary-General of Eurelectric (Belgium); Malcolm Keay, Senior Research Fellow at the Oxford Institute for Energy Studies (UK); and Giacomo Luciani, Scientific Director of the Master in International Energy of the Paris School of International Affairs at Sciences-Po (France).

Kristian Ruby

Secretary-General of Eurelectric (Belgium)

Giacomo Luciani

Scientific Director of the Master in International Energy of the Paris School of International Affairs at Sciences-Po (France)

Malcom Keay

Senior Research Fellow at the Oxford Institute for Energy Studies (UK)

The Brexit white paper – The United Kingdom Exit from and the new partnership with the European Union – defines guidelines for Great Britain's exit from the European Union, but says little about energy policy and the consequences of the Brexit within Europe, or about strategic objectives for either the EU or the UK.

In an interview with The Guardian, Rachel Kyte, special representative on sustainable energy to the UN Secretary General António Guterres, clearly expressed the EU's concerns: "Brexit is at best a distraction, at worst a disruption of the need to continue to drive energy productivity across the UK and Europe – of having a much less energy-intensive economy and getting more productivity from each unit of energy, of having a cleaner energy system, of having much less use of carbon-intensive fuels." And experts and operators in the British sector are no less concerned.

On one hand, carbon-free inevitably remains the reference scenario. On the other, the lack of a clear perspective with respect to strategic choices and specific objectives in several particularly delicate sectors – for example network interconnections between Great Britain and the continent, Electronic Transfer Systems, the nuclear sector, oil and gas – is alarming. A "hard Brexit" in the oil and gas sector, for example, would have repercussions within the World Trade Organization as well, potentially causing a considerable increase in the costs of raw materials. Uncertainty also reigns in the nuclear sector, with Great Britain's exit from Euratom now inevitable.

These are delicate issues with multiple aspects to consider. We sat down with experts for a three-way interview designed to define the framework within which these issues are playing out today.

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1. When it comes to energy policy, the Brexit Policy Paper is quite vague. At heart, it emphasizes that "all options remain open." Experts have identified three potential scenarios. Among these three, in your opinion which is the most probable?

a. **Brexit-Lite**:
A Norway-style agreement, providing access to the single market, but remaining outside the EU.

b. **Brexit-Select**:
Based on bilateralism, with different aspects of EU policymaking negotiated on a case-by-case basis, akin to Switzerland.

c. **Brexit-Hard**:
A new relationship is negotiated around a free trade agreement, akin to Canada.

Kristian Ruby

EURELECTRIC, the Brussels-based association representing the electricity sector in Europe has established a working group to analyze the technical consequences Brexit can have on the electricity sector from a European perspective. We advocate for a scenario that will allow free and fair trade of electricity between the EU and UK, with particular reference to Ireland. The unique networked characteristics of the electricity sector and importance of energy to both economies require mutual collaboration irrespective of wider trade negotiations between the UK and the EU.
We appreciate that when it comes to energy, the UK government's current approach seems to lean toward a soft Brexit. Greg Clark's intervention at the BEIS Select Committee hearing showcased energy as a good example of an area in which there is a mutual interest – both for EU27 and the UK - to keep working together, avoiding unnecessary disruptions. Therefore, to directly reply to your question, we hope the UK will remain an active participant of the Internal Energy Market as well as the Single Energy Market established with Ireland.

Giacomo Luciani

Of the three solutions, the second is the least likely. The Commission is unhappy about the bilateral solution with Switzerland and is increasingly impatient. Besides, Switzerland demonstrates that the bilateral solution would not allow the UK to achieve its goals for Brexit, i.e. immigration control and supremacy of national judiciary. The alternative will be between the EEA (Norway's solution), which would amount to a surrender by the UK, and a new FTA, which would require a fairly long transition process. In both cases I believe the Brexiters would lose the next election having failed to accomplish what they promised. Whether this will be before or after Scotland's secession depends on when a new Scottish independence referendum is held.

Malcolm Keay

The likely outcome is somewhere between the second and third options. In the energy sector tariffs are not a major issue, but there may need to be a bilateral agreement on policy measures like renewables support and carbon trading as well as on market structures and the like.

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2. In your opinion, what is the most critical energy policy issue that the Brexit will force Great Britain and the European Union to deal with?

KR: Overall, it is in the interest of customers, member states and the industry to maintain the integration of energy markets to the widest possible extent and to minimize to the greatest possible extent barriers to participation in the internal energy market.
The most important issue is to preserve tariff-free, fair trade across interconnectors. Coupled with this is agreement on the mutually supporting arrangements in place to address security of supply emergencies. A secondary significant market issue is the preservation of a SEM (Single Electricity Market) on Ireland. Agreeing to a satisfactory resolution to non-participation in the Euratom Treaty will also be important from a UK perspective. The ideal outcome to permit continuation of the above would be full UK participation in the IEM, but this may not be a reasonable expectation. To facilitate a positive outcome requires: a mechanism independent of the ECJ to arbitrate on disputes; early resolution of issues associated with financial markets including MIFID, EMIR, REMIT, MAD, MAR etc.; continued participation in some form of the UK in EU regulatory agencies; a framework to determine "equivalence" requirements with energy related policy initiatives so as to address EU concerns regarding regulatory "dumping" – this applies in particular in the context of the 2030 package - and a transitional mechanism that provides a significant level of certainty to market participants (and their customers) until final agreements are delivered.

GL: It seems to me that energy policy is not a bone of contention in the Brexit context. The UK will keep on pursuing its energy policy and trading energy with the EU.

MK: In the immediate future, the main issue is how to address policy uncertainty, which creates problems for the investment needed to move toward a secure, low carbon future. In the longer run, the key objective will be to minimize barriers to energy trade, in the interests of energy security and competitive energy prices.

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3. One of the most delicate issues – in part due to the implications it has for domestic policy concerning relations with Scotland and Ireland – is that of interconnected networks with the continent. In what ways do you believe the situation could evolve from this point of view?

KR: Trade in any product, including electricity, is a natural part of the global economy. Market conditions, stable frameworks regulating cross-border trading rules and agreed arrangements to address security of supply during emergencies will determine future investment in interconnection. We hope the final agreement will allow rational economic decisions to be made regarding investments in future interconnectors.
In this context, the UK has been physically connected to the continental European electricity system via France since 1986, and Ireland since 2002. The electricity market in Great Britain currently has 3 GW of interconnection capacity with continental Europe, as well as 1GW of interconnection capacity with the SEM operated jointly between Ireland and Northern Ireland.
By 2022, if all projects that have regulatory approval are developed, we expect there will be an additional 6.8GW of interconnection capacity between continental Europe and Great Britain (9.8GW in total), and an additional 0.5GW between the Irish SEM and Great Britain (1.5GW in total).

GL: Neither side has an interest in disrupting interconnected networks. Even in the event of a hard Brexit, some transitional arrangement will be put in place to allow business as usual. In the longer run, the UK has an interest in these

MK: There are a number of active interconnection proposals that may be put at risk by the current policy uncertainty. On the other hand, interconnections between the Republic of Ireland and France might be brought forward as a consequence of Brexit. The outcome could be a network driven as much by political as by economic considerations.

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> "It seems to me that energy policy is not a bone of contention in the Brexit context"
>
> *Giacomo Luciani*

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4. In terms of policies designed to combat climate change, does Great Britain's exit from the Emission Trading Scheme risk creating disadvantages first and foremost for Europe, given that Great Britain is currently the second largest carbon emitter and a major importer of carbon allowances from its fellow EU states? In what ways will this effect other European countries?

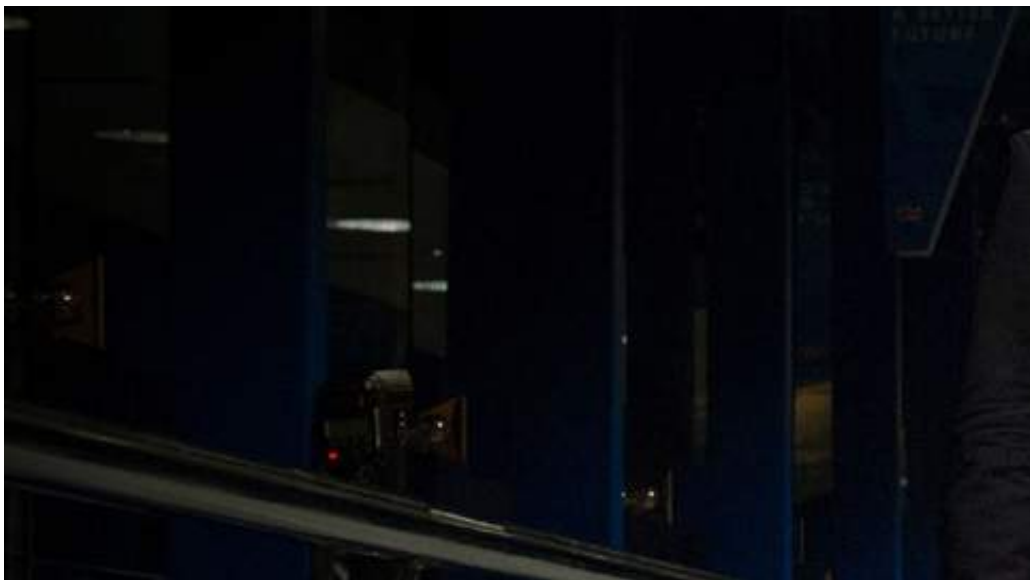
"The UK and EU should work together on climate issues, including continued UK participation on emissions trading with the EU and at minimum participation in the EU ETS until the end of the current trading phase (2020).

Kristian Ruby"

KR: First, it is important to bear in mind that the UK has been a major actor in developing liberalized energy markets, addressing climate change and establishing the world's first major carbon market. Second, it is true that it is a large emitter and net importer of carbon allowances. If the UK leaves the EU ETS this will affect the carbon market as a whole, including its flexibility and solidarity elements. In the absence of a formally linked domestic UK ETS there may also be a short- to medium-term effect on the price of EUAs and consequential impacts on electricity prices and new investments. To ensure the fair trade of electricity, the carbon price paid by electricity generation in interconnected countries is key. Therefore, the UK and EU should work together on climate issues, including continued UK participation on emissions trading with the EU and at minimum participation in the EU ETS until the end of the current trading phase (2020). Given the potential market impacts are now less than two year away, a resolution to prevent this scenario should be agreed as soon as possible.

GL: The UK's exit from the ETS will necessitate a revision of permit numbers. This actually may be an opportunity to eliminate the excess supply of allowances. If supply of allowances is not reduced and a major importer is subtracted, the system will definitely slip into irrelevance.

MK: The UK has already reduced its emissions by more than 40% (the EU 2030 target) since 1990. If the EU is going to maintain the 2030 target, the remaining 27 countries will have to take on more demanding emissions reductions targets. That is likely to be difficult to negotiate and make the target more difficult to achieve. For both UK and EU 27 it would probably make sense for the UK to stay in the EU Emissions Trading Scheme, but that will not necessarily be easy to negotiate.



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5. Nuclear energy warrants an in-depth look: the Brexit calls for Great Britain to exit Euratom. But making changes in this area outside international agreements is unthinkable. Therefore, what do you believe will be the framework of reference?

KR: Leaving Euratom is a direct result of leaving the EU and, indeed, making changes in this area outside international agreements seems unthinkable. However, the British government has asserted that its aim is to maintain "mutually successful civil nuclear cooperation with the EU." At this point it's too early to determine how much this wish will shape a revised framework of reference for nuclear issues. Nonetheless there are clear mutual benefits for both the EU and UK in ensuring a revised arrangement is established as early as possible. On one hand, leaving Euratom may damage free movement of goods and skills in the nuclear sector, as well as the exchange of information on nuclear energy with the EU. On the other hand, it seems more and more unlikely that the Brexit negotiations on trade will not be finalized within the period scheduled by Article 50. There is a need for predictability in terms of security of supply. Therefore a transitional arrangement on Euratom and the nuclear sector and, more generally, in relation to all aspects of energy trade would not only be welcomed but is necessary and required. Such a transitional framework in relation to nuclear issues would give time to negotiate and implement the next framework of reference and new cooperation agreements with the EU, third countries and also international institutions such as the IAEA. One of its main goals should be to ensure and preserve the "acquis" of the Euratom treaty.

GL: If the UK exits Euratom in a hard Brexit context I would expect some kind of transitional agreement to be put in place. The UK will pursue its nuclear program and would be hard put setting up a national safety and security architecture and monitoring that's independent of Euratom. I don't see this as a priority for the UK, or for the EU. Eventually, the UK would establish its own national solution, in the context of IAEA rules, which will remain relevant in any case.

MK: The UK will need to negotiate a new framework for trade in nuclear materials – it will no doubt aim to reproduce the Euratom framework as closely as possible. Given that this is a largely technical area, it may be somewhat easier to agree on this than on other, more political issues. Nonetheless, one effect might be to slow down the UK's current ambitious nuclear program.

Industries & Countries

A European *Energiewende*

A pioneer of the energy transition through its *Energiewende*, today Germany needs the rest of the continent to transfer to a flexible, smart and renewable energy system in order to fully achieve its objectives. France, which shares a dependency on nuclear power, initiated its own "*transition énergétique*" in 2015, and today stands alongside its Teutonic neighbor. These two nations offer ideals and a vision that Europe lacks, and desperately needs.

With its *Energiewende* (Germany's Energy Turnaround Act), a strategic plan designed to drive the German industrial engine from an economy based on fossil and nuclear fuels to a sustainable model structured around renewable resources, Germany took up a pioneering mantle in the energy transition in the eyes of all of Europe. Initiated already in the 1990s, *Energiewende* took a leap forward in 2011, when the decision to abandon nuclear energy grew increasingly radical, in the wake of the events in and around Fukushima. It was a move that enjoyed strong public support, and is still viewed highly favorably today: recent surveys indicate that more than 90% of the German population supports the country's energy transition program.

From 2000 through today, growth in the contribution made by renewable sources to the production of electric energy has equaled 25%. In 2015, 32% of all German electric energy was produced through renewable sources. The long-term objective (2050) is 80%, with an intermediate target of 40% set for 2020. Solar and wind energy form the foundation of this energy revolution: on the best (i.e. the windiest and/or sunniest) days, renewable sources can provide up to 50% of the country's national electric energy needs.
In order to take full advantage of renewables, Germany has also initiated an extremely important modernization process for its transmission network. Three HVDC corridors form a true electric highway (e-highway), moving energy produced in offshore wind farms in the north, as well as that produced in photovoltaic parks in the south, to industrial production facilities in the heart of the country. The technological HVDC solution guarantees important advantages for the system overall, not only significantly reducing energy dispersion and maximizing efficiency, but also supplying greater guarantees for avoiding blackouts, and effecting a minor environmental impact compared to traditional infrastructures.

The most interesting characteristic of this imposing transformation is that, according to data, more than half of all investments concern small systems. The *Energiewende* is being powered not simply by large wind farms located in the North Sea, as many tend to believe, but also by a proliferation of photovoltaic panels and small wind parks, especially in rural areas. These "minor players" are making a substantial contribution to creating a system of distributed energy production that is at once widespread and efficient, all supported by one of the world's most advanced smart distribution networks.

Energiewende is having significant effects from an industrial point of view as well, both in terms of jobs (350,000 Germans work in this sector), and in terms of financial support (investments in the energy sector are estimated at 200 billion euro over recent years). Contrary to what many think, *Energiewende* has also made Germany an attractive option for energy-intensive industries: the low prices of solar and wind energy make this kind of production less costly in terms of energy supply.

Paradoxically, results of the *Energiewende* are less straightforward when it comes to emissions: targets for 2020 (-40% compared to 1990) and 2030 (-55% compared to 1990) currently look difficult to achieve. According to data supplied by the German government, in absolute terms they've seen a drop in CO_2 emissions equal to 69 million tons from 2008 to 2016. But despite this, achieving the above-cited objectives would require an ulterior, drastic reduction in emissions totaling 155 million tons in 2020, and 343 million tons in 2030.

As the magazine The Economist explains in detail, this situation is due to two key factors. As we've already seen, *Energiewende* was born primarily of anti-nuclear sentiment: renewable production was used to substitute nuclear production as nuclear power plants were progressively shut down; while at the same time energy plants using traditional fossil fuels continue to run. The energy sector saw a 13% reduction in emissions since 2007, but an ulterior effort will be required, especially in energy production from coal, which continues to account for 43% of all German energy consumption. According to data from Germany's Federal Environment Agency, production capacity from coal will need to be cut by half by decommissioning the oldest power plants, which run on lignite and hard coal. It will also be important to make changes in the transportation sector, where there have been few changes and only extremely limited reductions in emissions since 2007 (less than 1% per year).

Therefore, the process cannot yet be considered conclusive: several of the most delicate phases are just now being launched. In 2016, the Bundestag approved no fewer than six different laws focusing on issues like regulation of the energy market, harmonizing energy legislation at the federal level, incentives, cogeneration and digitalization. This last element is particularly significant: the *Energiewende* will take another, important step forward through the Gesetz zur Digitalisierung der *Energiewende*, or New Digitization of the Energy Turnaround Act, signed into law in September 2016.

The law establishes a roadmap for the introduction of smart meters into the German electric system, thereby promoting progressive digitalization. The energy sector will be one of Germany's first industrial areas to go completely digital. In reality, this law allows Germany to respond somewhat late to requests that Europe was making already in 2009: the Third Internal Market Package called for introduction of smart metering in all member states, and aims to reach 80% of all European consumers by 2020.

This tardiness in digitalization of the sector is justified by the costs connected with introducing this technology on a large scale, and especially by data security issues. Today, however, any further delay would have significant effects on additional development of the *Energiewende*, and there is no more time to waste: an information network that brings together both production and demand data in real time is key to the efficient use of such a volatile energy as that provided by renewables. Nevertheless, the plan calls for a slow progression that will not fully conclude until 2032.

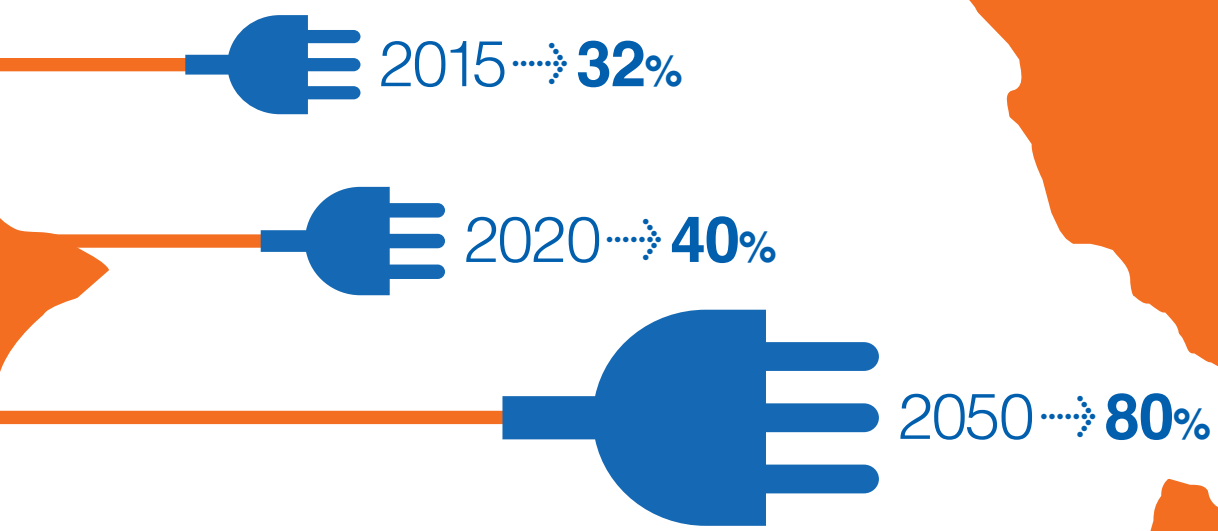
Germany is not the only European country to have initiated such a radical transformation of its energy system. France has also begun a similar revolution through its law "rélative la transition énergétique pour la croissance verte," proposed by Ségolène Royale in 2014 and definitively approved following widespread public debate in the summer of 2015. The law amounts to an ambitious legislative corpus that redesigns France's energy future and the trajectory the country must follow in order to achieve its objectives. Diversification of the energy mix and security of supply form the core of the law, but the legislation also defines new targets for emissions, adjusting for commitments made though the Kyoto protocol and renewed in the Paris Agreement. Like Germany, France based its energy solidity on nuclear power, relying on nuclear plants for 78% of its electricity needs as recently as 2012, and now aims to reduce the contribution made by nuclear up to 50% by 2025. This energy strategy involves regional and local authorities in a direct, operational manner: they'll be charged with laying out specific plans for energy, air quality and efficiency. This decentralized approach may favor the move to a demand-oriented system, as the IEA underlined in the report on France it presented in January 2017, though the approach must also be given the right level of support. The IEA believes the objectives France has set for itself are achievable, but will need a greater push in two areas in particular: mobility and energy requalification for buildings, which remain an Achilles heel for both France and Germany.

Today two energy giants of the European Union – Germany and France – represent one third of all electricity produced and consumed on the continent, and share a similar energy profile characterized by a longstanding dependence on nuclear power. But they're working on a shared paradigm for change. Both need Europe as well, without which neither the German nor the French project can effectively be seen through to completion. *Energiewende*, whether German or French, needs Europe. It remains to be seen if Europe needs the *Energiewende* too. Given the current condition of fragility and deeply rooted Euro-skepticism, embracing an ideal that blends sustainability, technological innovation and jobs might help foster that sense of belonging and shared identity in citizens of the European Union that Europe currently finds in short supply.

Germany emission's reduction target

1990 2020 -40% 2030 -55%

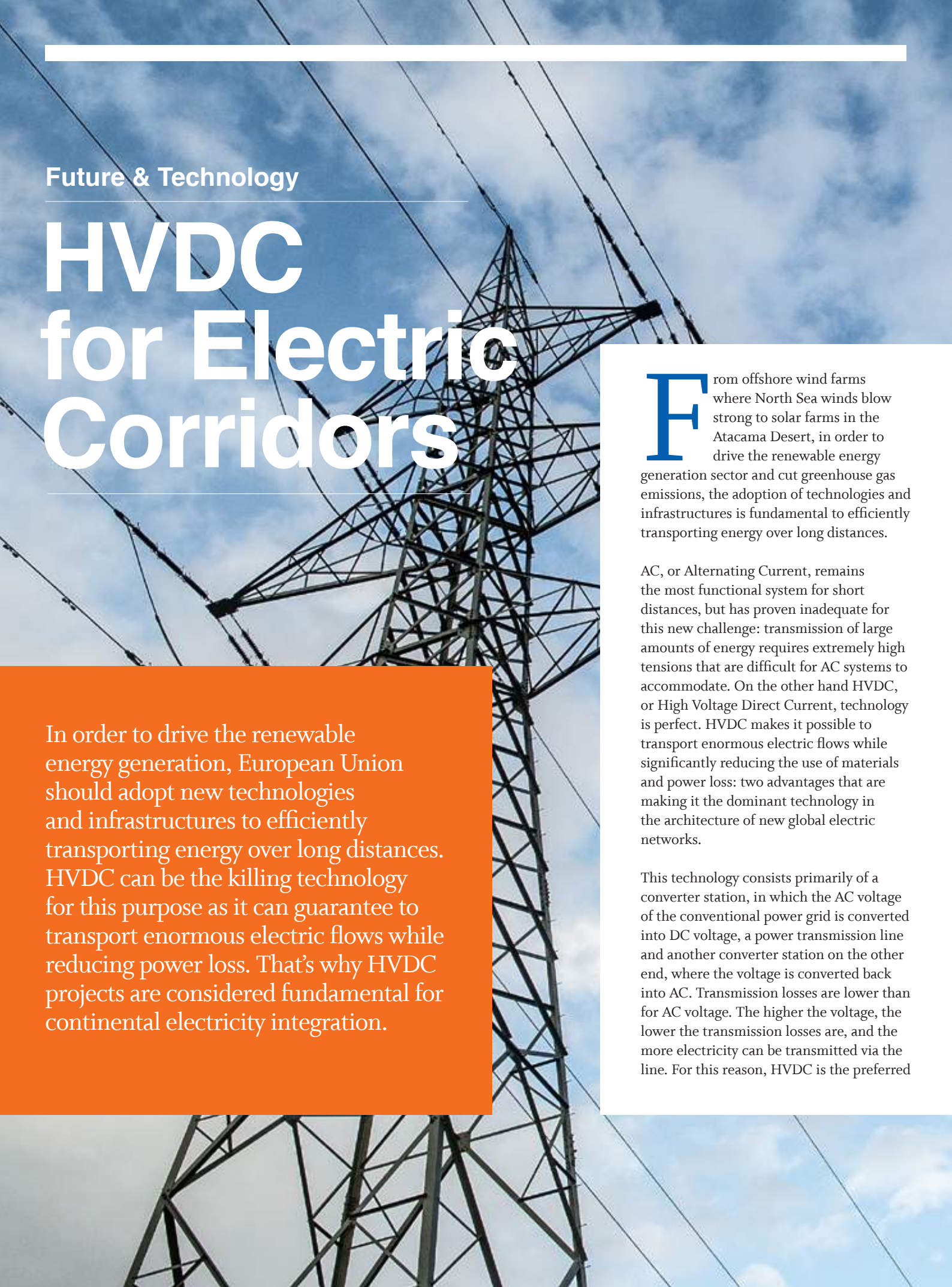
Electric energy produced by renewables in Germany



2015 32%

2020 40%

2050 80%



Future & Technology

HVDC for Electric Corridors

In order to drive the renewable energy generation, European Union should adopt new technologies and infrastructures to efficiently transporting energy over long distances. HVDC can be the killing technology for this purpose as it can guarantee to transport enormous electric flows while reducing power loss. That's why HVDC projects are considered fundamental for continental electricity integration.

From offshore wind farms where North Sea winds blow strong to solar farms in the Atacama Desert, in order to drive the renewable energy generation sector and cut greenhouse gas emissions, the adoption of technologies and infrastructures is fundamental to efficiently transporting energy over long distances.

AC, or Alternating Current, remains the most functional system for short distances, but has proven inadequate for this new challenge: transmission of large amounts of energy requires extremely high tensions that are difficult for AC systems to accommodate. On the other hand HVDC, or High Voltage Direct Current, technology is perfect. HVDC makes it possible to transport enormous electric flows while significantly reducing the use of materials and power loss: two advantages that are making it the dominant technology in the architecture of new global electric networks.

This technology consists primarily of a converter station, in which the AC voltage of the conventional power grid is converted into DC voltage, a power transmission line and another converter station on the other end, where the voltage is converted back into AC. Transmission losses are lower than for AC voltage. The higher the voltage, the lower the transmission losses are, and the more electricity can be transmitted via the line. For this reason, HVDC is the preferred

technology for moving large amounts of power across long distances and the preferred technology for market integration and electric interconnection of isolated or loosely interconnected areas.

It should come as no surprise that several different HVDC interconnection projects are among those the European Union is most interested in for realization within the common market area. According to the investment strategy outlined in the 2016 TYNDP (Ten Year Network Development Plan) produced by ENTSO-e, the association of European TSOs, there are no fewer than 87 HVDC projects to be considered fundamental for continental electricity integration if Europe is to achieve its shared environmental objectives and guarantee economic sustainability for the entire sector.

HVDC can guarantee considerable economic advantages as well. For example the "Piemonte-Savoia" HVDC line currently being built between Italy and France (a project CESI is actively involved in, both for the realization of research studies and for engineering efforts) will permit savings on Italian energy bills of approximately 150 million euro per year. Already today the SAPEI connection between Italy and Sardinia has lowered operating costs by 60 million euro per year.

Across European territory, and in the Mediterranean basin in particular, HVDC interconnections are spreading in a capillary manner. From Italy's most avant-garde experiences (SACOI, providing interconnection between Sardinia, Corsica and the Italian peninsula) to participation in projects in Spain, France, Greece and more recently in the Balkans, there are now no fewer than 27 international HVDC interconnection networks around Europe. CESI's experience in designing and researching HVDC technologies, both underground and underwater, has contributed to the realization of almost all these projects, several of which are among the biggest interconnection engineering challenges nations around the Mediterranean have had to face.

CESI was also one of the first European engineering realities to study and design direct current transmission systems outside of Europe. CESI's experience in this field began in the early 1980s, with the realization of a connection between the Paraguayan section of the Itaipu Dam (still the world's number one dam for electric energy produced) and San Paolo: over 800 km of electric cable that supplies 6,300 MW of power generated by the waters of the River Paranà to southwestern Brazil. It is an infrastructure that has changed the lives of over 1.5 billion people, bringing electricity to homes that previously had none.

“HVDC is also proving fundamental for the electrification of developing countries, where a new paradigm of sustainable energy and the need for adequate networks go hand-in-hand.”

HVDC is also proving fundamental for the electrification of developing countries, where a new paradigm of sustainable energy and the need for adequate networks go hand-in-hand. Examples can be seen in China, where State Grid has earmarked no less than 88 billion dollars for the realization of HVDC lines across the country, in the Ethiopia-Kenya line, which will guarantee full use of the immense water reserves present in central Africa, and in the rediscovery of this technology in South America and the consequent realization of the large Rio-Madeira (2,375 km) and Belo Monte (2,500 km) corridors in Brazil.

Thanks to technical and technological know-how developed while working in the Mediterranean basin, today CESI can bring utility companies, electro-mechanical industries and international financial institutions together to the same table in order to fully develop ambitious projects like these. Evaluation of economic and environmental impacts, as well as engineering and support for their realization, are key contributions in the definition and success of projects that represent the skeleton upon which our global electric system is being built.

Scenario

Energy Poverty in Europe

Universal access to energy is a right that must be guaranteed, similar to rights for education, health and work. Countries at risk are found not only in the third world, as many might think. Across Europe, 10.8% of the population lives in what can be defined as “energy poverty” conditions, and today the EU is poised to change all that.

Universal access to energy is one of the ten Millennium Goals outlined by the United Nations. Guaranteeing universal access to safe, reliable, sustainable and modern energy is considered on par with fundamental rights like education and water, and a necessary precondition for a life with dignity.

While the theme of energy poverty is nothing new, up till now it has mostly been dealt with by focusing on third world countries, rural Africa, South American favelas and Indian megalopolises. But the European Observatory for Energy Poverty, launched in December 2016, attempts to change this, putting Europe and its environs in its sights. According to EUSILC research statistics, as recently as 2012 there were 54 million (10.8% of the continent's total population) people in Europe living in energy poverty conditions. Those same estimates rise to 17.4% when looking back to 2009: data that immediately highlights the connection between this phenomenon and the global financial crisis that struck the European Union with such severity. In Greece, for example – one of the countries that suffered the effects of that crisis the most – energy poverty conditions affected 36% of the population.
The problem is relatively unknown and underestimated. The European Union only recently began to address it, and things look no better when analyzing the problem on a country-by-country basis: only one third of the 28 EU member states officially recognize energy poverty as a problem, and only four of these – Great Britain, France, Cyprus and Ireland – have enacted specific laws to deal with it. Since the 1990s, Great Britain remains the only country to have initiated serious discussion of this issue.

> “Energy poverty is a more pervasive, heterogeneous presence that involves several different social strata in different ways”

What is “energy poverty”?

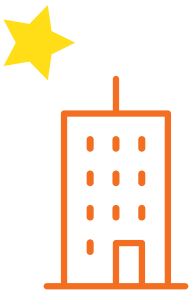
The first problem lies in giving the concept of energy poverty a single, shared definition, one that can form the foundation for legislation that is homogenous and coherent across different countries. What exactly is “energy poverty”? Generally speaking, it indicates an individual's impossibility to meet domestic costs for electric heating and/or cooling of a home. According to the definition given by Energy Action Scotland in 2016, for example: “A household is in fuel poverty if in order to maintain a satisfactory heating regime, it would be required to spend more than 10% of its income on all household fuel use. If over 20% of income is required, then this is termed as being in extreme poverty.”

This definition can boast the advantages of synthesis and clarity, as well as immediately establishing a relationship between earnings and energy costs, but it lacks a number of equally central aspects; just consider that today people tend to include the theme of mobility along with that of energy poverty.
Just a few months ago the Observatory began working first and foremost on a research and study effort that will eventually allow the European Union to initiate an awareness campaign on the issue and favor the introduction of specific measures. Today, the Observatory has made available the first handbook on energy poverty which, country-by-country and data in hand, analyzes energy poverty levels, existing legislation and specific actions undertaken.

European citizens

10.8%

are living in energy poverty conditions



15%

live in low efficiency buildings

In addition to low earnings, key drivers behind energy poverty conditions include thermal efficiency and the cost of energy. For European citizens, the risk of winding up in energy poverty conditions is determined by five principle factors: first, the relationship between growth in energy prices and individual earnings; second, the opportunity or lack of opportunity to achieve a protected status; third, lower, settled prices; fourth, the family's energy needs; and fifth, the energy efficiency of the edifice in which a family lives. Any policy that wants to resolve these problems for the long term will therefore have to work on multiple levels though specific energy opportunities offered to energy-poor consumers, attenuating contingent aspects of the problem, as well as through energy efficiency policies and the requalification of real estate.

Geographic inequalities

Comparison of current and historical data made available by Eurostat highlights enormous inequalities between different member states: the greater or lesser relevance of economic poverty, in fact, is determined not only by that country's level of development, its GDP or pro-capita earnings, but also by infrastructural adequacy, the kinds of energy policies adopted, and the culture and history of each nation.

> "The impact on the social lives of individuals living in energy-poor conditions risks generating a negative spiral leading to true forms of social marginalization"

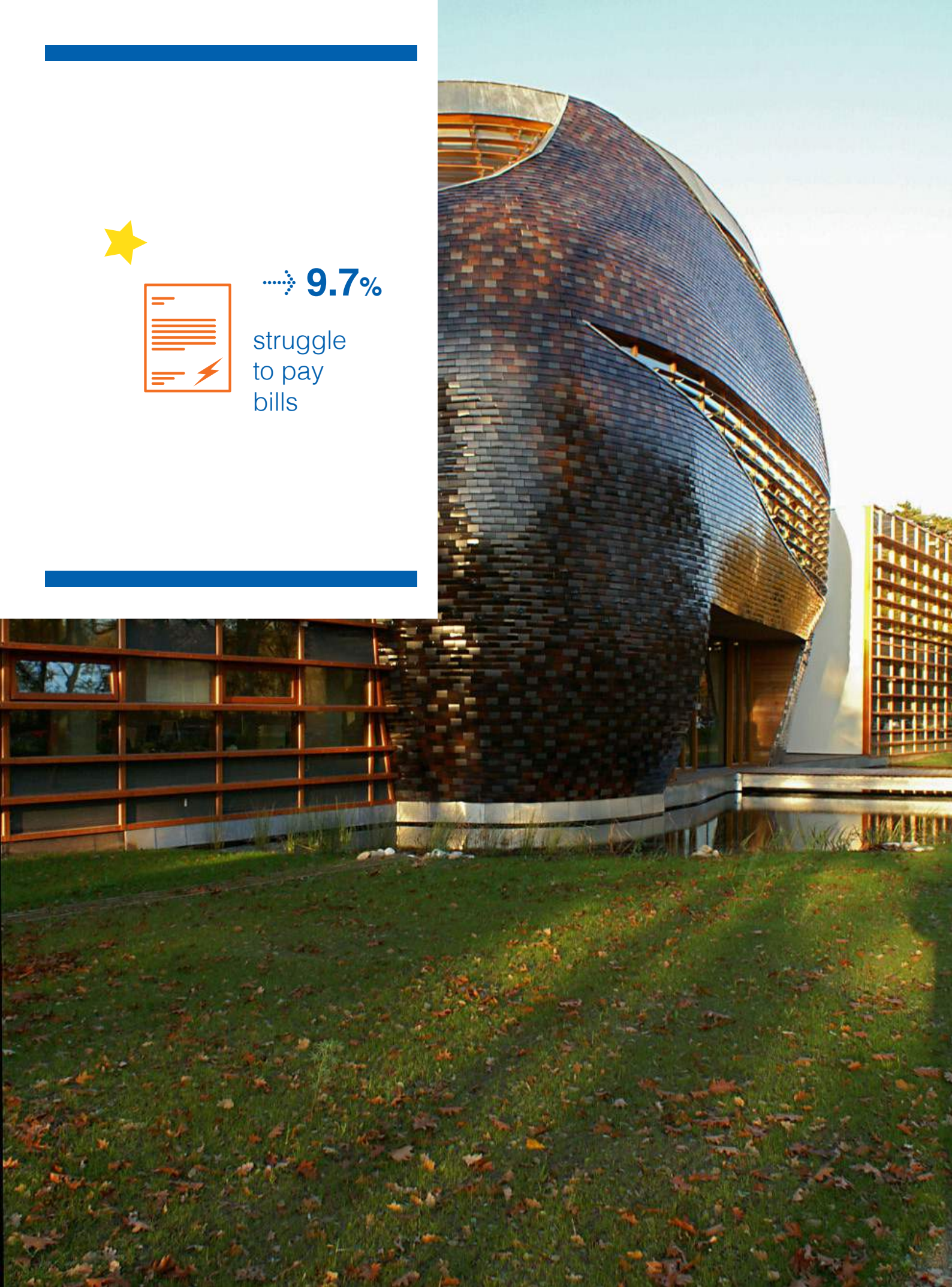
According to the Energy Poverty Handbook, Northern Europe boasts a series of relatively well-to-do countries in which energy poverty is restricted to specific demographic groups; in Southern and Eastern Europe, however, energy poverty is a more pervasive, heterogeneous presence that involves several different social strata in different ways. In light of this evidence, the concept of energy divide should be extended to include, in addition to typically social aspects, inequality in the access to energy infrastructures on national, regional and local levels as well.

The damage

Several different studies underline the gravity energy poverty can have on health. Living in houses that cannot be appropriately heated, in humid spaces, or in rooms that cannot be sufficiently cooled in the summertime all carry serious repercussions, especially for the less protected groups in society – the elderly, children and the chronically ill – that translate to health costs for society as a whole.

9.7%

struggle
to pay
bills



People living in Europe

In 2009 in Great Britain both the Public Health White Paper and the Chief Medical Officer's report recognized this form of direct economic impact: "The annual cost to the NHS of treating winter-related disease due to cold private housing is £859 million. This does not include additional spending by social services, or economic losses through missed work. The total costs to the NHS and the country are unknown. A recent study showed that investing £1 in keeping homes warm saved the NHS 42 pence in health costs."

And that's not all. The impact on the social lives of individuals living in energy-poor conditions risks generating a negative spiral leading to true forms of social marginalization. For example, on one side of the professional front, energy poverty leads to a potential increase in the risk of sick days; on the other, it limits the possibility of dealing with banal activities that are crucial for someone wishing to lead an active social and professional life, for example bathing with hot water so that one can show up clean and ready for work.

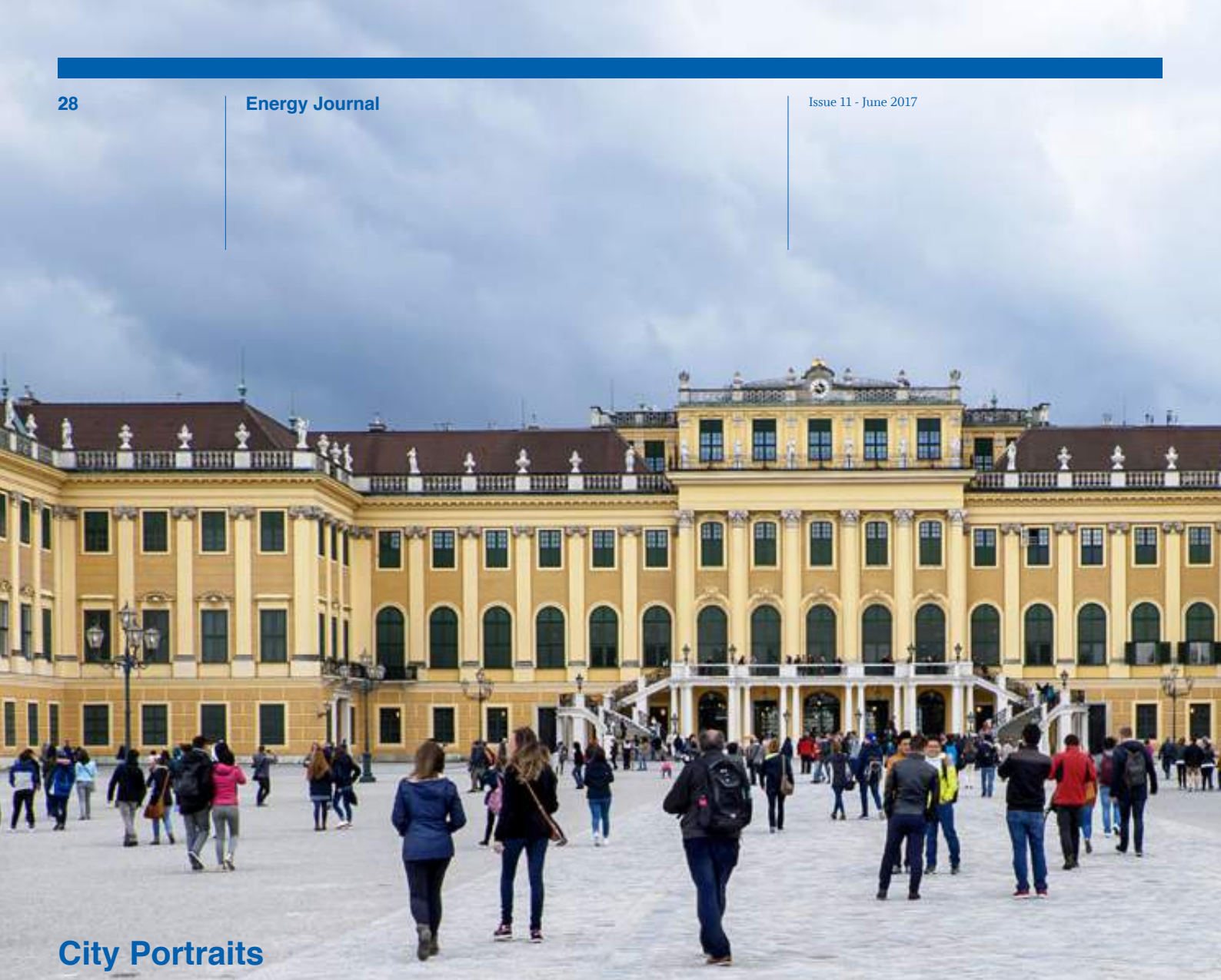
The energy efficiency of buildings

As data from the Energy Poverty Observatory shows, 15% of Europe's citizens claim they live in a home with low efficiency standards, and 9.7% admit they have a hard time paying their energy bills. Acting to correct the first element in order to contain the second appears logical. On one hand, any intervention would necessarily need to deal with pricing policies, introducing special tariffs, favoring an individual's ability to exercise direct control over energy consumption through tools like smart meters. But in the long term, policies designed to contrast energy poverty cannot help but be interwoven with energy-efficient building policies. From this point of view, historically speaking the European real estate market, most of which dates to the 1960s and 1970s, has a roughly 80% inefficiency rate. We also know that 40% of European energy consumption arises from residential buildings. Every year a mere 1.2% of European edifices are treated for energy efficiency improvements, meaning there's a wide margin for improvement.

Through the EU Building Stock Observatory, the EU monitors the energy efficiency of buildings all over the continent, evaluating in particular improvements in energy efficiency and the ways these influence the effective consumption of energy in the sector and in construction as a whole.

Ideally, at least as far as new buildings are concerned, the European Union appears to have clearly chosen the direction it wants to take: starting in 2020 all new buildings will have to be nZEB (nearly Zero Energy Building), in other words edifices with an overall energy balance between energy consumed and energy produced roughly equal to zero over a calendar year. On a global level, there are a number of new, extremely interesting and innovative applications: from passive solar homes in Edmonton (Canada) to the rotating house realized by the architect Disch in Germany, or the K19B building in Milan, or that in Kowloon Bay in Hong Kong. But it's more difficult to translate these ideals into a new design approach that will allow builders to create residential buildings according to these criteria on a large scale. The first step in this direction is to establish a clear, shared definition of just what a "nZEB" building is, as well as the main principles, objectives and targets: the BPIE (Building Performance Institute Europe) is making an attempt at doing precisely this.

"In the long term, policies designed to contrast energy poverty cannot help but the interwoven with energy-efficient building policies."



City Portraits

New Energy for Vienna

Among the "smartest" cities in Europe, Vienna symbolizes Mitteleuropean culture. But the capital of Austria isn't settling for a conservative role: today Vienna is aiming for a future as prestigious as its past, built on entirely new foundations. Innovation, energy efficiency and sustainability stand at the center of policies designed to draw a new profile for this middle European metropolis.

> The city chose to act to maintain its position as a Mitteleuropean epicenter of wellbeing and refined culture

Increasingly cities stand at the center of global transformation. There isn't a single strategic plan or program that fails to recognize their role as key player, around which specific policies and interventions need to be organized. The Second State of the Energy Union, for example, dedicates an entire chapter to the role and commitment of cities in achieving environmental sustainability objectives. This newfound centrality represents a dynamic response to increasingly marked urbanization. Statistics show that today, half of the world's population lives in an urban center, and by 2050 that number is expected to increase to 70%. Given this strong drive, in order to maintain a high standard of living and guarantee environmental sustainability and public health, cities are being called upon to change their paradigms. Challenges can be found in the consumption of energy resources, combatting emissions, basic infrastructure, network interconnections, fundamental public services, getting citizens involved, and grappling with social and economic inequalities.

Vienna's strategy

Big capital cities like London and Paris, or other cities like Amsterdam that have always paid close attention to innovation aren't the only urban centers in Europe that are accepting this challenge as an opportunity to redefine and consolidate. The movement has drawn in smaller cities as well, and Vienna has made an interesting choice. Traditionally considered the European city with the highest standard of living (according to a classification created by the IESE Business School, Vienna stands 26th in the world overall), the city chose to act to maintain this position as a Mitteleuropean epicenter of wellbeing and refined culture, launching its own Wien Smart City Framework in 2013, a program that outlines Vienna's desired profile for 2050.
This framework identifies three priority areas for interventions:

1. Resources – energy, mobility, infrastructure, buildings;
2. Innovation – teaching, research and innovation, business;
3. Quality of life – social inclusion, participation, health, environment.

As of today, the city has launched roughly one hundred projects in this direction. The local administration is responsible for overseeing these efforts, promoting, coordinating and guaranteeing the various activities within a collaborative, participatory environment. It is an "extended enterprise" model, built around

different players (public and private organizations) contribute complementary goods and services that are ultimately integrated into a single, overall final service.
For example the city created "Tina Wien," a mixed public and private entity that is responsible for achieving fundamental objectives for energy projects, for example those connected with energy savings, efficiency, the production of renewable energy sources, emissions and so forth.
For 2050, the Framework aims to reduce pro capita CO_2 emissions by 80% compared with 1990 (moving from the current 3.1 tons per individual to just 1 ton). Also by 2050, energy from renewable sources will be required to cover 50% of the city's primary energy consumption, while new efficiency policies will reduce pro capita energy consumption from 3,000 to 2,000 watts.
Important interventions are planned for transportation as well: vehicular traffic should drop from the current 28% to 15% in 2030; and in 2050, all vehicles in the municipal area will have to be powered by non-conventional engines.
Vienna's strategic program places emphasis on development strategies as well, as the city aims to become one of the five hubs of European innovation, with target growth in exports for the high-tech sector set at 20%. All of this is expected to take place while improving the relationship between green spaces and buildings: more than 50% of the urban area will have to be green.

Concrete action

In September 2013, the local government inaugurated an independent excellence center – Energy Center Wien – that acts as a strategic consultant, working alongside the local administration to make sure projects are successful, and is the point-of-reference for companies and research centers as well.
For renewable energy production, Vienna has collaborated with Wien Energy to create an innovative project, the "Citizen Solar Power Plant." This initiative gets inhabitants directly involved in the purchase of solar panels through crowdfunding. The project has proven quite successful, allowing the city to gather enough funding to purchase the solar panels for two separate facilities in a single week. For the third facility, the city's inhabitants bought all the modules within 24 hours of the launch. Today Vienna can boast no fewer than ten active Citizen Solar Power Plants, and the same program is being activated in southern regions like Trumau, Oberwaltersdorf, Bisamberg and Trumau-Schönau.

> "More than 50% of the urban area will have to be green"

Vienna is also participating in klimaaktiv, an Austrian program designed to combat climate change that intervenes on building heating systems. From this point of view the city has already established a pioneering pilot project – Seestadt – for requalification of an area to the southwest.

Seestadt calls for investments of 38.5 million euro, and is being led by ASCR, an entity that includes businesses and utility companies, working in close collaboration with the city government. It will encompass an area totaling 240 hectares, corresponding more or less to the extension of two citizen municipalities, and calls for the realization of new neighborhoods, research centers, schools, shops and offices built according to strict sustainability criteria. Initiated in 2011, construction of new neighborhoods in an area to the northeast of the city should conclude in 2028, when the zone will be able to host up to 20,000 new inhabitants and supply at least as many jobs.

Many of the innovative elements are new. The project calls for creation of "first energy plus buildings," which can boast extremely high efficiency standards. It also includes plans for "prosumer" buildings, which use photovoltaic panels, thermal solar panels, hybrid panels, heat pumps and storage systems to produce more energy that they consume, and are capable of acting as a reservoir for renewable energy to be released into the electric network as needed. These buildings will be active protagonists in the energy production and distribution system, becoming true players within the Austrian electricity market. Complex ICT systems that can interpret the multitude of data produced make it possible to manage the entire system in an efficient manner. For this reason, Seestadt will be equipped with a system capable of evaluating consumption in real time. BEMS (the Building Energy Management System) boasts an interface that allows Seestadt to interact with the Austrian distribution system, the Energy Pool Manager, and interfaces between the buildings and the network at large.

Not by chance, these buildings have earned a number of different national and international sustainability awards, including:

- The "Building of Tomorrow" program of the Federal Ministry of Transport, Innovation and Technology;
- the Klima:aktiv passive-energy house gold award (1000 out of 1000 points);
- the ÖGNB award (974 out of 1000 points);
- and the European Green Building Integrated Design Award 2014.

A city network

The strategy put into play by the Austrian capital is interesting from other points of view as well. Over recent years Vienna has become the headquarters for the Central Europe project, a cross-border cooperation program that brings together countries in continental Europe to experiment with innovative energy efficiency and renewable energy source initiatives.
First activated in 2007, Central Europe has already financed 124 such energy projects around Europe in countries including Austria, the Czech Republic, Germany, Hungary, Italy, Poland, Slovakia, Slovenia and the Ukraine, investing a total of 230 million euro. It aims to support the use of locally available alternative energy sources. The challenge lies in turning the diversity of central Europe into a source of wealth and opportunity, developing cooperative networks between different countries and regions.

Vienna's virtuous example may well expand quickly across the continent!

> "Vienna has become the headquarters for the Central Europe project, a cross-border cooperation program that brings together countries in continental Europe."

News & Events

Next Energy Events

Grid Edge World Forum 2017

June, 27-29 San Jose, California

https://www.greentechmedia.com/events/live/grid-edge-world-forum-2017

Greentech Media's Grid Edge World Forum 2017 is the only conference and exhibition focused exclusively on tomorrow's distributed energy system. Conferences and debates on the latest issues and opportunities impacting tomorrow's distributed energy system.

Power Talks – Energy Poverty

June, 28 Brussels, Belgium

Electricity prices and "energy poverty" have recently been top of the news in several European countries where consumers are reported to struggle paying for their energy bills. Starts being discussed by the European Parliament and Council, EURELECTRIC oragnizes a debate on this major challenge for Europe – and the best way forward - with high level panellists.

International conference on Energy

Engineering and smart material

July, 7-9 Lyon, France

The aim as well as objective of ICEESM 2017 is to present the latest research and results of scientists related to Energy Engineering and Smart Materials topics. The focus of the conference is to establish an effective platform for institutions and industries to share ideas and to present the works of scientists, engineers, educators and students from all over the world. The organizing committee of conference is pleased to invite prospective authors to submit their original manuscripts to ICEESM 2017.

International Conference on green energy technology

July, 18-20 Rome, Italy

http://www.icget.org

2017 2nd International Conference on Green Energy Technology (ICGET 2017) will be held in Rome, Italy during 18-20 July, 2017. ICGET 2017 is Co-organized by Sapienza University Faculty of Architecture. It serves to foster communication among researchers and practitioners working in a wide variety of scientific areas with a common interest in improving Green Energy Technology and related techniques.

International conference on Smart Grid and Smart Cities

July, 23-26 Nanyang, Singapore

http://www.csgsc.net

The smart grid is envisaged to be the next generation electric grid for Smart Cities. It enables the smart integration of conventional power generation, renewable generation, distributed generation, energy storage, transmission, distribution and demand management. The benefits of smart grid include the enhanced reliability and resilience, higher intelligence and optimized control, decentralized operation, higher operational efficiency, more efficient demand management, and better power quality. However, all these prospected transformations also bring with them numerous challenges and opportunities.

World Energy Leaders'Summit and Trilemma Minister Roundtable

September, 12 Mexico City, Mexico

https://www.worldenergy.org/events/future/

World Energy Leaders' Summits (WELS) are high-level exclusive events organised by the World Energy Council for the global energy leaders' community to facilitate on-going dialogue on critical issues affecting the energy sector.
The Mexico City WELS will be co-hosted by Mexico's Secretaría de Energía (SENER) and participation is by invitation only to Ministers, the Council's Patron and Global Partner CEOs, officials and selected high-level guests. The agenda will build upon insights gained from the World Energy Council's on-going studies, including the World Energy Scenarios, and the World Energy Trilemma.

Nordic Edge Expo

September, 26 -28 Stavanger, Norway

http://www.nordicedge.org

Nordic Edge Expo is today considered one of the most important smart cities arena.
The exhibition covers a broad range of subjects and themes related to smart, technological solutions such as Mobility, EdTech, Energy and Renewables, Infrastructure, Enabling technologies, Health, City Governance, Citizen Involvement and Smart Living. Smart Happiness is this year theme.