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The $48 trillion question

What should policymakers be doing to ensure our future energy needs are met?

The ability of countries to meet the future energy needs of their people could be jeopardised unless policymakers take urgent action to facilitate energy investment. So says the latest World Energy Trilemma report from the World Energy Council. Meanwhile, the WEC's annual ranking of how well 129 countries are handling the three dimensions of the energy trilemma – reliability, affordability and sustainability – finds the number scoring an AAA rating has fallen from five to three, with four countries on negative watch.

With global energy systems coming under increasing strain – and global energy demand projected to rise strongly *(see story on p6)* – the WEC has questioned whether the US$48 trillion of investment needed between now and 2035 will materialise without better help from governments, regulators and international financial institutions. That is the blunt message of a report launched by the WEC in Washington DC last month, following a study conducted with Oliver Wyman, a global management consulting firm.

The $48 trillion, made up of $40.2 trillion for energy supply infrastructure and $8 trillion for energy efficiency, does not include the extra costs that would need to be incurred to put the world on a path that limits global warming to within 2°C of pre-industrial levels. That would require a further 10%, taking total cumulative investment to $53 trillion by 2035.

Entitled "World Energy Trilemma: time to get real – the myths and realities of financing energy systems", the report – based on interviews with close to 50 leaders from the international energy finance community – analyses what is needed to ensure that enough capital becomes available. Specifically, it makes three recommendations:

- Policymakers must focus on implementing policy and regulatory frameworks that encourage investment by reducing political and regulatory risks. "Coherent, long-term, accessible, predictable and transparent energy policies – underpinned by well-implemented regulations and independent regulatory bodies – can significantly increase investors' confidence," comments the report. "Policymakers must strive to keep politics out of energy policy and reduce concerns that investing in energy results in unrewarded exposure to political and regulatory risk."
- Financial infrastructure needs to be put in place to allow capital to flow easily into the energy sector, while financiers need to get more comfortable with investing in new technologies and in developing countries, where the need for new infrastructure is greatest.
- The energy sector needs to bring a pipeline of clearly bankable projects to the market, given that much of the required capital will have to come from the private rather than public sources.

THE NEED TO SCALE UP

"The amount of investment needed in energy infrastructure needs to scale up by about 50% from its current level if we're going to replace ageing infrastructure in the developed countries, build out new infrastructure in the developing countries, and make the transition to a low-carbon economy," said Joan MacNaughton, Executive Chair of the World Energy Trilemma work, in an interview with World Energy Focus.

"What we found is that there's plenty of capital. That was the strong message that we got consistently from investors, across various types of financial institution. But it won't flow to energy infrastructure unless certain things happen. In particular, there is great concern about the misunderstanding on the part of policymakers of the risk/reward equation for investors – the perception of risk and reward that drives investment decisions.

"The energy sector is characterised by a strong private sector involvement but strong government intervention, so the policy framework is absolutely crucial. Most of the money needed will have to come from the private sector; the required

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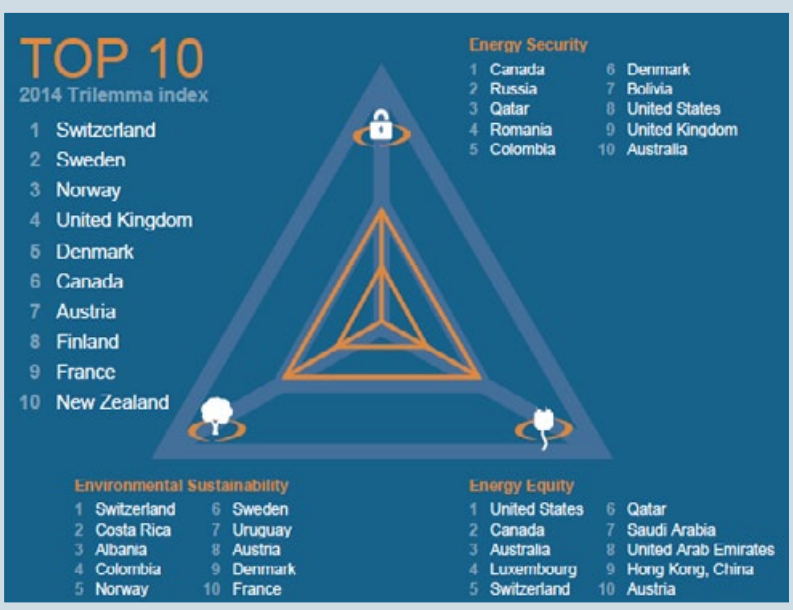
investment is just not going to come from governments.

'WALL OF MONEY'

"That suggests that the financial community and the energy sector need to engage more proactively with the policymakers if we're going to get the scale-up of finance – because, of course, that money can go to other places. We had some very interesting quotes. People talked about 'a wall of money' that could flow if the framework were right and if there were a pipeline of bankable projects. One person said: 'If you get the framework right, the private sector will pile in.'"

According to MacNaughton, an issue discussed at the Washington launch of the report was that such investment as government makes should leverage private capital. "For example, the Green Climate Fund has now got $10 billion in pledges following on from recent US and UK pledges. One panellist said 'you could use that money to build power generation infrastructure in developing countries and you'd get about ten power stations'. Instead, what you really need to be doing is thinking how can that money be deployed so as to leverage private sector investment. There was quite a lot of discussion around things like building capacity and risk guarantees."

Also important, says MacNaughton, are export credit guarantees and government support for research & development for energy technology, particularly low-carbon technologies. François Austin, Global Head of Energy Practice at project partner Oliver Wyman, adds that: "Uncertainty around technological developments, energy politics, changing regulations, and volatile energy and commodity prices are all adding a significant risk premium to the cost of capital for energy investments."The huge energy needs around the world offer significant market opportunities if robust and equitable pathways are provided for the private sector. The recommendations to improve countries' balance on the energy trilemma through necessary investments can be delivered with coordinated efforts by governments, investors and energy companies." ●



'WHAT GETS MEASURED, GETS DONE' – RANKING COUNTRIES' ENERGY TRILEMMA PERFORMANCE

The WEC's World Energy Trilemma report is accompanied by an annual ranking of 129 countries showing how well they are performing in terms of the three dimensions of the trilemma: energy security (reliability and ability to meet demand), energy equity (accessibility and affordability of energy supply) and environmental sustainability (supply- and demand-side energy efficiencies and development of low- and zero-carbon supplies).

Comparative rankings highlight how well a country is addressing the energy trilemma overall, as well as each of the three dimensions. A balance score provides a snapshot of how well a country manages the trade-offs between the three dimensions.

The index is increasingly being seen as a benchmark for assessing good energy policy at a country level. It points to key areas that countries must give extra attention to in order to further develop a balanced energy profile and minimise the risk and uncertainties investors face.

The results of the 2014 Energy Trilemma Index show that the top 10 countries (see chart) are developed countries with higher shares of energy coming from low- or zero-carbon energy sources, supported by well-established energy-efficiency programmes. The number of countries with an AAA rating is down from five last year to three in 2014: Switzerland Sweden and the United Kingdom.

Four countries are on "negative watch": Japan, Germany (see Country Focus on p8), Italy and the UK. Two are on "positive watch": Mexico and the United Arab Emirates.

Full World Trilemma Index results and country profiles can be found on the WEC website at http://www.worldenergy.org/data/sustainability-index

ABOUT
WORLD ENERGY FOCUS

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Alex Forbes has been reporting on energy developments and analysing trends for more than three decades. His expertise covers all the mainstream energy sources, policy, regulation and climate change. In 2013, Alex received the annual award from the International Association for Energy Economics for Excellence in Written Journalism.

Voice of power

What electricity companies are saying about the new realities they face

300 GW of new generation capacity is needed a year, says the GEI (Photo: Siemens)

In an increasingly electrifying world, electricity utilities will play an ever more important role in meeting fast-growing demand for power. The utility membership of the Global Electricity Initiative covers countries that together account for over 80% of global installed generation capacity. In this exclusive interview, Executive Chair Philippe Joubert reveals the results of a survey of its members – and explains why policymakers and regulators need to tap into the knowledge, experience and ideas of the companies that generate and deliver our electricity.

Why was the Global Electricity Initiative (GEI) formed and what are its objectives?

We formed this initiative because we thought it was important to convey the voice of the electricity sector at a global level to give a global picture. The electricity sector is more and more important in the transition we are living through towards respecting the environment while bringing affordable and secure energy – what the World Energy Council (WEC) calls the energy trilemma.

The initiative was started at the Durban COP 17 climate talks in 2011 under the leadership of the South African utility Eskom. After Durban the utilities' leaders decided to widen the initiative which led to the formation of a coalition of the World Business Council for Sustainable Development (WBCSD), the WEC and the Global Sustainable Electricity Partnership (GSEP). We now represent nearly 80% of the electricity generated in the world and we will continue to reinforce our geographical footprint and to build alliances.

You're one of a number of organisations working towards giving everyone access to modern energy sources. They include the United Nations' Sustainable Energy For All (SE4ALL) initiative, the US Power Africa initiative, and of course GSEP. What is the GEI's particular role and how is it co-operating with other initiatives?

We work with these initiatives and are partnering with some of them. But we are a very specific initiative: our goal is to get a voice from the leaders of the companies that are generating electricity. What is their opinion? What are they already doing to fulfil their obligation of supplying secure, competitive and environmentally friendly electricity? And what messages do they have for policymakers?

You are about to publish – at the COP 20 climate talks in Lima, Peru – an annual survey of your membership. What are the key findings?

The utilities that are members of the GEI understand the importance of the objective of bringing energy to all by 2030. But they think it will be difficult to do if we don't change business models and regulatory frameworks. The membership thinks it's possible if these change.

Secondly, they are saying that we will have to continue using fossil fuels to generate electricity. We would really like to become completely CO_2-free but there are problems that we have to solve. We have to increase the adaptation of generation sources to the grid or we have to adapt the grid. We have to solve the issue of intermittency. We need technology for electricity storage. We need carbon capture and storage (CCS) and for that we need a meaningful price of CO_2. We need stable, long-term policies that allow us to change our portfolio of technologies.

The GEI utilities consider that climate change is a reality so they will have to invest as much in adaptation and resilience as in mitigation.

The membership also considers that access to land and water will be among the difficulties they will have to face in years to come because the technologies we are pushing now are much more voracious in terms of land use than the classical ones. We all know that the water-energy nexus is one of the key issues as water is fundamental to energy and energy is fundamental to water and we will have to address this, given climate change and the perturbation of all the cycles that we are experiencing.

Finally the membership considers that our first responsibility is to supply secure and reliable electricity. We see that our customers are not willing to pay for more for clean power and we are receiving a lot of contradictory information or guidance from the stakeholders that we have to satisfy. So they are asking for a little more consistency between what is expected from them and the signals sent to them.

From the findings of your survey, what are the key messages for policymakers?

We all have to understand that this sector remains highly regulated. The messages that regulators send to utilities are important because most of them have to follow them.

Second, this is a long-term, capital-intensive industry. So long-term stability is a

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very important factor for investment decisions. Utilities need certainty that the rules in place today are not going to be changed in two or three years because when they start an investment they are talking in terms of decades, not years. So they need to be extremely comfortable with the stability of the rules. If not, we run into a world of stranded assets, which is not in the interests of the utilities, or the public, and certainly not of the government.

Also, pricing of externalities should be consistent with the messages we are sending to utilities. We cannot say "OK, you have to go to CO_2-free" and maintain the CO_2 price at two dollars per tonne, for example in Europe.

You note in the foreword to your survey report that over the past two decades many changes have taken place in the electric power sector. What is the new reality that electricity utilities are facing?

We are entering a new world and the trilemma is here to remind us that we really need to consider the three dimensions of energy. The dimension of the environment is taking a big importance in the equation. The renewables surge has completely changed the structure of price, but also the relationship with customers, with more and more "prosumers" rather than just "consumers". People want to decide the type of electricity they use and to sell the excess electricity they may produce.

Obviously the pressure on the system has increased. Growing numbers of people and growth in the level of welfare are demanding more and more power. We have gone from a world that was used to putting around 100 GW of generation capacity online every year to 300 GW every year. To fulfil this demand, supply has to adapt.

A clear message from the Global Electricity Initiative survey is that technology needs to play a crucial role in meeting policy objectives. Which are the key new technologies?

I will not comment on the production side because it's well known, but CCS will be important. For transmission and distribution you have the alliance between information technology and classical transport of power by cables – the whole concept of the smart grid which will be an important field of technology evolution.

Because of the intermittent character of renewables we need to increase the size and decrease the cost of electricity storage. Currently, we can store electricity on a large scale only with pumped-storage hydroelectric facilities that work by using electricity to pump water upstream. We need to be able to store electricity in other ways. These don't exist yet at industrial scale.

The growth of zero-carbon but intermittent renewable energy sources poses particular challenges to electricity utilities. What are the challenges and how can they be tackled?

In an electrical network you have to have an equilibrium between the demand and the offer at all points of the network at all instances. So when you offer electricity that is not constant, but can grow fast or decrease fast in a matter of minutes or hours, you need to adjust because the demand is still there. So you need backup generation, generally a thermal source of electricity or a dam with a reservoir.

The second problem is that when you have an excess of electricity at the wholesale side you need either to find a use for this electricity or a way of storing it. If not, you will have a problem with equilibrium.

Another point – rarely commented on but something we intend to study in the GEI – is regionalisation of networks. When you aggregate networks with different characteristics you can solve the issue of peak and valley more easily than in a single network.

There is widening consensus that meaningful carbon pricing is vital to provide appropriate investment signals for low- and zero-carbon technologies. How hopeful are you that meaningful carbon pricing will become a reality?

People are conscious now that sooner or later a price will come – so they are asking for guidance, because today's volatility is increasing the level of risk and not solving the issue. The uncertainty caused by yo-yo type prices is not helping long-term investment. The business model based on the assumption that externalities don't exist – that the services rendered by nature are free and unlimited – is finished. So we need to put a price on the services rendered by nature. CO_2 is not the only issue but it is one of the most important when it comes to climate change.

In terms of climate change, the next twelve months will be dominated by the build-up to the UN COP 21 talks in Paris where, it is hoped, a meaningful international climate change treaty will be agreed. Is the time right for an international climate treaty? And how important is the achievement of that to the GEI membership?

I am impressed by the momentum which is building around the Paris COP 21 event. The COP 20 talks taking place in Lima are an important step also. For the GEI this is key because the electricity sector is responsible for around 40% of the emissions. The utilities are saying that climate change is a reality and we have to tackle this problem. So we are working to make sure that the voice and the proactive attitude of the utilities is taken into account.

An international agreement is not sufficient but it is necessary to ensure that the behaviours of individual countries and companies – and ultimately of citizens – are in line with what is probably the number one threat to humanity today.

Interview by Alex Forbes

The Global Electricity Initiative's survey results will be presented on 9 December at the COP 20 climate conference in Lima, Peru – at an official side event with the International Energy Agency – and will be available to download from *http://www.worldenergy.org*

New era for oil price as OPEC backs away from output cut

Oil prices moved into unknown territory at the end of November when the Organisation of Petroleum Exporting Countries (OPEC) decided to leave its 30 Mb/d output target unchanged at the ministerial meeting in Vienna. The response of the markets was immediate and dramatic. The price of Brent crude fell towards $70/b on the day of the announcement while shares in energy and energy services companies tanked, along with the currencies of oil-exporting countries, notably Russia.

The following day, the price of Brent briefly dipped below $70/b to $69.78/barrel – breaching an important psychological level – 40% down on the peak of $115/barrel reached in June.

In the last issue of World Energy Focus *(see p6)* we posed the question of whether the oil price slump of recent months was a blip or a structural change. We concluded that: "There are good reasons to think that we are seeing structural changes that could lead to a period of softer prices, unless OPEC decides, as it has in the past, to defend them."

OPEC's decision to leave its output target unchanged has led to overwhelming consensus that we are almost certainly entering a period of lower oil prices than we have become used to over the past four years. Indeed, the head of the Russian state oil group Rosneft, Igor Sechin, was widely quoted as saying he believed prices could fall below $60/barrel in the first half of 2015.

The sharp slide in oil prices has raised fears that as much as $100 billion of capital spending could be at risk, a threat to high-cost oil production such as oil sands, deep-water offshore and, crucially, light tight oil produced from shale plays in North America, where production has been rising sharply. There has been widespread speculation that the outcome of the OPEC meeting – described by Saudi Arabia's oil minister Ali Al-Naimi as a "great decision" – is part of an OPEC strategy to make high-cost oil production uneconomic. Saudi Arabia is the largest OPEC producer and its most influential member.

In a report published in October, the International Energy Agency concluded that "all told, roughly 2.6 Mb/d of world crude oil production comes from projects with a break-even price in excess of $80/barrel". This compares with current global production of around 90 Mb/d, so prices of $80/barrel and above would have relatively little impact. The same cannot be said of prices below $70/b, at which level a much greater proportion of oil production would struggle to turn a profit.

What we have yet to see is what the trajectory of oil prices will turn out to be in practice between now and the end of 2015, and, indeed, the level of distress in the oil industry that prices below $80/barrel could cause. It remains a possibility that OPEC will call an extraordinary meeting of its oil ministers if the price collapse continues. Its next scheduled meeting is in June 2015.

China took another significant step towards meeting its fast-growing energy needs last month when it signed documents that prepare the way for a second gas export deal with Russia. The framework agreement signed by Gazprom and China National Petroleum Corporation covers 30 Bcm/year of supply via the so-called "western route". In May of this year Russia and China finalised a deal for 30 Bcm/year via the "eastern route".
The picture above shows the Chinese capital Beijing. ***(Photo: Gazprom)***

NEWS IN BRIEF

COP 20 CLIMATE TALKS GET UNDER WAY IN PERU

The latest round of climate talks, the 20th Conference of the Parties (COP 20) to the UN Framework Convention on Climate Change (UNFCCC), began in the Peruvian capital Lima on Monday 1 December amid high hopes that a draft treaty can be hammered out for the Paris COP 21 talks next year.

Christiana Figueres, Executive Secretary of the UNFCCC, said: "The litmus test of success in Lima will be a clear draft of the universal agreement, a shared determination by all to deliver significant national contributions to build a low carbon resilient future, initial capitalisation of the Green Climate Fund, and the mobilisation of a broad coalition of actors turning potential into reality on the ground without delay."

DEADLINE FOR IRAN NUCLEAR DEAL EXTENDED AGAIN

Iran and the six world powers attempting to negotiate a deal on the country's nuclear programme – which would in turn open the path to a lifting of sanctions – failed to meet their 24 November deadline to finalise talks in Vienna. The deadline has been extended to the end of June 2015.

DATE SET FOR SE4ALL IN 2015

The Second United Nations Sustainable Energy for All (SE4ALL) Forum will be held at the United Nations' headquarters in New York between 18 and 22 May 2015. It will build on the success of the inaugural forum held in June 2014 and hosted by Secretary General Ban Ki-moon.

IEA warns of stressed global energy system in latest Outlook

Decision-makers need to focus on long-term signs of stress in the global energy system and should avoid being "lulled into a false sense of security" by current events, says the International Energy Agency in its latest World Energy Outlook (WEO). Specifically, the agency warns that "the short-term picture of a well-supplied oil market should not disguise the challenges that lie ahead as reliance grows on a relatively small number of producers".

Launching the agency's flagship publication in London last month, Executive Director Maria van der Hoeven said: "World events have served to make this WEO a hotly anticipated one. We have seen turmoil in parts of the Middle East, tensions between Russia and Ukraine, some signs of economic slowdown, lower oil prices in recent months, and even a deal between China and the United States on climate *(see next story)*."

For this first time the WEO scenarios make projections to 2040. In the central scenario world primary energy demand is 37% higher by then, despite efficiency improvements. A conclusion that some may find surprising is that by 2040 world energy supply is divided into four equal parts: low-carbon energy sources such as renewables and nuclear, oil, natural gas and coal. In other words, fossil fuels will continue to supply three-quarters of the world's energy needs – with obvious implications for carbon emissions.

In an in-depth study of nuclear power, the IEA sees installed capacity growing 60% by 2040, but most of the growth is in just four countries: China, India, Korea and Russia.

World oil supply rises to 104 Mb/d in 2040, "but hinges critically on investments in the Middle East". Interestingly, given recent oil price movements, the IEA sees tight oil output in the US levelling off and other non-OPEC supply falling back in the 2020s – with the Middle East becoming "the major source of supply growth".

Demand for gas rises by half by 2040, making it the only fossil fuel still growing by then. Coal use rises by 15% but levels off in the 2020s.

The regional focus in this year's WEO is on Sub-Saharan Africa, where two-thirds of the population still lacks access to electricity – "a severe constraint on economic and social development". *(This section of the report was covered in detail in the cover story of the November issue of World Energy Focus.)* ●

US/China carbon pledges boost hopes for Paris climate deal

The presidents of the United States and China, Barack Obama and Xi Jinping, last month took most observers by surprise with joint pledges to cut carbon emissions during Obama's tour of Asia. China's pledges – to ensure its carbon dioxide emissions peak by 2030 and to raise the share of non-fossil energy sources by then – are particularly notable. This is the first time that China has agreed to a date for peak emissions.

For his part, Obama pledged to reduce US carbon dioxide emissions by 26–28% below 2005 levels by 2025, a significantly more ambitious target than the 17% by 2020 he had previously committed to. The new US goal will double the pace of carbon pollution reduction from 1.2%/year on average during the 2005–2020 period to 2.3–2.8%/year on average between 2020 and 2025.

A White House statement said that: "This ambitious target is grounded in intensive analysis of cost-effective carbon pollution reductions achievable under existing law and will keep the US on the right trajectory to achieve deep economy-wide reductions of the order of 80% by 2050."

While some observers reacted with scepticism, the pledges were widely seen as a boost to UN climate talks aimed at reaching a meaningful international climate treaty at COP 21 in Paris in December 2015.
In a letter to the *Financial Times*, Professor Nicolas Stern, author of a landmark report on the economics of climate change and Chair of the Grantham Research Institute on Climate Change and the Environment, wrote: "Presidents Xi and Obama, and their governments, should be congratulated for demonstrating real leadership [and] commitment." ●

In yet another sign of growing interest in the use of LNG as a marine fuel, Qatari shipyard Nakilat-Keppel Offshore & Marine has signed an MoU with classification society DNV GL aimed at promoting LNG as fuel in the offshore and shipping industries. The technology-sharing deal was signed by DNV GL's CEO, Dr Henrik O. Madsen, and N-KOM's CEO, Chandru Rajwani (left). Qatar is the world's largest producer of LNG ●
(Photo: Laurence Tissot)

Testing times for Germany's energy policymakers

Two big issues are keeping Germany's energy industry preoccupied: the ongoing energy transition, or *Energiewende*, with all its complexities – renewables, climate, market design, energy efficiency, grid reinforcement and so on – and uncomfortable dependency on Russian natural gas imports. Frank Holtrup from the WEC's German Member Committee gives an insight into the challenges and the policy responses.

Germany's ongoing energy transition – the *Energiewende* – is characterised by two key developments: a rapid build-up of renewable energy sources, supported by feed-in tariffs; and the decision to decommission all of the nation's nuclear power stations. In the aftermath of the Fukushima events of 2011, parliament decided to close eight nuclear power stations immediately, with a full exit from nuclear to be implemented by 2022 – a move supported by an overwhelming majority of Germans.

The long-term national objectives of the Energiewende were determined by the government in 2010: to reduce greenhouse gas (GHG) emissions by 80–95% by 2050, compared with 1990 levels; to cut primary energy consumption by 50% by 2050, compared with 2008 levels; and to raise the share of renewable energy sources to 60% of gross energy consumption and 80% of gross electricity consumption by 2050.

For 2030, a target share of at least 50% of renewable energy in gross electricity consumption has been defined. This is in line with the EU's recently agreed 2030 framework for climate and energy policies *(see p5 of our November issue)*, which calls for a 40% cut in GHG emissions compared with 1990, a 27% share for renewables, and a 27% increase in energy efficiency.

Growing renewable energy capacity – with a focus on wind and solar – is causing deep structural challenges in Germany's energy market.

REFORMING RENEWABLES

Several important reforms of the country's feed-in tariff system for renewable energies have been instituted, strongly reducing specific levels of support. For example, feed-in tariffs for solar photovoltaic power have fallen from 46–56 cents/kWh in 2004 to 9–12 cents/kWh in 2014. However, these reductions came late, meaning that the cumulative effect of the very rapid deployment of installations has led to immense financial commitments for the next 20 years.

The annual bill for renewable energy support – passed on to end-consumers via a surcharge – amounted to €19 billion in 2013, and almost €24 billion in 2014. The most recent reform of the renewable energy act (EEG) prescribes a transition to a market premium system for renewable energy support, in the hope that this will reduce the cost of further additions to the installed renewable energy base.

To address the urgent need to increase the level of coordination regarding the *Energiewende*, the government has devised a "10-item agenda" comprising key policy actions to secure a successful transition. These policy priorities illustrate that there is a strong need not only to fix and modernise instruments such as renewables support and energy efficiency, but also to think more holistically about energy market design and to increase Europe-wide collaboration.

The high dynamics of additions to Germany's renewable energy capacity – with a focus on wind and solar – are causing deep structural challenges in the energy market. This change is being felt in the wholesale market where large volumes of volatile feed-in power have a disruptive potential for conventional power plants.

INVESTMENT UNCERTAINTIES

On the wholesale power market, the impact of more than 84 GW of installed renewable power generation capacity – more than half of it installed since 2008 – has translated into a price drop from 2008 levels of around €60–70/MWh to about €30–40/MWh in 2013. This price level renders many conventional power plants unprofitable and provides no incentives for investment in modern, highly efficient power plants. At the same time Germany is phasing out nuclear power and retiring many ageing conventional power plants. Meanwhile, the question of how to finance new, assured power generation capacity remains unresolved.

Consequently, a lively discussion is under way regarding the design of the electricity market and the possible introduction of a capacity market. The debate is highly complex as the issue is deeply interdependent with other policy-driven developments, such as the speed of expansion of renewable energy systems in > see page 8

DECOUPLING ENERGY USE FROM ECONOMIC GROWTH

Germany, Europe's largest economy, consumed 234 million tonnes of oil equivalent (Mtoe) of energy in 2013 – a little more than Brazil and equivalent to 14% of the United States' energy consumption or 12% of China's. Despite continuing economic growth, Germany's energy consumption has been on a slight downward trend over the past two decades, a result of improving energy efficiency and a population that is declining rather than growing.

Electricity consumption in 2013 was 528 TWh, down from a peak of 542 TWh in 2008. This downward trend is despite the fact that Germany was impacted to a far lesser extent by the global economic downturn of 2008-09 than other countries, and the fact that it has maintained a significant industrial base, including energy-intensive chemicals and manufacturing.

Germany has therefore succeeded in decoupling economic growth from energy consumption, partly because its comparatively high energy prices have encouraged efficient energy use.

Europe and the setting of quotas for the European Union's emissions allowance trading system.

For transmission and distribution grid operators, the greatly increased share of volatile renewable energy fed into the grid has necessitated significant change in the way grids are managed as well as substantial investment in grid and transformer capacities. Germany needs to strengthen its north-south transmission capacities in order to deal with the structural mismatch of high – and continually increasing – wind-power production in the north and key demand centres in the south and west.

A national grid development plan has confirmed the need for four major "transmission corridors" that should be developed with a mix of projects, including upgrading existing lines and constructing new ones. However, these projects have met significant resistance in the regions affected by the new power lines. It remains to be seen whether the desired acceleration of grid infrastructure projects will be achieved.

Overall, the main challenges for Germany's *Energiewende* are not primarily the technical issues surrounding system integration. The key challenges lie in the adaptation of market designs and business models so that they are capable of dealing with the increasing complexities and uncertainties of the energy market.

UNCOMFORTABLY DEPENDENT

Apart from the *Energiewende* with its self-created challenges, Germany faces the challenge that it is poorly endowed with energy resources, most of which have to be imported. The nation imports more than 95% of the oil it consumes and more than four-fifths of its natural gas.

Specifically, over one-third of Germany's gas comes from Russia – so the geopolitical conflict between Russia and Ukraine that has been going on for almost a year, has not only led to political destabilisation of that region, but has also raised fears about disruption of gas supplies from Russia to Europe. Fortunately, the problems between Russia and Ukraine regarding the delivery of natural gas have recently be resolved for the winter 2014/15 *(see p5 of our November issue and p4 of our October issue)*. But long-term dependency on Russian gas imports persists.

In the WEC's latest World Energy Issues Monitor, Russia has been rated by German energy leaders as the biggest critical uncertainty. While the risk of a potential supply interruption from Russia cannot be completely eliminated, the effects could be mitigated by well-filled gas storage, a higher share of Norwegian natural gas imports, more LNG from the Middle East, and closer cooperation between EU countries. ●

Further information on Germany's *Energiewende* is available at: *http://bit.ly/weltenergierat_report*

WEC EVENTS

Africa Energy Indaba Johannesburg, South Africa

17–18 February 2015

Africa Energy Indaba (AEI) is the foremost African energy event for energy professionals from across the globe. The event gathers international and African experts to share insights and solutions to Africa's energy crisis, while exploring Africa's vast energy development opportunities. It includes a conference and an exhibition. Designated the WEC's African regional event, the AEI is presented by the South African National Energy Association (SANEA), the WEC national committee. It is supported by the African Union Commission and the NEPAD Planning and Coordinating Agency.
http://www.africaenergyindaba.com

Executive Assembly Addis Ababa, Ethiopia

26–30 October 2015

The WEC's annual meeting. The full week of events will welcome the WEC community and representatives from the African and global energy sectors for open and private discussions. It will also host the WEC's governance meetings.

WEC MEMBER COMMITTEE EVENTS

India Energy Congress New Delhi, India

28–29 January 2015

Held under the theme "Securing India's energy future: integration and action", the congress will discuss issues of integrated energy governance and planning and the actions needed to secure energy to foster inclusive growth, while balancing the energy trilemma. Ministers, policymakers, industry leaders and other stakeholders will lead discussions while international experts will provide global perspectives.

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ABOUT THE WEC

The World Energy Council (WEC) has been at the forefront of the energy debate for nearly a century, guiding thinking and driving action around the world to achieve sustainable and affordable energy for all. It is the UN-accredited energy body and principal impartial network, representing more than 3,000 organisations – public and private – in almost 100 countries.

Independent and inclusive, the WEC's work covers all nations and the complete energy spectrum – from fossil fuels to renewable energy sources.

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