



The critical role that the energy sector plays in the functioning of a modern economy makes it a highly attractive target for an increasing number of cyber-attacks. Addressing this recent phenomenon, a new report: ‘The road to resilience: managing and financing cyber risks’, published by the World Energy Council in collaboration with Swiss Re Corporate Solutions and Marsh & McLennan Companies, was launched on 29 September, ahead of the World Energy Congress in Istanbul. Team members Andrew George, Chairman of Energy & Power at insurance brokers Marsh, and Andrew Herring, Marsh’s Head of Energy for EMEA, share their insights into this new threat facing energy companies, and how to deal with it.

“Although there are many industries that are vulnerable to cyber-attack, what we see from our research is that there are four sectors where this is a major threat: the health sector, financial services, businesses who trade exclusively online, and critical

infrastructure – such as water and energy,” says Andrew George. The report ‘The road to resilience: managing and financing cyber risks’ highlights that energy companies have seen a massive increase in the number of successful cyber-attacks

Cyber-attacks in real time. Photo Bill Smith licensed under Creative Commons

over the past year, and cites eleven recent case studies of cyber-attacks on energy companies.

On 15 August 2012, Saudi Aramco, the state-owned group that runs all of Saudi Arabia’s oil production, was attacked by a virus, ‘Shamoon’, that damaged approximately 30,000 computers by malware infestation and destroyed 85% of the hardware on the company’s devices.

On 23 December 2015, hackers entered the computer and supervisory control and data acquisition (SCADA) systems of the Ukrainian electricity distribution company Kyivoblenergo and disconnected seven 110 kV and twenty-three 35 kV substations, causing a 3-hour outage for around

Cyber threats are among the top concerns for energy leaders

80,000 customers. This attack was the first publicly acknowledged cyber-attack on a country’s power supply.

A recent survey of over 150 US-based IT professionals in the energy, utilities, and oil and gas industries that focused on cybersecurity challenges found that 77% of the respondents reported a rise in successful cyber-attacks in the last 12 months, and 68% said the rate of successful cyber-attacks had increased by over 20% in the last month.

“A big issue is that you don’t always know you’ve been hacked or spied upon,” says George. “The conviction rate for cyber-attackers is very low: it’s difficult to trace and very expensive”, adds Andrew Herring.

ENERGY SECTOR ‘A HIGHLY ATTRACTIVE TARGET’

The increasing interconnection and digitisation of the energy sector, including smart grids, smart devices and the growing Internet of things, and its critical role in the functioning of a modern economy make the energy sector a highly attractive target for cyber-attack. Although digitisation increases operational efficiency in the industry, growing interconnection also raises the complexity of cyber risk management.

Cyber-attack on energy infrastructure has the potential to cause massive operational failure of an energy asset. Large centralised infrastructures are especially at risk due to the potential ‘domino effect’ damage that an attack on a nuclear, coal, or oil plant could cause. [> see page 2](#)

Exclusive preview: World Energy Scenarios 2016 3

Commitment and ambition can limit global warming to 2 degrees Celsius, shows the new edition of the World Energy Council’s flagship study, World Energy Scenarios 2016. Executive Chair Ged Davis talks us through the major findings.

World Energy Congress Preview 5

At the World Energy Congress in Istanbul from 9-13 October, energy leaders and policymakers from across the world will exchange views on today’s critical energy issues. The theme this year: Embracing New Frontiers. A preview.

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Describing the different categories of cyber-attacker, Herring says: “The most obvious motivation is criminal activity – there’s money to be made out of sourcing data like credit cards

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and personal data. Also intellectual property, for instance, oil companies getting information on where to drill.”

“Hacktivists may be motivated by demonstrating public support for a cause or damaging a brand, and terrorists may choose a cyber weapon instead of a bomb,” he adds.

State-sponsored espionage, usually to do with competition and disaffected employees or former employees are also potential agents of cyber-attack. Of these, Herring says, “Criminal activity is the most prevalent – there’s more to be gained.”

GROWING AWARENESS

“Awareness levels are improving, as cyber-attacks are being reported in the media every day,” says Herring. According to the report, cyber threats

are among the top concerns for energy leaders, especially in countries with high infrastructure maturity, particularly North America and Europe. In these regions, energy leaders are increasingly recognising the importance of viewing cyber-attacks as a core threat to business continuity, and the need to create an organisation-wide cyber awareness culture that extends beyond traditional IT departments.

In addition, technology vendors can play a critical role by building security standards into their products. “Technology is moving faster than legislation in this area. The software and technology companies are very proactive – they see this as a business differentiator,” says Herring. “However, it doesn’t solve all problems – the company systems may be operating on software that is no longer supported, and it’s also challenging to stay ahead of the hackers.”

The report notes that ‘measures that require supply chain compliance or cross-border cooperation are more difficult to implement, and require increased cross-sector cooperation.’ Herring describes current co-operative efforts as “nascent”. “It’s a slow process, and ad hoc at present, as companies are very sensitive about cyber security and not always willing to share and make more information available,” he says.

SILVER LINING

According to estimates from Bloomberg, by 2018 oil and gas

companies globally could face costs of up to US\$1.87 billion in cyber security spending. In Europe alone, consulting and testing services associated with cyber security at utilities are expected to be €412 million (US\$ 564 million) a year by 2016.

“Big energy companies are spending more on cyber security than on insurance,” says Herring. Nevertheless, cyber insurance is one mechanism to help offset potential financial losses from a cyber-attack. “Utilities are very active in looking for insurance. Over the last five years, this has become a board-level issue. The first insurance policy was taken out in 1996, insurance

“Big energy
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premiums totalled €1 billion in 2012, and €2 billion in 2014,” says George. “However, this doubling in insurance premiums understates the amount of activity in this area, as we also address the issue in other ways, such as through contract wording.”

The underwriting process includes an analysis of a company’s technical defences, incident response plan, procedures for patching software, policies for limiting access to data and systems, monitoring of the vendor network, reporting on cyber risks and training of internal staff.

“It’s widely regarded as a huge new area to offer clients, and it’s just getting bigger,” says Herring. The report calls upon the insurance industry to continue to develop new products to address the potentially catastrophic losses and the complexity of cyber risk. Challenges include the limited historical data related to cyber-attack and the relative immaturity of the cyber insurance market. Better information from the energy industry will help the insurance industry improve its coverage of energy assets, according to the report. And energy companies also need to identify more clearly where insurance is most needed to fill the protection gap, and work with underwriters to further develop cyber insurance products.

“This is a fast moving area – from the technology aspect to the rise in demand. Compared to the rise in ‘terror cover’ that we saw after 9/11, the interest in cyber cover is much quicker, much steeper and with bigger supply chains. We are much more interconnected in real time now,” says George. ●

The report is available for download on www.worldenergy.org/publications



Andrew George, Chairman of Energy & Power at insurance brokers Marsh

On the second day of the upcoming **World Energy Congress** [<http://bit.ly/2d5yM9y>], the session ‘Cyber threat: are we at risk of the lights going out’ will be led by Michael Bell, President and CEO of Silver Spring Networks; Steve Holliday, former CEO National Grid; Andrew George, Chairman of Marsh’s Energy Practice. Building on the findings of this report they will look at the increasing interconnection and digitisation of the energy sector, ranging from smart grids, or digital oil fields smart devices and the growing internet of things, along with the sector’s critical role in the functioning of a modern economy.



Meeting the 2°C target set in the Paris Agreement is possible – but only if national governments enforce international agreements to curb greenhouse gas emissions. That’s one of the key conclusions of the new World Energy Scenarios 2016 report, which looks at how global trends will shape the energy industry over the next 45 years and will be launched at 10 October at the World Energy Congress.

“If the commitment is there, the ambitions of COP21 can be achieved,” says Ged Davis, the Executive Chair of the team producing the scenarios, summing up the most important message of the flagship publication World Energy Scenarios 2016.

The World Energy Scenarios is the fruit of three years’ work by the World Energy Council and enables policymakers and energy leaders to evaluate key factors and consequences, in order to better shape tomorrow’s energy world.

The Scenarios offers three alternate paths to the year 2060: Modern Jazz, Unfinished Symphony and Hard Rock.

Modern Jazz is a future where enterprises are able to innovate and compete in open markets, and supply low-cost energy for all. **Unfinished Symphony** foresees a world where international agreements and national policies prevail and determine choices, but energy costs are high. **Hard Rock** anticipates slower growth and more conservative national policies as a result of conflict, environmental chaos and migration crises.

Only in the Unfinished Symphony scenario is total energy consumption – and energy intensity – reduced sufficiently to get near the 2°C target. Hard Rock gets to about 4°C. Modern Jazz is in the middle.

“In Modern Jazz, if you don’t have strong carbon prices it slows down the migration to a low carbon economy,” says Davis, “whereas in Unfinished Symphony governments enable relatively high carbon prices which accelerates decarbonisation.”

However, a strongly regulated world restricts the ability of private enterprise to innovate and compete. In the Modern Jazz scenario, higher productivity rates lead to higher GDP per capita and lower prices, enabling affordable energy and water access for more people.

In the Hard Rock scenario, economic growth is weaker and subject to various crises, countries retrench, slowing progress on decarbonisation and addressing wider issues such as jobs, conflict management and migration control. GDP is much lower and there is much greater use of fossil fuels.

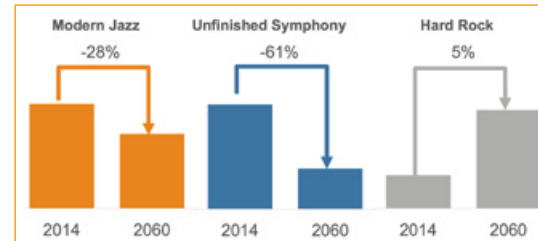


Figure 1. Carbon emissions in 2010 and 2060 (GtCO2/yr). The greatest drop is in Unfinished Symphony – but even then it doesn’t quite result in 2°C.

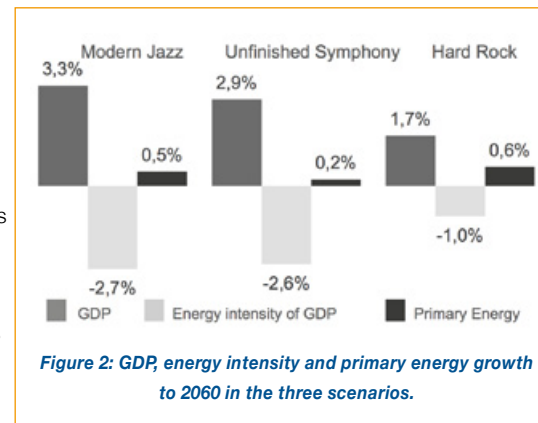


Figure 2: GDP, energy intensity and primary energy growth to 2060 in the three scenarios.

INTELLIGENT ECONOMIES

In the policy-led world of Unfinished Symphony, carbon pricing helps to dampen energy demand growth, to reach the lowest energy use per capita, and total primary energy supply is just 17% higher than in 2010. The share of fossil fuels falls to 48% and the rich-poor gap narrows. Strong global governance leads to the design of intelligent and circular economies, resulting in a resilient, integrated global energy system. > see page 4

**ABOUT
WORLD ENERGY FOCUS**

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By 2030, there are over 185 million electric and hybrid vehicles on the roads, rising to 1.5 billion by 2060.

Nuclear power grows at 2.1% p.a. to 18%. Just 200-500 million people have no access to electricity. Electrification of mass transit happens in the world's largest cities, and by 2030, most developed countries have coal plants retrofitted with CC(U)S technology, as do natural gas plants after 2050.

Table 1:
How energy fares in the different futures:

Energy source	Modern Jazz	Unfinished Symphony	Hard Rock
Non Fossil Fuels	<ul style="list-style-type: none"> Accelerated by technology innovation and supporting policies 	<ul style="list-style-type: none"> Accelerated by top down mandates Nuclear and hydro more significant 	<ul style="list-style-type: none"> Driven by demand for domestic energy production Nuclear and hydro more significant
Oil	<ul style="list-style-type: none"> Demand peaks in 2035 at 99 mb/d Diversification of transport fuels 	<ul style="list-style-type: none"> Demand peaks in 2030 at 91 mb/d Lower demand and diversification of transport fuels 	<ul style="list-style-type: none"> Demand peaks in 2040 at 110 mb/d Status quo technologies
Gas	<ul style="list-style-type: none"> No. 2 fuel in 2040 Growing share in transport and power Cheapest emissions reduction 	<ul style="list-style-type: none"> No. 2 fuel by 2030 CCS mandate by 2050 depresses demand 	<ul style="list-style-type: none"> Competes with coal Unconventional gas driven by energy security
Coal	<ul style="list-style-type: none"> Demand peaks in 2020 at 4,091 MTOE Falls to no. 3 fuel in 2040 	<ul style="list-style-type: none"> Demand peaks in 2020 at 3,838 MTOE Falls to no. 3 fuel in 2030 	<ul style="list-style-type: none"> Demand does not peak Becomes no. 1 fuel in 2040

SMARTLY CONNECTED

In enterprise-led Modern Jazz, the rich-poor gap widens but average GDP per capita is higher than in Unfinished Symphony, and there is the highest energy and electricity use per capita. Although most people have access to water, millions are forced to migrate.

Globalisation and technology transfer lead to more efficient industrial activity. Natural gas and electric vehicles power transport in heavy freight and shipping. All buildings are smartly connected and energy efficient. Energy systems are distributed. Natural gas is used widely as a chemical feedstock.

By 2030, there are over 185 million electric and hybrid vehicles on the roads, rising to 1.5 billion by 2060. Gasoline use peaks in 2050 and

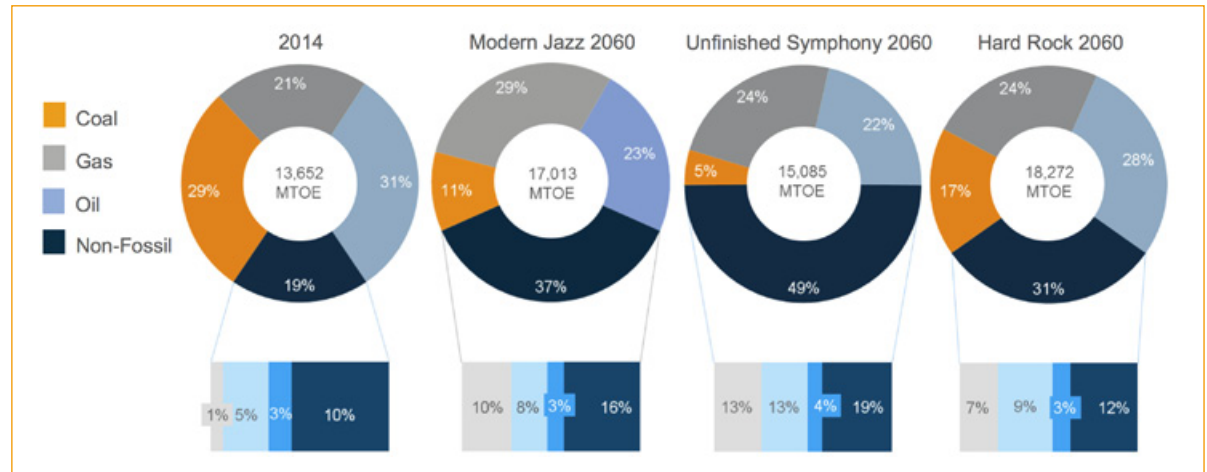


Figure 3: The energy mix in 2060 under different scenarios.

diesel in 2040. But a decline in coal consumption in North America, Europe and China is offset by growth in India and Pacific Asia.

Natural gas does pretty well in both Modern Jazz and Unfinished Symphony, although it starts to decline a decade earlier without a free market. Coal fades out even earlier. In the more dystopian Hard Rock future, coal remains king up to 2060 as more and more coal-fired power stations are built to fuel growth.

PARADIGM SHIFTS

The biggest challenge in all the scenarios is the potential economic slowdown. Davis says "If we look back 45 years we've had exceptional economic growth of 3.5% per year, pretty much evenly split between productivity and labour force. In the next 45 years, labour force growth will reduce to 0.7% or less. The slowdown

in productivity means a re-emphasis on where growth is, and it will be challenging to address this."

The changing nature of work and technology will have a big effect. Davis says: "The problem we have is that the more productive a nation is the less jobs needed, so there is a big need to continually retrain the workforce into new areas. The challenge in Hard Rock is about addressing this productivity paradox in a world in which the political and economic centre of gravity is shifting."

Other major changes include a shift in the world's economic centre of gravity to Asia, wider environmental concerns, population growth and climate change. In Modern Jazz and Unfinished Symphony radical improvements in energy efficiency and a shift towards a less energy-intensive economy play a big role. In addition,

the new generation of "millennials" may care more about wider social, environmental and political issues than the "baby boomer" generation. "These new values, if they persist, will reshape the nature of how we address large-scale economic and post-industrial development," says Davis. ●

The full Scenarios report will be available for download on www.worldenergy.org/publications after the launch on 10 October.



**‘Innovate or Die’
the energy transition
is here**

The 23rd World Energy Congress will take place on 9–13 October 2016 in Istanbul, Turkey. Under the theme ‘Embracing New Frontiers,’ the event will bring together a plenitude of influential energy players with a view to defining, engaging and negotiating today’s critical issues.

Organised by the World Energy Council, the triennial World Energy Congress is the largest energy gathering in the world, and an enormously influential event for the energy agenda. As a non-governmental global organisation, the Council is ideally placed to host important energy debates from a variety of perspectives. Government ministers from almost 50 countries are among the 257 influential senior leaders confirmed to speak at the event.

Research reports and academic papers are the lifeblood of the Congress, giving

a global audience to the world’s best thinkers and innovators. Culminating three years’ work by the Council, the Congress is an opportunity to present the findings of their new ‘World Energy Scenario 2016’ report, as well as award-winning papers such as Shruti Shengal’s ‘Innovative Pricing Models for Sustained Growth of the Solar Power Sector.’

The issues facing the energy sector are all deeply interconnected, but untangling them is part of the work of mapping the new energy terrain. The Congress comprises four days of panel

discussions, papers and addresses. Each day will explore a broad theme, unpacking a ‘new frontier.’

DAY ONE – ‘VISION AND SCENARIOS FOR THE FUTURE’

There is a huge shift on the horizon for the global energy sector. The future demands the decarbonisation of the energy supply mix, increase in energy access and affordability, and an extreme boost in energy efficiency. ‘It is important to better understand what the future may look like, and to explore possible future energy landscapes,’ says outgoing Council chair, Marie Jose Nadeau. The overarching goal of Day One, is to facilitate discussions on the complex and controversial future of energy, with a view to identifying solutions to the challenges ahead.

The opening session, ‘Scenarios 2060: The grand transition’ will be led by Isabelle Kocher of ENGIE France, Guler Sabanci of Sabanci Holding Turkey, Steve Bolze, of GE Power United States and Fatih Birol of the International Energy Agency, as well as WEC President and CEO, Gerald Davis. The discussion will address the findings of the report, ‘World Energy Scenarios for 2060,’ which reveals that the future of CO₂ reduction relies heavily on civil values.

Rather than outlining how to achieve policy goals, the report presents three scenarios, allowing policy makers and energy leaders to evaluate the key factors and their consequences. The alternate pathways are presented under musical analogies: ‘Modern Jazz’

is a future of open markets, innovation and low-cost energy; ‘Unfinished Symphony’ is a policy-led world of strong enforcements, high cost energy and international cooperation; and the dystopian ‘Hard Rock’ is a scenario of increasing conservatism resulting from conflict and natural crisis.

The centre of the global energy system is shifting from mature markets in Europe and North America, to fast growing markets in Asia. Nadeau professes that ‘The response of governments to these challenges is the biggest single uncertainty facing us.’ These emerging markets will be addressed on in relation to 2060 in discussions such as ‘China’s energy outlook to 2060,’ led by sustainability experts Kang Yanbing and Jianyu Zhang.

DAY TWO: ‘IDENTIFYING BUSINESS OPPORTUNITIES: RESOURCES AND TECHNOLOGIES’

‘One of the goals of the World Energy Council is to nurture the next generation of energy leaders,’ says Younghoon David Kim, incoming chair of the Council, ‘This means that we need to inspire younger generations with passion for, and devotion to, innovation in the energy sector.’

While the transformation of the energy sector is essential for the survival of our planet; the successful adaptation of the business sector is critical for the global economy. With new developments challenging existing business models, investors today are struggling to

understand the future of energy. ‘There is no such thing a business as usual,’ says World Energy Council Secretary General, Christoph Frei; ‘The message is: innovate or die.’

Opening with the discussion, ‘Innovative business models: The new frontier,’ Day Two will identify business opportunities in the changing energy world, addressing issues like resource management and developing technology. Saltuk Düzyol, CEO of TANAP, Turkey will discuss the implications of the Southern Gas Corridor for the energy map in ‘Central Asia: Bringing Caspian Basin gas to world markets.’ The day will close with ‘The commodity price storm: Signal of a new normal?’ which will enable delegates some insight into how the volatility of oil and gas prices interact with carbon budgets. The two-panel discussion will be moderated by Stephen Sedgwick of CNBC.

DAY THREE: ‘POLICY SOLUTIONS TO SECURE PROSPERITY: EMBRACING THE TRILEMMA’

On Day Three, the Congress will move to the policy implications of the energy transition, with sessions designed to address possible institutional changes and explore real solutions to address the sometimes conflicting priorities of global energy goals.

The World Energy Council has long discussed the concept of the ‘Energy Trilemma’ – the struggle to deal with the triple goals of energy security, affordable energy

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and lower carbon emissions. Today, the global energy sector faces another trilemma, what the UN calls the 'water, energy and food nexus' – the interplay of energy supply with water and food security. In 'Energy-water-food-nexus,' a panel including Undersecretary for the United Arab Emirates Ministry of Energy, Matar Al Neyadi, World Health Organisation's Maria Neira, and business innovators from across the globe, will explore potentials for reconciling these priorities.

Recently incorporated into the UN Sustainable Development Goals, affordability of energy is a key issue for world development and energy sustainability. Regional leaders such as National Energy Director of Uruguay, Olga Otegui, will discuss the issue of balancing affordability with access.

DAY FOUR: AFRICA

Africa is a chief example of how the intersection of energy with poverty and the climate change debate can impact on developing regions. It is also the world's

largest investment and development opportunity. With an impressive gathering of African leaders, Day Four will present a series of sessions dedicated to exploring the energy future of Africa. In the opening session, 'Empowering Africa: Realising the potential' a diverse group of stakeholders including Commissioner Elham Mahmood Ahmed Ibrahim, and Econet founder Strive Masiyiwa, will discuss methods for harnessing Africa's renewable energy potential, and increasing access to reliable, clean and affordable energy.

In the panel discussion, 'Disruptive business models: Reshaping rural opportunities' delegates will learn about the fascinating rise of innovative and disruptive business models for off-grid power in Africa; a phenomenon that is now challenging the conventional wisdom of energy infrastructure. development.

ONE FUTURE

'I believe that the Council can play a vital role in forging connections between innovators and investors in the energy sector,' says Kim, 'and stimulate ingenious collaborations between the food, energy and water sectors.'

The energy sector faces a challenging future; but environmental and economic sustainability is a critical global goal uniting all energy players. The 23rd World Energy Congress offers some insight into ways that the transition can be shaped for a prosperous, sustainable and fairer tomorrow. ●

For more information on the Congress programme and to register see <http://bit.ly/2d5yM9y>



Don't miss the annual World Energy Focus magazine 2016! It will be launched at the World Energy Congress in Istanbul 9-13 October 2016 and published for free on the World Energy Focus website www.worldenergyfocus.org

Major shift in energy investment underway

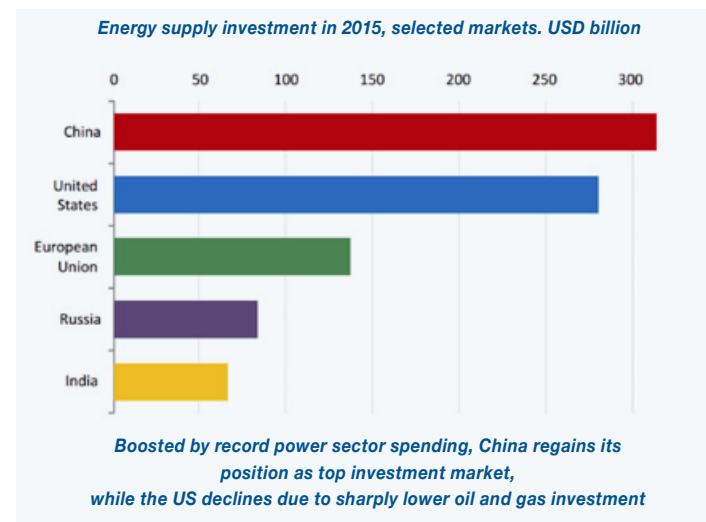
"A major shift in investment towards low-carbon sources of power generation is underway", according to a first-ever detailed analysis of investment across the global energy system from the International Energy Agency (IEA).

Global energy investment declined last year by 8% (in real terms) to \$1.8 trillion, mainly due to "a sharp fall in upstream oil and gas investment", reports the IEA in its World Energy Investment 2016 report. China "retook" the number one position from the US as top investor: whereas US investment in oil and gas production fell sharply, Chinese investment in the electricity sector rose to a "record level".

China increased its investment both in renewable energy and in nuclear power. World Energy Investment shows that renewables "are expanding rapidly but asymmetrically". Whereas "wind, solar and hydropower are reshaping the electricity system, the investment in biofuels and renewable heat remains minor". Investment in

electricity storage is growing, but at \$10 billion in 2015, "remains nowhere near big enough to allay fears of a shortfall in dispatchable capacity."

Investments in gas-fired power plants are down. In non-OECD countries, "investment in conventional generation generally remains strong, dominated by state-owned utilities and independent power producers contracting with them. The growth in coal-fired capacity remained strong in developing Asia, with over 75 GW starting operation in 2015 – as much as all renewable capacity additions in the region combined." This means that although a transition to low-carbon energy is underway, it is not taking place fast enough to limit global warming to 2 degrees Celsius, according to the report.



Interestingly the IEA notes that "around 95% of power generation investments rely on vertical integration, long-term contracts or price regulation to manage risks. The role of wholesale price signals in driving investment in power generation is declining. Utility-scale renewables benefiting from long-term fixed-price contracts or regulated pricing is the largest and fastest-growing component of power generation investment worldwide, representing over half of the total." ●

Technology and policy solutions for grid integration of renewables

In the light of the growing importance of renewables, policymakers and industry must address emerging issues to ensure continued growth and successful integration in electricity systems. A new report published by the World Energy Council in partnership with CESI SpA in the run up to the World Energy Congress, identifies critical success factors and practical solutions for integrating variable renewable energy sources.

In 2015 a record US\$286 billion was invested in 154 GW of new renewables capacity, of which 76% was in wind and photovoltaics. Increased capacity of conventional generation was 97 GW. Yet the combined contribution of variable renewables to the global electricity supply is currently only 4%, according to a new report by the Council launched on 20 September.

The report 'Variable Renewables Integration in Electricity Systems 2016 - How to get it right', draws upon 32 country case studies, representing about 90% of installed wind and solar capacity worldwide.

One of the authors of the report, Alessandro Clerici, Chair of the Renewable Energy Systems Integration (RESI) knowledge network of the Council, says: "Appropriate policies, including regulation and market design play a fundamental role in both development of variable renewables and their efficient integration in electricity systems. Policy solutions are complementary to effective and affordable technology solutions."

Policy and market design recommendations include market rules to ensure a more sustainable energy system in line with the objectives of the Trilemma, including clearly defined CO₂ emissions regulations. The report also highlights that capacity markets can help ensure security of supply, as energy-only based markets are often insufficient to guarantee supply in systems with a large share of variable renewables.

"At the EU level, legislation for capacity markets is currently under discussion. However, it is difficult to find agreement between the different proposals from different countries, types of plants, caps, and floor prices, as what works in any particular country depends both on its individual circumstances and the quality of execution of policies," comments Clerici.

In the UK, capacity market auctions in £/MW started in 2014 for capacities of 49 GW for winter 2018/2019. A second auction took place in 2015, and a third auction is planned for 2017 for 53.8 GW of capacity with an innovative demand side auction for



*Solar Thermal Power Plant, Abu road, India.
Photo Brahma Kumaris*

300 MW. In Italy and Poland legislative proposals for capacity market design are under discussion.

Technology recommendations include: improving weather forecasts, advanced operating procedures to optimise reserve capacity, further development of demand response, energy storage technologies and an expansion of the transmission and distribution grids, together with an optimum operational cooperation between Transmission System Operators (TSOs) and Distribution System Operators (DSOs).

On this last recommendation, Clerici says, "The movement towards market unbundling of TSOs and DSOs was intended to lower costs, but in reality has created barriers between operators who are trying to maximise their own business interests, rather than optimising the behaviour of the system." Matteo Codazzi, CEO of CESI, adds, "The success of both the development of intermittent renewables and their efficient integration in electricity systems depends on an effective market design and regulatory framework and

concrete regional planning to avoid bottlenecks. To really address the goals set out in the COP21 it is necessary to promote greater international cooperation between policy makers, regulators and operators." ●

The report is available for download on www.worldenergy.org/publications

Shale oil breakthrough in Russia

Gazprom Neft, a subsidiary of Russian state-owned company Gazprom, announced this week that it has managed to produce shale oil successfully for the first time in Russia.

A company statement said: "The drilling of 1,000-metre horizontal wells and the performance of multi-stage hydraulic fracturing under current foreign economic restrictions is a unique breakthrough not only for the company, but for the whole of Russia's oil and gas industry."

"The success of the operation can be regarded as a huge step forward in the exploration of shale oil," said Gazprom Neft's first deputy director-general, Vadim Yakovlev.

It is believed that the Bazhenov formation, where the well was drilled, contains one of the world's biggest reserves of tight oil. Wood Mackenzie has estimated that it could hold 2 trillion barrels of oil, though only a fraction of this would be recoverable. In 2012, the Russian government agency Rosnedra estimated that Bazhenov contained 180-360 billion barrels of recoverable reserves. The US Energy Information Administration (EIA) said in June 2013 that the Bazhenov's risked, technically recoverable shale oil reserves totalled 74.6 billion barrels. It also estimated that the Bazhenov held 1.92 quadrillion cubic feet (54.4 tcm) of risked shale gas in place, with 285 tcf (8.1 tcm) of this technically recoverable. ●

2016 World Energy Congress

Istanbul, Turkey, 9–13 October 2016



In a few days the movers and shakers of the energy world will map out the energy future at this largest energy gathering worldwide – be part of it!

10 Oct 2016 (Mon)	11 Oct 2016 (Tues)	12 Oct 2016 (Weds)	13 Oct 2016 (Thurs)
Vision and Scenarios for the Future	Identifying the Business Opportunities: Resources and Technologies	Policy Solutions to Secure Prosperity: Embracing the Trilemma	Africa: Securing a Sustainable Energy Future

With only a few days to go until the 2016 World Energy Congress kicks off, Khalid Al-Falih, Saudi Arabia's Minister of Energy, Industry and Mineral Resources, and Amin Nasser, CEO of Saudi Aramco have been confirmed as speakers. Al-Falih joins the industry's elite at the Congress, including BP's Bob Dudley, Gazprom's Alexey Miller and EDF's Jean-Bernard Lévy. Together these and many more energy big-hitters will seek solutions to the biggest energy issues facing the planet.

Other speakers include representatives from intergovernmental and international

organizations, including the EU, the IEA and the WWF, as well as ministers from Iran, Iraq, UAE, Jordan, Germany, Switzerland, Algeria, Nigeria and Uruguay, among others. In total 257 speakers from 80 countries and 54 government ministers have confirmed to feature at the event. **The registration deadline** for the Congress is looming – online registration closes on September 30th. You can register by following this link: <http://bit.ly/2d5xzgU>

For more information on the Congress <http://www.wec2016istanbul.org.tr>

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2016 Executive Assembly

Istanbul, Turkey

7-9 October 2016

The World Energy Council's annual meeting, welcoming the Council's community and representatives from global energy sector, will discuss sustainable energy systems on national, regional and global levels. The Executive Assembly will also host the World Energy Council's major

governance meetings, culminating in the full Executive Assembly Plenary on Sunday, 9 October, where the Council's members will agree on the strategic direction of the organisation. On the same night the Opening Ceremony for the World Energy Congress takes place, where the Council's Member Committees will be joined by many thousands of delegates under the theme of "Embracing New Frontiers".

MEMBER COMMITTEE EVENTS

2030: Which mobility, which fuels, which network?

Verona Fiere, Italy
11 October 2016

What are the most innovative and promising technological solutions in development that could create a technological leap in new engines and in the usage of new fuels? Will the current increasing trend of vehicles with engines that use alternative fuels (LPG, natural gas, electric / hybrid) be confirmed also in the Italian market? What factors will drive the demand for transport fuels and in which direction? The meeting will offer interesting insights to individuals working in the sector on the future development of mobility and its potential impact on the Italian demand for fuel.

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Challenges of the Ecuadorian Electricity Sector

26 - 28 Oct 2016
Quito, Ecuador

One of the main objectives of the '31st National Seminar of the Ecuadorian Electricity Sector' is for energy experts to share experiences to facilitate policies that will assist the development of a sustainable energy policy for Ecuador. A key topic is the Trilemma challenges and how to address the economic, social and political issues

facing the country. Also, World Energy Scenarios will be discussed. World Energy Council Ecuador organises the meeting in association with the Ecuadorian Committee of the Regional Energy Integration Commission, ECUACIER.

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Clean Energy Week 2016

Harare, Zimbabwe
2-5 November

World Energy Council Zimbabwe hosts the third edition of Zimbabwe's biggest event for the renewable energy and energy efficiency industry this year under the theme 'Accelerating energy access – the power of partnerships'.



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SEE MORE COUNCIL EVENTS AT
www.worldenergy.org/events/future

ABOUT THE COUNCIL

The World Energy Council 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 Council's work covers all nations and the complete energy spectrum – from fossil fuels to renewable energy sources.

JOIN OUR NETWORK

Join the debate and help influence the energy agenda to promote affordable, stable and environmentally sensitive energy for all. As the world's most influential energy network, the World Energy Council offers you and your organisation the opportunity to participate in the global energy leaders' dialogue.

Find out how you can:

- join a Member Committee;
- become a Project Partner, Patron or Global Partner;
- take part in annual industry surveys, study groups and knowledge networks;

by visiting our website and contacting our team on: <http://www.worldenergy.org/wec-network>

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