

**WORLD  
ENERGY  
COUNCIL**

# **World Energy Issues Monitor | 2017**



**EXPOSING THE NEW  
ENERGY REALITIES**

## **ABOUT THE WORLD ENERGY COUNCIL**

The World Energy Council is the principal impartial network of energy leaders and practitioners promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all.

Formed in 1923, the Council is the UN-accredited global energy body, representing the entire energy spectrum, with over 3,000 member organisations in over 90 countries, drawn from governments, private and state corporations, academia, NGOs and energy stakeholders. We inform global, regional and national energy strategies by hosting high-level events including the World Energy Congress and publishing authoritative studies, and work through our extensive member network to facilitate the world's energy policy dialogue.

Further details at [www.worldenergy.org](http://www.worldenergy.org)  
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## **ABOUT THE WORLD ENERGY ISSUES MONITOR**

The World Energy Issues Monitor provides a snapshot of what keeps CEOs, Ministers and experts awake at night in over 90 countries. The monitor helps to define the world energy agenda and its evolution over time. It provides a high-level perception of what constitute issues of critical uncertainty, in contrast to those that require immediate action or act as developing signals for the future. It is an essential tool for understanding the complex and uncertain environment in which energy leaders must operate, and a tool through which one can challenge own assumptions on the key drivers within the energy landscape.

This eighth iteration of the monitor is based on insights provided by more than 1,200 energy leaders to provide over 35 national assessments across six regions.

# FOREWORD

I am pleased that participation in this year's survey has again exceeded 1200 energy leaders; including Ministers and CEOs from over 90 countries. For the first time we have deep-dives in Algeria, Argentina, Botswana, Congo (Dem. Rep.), Dominican Republic, Ghana, Iceland, Kenya and Swaziland taking the number of national level assessments to over 35 individual countries. I would like to thank all who have taken the time to respond to the World Energy Council's issues survey to provide the basis for our unique macro perspective of the perception changes on critical issues in the energy sector, how they change over time and differ across regions. I would also like to thank our Future Energy Leaders for their contribution. It is clear from the results that the leaders of the future rapidly embrace the new energy reality.

The context at the outset of 2017 is equally defined by a challenging growth, the environmental and geopolitical backdrop and by exciting innovation on the technology and business model front. Continued uncertainty around economic growth puts pressure on China and Europe. Geopolitical complexity in all major regions is accentuated by populist protectionism, state-driven cyber tensions, and by uncertainty arising from a dichotomy between orchestrated oil prices and the risk of stranded fossil resources. Intensifying environmental stress around the world exposes our insufficient response to coping with planetary boundaries, which place strain on infrastructure resilience. Meanwhile, technology innovation and new business models advance rural access to electricity at unprecedented speed, provide new solutions for clean energy and smart transportation, while blockchains seem to hold the key to an internet of things in energy with a promise of revolutionary system benefits. The issues monitor provides a powerful illustration of some key changes highlighted in our latest scenarios and at the 2016 World Energy Congress.

**Firstly, the issues monitor shows commodity price uncertainty as the global number one insomnia issue impacting the decision making of energy leaders.** This uncertainty is heightened by emerging concerns surrounding “peak demand” and “stranded resources”, concepts. The impact of these concepts were set out in our World Energy Scenarios report and further developed at the World Energy Congress. After the Congress, organisations including OPEC began to refer to the possibility of peak demand in oil in the next decade – which truly is the start of a new energy reality.

**Secondly, the issues monitor shows the increasing acceptance of lower global economic growth as a reality** that needs to be managed. We have described in our scenarios that there is a possibility that driven by lower population growth and environmental stress this may become a global “new normal” – unless we deliver high productivity growth and address planetary boundaries through accelerated innovation.

**Thirdly, new physical and digital risks are posing ever greater threats to the energy sector.** The Congress has clearly illustrated that different risks and aspects of resilience have very distinct meaning and priorities in different regions. The issues monitor captures this great regional variety. Cyber threats are keeping energy leaders in Europe, East Asia and North America on alert. The Energy–Water–Food nexus is among energy leaders' top uncertainty issues in China, the Middle East, and parts of the Americas. Extreme weather events are among energy leaders' top uncertainty issues in large parts of the Asia Pacific region, Latin America and Africa.

**Fourthly, innovation issues such as digitalisation, decentralisation, innovative market design and electric storage are the most rapidly upward moving issues.** We are misled by some of these terms and the discussion of a democratisation of energy if we think this is leading to a “de-politicisation” of the energy sector. This report illustrates that at least in the short term the opposite is true: half of the world’s invested capital is sunk in energy and related infrastructure and key geo-economic relations are directly based on energy makes, which makes an energy transition hugely political and geopolitical. While priorities differ across regions, every single region has its own key geopolitical issue that is high on the agenda.

This rapid increase in the importance of innovation issues highlights a new energy reality. Only three years ago, when suggesting to energy professionals that there could be “leap frogging” in energy, similar to what has happened in the telecommunications sector, the response would have suggested little understanding of energy realities. We now see hundreds of thousands of direct household solutions being rolled out in rural Africa without a formal supply chain and in the absence of any energy infrastructure backbone. What does leapfrogging mean, if not this?

Digitisation has made it to the top tray of energy leaders in industrialised countries around the world. The need to understand the new business models that are driven by intelligence from big data and enhanced supply chain management, machine learning and automated system response, prosumer and cloud solutions and enabling energy block-chains is probably the most exciting development on the desks of energy leaders with as many visionary implications as practical unknowns.

Innovative business models that reduce carbon footprint, energy costs and system risks, multidisciplinary talent able to cope with increasing complexity, as well as robust, balanced and forward oriented policy frameworks that encourage investments are critical ingredients to success and prosperity. This report acts as a unique benchmark and reality check to enable leaders to better understand and guide the energy transformation. The findings help energy leaders shape our response to the grand energy transition and secure a sustainable and prosperous future.



**Christoph Frei**

Secretary General, World Energy Council

# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b>	3
<b>INTRODUCTION</b>	7
<b>1 ASSESSING THE GLOBAL ENERGY AGENDA</b>	10
<b>2 ASSESSING THE ENERGY AGENDA FOR AFRICA</b>	29
Africa	30
Algeria	33
Botswana	35
Democratic Republic of Congo	38
Ethiopia	41
Ghana	44
Kenya	47
Namibia	49
Nigeria	51
South Africa	53
Swaziland	55
<b>3 ASSESSING THE ENERGY AGENDA FOR ASIA</b>	57
Asia	58
China	60
Japan	64
New Zealand	67
South Korea	69
<b>4 ASSESSING THE ENERGY AGENDA FOR EUROPE</b>	71
Europe	72
Austria	74
Belgium	76
Estonia	78
Germany	80
Iceland	82
Italy	85
Latvia	87
Lithuania	89
Poland	91
Portugal	93

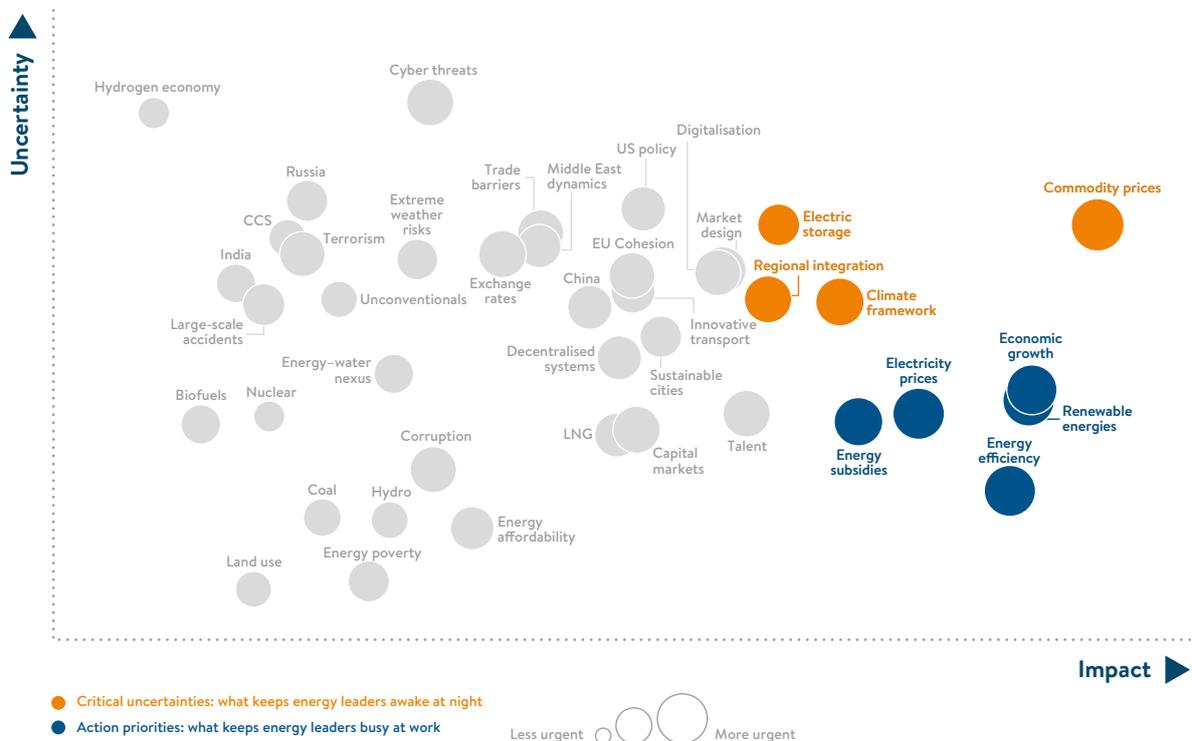
Serbia	95
Spain	97
Switzerland	99
United Kingdom	102
<b>5 ASSESSING THE ENERGY AGENDA FOR LATIN AMERICA AND THE CARIBBEAN</b>	<b>104</b>
Latin America and the Caribbean	105
Argentina	112
Brazil	115
Colombia	120
Dominican Republic	122
<b>6 ASSESSING THE ENERGY AGENDA FOR THE MIDDLE EAST AND NORTH AFRICA</b>	<b>124</b>
Middle East	125
Lebanon	127
<b>7 ASSESSING THE ENERGY AGENDA FOR NORTH AMERICA</b>	<b>130</b>
North America	131
Canada	133
Mexico	137
<b>8 ASSESSING THE ENERGY AGENDA FOR THE FUTURE ENERGY LEADERS</b>	<b>140</b>
<b>9 METHODOLOGY AND PROJECT CONTRIBUTORS</b>	<b>144</b>

# EXECUTIVE SUMMARY

As the Grand Energy Transition fast becomes a reality, the minds of global energy leaders are becoming increasingly focussed on long term trends that threaten existing economic and business models rather than concerns about short term risks. Issues that will dictate the speed and the breadth of the energy transition rise to the top of the global energy agenda as government and corporate take stock of the impacts and opportunities that arise as the world goes down a path of increased decarbonisation. This includes regional integration, climate framework, electric storage, renewables, energy efficiency, electricity prices and economic growth.

## COMMODITY PRICES STAND OUT YET AGAIN

The biggest single critical issue in terms of both high uncertainty and higher impact is commodity prices, an issue that has remained at the top of the global agenda for much of recent history. Ostensibly a short term-term concern of critical importance to resource-holding governments, international hydrocarbon developers and all consumers, commodity prices takes on an increasingly long-term perspective within the context of the energy transition. Increased price volatility is a likely consequence of the peak in energy demand growth predicted by the latest World Energy Scenarios as International Oil Companies and National Oil Companies reduce their investment spending in anticipation of falling demand. Already, the IEA has warned of such price volatility as necessary investments fail to keep up with natural declines from existing oilfields and increasing demand in the run-up to the anticipated peak.



Commodity price volatility is an issue of importance for all regions but resource-holders and consumers in developing economies show the highest levels of concern. Energy leaders in Asia and Africa, regions heavily dependent on energy imports, reveal this to be the biggest issue in terms of critical uncertainty. Likewise, MENA countries dependent on hydrocarbon exports see the issue as undermining long term economic models. Already, Saudi Arabia has embarked on a what it calls a National Transformation Plan outlined in a document known as Vision 2030 that aims to leverage current oil revenues to provide long term investments necessary for a future beyond oil. Oil price volatility undermines this plan and helps explain the Kingdom's current commitment to maintaining oil price stability. For their part, North American energy leaders are equally concerned buoyed by the fact that they are major producers and consumers of energy. Here, the slow decline in coal has an impact on commodity price concerns but, more than anything, it is the future of the tight and shale oil/gas industries that keeps energy leaders awake at night. Massive amounts of capital are now tied up in the industry in both the United States and Canada and they are held hostage to a single issue: price.

### **CLIMATE CONCERNS WANE**

The global climate framework remains in the quadrant of critical uncertainties but global leaders believe that this issue has less uncertainty and a lower impact than commodity prices. Again, at first sight this is surprising: after all, the move towards the decarbonisation of energy is the biggest single driver behind the energy transition. However, in the wake of the agreement at the COP meeting in Paris in December 2015, this is a clear signal that energy leaders believe that the world is in an irrevocable path towards decarbonisation, one that is no longer entirely dependent on a global climate agreement.

### **TECHNOLOGY IS KEY TO THE GLOBAL ENERGY FUTURE**

Energy leaders clearly believe that technology, in its many forms, is the key to a decarbonised energy future. In particular, advances in electric storage and renewable energy are key areas that have the potential to dictate the pace and the scale of the energy transition. The rapid implementation of renewable energy capacity across the globe, notably wind and solar PV, means that there is a degree of certainty about the future role of renewable energy in the global energy mix. However, its impact is growing as renewable energy displaces hydrocarbons, particularly oil and coal, in power generation. In turn, the anticipated improvement in electric storage, notably batteries, has the potential to revolutionise the transport sector as the electric vehicles (EVs) become a viable alternative to petrol and diesel fuelled cars. Factors that could further dampen the growth in energy demand growth such as energy efficiency and the end to energy subsidies remain high on the agenda of global energy leaders. While energy efficiency gains tend to come in slow increments and are hard to retrofit, there is an increasing certainty that it will have a major impact on the future of energy. There is greater uncertainty about the end of energy subsidies but the fact on the ground is that countries throughout the world are using the window of opportunity afforded by relatively low energy prices to trim energy subsidies and accustom consumers not just to the need to pay real prices for their energy needs but also to provide an economic signal for them to moderate consumption. Leading the way are some of the countries with the highest per-capita energy use such as the GCC where the United Arab Emirates and Saudi Arabia are both in the process of reducing or eliminating subsidies for both transport fuels and electricity.

Global economic growth that both drives energy demand and is directly impacted by energy price volatility remains high on the global agenda. Recent history has shown that falling oil prices have largely failed to boost economic growth in consuming countries but they have had a dramatic impact on the fiscal balances of hydrocarbon-producing countries. Societal welfare and employment depend on continued economic growth which in turn is closely intertwined with energy consumption and production. Falling energy prices might not boost economic growth but the inverse is true: economic growth does boost energy demand.

## **TRADITIONAL ENERGY SOURCES FAIL TO EXCITE ENERGY LEADERS...**

As global energy leaders focus on the big picture, there is a noticeable lack of concern regarding historic primary energy sources. On a global level, coal, nuclear, and hydro all fall off the radar screen, rated as low-impact, low-uncertainty issues. Coal use falls over the coming decades under most energy scenarios, including the Council's World Energy Scenarios while both nuclear and hydro have seen their growth constrained by public concerns regarding safety, in the case of nuclear, and environmental impacts, in the case of hydro. Notwithstanding the apparent lack of interest in these energy sources at the global level, there is a noticeable divergence at the regional level. Coal remains a major primary source of energy in Asia and, as a result, energy leaders in those regions fret about the future of that fuel notably in India, Indonesia and China. Likewise, energy leaders in South Africa, a major producer and consumer of coal, worry about its future.

Similar regional and national divergences can be seen around nuclear power. This is a lack of concern about the future of nuclear energy not just in those countries and regions that do not have it but also in some key nuclear states. For example, and perhaps surprisingly, the future of nuclear energy in South Korea, which generates nuclear energy and exports nuclear technology, is not an area of critical concern for energy leaders in that country. Similarly, most Europeans do not rate the issue as being critical. However, the same is not true for other nuclear power users such as UK, China, North America, South Africa, Japan and Belgium. Most of these countries are either grappling with the choice of whether to advance or not with planned new nuclear or whether to go ahead with planned closures. A clear message arises from the Issues Monitor: nuclear energy is a contentious issue in many countries that have it with some surprising exceptions.

## **...BUT LNG REMAINS CLOSELY WATCHED**

A more complex picture arises from the future of liquefied natural gas (LNG). Consumption of natural gas under most global energy scenarios, including World Energy Scenarios, will continue to enjoy modest growth for the foreseeable future. Much of this will be supplied in the form of LNG, a market that for much of 2016 was volatile. While energy leaders in Europe, Africa and Asia see LNG as an issue of little concern, it was a major issue in individual countries where LNG plays an important role. For Singapore, a state that aims to become a leading regional hub for LNG, and has invested heavily in LNG storage infrastructure, it is a critical uncertainty. Singapore's LNG business model depends on the continued role of natural gas in Asia and benefits from a new focus of spot sales of LNG instead of gas supplied under long term contracts. LNG is also an important issue for the MENA region which is increasingly dependent on LNG imports for domestic power generation. Qatar, the

region's main gas exporter, has effectively capped gas exports to neighbouring states forcing Kuwait and the UAE to start LNG imports.

### **REGIONAL PERCEPTIONS OF KEY ISSUES VARY WIDELY**

If there is a single message from the World Energy Issues Monitor it is that many regions view issues very differently. An example that illustrates this is the issue of cyber threats, viewed very differently throughout the world. For Africa, Latin America and indeed the non-OECD as a whole, cyber threats are seen as a low impact, if uncertain, risk. Not so for other regions who all view this is an area of uncertainty but with various degrees of seriousness. Regionally, leaders in Europe, MENA, North America and Asia all agree that cyber threats offer a moderate risk to business continuity. However, in the UK, Japan and Singapore, this is an area of critical uncertainty, representing a major risk to energy security.

Likewise, there is even greater variability in the perception of extreme weather risks. In Latin America, in a year when the El Nino phenomenon is peaking, minds have become acutely sharpened to extreme weather risks with leaders in Columbia and Ecuador showing particular concern. The issue is also regarded as a major risk in Asia though to a lesser extent than in Latin America. Inversely, for leaders in other regions, extreme weather risks are not regarded as significant at all. For those in North America, Africa, Europe and MENA, extreme weather events are low on their radar screen.

# Introduction

# INTRODUCTION

## ABOUT THIS REPORT

The World Energy Issues Monitor provides a snapshot of what keeps CEO, Ministers and experts awake at night in nearly 90 countries. The monitor helps to define the world energy agenda and its evolution over time. It provides a high-level perception of what constitute issues of critical uncertainty, in contrast to those that require immediate action or act as developing signals for the future. It has developed into an essential tool in understanding the complex and uncertain environment within which energy leaders must operate, and a tool through which one can challenge own assumptions on the key drivers within the energy landscape.

This eighth iteration of the monitor provides over 30 individual monitors across six regions to highlight differing regional and national priorities. For 2017, insights were provided by over 1,300 energy leaders across the Council's national member committee network. These insights and the findings from the World Energy Issues Monitor enable the World Energy Council to facilitate the dialogue among energy leaders on the critical issues affecting the global energy agenda.

## HOW TO READ THE MONITOR

### Categories and individual issues

The World Energy Issues Monitor assesses 41 issues in a high-level overview, covering four categories (see table 1 – the world energy issues survey):

- macroeconomic risks
- geopolitics
- business environment
- energy vision and technology

### Dimensions/Axes

The responses are translated into issue monitors with the three assessed dimensions:

- The impact of an issue on the energy sector – this forms the x axis.
- The degree of uncertainty related to its impact – this forms the y axis.
- The urgency with which we need to address the specific issue – this is represented by the proportional size of the issue bubble. A larger size corresponds to a higher degree of urgency.

### Zones within the Monitor

- **Critical uncertainties:** Issues with high uncertainty and high impact (in the top-right quadrant) are the 'critical uncertainties' with no clear path of action. These issues keep energy leaders most awake at night need to be part of the energy leaders' dialogue and scenario analysis.
- **Action priorities:** The issues in the high-impact and low-uncertainty space are those which keep energy leaders busiest (bottom-right, 'action issues').
- **Weak signals:** The low-impact and low-uncertainty issues (bottom-left quadrant) include those of perceived lesser importance or those that are still not fully understood and need further investigation.



# Chapter one

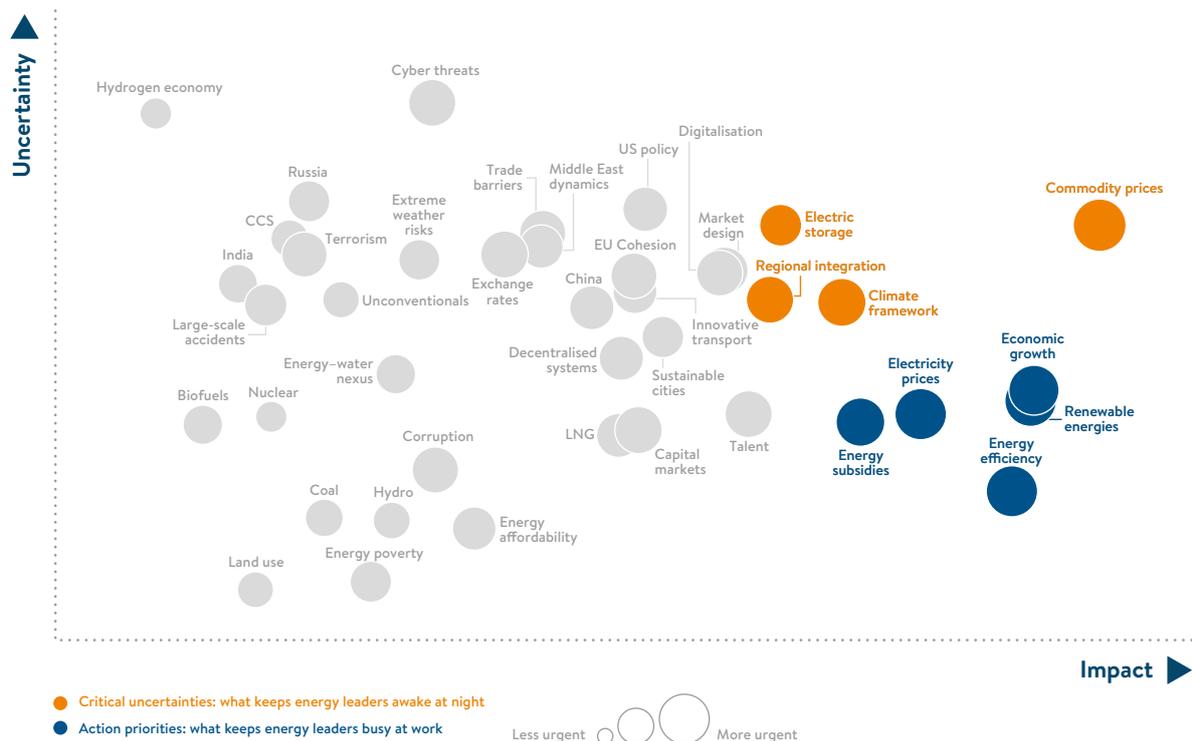
## Assessing the global energy agenda

## ASSESSING THE GLOBAL ENERGY AGENDA

The 2017 World Energy Issues Monitor finds that industry leaders remain most concerned by commodity prices and associated volatility. The ‘new normal’ for economic growth is perceived with greater certainty as the sector prepares to operate within this prolonged macroeconomic environment. As progress is perceived to be made on the decarbonisation agenda, the response has been for renewables to have become one of the most impactful issue in this year’s findings. As a result, the role of supporting technologies including new market design, electric storage and digitalisation have gained greater prominence, creating a notable divergence from traditional resource technologies around coal and nuclear which have moved down the agenda to a lower impact.

This report provides a snapshot of the current priorities, set in the broader context of the Grand Transition as identified by the latest World Energy Scenarios, in which disruptive trends emerging will create a fundamentally new world for the energy sector. This will be characterised by lower population growth, radical new technologies, greater environmental challenges and a shift in economic and geopolitical power.<sup>1</sup>

**FIGURE 1: COMMODITY PRICES, ECONOMIC GROWTH AND RENEWABLES ARE AMONG THE STAND OUT ISSUES IN 2017**



The top critical uncertainties on the energy agenda in 2017 include commodity prices, regional integration, climate framework and electric storage while action priorities issues are renewables, energy efficiency, energy subsidies, electricity prices and economic growth.

1. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

## Commodity prices at the top of the global agenda for 2017

Commodity prices and associated volatility remains the number one critical uncertainty on the global energy agenda. This continues the perception set out at the start of 2016, in which expectations were set that price adjustments were not temporary and would continue to dominate the agenda beyond the short-term.<sup>2</sup> The importance of the issue is now reinforced by commodity prices enduring as one of high impact in every region.

**FIGURE 2: COMMODITY PRICES: HIGH-IMPACT IN EVERY REGION**

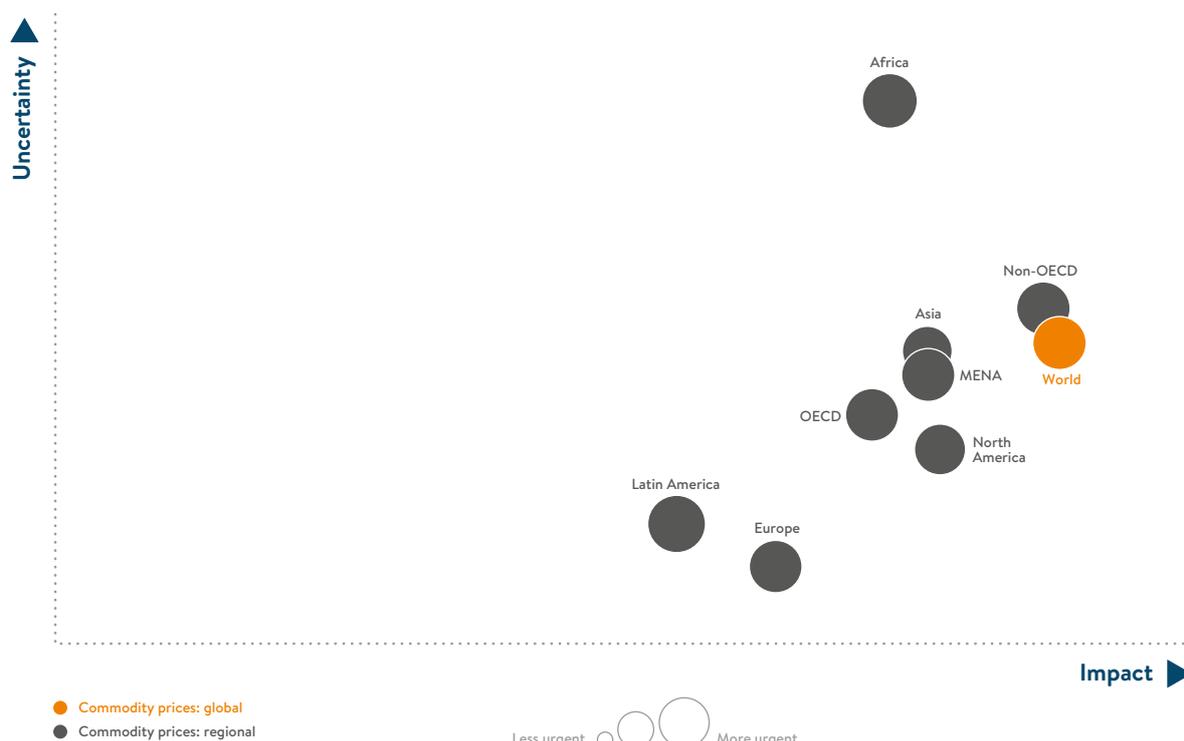


Figure 2 shows that whilst of great significance to all regions, the highest impact of commodity prices is seen in North America, the Middle East and Asia. As the oil industry faces the worst downturn in a generation, the speed of change and the effects for executives in the broader energy sector remain of fundamental importance.

The magnitude of these changes can be seen in the fact that since June of 2014 oil prices dropped from over US\$110 per barrel to under US\$30 in January and February 2016, falling from an annual average price of US\$99 in 2014 to US\$43 in 2016.<sup>3</sup> Over the past year, supply-side dynamics have added further weight to this price environment, with the US administration’s decision to lift US sanctions on Iran enabling an additional 2.5 million bpd to be added to the world’s market<sup>4</sup> and

2. World Energy Council, 2016, World Energy Issues Monitor 2016

3. [www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/](http://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/)

4. CNN, 2016 <http://money.cnn.com/2016/06/16/investing/iran-pumping-lots-more-oil-sanctions/index.html>

increased broader OPEC supply offsetting non-OPEC declines over the past year.<sup>5</sup> The anticipation is that this issue will only continue to dominate the agenda for many executives in the months ahead as geopolitical dynamics, both within and outside of the OPEC countries, as well as other cost and productivity improvements, create further tensions between producing regions and add to the potential for continued volatility.

On the public sector side, the implications remain worst for those countries with the most oil-intensive economies. In Venezuela, the economy was expected to have contracted 8% in 2016 with inflation anticipated to rise 481.52% through the year and 1,642% in 2017.<sup>6</sup> Elsewhere, rebel attacks in Nigeria have curtailed supplies whilst continued fighting in Libya has prevented the industry returning to previous levels of production throughout much of the past year. Furthermore, state-backed investment vehicles have also come under strain in the low price environment, with over US\$85bn being withdrawn from asset managers by sovereign wealth funds since June 2014.<sup>7</sup> Such dynamics highlight the continued uncertainty attributed to commodity prices as energy leaders look ahead to the coming year.

This report shows that **unconventionals** are perceived to have the highest impact for energy leaders in North America, as well as specifically in countries including the United States, United Arab Emirates, Russia, Saudi Arabia and Nigeria. In the private sector, it is estimated that over 250,000 oil industry workers alone have lost their jobs – approximately half of which from the United States.<sup>8</sup> In North America this has corresponded with over 200 companies filing for bankruptcy across the onshore, midstream and oil services space alone since the start of 2015.<sup>9</sup> Globally, more than US\$ 380 billion of total project capex has been deferred (in real terms), from over 68 projects, as executives have focused on repairing balance sheets and reorganising businesses in order to better operate in the low price environment. At the same time, stricter investment criteria have led to increased levels of pre-FID delayed projects<sup>10</sup> with only 11 major decisions taken on projects throughout 2016.<sup>11</sup> Therefore, the high impact associated to the issue of commodity prices for the energy sector leadership in today's context also has an implication and creates a stronger causality towards future volatility. Furthermore, it raises a number of knock-on effects and pressures to associated issues including around the labour market as well as for energy infrastructure development.

However, this has also led to significant productivity improvements, hence it is no surprise to see the close clustering of energy efficiency and unconventionals as action priorities for leaders in North America. Whilst rig count volumes for US land ended the year down on an annual basis,<sup>12</sup> the benefits of improved technology and drilling techniques forced by the low price environment have boosted efficiency in Shale production. This is particularly noticeable in areas such as the Bakken where the

5. IEA, 2016 [www.iea.org/oilmarketreport/omrpublic/currentreport/](http://www.iea.org/oilmarketreport/omrpublic/currentreport/)

6. IMF, 2016, World Economic Outlook Database

7. Financial Times, 2016 [www.ft.com/content/9016ae44-8bd4-11e6-8cb7-e7ada1d123b1](http://www.ft.com/content/9016ae44-8bd4-11e6-8cb7-e7ada1d123b1)

8. New York Times, 2016 [www.nytimes.com/interactive/2016/business/energy-environment/oil-prices.html?\\_r=0](http://www.nytimes.com/interactive/2016/business/energy-environment/oil-prices.html?_r=0)

9. Haynes and Boone LLP, 2016, [www.haynesboone.com/publications/energy-bankruptcy-monitors-and-surveys](http://www.haynesboone.com/publications/energy-bankruptcy-monitors-and-surveys)

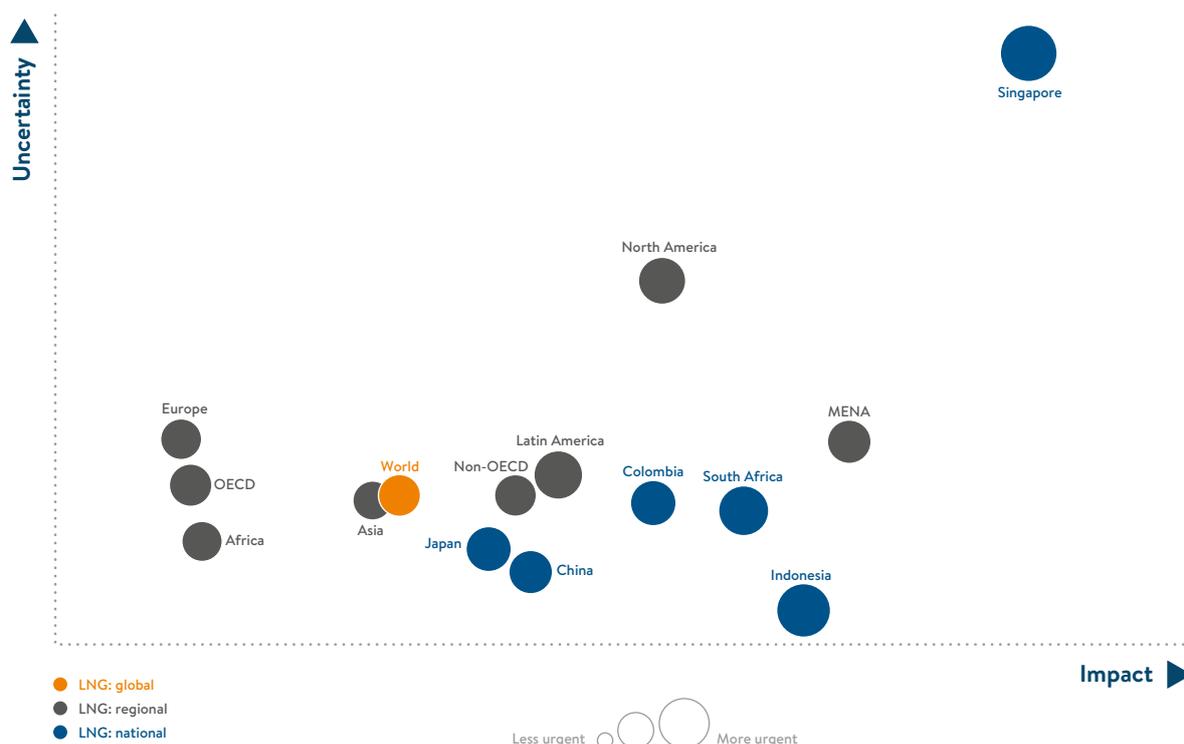
10. Wood Mackenzie, 2016, [www.woodmac.com/analysis/12530462](http://www.woodmac.com/analysis/12530462)

11. BMI, 2016, Industry Trend Analysis – Key Themes for Oil & Gas in 2017

12. Baker Hughes, 2016, North America Rotary Rig Count

breakeven cost per barrel, had, on average, fallen from US\$59.03 in 2014 to US\$29.44 in 2016.<sup>13</sup> 2017 brings the further possibility for continued acceleration of upstream technologies, drilling efficiencies and well recovery.

**FIGURE 3: ENERGY LEADERS IN LATIN AMERICA, NORTH AMERICA AND MENA MOST CONCERNED ABOUT LNG**



For other regions, such as in Asia and Latin America, the impact of **liquefied natural gas (LNG)** is perceived with higher importance relative to the role of unconventional and has remained as a relatively stable issue for energy leaders globally throughout the severe volatility over the past two years. The issue has particular importance in the latest findings of this report for Japan, Singapore, Indonesia, and China. Indeed, whilst LNG prices in Asia LNG-AS have fallen by over 60% since their peak in June 2014,<sup>14</sup> the consistency of impact for energy leaders reflects both the longer-term nature of investment and projects already committed to bring new supply online in the coming years – by some estimates adding close to 100 million tonnes a year of production capacity by 2020 to the existing production of approximately 300 mtpa.<sup>15</sup> In turn, this has increased the certainty for those countries most reliant on LNG imports whilst simultaneously enabling a greater push towards contract amendments focused around destination restrictions and shorter-term pricing.

13. Reuters, 2016, [www.reuters.com/article/us-opec-meeting-usa-shale-idUSKBN13POC8](http://www.reuters.com/article/us-opec-meeting-usa-shale-idUSKBN13POC8)

14. Reuters, 2016, [www.reuters.com/article/lng-japan-qatar-alsada-idUSL4N1DP2SQ](http://www.reuters.com/article/lng-japan-qatar-alsada-idUSL4N1DP2SQ)

15. Reuters, 2016, [www.reuters.com/article/lng-japan-qatar-alsada-idUSL4N1DP2SQ](http://www.reuters.com/article/lng-japan-qatar-alsada-idUSL4N1DP2SQ)

## The New Growth Normal

**The effects of economic growth, or lack thereof, was one of the issues of highest change globally from 2016 to 2017.** Leaders attributed both a reduced level of uncertainty and higher impact to the issue as the significance of continued pressures on the macroeconomic climate move to the top of the agenda. This reflects the ‘new normal’ for economic growth with World GDP forecast to grow by 3.1% and 3.6% in 2016 and 2017, respectively, primarily driven by the US, India and China.<sup>16</sup> In turn, new expectations must be set around primary energy demand growth, which is anticipated to diminish in the coming years to 2060 while per capita energy demand will peak before 2030 as a result of new technologies and energy policies.<sup>17</sup>

The fact that economic growth is identified as a clear action priority for 2017 reflects its significance in determining the extent and severity to which the sector must make adjustments in terms of expectations for energy demand, commodity price pressures and future investment. The ability for energy leaders to navigate the challenges of the year ahead will be linked to their ability to adapt and respond to the realities of this macroeconomic environment.

The **climate framework** issue presents the perception that it is better understood today than in previous years. Following the significant drop in uncertainty highlighted in the 2016 World Energy Issues Monitor, in line with the agreements made at the Conference of Parties (COP21), the issue has now stabilised. The commitments around an agenda of decarbonisation are of high impact within the latest findings, but with a strong divide between the OECD and non-OECD regions. The highest impact attributed to the issue comes from Europe and North America, in contrast to the Middle East, while the degree of uncertainty on this global climate framework is notably higher for leaders in Asia.

The continued importance of the issue is underlined by the fact that the commitments of governments’ to COP21 are not sufficient to stay within the 1000Gt CO<sub>2</sub> carbon budget necessary in order to keep the temperature increase below 2 degrees Celsius. To meet this upper limit will require annual global carbon emissions-reduction rates of a minimum 3% per annum – an unprecedented challenge.<sup>18</sup>

In line with an increasing impetus towards a lower carbon future for the energy system, **renewable energies** have become a top action priority for energy leaders in 2017. This issue has a high impact for every region, whilst resonating most for those in Europe and Asia, with priority at the national level for numerous countries including Germany, Iceland, India, Spain and China – the latter of which represented 36% of the global investment in renewables for 2015.<sup>19</sup> This impact reflects both the short-term and longer-term dynamics around renewables, perhaps best exemplified by developments in solar PV and wind power generation.

16. Goldman Sachs, Global Investment Research and Forecasts as of Dec-2016

17. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

18. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

19. Frankfurt School-UNEP Centre/BNEF, 2016, Global Trends in Renewable Energy Investment 2016

**FIGURE 4: RENEWABLE ENERGIES OF GREAT IMPORTANCE FOR BOTH OECD AND NON-OECD REGIONS**



For solar, installed capacity globally has seen immense growth, reaching approximately 227GW<sub>e</sub> by the end of 2015, equivalent to producing 1% of the electricity used globally.<sup>20</sup> At the same time, since 2007 solar PV module prices have declined 80% from approximately US\$4/W in 2007 to US\$1.8/W in 2015.<sup>21</sup> Each of the countries that has led the way in terms of solar PV capacity installations has renewables featured with high-impact in the national findings of this issues monitor report – namely, China, Japan, Italy and the US. In such countries, the drive to reduce cost has been built through advancements in technology, an oversupply of installation components as well as the necessary regulatory incentives.

Global wind power generation capacity increased at a rate of 16.4% for 2014 increasing to 17.2% in 2015 which, at 435 GW, represented around 7% of total global power generation capacity. A particular emphasis can be seen in countries such as Denmark and Germany where wind power contributed 42 and 13%, respectively.<sup>22</sup> The regional and national impact of renewables in the latest monitor also align with the cost basis. For instance, in onshore wind, China has the lowest weighted average LCOE with a range between US\$50/MW to US\$72/MW while the Middle East and Africa, where renewables are viewed with a lower relative impact, the cost is at US\$95–99/MW.<sup>23</sup>

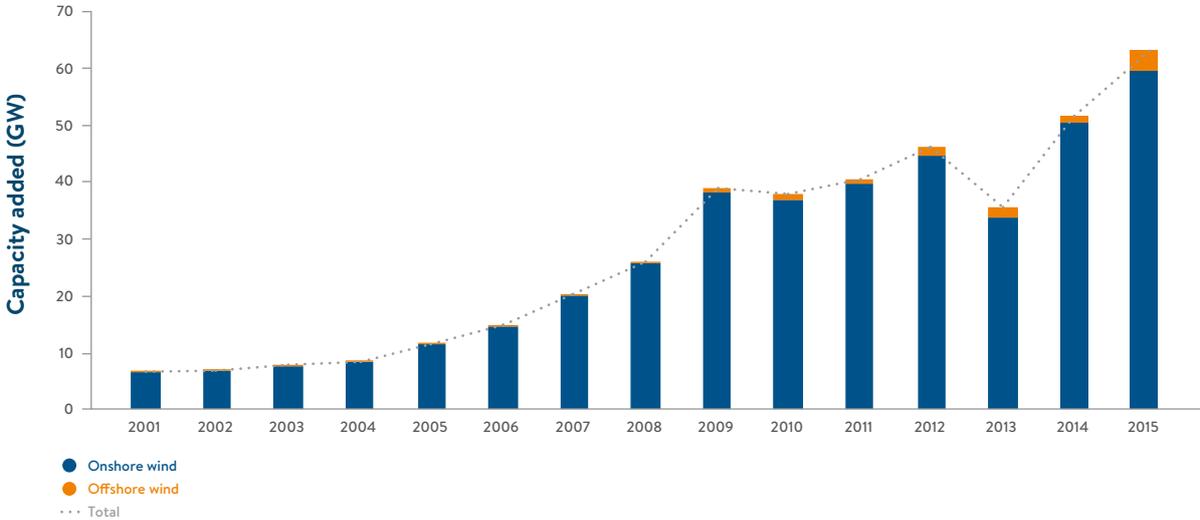
20. World Energy Council, 2016, World Energy Resources

21. World Energy Council, 2016, World Energy Resources

22. World Energy Council, 2016, World Energy Resources

23. World Energy Council, 2016, World Energy Resources

**FIGURE 5: ANNUAL NET GLOBAL WIND CAPACITY ADDITIONS, 2001–2015**



Source: IRENA, GWEC

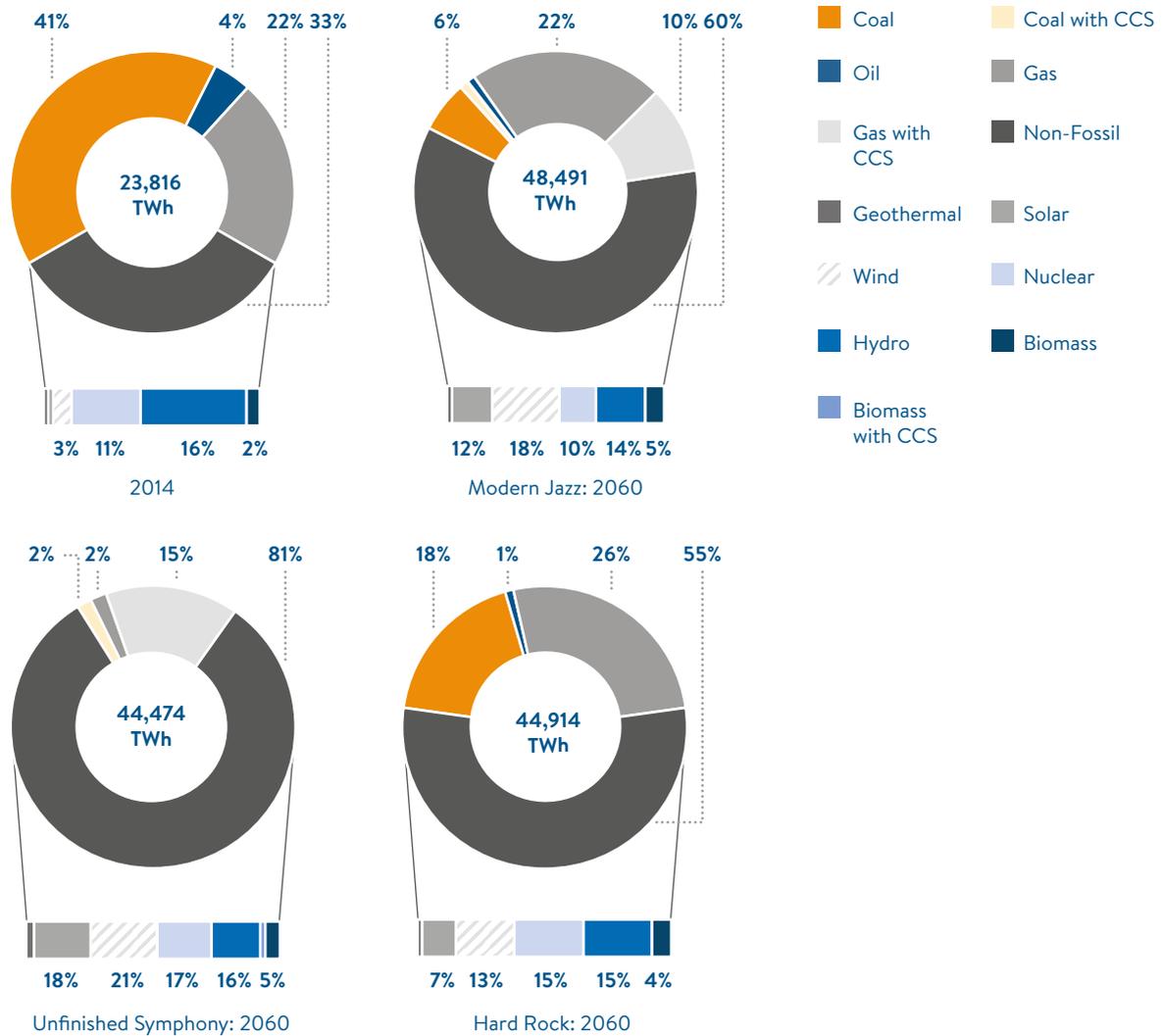
The role of stable policy frameworks is critical to enable the necessary investment for the continued development of renewable energies. In 2015, 164 countries had renewable energy support policies in place; 95 of which were from developing countries, compared to 15 countries in 2005.<sup>24</sup> This highlights the link between renewables and **energy subsidies**, which features as a high-impact issues for all regions except North America.

Further renewable energy development linked to rapid decarbonisation must also be based on technology learning curves being able to bring the cost renewables closer to fossil fuel parity – a particular challenge in a low commodity price environment. Concerns around energy access, equity and affordability all have the potential to slow developments, especially when combined with weaker economic growth, limited investment and the funding available to subsidise low-carbon technologies. Looking out towards 2060, the tremendous pace of change for renewables is expected to continue with the rise of solar and wind energy at an unprecedented rate, which will create both new opportunities and challenges for the energy sector.<sup>25</sup>

24. World Energy Council, 2016, World Energy Perspectives: Renewables Integration

25. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

**FIGURE 6: SCENARIOS OF FUTURE GLOBAL ELECTRICITY GENERATION (TWH)**

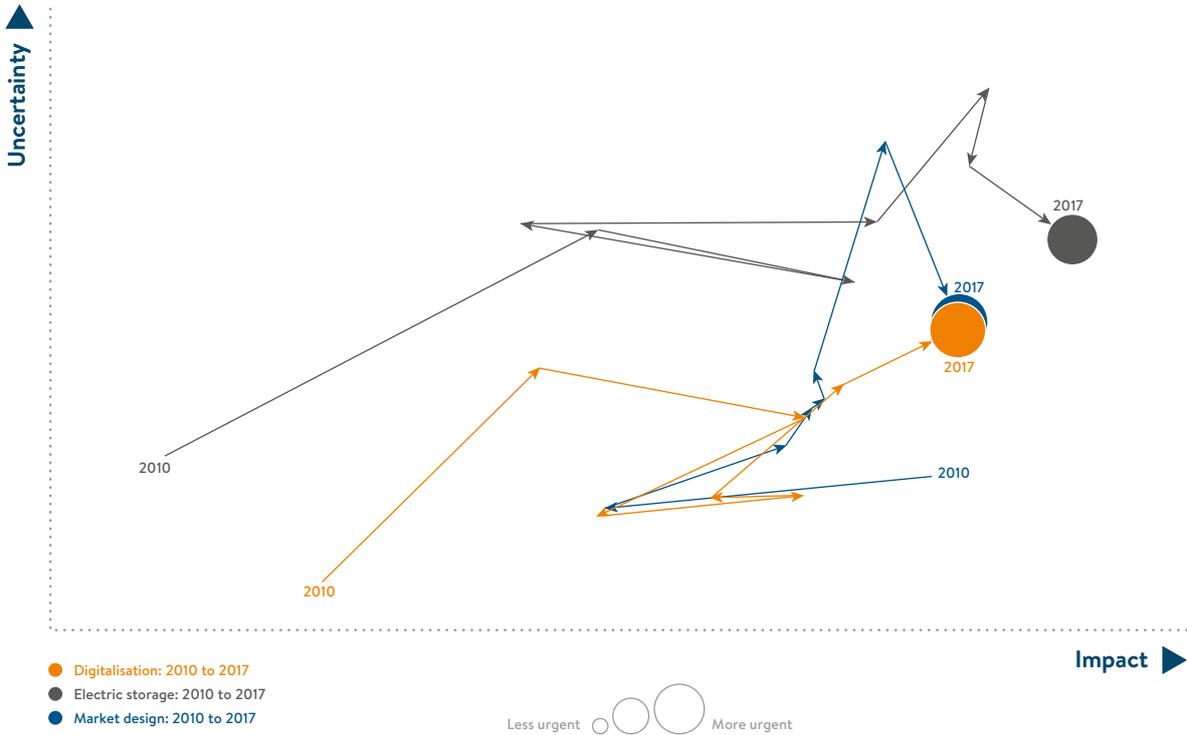


Source: The World Energy Council, Paul Scherrer Institute, Accenture Strategy

**The innovation agenda**

This combination of an increasing political commitment towards decarbonisation and the rate of growth of renewables has led to the rise of supporting technologies, including new market design, electric storage and digitalisation. Hence, the latest findings for 2017 represent a consolidation of the significant upward trend of these issues, which stand in stark contrast to perceptions in 2010 (Figure 6). However, as the impact attributed to these issues has risen so too has the uncertainty. This implies that energy leaders do not currently see a clear path to fully realise the potential for the energy sector as a number of challenges remain and tensions arise between this dynamic and the role of traditional generation and associated systems.

**FIGURE 7: THE RISE OF THE INNOVATION CLUSTER FROM 2010 TO 2017**



Time-tracking for electric storage, market design and digitalisation from 2010 to 2017: moving up the agenda for energy leaders.

As anticipation builds for the role that renewable energies will come to play in the future electricity generation mix, as represented by figure 5 which implies that in 2060 non-hydro renewable energies will represent between 21 and 42%, depending on the specific scenario,<sup>26</sup> the need for solutions to enable an increasing scale-up become of the utmost importance. The rise of variable generation sources, including wind and solar, has necessitated a need for solutions to balance system requirements and to enable a more flexible and responsive grid in developed countries as well as to provide smaller scale solutions for remote developing country locations which do not have grid access.

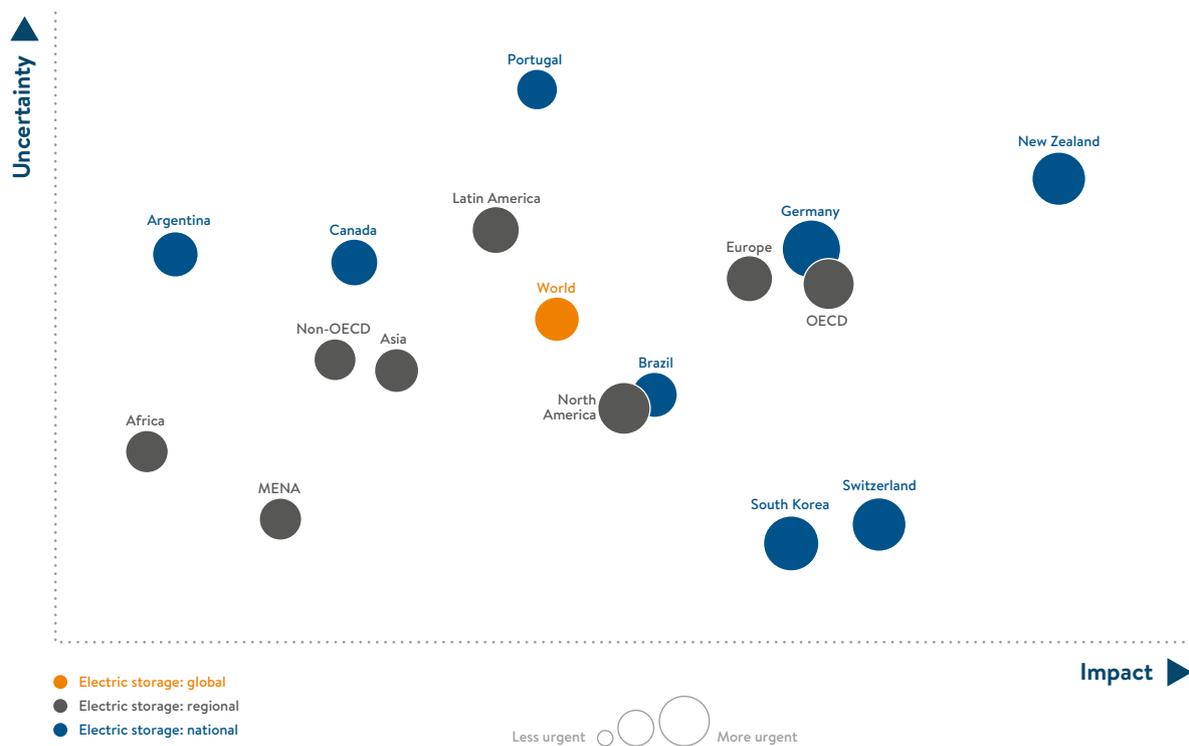
Such challenges can be seen in the current status of **electricity storage**, which has moved strongly up the agenda in alignment with this increased growth and impact of renewable energies globally, with a particular regional importance in both North America and Europe. In 2015, 250MW of utility scale electricity storage was installed, an increase from 160MW for 2014 at the global level.<sup>27</sup> In 2017, the issue is perceived with a high degree of uncertainty for which solutions must be found if it is to reach its full potential impact as one of the leading energy storage solutions for the longer-term. Developments around electric vehicles has helped to reduce the cost of batteries, with the average pack price falling from US\$1000 per kWh in 2010, to US\$ 350 per kWh. However, the critical

26. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

27. Frankfurt School-UNEP Centre/BNEF, 2016, Global Trends in Renewable Energy Investment 2016

challenge to the future viability and adoption of technologies such as battery storage remains cost. For example, in 2015, the levelised cost of electricity per MWh would have been raised by at least an estimated 25% by the addition of batteries to a wind farm.<sup>28</sup>

## FIGURE 8: ELECTRICITY STORAGE SPLITS THE GLOBAL AGENDA FOR ENERGY LEADERS



Electric storage splits the agenda for energy leaders, with a strong OECD versus non-OECD divide. Energy leaders in Europe perceive the issue to be of highest impact while those in Africa and MENA are least concerned.

Another crucial issue linked to this innovation cluster with a similar degree of uncertainty is that of **future transportation**, including electric vehicles. The multitude of options and differing expectations around timeframes add to the associated uncertainty. Developments in this area could have a major impact of global emissions over the next 25 years and beyond, as well as potentially complex effects for both renewables and conventional generation. Considerations in this regard involve the importance of the underlying source of generation to charge electric vehicles. Though not a standout issue in the current findings relative to other priorities, particular expectations are given to the issue looking forward for the European Union, the US and China – where targets for fuel economy improvement from 2014 to 2020 have been set at approximately 30% for cars.<sup>29</sup> The World Energy Council scenarios highlight the diversification of transport fuels as driving a disruptive change that helps to enable substantial reductions in the

28. Frankfurt School-UNEP Centre/BNEF, 2016, Global Trends in Renewable Energy Investment 2016

29. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

energy and carbon intensity of transport. Under the different scenarios, oil’s share of transport falls from 92% in 2014 to 2060 ranges from 60 to 78%.<sup>30</sup> There is a contrasting range of expectations for adoption, for instance with OPEC forecasting a figure of 1.7 million electric vehicles on the road by 2020<sup>31</sup> in comparison to BNEF estimates for 7.4 million.<sup>32</sup> Such differences demonstrate the continued uncertainty and implications for many of the assumptions around the rate of battery price declines and expansion in the necessary charging infrastructure<sup>33</sup> but also the broader complexities facing decision makers.

**FIGURE 9: THE ANTICIPATED RAPID PENETRATION OF ELECTRIC VEHICLES**

**Electric Vehicles Share of Light-duty Vehicle Fleets**



Source: World Energy Council, Paul Scherrer Institute, Accenture Strategy

The uncertainty associated with this innovation cluster relates to a range of issues which are heavily influenced in their future direction both directly and indirectly through association to the role of renewables and the implementation of climate framework agreements. This includes supportive and stable policy frameworks to enable funding and development; the application of such initiatives to ensure long-term investments are not negatively impacted by retrospective legislation. This is highlighted in terms of policy frameworks stability by the World Energy Trilemma; that is the relationship between dimensions of energy security, energy equity and environmental sustainability.<sup>34</sup>

Policymakers across the globe must address the challenge to keep up with rapidly evolving markets and business models. Leading companies will increasingly have to be able to adapt and respond to new consumer behaviours and demands with more flexible and effective business models. Further disruption to the traditional market structure poses not only a new dynamic to the energy sector but across many industries. The challenges around this are magnified by the interconnected nature of many of these technology innovation issues and the need for further clarity on how costly many of the policy choices will ultimately be.

30. World Energy Council, 2016, E-Mobility: Closing The Emissions Gap  
 31. OPEC, 2015, World Oil Outlook 2015  
 32. Bloomberg New Energy Finance, 2016, Research Note Global EV Sales Outlook to 2040  
 33. World Energy Council, 2016, E-Mobility: Closing The Emissions Gap  
 34. World Energy Council, 2016, The World Energy Trilemma 2016: Defining measures to accelerate the energy transition

Despite having been replaced as the number one issue in perceived impact this year, **energy efficiency** remains an action priority and plays a fundamental role in supporting the transition towards a more sustainable energy system. This reflects the issue being regarded in the need for action area across all regions in 2017, as it has at the global level since the first Issues Monitor findings in 2010. The increasing number of countries with an energy efficiency law signifies a strengthening and consolidation of the institutional commitment to energy efficiency. Energy productivity is improving in most countries and regions due to factors such as previously high energy prices and expanding GHG emissions abatement regulations.<sup>35</sup> However, further improvements in energy productivity are essential for the energy sector, especially in areas such as thermal power generation where average efficiency improvements must be led by greater penetration of more efficient coal plants and CCGTs. The expectation for the year ahead is that energy efficiency will continue to remain a priority action area, enhanced by the upward trend associated to digitalisation, the role of smart grids as well as in contributing to the decarbonisation agenda. For example, in Europe, it is expected that the recent ‘Clean Energy for all Europeans’ package of measures from the European Commission will be crucial to the way in which energy efficiency is prioritised to enhance the competitiveness of the European Union (EU) against the backdrop of a clean energy transition, with a proposed binding 30% energy efficiency target for 2030.<sup>36</sup>

### **Coal, Nuclear and CCS falling down the agenda**

At the same time as this rise in impact around renewables and the importance of supporting technologies, we have for the second successive year seen both coal and nuclear move down the agenda to a perceived low impact.

This change in perception reflects the significance of global declines in **coal** production, at 0.6% for 2014 and 2.8% for 2015, the first such movement since the 1990s.<sup>37</sup> In some regards, the low impact attributed to coal is surprising when considering that coal currently fuels 40% of the world’s electricity supply and is forecast to be a significant contributor for at least the next three decades.

However, we see a strong divergence emerge when examining the geographical findings, with Asia, accounting for 66% of global coal consumption, perceiving the issue with far greater impact than any other region. This is reinforced from the production perspective, as the national implications highlight coal as a high-impact action priority for the energy sector in Australia, China, Indonesia, India and South Africa, while it has a higher uncertainty for both the US and Russia – all seven of these countries were in the top ten coal producing countries in terms of total production in 2014<sup>38</sup> and 2015.<sup>39</sup>

35. World Energy Council, 2016, Energy Efficiency: A straight path towards energy sustainability

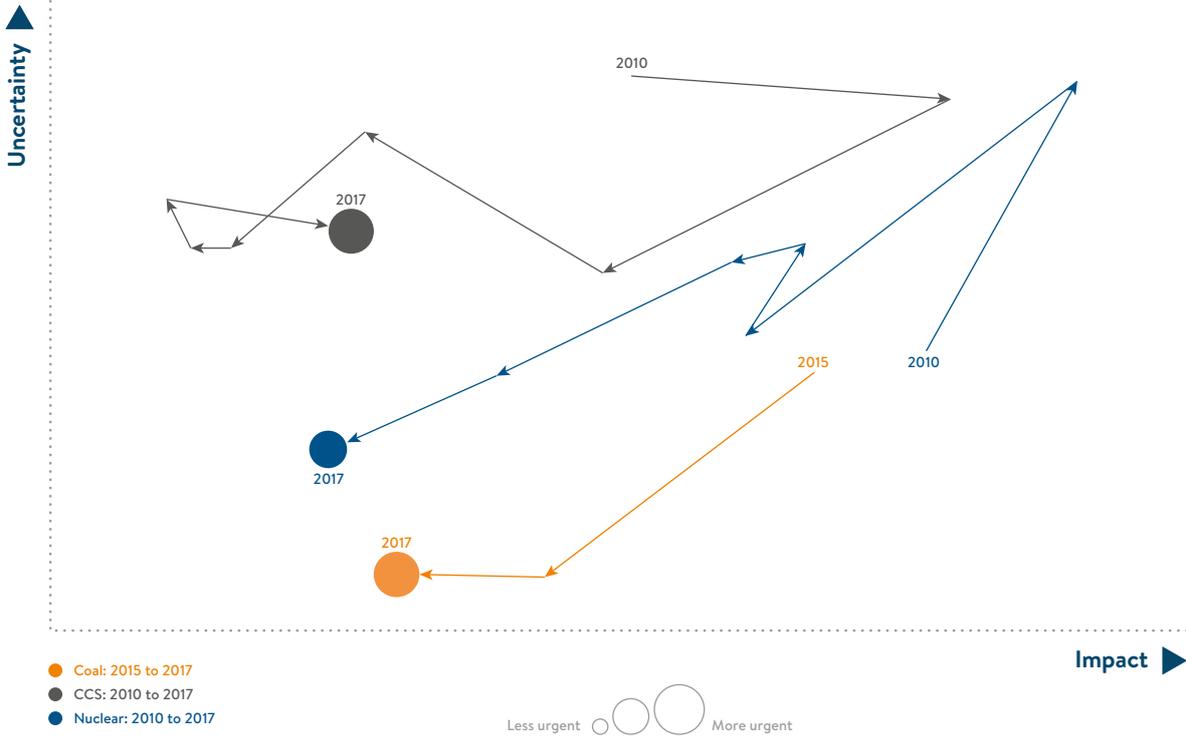
36. European Commission, 2016, Proposal for a revised energy efficiency directive

37. German Coal Association, 2015, Steinkohle

38. BGR, 2015, Energy Study 2015, Reserves, resources and availability of energy resources

39. BP, 2016, Statistical Review of World Energy

**FIGURE 10: COAL, NUCLEAR AND CCS BECOME LOW IMPACT ISSUES**



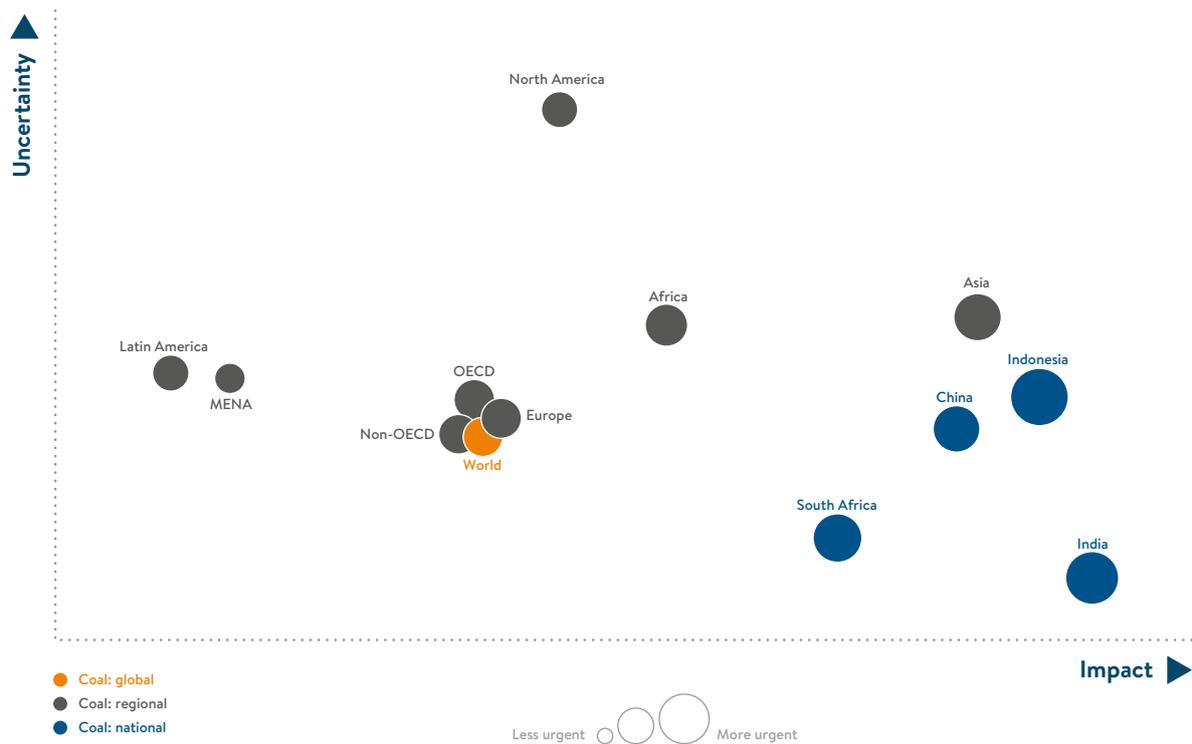
In contrast to figure the rise of innovation issues, the time-tracking for coal, nuclear and ccs shows the issues have moved into the low-impact zone between 2010 and 2017.

Therefore, tensions are clearly apparent for an industry which was classified as the fastest growing fuel in absolute terms for the period between 2000 and 2014 as coal consumption increased by 64%.<sup>40</sup> On the one hand, it remains a fundamental supply base for power generation, especially regarding hard coal and lignite (brown coal), but must at the same time contend with the increasing demands around climate change mitigation, the transition in many locations to cleaner forms of energy as well as increased competition from other sources of energy supply – particularly natural gas. While the difference in the existing base for conventional generation capacity in comparison to renewables is vast, it is nevertheless telling that global investment in 2015 for renewable power capacity, excluding large scale hydro, at US\$ 265.8 billion, was more than double the dollar allocations made to new coal and gas generation, estimated at US\$130 billion.<sup>41</sup>

40. World Energy Council, 2016, World Energy Resources

41. Frankfurt School-UNEP Centre/BNEF, 2016, Global Trends in Renewable Energy Investment 2016

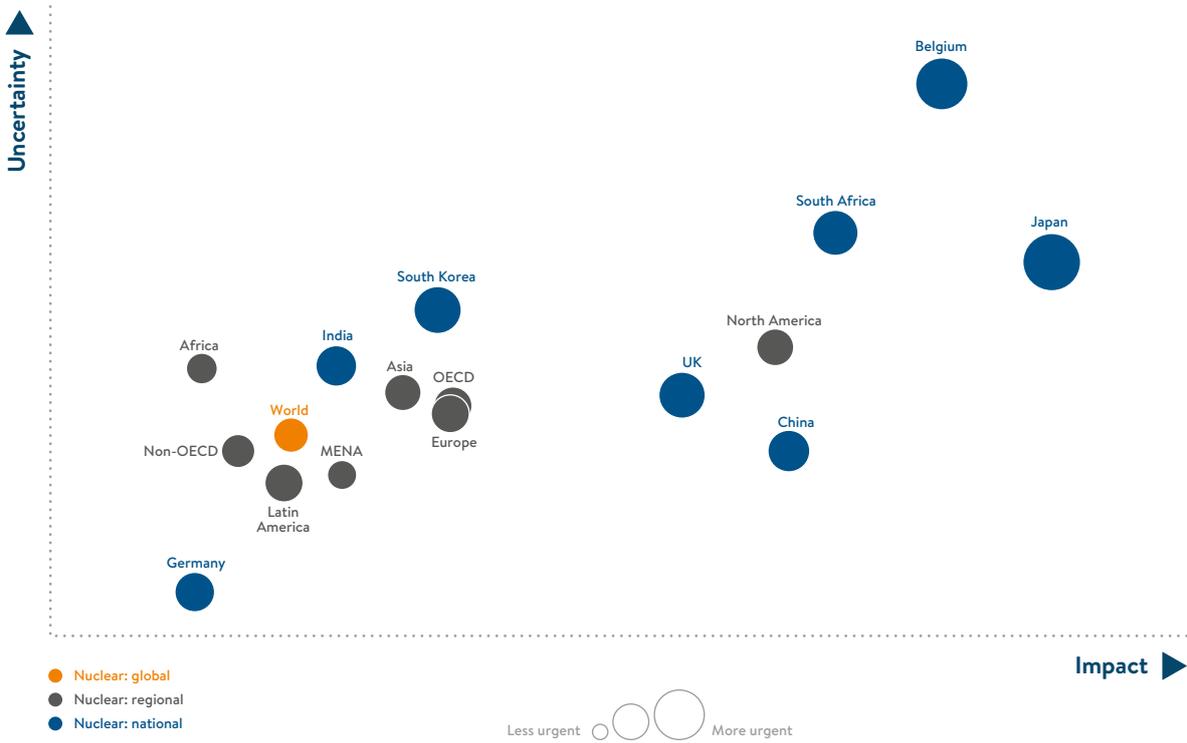
**FIGURE 11: THE IMPACT OF COAL SPLITS THE REGIONAL AGENDA**



Coal is perceived global as a low-impact issue; especially in Latin America, the Middle East and Europe. Asia stands out with the issue being of high-impact while the true importance is seen for leaders in the top producing countries.

The low-impact positioning of coal, must also be viewed in regards to expectations around **carbon capture and storage (CCS)**. Since finding relevance for leaders in the energy sector in 2011, the issue has continually moved to a point as one of the weakest signals in terms of its anticipated role in 2017. Whilst acknowledged as an essential element of any low-carbon energy future, the latest global findings reinforce that expectations for CCS are very low in the current environment as the issue remains one of the lowest relative impact with a high degree of uncertainty. The implication is that the future direction is not clear and without a specific policy framework technological expansion at a meaningful scale is unlikely, especially beyond intended use for enhanced oil recovery (EOR). The one regional exception is for North America, where the issue is perceived with a more moderate impact, linked to the location’s predominant basis for projects either in operation or under construction, including the world’s first large-scale application of technology to capture carbon dioxide for the power sector commenced in October 2014 at the Boundary Dam power station in Saskatchewan, Canada.

**FIGURE 12: DIVERGENCE AROUND THE NUCLEAR AGENDA**



Nuclear remains of perceived high-impact for North America, alongside particular countries where the issue is of most relative importance namely Belgium, Japan, China, United Kingdom, South Korea and India. This contrasts to the positioning in Germany, where the Energiewende has moved the issue from the top to the bottom of the national agenda.

The downward trend for the impact of **nuclear** represents the increasingly select group of countries in which future industry development is targeted. As of December 2015, 65 nuclear reactors were under construction with a total capacity of 64 GW. 40 of the units under construction are located in four countries: China, India, Russia and Korea. Currently there are more than 45 Small Modular Reactors designs under development and four reactors under construction.<sup>42</sup> Outside of these countries, the issues attributed to further nuclear development are perhaps best demonstrated by the national agenda set out in the United Kingdom and Japan, where political sentiment, social acceptability, relative affordability and investment ownership decisions merge to create an increasingly complex challenge in which to take final regulatory, pricing and investment decisions for long-term energy infrastructure.

**Regional priorities: the resilience challenge**

The differences in regional findings demonstrate a natural geographical bias in terms of geopolitical priorities; hence, **US policy** dominates the agenda most in North America and Latin America – linked to the ongoing implications of recent elections. In Europe the discussion has moved from the role

42. World Energy Council, 2016, World Energy Resources

of **Russian foreign policy** to that of **EU Cohesion**, connected to the United Kingdom’s (UK) ‘Brexit’ decision – the potential departure of the UK from the European Union – and challenges to political integration, while for Asia the role of **China** is critical – in terms of growth, innovation and policy influencing energy markets. Thus, geopolitics remain hugely important for the energy sector as the impact of political decisions has a direct bearing for the future direction of the environment in which leaders must operate, including the implications of disruptive technologies which challenge existing models and create new tensions on many traditional resource bases tied to national agendas.

**FIGURE 13: THE OECD VS. NON-OECD SPLIT ON THE IMPACT OF CYBER THREATS**



Cyber threats feature most prominently for leaders in Europe, Asia, North America and the Middle East, with national priority for Singapore, Japan and the UK.

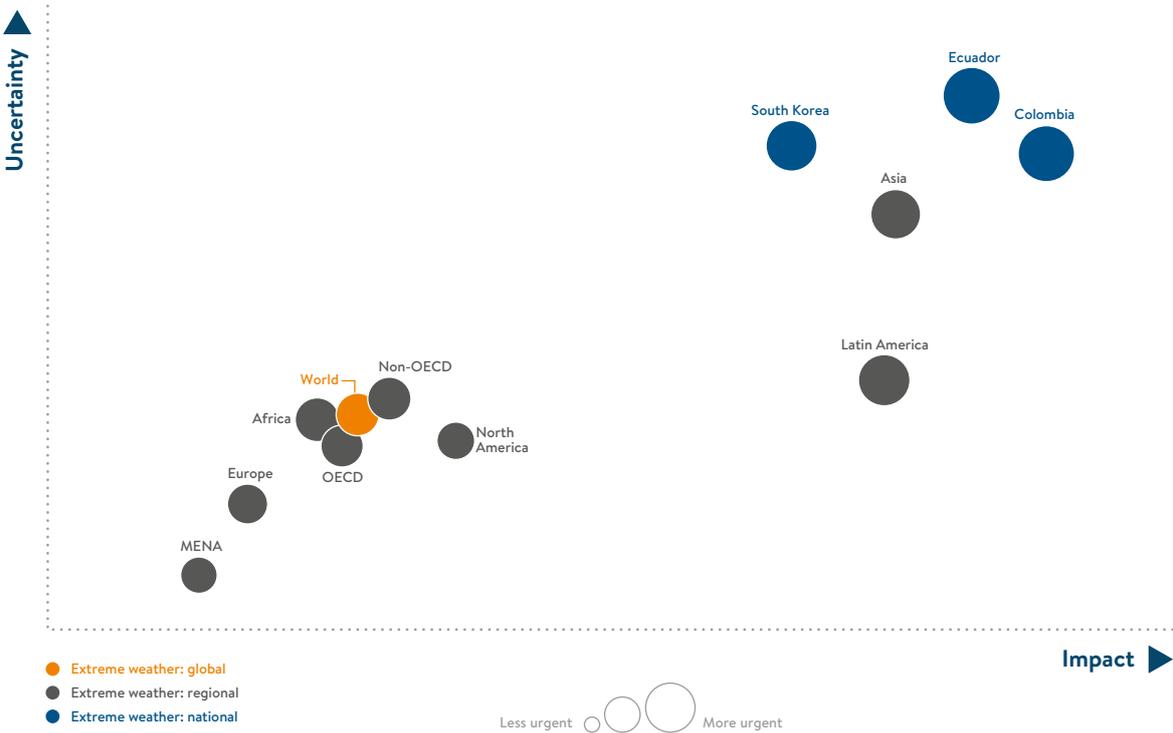
The findings of this report showcase that regions have profoundly different resilience challenges. This includes **cyber threats**, which are most prominent for Europe, Asia, North America and the Middle East with highest impact in Singapore, Japan and the United Kingdom. As increased digitisation creates greater efficiencies and grid management improvements, with such benefits also come increased vulnerabilities, in particular due to the automation of Industrial Control Systems.<sup>43</sup> With an estimated 41%

43. World Energy Council, 2016, The road to resilience: Managing cyber risks

of cyber-attacks targeting the energy industry, and in particular oil and gas companies<sup>44</sup> this recognises that for many energy sector stakeholders a greater resilience to cyber risk is critical to current and future energy security. Cyber threats must therefore be addressed with a systemic approach to risks across the entire energy supply chain, utilising both technical measures of resilience combined with human resilience measures built on developing a robust cyber awareness culture.<sup>45</sup>

**Extreme weather risks** are perceived as a critical uncertainty for leaders in both Asia and Latin America with particular emphasis in the national findings for Colombia, Ecuador and South Korea. The number of extreme weather events recorded each year has more than quadrupled over the past 40 years.<sup>46</sup> Changes in the intensity and frequency of extreme weather events, as well as unseasonal deviations from average weather, affect current and future energy infrastructure and the energy sector’s profitability. The impacts on energy systems can include blackouts, shut down of nuclear and thermal power plants due to long-lasting heat waves, or droughts and changing rainfall patterns affecting hydropower generation.<sup>47</sup>

**FIGURE 14: EXTREME WEATHER RISKS KEEPING LEADERS AWAKE IN ASIA AND LATIN AMERICA**



Extreme weather risks have the highest impact for leaders in Asia and Latin America, with a particular emphasis in countries including Colombia, Ecuador and South Korea.

44. General Keith Alexander, Former Director of the National Security Agency, 2016, <https://soundcloud.com/venturedpodcast/general-alexander>

45. World Energy Council, 2016, The road to resilience: Managing cyber risks

46. Swiss Re Economic Research and Consulting, 2015: Sigma world insurance database

47. World Energy Council, 2015, The road to resilience – managing and financing extreme weather risks

These resilience challenges become critical to understand in terms of how each of these locations will react to enable the necessary energy infrastructure for the future. In turn, how regions and sub-regions react to this challenge will also help to set the innovation agenda.

## CONCLUSION

Overall, the priorities for energy leaders looking ahead through 2017 continue the dynamics set out in the last report. The latest findings highlight that with the strong change and volatility in the findings seen through 2014 to 2016, we now see a more settled view for 2017, but one in which a number of critical tensions in the system emerge against the context of the grand energy transition underway.

Firstly, as climate framework presents the perception that it is better mastered today than in previous years' renewable energies have now become the number one action priority. In turn, the role of supporting technologies, including new market design, electric storage and digitalisation, becomes critical. However, this is juxtaposed against the need for continued security of supply and affordability advantages often attributed to traditional generation, especially in contribution towards the baseload electricity mix for many countries.

Secondly, the role of geopolitics in energy are as important now as ever. The implications of digitalisation and developing trends on resources is massive, at a time when global energy demand per capita is forecast to peak in the coming years.<sup>48</sup> The implication of this when combined with the climate agenda issue leads to the potential role of stranded resources, which, if realised, poses an existential threat to the status quo for many key industry entities.

Thirdly, the tensions around shifting business models for the energy sector. What might have seemed impossible even a few years ago now becomes challenged by the increasing speed of change, shifting resource priorities and policy framework adaption. Prescient reminders are apparent through the examples seen in other areas such as the transformation of the telecommunications industry.

Finally, the tensions between and within regions, as they are increasingly defined by their solutions to address profoundly different resilience challenges. In this context it becomes critical to understand how each of these areas will react and enable the necessary infrastructure for the future. In turn, how regions and sub-regions react to this challenge will also help to set the innovation agendas for the future.

48. World Energy Council, 2016, World Energy Scenarios 2016 – The Grand Transition

# Chapter two

# Assessing the energy agenda for Africa

## AFRICA

Algeria

Botswana

Democratic Republic of Congo

Ethiopia

Ghana

Kenya

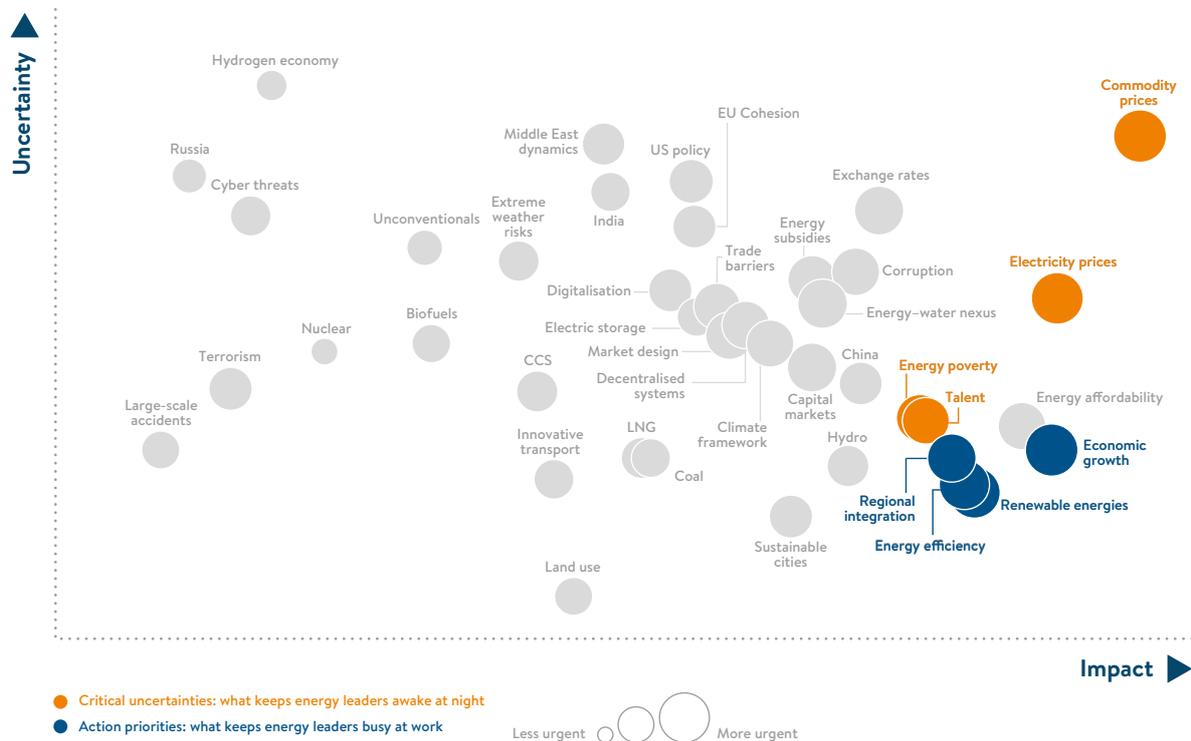
Namibia

Nigeria

South Africa

Swaziland

## AFRICA



The economic growth for the Continent declined this year, amid global headwinds, losing momentum compared to the last year. This marks a significant downward move compared to the steady economic growth experienced during the last five years. Although the countries' performances are uneven, the Continent as a whole is still confronted with critical challenges, including falling commodity prices, high electricity prices, energy poverty and energy affordability; and for an increasing number of countries, insecurity, political instability and corruption. However, the African map also highlights the exciting opportunities to address the solutions in these areas.

The electricity sector continues to be critically challenging. Some countries have managed to strengthen their electricity infrastructure, often at the expense of increased high tariffs; but most countries are still facing an electricity crisis; and overall, shortcomings in the sector continue threatening the Continent's economic and social growth and industrial competitiveness.

To push forward its last year "New Deal for Energy in Africa" in order to solve Africa's huge energy deficit and end energy poverty by 2025, the African Development Bank has leveraged strong international and regional partnerships (with all relevant stakeholders), and together, they have initiated collective and coordinated key priority actions.

Renewable Energies keep a high impact on the African agenda and is set to enjoy strong and increased roll-out (for power generation in grid-connected areas and also in remote communities and rural areas), this year seeing substantial developments in leading countries (Morocco, South

Africa, Ethiopia, Algeria, Egypt, Tanzania, Kenya, DRC) forming the breakthrough of a Renewable Energy transition in Africa.

To further support the deployment of Renewable Energy in Africa, a new initiative 'Africa Renewable Energy Initiative' has been launched at the Paris COP21, under the mandate of the African Union and endorsed by African Heads of State and Government, with the aim to bring about at least 10 GW of new and additional renewable energy generation capacity by 2020, and to mobilise the African potential to generate at least 300 GW by 2030.

The top critical uncertainties emerging this year are: commodity prices, electricity prices, energy poverty and talent. African governments should drive adequate policies to better manage or adapt their economies to those critical issues and take appropriate strategies to cope with their potential impacts in the energy system.

The most important need for action issues are: economic growth, renewable energy, energy efficiency and regional integration. While the economic growth has been a global issue this year, exacerbated by the global recession, and impacting Africa as well, African energy leaders should take urgent and appropriate actions and regulatory reforms to better deploy renewable energies, boost energy efficiency through the whole value chain, and make substantial progress on regional integration. The Council's works on these may be interesting tools to help make further progress.

Additional major issues of interest are: energy affordability, sustainable cities, capital markets, hydro and China. As for the previous years, most of those issues continue to be critical because of not moving fast enough towards a sustainable path. Accordingly, economic, social and energy policies should be strengthened nationally and better coordinated in a regional perspective, to maximise their impacts.

In terms of comparison with the global map, the key issues in common are: commodity prices, economic growth, energy efficiency, renewable energies, talent and capital markets. And specific to Africa, the following issues are of utmost importance for the Continent's socio-economic development and energy sustainability: energy poverty, energy affordability, corruption, exchange rates and trade barriers. Although this has been assessed in a regional perspective, all those issues have stayed dominant in most African countries.

Issues of resilience, such as extreme weather risk and energy-water nexus have been quite stable in perception compared to the previous year, while cyber-threats issue has undergone significant change moving from the weak signals to the high uncertainty area. However, behind the regional averages, there are interesting facts to emerge from geographical tracking. Although cyber threats are highly uncertain for the region as a whole, they have greater impact in few countries well connected to the Internet, including Nigeria, Tunisia and Ethiopia. Moreover, African countries with highest concerns for extreme weather patterns, and suffering risks of disruptions from the La Niña, are mostly located in Eastern and Southern Africa, but also, in a lesser extent, in West Africa. Energy-water nexus got more impact in the region as whole, with many parts of the Continent suffering from severe drought related to El Niño effects; and this had led to severe water scarcity, curtailed

agricultural production, decimated crops and livestock; these threaten food security and pushed up inflation of food process in affected countries. Resilient solutions must be put in place, to make the African energy system better capable of handling these new risks, and thus to be more resilient.

The most relevant year-to-year changes and specific observations are related to the following issues.

Commodity prices moved strongly from the priority actions area to a very high position in the critical uncertainties. The volatility occurring in the global commodity market, with sharp decline of commodity prices in most world regions including Africa, impacted Africa's economic growth in mining and oil commodity exporters that have not built up enough resilience or have a need to further diversify their economies.

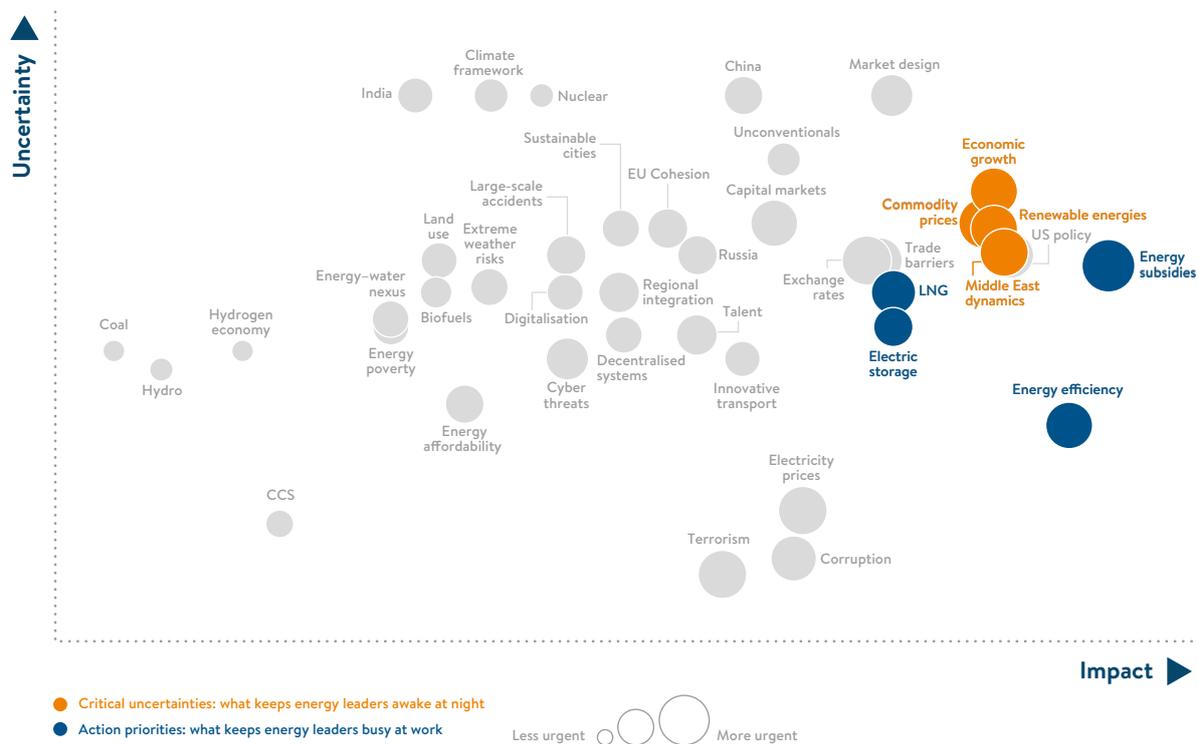
Electricity prices moved to a higher uncertainty and also gained more impact this year; thus appealing for further priority actions, because high electricity tariffs continue to emerge as the most limiting factors to Africa economy's ability to grow at a faster rate.

Talent still remains in the critical uncertainties area but with a lower position than the last year, and keeps the same impact. This issue needs to be dealt with most determination and willingness from African government and energy leaders, more so than is the case today, because of having a critical influence in the sustainable and accelerated development of the Continent and nations.

Climate framework took lesser uncertainty and gained more impact approaching towards the priority actions area, thus requiring bold actions and committed implementation plans from every nation. It is clear that the positive signals created by the Paris COP21 agreement and the Marrakech COP22 have been very instrumental on the perception and engagement of African nations, relatively to their commitments to implement climate change measures (INDCs).

Decentralised systems moved to lesser uncertainty and gained greater impact this year, although not as substantial as it should be. It is clear that robust actions should be put on this issue, because of its playing an important role for energy supply and distribution, enabling further access to modern energy in remote and rural areas through off-grid systems.

## ALGERIA



This first issues monitor deep-dive for Algeria identifies **commodity prices** as a top critical uncertainty. Indeed, the 2017 Algerian issues map shows the significant impact that commodity price volatility can have on a highly fossil-fuel dependent country. The oil price slump, together with an overall decline in the country’s hydrocarbon exports, which were a major source of government revenue, have had significant effects on the Algerian economy. The critical uncertainties of **market design**, **exchange rates** and **economic growth** as well as the top action priorities of **US policy**, **energy efficiency**, **energy subsidies** and **Middle East dynamics** show the pressing need, as well as the obstacles for the Algerian government to adapt to these changed circumstances.

The decrease in revenue from hydrocarbon exports, chiefly crude oil, natural gas and LNG, which accounted for only 19% of GDP in 2015, down from 36% in 2011,<sup>49</sup> has had a significant impact on the Algerian Dinar, which has undergone a 20% nominal depreciation to cope with decreasing revenues, leading to a 4.8% inflation rate in 2016.<sup>50</sup> This makes the **exchange rate’s** impact on the energy sector a critical uncertainty for Algerian energy leaders. Similarly, **economic growth** has been stymied by the decline in export revenues, and is expected to be only a moderate 4.3% in 2016. Rising debt leads to the increasing importance of attracting more foreign direct investment into the country. However, to create an attractive and secure investment environment, Algeria will have to rethink its **market design** strategy, which currently makes it very cumbersome for foreign entities to

49. [www.worldbank.org/en/country/algeria/publication/economic-outlook-spring-2016](http://www.worldbank.org/en/country/algeria/publication/economic-outlook-spring-2016)

50. Reuters (<http://uk.reuters.com/article/algeria-currency-idUKL8N18S1PR>) World Bank ([www.worldbank.org/en/country/algeria/publication/economic-outlook-spring-2016](http://www.worldbank.org/en/country/algeria/publication/economic-outlook-spring-2016))

invest in the country.<sup>51</sup> However, the fact that this issue is a critical uncertainty rather than an action priority can be traced back to the fact that external factors, chiefly **Middle East dynamics**, contribute to decrease the attractiveness of Algeria's investment environment.

US policy is an action priority with strong impact and relatively high uncertainty, mainly due to the ever decreasing crude oil exports from Algeria to the US. Whereas at its peak in 2007, the US was responsible for a significant portion of Algerian crude oil exports (approximately 443,000 bbl/d), according to the EIA this figure was only 31,000 bbl/d in 2015.<sup>52</sup> Future developments in US policy as well as advances in tight oil recovery technology may lead to a further decrease in US imports of Algerian crude oil.

Domestically, the decline in revenues has also put a strain on Algeria's extensive subsidy scheme, which accounted for 14% of GDP in 2015, and which leads to domestic energy prices being among the lowest in the world.<sup>53</sup> **Energy subsidy** reform is thus understandably high on the list of action priorities for Algerian energy leaders. A potential reduction in subsidies, however, would also have to be accompanied by **energy efficiency** measures to curb demand, which has grown exponentially due to the low energy prices. Efficiency measures also have the advantage of freeing up more resources for export. While the government has taken first steps in this direction,<sup>54</sup> subsidy reform and energy efficiency are likely to be prominent issues on future Algerian issues monitors.

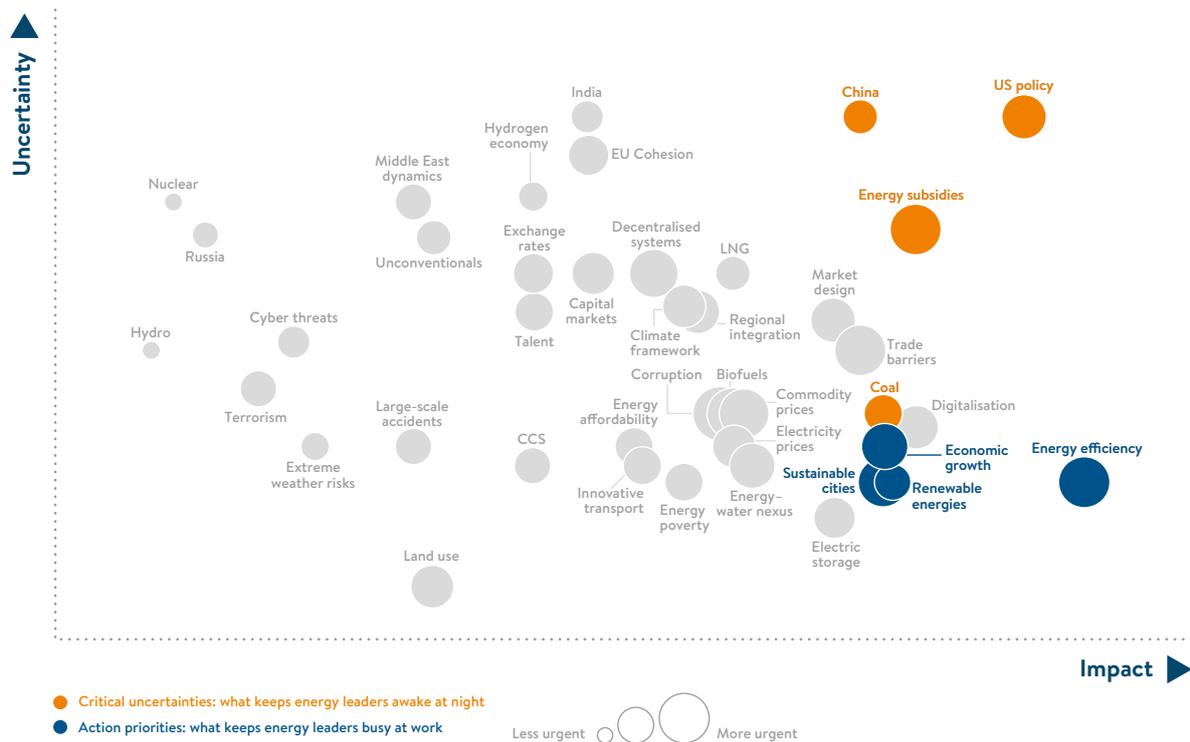
51. Reuters ([www.reuters.com/article/algeria-economy-idUSL5N1760LF](http://www.reuters.com/article/algeria-economy-idUSL5N1760LF))

52. [www.eia.gov/beta/international/analysis.cfm?iso=DZA](http://www.eia.gov/beta/international/analysis.cfm?iso=DZA)

53. IMF ([www.imf.org/external/np/blog/naftida/083116.pdf](http://www.imf.org/external/np/blog/naftida/083116.pdf))

54. [www.bloomberg.com/news/articles/2016-06-13/new-algeria-energy-minister-is-advocate-of-domestic-price-hikes](http://www.bloomberg.com/news/articles/2016-06-13/new-algeria-energy-minister-is-advocate-of-domestic-price-hikes)

## BOTSWANA



### Energy efficiency

in order to mitigate the high cost of both electricity and petroleum product imports, the Government of Botswana (GoB) is keen to improve energy efficiency in the country. This is reflected in Botswana’s 10th National Development Plan (NDP 10) that states that for energy conservation and demand management the strategy will be to “target efficient utilisation of energy in buildings, transport and industry, promotion of energy efficient equipment, and the development of policy and legislation for demand-side management including price as a regulator of demand”. Improved energy efficiency is also viewed as a positive means of contributing to Botswana’s international climate change and carbon emissions obligations.

Over the last several years’ various initiatives aimed at realizing these savings have been undertaken. These have included the distribution of 820,000 CFL bulbs to replace incandescent bulbs in 2010 which was estimated to have “shaved” 30MW off the peak demand, and the implementation in 2013, of ripple control to remotely turn on and off domestic hot-water heaters estimated to have reduced peak demand by a further 30MW.

Despite GoB’s policy pronouncements on energy efficiency and the number of actions undertaken, progress in achieving sustained improvements in energy efficiency has been slow and limited. Studies have indicated that 10–15% of the energy consumed in Botswana could be saved by implementing short-term energy efficiency measures. In December 2016, GoB through support from the World Bank completed a National Energy Efficiency Strategy document with key short and medium term initiatives that are required to achieve the 10–15% energy savings.

### **Energy subsidies**

The country introduced subsidies in electricity connection in rural areas and in the tariff as a measure of lowering the affordability margins and of increasing energy access. The continued non cost reflective tariffs means the subsidy is still highly crucial in the development of our country. Other forms of energy do not enjoy the benefits of subsidies.

### **Economic growth**

From independence (1966) Botswana experienced a significant increase in economic growth within the region. The decline in economic growth has since been an issue of concern as Botswana experienced serious decline in GDP real growth rates 2013, 2014 and 2015 of 9.9%, 3.2%, and 0.3% respectively. On the energy front the declines has resulted in lower rates of energy products (electricity, coal etc.) and consequently under employment as employees were kept on the same salaries. This has been a cyclical event which is keeping the leaders engaged on how the economy can be diversified to regain its initial growth rates.

### **Sustainable cities**

The concept of sustainability has long been accepted in Botswana, as reflected in the just ended vision 2016. However, it has never been a priority area for any of our cities. This could be attributed to a number of factors such as lack of public and political awareness. The current governance set up, where cities are still under the direct control of the ministry of local government, also acts as a barrier.

Despite the barriers outlined, there are minimal efforts made by some of the cities especially in terms of waste management. In 2013 Lobatse Town Council and Selibe Phikwe Towns Council partnered to implement the best practice environmental management which ensures that waste management hierarchy (reduce, reuse, recycle) is effectively implemented.

### **Digitalisation**

While digitalisation is perceived to be an action priority, the transition from traditional methods is still insignificant. Although this must be changed in this age of digitalisation, there does not yet exist any political mobilisation in the scope of policy or legislature to make it obligatory for the energy industry to move with a wide range of technological evolutions. Thus far, Botswana has deployed e-payments and smart meters which are not explored to their full potential as customers are still unable to monitor their energy consumption remotely. It is without a doubt that the level of contribution that automation and most importantly digitalisation brings to Energy processes will help a great deal in efficiency. In essence the slow development in digitalisation cost the energy industry quality data, good communication, customer satisfaction and lots of money.

### **Renewable energy**

GoB recognizes that the country is endowed with significant renewable energy potential, especially solar energy. This potential however remains largely untapped and therefore GoB supports the development of renewable energy to increase its contribution to the energy supply mix. Currently renewable energy is estimated to contribute less than 1% to the energy supply.

Exploiting renewable energy is consistent with Botswana's National Development agenda which emphasises the importance of sustainable development and improved energy supply security. GoB has ambitions for the country to become self-sufficient in electricity production and wishes to be a net exporter of electricity. To further show its commitment to increased use of Renewable Energy GOB restructured the Ministry of Mineral, Energy and Water Resources to become the Ministry of Mineral Resources, Green Technology and Energy security.

Botswana has traditionally relied on imports from South Africa and other Southern African Power Pool (SAPP) countries for a significant portion of its electricity supply. This is however increasingly at risk due to the electricity supply shortages that South Africa and the region at large now faces. GoB also recognizes its international obligations and wishes to limit its carbon footprint to the greatest extent possible.

As part of GoB's efforts to promote renewable energy in the country, a number of studies have been undertaken. These include: feed-in tariffs for renewable energy (2011); solar water heating (2005); biomass potential (2007, 2009); and prefeasibility and feasibility studies for Concentrated Solar Thermal (CST) technologies (2009, 2013). There is also a 1.3 MW grid connected solar photo-voltaic plant, just outside Gaborone at Phakalane that was completed in 2012. National utility, Botswana Power Corporation (BPC) has also played a role in the promotion of renewable energy technologies through its subsidiary BPC Lesedi, solar water heaters, solar home systems, efficient biomass cooking stoves and rechargeable solar lanterns have been distributed in the country. The programme was implemented for a five-year period from 2009 to 2013 when the company closed.

The rising average cost of electricity generation in Botswana together with GoB's commitment to international environmental obligations and the observed downward trajectory in the cost of renewable energy technologies, makes this an opportune time for the country to exploit this important energy source.

GoB with the assistance of World Bank is currently finalizing a comprehensive renewable energy strategy that will provide a sound basis for scaling-up the deployment of renewable energy technologies in the country. The strategy is looking at both the off-grid and grid connected Renewable Energy technologies and will be completed in January 2017. It is hoped that the implementation of the strategy will go long way in removing policy barriers for the adoption of Renewable Energy.



Chinese participation in the grand Inga Dam is creating uncertainty for energy leaders in the country. The Inga Dam has been under proposed development for several years; however, there is yet to be confirmation of when construction will start. In addition, the building of the dam has caused significant concerns where there is likely displacement of people, and is currently likely to be built without any environmental impact assessment to be undertaken. Such delays have significantly impacted the development of energy policy, where uncertainty exists in how to best plan for future investment in the event construction does not take place for a number of years, if at all.

India is another key uncertainty for the country. Given the investments into local infrastructure stemming from India, this is not a surprise. The Export-Import Bank of India agreed loans totalling \$144.44m to fund transmission and distribution infrastructure to evacuate power from the Katende and Kakobola dam. Again, there are concerns that over reliance on inward investment is unreliable due to potential stagnating economies and lack of transparency surrounding international investment.

Exchange rates are another key uncertainty for the country this year. Exchange rate fluctuations have contributed to an increase in the national trade deficit, resulting in increased costs for consumers due to increased import prices. At the same time the exchange rate is favourable to the country's crude oil exports, hence Congo would benefit from developing refined oil.

### **Top action priorities this year include talent, climate framework, hydro.**

**Talent** is highlighted as a need for action item for Congo (Dem. Rep.), indicating the difficulty employers are facing when attempting to find methods to adequately source, retain and develop energy specialists and those at the senior level. Although Congo (Dem. Rep.) has improved in democratic governance and has seen a growing economy in recent years - primarily due to high levels of Chinese FDI in infrastructure - high levels of corruption and low national access to electricity all play a role in failing to attract high levels of talent to the country<sup>56</sup>.

Climate framework is another action priority for the country. COP21 established a clear mandate for the need to act quickly to ensure a successful decarbonisation and reduction in emissions of the energy sector. However as of early 2016 no clear frameworks were in place that would enable this to successfully be put into action. In addition, the lack of submission of a Sustainable Energy For All Action Agenda and Investment Prospectus through a joint collaboration between the Ministry of Energy and Water and the African Climate Technology Centre both can explain the **climate framework** priority<sup>57</sup>. In addition to that, ongoing droughts in the region have affected water levels in dams and with that the electricity production in the region. This is increasingly raising awareness towards climate change vulnerability in the country.

Delays in construction and a lack of regard for international guidelines regarding potential environmental and social impacts for the proposed construction of the Grand Inga Dam is the main reason for the need for action regarding **hydropower**. If constructed the dam has been purported to supply almost 40% of Africa's power, with a proposed capacity of around 40GW and so delays due to

56. <https://ambardcusa.org/drc-articulates-proposed-climate-change-adaptation-plan-at-un-climate-conference/>

57. <https://www.african-ctc.net/our-activities/projects/mitigation/democratic-republic-of-congo-se4all/>

potential non-compliance with national law, as well as World Bank and Chinese guidelines for overseas contractors, were a significant concern in 2016<sup>58</sup>.

Congo (Dem. Rep.) shows some similarity with Africa in the Issues Monitor findings; however, it is not as striking as some other African nations. For example, Congo (Dem. Rep.) does not rely significantly on crude oil for power consumption, with around 99% of electricity being produced from hydropower for domestic use, and so as such is less affected from volatility in **commodity prices**. This is also the case when looking at the world Map<sup>59</sup>.

58. <http://www.globalconstructionreview.com/news/world-bank-halts-funding-grand-in7ga-da7m-d7r/>

59. <http://global-climatescope.org/en/country/dr-congo/#/details>



Climate change is a challenge to be addressed at both the national and the international level. It requires a collective response; it is essential that major players agree internationally on a common agenda and discuss core issues such as greenhouse gases reduction targets, diversification commitments and financial and technical assistance for developing countries. In this regard, the Paris agreement is one major step taken forward by the international community to translate the agenda at the domestic level and allow each country to develop a pathway towards a secure and equitable distribution of energy in a low-carbon world, if it is implemented by every stakeholder accordingly.

The inter-linkage between the water, energy and food supply systems – the nexus – is a major consideration in the country's sustainable development strategies. Rapid economic growth, expanding populations and other socio-economic changes are driving up demand for energy, water and food. The ability of existing water, energy and food systems to meet this growing demand is constrained with various factors, including climate change impacts.

According to a recent report of the World Bank, China and Ethiopia had similar levels of income in the 1980s, however, China is now 14 times richer than Ethiopia. Ethiopia is now managed to grow at Chinese rates for about decade. Encouragingly, Ethiopia's growth performance over the past decade was part of a broader and very successful development experience, which moved closer to its goal of becoming a middle income country by 2025. China has been playing a significant role in Ethiopia's development as one of its key development partners. If China growth, in relation to innovation and policy influencing global energy trade, market dynamics and global governance, continue to be sustaining in the years ahead, it is expected to have a high positive potential impact in the development of Ethiopian energy sector.

The development of renewable energies including hydro, regional interconnection and energy access are dominant issues in the need for action space.

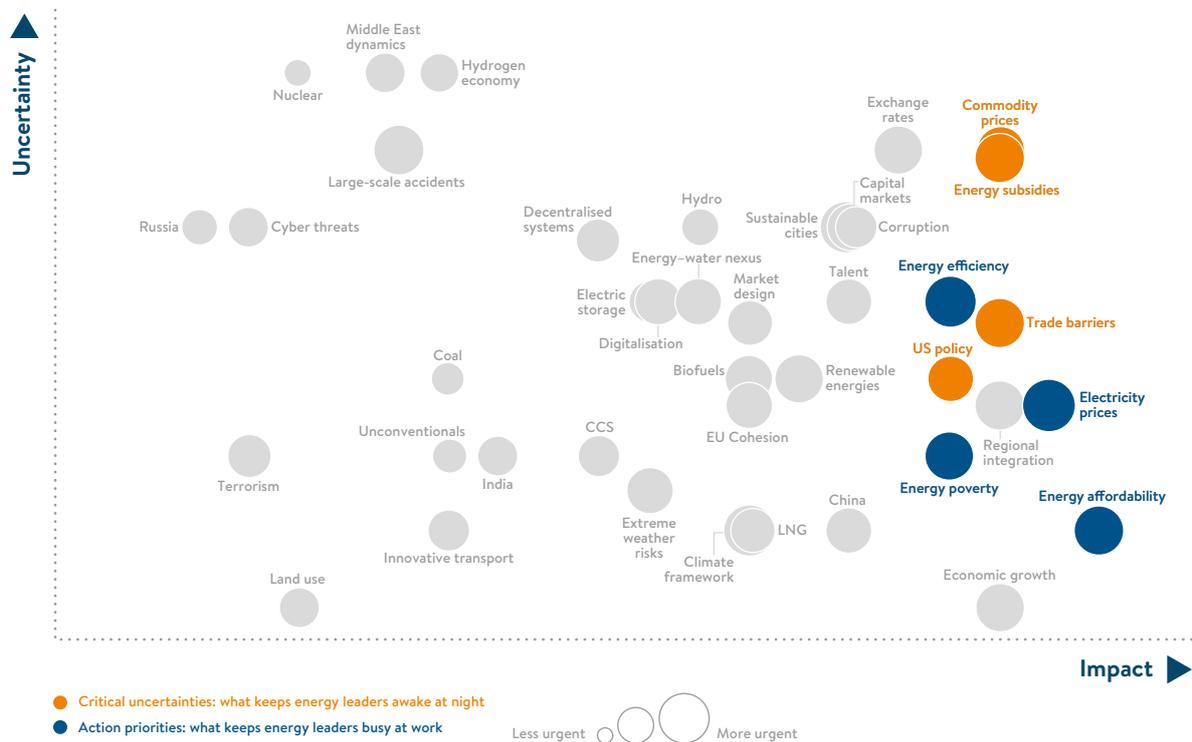
The country's energy development strategy is closely interlinked with the country's economic development plans. Ethiopia has therefore continued investing in the development of renewable energy technologies across the country. In this regard close to 60% of the construction of the country's flagship project, the Grand Ethiopian Renaissance Dam (GERD) on the Nile, has been finalised so far. And preparations to generate 750MW of electricity from two turbines, which are part of the construction targeted to be launched soon, are nearly complete.

The expansion of the Ethiopian power system is focused on development of the renewable indigenous energy resources; primarily on the hydro resource which the nation is particularly endowed with, as this will going to be the best alternative to serve the regional demand for electricity as well in the coming future. The long-term generation expansion plan of Ethiopia is also tailored in line with such perspective, as it helps to reduce the neighbouring countries thermal based mode of generation, which is quite expensive, and makes the country electricity exporter in the region.

In this respect, Ethiopia has been working to foster its cooperation with East African countries in the political, economic, and social fields. The aim is to promote the integrated development of the power system and interconnection facilities and the development of sound power exchange agreements to increase mutual benefits.

The other important issue in the need for action space of the Ethiopian Deep Dive is energy access – lacking access to modern energy services including household access to clean cooking facilities and electricity. The high dependence on traditional biomass fuels in Ethiopia has implications for deforestation and forest degradation to the extent that there is a net negative effect on forest cover and health problems on the society due to indoor air pollution. Business, industry, commerce, and public services, such as modern healthcare, education, and communication, are highly dependent on access to modern energy services. Without the provision of sustainable energy to all sectors of the economy, there is a risk that the government’s long term commitment to eradicate poverty and develop the economy could be seriously impaired. Therefore, in countries like Ethiopia where the availability of modern energy is very limited for most households providing sustainable energy to all sectors is crucial.

## GHANA



Ghana experienced much political change through 2016. Akufo-Addo being elected has signalled a shift in direction providing renewed confidence that continuing blackouts, “dhumsor”, can be decreased in frequency, and energy access for the Ghanaian population will increase. Additionally, structural changes to key areas of government including the Ministry of Power and Ministry of Petroleum which have been merged to create one Ministry, the Ministry of Energy, Petroleum and Power. It is also expected that there will be leadership change to the Ghana National Gas Company (GNGC) and the Energy Commission.

The result of the blackouts has increased debt payments to energy suppliers and increased the costs for purchasing fuel due to an increase in the reliance on thermal power. The president of Ghana stated that it is the intention of the government office to tackle the issue of blackouts through the introduction of new reforms. These reforms include policy developments such as the Renewable Energy Act 2011, promising to achieve renewable energy generating capacity of 10% by 2020, and the Nuclear Authority Act 2015 which allows for provisions for nuclear power facilities to be developed. In addition, a liquefied natural gas regasification plant is being considered to assist in decreasing the frequency of blackouts.

The Issues Monitor Map shows that commodity prices, energy subsidies, trade barriers and US policy are key concerns for Ghana going forward.

The uncertainty surrounding **commodity prices** can be explained by the volatility of global oil prices and to some extent the first stage of price deregulation that took effect in Ghana from June 2016. The decline in oil prices in recent years as well as uncertainty regarding any future rise has led to a

significant lowering of projected revenue for several current operating as well as proposed oil development projects in Ghana for 2017 and onwards. The transition to a deregulation of petroleum pricing was first proposed in 2005 but it is only recently that the legislation has been acted upon. The switch from the Automatic Petroleum Product Pricing Formula to the current pricing structure caused several Oil Marketing Companies (OMCs) to decrease oil prices, for example from GH¢3.97 per litre for petrol to GH¢3.53 per litre<sup>60</sup>, however it is unclear at present what effect this will have on profits.

**Energy subsidies**, introduced by the Ghanaian government, aimed at reducing the cost of electricity for consumer has resulted in decreased revenues for the Electricity Company of Ghana where the government has failed to pay. In December 2015, the Energy Sector Levies Act (Act 899) was introduced to alleviate some of this debt; however, the result has been the default on payments resulting in Bulk Distribution Companies refusing to supply crude oil to the plants owned by the state-owned Volta River Authority, responsible for generation of power. The situation has resulted in Ghana's energy sector utilities facing significant financial challenges in the form of unpaid legacy debts. One suggestion to reduce the burden on companies is to privatise the ECG, however this suggestion remains hypothetical.

In 2015, 44% of Ghana's total gas imports came from Nigeria via the West African Gas Pipeline (WAGP) to power its thermal plants. However, energy companies providing fuel via this route currently impose high tariffs to Ghana resulting in the creation of **trade barriers**. Continued sabotage of sections of pipeline by groups such as the NDA in Nigeria, and outstanding debts by the Government of Ghana of over 100 million dollars to oil suppliers, such as N-Gas, have both contributed to these high tariffs. Thus, Ghana's increased reliance on gas to fuel its thermal plants is therefore resulting in a long-term financial concern.

The uncertainty surrounding **US policy** was due highly contested political election race in 2016, where a Trump presidency would result in uncertain foreign and energy policy. References made by Trump to 'America First', and decreasing funding for UN programmes, as well as uncertainty regarding the future of Power Africa created concern for companies which are in the sustainable energy sector.

The Issues Monitor Map indicates that key action priorities for Ghana include **energy access and affordability, electricity prices** as well as **economic growth**.

It was estimated in 2010 that Ghana loses between 2 and 6 % of gross domestic product (GDP) annually because of an inadequate and unreliable power supply<sup>61</sup>. Therefore, **energy access is a top priority for Ghana**. Currently access is at 76% as of 2015, according to the Global Tracking Framework, however under the Sustainable Energy for All Targets Ghana has set a target to provide full national electricity access by 2030, including 100% access to non-solid fuels by 2030<sup>62</sup>.

60. <http://www.ghana.gov.gh/index.php/media-center/news/1644-omcs-reduces-fuel-prices-drastically>

61. <http://download.springer.com/static/pdf/806/art%253A10.1186%252Fs13705-016-0075-y.pdf?originUrl=http%3A%2F%2Fenergysustainoc.springeropen.com%2Farticle%2F10.1186%2Fs13705-016-0075-y&token2=exp=1490201869~acl=%2Fstatic%2Fpdf%2F806%2Fart%25253A10.1186%25252Fs13705-016-0075->

62. <https://www.se4all-africa.org/se4all-in-africa/country-data/ghana/>

Due to levies imposed on consumers by The Energy Sector Levies Act, 2015 (Act 899), as well as a depreciation of the cedi to the dollar, utility tariffs have increased significantly, causing an increase in **electricity prices** for consumers, and the highest in sub-Saharan Africa in late 2015<sup>63</sup>.

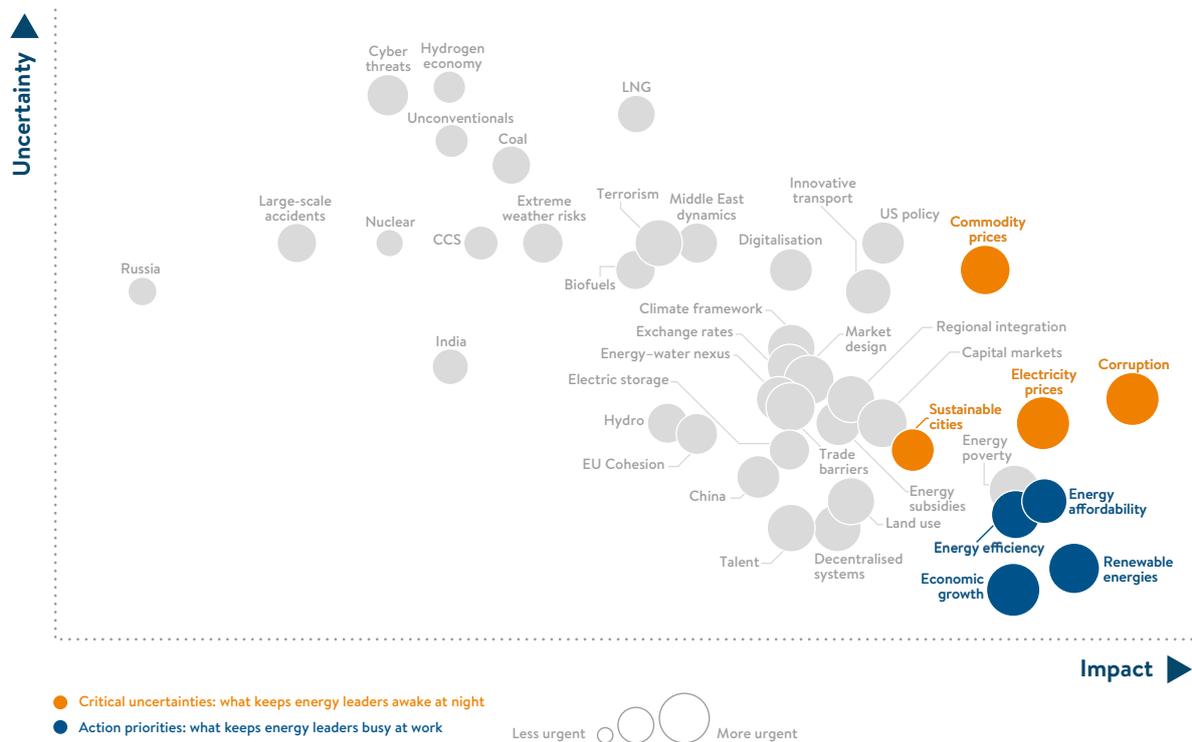
Ghana has been increasingly reliant on importing natural gas to power its thermal plants through the West African Gas Pipeline (WAGP). The decline in hydropower output and the attacks on pipelines have meant that prices for fuel from the WAGP continue to mount - according to Ghana's Energy Outlook Document 2016, Ghana must pay \$1.18 billion for fuel only. Added to debts already owed to companies supplying gas to the WAGP by the Ghanaian government, this has caused the WAGP to impose high tariffs for the import of gas to Ghana. The Energy Sector Levies Act, 2015 (Act 899) has also impacted prices of electricity. A survey conducted in 2016 by GN Research for example, a multinational research company, found that most hotels in Accra paid around 140 percent more for power in mid-2016 than they did in December 2015<sup>64</sup>. The above reasons thus explain the issue regarding **energy affordability**

A report issued in April 2016 by the International Monetary Fund forecasted that the economy will not see much growth, explaining the reason behind a concern regarding Ghana's **economic growth**. Reasons for the lower than expected growth rate were primarily due to declining commodity prices. When comparing Ghana's Issues Map to the world as well as to Africa as a whole it is clear that all have very similar issues with regard to commodity and electricity prices, as well as energy subsidies. Global oil price volatility continues to play an important role.

63. <http://pulse.com.gh/oil-gas/value-for-money-ghanas-electricity-cost-highest-in-west-africa-acep-id4389656.html>

64. <http://www.graphic.com.gh/news/general-news/electricity-rates-goes-up-140-percent-instead-of-59-2-percent-research.html>

## KENYA



Critical uncertainties in Kenya were observed to include commodity prices, corruption, electricity prices and sustainable cities. The action priorities were identified as renewable energy, energy affordability, energy efficiency and economic growth.

### Critical uncertainties

**Commodity prices:** In this case commodity price is interpreted to mean oil price. Uncertainty in the Kenyan price of oil is caused by its tie to the international suppliers as Kenya does not refine its own oil. The international oil price was as low as US\$32 per barrel in the beginning of January 2016.<sup>65</sup> This resulted in uncertainty surrounding the commercial viability of oil production in Kenya which has led some multi-national operators to scale down their activities.

**Electricity Prices:** The uncertainty in the price of electricity is also attributed to the oil price. In 2016, oil based fuels generated 14% of Kenya’s electricity and constituted 30% of generation capacity.<sup>66</sup> The price of electricity and oil are interlinked through the fuel cost charge (FCC). Fuel cost charge is the cost transferred to electricity consumers by the utility to cater for the uncertainty in oil prices.<sup>67</sup> The uncertainty in the electricity price is also attributed to variation of water in the dams used for generation of hydroelectricity. During periods of drought the quantity of electricity generated using oil based fuels increases which in turn leads to a higher fuel cost charge and consequentially a higher electricity price.

65. [www.nation.co.ke/lifestyle/smartcompany/Low-oil-prices-dim-hope-for-economic-boom-in-Kenya-/1226-3030550-lsk5fq/index.html](http://www.nation.co.ke/lifestyle/smartcompany/Low-oil-prices-dim-hope-for-economic-boom-in-Kenya-/1226-3030550-lsk5fq/index.html)

66. [www.kplc.co.ke/AR2016/KPLC%202016%20Annual%20Report%20Upload.pdf](http://www.kplc.co.ke/AR2016/KPLC%202016%20Annual%20Report%20Upload.pdf)

67. <http://kplc.co.ke/content/item/719/electricity-bill-components>

**Corruption:** Corruption in Kenya has hindered performance of financial and economic governance as well as the development of the private sector and infrastructure which in turn hampered economic growth.<sup>68</sup> Despite the government's conveyed commitment to eradicating corruption, the reported incidences have been in the rise in the recent past. The reported rise of corruption has contributed to the uncertainty in the rate of economic development.<sup>69</sup>

### Action priorities

**Energy affordability and economic growth:** The government has cited its commitment to reducing the cost of electricity with the aim of promoting industrialisation and economic growth.<sup>6</sup> Reducing generation of electricity from oil by diversifying Kenya's electricity mix and decreasing dependence on hydropower has also been identified as a strategy of decreasing the uncertainty in the electricity price and promoting affordability. This has been seen by the increase in Kenya's electricity generation from geothermal power.<sup>70</sup>

**Renewable Energy:** Solar power in Kenya has been used to promote electricity access in off grid areas through mini-grids and solar home systems. The use of solar home systems has seen an increase in the recent past due to the introduction of the pay as you go financial model that has enabled low income communities to access financing for the acquisition of solar home systems<sup>71, 72</sup>. Investment in renewable energy needs to continue with the aim of promoting modern energy access in off grid areas and low income communities. To promote this, the Government exempted solar products from VAT. The Government has also made efforts towards promoting grid tied renewables by reviewing the feed-in-tariff policy with the aim of attracting investors<sup>73</sup>.

### Comparison with Africa and the rest of the world

The only common critical uncertainty observed in Kenya, Africa and the rest of the world is commodity prices. This is attributed to the variation in oil price discussed above. Africa and Kenya had an additional uncertainty in common, electricity prices.

Renewable energy and economic growth were identified as action priorities in Kenya, Africa and the rest of the world. Renewable energy has been identified as an action priority globally due to concerns surrounding emissions from fossil fuels and climate change.

68. [www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018\\_-\\_Kenya\\_Country\\_Strategy\\_Paper.pdf](http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018_-_Kenya_Country_Strategy_Paper.pdf)

69. [www.nation.co.ke/business/Corruption-the-biggest-threat-to-Kenyas-growth-says-study/996-3012642-t96a5q/index.html](http://www.nation.co.ke/business/Corruption-the-biggest-threat-to-Kenyas-growth-says-study/996-3012642-t96a5q/index.html)

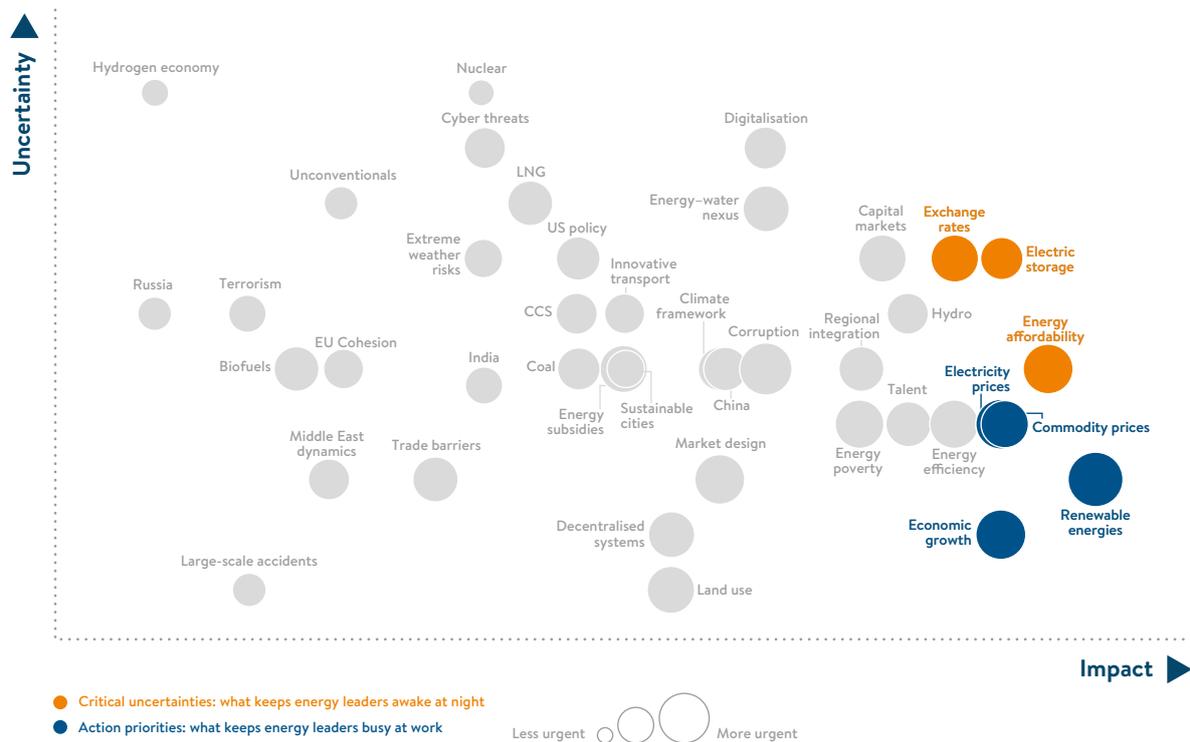
70. [www.vision2030.go.ke/lib.php?f=vision-2030-popular-version](http://www.vision2030.go.ke/lib.php?f=vision-2030-popular-version)

71. [www.sciencedirect.com/science/article/pii/S1364032113007090](http://www.sciencedirect.com/science/article/pii/S1364032113007090)

72. <https://pdfs.semanticscholar.org/7f7d/f435d60e0535d239bd600649f7f44fd3d3f8.pdf>

73. <https://www.iea.org/policiesandmeasures/pams/kenya/name-127280-en.php>

## NAMIBIA



The Top action priorities in Namibia include Economic growth, Renewable energies Electricity prices and Commodity prices (also a critical uncertainty) as well as the completion of the Bulk Fuel Storage Terminal (BFST).

Other key issues this year were that of energy demand and access and fears of food shortages in many parts of Namibia. The poor season was due to the drought cycle in the region, with the worst drought in 35 years caused largely by a strong El Niño weather phenomenon that refers to the warming of the Indian Ocean waters off South America. This cyclical event is associated with extreme global weather patterns, including drought in southern Africa.

2017 could prove to be a challenging year for economic growth in Namibia as the government faces an uphill battle in its efforts to achieve its goals of industrialisation and sustainable growth. The Namibian government has accepted that accelerated deployment of all renewable energy technologies and continuous innovation will bring the next step-change that is required to set Namibia on the path of sustainable energy future.

Top critical uncertainties in Namibia include electric storage, exchange rates, energy affordability and again commodity prices.

### Electric storage

Namibia has put in place plans to make use of readily available resources, such as Concentrated Solar Power and Biomass and wind power resources in Namibia, which is known to have capacity factors

of about 49%. The increased utilisation of these resources will be vital in the efforts to address the uncertainty around Namibia meeting its base load requirements. It is expected that the solar PV power will be dispatched given the favourable climate.

All efforts to ensure security of supply, electrification, improve access and address the issue of affordability are meant to compliment the initiatives as articulated in the Governments plan for the energy sector. Presently, the Ministry of Mines and Energy is guiding the development of three important national policies, which will, amongst others, complement government efforts towards industrialisation and sustained growth.

Policies under development are: the policy for Independent Power Producers, or 'IPP Policy'; the 'Renewable Energy Policy'; and the Review and Update of the 'National Energy Policy'.

In addition to the above mentioned policies, the Ministry is in the process of finalising the update of a National Integrated Resource Plan (NIRP).

**Affordability** has featured as a critical uncertainty for the past 5 years of Namibia's mapping of the issues monitor index. Namibia's real GDP is currently forecast to grow at a rate of 4.3% up until 2025, although income inequality levels are amongst those ranked highest in the world. This implies that, although economic growth is healthy, the average consumer's ability to pay will not increase by the same margin until income equality improves.

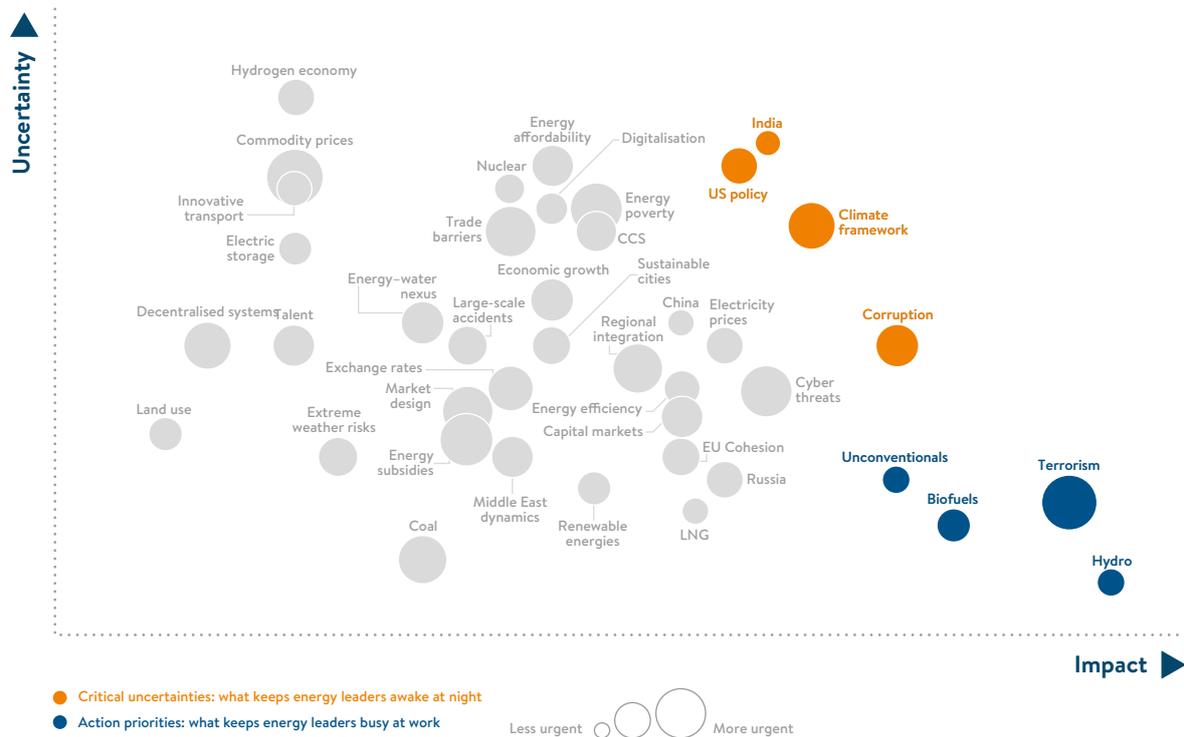
To ease the constraints of high electricity prices, the national electricity regulator has established a National Electricity Support Mechanism, a project that aims to address the issue of affordability of electricity to low consuming households. It intends to make electricity affordable through a subsidised tariff to household consumers on connection capacity below 15 Amps.

Namibia remains an energy dependant country, importing 100% of its fossil fuel requirements and an average of 58% of its electricity requirements. During this period, the average tariff of imports was higher than the Namibian local bulk generation tariff. This implies that the generation tariff is substantially determined by imports which the industry has little influence over, which negatively impacts all attempts to address electricity affordability. It is worth mentioning that the Government of the Republic of Namibia is constructing a bulk fuel storage facility in Walvis Bay, with a capacity of 75 million in total, for the storage of petroleum products such as diesel, High Furnace Oil (HFO) and Jet Fuel, which will be operated by state oil company, NAMCOR.

**Commodity prices** – Expansion plans and new developments are largely dependent upon prices for commodities, its volatility has a detrimental impact on the local economy and government budget, which explains the high uncertainty and impact associated with the issues.

**Regional interconnection** – The Government should also play a sustainable role in negotiating power purchase agreements with countries within the region or within the SAPP. Regional cooperation is required as the generation capacity of even a small nuclear power plant may exceed Namibia's ability to absorb the full generation capacity.

## NIGERIA



Critical uncertainties for energy leaders in Nigeria include corruption, US policy, the global climate framework and India’s economic growth. With regards to action priorities, terrorism, biofuel, hydro-power and unconventionals are keeping energy leaders in Nigeria busy at work.

Nigeria has significant **hydropower** potential, most of which still remains untapped and its further development is part of Nigeria’s Renewable Energy Master Plan (REMP). One planned development, the 700 MW Zungaru Project, once finished, will become the country’s largest hydroelectric power plant. Building works started in 2013 but legal challenges have been slowing its progress for a number of years, which may be contributing towards the uncertainty associated with this issue.

**US policy** is an issue that is continuously perceived with a high impact in the country. While it was an action priority for Nigeria in 2016, the issue is moving towards being a critical uncertainty in the country in 2017. The uncertain position associated with this issue could be related to the uncertainties in the relationship between the USA’s President Trump and Nigeria’s President Buhari, given the recent elections in both countries. Hopes are that the relations between the US and Nigeria can be improved under the tenure of the new presidents.

President Buhari has also received a reputation on cracking down on **corruption**, another critical uncertainty in the country. A number of high powered individuals are currently being prosecuted and it is expected that the issue will consequently lose importance and become an increasingly weak signal in the coming years.

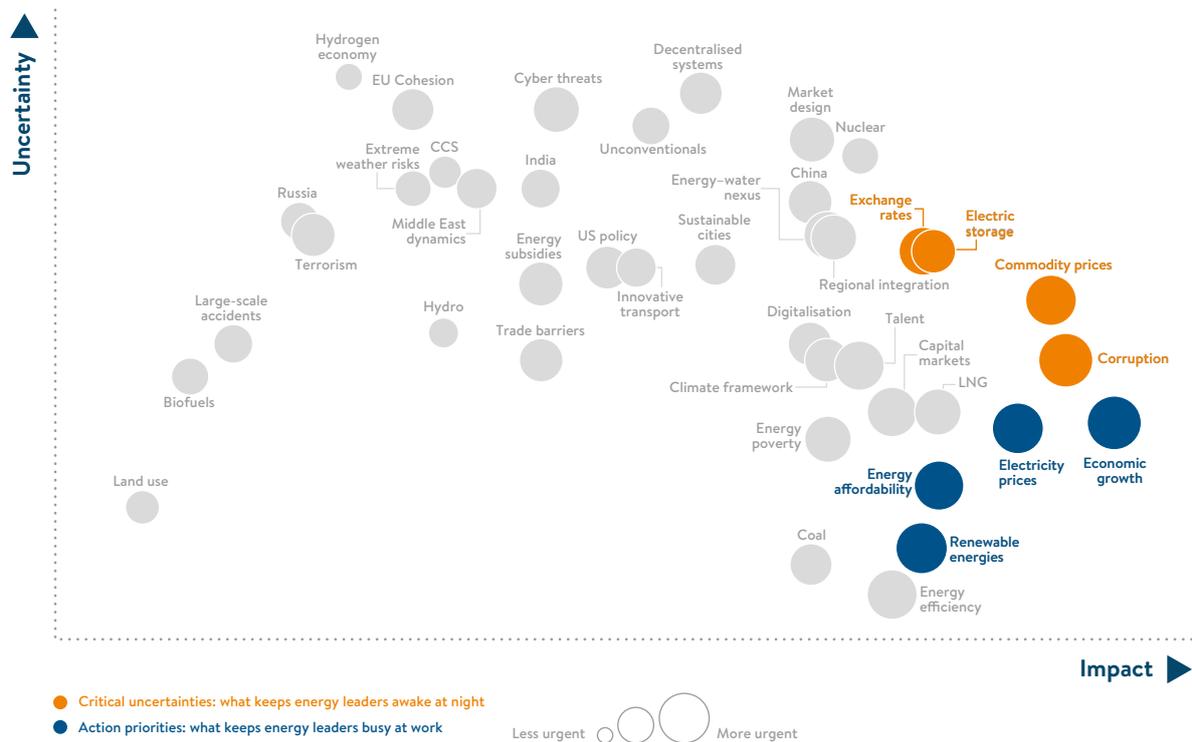
While **trade barriers** are associated with a relatively high level of uncertainty, it is interesting to note that the issue of **exchange rates** is positioned in a relatively central location in the Nigerian Issues Map. However, the Naira has been on a downward trend, with foreign reserves down by more than 30% by the end of 2015 compared to January 2014. The continued low oil price environment is thereby posing a challenge to the country with approximately 90% of foreign exchange income being linked to oil revenues.

**Renewable energy** is assigned a relatively high level of impact by Nigerian energy leaders as it is seen as a solution to tackle the power crisis in a sustainable manner. The country has significant renewable energy potential with solar PV topping the list with an estimated potential of 325 TWh if merely 1% of the available land were utilised. To put this into perspective – the current electricity generation of the country as a whole amounted to 3,500 MW with an electrification rate of 55.6% in 2012. The government has already introduced a number of measures to further promote the deployment of renewable energy sources. The Electricity Regulatory Commission of Nigeria has, for example, introduced feed-in-tariffs in 2012 to promote renewable energy deployment (small / large scale hydro, wind, solar and biomass), with the largest tariffs being allocated to solar projects.

The global **Climate framework** is another critical uncertainty that keeps energy leaders busy at work in Nigeria. The northern part of Nigeria has been affected by desertification partly driven by increasing rates of deforestation. At the same time other parts of the country have been affected by flooding exacerbated by El Niño, which highlights the vulnerability of the country to changes in weather patterns.

Over the past year, **terrorism** has developed to be an action priority with a high impact in the country, having moved from a neutral position in the centre of the Issues Map to the bottom right in 2016. The main drivers behind the perceived impact of the terrorism issue are the activities of the Boko Haram militants, which have staged a number of attacks, mainly in the northern part of the country.

## SOUTH AFRICA



During 2016 South Africans have been concerned about low economic growth, increasing evidence of corrupt practice in government and inexplicable political decisions, all of which have put the country at risk of further downgrading by the ratings agencies. However, power supply was much more stable due to the lack of economic growth (resulting in lower demand), improved performance on the generation plant and connection to the national grid of the first PV and wind projects initiated in the acclaimed Renewable Energy Project Procurement Programme.

South Africa’s priorities differ from the global ones and reflect its national imperatives as a developing country with a growing population and struggling economic growth. At the same time, South Africa’s priorities also differ from the African aggregate due to its position as one of the most developed countries on the continent now focusing on boosting its lagging economic growth whereas many other African countries are experiencing positive growth and development, albeit from a lower base, and have a more expansive focus.

The top three Critical Uncertainties are: **Commodity Prices, Electric Storage and Exchange rates.**

Given the strong linkage of the South African economy to commodity prices, it is understandable that commodity prices, already identified as a critical uncertainty in last year’s issues monitor, top the list.

High energy prices (electricity and oil products) are incentives for consumers to become increasingly independent. A cost-effective solution to **electric storage** would be a game changer for the use

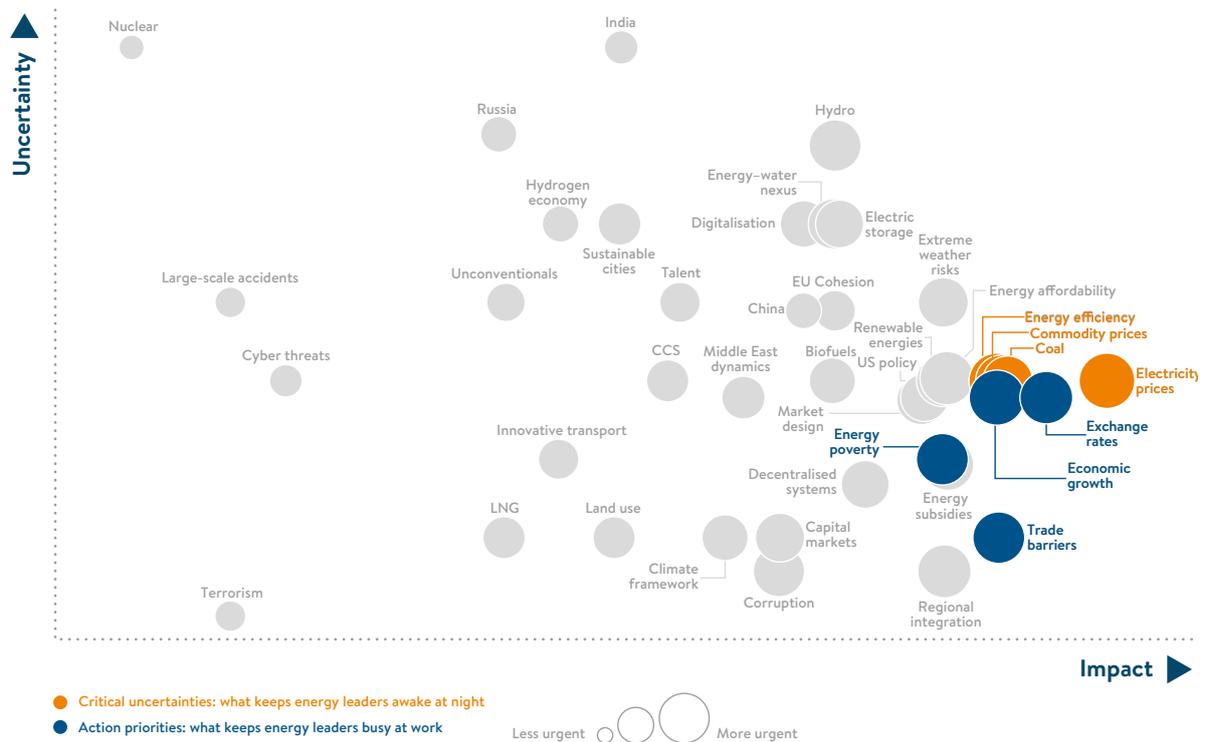
of wind and solar power and the viability of e-vehicles. The South African **exchange rate** has fluctuated considerably, driven both by domestic and international events such as the UK's 'Brexit' vote and the US elections. This has a big impact on imported goods, especially crude oil and imported refined fuel.

Given these uncertainties, it is not surprising to see **Economic Growth** head the list of Action Priorities followed by **Corruption** and **Electricity Prices**.

In 2016, South Africa will achieve less than 1% growth in GDP, a very low figure for a Developing Country. As a result, unemployment has increased, service delivery is lagging and the social climate is unhappy. At the same time, **corruption** continues to be a concern in the country and the need to act to eradicate the problem is becoming more urgent. Although less than in 2015, the **Electricity Price** increased by 7.6% in 2016, which was above inflation and drives this item to the third level of priority for action.

Other notable developments included the fact that interestingly the **Energy Water Nexus** dropped in priority even though the drought intensified from 2015 to 2016. Further, the issue of **Capital Markets** shifted from a Critical Uncertainty to an Action Priority, signalling a need to mitigate the threat of a ratings downgrade.

## SWAZILAND



The past year in Swaziland has seen drought being declared as a national disaster, owing mainly to a shortage of rain as an after effect of climate change. This has grossly affected our agricultural sector as well as our energy sector. As a country that has more than 70% of its local power generation coming from Hydro, the drought has resulted in a total shutdown of all its hydropower plants inducing a more than 90% reliance on imported power. Thus the issue of **Hydropower** is reflected as one with critical uncertainties on the issues map.

Amongst the top critical uncertainty issues, as highlighted in the issues map, with the Energy leaders in Swaziland are Electricity prices, Commodity Prices, Energy Efficiency and coal. Energy Access, Trade Barriers, Exchange rates and Economic growth are the action priorities that keep Swaziland’s energy leaders awake.

Swaziland imports all its petroleum products and about 75% of its electrical energy requirements. The bulk of its power supply comes from the neighbouring countries. High dependency on power imports contributes significantly to the country’s current account deficit and increases the country’s risks on supply security and **electricity price** shocks. Similarly, the 100% reliance on petroleum imports exposes the country to supply risks and **commodity price** fluctuations. These issues were exacerbated in 2013–15, when there was an energy crisis in South Africa.

The Country is well-endowed with conventional and renewable energy resources, including coal, solar, hydro, wind and biomass residues from the sugar and forestry industries and could meet the entire national energy demand if fully exploited, as well as exporting excess to neighbouring

countries. One of the main challenges for the country has been attracting investment in power generation. Combating climate change has also limited the country in the use of some of its available energy resources such as **coal** in power generation, which may be contributing to the uncertainty around coal.

In the recently launched Intended Nationally Determined Contribution (INDC) to climate change, Swaziland has committed to implement small scale, decentralised **renewable energy** technologies to improve energy access in line with Swaziland's Vision "to ensure **access to energy** to all by 2022". Currently the national access to electricity is 69% (81% urban and 56% rural) and is set to increase to more than 75% by the end of 2017. Thus energy access is top on the action priorities for Swaziland.

**Economic growth** is one of the action priorities for Swaziland. The GDP currently stands at 4.21 billion USD with a projected annual growth of about 1.7%. Unlocking **trade barriers** is an action priority for the country to attract investment in the Energy Sector, thus growing the economy. Swaziland's currency is pegged to the South African Rand, exposing the country to exchange rate risks associated with the South African economy. The **exchange rate** factor also plays a key role in the uncertainty associated with prices of petroleum products. Swaziland, as a country, therefore has less effect and control on its currency rate. It is therefore interesting that it is perceived as an action priority.

# Chapter three

## Assessing the energy agenda for Asia

ASIA

China

Japan

New Zealand

South Korea



expanding and Asian leaders are having to cope with this fast growth of renewables but struggling for the accompanying challenges, such as complicating power grid operation and raising electricity prices due to FIT, etc. This links to the high impact positioning of Energy Efficiency, which is also perceived by leaders in the region as a key avenue to reduce GHG emissions. In Asia, there is a continued high interest in Coal, on the other hand nuclear and hydro, both of which are advantageous in terms of CO<sub>2</sub> emissions, are moving relatively downward on the Asian energy agenda due to the requirements of huge investment, longer construction periods, and environmental concerns.

The most prominent single issue for leaders in Asia is China. Uncertainty of Commodity Prices in Asia is continuing and it grows rather higher than the global average. Looking at the specific fuels, Asian interest in Coal is greater than the world and it is because a number of countries in the region are ranked at the top of the world production and consumption of this conventional fuel. In addition, Asian energy systems are still vulnerable from natural disasters so awareness for extreme weather risks is on the rise, as well as Cyber Threats gaining attention.

The Asian energy landscape is changing and becoming more complex. But thinking about the steady prospect of growing energy demand and GHGs emissions, this region needs comprehensive cooperation and consistent collaboration towards sustainable future for energy. For energy leaders in this region the role of China takes the highest priority; however, signs of looking towards the future are already apparent through aspects including renewables, digitalisation and electric storage.



globally.<sup>77</sup> Regarding future investment in further renewables capacity, China claims the top spot in the 2015 Climatescope project, which ranks 55 emerging economies according to their ability to attract investment in clean energy,<sup>78</sup> and places second globally after the US in Ernst and Young's 2016 Renewable Energy Country Attractiveness Index.<sup>79</sup> However, the high level of uncertainty assigned by energy leaders to this action priority is associated with the fact that rapid renewables capacity expansion entails the challenge of its efficient integration into the existing infrastructure and a national energy mix that is still heavily dependent on coal, the latter still accounting for 66% of total energy consumption in 2014.<sup>80</sup>

This explains the continued relevance of **energy storage solutions**. Efficient storage technologies have the potential to help the integration of new intermittent generating solutions.<sup>81</sup> Indeed, the 13th Five-Year Plan calls for breakthroughs in storage technology and the China Energy Storage Alliance (CNESA) recently projected that storage capacity in the country would reach 14.5 GW by 2020 (excluding pumped hydro), even under a business-as-usual scenario.<sup>82</sup> However, the high level of uncertainty surrounding this issue stems from the lack of a coherent government support policy of storage technology that fleshes out the tenets of the Five-Year Plan.<sup>83</sup> In fact, the design of a comprehensive energy storage policy framework is a problem that many countries that are looking to storage as a solution for variable renewables integration, such as the United Kingdom, are currently facing.<sup>84</sup> A key reason for this is that the rapid speed of innovation in the sector, while it could significantly enhance the commercial viability of both utility-scale and residential storage solutions in the future, also complicates the drafting of forward-looking energy storage regulations.

Emission reduction and energy efficiency targets, as well as the need for renewables integration, also drive the search for more easily dispatched and less carbon-intensive thermal generating solutions. This explains why **unconventionals** are another critical uncertainty in China in the 2017 issues monitor. Having the world's largest technically recoverable resources of shale gas according to the EIA,<sup>85</sup> and being one of the few countries able to produce shale gas on a commercial scale,<sup>86</sup> China is still having problems tapping its vast resources, mainly due to geological difficulties, which have caused

77. REN 21, 2016, Renewables 2016 Global Status Report, p. 63

78. Climatescope 2015 ([global-climatescope.org/en/](http://global-climatescope.org/en/))

79. Ernst and Young, 2016, Renewable Energy Country Attractiveness Index ([www.ey.com/Publication/vwLUAssets/EY-RECAI-48-October-2016/\\$FILE/EY-RECAI-48-October-2016.pdf](http://www.ey.com/Publication/vwLUAssets/EY-RECAI-48-October-2016/$FILE/EY-RECAI-48-October-2016.pdf))

80. National Bureau of Statistics of China, 2015, 2015 China Statistical Yearbook, 9–2 ([www.stats.gov.cn/tjsj/ndsj/2015/indexeh.htm](http://www.stats.gov.cn/tjsj/ndsj/2015/indexeh.htm))

81. See World Energy Council, 2016, World Energy Resources, Chapter 13: E-Storage

82. Cina Energy Storage Alliance, "Energy Storage China 2016 Review – China's Energy Storage Market to Reach 64.2 GW by 2020" (16 June 2016) (<http://en.cnesa.org/featured-stories/2016/6/8/energy-storage-china-conference-2016-review-chinas-energy-storage-market-to-reach-642-gw-by-2020>)

83. Reuters, "China to Boost Energy Storage to Cut Power Waste: Industry" (Reuters, 18 May 2016) (<http://uk.reuters.com/article/china-power-idUKL3N1873CH>)

84. On the UK, see Bird & Bird, 2016, "The role of Energy Storage in the UK Electricity System" (<http://www.twobirds.com/~media/pdfs/news/bird--bird--the-role-of-energy-storage-in-the-uk-electricity-system.pdf?la=en>)

85. EIA, 2015, "Technically Recoverable Shale Oil and Shale Gas Resources: China" ([www.eia.gov/analysis/studies/worldshalegas/pdf/China\\_2013.pdf](http://www.eia.gov/analysis/studies/worldshalegas/pdf/China_2013.pdf))

86. EIA, 2015, "Shale Gas and Tight Oil Are Commercially Produced in Just Four Countries" (13 February 2015) ([www.eia.gov/todayinenergy/detail.php?id=19991](http://www.eia.gov/todayinenergy/detail.php?id=19991))

investors in the country's shale gas sector, such as Shell and ConocoPhillips, to cease their recovery efforts. Looking ahead, the recent conclusion of shale gas production sharing contracts between BP and the China National Petroleum Corporation (CNPC),<sup>87</sup> as well as possible future advances in shale gas production technologies which could make them better suited to the Chinese geology, could decrease the uncertainty assigned to this issue in future reports.

The 2017 issues monitor also reflects concerns surrounding the uncertainties resulting from shifts in the domestic and global economy. **Economic growth**, which, according to the IMF and the World Bank is projected to further slowdown in coming years,<sup>88</sup> has caused concerns to many investors, and is thus identified as a critical uncertainty by Chinese energy leaders. This, in turn, explains the identification of domestic policy and innovation in **China** as an urgent action priority, as the government's efforts to transition the country towards a more service-intensive, market-driven economy, must be very delicately implemented so as not to cause long-term damage.

This latter development has also seen the efforts by the government to increasingly marketise the electricity sector, chiefly by decoupling transmission and distribution from generation to create better integration and foster competition,<sup>89</sup> resulting in **electricity prices** being seen as an action priority with high uncertainty. Seeing through the electricity market reform in a careful and coordinated manner is thus a key priority in China. These developments occur at a time where global concerns about **commodity price** volatility, the overarching theme of the 2016 report, are even higher than they were in 2016.<sup>90</sup>

Another noteworthy trend visible in China is increasing concerns about energy security. Compared to last year, security issues surrounding the energy sector such as **terrorism**, **extreme weather** and **cyber-attacks** all have seen an increase in both impact and uncertainty,<sup>91</sup> while the development of **decentralised systems**, including decentralised generation and demand response mechanisms, has increased in the potential impact assigned to it by Chinese energy leaders. Decentralised systems, seen as a key component of realising the 2016 World Energy Scenario's Modern Jazz projection,<sup>92</sup> have the potential to improve the resilience of the energy system to emerging security threats, while at the same time encouraging the further uptake of renewable energies and diversification of the energy mix.

In summary, this year's issues monitor indicates that China has moved from making plans for its energy future towards engaging in more depth with the details of facilitating the realisation of

87. BP, "BP Signs Second Chinese Shale Gas Contract with CNPC" (01 September 2016) (<http://www.bp.com/en/global/corporate/press/press-releases/bp-signs-second-chinese-shale-gas-contract-with-cnpc.html>)

88. World Bank, 2016, Global Economic Prospects, (<http://www.worldbank.org/en/publication/global-economic-prospects#-data>); IMF, 2016, World Economic Outlook ([www.imf.org/external/datamapper/index.php](http://www.imf.org/external/datamapper/index.php))

89. Regulatory Assistance Project, 2016, "China Power Sector Reform: Key Issues for the World's Largest Power Sector" (<http://www.raponline.org/knowledge-center/china-power-sector-reform-key-issues-worlds-largest-power-sector/>); Xinhua, 'China to Promote Electricity Pricing Reform Nationwide' (29 March 2016)

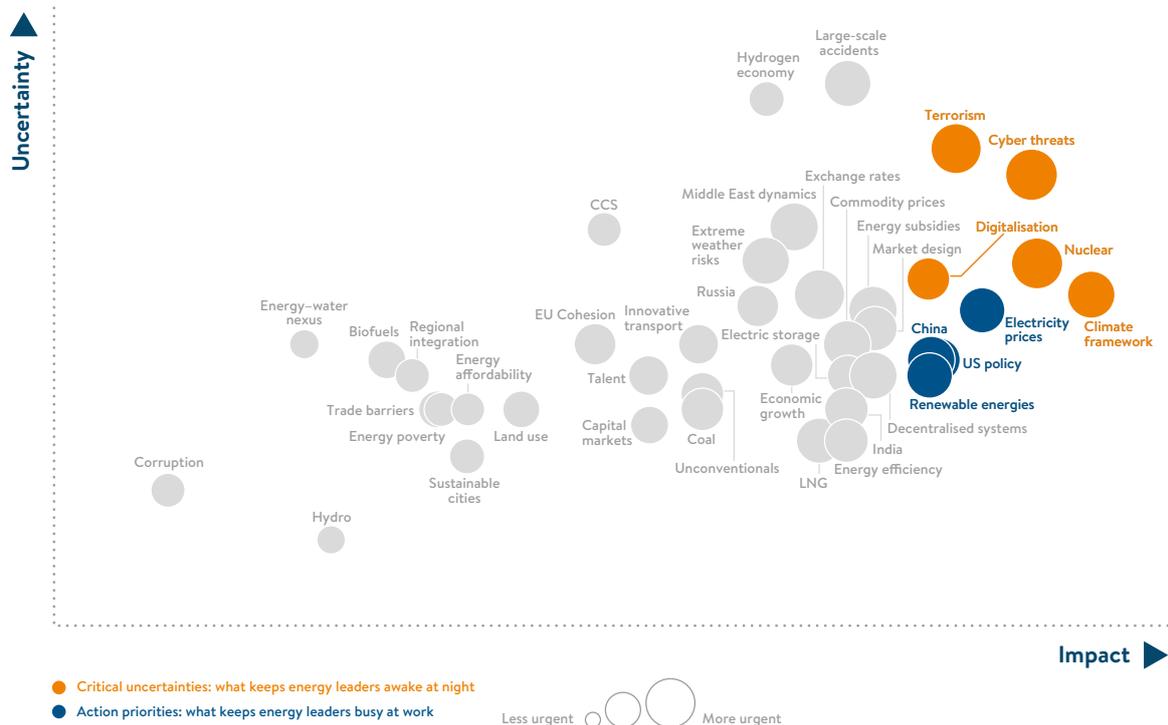
90. World Energy Council, 2016, World Energy Issues Monitor: A climate of Innovation – Responding to the Commodity Price Storm, pp. 13–14

91. In emerging risks in the energy sector, see for example World Energy Council 2016, World Energy Perspectives, the Road to Resilience: Financing Resilient Energy Infrastructure.

92. World Energy Council, 2016, World Energy Scenarios: the Grand Transition, especially pp. 46–47

these plans in a sustainable fashion given the continuously changing circumstances of the global and domestic economy. Technological advances in energy storage and shale gas recovery, as well the way in which the government engages with the economic transition, will be the key factors in shaping future issues monitors.

## JAPAN



The current context for Japan is strongly influenced by the Strategic Energy Plan formulated in April 2014, and the Long-term Energy Supply and Demand Outlook was approved in July 2015. Though this Outlook shows that nuclear power will provide approximately 20 to 22% of the electric power supply in 2030, it is still uncertain as to whether the target value can be achieved. This is because there are uncertainties not only in constructing additional nuclear power plants and replacing the existing plants but also extending the operation period of aged plants from 40 years to 60 years.

On the other hand, renewable energy, with a target of 22–24%, has been increasing very steadily. Since the restart of the Sendai No. 1 reactor in August 2015, five reactors have also restarted, but two of them are shut down by the provisional disposition of inoperative injunction. As a result, only three reactors are in operation at present. The safety review of the Nuclear Regulatory Commission takes time and the restarting is also dependent on the judgements of courts and local governments. So it cannot be said that the restart of the plants is going smoothly.

In spite of the fact that Japan’s present energy self-sufficiency rate is extremely low at about 6%, there is also strong public opinion that makes it unnecessary to restart nuclear reactors, as the total energy consumption is decreasing.

Other important factors contributing to the overview for leaders in Japan include that the electricity retail market was fully liberalised in April 2016 and the full liberalisation of the gas retail market will follow in April 2017.

The rise of the consumption tax, which is also imposed on energy, from 8% to 10%, was postponed

from April 2017 to October 2019, because the Abe administration considered that the present economy has not yet recovered enough. Though this negative effect to the Japanese economy will be avoided for a while, ‘the growth strategy’, which is the third arrow of Prime Minister Abe’s three fundamental policies, ‘Abenomics’, is assumed to not yet be on track.

The main critical uncertainties for energy leaders in Japan are terrorism, cyber threats, nuclear, climate framework, and digitalisation. Terrorism and cyber threats reflect the anxiety in the society, caused by the frequent occurrence of terrorist incidents not only in the Middle East conflict areas but also in developed countries. Additionally, in the present digital information society, the possibility of cyber-attacks is growing. Furthermore, because of Tokyo Olympic Games to be held in 2020, awareness about resilience of social infrastructure is also increasing.

At the time this survey was carried out, it was subtle whether domestic ratification of the Paris Agreement was in time for the entry into effect of the agreement or not, and in advance to COP22, the climate change was a matter of great concern. There were two important strategies formulated in April 2016, “Innovative Energy Strategy” targeting 2030, and “Innovative Strategy for Energy and the Environment” aiming at the subsequent period to 2050. In accordance with the two strategies, to realise NDC in Japan, it is necessary to aim for a multi-faceted realisation of technological innovation in various fields such as electric power, industry, and consumer use in the future.

Digitalisation also makes leaders uncertain. Because of the liberalisation of the electricity market based on the electricity system reform, it is impossible to continue utilising the conventional centralised control of a demand and supply system. Furthermore, the penetration of large amounts of renewable energy into the grid causes an increasingly unstable grid operation. To solve this problem, the realisation of smart grids by the use of the ‘internet of things’ (IOT) and artificial intelligence (AI) will be required, where an increase in the electrification rate is expected to continue in the future.

US policy and China are positioned as urgent need for action issues. This is because this survey was carried out at the time just before the US presidential election; there were concerns about a period where the current US government cannot set new policies with the new government for 2017. Also, for the United States, as the largest allied nation, to maintain and to develop a politically and economically close relationship is both expected and desired. As for China, it has grown into one of the world’s leading energy consuming countries, and its trends have a great impact on energy issues, including market prices.

In addition, renewable energies and electricity prices also belong to the same category. Regarding the current FIT that brought the bias to industrial photovoltaic power generation, so called Mega Solar, although the review in April 2017 was decided, the level of Japanese FIT will be still almost twice as high as that of the other developed countries. Therefore, the sense of burden on electricity charges due to the FIT surcharge is increasing among the households and industries.

Furthermore, an adverse effect on the grid system due to rapid increase of solar power and wind power is also growing. Meanwhile, further installation of renewables is expected to continue in the future, so it is required to reduce the necessary costs to enhance the grid including batteries by

introducing technological innovation and in addition to realise the fairness of the cost burden that the grid system expenses seeking responsibility for the negative effect it brings.

In comparison with the rest of World Map, what is unique in the findings for Japan is that large scale accidents and nuclear are the top priority need for action issues, as The Great East Japan Earthquake occurred in 2011 and most of nuclear power plants are still not operating in Japan. In addition, because of terrorist incidents involving Japanese victims, concerns about terrorism and cyber threats are increasing. On the other hand, interest in commodity prices is not high, reflecting low prices of imported primary energy sources and a low inflation rate. As Japan is an island country, generally, the needs of regional integration are not high, although pipeline connection plans with Russia and the Far East super-grid concept are proposed.

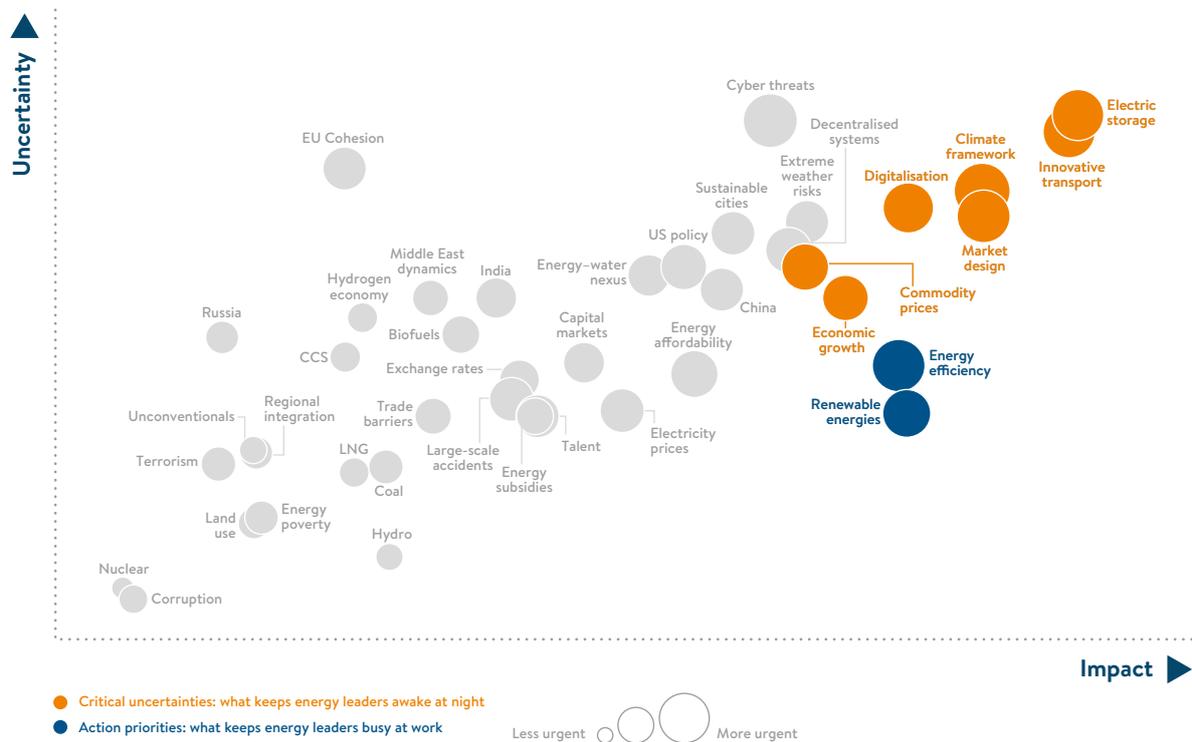
When comparing with last year's results, hydrogen economy, decentralised systems, innovative transport and energy subsidies have an increased weight and to the contrary, Russia, energy affordability, large scale accidents and regional integration moved down on the agenda.

Hydrogen economy is one of the topics of the “Energy Innovative Strategy” and research projects on the production, distribution and utilisation of hydrogen are progressing to build a hydrogen supply chain. From the point of liberalisation, renewable energy dissemination and disaster prevention, the establishment of onsite power generation facilities in various places is progressing gradually. In terms of innovative transport; the development of electric, natural gas, hydrogen vehicles and vessels utilising natural gas, that are not dependent on oil, is proceeding. The surcharge imposed by FIT is rising at a rate higher than expected (2016-unit price: 2.25 yen / kWh), and the burden on households and industries is increasing, hence the strong priority indicated in the findings around energy subsidies.

Since the ceasefire on the Crimean Peninsula was agreed and the tense situation has settled down a little, there are signs of progress in economic cooperation between Japan and Russia. Following the Japan-Russia summit meeting in Sochi in May 2016, the President Putin visited Japan in December and the Japan-Russia Summit Meeting was held. Now expectations for the progress of bilateral relations in politics and economics are increasing. Due to the continuing low prices of imported oil and LNG, domestic energy prices are considerably low, so the interest in energy affordability is not high. Meanwhile, more than five years have passed since the Great East Japan Earthquake and measures against the damage were almost done. However, due to the Kumamoto earthquake in April 2016, the anxiety about the occurrence of the next major disaster is not low.

In addition to natural disasters, increasing terrorism and cyber terrorism are key risk factors, but efforts to widen the usage of energy conservation, renewable energy and new energy are progressing. On the other hand, the public interest in the importance of energy, including nuclear energy, is extremely weak and it is important to evoke interest in energy issues on a national scale. Technological innovation through public and private initiatives that involve energy conservation, renewable energy and new energy utilising digitalisation is essential for achieving both “the growth strategy” and Japan's response to the national trilemma problem of balancing the needs around energy security, economic efficiency and the environment and safety. Promotion of energy conservation by improving energy efficiency in terms of energy utilisation, especially that of heat pumps, is at the core of those efforts.

## NEW ZEALAND



New Zealand energy executives continue to be exercised by uncertainty and the opportunities that might arise from it. This is reflected in the map as a seemingly growing gravitational pull of issues into the quadrant of critical uncertainties.

The reason for this seems to lie in the changes to New Zealand’s energy policy as a result of the ratification of the Paris Agreement. This has seen amongst other things the broadening focus of energy policy away from renewable electricity to include a proposed target for industrial emissions intensity, the review of the New Zealand Emission Trading Scheme (ETS), and the introduction of supporting actions to encourage the uptake of electric vehicles (EVs)

Having ‘banked’ our 90% renewable electricity target (New Zealand has already reached 80% and the current conversation is how to go beyond 90% in the coming years) the Government seems increasingly willing to send stronger signals to the energy sector about the desired direction of travel, consistent with the Paris Agreement and a move towards a lower carbon future. What is creating uncertainty for energy executives is the as yet unclear nature of the changes and how they will play out. Will the Government, for example, intervene more in the market or set market frameworks within which choices can be made by the sector participants as to the most appropriate option? Energy executives are wondering how far beyond a focus on efficiency will the Government move towards changing the economy’s structure. In the back of their minds is also the looming general election in 2017 with the possibility of a government that will place a higher priority on climate change action.

In light of this, the map signals that New Zealand energy executives are uncertain about climate framework and extreme weather risks. Balancing these are the critical uncertainties of electric storage, innovative transport and market design. Transport is the second largest consumer of energy (with 99% of its fuel sourced from oil) and accounts for around 17% of New Zealand's greenhouse gas emissions. While the Government, with the support of business, has introduced a modest package of measures to encourage the uptake of EVs, it has aggressive EV-uptake targets. While hydrogen and biofuels seem to be off the table in the minds of energy executives they remain uncertain about how factors such as the speed of the reduction of technology costs, carbon price, oil price and consumer behaviour change will interact. Several energy companies have already recognised these challenges as opportunities to invest in new business models.

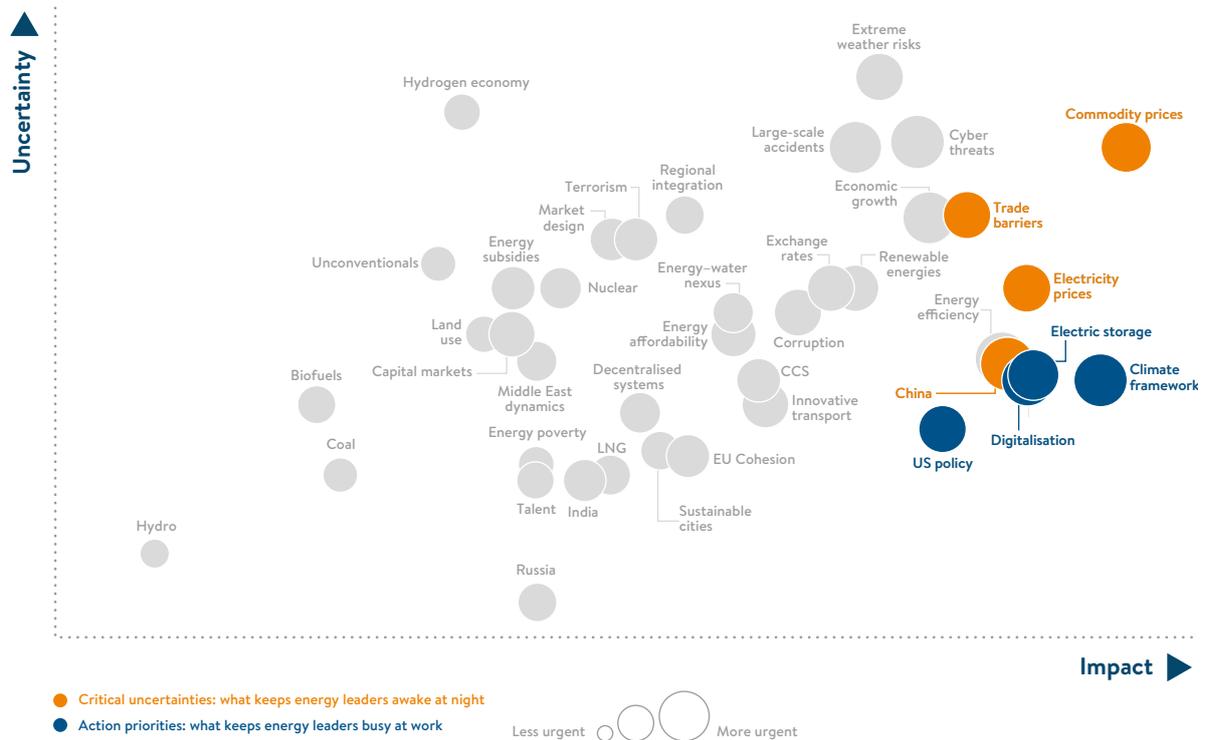
In the electricity system, energy executives seem less concerned with energy affordability and electricity prices, but continue to grapple with the challenges of decentralisation and smarter grid management as the number of 'prosumers' increases and home electric storage solutions become more widely available. The integration of smart technology and digitalisation continue to raise questions about how to protect sensitive data and minimise the potential of cyber threats.

In this context, the rise of sustainable cities should come as no surprise. Energy executives are clearly increasingly engaged in the wider social context of the energy system as the way urban infrastructure is shaped will not just determine how connected and liveable cities might be, but also how energy productive and environmental friendly they are.

Economic growth, an issue mapped for the first time, sits on the border of those issues which are critical uncertainties and action-oriented. As an export-oriented economy, highly dependent on global trade, this positioning seems to reflect some level of anxiety about global trade and domestic economic prospects in light of Brexit and the then looming US presidential election. This will be an issue to watch.

Finally, an interesting feature of this year's map is the rise in uncertainty in respect of what have previously been firm action priorities. While still keeping energy executives busy in the day-to-day, energy efficiency and renewable energies have become much more uncertain. This movement too would appear to be explained by the uncertainty surrounding what policy approaches the New Zealand government will actually take to successfully achieve its Paris Nationally Determined Contribution.

## SOUTH KOREA



In the Korean Issues Monitor map for 2017, extreme weather risk is identified as the most uncertain issue, reflecting the unprecedented heatwave during the summer in 2016. The high temperature has caused a spike in the demand for electricity. Consequently, the importance to prepare for extreme weather events is highlighted among energy leaders as a key issue to address for a stable and reliable energy supply.

The extreme hot weather and increasing power consumptions have additionally raised the concern about electricity prices and energy affordability. As a result, these two issues have moved significantly to the high impact, high uncertainty area compared to the country's previous Issues Map. The current progressive electricity billing system in Korea applies six different rates per unit based on the amount of usage of a household. Growing electricity demand, which due to the extreme weather calls for a revision of the billing system to assure energy affordability.

Another considerable change has occurred in with regards to the trade barriers issue, which is shown at the top right side of the chart. This result can be explained by two perspectives. Firstly, the implementation of trade barriers tends to take place more frequently in overseas trade markets due to the ongoing global recession. Korea has an export-oriented economic structure and is therefore vulnerable to foreign trade measures. Particularly in the case of the high energy-intensive industry, trade barriers may affect industrial consumption of energy significantly. In this respect, trade issues are recognised as an important trend.

To promote economic growth and improve the energy sector's sustainability, Korea has been promoting the development of the new energy industry and energy technologies. These include e.g., electric storage and renewable energies. It is therefore not surprising that these issues, combined with climate framework are increasing with regards to the perceived impact and need for action compared to last year's Issues Map. The country has announced a 36.6 billion-dollar investment strategy on new energy industries by 2020 in order to nurture a new export industry and tackle climate change. For example, approximately 26 billion dollars will be spent on the construction of renewable power plants, which will amount to nearly 13 million kilowatts. At the same time the renewable portfolio standard will be increased. At the same time, some incentives and deregulation will be implemented to reduce the uncertainties of business and to facilitate the private sector's investment. Additionally, the installation of energy storage systems will be incentivised to address the intermittency challenge that result from the increased uptake of renewables.

On the contrary, LNG, unconventional and coal face a significant drop in the perceived impact in this year's Issues Map. Continuing low oil price remaining around under 50 dollars per barrel since January 2015 has limited the attractiveness of shale gas development on the supply side. In addition, the potential of LNG and unconventional as alternative energy source has been weakened on the demand side. Despite these developments a series of measures to strengthening the role of natural gas in the long term are still retained. It may therefore be possible that LNG and unconventional may move to the top of energy leaders' agenda in the coming years.

Coal by contrast is increasingly becoming less significant in the Korean energy mix with the government's recent plan to phase out old coal-fired power plants and retrofitting newer ones. According to the plan, coal plants which have been operating for more than 30 years will be shut down and other plants under 20 years will be retrofitted with improved facilities. In addition, coal plants that are currently planned or under development may be subject to more stringent rules on greenhouse gas emissions.

# Chapter four

# Assessing the energy agenda for Europe

## EUROPE

Austria

Belgium

Estonia

Germany

Iceland

Italy

Latvia

Lithuania

Poland

Portugal

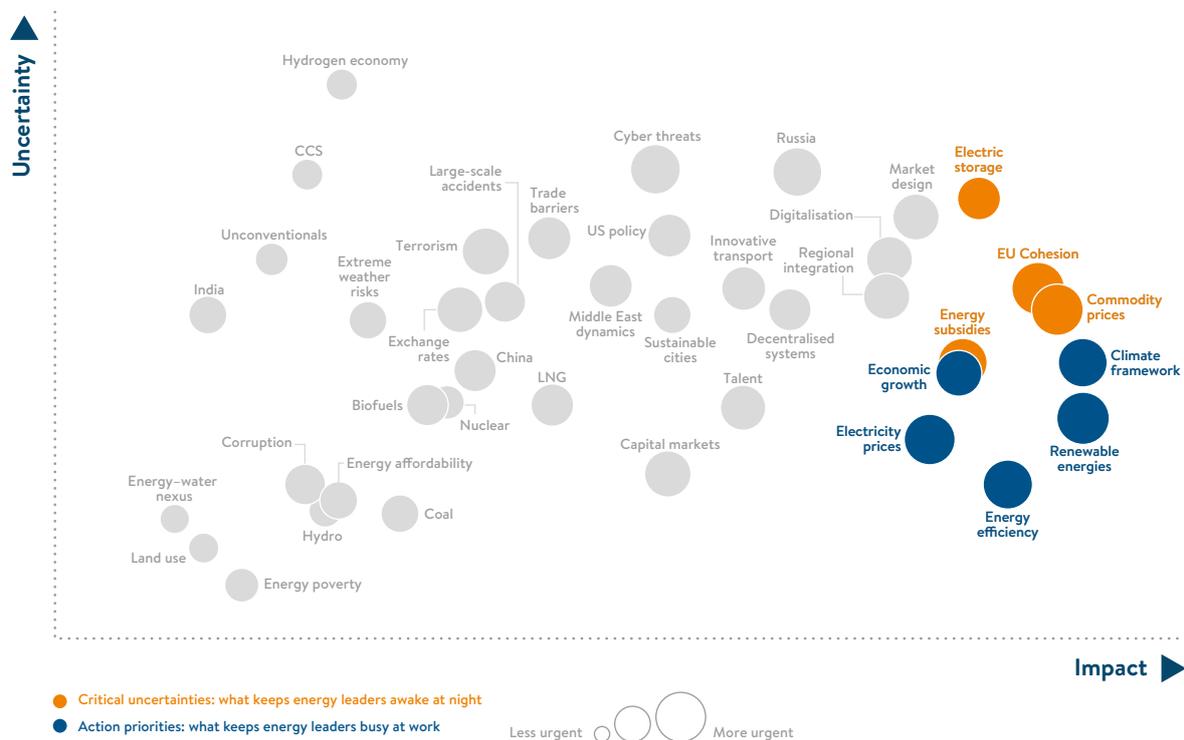
Serbia

Spain

Switzerland

United Kingdom

## EUROPE

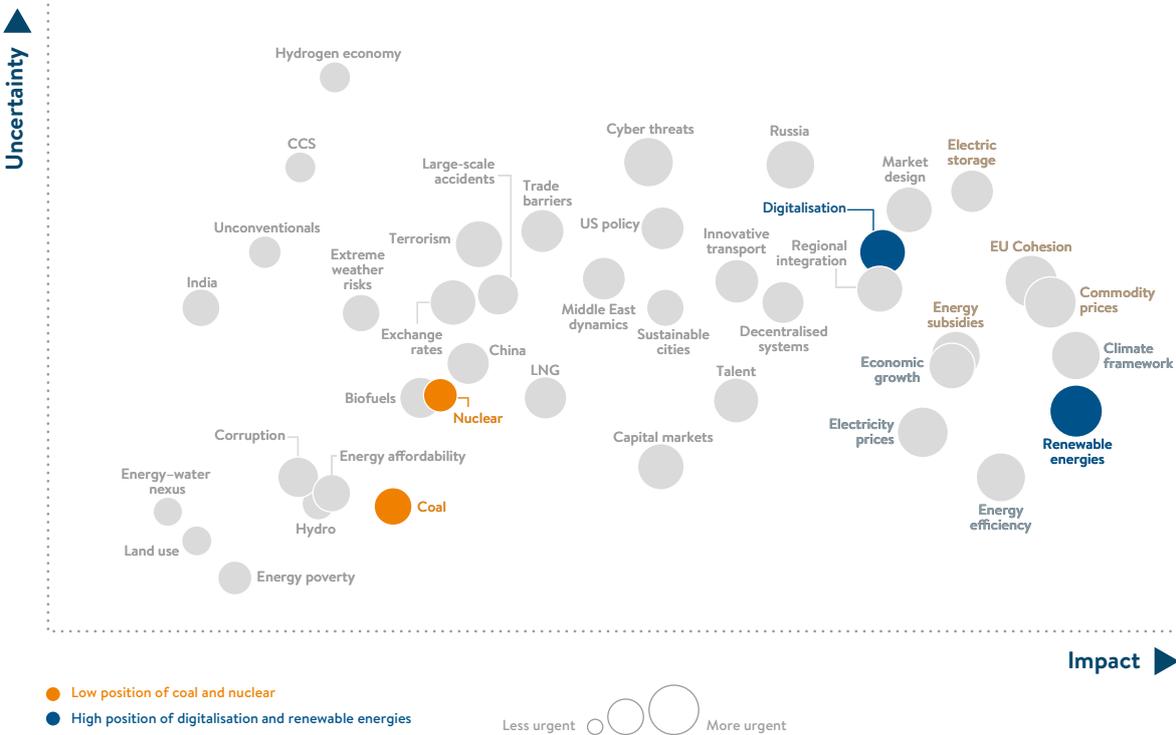


The European energy sector has witnessed a continuation of the main trends from previous years, but has also seen a significant change in the political context. The climate agenda is apparently still strong for energy leaders in Europe and stronger still in comparison to the worldwide view on the impact associated to the issue. An increase in the share of renewables in the electricity sector has put pressure on energy economics, indicating that we are already in the energy transition taking us to new technologies and business models. Overall, there are three areas where we have seen significant changes during the last year in Europe.

Firstly, the rise of concerns over increasing tensions in the EU is getting stronger and is experienced as a new challenge for the leadership within the energy sector. The decision of the UK voters on BREXIT is just one illustration of how much trust EU institutions and national governments have lost during recent years. The ongoing economic and financial crisis and the increasing pressure on bank balance sheets have led many Europeans to the impression that problems are not really solved. This is reflected in the Issue Monitor with clear rise of concerns over EU cohesion.

Secondly, general fuel mix decisions in Europe lead to some remarkable changes on energy sources. Whereas the climate issues and subsidies for renewables were the kick-starter for changes, now the development is as much driven by technological advances. Traditional centralised solutions with nuclear and coal are fading away in several European states as the renewable share increases, leading to a stronger focus on flexibility technologies and less on generation technologies. In this context the topics of innovation in electricity, heating/cooling and transport sectors, combined with smart systems, have moved clearly up in the regional agenda.

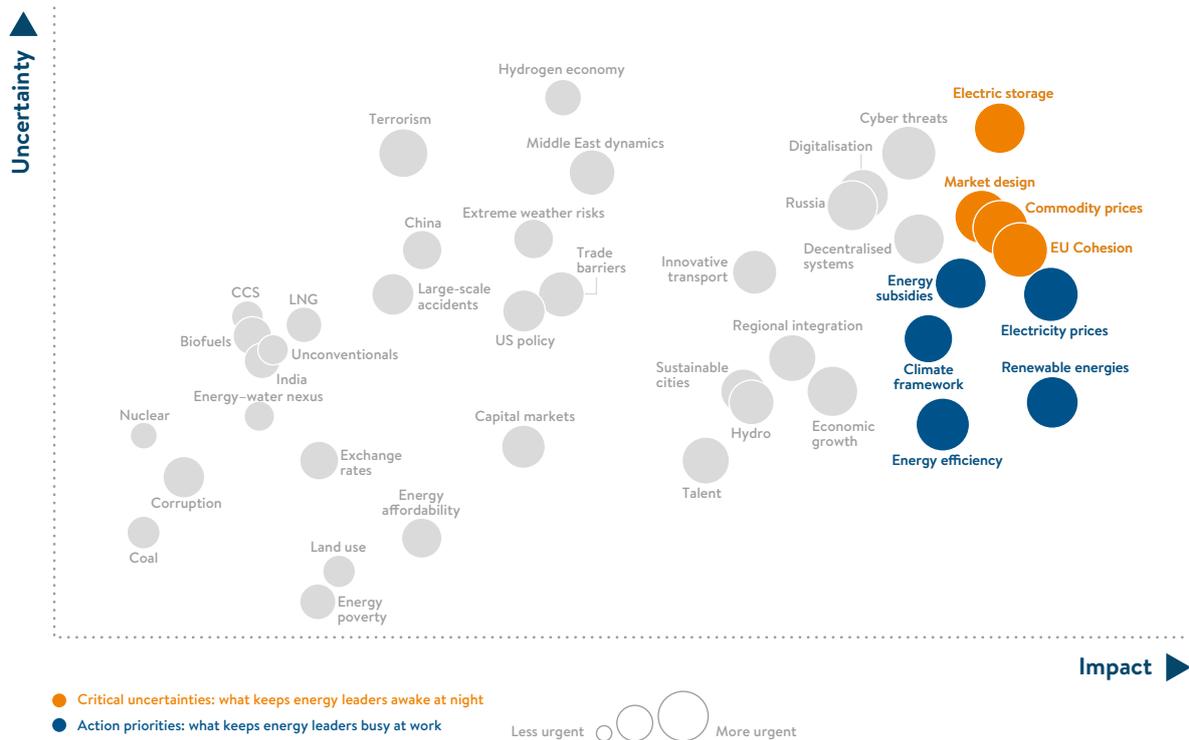
# EUROPE – ENERGY LEADERS HIGHLIGHT THE HIGH IMPACT OF RENEWABLES AND DIGITALISATION VS. COAL AND NUCLEAR



Thirdly, there is an increased concern over energy sector talent. The increasing interest for talent is not only driven by demography and that the staff of energy companies is aging: it also underlines that there are new challenges like the digital agenda (including cyber threats) that have to be addressed. This requires a more prominent focus in the energy sector to additional demand for certain skills of employees. Consequently, the search for talent is rising on the agenda in Europe with a higher perception towards the impact of the issue.

Overall, Europe already has a very well-advanced energy system thus change here happens more in terms of quality and less in terms of quantity. European Union states are working now on new energy sector regulations that have been presented by the European Commission. In particular, the regulations on market design are expected to address several concerns that are currently high on the agenda and this, combined with the above mentioned priorities, is anticipated to take a prominent role in determining the future direction of the regional energy agenda as we look to the year ahead.

## AUSTRIA



Total primary energy supply (TPES) in Austria was 1.4 EJ in 2015. Energy supply has been relatively stable in recent years, decreasing by a total of 2% since 2005.

The energy mix in Austria is dominated by fossil fuels, which account for 66% of TPES. Oil is the largest source of energy at 36% of TPES, followed by natural gas at 20% and coal at 10%. Renewable energy and waste account for 31% of TPES.

Over the past decade, the shift in energy sources has been noticeable, with the share of fossil fuels in the energy mix falling from 77% of TPES in 2005. This includes oil, gas and coal which have seen a decline in supply. The supply of renewable energy and waste increased by 40%, with biofuels doubling since 2005 and the supply of wind and PV increasing by four fold.

Around 40% of Austria's energy needs are produced locally and the country relies on energy imports in order to satisfy its energy demand.

Energy policy developments in Austria and targets for 2020 are compatible and in line with EU policy, including: an increase of the share of energy consumption produced from renewable resources to 34% by 2020; reducing greenhouse gas emissions by 16% from 2005 levels for sectors not included in the EU Emissions Trading Scheme (EU ETS) and 21% from 2005 levels for sectors included in EU-ETS; and a 20% improvement in energy efficiency till 2020.

In view of the climate change conference in Paris in December 2015 a debate on an integrated energy and climate strategy was launched in Austria. The 2030 goals are to be discussed, as well

as long-term prospects to 2050. With the so-called “Green Paper”, the Austrian government has launched an extensive consultation. A key point is that global warming is to be kept below two degrees and, if possible, at 1.5 degrees above pre-industrial levels. Another major aim is the mandatory shift towards an energy industry free of fossil fuels.

The new energy package revealed from the European Commission is also a time-bar for a new Austrian energy policy.

The energy policy discussion in Austria 2016 was characterised by:

- signing COP21
- a debate on an integrated energy and climate strategy
- the discussion on the separation of the German-Austrian electricity market
- a debate on whether subsidies for renewable energies should be phase out and to stop electricity market distortions

Compared to the global monitor, the problematic area of “electric storage” might have a higher significance in Austria due to the number of its storage power stations and its pumped storage (hydro) power stations, which makes Austria regard itself as some kind of “battery” for the CWE-region. On the one hand, those kinds of power stations are needed for a successful energy transition but on the other hand they are under considerable economic strain due to the present market distortions. The current discussion regarding the separation of the German-Austrian market area poses further threat potential.

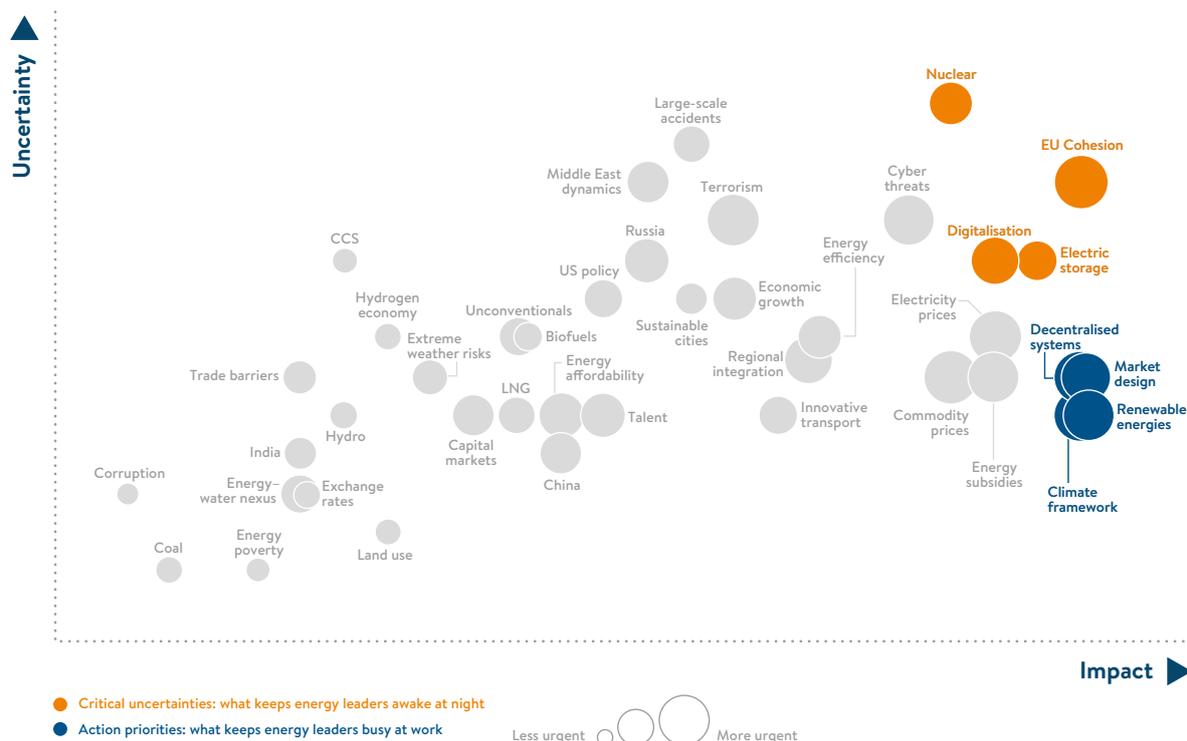
Besides that, Austrian future perspectives about its power industry are being discussed right now. The Austrian electricity sector struggles with unclear framework conditions concerning energy policies and climate policies, as well as low spreads and a lack of planning abilities concerning investments.

It is necessary to coordinate and harmonise the design of energy systems on the European scale. The CO<sub>2</sub>-market should be the guidance system to achieve the energy transition and it should support the development of renewable energies and manufacturing technologies, which are poor on CO<sub>2</sub>. Renewable energies should be integrated into the competitive markets as fast as possible. If certain technologies are ready for the market, subventions should be limited in time.

We see an overall agreement concerning issues like the ability to afford energy, further development of renewable energies also in connection with the future design of conveying systems as well as questions of energy efficiency. Uncertainties caused by Russia are specific for Europe/Austria and they can be explained by the dependence of Russian gas imports.

There is also a consensus concerning the need for consistent and coherent EU Energy Politics. In addition, problematic areas like renewable energies, energy efficiency, subventions for renewable energies and uncertainties caused by Russia are seen similarly. Compared to last year’s investigation, there’s much more emphasis on the necessity for a power market reform.

## BELGIUM



Much of the Belgian context is still dominated by European circumstances, although some particular Belgian issues are reflected by the issues map. At the time of the poll in the early fall of 2016, the European energy theatre was still dominated by low CO<sub>2</sub> prices in the Emission Trading Scheme (ETS), by the substantial presence of intermittent renewable sources in the electric system (although the growth rate has decreased over the last few years, because of reviewed and more stringent support schemes). Combined with electricity generation overcapacity in the Central-West region of Europe, electricity wholesale prices were still relatively low with the continuing difficulty for gas-fired generation to compete in the market (even though the natural gas prices during much of 2016 were lower than in 2015). During 2016, European oil prices were gradually increasing, with expected later increases in natural gas prices (which indeed happened towards the end of 2016). At the time of the poll, European energy market players and observers were in a “wait and see” mode awaiting the European Commission’s Energy Winter Package, with many new legislative and regulatory proposals. Much had been leaked before formal release, e.g., on the new energy market design, but it remained uncertain until the publication date of November 30, 2016.

As to natural gas, apart from price fluctuations, no concerns on the gas supply side exist. Although Belgium has no gas resources, supply diversity has always been the rule in Belgium. Its gas-contract portfolio is not very sensitive to external influences, at least not in the short run. However, with a currently scheduled nuclear phase out by 2025 and a mono-fuel electricity generation mix based on gas, it is important to remain vigilant for a balanced gas portfolio.

As to security of supply of electricity, 2016 was characterised by a “normal” availability of the nuclear generation park (after thorough safety studies cleared the hydrogen-flakes-affected units Doel3 and Tihange2 to come back online). The return of these units and the permission by the government for continued operation of the nuclear units Doel 1 and 2 together with a probabilistic adequacy assessment by the TSO have shown that no major security of supply issues are to be expected for the winter 2016–17.

The results of the Belgian issues map reflect more or less the above concerns.

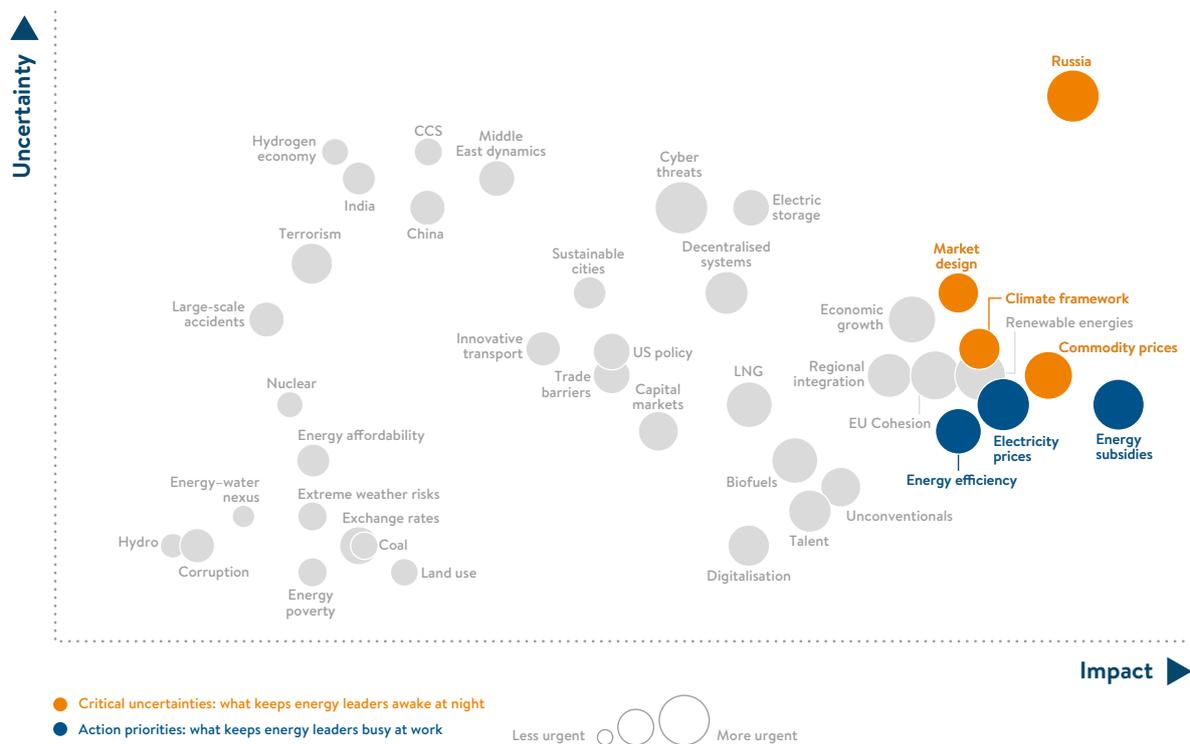
The critical uncertainties are the nuclear, EU cohesion, electrical storage, and digitalisation. ‘Electrical storage’ and ‘digitalisation’ reflect the fact that the future energy system development will indeed depend to a large extent on cheap bulk electricity storage and the possible role of digitalisation. The nuclear issue in Belgium reflects not so much the safety of the technology as such, but rather the issues of future availability: will the hydrogen-flakes-affected reactors continue to remain online? will the operational life-extended units Doel1 and 2 survive the legal appeals by certain organisations? Will the full nuclear phase-out take place as currently planned for 2023–2025? The concerns about the EU cohesion after the Brexit and other political occurrences and its effect on the common climate and energy policy does not require much comment.

The most important needs for action (the issues that keep the leaders busy at work) are the climate framework, renewable energies, decentralised systems and the market design. After the Paris COP21 agreement, most energy leaders acknowledge that climate issues, renewables and decentralised systems get a major boost and will play a very important role. A new energy market design (needed to cope with the three previous issues) was expected, hence it will be very important (even though the details were unknown at the time of the poll).

Compared to the issues map of 2016, the biggest shifts are those for EU cohesion and nuclear, which have more moved to the upper right corner for reasons already explained. Terrorism and cyber threats, have moved to the right and are perceived to be more important. Terrorism undoubtedly moved as a consequence of the attacks in Brussels in March 2016, reflecting the realisation of vulnerability to some parts of the energy system. The last comment applies also to cyber threats. The climate framework moved downward (and as more certain and strong impact) after the Paris COP21. The role of coal is now even less of an issue, since almost no coal is being used in Belgium at present.

The Belgian answers are to a large extent similar to the European issues map. Noteworthy differences are, nevertheless, the nuclear issue as being more in the focus in Belgium. Energy efficiency and commodity prices are less explicit in the Belgian map although they are not unimportant. The digitalisation appears in a key place in Belgium, but it does not seem to be present at all in the European map.

## ESTONIA



The Estonian national issues monitor reflects the situation in Estonia during the first half of 2016. There was ongoing debate about the following legislation: a new electricity bill, renewed long-term national energy strategy, and long-term climate framework. These processes are now in their final phases and should be finished during 2017. As a result, investors will have more certainty about Estonian long-term energy policy and this should make Estonia more attractive to potential investors. In addition, the one other issue that is very prominent on the map is Russia. This is also easy to understand; Russia is a big supplier of natural gas and the Estonian electricity system is connected to the Russian one. The current geopolitical situation is the reason why Russia is the key uncertainty and this will most likely continue to be the case moving forward.

For Estonia the critical uncertainties are Russia, market design, climate framework, and commodity prices. Market design is high on the agenda because Estonian electricity market is next to the Russian market, a market where there is also a capacity market, while in Estonia and the whole NordPool area an energy-only market is used. Another issue is the prevailing low power prices, that are too low to warrant any new investments. This puts a huge pressure on the security of supply. Commodity prices stand out because Estonia is quite a large producer of shale oil, and the low oil prices seen in the first half of 2016 really put the industry under pressure. Many people were laid off and some of the plants were temporarily shut down. Now as the oil price has recovered this issue is off the table, but commodity prices still play a huge role for the shale oil industry.

Action priorities include energy efficiency, electricity prices, energy subsidies, renewable energies, and EU cohesion. Energy efficiency is a high action agenda because Estonia is a country with a

cold climate and heating is a significant cost for Estonian households and businesses. Furthermore, increases in energy efficiency reduce the need for fuel imports and reduce the CO<sub>2</sub> emissions. Renewables along with subsidies are high on the agenda because the political debate about how to change the support schemes for renewables has been going on for many years. Right now, Estonia is very close to implementing a system where all new renewable capacities will be financed by auctions where a lowest bidder is chosen.

Unconventionals and biofuels are other issues of high importance in Estonia. Unconventional oil from shale oil is something Estonia is a world leader in, and it is also something that is one of the key drivers of Estonian energy policy. Therefore, it is quite understandable that unconventionals are high on the impact category. Biofuels are high on the action priorities list because Estonia will soon have to fulfil the goal of having 10% biofuels in the transport sector, which currently seems a task that will be very hard to achieve. Nevertheless, politicians and companies are working on it.

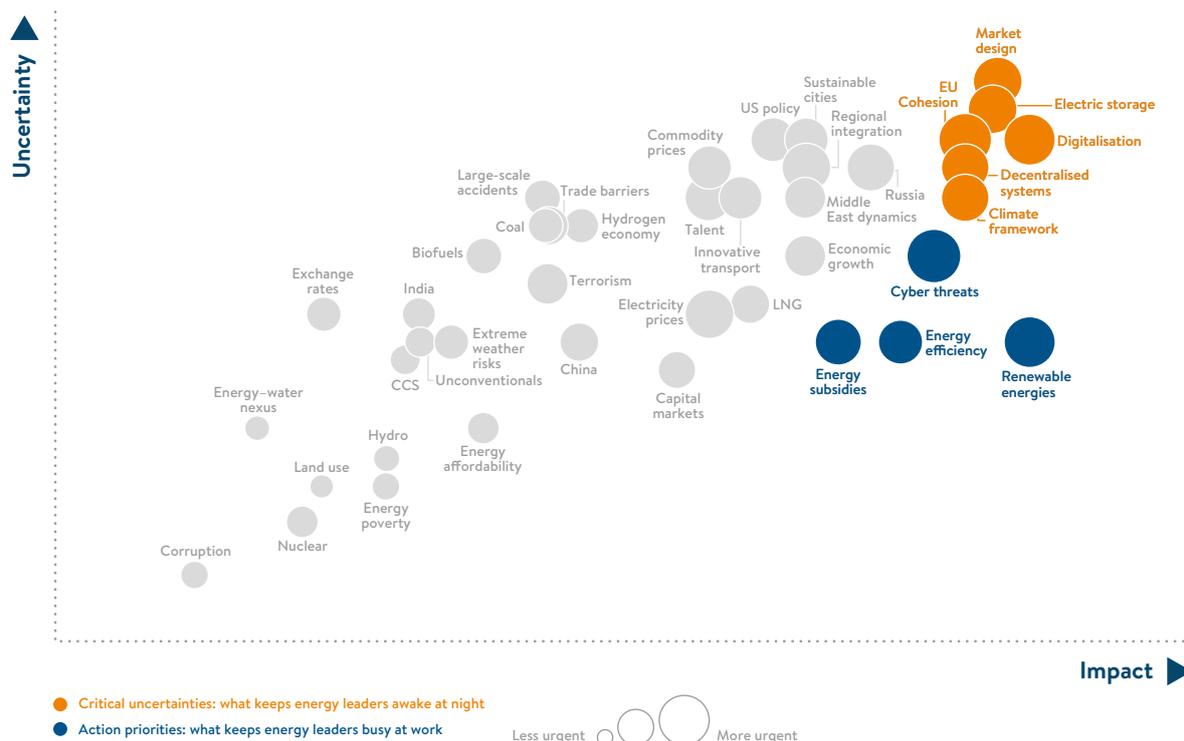
One of the interesting things about the Estonian issues map is that the issues are in clusters. There is a cluster of issues that are not relevant at all, then there is a cluster in between, and finally a cluster with those most relevant issues. This cannot be seen on the European nor on the world map.

Cyber threats are less prominent on the Estonian map, which might be because the issue has been on the agenda in Estonia for a long time and mostly there are strategies in place to deal with this. Also, extreme weather, large scale accidents, and energy access are topics that are not relevant in Estonia because these issues have been solved or are not really problems in Estonia. Conversely, unconventionals is much higher on the agenda than elsewhere.

In comparison to previous findings in Estonia, decentralised systems and market design have moved up on the agenda, due to the rapid fall in the cost of PV systems which has resulted in many people installing their own PV systems. A rising share of prosumers means that the market design for retail power markets and distribution grid services needs to be changed. Commodity prices has gone massively up on the map, which is explainable by the fact that the oil price has been low for the past year.

It is quite interesting to note that innovative transport has not moved much on the map; however, most probably this will become one of the changes that will be seen on 2018 national issues map. All in all, the Estonian Issues Map reflects the situation in Estonia during the time the answers were collected. It is quite surprising to see hydrogen economy, CCS, and India so high on the uncertainty category and nuclear rather low. It was in line with expectations to see Russia, market design, climate framework, commodity prices, and energy subsidies so high on the agenda. Although, given current realities the issue of energy subsidies could have been even higher and is anticipated to remain important looking to the year ahead.

## GERMANY



In 2016, the decision to transform the electricity market in Germany from a feed-in-tariff based system towards a bidding process for green power producers represented an important change, aiming at a more economical and affordable transition. The government also enacted a new law on market design in July 2016, which was widely discussed in Germany. Germany decided to further develop the energy-only-market, instead of implementing a capacity market. Nevertheless, tools like a grid and capacity reserve were installed to ensure security of supply. Over 30% of the electricity was produced by renewable energy resources, representing about 50% of the installed capacities, around 100GW. Renewable energies and their integration into the existing system, in economic and technical terms, will represent the major challenge in energy politics for the next government which will be elected in autumn 2017.

Moreover, the political decision to gradually install smart meters throughout the country, beginning with large consumers and producers from 2017 onwards, was an important step towards digitalisation in the electricity sector. The collection and interpretation of data as the consumption behaviour will be possible in the near future, which inspires new business models. Also cyber threats increasingly get noticed as a substantial issue, when the loss or misuse of data start playing a crucial role in a critical infrastructure like the energy system. Demand-side-management and virtual power stations where small scale renewables and batteries are pooled become part of the electricity market. The link between digitalisation and decentralised systems is becoming more evident in cases where ‘prosumers’, for example a household with installed rooftop photovoltaic and battery storage, sells and receives electricity whenever he wants within one virtual community.

With a growing capacity of intermittent renewable energies, with extreme surpluses and shortfalls of electricity production, the question of future storage possibilities is crucial. While experts expect battery storages to become cheaper in the future, the market is still very exclusive. 'Sector coupling' has appeared on the agenda of the German energy discussion. On the one hand, this concept refers to the electrification of the transport and heating sector, use and store surplus electricity. While the transportation sector is largely based on oil (94%), the dominant fuel in the heating sector is gas (45%). Due to the large gas network and storage infrastructure in Germany, another idea emerged in the context of 'Sector coupling' which referred to the usage of surplus electricity for power-to-gas or power-to-fuels technology. Synthetic methane or hydrogen could potentially be injected into the existing gas infrastructure, which thus can act as a storage facility.

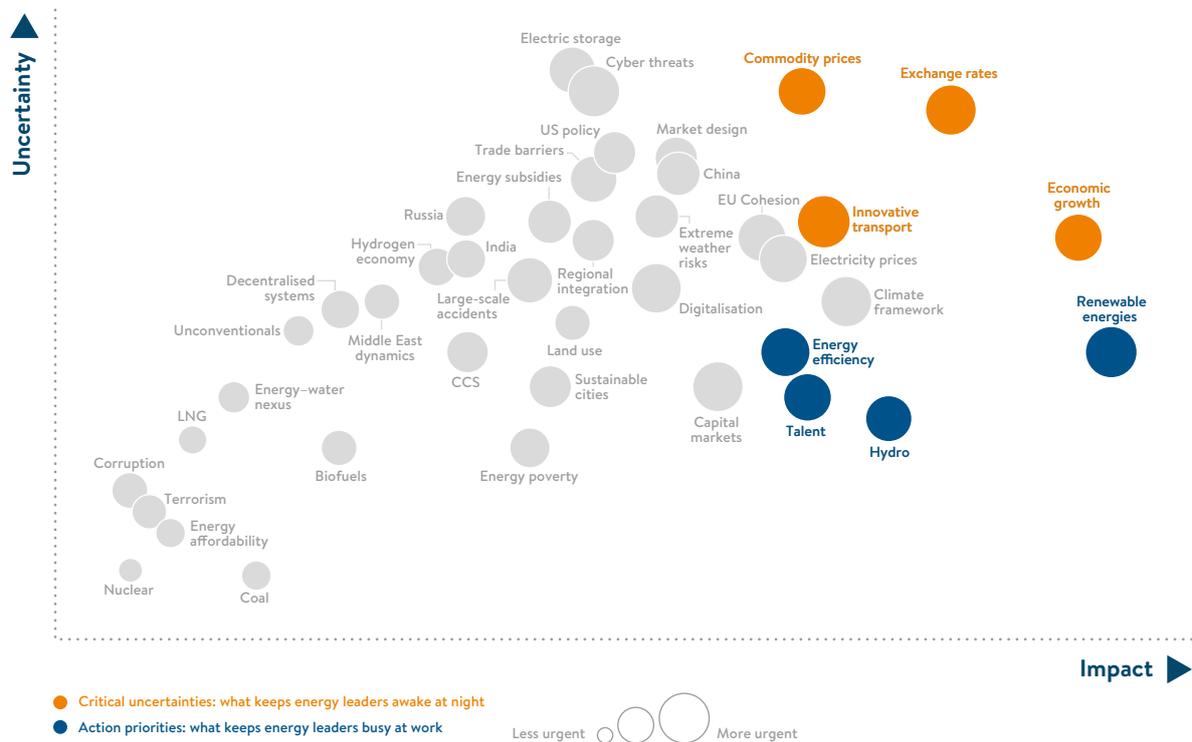
Further topics in the national debate have been climate framework as well as energy efficiency. In November 2016 the government presented a new climate protection plan 'Klimaschutzplan 2050', which determines measures as to how Germany should reach its greenhouse gas goals (80 to 95% reduction compared to 1990) until 2050. The plan was at the centre of a vivid discussion as it interfered with various competences of the other ministries. It includes greenhouse gas emission reduction targets for each sector (transport industry, building, energy and agriculture) until 2030. Energy efficiency was further emphasised as a key instrument to reach climate goals. The government presented a green book on energy efficiency, which went into a broad consultation process.

On the international level, four major areas were perceived as uncertain but highly relevant: Russia, US policy, Middle East dynamics and EU cohesion. Russia remains on the agenda of political discussions: Economic sanctions are still in place due to the political conflict in Ukraine. Moreover, the dispute around the expansion of the direct gas pipeline from Russia to Germany, 'Nord Stream II', with a capacity of 55 bcm, is still pending in the beginning of 2017 as the compliance with European energy market rules was contested.

The geopolitical as well as the market impact of the new US government remains uncertain, too. The US' political engagement in the Middle East, also with regard to the sanctions against Iran is of special interest for German companies. The Iranian elections in 2017 will be closely observed. The Middle East dynamics rank high in terms of uncertainty and impact: On the one hand, it represents the world's largest oil and gas reserves and an important market for Germany, on the other hand it is a region with waves of geopolitical conflicts in the neighbourhood of Europe.

The issue of EU cohesion is not only extremely relevant for the German economy and politics, it is also challenged by various nationalistic movements at rise, with Brexit as a warning reminder that nothing is for granted. The elections in various European countries in 2017 will reveal to what extent nationalistic arguments gain ground. While great steps towards a more and more Europeanised energy sector have been made, including the EU Commission's winter package in 2016, energy politics and debates on the national level tend to exclude the regional or international level from their perspectives.

## ICELAND



In 2016 Iceland participated in Energy Issue Monitor Survey for the first time, as a part of the Icelandic World Energy Council delegation policy to participate more in the World Energy Council cooperation. Participation of Icelandic partners in the survey was good, resulting in a higher quality of the results. The overall picture of the results reflects mostly domestic factors both regarding uncertainty and impacts.

The Critical Uncertainties and Impacts are in exchange rate, commodity prices, economic growth, innovative transport, EU Cohesion, electricity prices and climate framework.

The greatest uncertainty and impact issues for the energy sector in Iceland was the domestic factor – Exchange Rates in the field of macroeconomic risks and vulnerabilities, which perhaps reflects the volatility of the krona which appreciated about 15% from the beginning to the end of 2016. This reflects a similar concern within the export sector, as large parts of energy are sold in foreign currencies to industries in Iceland, while the operational costs are in local currencies. In addition, the energy sector is a capital intensive sector and a large part of the energy company’s loans portfolio is also in foreign currencies, which will affect the overall operational and financial risk and cost to companies.

The second most critical uncertainties and impact factor is that relating to the world market factor – Commodity Prices, (price and volatility risks for energy and related commodities) which can have a great influence on the energy sector, both domestically and globally. The commodity prices were still low in 2016, although many had predicted an increasingly tight oil market and expensive fossil fuels. This instability resulted in uncertainty and in some instances fear that low prices might damage political support for climate protection.

Effects of Economic Growth (or lack thereof) on energy markets is the third most critical uncertainty factor, although it is less uncertain than the first two. The economic growth concern in the energy sector is also somewhat linked to volatility of the world commodity prices, although it is also reflecting the picture regarding broader growth importance for both the economy in Iceland and worldwide. Economic growth in Iceland is strong with continued expansion in tourism, robust private consumption and favourable terms of trade. Steep wage gains, employment expansion and large investments are fuelling domestic demand. The capital controls introduced during the financial crisis are in the process of being lifted step by step. Economic growth is therefore ranked with similar importance as in other countries.

Innovative transport in the area of energy vision and technology, is described as new modes and fuel sources including electric vehicles, hybrid and natural gas vehicles. In recent years there has been rapid development globally in this sector especially in electric vehicles as they have been growing in the consumer market as a result of lower prices, longer driving distance and quality. This development will require more challenges of supply of electricity in concerned countries like Iceland to the consumer e.g. in the form of new infrastructure to provide supply of electricity to those cars, etc.

EU cohesion, electricity prices and climate framework have also been mentioned as issues of relatively high uncertainty and impact. In addition to that but perceived with less importance, are electric storage, cyber threats, US policy, market design, trade barriers, China, extreme weather risks, and digitalisation.

The top Action Priorities of Icelandic energy leaders are renewable energy, hydro, talent, energy efficiency and capital markets and land use, which are all more or less interconnected issues.

The most important high-impact action priority of energy leaders is Renewable Energy, as Iceland has an abundant supply of clean energy. Iceland has a very low-carbon energy mix as renewable energy sources accounted for 85% of total primary energy supply in 2012, far more than in any other OECD country. Imported fossil fuels make up the rest and are used primarily in transport and fishing.

The second priority is the Hydro sector which is interconnected to the first priority of renewable energies more broadly, especially when considering Iceland's combination of geological activity, large glaciers and numerous rivers which provide vast potential for geothermal and hydropower development, only part of which is currently exploited. All electricity and 95% of heat (geothermal) are generated from these two sources, with no need for support measures such as those used in many countries. Both geothermal and hydropower production have increased considerably, especially since 2005. Households and businesses can benefit from energy prices that are among the lowest in Europe owing to the renewable nature of power generation, which is capital intensive but entails no fuel costs.

Talent, the availability of labour with the necessary skills, qualifications and experience is the third most priority on the agenda of energy leaders, as human resources are perhaps the most important asset within each industry and company.

Energy efficiency, the role of measures (designs/operations/technologies) to reduce energy consumption – is additional priority issue of energy leaders. The relatively low energy prices in Iceland can contribute to less concerns of energy saving both in homes and industry. Although geothermal energy for heating may be abundant as well as renewable power in general, more focus on energy efficiency for home and industry could be a prudent policy to gain efficiency and energy saving. Energy efficiency is ranked lower in impact than in most other countries.

Capital markets, are also classified as important impact factor for the industry, as it is very capital intensive. This can reflect the fact that capital controls have been in place since the financial crisis, but are now in the process of being lifted step by step. This may also reflect the fact that the greatest uncertainty and impact factor for the energy sector in Iceland was exchange rate concerns. Classification of capital markets in Iceland is in harmony with most other countries.

Land use was also mentioned with less impact which is interconnected to earlier issues of renewables and hydro, as both of these factors require land use in harmony with the environment and climate issues as well as economic and social issues in concerning area. Land use is ranked higher in impact than in most other countries.

In general, there are some similarities between the survey conclusions for Iceland in comparison to other countries. However, in the area of uncertainty the exchange rate issues in Iceland, is ranked with much higher uncertainty and impact than in Europe and the world and has the nearest similarities with the positioning for Africa. Commodity prices is higher in uncertainty but lower in impact than in most other countries. Economic growth is ranked similar as in other countries, but innovative transport is ranked higher in impact for Iceland than in other countries. EU cohesion, electrical prices and climate framework are all ranked with a similar degree of uncertainty but lower in impact.

In the area of action priorities there are further similarities with Europe and the world. Renewable energy, hydro and capital markets, however, are ranked higher in impact than in Europe and the world, meanwhile talent is similar but energy efficiency is ranked lower in Iceland than in Europe.

The key area of critical uncertainty concerns for energy leaders in Iceland are exchange rates, commodity prices, economic growth, innovative transport, EU cohesion, electricity prices and climate framework. In the area of impact and action priorities the main priorities are, renewable energy, hydro, talent, energy efficiency and capital market. Both in the area of uncertainty and impact, the exchange rate and financial market in Iceland, is ranked much higher than in Europe and the world and has the most similarities with Africa.



High uncertainty is also perceived with reference to the commodity prices issue. Oil (WTI), natural gas and coal prices have been affected by many factors over the last years and the current situation remains uncertain, mainly because of: the difficult geopolitical situation in the Middle East; the return of Iran between international most important energy producers; OPEC agreements of the second half of 2016 regarding oil price and the doubts about the implementation of these agreements. It is important to underline that also Middle East Dynamics and relations with Russia are positioned in the critical uncertainties area.

What has mostly changed since last year in the Italian map is the entrance of cyber threats between critical uncertainties. This indicates a high level of awareness of Italian energy leaders about the potential impact that cyber threats could have on energy sector.

In Italy the electric storage issue – connected to the development of both renewable energies and electric mobility – is perceived uncertain mostly for its regulatory and technological developments, but it is approaching the action priority area.

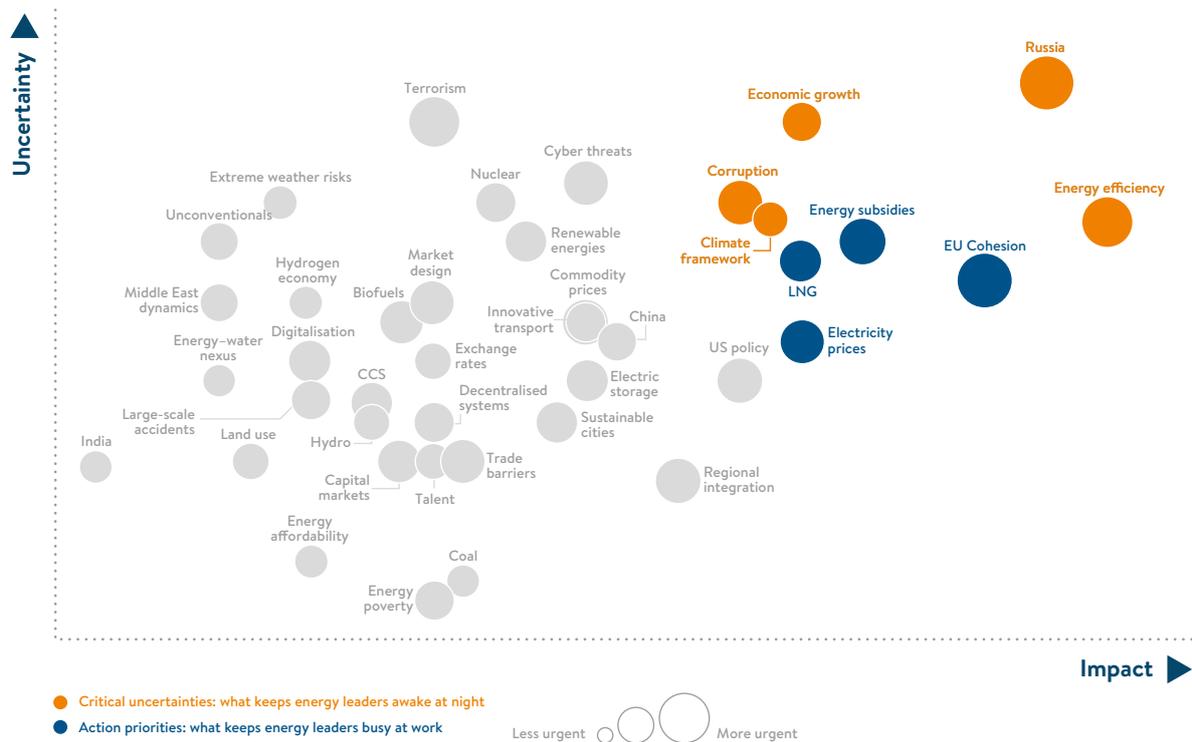
Energy efficiency remains a priority action for national energy stakeholders, both private and institutional. The European Directive on Energy Efficiency and the Italian Action Plan for Energy Efficiency continue to create a favourable environment in Italy for investment in energy efficiency both in energy production and consumption. This is confirmed by the interest of end-users for a more efficient use of energy in private houses, thanks also to the adoption of ministerial decrees issued on June 26th, 2015 (transposition of Directive 2010/31/EU).

The renewable energies issue remains between the action priorities for Italian energy leaders. In this field there is also a perceived need for a new market design, that can integrate increasing amounts of intermittent renewable energies into the electricity system, while continuing to encourage investments needed for its safety and efficient use. In the first nine months of 2016 non-programmable renewable sources – wind and solar – covered 14% of the national demand for electricity; an all-time record, registered while primary energy consumption dropped compared to the same period of 2015. The share of electricity produced from all renewable sources remains near 41%.

Also this year LNG, and its end-uses, is confirmed in the area of action priorities. With regard to this issue Italy is engaged with the national strategy on LNG issued by the Ministry of Economic Development in the context of the European Directive on the deployment of alternative fuels infrastructure – DAFI – transposition process.

Comparing European and Italian maps, the EU one appears more stable on an annual basis than the Italian one, mainly in the area of critical uncertainties (European Cohesion, Climate Framework, commodity prices and electricity storage), as well as partially also in the action priorities area where the only change is the replacement of the interconnections issue with that of energy prices. Italian and world energy leaders share concerns about commodity prices, even if globally the perceived impact of this issue is larger. Energy efficiency is among action priorities for all global energy leaders; however, compared to the Italian map, at a global level cyber threats are still perceived as a low impact issue.

## LATVIA



The latest issues monitor for Latvia is mainly influenced by such geopolitical uncertainties as EU and Russia limitations in cooperation, which creates uncertainties in energy sector development and national economic development in general. While the Latvian energy system is interacting with the Russian energy system, fulfilling each other in gas and electricity supply, Latvia have been taking all necessary actions to ensure security of supply in the gas sector and transitions to liberalise the market. This will finalise changes in legislation and regulatory acts and increase security of supply.

Most of the national action priority issues are also highly uncertain, but due to a strong impact they feature on the current agenda.

Despite the relatively rapid growth, 2–3% in 2016, the Latvian economy has started to slow down. In this regard, Russia's and the EU's geopolitical influence is important, as well as the electricity price, which is affected by the geopolitical changes and the lack of legislative and strategic planning on an EU cohesion fund.

Energy subsidies have a significant impact on the energy sector at national level, but critical is the uncertainty regarding future support for development of RES after 2020 in Latvia, as no agreement or concept has been found yet. At present, a great amount of electricity subsidy levy is placed on industry decreasing its competitiveness, which has caused contention and debates in Latvia. Consequently, the Latvian parliament in 2016 made legislative amendments to decrease the levy on energy intensive industry starting in 2018. Jointly with EU Climate framework and COP21 targets, this issue could have a significant influence on development and economic growth in the near future.

Energy efficiency law was issued in 2016, but large uncertainties remain regarding obligation schemes and alternative measures which will be made. Sector leaders are working on this issue with the target to unlock energy efficiency solutions, including to intensify insulation of public and private buildings amongst others.

Issues also important for energy sector development are the diversification and increasing of security of gas supply in Latvia; acknowledgement of the possibilities of LNG deliveries; changes in Gas Supply; storage and related legislative acts. New legislation on transmission and storage infrastructure has been created. These actions will ensure safe diversification of gas supply after the opening of the market in 2017 with a more level playing field for all participants.

Comparing the national, Europe (regional) and world monitor there are many of the same action priority issues such as for energy efficiency, trends on energy preservation and climate change, electricity prices and the consequence of policy. A number of unsolved conditions at the national level for Latvia makes energy subsidy issues critical while at regional and world level it is an action priority together with RES. This indicates the presence of an organised system; however, since the Latvian government RES support stoppage it is much less uncertain and critical issue.

On critical issues for all three monitors is Climate Framework in respect to the previous Paris agreement and setting of new targets globally and regionally. On the other hand, Russia was a less significant factor for the region in the latest findings due to internal issues that overshadow it, and a perception of insignificance at the global level due to clear limitations in those areas with highest cooperation and linkages with Russia.

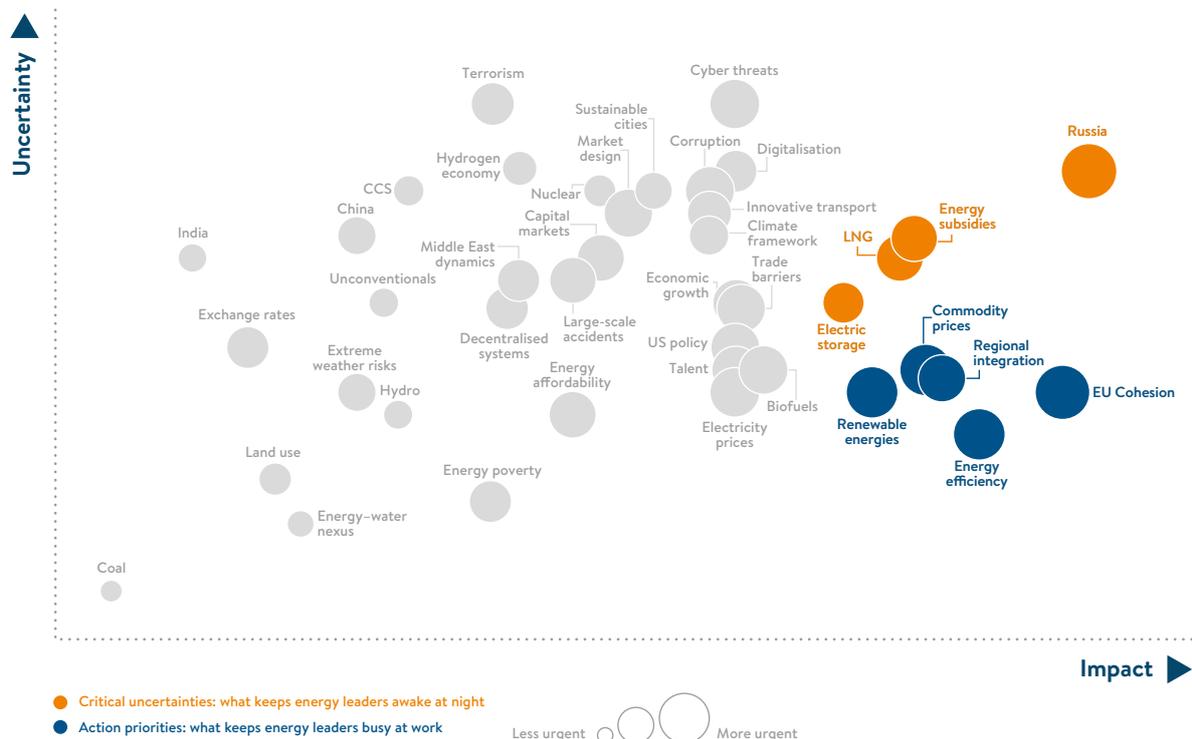
Such factors as Russia, energy efficiency, energy subsidies and energy prices remain highly relevant in 2017, due to new game changers that came in place in the end of year, such as continued COP momentum and EU RES targets. After sub-regional partners Lithuania has announced that Nuclear is not priority, this issue went off the agenda this year for energy leaders in Latvia, but acknowledgement of LNG became much more important in the context of gas market liberalisation.

In the action priority list there is still a lot of uncertainty, but necessary actions should be taken due to the level of impact on the energy sector. As for critical uncertainties, some of them are likely to become priority actions in the coming years where a pathway for the future is beginning to emerge at the national level, i.e. Energy subsidies and Climate framework.<sup>93,94</sup>

93. Ministry of Economics of the Republic of Latvia. Report on the Economic Development of Latvia June 2016 [www.em.gov.lv/files/tautsaimniecibas\\_attistiba/zin/2016\\_jun\\_eng.pdf](http://www.em.gov.lv/files/tautsaimniecibas_attistiba/zin/2016_jun_eng.pdf)

94. Latvenergo Group. Unaudited Condensed Consolidated Financial Statement. [www.latvenergo.lv/files/news/01\\_Latvenergo\\_Interim\\_2016\\_9M\\_ENG.pdf](http://www.latvenergo.lv/files/news/01_Latvenergo_Interim_2016_9M_ENG.pdf)

## LITHUANIA



Keeping energy leaders in Lithuania most awake at night are the geopolitical risks arising from Russia together with other issues related to energy subsidies of the household sector for district heating and power supply. Klaipeda LNG terminal is both securing gas supply and importing competitive prices for the whole Baltic region but has still not solved infrastructure maintenance costs, which are covered by Lithuanian domestic consumers. Rapidly increasing concerns over electric storage is not only related to global technological progress paving the new opportunities for more wide scale usage of renewables and electrical transportation, but also over Kruonis Pumped Storage Hydroelectric Power Plant and its future possibilities.

The key factors affecting the energy sector in Lithuania have included the NordBalt power interconnector, which has brought lower electricity prices into the Lithuanian power market. The use of the LitPollink interconnector is still very limited. Domestic power generation is only competitive during stops of the NordBalt power interconnector and is further declining. The government decision to halt subsidising electricity generation in gas fired cogeneration plants has raised a big concern about their future and the potential for stoppages in the near future. Meanwhile, electricity consumption is rising at a rate of approximately 5% per year while domestic power generation capacities are declining.

Particular issues of importance include energy efficiency, which is keeping energy leaders in Lithuania most busy at work because of some delays of the implementation of national law on energy efficiency. Energy efficiency targets are very ambitious. There is not a clear situation remaining for refurbishment of internal energy systems in the multifamily houses which are prevailing in Lithuania. EU Cohesion helps to modernise the Lithuanian energy sector; however, there is some

delay to preparing conditions for further development of wind energy in the country. The creation of a regional gas market requiring harmonisation of legal bases and to agree to internalise infrastructure maintenance costs including both Klaipeda LNG terminal and Incukalns underground gas storage create further concerns to the energy sector leadership.

When comparing the national to regional priorities, Lithuania is geographically located closest to Russia and was most notably damaged by Russian economic sanctions with the EU. It is therefore for this reason that Europe's concern over Russia is decreasing but in Lithuania it is remaining high. Other factors to consider include that Lithuania, similarly to Europe, is concerned about EU cohesion after the Brexit decision in 2016.

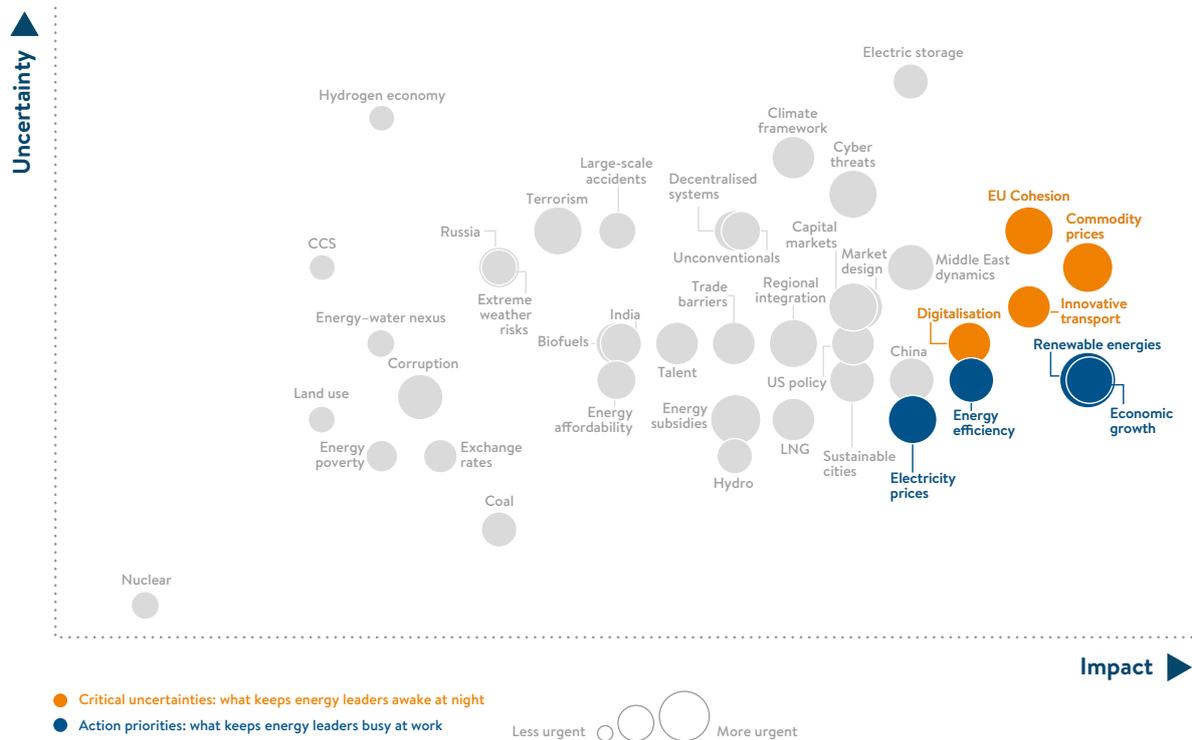
For the Lithuania the main issue is to achieve the ambitious targets of energy efficiency. Regional integration is necessary to implement the strategic aim of all three Baltic countries – Lithuania, Latvia and Estonia – in order to have a synchronised power system with continental Europe power systems. The connection of the Baltic countries gas market with Poland is another top priority target.



account diversity of primary energy sources and RES potential in particular EU countries. The context of the Brexit makes EU cohesion even more difficult to achieve. According to electricity prices in wholesale markets we can still observe decreasing trend. The main reasons for this are cheaper primary energy sources (regardless of fuel type) and increasing shares of renewables with near zero short-term marginal energy production cost (wind, solar, etc.). It is perceived as a very important issue in Poland where more than 80% of installed capacity is based on coal.

The Polish map is consistent with the regional (European) map. Most of critical uncertainties and need for action issues are perceived exactly the same or in a very similar way in Poland and in Europe. Coal is still the only issue that is perceived with a substantial difference. This is an effect of coal resources and the strategic meaning of this fuel for Poland – both in the energy sector and the economy as a whole.

## PORTUGAL



The national context for energy leaders in Portugal is one in which renewables are receiving renewed attention by investors. Several large-scale PV projects are in licensing procedure for the South of the country and new demonstration projects will be implemented in 2017, namely Windfloat offshore generation at industrial scale (25MW) and the testing of the Swell wave technology. Costs reduction to the electric system are being pursued by the Government, through measures that include the end of FIT to mature technologies and the design of a new power guarantee system, based on market mechanisms.

EU Cohesion is felt as a main concern by the energy sector, due to Brexit and other threats to economic and financial stability of the EU area that may affect, namely, energy demand. Innovative Transport and Digitalisation are also receiving close attention, as these issues are expected to produce deep changes on grid operation and demand and also on consumer's empowerment. This will require a great adaptation effort all over the sector to these new generation patterns and behaviours. Oil and Gas prices were quite unstable in recent years, putting further stress to the economy of conventional electricity generation.

Renewable energies are a main part of energy supply, but uncertainty was felt by investors due to adjustments introduced in FIT to reduce energy costs. Due to the very high share of renewable energy, which has priority dispatching, electricity market prices are quite depressed, causing financial losses mainly to CCGT owners.

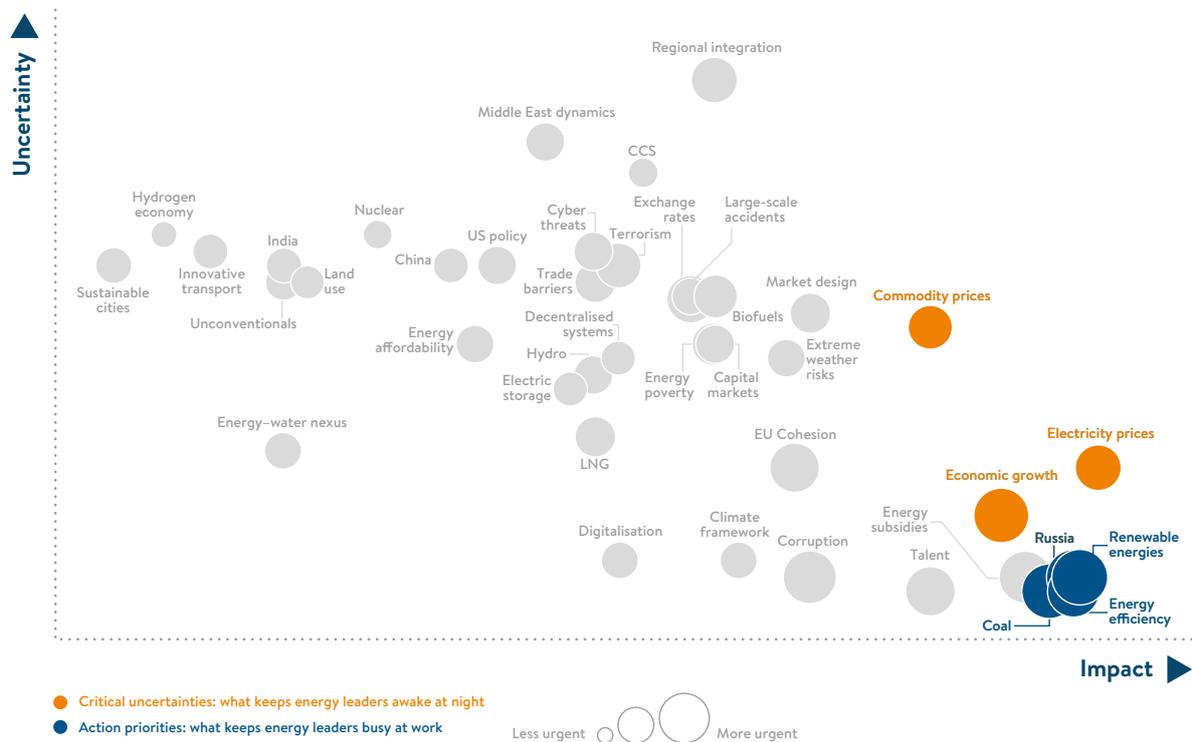
The most striking differences between the Portugal and Europe maps are around Russia and Nuclear issues, with Portugal placing both with a much lower impact and uncertainty, reflecting its independence of supplies from Russia and the no-nuclear option of the Portuguese energy policy.

Also noticeable is the greater impact attributed in Portugal to Innovative transport, due to the Portuguese policy bet on cars' electrification.

Unconventional fuels gained impact in comparison with the previous year, probably due their effect in smoothening oil and gas prices' hikes. Regional integration lost impact but gained uncertainty, reflecting the lower expectations of a short time reinforcement of power and gas interconnections from Iberia to France. Innovative transport also gained impact, reflecting the relevance electricity is gaining again in transportation policy.

Energy policy and industry initiatives are keeping Portugal in the front line of the changing energy paradigm, reaching a high supply share and a successful integration of large scale variable and distributed energy, testing electric mobility infrastructure and implementing smart grids demonstration projects. The integration of the southwest part of Europe in a true Energy Union, a not yet fulfilled objective, is required to realise the full development of renewable electricity generation potential of the country, that is attracting the interest of investors.

## SERBIA



Energy consumption in Serbia continues to grow, with the dominant share from the residential sector. Serbia is implementing its new Energy Law regarding restructuring of power and gas sectors and opening of the energy market for competition. The new Energy Sector Development Strategy by 2025 with projections to 2030 incorporates already adopted national action plans for energy efficiency (9% by 2018) and an increase of the share of renewable sources in the total gross final energy consumption (27% by 2020). Serbia also declared its intention to reduce emissions of greenhouse gases until 2030 by 9.8% compared to its 1990 emissions.

The Serbian energy sector is facing uncertainties concerning the recovery of the national economy, so there is an increased difficulty to enable consumers to pay energy bills at prices that reflect the costs whilst maintaining the possibility for new investments. These costs are expected to rise considerably to include both the environmental protection measures and the subsidies to be paid for renewables. Also, an effort by the Serbian energy sector to reduce emissions of greenhouse gases will put additional pressure on the energy costs. These emissions might even put at risk the long-term use of local coal resources, thus increasing import dependency on natural gas supplies.

A particular challenge for Serbia's energy sector is the need to increase security of supply by diversifying supplies of natural gas. In the power sector, Serbia is investing in the refurbishment of its obsolete generation fleet based on coal, including new environmental protection systems to meet environmental standards of the EU (in particular, Large Combustion Plants Directive and Industrial Plant Directive). Also, construction of a new coal-fired power plant and several wind and solar facilities has begun. For the planned increase of the share of intermittent renewables in power sector, new investments in additional storage capacities will be necessary.

Energy efficiency is one of the major challenges for the energy sector in Serbia, and is therefore ranked high in the list of priorities of its energy policy. The Law on the efficient use of energy is the legal framework for establishing a fund to support energy efficiency projects. While the energy efficiency measures may slow down the upwards trends in energy consumption to some extent, further deployment of renewables is expected to remain critical for action even if the current economic recession in Serbia eases.

The top action priorities in the Serbian Energy Issues Map for 2017 include coal, renewables, energy efficiency, electricity prices and energy security. The coal issue in Serbia is perceived with a high impact because of its environmental and climate concerns, bearing in mind the major role of indigenous lignite in Serbia's electricity generation mix. The security issue is mainly linked with natural gas imports from Russia as the only supplier, particularly because the gas transport goes via Ukraine, and is exposed to risks both due to the current political crisis there and due to uncertainty that the existing contract on gas transport from Russia over Ukraine, which expires in 2019, will be extended.

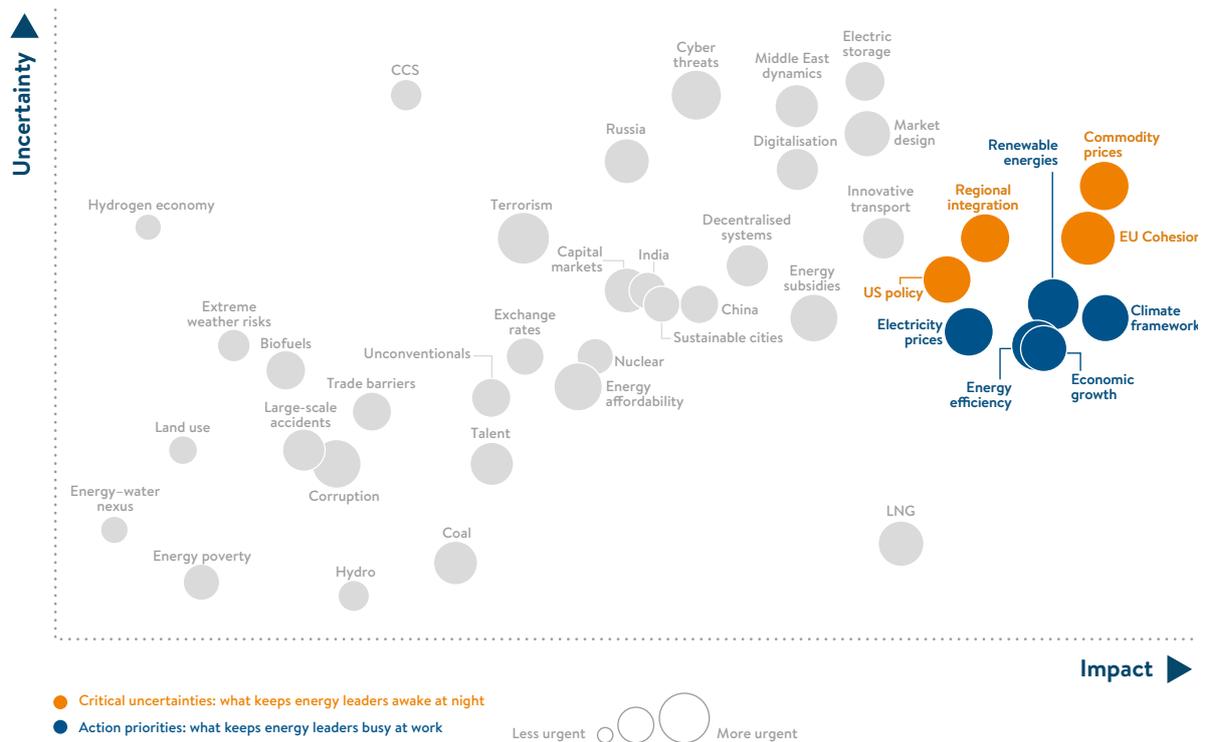
There are no major differences between the Serbian and World Issues Maps, except for coal (due to the obvious reasons; the role of coal in Serbia is perceived with a much larger impact than in the world average). With several other exceptions (electricity storage, digitalisation, corruption, bio-fuels and CCS), such a comparison between Serbian and World Energy Issues Maps applies both to the critical uncertainties (regional integration, market design, commodity prices) and action priorities (energy efficiency, energy subsidies, economic growth, electricity prices, renewable energies, climate framework).

The issue of coal in Serbia differs also from that in the region of Europe. However, most of the action priorities in Serbian and European Energy Issues Maps are almost the same (energy efficiency, renewable energies, electricity prices, energy subsidies). Similar are also some of the critical uncertainties (market design, commodity prices, regional interconnection), while some other important issues (e.g. electricity storage) are different due to different conditions (lower penetration of intermittent renewables in Serbia).

The 2017 Issues Monitor for Serbia shows that some energy issues became more certain over the last period (coal, climate framework), while some have been attributed a higher impact than in previous years (market design, electricity prices). The issues of sustainable cities, hydro, Russia, extreme weather risks, talent and corruption have had the highest change over the last period, while those of CCS, energy affordability, exchange rates and LNG had the lowest change over the same period.

Overall, despite some positive signs of recovery, the Serbian economy is still below its level of the late eighties, while the energy consumption continues to grow. The 2017 Issues Monitor for Serbia puts in focus national economic growth, commodity and electricity prices, with particular emphasis placed on energy efficiency, coal, renewables, secure gas supply and climate framework. The most controversial appear issues of hydro, nuclear, cyber threats and bio-fuels, while the greatest consensus is shown for energy efficiency and sustainable cities.

## SPAIN



One more year, the Spanish monitor shows the close interrelation between global and local issues and the main interests that constitute the central space of the country’s energy agenda.

In the first place, **Commodity Prices** still represent one of the top critical uncertainties, as it also happens in the European and Global monitors. Among other factors, the high degree of impact and uncertainty related with this issue may come from the increase in electricity prices, the volatility in oil prices, its demand, and the general standstill in global economic growth. For instance, China has experienced a decrease on the demand of commodities, having a direct global impact, in particular in emerging countries, especially regarding the BRICS due to its commodity exporter nature.

For this edition, **EU Cohesion** is also considered as a critical uncertainty for Spain energy experts, aligned with the European map. The result of the British Referendum about leaving the European Union meant a setback to the European project, which might justify the high uncertainty degree for this issue. In addition, there is a rise of populism movements around EU Member States, some of them holding general elections this upcoming year.

The relevance of geopolitical issues as well as regional topics still holds a preeminent place in the range of critical uncertainties in the Spanish map. In this way, the national issues monitor perceives **Regional Integration** and **US Policy** as important critical uncertainties, something that does not necessarily match the European Map, where they are perceived in less relevant positions. Regarding the position of **Regional Integration**, the persistent lack of enough electricity and gas interconnection with the rest of Europe keeps its preeminent status in the Spanish experts’ agenda. On the other

side, the US presidential election process has opened a period of global and local economic uncertainty, which might have repercussions on the large presence of Spanish companies in that country, where more than 800 companies are registered.

The most important need-for-action issue in this edition for Spain is **Climate Framework**, aligned with the European monitor. The important milestone in the climate negotiations of COP21 together with the European strategy highly committed on this matter, explain to a large extent the importance of acting on this issue.

**Renewable Energies** and **Energy Efficiency**, along with **Economic Growth** represent, as in previous years, the rest of the top need-for-action priorities in the national agenda, as well as in the European and Global monitors. As it has been stated before, overcoming the impasse in economic growth still persists as one of the major challenges that the international community is facing. Regarding Renewables Spain is currently involved in achieving its 2020 and 2030 goals in accordance with the European Commission guidelines.

There are certain issues that have moved towards a higher “uncertainty / impact” area over the last year, such as **Sustainable Cities**, **Market Design** and **Electric Storage**. Regarding the first one, it should be highlighted that the main Spanish cities have a great concern about the sustainability of their models and have already started implementing measures to review them. The movement of Market Design may be linked with the growing debate in Europe concerning the release of the legislative package concerning the design of the electricity market which searches to adapt the current market rules to new market realities and that will modify traditional business models all over Europe. The increase of impact and uncertainty of **Electric Storage** evidences the recent evolution of its related technologies and that there is a real challenge for the sector on this matter.

However, there have been other issues moving towards a lower “uncertainty / impact” area over the last period, such as **Unconventionals** or **Russia**. Unconventionals may have lost its relevance compared to previous editions due to the smoothing of the debate in the national framework as well as in the European Union. In the case of Russia, its impact loss may be caused by the vanishing effects of the Ukrainian crises over the last two years.

**Middle East dynamics** has slightly moved towards a higher uncertainty area in this edition but has reduced its impact level. The increasing geopolitical tensions between Iran and Saudi Arabia contribute much to this uncertainty, while the development of the fight against ISIS and the state of the Syrian Civil War may have been key to the change of perception of the energy leaders.

Overall, it may be stated that there is a clear alignment between Spanish energy leaders’ priorities and their Global peers, as it has been underlined in the cases of **Renewables**, **Energy Efficiency** or **Commodity Prices**. When comparing with the European perception, the **EU Cohesion** and **Climate Framework** are also common high interest issues in both energy agendas.



on 30 September 2016. As a party subsequently requested a national referendum, the Swiss citizens will vote on this set in the course of 2017. Until then, the measures will not come into force.<sup>96</sup>

By the end of November 2016, the Swiss citizens rejected in a national referendum a claim that the five nuclear power stations should be shut down earlier than currently planned.

These discussions in market design have been named as a critical uncertainty in the 2017 Issues Monitor for Switzerland. Additionally, critical to the energy sector has been the decrease in commodity prices (mainly oil, coal and electricity, partly gas). As consumers of gasoline could profit from lower prices, the Swiss-based global oil, gas, coal mining and trading companies struggled with the new realities. Swiss power companies had to impair their hydro assets and are facing cost uncertainties in relation to their nuclear assets portfolio. Rulings on the illegitimacy of transferring levelised cost of electricity only onto bound private clients (as the market is not fully liberalised) have further lead to an economic uncertainty, which is likely to decrease margins among utilities with Swiss generation assets.

Consequently, **commodity prices** have been ranked as critical uncertainties in the 2017 Issues Monitor, as they drive profitability and future development of the sector. For electricity companies, **energy subsidies** have been named as uncertainty as well, being a chance (or hope) to improve their economic situation. **Digitalisation** is another critical uncertainty which will be largely driven from a demand and consumer perspective, increasing the need for energy companies to act and position themselves in this field before new market participants will step in. The threat of **cyber-attacks** is omnipresent in the entire sector. As international terrorism has influenced the agendas and potential cyber-attacks are discussed in the media, measures to protect companies and critical infrastructures will dominate the discussions on a secure energy supply. The political situation between the EU and Switzerland has led to a number of unaddressed energy-related topics, having increased the market uncertainty around EU cohesion.

The fields of electric storage, renewable energies and decentralised systems are – according to the Issues Monitor – the highest action priorities. These fields are closely linked to the envisioned energy landscape of the future, where consumers are interlinked, produce part of their electricity themselves and support renewable energies at large.

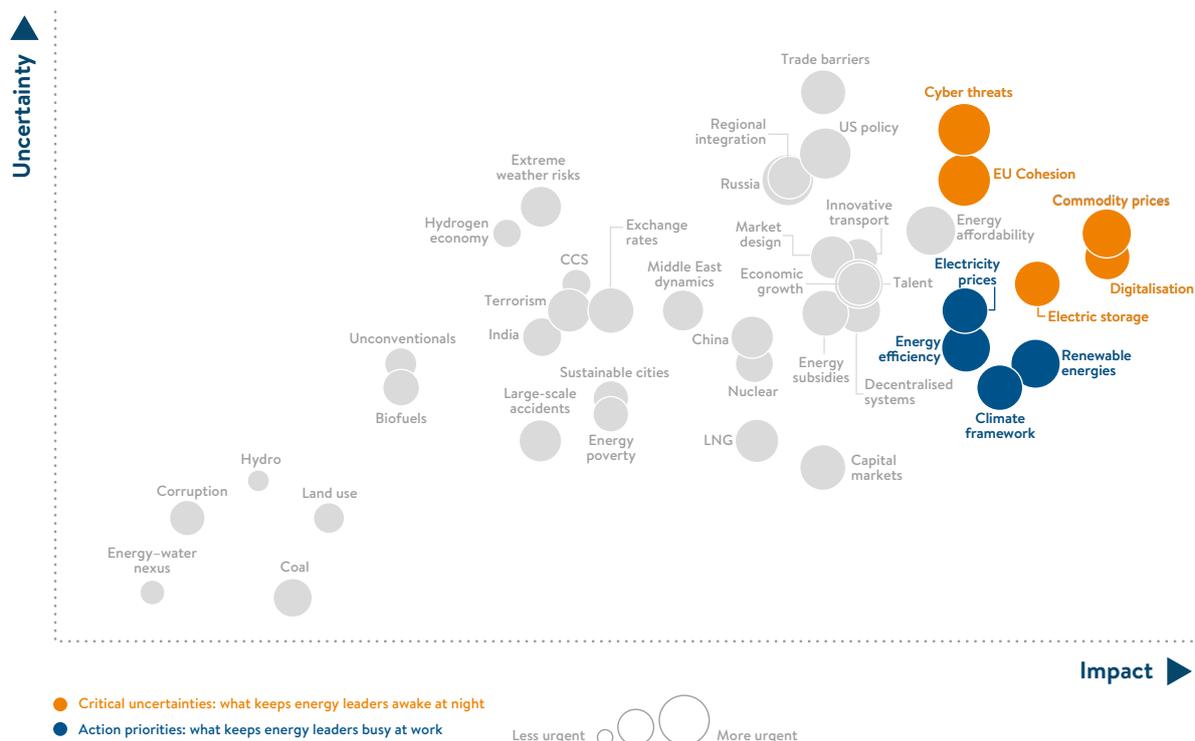
Although companies in oil, gas and coal have identified equivalent fields with high uncertainties, their related impact is being assessed as lower compared to the above mentioned fields. Geopolitical developments could thereby have a larger impact than national regulations.

While the potential impact of **market design**, **digitalisation** and **electric storage** has significantly gained importance in the last two years, other areas such as **capital markets**, **talent** or **terrorism** have remained rather unchanged.

96. Federal Department of the Environment, Transport, Energy and Communications DETEC 2017: Energy Strategy 2050 – Chronology [www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=en&name=en\\_182152393.pdf&endung=Energy Strategy 2050: Chronology](http://www.bfe.admin.ch/php/modules/publikationen/stream.php?extlang=en&name=en_182152393.pdf&endung=Energy Strategy 2050: Chronology)

Overall, the national regulation is aiming at updating its framework to allow for a secure, economic and sustainable energy supply and further accompanying measures such as energy efficiency. The facts of having not fully liberalised the electricity markets for small customers or of granting the Swiss citizens the chance to support and/or oppose regulatory developments bring uncertainties into the market and onto market participants which will take time to resolve. On the other hand, European and global commodity price developments – together with political changes and national regulations – will influence the energy sector as a whole, making 2017 a year to re-think businesses and strategies.

## UNITED KINGDOM



For the 2017 edition of the Energy Issues Monitor, UK Energy Leaders have expressed a distinctive view on the key critical uncertainties in the energy landscape. The UK map shows **cyber threats**, **European Union (EU) cohesion**, **commodity prices**, **digitisation** and **electric storage** as the critical uncertainties. The action priorities are **renewable energy**, **climate framework**, **energy efficiency** and **electricity prices**.

The UK Government is expected to invoke Article 50 in March 2017 to withdraw the UK from the EU and exit the single market. The energy sector waits to see if crucial elements, such as continued free trading of electricity and gas, will be secured and what arrangements will be put in place in order to access European staff and specialist equipment and components post Brexit.

The UK has been a significant recipient of **EU** R&D and investment funding for the energy sector. The UK Government has stated its intention to remain at the forefront of science and innovation post Brexit and the green paper resulting from the Government's new Business, Energy and Industrial Strategy is the first evidence of this intention being realised.

**Digitisation** and **cyber threats** differentiates the UK map from the European and global view, with the UK ranking them as more significant in terms of both impact and uncertainty. This is due to the relatively rapid transformation of the UK energy system to greater levels of low-carbon generation and a growing trend towards flexible demand and local generation. Factors, such as the rapid expansion of solar, particularly in the South West, the domestic and SME smart meter roll-out by 2020, and the introduction of half hourly metering, has meant that the evolving energy architecture and

adoption of industrial control systems has increased the level of data needs, system inputs and digital reliance, resulting in an increase in the susceptibility of energy systems to **cyber threats**. Energy Leaders have a responsibility to address this issue.

**Electricity storage** promises to be a game changer in the UK, but a number of regulatory and commercial barriers need to be overcome to enable greater take up, even as costs fall. The current Ofgem/Government call for evidence on the move to a Smart, Flexible Energy System provides a much needed focus on this issue.

This year's survey noted a need for greater clarity regarding **climate framework** given the uncertainty relating to the continued US role in international talks and the UK's future contribution to the EU climate agreement. Having put the domestic Fifth Carbon Budget into law at the end of 2016, the much awaited Carbon Emissions Reduction plan expected in Spring 2017 will need to deliver significant new policy to keep the UK on track to meet its carbon targets. Despite the need for clarity, the Government's new Industrial Strategy and statements by the Prime Minister in relation to Brexit show that the UK remains committed to clean energy.

**Energy efficiency** has increased in significance due to the lack of action on this key topic, with activity in the domestic sector falling dramatically over recent years following the failure of the Green Deal, the abolition of Warm Front, and significant cuts to the Energy Company Obligation. The potential removal of key European legislation on energy using products and building standards is also a concern. The Carbon Emissions Reduction Plan is expected to focus on heat and transport and may offer some new policy to make up this short-fall. In addition, the Government's review into industrial energy efficiency later this year, announced as part of the industrial strategy will hopefully identify new policies in the non-domestic sector to stimulate investment.

A focus on **energy prices** will continue this year as some of the findings of the Competition and Markets Authority 2016 report on the retail market are implemented amid continued political pressure and debate. The weakening pound and uncertainty around the future impact of Brexit are also likely to put growing pressure on prices. This is unlikely to end as new policy-driven elements, such as the Contract for Difference support for renewable electricity, and payments under the capacity market start to feed through onto consumer bills.

# Chapter five

## Assessing the energy agenda for Latin America and the Caribbean

### LATIN AMERICA AND THE CARIBBEAN (LAC)

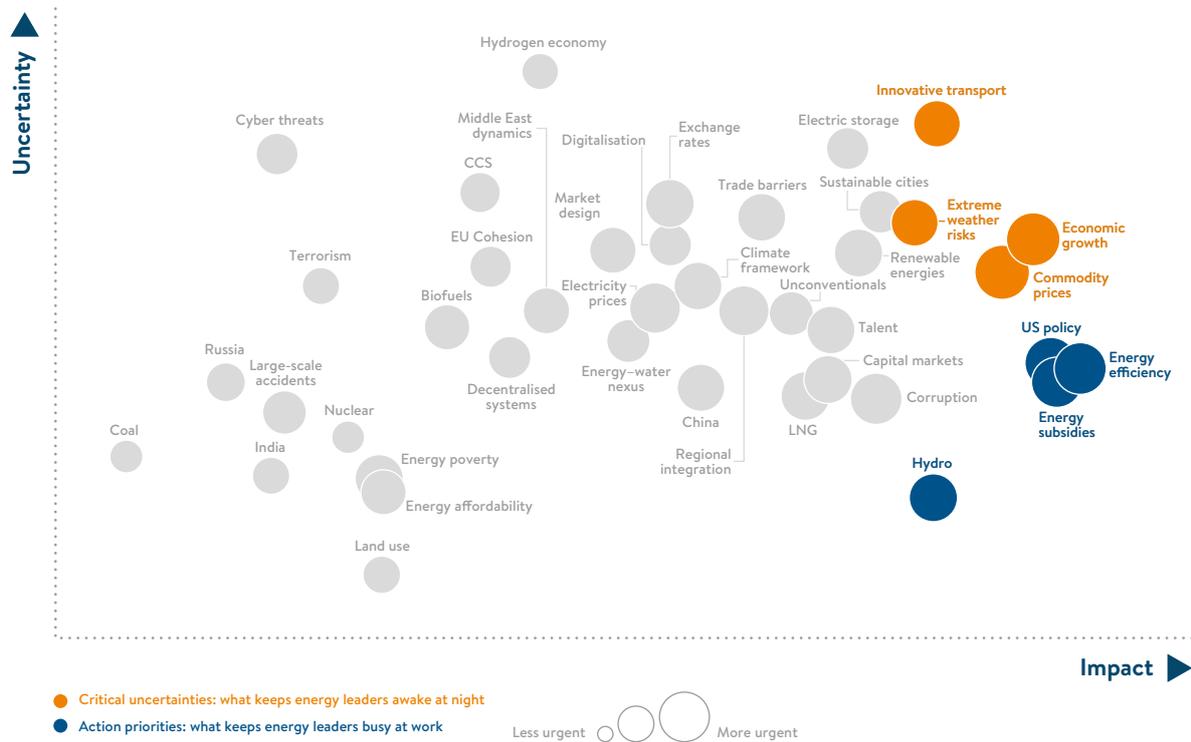
Argentina

Brazil

Colombia

Dominican Republic

## LATIN AMERICA AND THE CARIBBEAN



The Latin America and the Caribbean (LAC) region continues to face a difficult economic situation in 2017 largely as a consequence of falling commodity prices; governments are adjusting to these new realities and cutting spending. The top macroeconomic uncertainty issues have been constant in the region for the past few years; however, this year there are new issues coming into this area related to technology, such as smart cities, electricity storage and innovative transport. The need to start addressing these issues and the uncertainty on the impact these may have in the electricity markets of the future may explain these movements. Latin America continues to be a region highly dependent on hydropower, making it vulnerable to extreme weather events and raising concerns on how large hydro projects should be developed and their socioenvironmental impact. The introduction of renewables or Regional Integration could be some ways to address the vulnerability issue, but the perceived importance of the former has decreased and advances on integration projects are slow.

The past year in the region has been a year of adjustment to the new environment of low commodity prices, devaluated currencies and lower economic growth. Commodity prices continue to be one of the top uncertainties for energy leaders in Latin America; the high dependence of most local governments and fiscal budgets on income from commodity exports explains the huge impact this issue has on their economies and the lower growth rates. Latin America is a region which lacks relative industrialisation and diversification and therefore is quite vulnerable to international commodity markets and prices. This relative lack of industrialisation leads to a dependence on imports of many manufactured goods to the region, which in turn leads to internal inflation due to devaluation in most countries as a consequence of falling commodity prices. All of these issues are illustrated in the map as key uncertainties for energy leaders in the region. However, the perceived impact of

exchange rates has diminished since last year, as large devaluation adjustments already took place and companies and countries are now accepting the new exchange rate levels which have been less volatile throughout 2016 than in 2015.

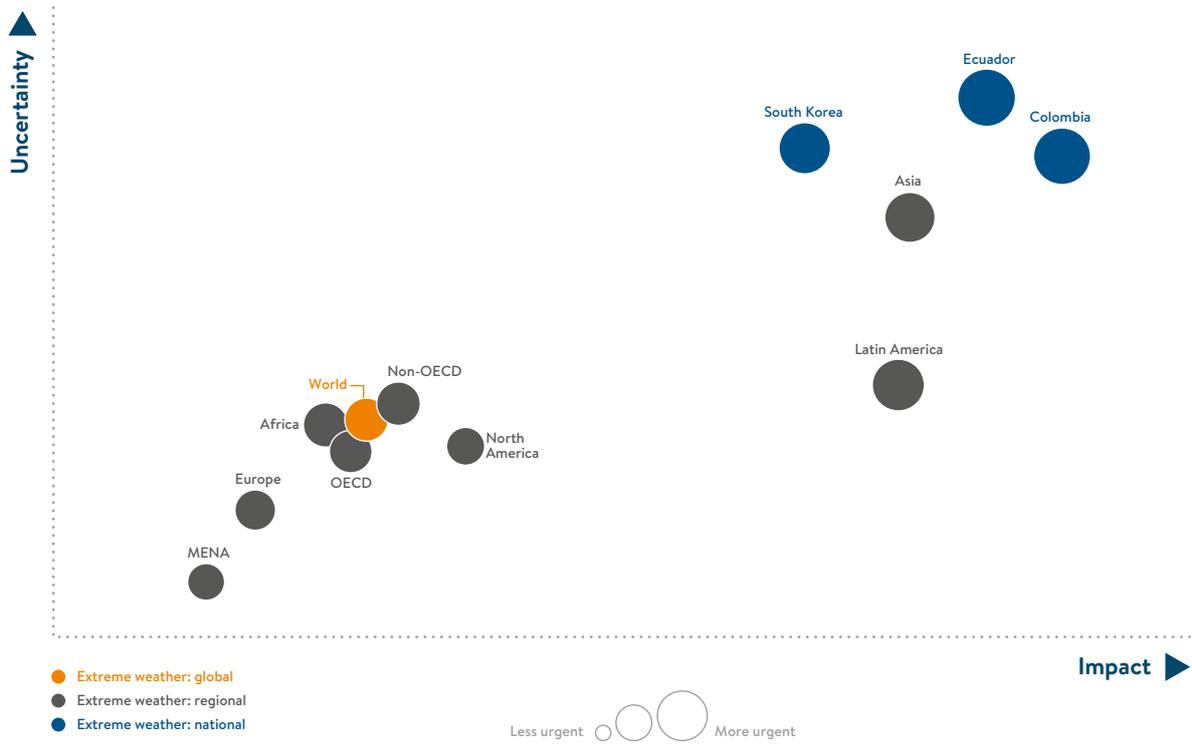
Lower commodity prices have also meant a challenge in terms of social policies in the region. Many countries, in particular those such as Venezuela and Ecuador, relied on income from oil exports to finance social expenditure and programmes. The new tight fiscal situation has put some of these policies in a difficult scenario and governments now have to deal with social unrest and protests. Not surprisingly energy subsidies have become a high impact issue, reflected most notably in the national agenda for Argentina, where, since the new government took office at the end of 2015, it has changed many policies the previous government had in place. One of the key reforms the government has intended to carry out is that of phasing out energy subsidies since the current scheme has seriously compromised investments in the market with many companies operating with losses for years. However, this has a huge social cost and the government has found this to be one of its greater barriers towards reform, hence the continued uncertainty associated to the issue. On the other hand, in energy importing countries, the debate is about whether a low commodity price environment is the moment to start ‘sun-setting’ and build momentum around declining subsidies to fossil fuels which currently represent a huge fiscal burden for governments and constantly prove to be inefficient and don’t reach the intended target.

It is no surprise that the Latin American map shows US policy as one of the critical uncertainties for the region. The election of Donald Trump as President of the United States brings a lot of uncertainty to Latin America. His promises during the campaign, in terms of immigration and trade, could have a potentially negative impact in the region which has a high dependence on the US thus could seriously affect investment flows. The other uncertainty relies on the impact future US policies towards coal and oil could have on international prices, which are critical for many governments in the region.

Moving onto other issues in the map, hydropower continues to be an action priority with particular emphasis for leaders in Latin America, in contrast to all other regions. Most countries in the region are still highly dependent on this resource to generate electricity; with much potential still to be developed; estimated at 1,400,066 GWh/year.<sup>97</sup> However, the increased frequency of extreme weather events and the growing social and environmental concerns to develop large hydro projects are issues which concern energy leaders in the region. In recent years’ big hydro projects have faced serious challenges due to social and environmental issues, demonstrated by projects such as Hydro Aysen in Chile which was stopped and Barro Blanco in Panama for which the future development remains yet to be determined. Future hydro projects in the region will face ever growing challenges and governments and companies must ensure the right policies and regulations are in place to ensure investment flows to develop these resources but at the same time do so in a way in which local communities are benefited and social and environmental impact are minimised.

97. World Energy Council, 2015, Charting the Upsurge in Hydropower Development

# EXTREME WEATHER RISKS AS A TOP CONCERN FOR LEADERS IN THE LAC REGION



Interlinked to the issues concerning hydro, it is no coincidence that Extreme Weather events are placed as a critical uncertainty for Latin America, much more than for any other region. The huge dependence on hydro to generate electricity makes the matrix very vulnerable to extreme weather. The droughts experienced with el Niño in early 2016 were some of the most severe in history with countries like Colombia and Venezuela seriously affected; the latter was able to go through the crisis with an energy saving campaign and imports from Ecuador but the former did have to go on power cuts. It is clear the region needs to address its vulnerability to extreme weather and make its system more resilient. Innovative financing options which take into account these risks should be introduced in the region; whilst simultaneously encouraging a greater diversification of the electricity matrix and utilising renewable energy resources such as wind and solar which are complementary to the hydrological cycles in the region.

The other key issue to address the lack of resilience in the regions electricity matrix is the issue of regional integration due to the complementarity of hydrological cycles between the north and south of the region. El Niño, for example, manifests itself as droughts in the north of the equator but as rains in the south of the equator; which means that while hydro generation in the north can be seriously diminished, southern countries can have excess generation at the same time, and it is here were regional integration can play a vital role. The position of regional integration in the map is surprising given the huge role it can play ensuring resilience. The region is highly aware of the benefits and many studies have been done in the matter; however, there are still barriers which prevent actual integration from happening, seen in the South America area through projects like SINEA not advancing at the

expected rate. On the contrary, Central America, through its SIEPAC project, which interconnects all countries from Panama to Mexico, is much more advanced on the matter and serves as a valuable experience on building a regional electricity market and the challenges involved.

Issues related to technology are now moving to the critical uncertainties area. The region has increased concern on these issues and recognises the importance they will play in the future, however there remains a lack of knowledge on them which is reflected by the high uncertainty. The movements show how smart cities, electricity storage and innovative transport have had important movements in the past year. All of these issues are interrelated and will play a key role in shaping the electricity markets and systems of the future and the region needs to increase its actions on these matters. In terms on innovative transport it is interesting how this issue has now become one of the top uncertainties for leaders in the region. An explanation for this positioning is not straight forward and could be due to the fact that transport plays an important role in Latin Americas energy use and it is doing so in an inefficient and costly manner, for example, in 2014 transport represented 37% of final energy consumption in the region compared to a global average of 28%.<sup>98</sup> Furthermore, there are increasing expectations around the future of transportation and innovation in this area as a key sector to address when referring to COP21 targets. New forms of transport need to be explored to make transport more energy efficient and less contaminant. However, this strongly contrasts with the position of biofuels which is categorised as an issue with low impact and uncertainty for the region, with a notable exception for the national agenda in Brazil with a higher impact attributed to the issue.

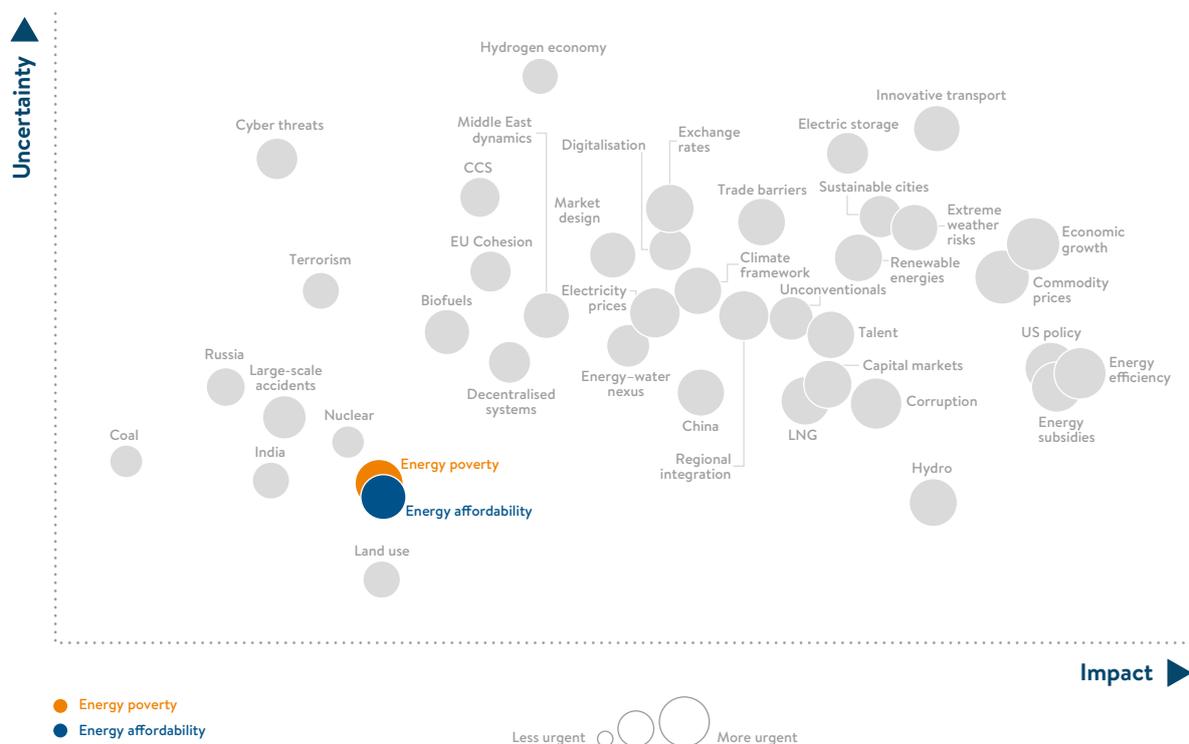
98. World Energy Council 2016, World Energy Scenarios: The Grand Transition

# HIGH UNCERTAINTY AROUND RENEWABLE ENERGIES FOR ENERGY LEADERS IN THE LAC REGION



Another surprising issue is that of renewable energies. When comparing to the rest of the world, Latin America is the only region where renewables remain classified as an issue of high uncertainty and not as one where action is perceived to be needed on a more certain basis. The region has an enormous potential for renewable energies and countries including Uruguay with a broad experience in wind. The past year successful auctions in Peru and Chile were carried out and renewables reached very competitive prices winning over other conventional resources. Although many countries in Latin America have done important advances on this, others like Colombia are still lacking a clear policy and regulation on the matter despite the enormous benefits the introduction of these resources could bring to the electric system, given the complementarity they have with the abundant hydropower in the country. In contrast, despite the reduced importance of coal at a global and a regional level, Colombia still sees impact of this issue in the national agenda. The Colombian government in its energy planning and scenarios, projects a higher proportion of coal thermal plants participating in the electricity mix aimed to take advantage of the abundance of the resource in the Cerrejón open pit mine.

## BOTH ENERGY POVERTY AND AFFORDABILITY PERCEIVED AS LOW IMPACT ISSUES



The map shows some issues which should be higher on the regional agenda but energy leaders have classified neither as a need for action nor a critical uncertainty. Energy access and energy affordability are classified as issues with very low impact and uncertainty. This is quite surprising and disappointing that energy leaders view them with such low priority given that Latin America still performs badly on these matters in the Energy Trilemma Index.<sup>99</sup> The region has still got big challenges in terms of ensuring all its citizens have access to energy services, including electricity and clean cooking, at an affordable price. Access to clean cooking in rural areas is only 54% in the region, below the global average of 57% and lagging behind more developed regions like Europe which has an 85% access to clean cooking. Countries like Ecuador have carried out interesting policies to address this issue, for example by replacing stoves for induction stoves all over the country at a rate of 5,800 stoves being replaced each week. All of this is supported by a change in their electricity matrix which was reliant on fossil fuels but is now mostly hydro powered thanks to the eight new hydro plants being constructed and beginning operations this year. This has allowed the country to increase access to clean cooking and at the same time it has resulted in savings for the government since it no longer has to subsidise GPL which represented a huge fiscal burden.

Finally, Latin America is a region which has suffered big changes in the past years which have affected its politics and economics. Some of the most important issues to highlight are the impeachment process and corruption scandal in Brazil, which is reflected on the map by a movement of the corruption issue from a critical uncertainty in last year's report to a need for action. On the other

99. World Energy Council, 2016, World Energy Trilemma Index: Benchmarking the sustainability of national energy systems

hand, the peace process in Colombia could have positive impacts in the economic performance of this country and the region. Finally, the crisis in Venezuela continues to grow and create tensions with its neighbours, the uncertainty of the situation here and the important role this country plays in the oil sector will be critical for the future development of the region.



matrix such as the bidding of 1.6 GW of renewable energy generation projects (mainly solar and wind energy) and the promotion of the production of the unconventional resources of Vaca Muerta (already the biggest unconventional oilfield outside US).

After a decade (2000's) of high GDP growth, recession has impacted in the country. The last four years show a total growth of 1% in GDP and 2016 seems to be in the same path. A smooth rebound in economy is expected in 2017. Regarding corruption, several trials and imprisonments of the former government have been made, yet there is long path to go.

Although the ambitious energy policies will actually benefit Argentinean energy sustainability, they are also related to the occurrence of four main critical uncertainties that have been determined by the latest Issues Monitor. These critical uncertainties are the **commodity prices, electricity prices, energy subsidies** and **capital markets**.

After a decade of a regulated oil price barrel, this policy seems to be ending or weakening to a large extent. The new government seems to be supporting the use of international oil prices, which will open foreign markets; however, adjustments of the oil and gas companies will be required. Furthermore, the new government is encouraging a rise in electricity and gas tariffs in distribution. The prices have been fixed for years, discouraging investment in these industries. The new policy may bring new investments to reduce blackouts or gas imports but there is a huge social impact with the new prices.

Finally, Argentina opened to international capital markets with relative success after years of isolation. The main issue to address in the following years is how to avoid the use of debt to pay current expenses and use it for long-term infrastructure.

When comparing the view of leaders in Argentina versus the global level; economic growth and energy efficiency are uncertainties in Argentina but an action priority in the world. In the case of efficiency, this may be explained by the recent priority given to this issue by the government. Maybe in the following years it may become an action priority in Argentina also as uncertainty is reduced. As for economic growth, the future is much more uncertain in Argentina than in the world. According to the issues monitor the critical uncertainties of the world are not the same ones of Argentina; with particular note to highlighted the poor performance of the climate framework and market design. As long as social needs are not covered, environmental awareness seems to be a "nice to have". Regarding market design, due to subsidies distortion its functioning was complicated at the national level.

In comparison to the regional picture for LAC; the action priorities in particular show some differences. Hydro is already developed in Argentina, therefore is an action priority for LAC but not for Argentina, and while there is some potential left it is not in the same extent as countries such as Ecuador, Colombia and Brazil. In addition, energy efficiency, is once again an uncertainty in Argentina but an action priority in LAC. Moreover, regarding critical uncertainties the issues monitor shows that the role of extreme weather risks and US Policy are less important in Argentina than LAC. This is due to the greater dependency of other powers such as China or Brazil and the lower amount of hurricanes (Central America), earthquakes (Andean region) or droughts (Brazil).

The major issues in Argentina seem to remain constant for the last three years. Two main exceptions can be remarked. First, exchange rates have stabilised after years of great fluctuation, thus the lower importance in the latest report. The same trend can be seen for sustainable cities; though the reason for this seems to be unknown or less clear at present.

Argentina shows economic growth, regional integration, energy efficiency and corruption as main action priorities and commodity prices, electricity prices, energy subsidies and capital markets as critical uncertainties. More than half of these issues are not the same ones that are seen as critical in LAC or in the world. Nevertheless, in general, the Argentinean main issues seem to be consistent across the years.



Both Petrobras in the oil sector and the electric power companies are highly indebted. Therefore, a review of corporate portfolios is underway, with possibilities for many mergers and acquisitions of operations. In this sense, some initiatives have been developed in the last few months, highlighting the change in the regulatory framework for the exploration and production of oil and natural gas in the Pre-salt areas, which was sanctioned by President Temer on November 29th, 2016. According to this modification, Petrobras will no longer be the only operating company in Pre-salt. In each bid, Petrobras will have the option to participate or not, depending on its evaluation and according to its business interests. In the previous regulatory framework, Petrobras was obliged to participate in all areas of the Pre-salt with a minimum participation of 30%.

### **Extreme weather events**

The National Electric System Operator (ONS) anticipates the recovery of hydroelectric reservoirs in 2017, according to information from its director general Luiz Eduardo Barata, disclosed by Reuters on October 27th, which means that Brazil will be better prepared to face the extreme climatic events in the months ahead.

South-eastern hydroelectric plants, which concentrate the largest reservoirs, are expected to be 40–50% capacity by November 2017, which would be almost double the 27% expected for the same period of this year. According to the director general of ONS, dams are expected to recover with the help of a wet period near the historical average in the Southeast and South, although signs are that the severe drought in the Northeast should continue.

“The signs that the climate group is giving is that we should have a summer (with rains) around the average in the Southeast and South. For the Northeast we should not have change,” said Barata. If this expected recovery of the Southeast reservoirs is expected, ONS may opt for a reduction in the dispatch of thermoelectric plants, which have a more expensive generation, which would reduce energy costs in the coming year. “This is less thermal, cheaper costs. What we want is cheaper fares with security,” he said.

South-eastern hydroelectric plants currently account for 35% of capacity. The mills closed November 2015 with 27.5%, while in 2014 the month ended with 16% storage in the region’s dams.

### **Renewable energy**

Hydroelectric plants, present a positive expectation for 2017: growth in the installed generation capacity and an increase of the reservoir levels of the plants in the Southeast region, which should result in an increase in generation in 2017, when compared to the levels reached in 2015 and 2016. With regard to the expansion in wind power, Brazil has just reached the flagship of 10 GW of installed capacity, distributed in 400 parks and more than 5,200 wind turbines. For example, the Belo Monte hydroelectric plant has a capacity of just over 11 GW. In 2015, wind energy was the fastest growing source in the Brazilian electricity matrix, accounting for 39.3% of the expansion, followed by hydroelectric power (35.1%) and thermoelectric power (25.6%).

In world terms, Brazil has stood out. According to the GWEC – Global World Energy Council, Brazil was the fourth largest wind energy country in the world in 2015, considering installed capacity

numbers behind China, the United States and Germany. In percentage terms, it was the fastest growing country in the world. According to the “Brazil and World Wind Energy Bulletin – Base 2015”, released by the Ministry of Mines and Energy in August 2016, Brazil has risen seven positions in the last two years, occupying eighth place in generation.

Wind energy accounts for 7% of the Brazilian installed capacity generation matrix, currently. Considering already signed contracts, the country will reach 2020 with more than 18 GW and has the potential to grow even more. For a country like Brazil, with so many abundant natural resources and one of the best winds in the world (average capacity factor of 38%, against the world average indicator of 24%), this is a path not only natural, but also strategic, to invest to expand wind energy. Wind power has a very important role to play in helping to achieve Brazil’s goals at COP21, since its environmental impact is very low and the operation is practically zero.

The favourable situation of the wind industry can be explained by the excellent quality of the Brazilian wind and also by the strong investment of the companies that in the last five years have built a national productive chain to sustain the commitments assumed and the enormous growth potential of this energy source. The major manufacturers of wind turbines, blades, towers and large components are installed in Brazil, producing and contracting here. In addition, dozens of Brazilian companies were created or started to dedicate themselves to offer components for the productive chain.

As for the expansion of solar energy plants in Brazil, it is still in an incipient stage, and possible incentives such as the reduction of the tax burden of the solar energy sector are under discussion, as presented by participants of an interactive public hearing promoted on 11/24 By the Infrastructure Services Committee (IC) of the Chamber of Deputies.

Another point to leverage the plants of the photovoltaic area, according to the president of the Brazilian Association of Solar Photovoltaic Energy (ABSOLAR), Rodrigo Lopes Sauaia, would be for the government to carry out at least two auctions per year of reserve energy specific to the photovoltaic area and that such contracts will move from the current 20 years to 25 or 30 years, which would help reduce the price of solar energy supplied to the government.

### **Fuel prices**

In 2016, Petrobras started a new price policy for oil products, aiming to align domestic and international prices. The new pricing policy provides for adjustments at least once a month. From October to December 2016 some oil products, such as diesel, gasoline and liquefied petroleum gas, had their prices changed downwards or upwards, due to the exchange rate and the alignment with international prices.

This new fuel price policy in Brazil represents a paradigm shift from the one adopted in recent years when domestic prices of oil products and natural gas were not aligned with those of the international market, generating huge subsidies and losses of revenues to Petrobras, especially when oil prices exceeded US\$ 100.00/barrel.

### Electricity prices

Electricity prices in 2016 are increasing near levels of inflation. Until September, compared to the same period of 2015, tariffs in the residential sector increased by an average of 9.6%, in the commercial sector 9.4% and in the industrial sector 8.0%. As we accumulate a larger period of 2016, the comparison with 2015 presents a lower percentage increase, because the high electricity price increases (+40%) were concentrated in the beginning of 2015.

In 2017, with a higher share of hydro generation in the energy supply, the need for natural gas thermo-generation will be lower, factors that cause prices to behave at the level of inflation in 2017, or even with a small decrease.

### Energy efficiency

The energy efficiency initiatives in Brazil are coordinated by the two institutional programmes: PROCEL (National Program for the Conservation of Electric Energy) and CONPET (National Program for the Rationalisation of the Use of Oil Products and Natural Gas). Both are managed by the Ministry of Mines and Energy.

PROCEL aims to promote energy efficiency through actions to combat the waste of electricity and reduce consumption. Established over 30 years ago, PROCEL has achieved significant results. In 2015, it was responsible for saving more than 11 billion kWh, or approximately 2.5% of the country's electricity consumption.

On May 3rd, 2016, Law 13,280 was approved, reinforcing the allocation of resources to PROCEL, which became entitled to 20% of the resources that electricity distributors should invest in energy efficiency actions. Based on the resources allocated by the distributors in recent times, the law may direct PROCEL to approximately R\$ 100 million per year. The new law also creates the Energy Efficiency Management Committee (CGEE) and assigns to the National Electric Energy Agency (ANEEL) the competence to define the collect schedule and the form of payment of the resources that must be invested in PROCEL.

In relation to CONPET, it acts in the energy efficiency of equipment labelling (stoves and heaters) and light vehicles, fuel quality, education through publications in schools and transportation. CONPET in transportation for heavy vehicles has the objective of promoting increased efficiency in the use of diesel oil in buses and trucks. As a result, in addition to fuel economy, there is a reduction in black smoke and gases associated with global warming. The programme's actions are developed through partnerships with syndicates and federations of transporters, state and municipal transport and environment secretariats, warehouses for loading or distribution of products, as well as refineries, supply terminals, fuel stations and engineering area of Petrobras. Like PROCEL, these are crucial points to ensure the achievement of CONPET's objectives, the issues of resources allocated, and the governance of initiatives to involve many class, business and government entities.

### Corruption

The investigations and results of the Lava Jato operation began in 2014 and have already resulted in the arrest of several executives of service companies, Petrobras and politicians who had served in

important positions. Unfortunately, the political uncertainties related to corruption continue and may also have negative impacts in 2017, as new revelations are evaluated and judged under the Lava Jato operation. The expectation of the Brazilian civil society is that the institutions of the Judiciary continue to exercise their full performance and that the results of the Lava-jet are a very positive turning point to reduce the cases of corruption in the Country.<sup>100,101,102,103,104,105</sup>

100. MME-Boletim Mensal de Energia (2016 September)

101. MME-Boletim de Energia Eólica Brasil e Mundo – 2015 Base

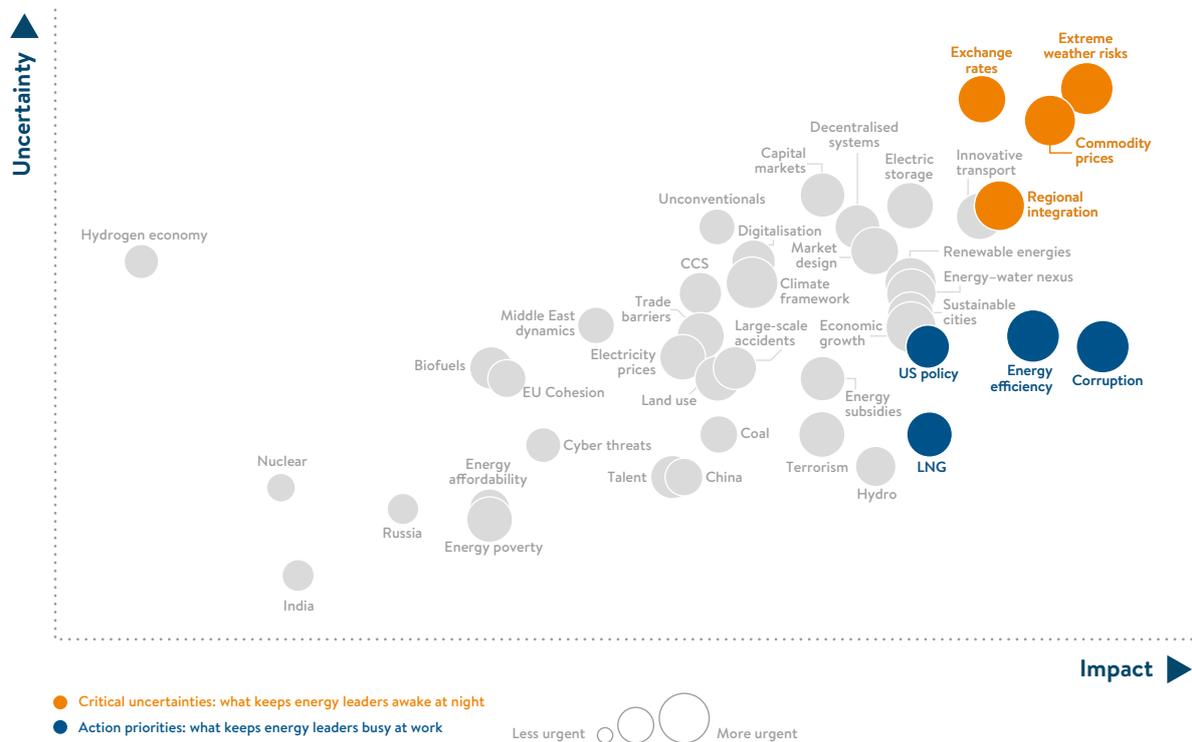
102. ANEEL-Boletins de Informações Gerenciais e de Geração – 2016 September

103. ANEEL – Boletim Mensal de Monitoramento do Sistema Elétrico Brasileiro – 2016 September

104. ANP – Boletim de Produção de Petróleo – 2016 October

105. Relatório Focus-Banco Central – 2016.12.02ABEEólica e ABSOLAR

## COLOMBIA



The El Niño phenomenon confirmed the vulnerability of the Colombian energy system to extreme weather events. This has highlighted the urgent need to diversify the energy basket in which electricity generation based on water resources is now predominant (75%). Diversification should include a greater participation of non-conventional renewable energies (solar, wind and biomass) for which is disposed a public policy instrument such as Law 1715 of 2014, which promotes these energies.

The low prices of oil and coal implied a reduction in hydrocarbon exploration activity, causing a deficit in the country’s fiscal revenues and causing a drop in economic activity, which was reflected in lower energy consumption. Looking ahead, regulatory action is being taken towards the modernisation of the country’s energy market. The congress has recently discussed a tax reform that would involve the implementation of taxes on fuels with large CO<sub>2</sub> emissions, a matter of concern to entrepreneurs.

The impact of the Paris Agreement, COP21, imposes the implementation of measures that reduce vulnerability to climatic phenomena in our energy mix. The different economic sectors and leadership currently expand their ‘Roadmaps’ to face the challenges associated with the commitments of the COP21.

Colombia, in 2017, begins the full implementation of the Peace Accords, which will involve formalising productive developments that will require modern energy supply. Equally, it is necessary to progress in meeting the goals related to the energy integration of the non-interconnected zones of the country.

The Colombian economy has not achieved a significant diversification, so it continues to depend on revenues from the hydrocarbons sector and therefore on the evolution of its international prices to guarantee its economic growth.

Colombia is an exposed country to major climatic impacts and natural disasters, which implies a great uncertainty about the management of the infrastructure and the energy sector as a whole. The regulatory developments, considered slow until now, should be more agile to achieve results in the diversification of the energy mix and decarbonisation of the Colombian economy.

On the other hand, the national findings show the evolution of the energy efficiency issue throughout the sector, where actions and policies are being undertaken that should generate results in the short term through regulation and measures such as energy labelling for household appliances circulating in the Country. These allow a better understanding for variables about the efficiency and the energy consumption. Also highlighted are issues such as US policy and Terrorism, which shows the perception of the senior leaders about having less uncertainty and greater criticality of these two factors, due to the great progress in the peace process.

Issues such as energy storage, decentralised systems, market design, renewable energies and sustainable cities, are beginning to have an increasing share in the energy issues of the country and an accelerated interest in the sector. As such these are being emphasised in impact for energy leaders, moving more and more towards the critical uncertainty space and becoming an increasing focus for events, initiatives and pilot projects that seek the development of these issues. Furthermore, corruption remains import in the country, with the potential to undermine the development of new projects or affect the activity of energy companies, compromising long-term security of supply.

The greater changes in the map in relation to the previous year can be evidenced in the exchange rates, given the dependence of the national economy on the hydrocarbons sector, and the previous fall in commodity prices which have considerably affected the behaviour of foreign exchange in the country. Issues such as energy efficiency become uncertain as regulation remains behind the country's needs. Corruption continues to increase its impact in a disturbing way in the evolution of the issues map of Colombia.

Finally, the map of Colombia, the LAC region and the world have many issues in similar positions, especially those related to technological innovations and those that help to reduce the consequences of climate change such as energy storage, innovative transport, energy efficiency and LNG. This shows that the country is increasingly aligned with the requirements and advances of the global energy sector which open opportunities for collaboration and international cooperation to build solutions.



Although there were presidential, municipal and congressional elections in the Dominican Republic in 2016, the political party remained the same. The authorities, looking for a solution to the crisis in the electrical sector, invited the national leadership to a dialogue called “Electric Pact” that is still under discussion, to seek out consensual solutions to the problem of the electricity sub-sector of the Dominican Republic.

At present, the most significant change that is expected regarding energy efficiency is the construction of a coal power plant called ‘Punta Catalina’, which is projected to be operational by 2018, which will significantly change the generation matrix, reducing fuel oil dependency.

One of the top priorities of the authorities is aimed at establishing a transparent climate for investment, where private investors feel that the rules are clear and defined without any change in the medium and long term. For that, at the moment, it is conducting tenders of purchase of energy where the generators are participating in similar conditions.

Across the country, the transport of goods and passengers is performed using gasoline and diesel. Due to the large number of old vehicles, narrow roads and poor enforcement of traffic laws, land transport is the biggest fuel consumer.

At a global and regional level, the priorities presented by the Dominican Republic are similar, although in some aspects the problems presented are more acute, while in others, their impact is insignificant, if not null. The fact of being an island, shared with another small nation and not in continental territory, has forced the energy sector to look for individual solutions that are much more expensive.

The challenges of the Dominican Republic are the financial impact of international fuel price fluctuation, for the central budget of the country. This variation in fuels affects multiple sectors, especially for both electricity generation and transportation.

The only way to mitigate the impact of changes in international prices is to make energy consumption more efficient to enable it to handle the energy subsidies. To that end, the country must give continuity to the National Development Strategy, which defines the guidelines to achieve acceptance rates in the energy sector as well as in the economy as a whole.

# Chapter six

## Assessing the energy agenda for the Middle East and North Africa

MIDDLE EAST AND NORTH AFRICA (MENA)

Lebanon

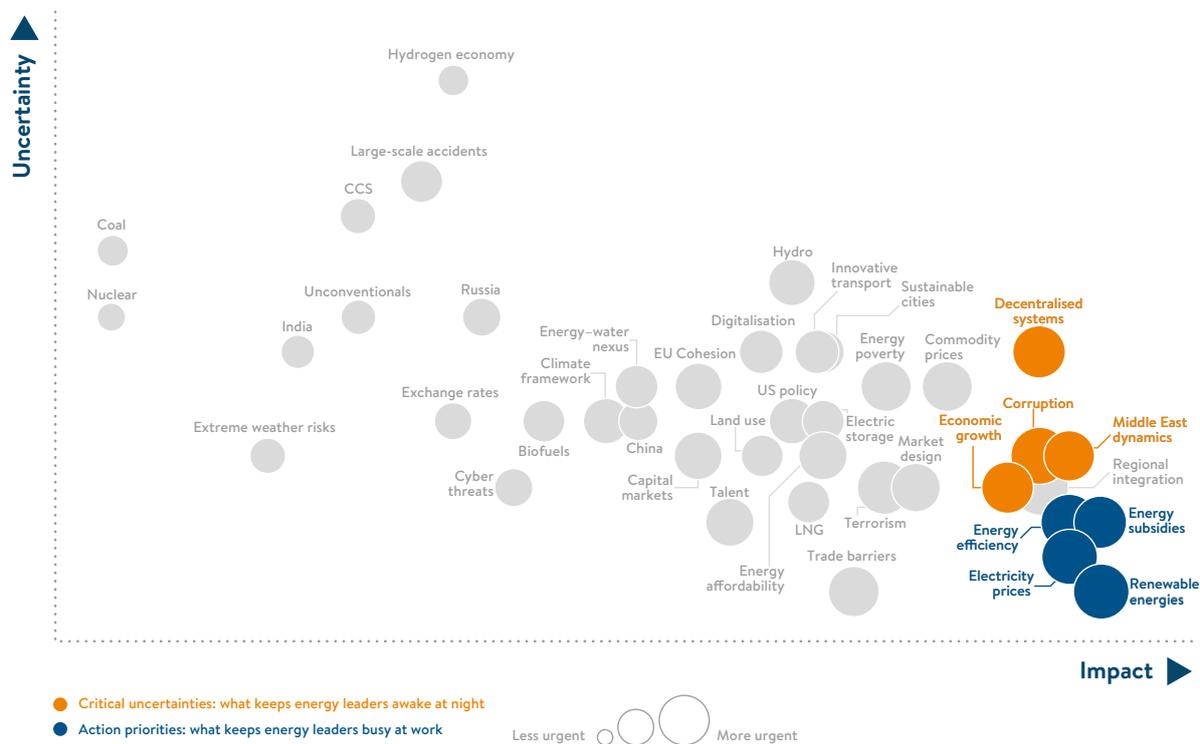


the Dolphin pipeline is currently under negotiation and the outcome is uncertain. In electricity, the regional interconnection grid provided by the GCC Interconnection Authority, provides an opportunity for the creation of a regional power market but the countries involved cannot agree what form such a market would take.

LNG moves linearly along the impact axis reflecting the growing market for natural gas in the region and falling production of associated gas from local oilfields. LNG imports are increasingly viewed as a solution to the region's gas shortage, especially in the GCC where both Kuwait and the UAE have recently built new LNG import facilities.

Of note, it the fact that most of the energy sources that compete with oil such as coal, biofuels, nuclear and hydro remain off policymaker's radar screen with low uncertainty and impact factors despite that fact that the region is planning a clean coal project (Dubai) and four nuclear reactors (Abu Dhabi). The major exception is renewable energy that remains a critical uncertainty even as the region races ahead to grab the opportunities afforded by low solar PV technology costs and high solar intensity. The critically uncertain factor for the reason could lie not in the opportunities at home but the threats from abroad where renewable energy is grabbing an ever-increasing slice of the global energy pie.

## LEBANON



Compared to the 2016 issues monitor, the main critical uncertainties and action priorities that concern energy leaders in Lebanon have not changed significantly. However, in this year’s monitor, many other issues have increased in the potential impact assigned to them by Lebanese energy leaders and we witness a clustering of issue areas around the medium to high impact area of the monitor. This trend visually captures the urgency with which the Lebanese government needs to address the key uncertainties and action priorities after more than two years of political paralysis caused by the repeated failure of parliament to elect a new president, a position which had been vacant since April 2014. Leaving the top critical uncertainties and action priorities unaddressed for so long has had clear knock-on effects on related issues, which are now increasing in perceived impact. This issues monitor reflects the enormous challenge that the government of Lebanon now faces: undertaking a fundamental reform of the country’s energy sector against a backdrop of continuing regional turmoil.

The Office of the United Nations High Commissioner for Refugees (UNHCR) estimates that by 31 December 2015, the number of Syrian refugees in Lebanon had reached 1,069,110 people.<sup>106</sup> This enormous influx of refugees has put a significant strain on the Lebanese budget. More than that, the conflict in Syria, in which Hezbollah is actively involved, still prevents the realisation of the Eight Country Electric Interconnection Project, which was concluded in October 2008 to connect the grids of Egypt, Iraq, Jordan, Libya, Lebanon, Palestine, Syria, and Turkey, and which would have the potential to increase Lebanese energy security, which in the 2016 World Energy Trilemma Index was ranked 113th in the world, making Lebanon the least energy secure country in the Middle East and

106. <http://reporting.unhcr.org/node/2520>

North Africa Region.<sup>107</sup> Middle East dynamics and regional interconnection are thus identified as critical uncertainties by Lebanese Energy leaders.

While external political events have stalled efforts to increase energy security through regional interconnection, gridlock over filling the vacant presidency in domestic politics has led to the continuous postponement of an auction process for the exploration and exploitation of Lebanon's significant off-shore gas reserves.<sup>108</sup> The government's inaction has also allowed corruption, identified as another critical uncertainty, to spread further, with Transparency International's 2015 Corruption Perceptions Index ranking Lebanon 123rd out of a total of 168 countries surveyed.<sup>109</sup>

Corruption is a substantial problem for the energy sector in particular as it is believed by many to have contributed to the ineffectiveness of the large amounts of government subsidies that have been given to the national utility, Electricité du Liban (EDL). The neglect of infrastructure maintenance requirements, the inefficient collection of electricity tariffs, and a substantial amount of power being lost due to pilferage have kept energy prices high, while quality and reliability of supply have remained poor.<sup>110</sup> The resulting urgent need for electricity subsidy and price reform leads to their classification as immediate action priorities.

The poor quality of electricity supply has caused a large part of the population, especially in rural areas, to fall back on small-scale local generators. But it has also triggered a movement towards the increasing uptake of renewable energies to harness the country's significant potential for solar PV and wind energy generation. A programme by the United Nations Development Programme and the Global Environment Facility, which will spend over 1,500,000 USD in the period 2014–2017 on capacity building and implementation of decentralised renewable energy generation (DREG) projects seems to have yielded its first results as solar capacity has increased substantially over the past years.<sup>111</sup> However, the high level of uncertainty that is assigned to the issue of decentralised systems may indicate that there is still some work to be done regarding knowledge and technology transfer.

In addition to DREG, the country has also started to put the tenets of the first National Energy Efficiency Action Plan, which includes plans for initiatives to scale up solar and wind power generation,<sup>112</sup> into practice through the construction of utility-scale renewables projects, such as the innovative Beirut River Solar Snake project, where 325 meters of the river is covered in solar panels resulting in a peak capacity of 1.08 MWp.<sup>113</sup> Renewable energies continue to be an action priority for Lebanese energy leaders.

107. World Energy Council, 2016, World Energy Trilemma Index 2016

108. [www.aljazeera.com/news/2015/06/billion-dollar-gas-deals-hang-lebanon-power-balance-150603101604881.html](http://www.aljazeera.com/news/2015/06/billion-dollar-gas-deals-hang-lebanon-power-balance-150603101604881.html)

109. [www.transparency.org/cpi2015#results-table](http://www.transparency.org/cpi2015#results-table)

110. [www.al-monitor.com/pulse/originals/2015/01/lebanon-electricity-supply-debt-disaster.html](http://www.al-monitor.com/pulse/originals/2015/01/lebanon-electricity-supply-debt-disaster.html)

111. 2015 Solar PV Status Report for Lebanon ([www.lb.undp.org/content/lebanon/en/home/operations/projects/environment\\_and\\_energy/small-decentralized-renewable-energy-power-generation.html](http://www.lb.undp.org/content/lebanon/en/home/operations/projects/environment_and_energy/small-decentralized-renewable-energy-power-generation.html))

112. [www.rcreee.org/sites/default/files/plans\\_neeap\\_lebanon\\_2011\\_en.pdf](http://www.rcreee.org/sites/default/files/plans_neeap_lebanon_2011_en.pdf)

113. [www.brsslebanon.com/](http://www.brsslebanon.com/)

On 31 October 2016, the Lebanese parliament elected a new President.<sup>114</sup> As the 2017 issues monitor clearly shows, the new administration is now facing a formidable challenge in trying to address the effects that over two years of gridlock in Beirut have had, while unrest in Syria continues. A key priority for the energy sector would be the swift implementation of the second National Energy Efficiency Action Plan (2016–2020), which focuses on energy savings, while at the same time continuing the momentum of renewables uptake and engaging in exploitation of the country's off-shore gas resources to improve energy security.

114. Note that results for the present issues monitor were collected before the October 2016 presidential election

# Chapter seven

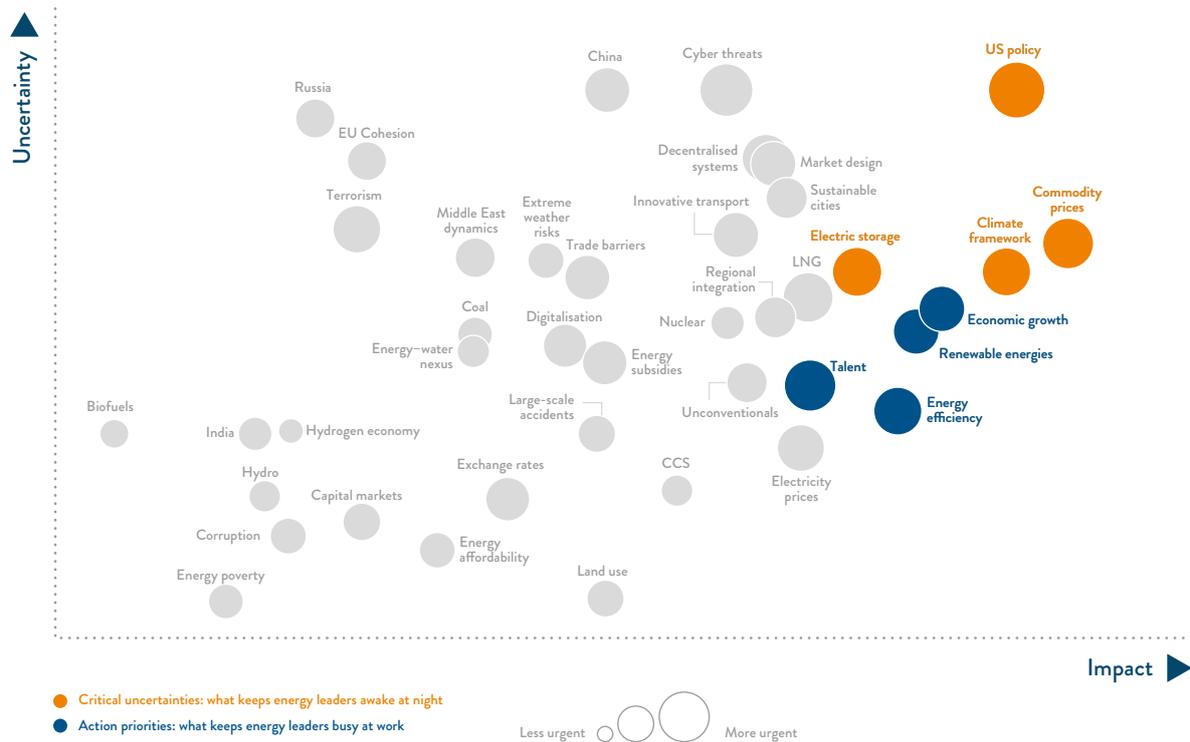
# Assessing the energy agenda for North America

NORTH AMERICA

Canada

Mexico

## NORTH AMERICA



There is no question that the recent presidential election and administration change is generating a renewed focus on US policy and creating uncertainty across North America. While many industries in our region face some form of policy uncertainty, the energy industry is feeling it acutely, particularly in the areas of carbon policy, energy efficiency and renewable energy development. US policy uncertainty extends beyond the US and will be felt in Canada and Mexico making energy trade and trade agreements other important issues.

US policy uncertainty at the federal level may be offset by the established trends in consumer demand and actions to date in key areas. In many parts of North America, the trajectory has been set toward clean energy, driven by consumer demand and state level climate change frameworks showing a continued push toward renewables, climate framework design and energy efficiency. While uncertainty alone has its issues, many in the industry are taking a “wait and see” approach as the policy agenda for the new administration takes shape and the pace of change becomes clearer.

Other uncertainties in our region include commodity prices and electric storage. While natural gas and oil continue to trade near historic lows (albeit creeping higher in the last year), energy infrastructure investments require long-term confidence in pricing. There remains a degree of doubt that the stability in commodity pricing will continue for the duration of those investments. The abundance of natural gas in the United States and Canada, however, has assuaged fears about energy security and commodity price risk based on foreign policy. Nonetheless, public dissent, largely around proposed fracking projects and building new pipeline infrastructure will continue to cast some doubt on the viability of these projects coupled with uncertainty around commodity prices into the future.

Even in a low commodity price environment, electric storage is becoming increasingly competitive in parts of the energy market, meaning that more renewable energies can be brought online without disrupting reliability. At this point, most storage projects are being done on a smaller scale but how and when large scale electric storage is developed will be partially based on outright cost competitiveness, but also climate frameworks, long-term commodity price uncertainty, progress on greening electricity generation, and advances in the efficiency of storage solutions.

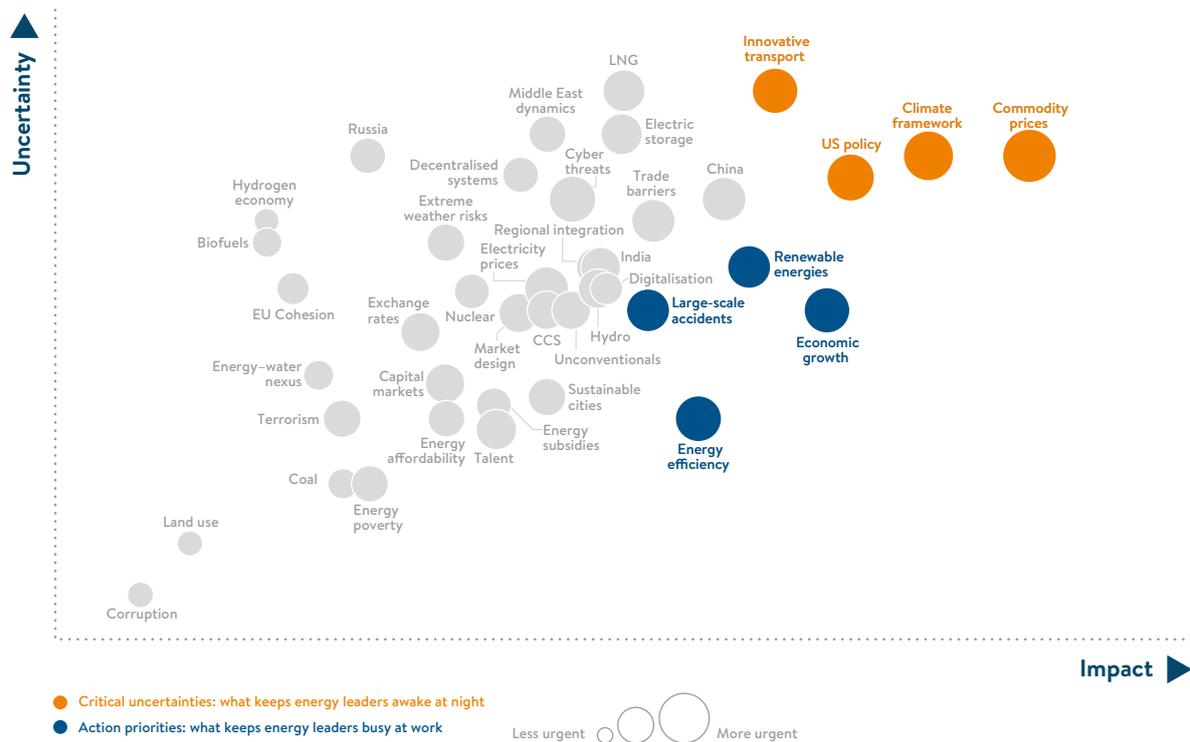
Not surprisingly, economic growth continues to be a key driver for energy market development in our region. If there is one action item that keeps the energy industry up at night, it is a desire to develop the economy to spur growth in energy industry development.

Economic growth is also the driver for energy use throughout North America and sets the tone for other energy industry action priorities like a focus on renewables and energy efficiency. In areas where the economy is struggling, there is greater focus on energy pricing. Higher growth areas may have a greater opportunity to adopt renewable energy more quickly. However, with the cost to build wind and solar projects starting to come close to parity with traditional generation, it won't be long before renewable energy projects are built without needing incentive support. Likewise, energy efficiency initiatives often require upfront investment and therefore they tend to be more prevalent in areas where the economy is thriving, but this is not always the case and as technology prices decrease, the correlation between a strong economy and the push for energy efficiency is likely to weaken.

Talent acquisition and retention will continue to be a focus for our industry in 2017. Like many industries that are transforming, the demand for top talent is critical as new opportunities and technologies continue to reshape the energy industry. Combined with generational turnover, energy leaders will continue to monitor this risk and be concerned about how to build the right teams required to achieve the transformational goals they have set for their organisations and the industry as a whole.

In general, the North American region is characterised by healthy regional collaboration and integration in key areas, reasonable energy prices, momentum on renewable generation and public support of climate change initiatives. In contrast, electricity prices are a higher priority in most other regions of the world. In North America, despite the focus on US policy uncertainty, there is abundant opportunity for the energy industry to develop both traditional forms of energy and new technology to deliver cleaner energy in the region.

## CANADA



### National overview

2016 has been a busy year for Canada’s energy sector. Highlights are major initiatives in energy and climate policy announced by the federal and provincial governments and federal approvals for to major energy pipeline projects and LNG projects.

Production, transportation and use of Canada’s abundant and diverse natural resources make up a significant share of the Canadian economy. Since these activities are highly energy-intensive and given the northern latitude and continent-wide dimensions of the country, energy plays a significant role in Canada’s economic activity and its emissions profile. These factors serve to explain the responses from Canada and similar resource-dependent countries relative to countries not so dependent on resource development.

### Recent developments

Canada’s governments have implemented the full spectrum of climate policy tools: carbon regulation, carbon pricing, cap and trade regimes within Canada and linked to U.S. markets, significant investment in new technologies, and policy directives to green the generation mix.

In October 2016, the federal government announced plans to implement a pan-Canadian carbon tax, to begin in 2018. Each jurisdiction will be able to choose between a direct price on carbon pollution or a cap and trade system. Any revenues will flow back to the province or territory.

Canada is a signatory to the Paris Agreement on Climate Change and has set a target of a 30% reduction in emissions by 2030 relative to 2005 levels.

The federal Cabinet announced their approval of two major pipeline capacity expansions which will increase exports to Asian and North American markets: Kinder Morgan's TransMountain Expansion, with 157 binding conditions which address potential Indigenous, socio-economic and environmental impacts, project engineering, safety and emergency preparedness; and, Enbridge's Line 3 expansion with 37 binding conditions.

Canada's provinces have the lead role in all things related to energy, in keeping with their constitutionally-assigned ownership of resources within their boundaries. Not surprisingly, a variety of emissions reduction policies has emerged; separate pathways, but with a common goal.

In November 2016, Nova Scotia announced an internal-to-Nova Scotia cap and trade system which will retain revenues and GHG reductions within the province.

In Ontario, to sustain nuclear's 60% share of generation, plant refurbishments are in progress. Ontario's cap and trade programme came into effect in July 2016, linked with California and Québec.

Alberta launched its Climate Leadership Plan in November 2015. Features are a complete phase-out of coal-fired generation by 2030, to be replaced by generation from renewables and natural gas, a target of 30% from renewables by 2030, and limiting emissions from oil sands plants to 100 Mt per year.

Marking recent technological progress are new electricity storage services in Ontario, based on a variety of storage technologies. Saskatchewan's world-first CO<sub>2</sub> capture facility at SaskPower's Boundary Dam plant began operation in late 2014. The captured CO<sub>2</sub> is used to enhance oil production at a neighbouring oil field, and any remainder is disposed of in a deep geological formation. To facilitate electricity trade, increased interconnection capacity has been installed between Québec and Ontario, and is being considered in other regions as well.

### **Top critical uncertainties**

Three critical uncertainties top the results from the Canadian respondents: commodity prices, climate framework, and US Policy.

Respondents remain very concerned about continuing low oil prices. Following their precipitous decline in the last half of 2014, oil prices were increased gradually in 2016 to end the year at a December average of US\$49 at Hardisty, Alberta. Noteworthy is the large discount, or differential, between the Alberta and Chicago prices (US\$17) at the end of 2016. Lay-offs, low levels of drilling and exploration activity, and postponement of projects and investments continued in the oil and gas sector in western Canada in 2016.

Canada's endorsement of the Paris Agreement on Climate Change and many leading-edge provincial initiatives kept climate change policy at the top of the policy agenda in 2016. Although uncertainties about the actual economic impacts still prevailed at the end of the year, greater clarity was provided by the federal government's announcement of a nation-wide carbon tax, roll-out of Alberta's Climate Leadership Plan, and announcements of new climate policies which will come into force at the beginning of 2017.

Uncertainties about the directions of US energy policy grew in prominence following the presidential and congressional elections in November. Energy markets in North America are highly integrated amongst Canada, the United States, and Mexico, so insular policies could have significant impact on the flows of oil, natural gas, and electricity. A mismatch on GHG mitigation policy would immediately affect the competitiveness of Canadian goods and services in the highly-integrated and mutually-beneficial Canada-U.S. market.

The highest-ranked critical uncertainty was the prospect for approval of major LNG projects on Canada's West Coast. Progress on one project was made with the federal Cabinet's approval of the Pacific North-west liquefied natural gas project in British Columbia. The approval comes with 190 legally binding studies, and after consultations with First Nations. The conditions cover wetland management, the quality of freshwater fish and fish habitat, marine fish and mammals, migratory birds, human health, concerns over cultural heritage sites and long-term environmental monitoring.

### **Top action priorities**

Respondents see three primary areas for action, characterised by a high level of impact and relatively low level of uncertainty; the impacts of economic growth on energy markets, deployment of renewable energy technologies, and energy efficiency.

Economic growth creates increasing demand for energy and is a primary driver for energy investment. Respondents may see growing economic strength in North American economies as a positive signal pointing to full recovery from the 2008 economic downturn and overall better prospects for growth in the near future.

As noted in previous reports, widespread deployment of renewable energy technologies is seen as a practical pathway to a greener generation mix. Provinces moving ahead with phase-out of coal fired electricity are setting aggressive targets for generation from wind and solar. Targets set by Nova Scotia are 25% of generation from renewables by 2015 and a 40% share by 2020, and Saskatchewan and Alberta are aiming for a 30% share by 2030.

Energy efficiency remains the highest ranked action priority with the lowest level of uncertainty. Respondents consistently see actions to improve the efficiency of industrial plants and field operations as direct paths to reduced operating costs and reduced emissions.

Respondents' views about carbon capture and storage has changed significantly over the last three years, moving from being seen as highly uncertain with little impact to the position representing much greater impact and reduced uncertainty in this year's results.

### **Looking ahead through 2017**

Increases in electricity prices, meeting Canada's 2030 target, and keeping Canada competitive with its trading partners will be issues to watch in 2017 and beyond.

The recent increase in electricity prices has become a hot button issue. In Ontario, monthly Toronto prices including taxes have increased significantly, from \$131.21 in April 2011 to \$201.23 in April 2016, an increase of 53%. Expect electricity prices to remain a political issue if such trends continue.

Second, there is a significant gap to be closed to meet Canada's national target of a 30% reduction in emissions relative to 2005 levels by 2030. According to government projections of Canada's emissions to 2030, annual emissions will at best remain flat at roughly 750 Mt to 2030, assuming implementation of all policies on September 2015. To reach the 2030 target, emissions will need to be reduced to 524 Mt, a significant drop of 225 Mt. Clearly more will be needed to meet Canada's national target.

Canada looks forward to working with the incoming U.S. administration to grow the positive energy relationship and the mutual benefits around energy in both countries.

### **Comparisons**

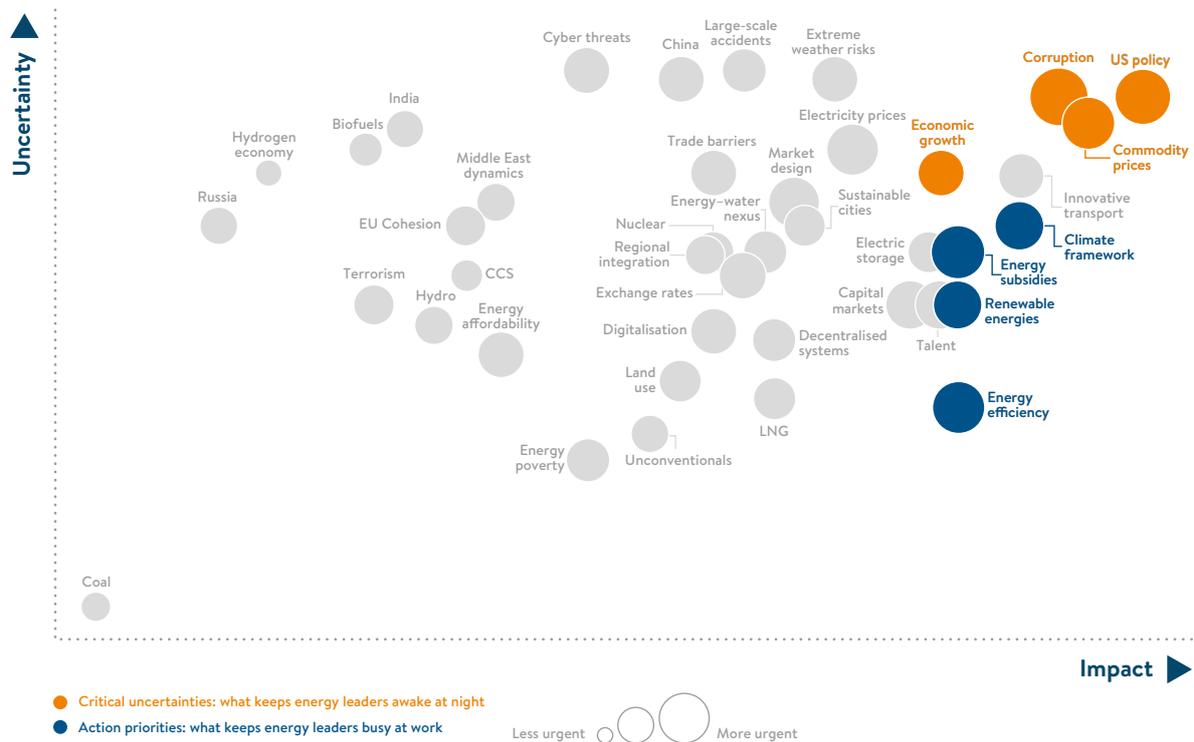
Canada shares areas of critical uncertainty with its neighbours in North America and also across the globe. Concerns around commodity prices, the national and global climate framework, US policy, and the opportunities arising from electric storage are held in common. Differentiating Canada are the responses about trade barriers and regional integration which speaks to the need for gaining access for Canadian oil and gas production to markets outside of North America.

Widespread concurrence exists on action priorities in fostering economic growth, renewables, and energy efficiency. Carbon capture and storage is identified as an action priority by energy leaders in Canada and North America, due in part to the significant recent progress on implementing the technology in Saskatchewan and elsewhere.

### **Conclusion**

Progress marked by federal approval of major projects and implementation of climate policies by provincial and federal governments highlighted energy in Canada in 2016. Key aspects to watch in 2017 are the impact on energy trade of policy directions set by the new U.S. administration and a reversal of recent trends in oil and gas investment, employment and project activity in the oil and gas sector as prices recover.

## MEXICO



There are three items that are important in relation to the Mexican energy sector of 2016 and 2017. The first is the initiation of the oil and gas and wholesale electricity markets. The second is the price of oil and the liberalisation of gasoline prices. The third is the great uncertainties inserted in the Mexican scene by the USA election of last November.

The implementation of the energy reforms has been quite successful as far as the present is concerned. Both the oil and gas as well as the electricity markets have carried out several tenders which have generated good results. The long term tender for renewable generation produced some of the lowest solar kWh seen worldwide. Furthermore, recently the deep water tenders for ten blocks as well as a farmout for PEMEX attracted a large number of bids and eight of them were assigned – far more than most energy analysts had anticipated. In this case, it seems that the perception of the medium term oil prices is that they will be above the present ones.

An important cluster of new anti-corruption laws was approved by Congress this year which should reduce uncertainties with respect to the various processes involved in the energy markets, both at the front end as well as during the operation of the new installations.

In the spring of 2016, environmental conditions in metropolitan Mexico City were so bad that several days, over two million vehicles out of the approx. five million were taken out of circulation, causing serious disruptions in the civilian activities. The approved government budget for 2017 will include additional incentives such as rebates in the purchase of hybrid and electric vehicles as well as other benefits that regular combustion vehicles do not have like not having to pass an environmental

verification every six months. This should promote the purchase of cleaner vehicles and reduce emissions of local pollutants and greenhouse gases.

Unfortunately, the presidential election results in the USA have inserted a large amount of uncertainties due to suggested public policies of the next administration which are contrary to the objectives of the North American Free Trade Agreement (NAFTA) and the collaboration of the energy sectors of the region. The rhetoric used during the election campaign, which most of the time was not based on reality but on wrong perceptions, has created a significant ambience of risk and consequently an economic impasse.

Therefore, the issues of US Policy, Commodity Prices, Corruption and Innovative Transport appear at the top of the quadrant of critical uncertainties in 2016 and 2017.

A low price of oil is a problem for the fiscal income of the government as well as for the financial situation of PEMEX, the public company that is the preponderant company in the oil and gas market. There were concerns that due to this low price, the oil and gas tenders would not attract many participants; apparently this has not been the case, as set out above.

The US Policy issue is perceived as a serious problem in relation to economic growth in México. The NAFTA treaty has been in operation now for more than two decades and it is regarded as an economic success in terms of a large increase in trade between the three countries. The rhetoric of the winning candidate during the US presidential race was basically against free trade and very specific against this treaty. As a result, the economic outlook for the Mexican economy has become quite pessimistic as all the economic indicators have had a decreasing tendency since the election results were known.

The top action priorities in Mexico are Energy Efficiency, Talent (human resources), Renewable Energies and Energy Subsidies.

At the beginning of 2016, a new law was passed by Congress, “The law for the Energy Transition”, where one of the main items is the concern for reducing the energy demand and consequently the emissions of GHG. One of the principal items is the programme for the sustainable utilisation of energy (PRONASE). This document is in preparation and should contain specific goals for the near future in relation to different energy indicators like energy intensity.

Talent is a very important item as in the last few years people with experience working in the oil and gas and electricity areas have retired. Furthermore, in the past, due to the economic problems of the two national companies, no young replacements were hired for the two or three previous decades in the quantities required. In 2016, a large human resources programme was created and is now operating with the goal of preparing over 100,000 professionals and technicians in the energy field over the next few years.

As far as renewable energies are concerned, at present the main force pushing for an increase amount of RE generating capacity is the 2024 goal stated in the law for Climate Change that 35% of the electricity generation has to be produced by clean energies. As the programmed nuclear and

hydropower plants will not initiate operations until much later, new generating capacity is being oriented to renewables and cogeneration.

In the area of oil products, subsidies have been reduced and their prices have become more or less similar to those in the USA. In electricity, only the consumers that use more than 250 kWh bimonthly pay un-subsidised prices; the majority of the consumers, all of them below this amount, pay subsidised prices.

Mexico's overall picture is described as a semiarid country. In the medium term the energy-water issue will be an important one, although in some regions of the country, it already is.

Extreme weather risk is another issue that is of concern as the country is geographically located in the hurricane belt. As the atmosphere's temperature increases due to climate change, the frequency and the strength of these climate phenomena will increase.

Economic growth is also at present a very important issue as the amount of uncertainties due to several factors but mainly the policies of the new US administration, have created an impasse in the economy.

The issues of both Climate Framework and commodity prices, which in our case refers to oil prices, are placed in both national and global maps with a similar degree of high uncertainty and impact.

As compared with the rest of the world, due to the fact that Mexico and the USA share a common land border of more than 3,000 km long and are active participants with Canada in NAFTA, US Policy has an impact across the spectrum not only in the energy sector. The recent results of the US presidential election have inserted very large uncertainties in all sectors of society due to the rhetoric displayed in the political campaign preceding the election.

When looking at the national priorities over time, the fact that renewable energies have moved from the critical uncertainties to the action priorities area is basically a result of the start of operation of the wholesale electricity market, with the consequence that now electric storage has increased its impact although it keeps the same amount of uncertainty.

The concern about the impact of Climate Change and its Framework has increased as the perception is that the probability of holding the temperature increase to 2°C is now very slim and thus the higher the temperature, the bigger the impact. The issue of Corruption has reduced its impact as the perception is that, with the new legal framework approved by Congress, it will be less prevalent.

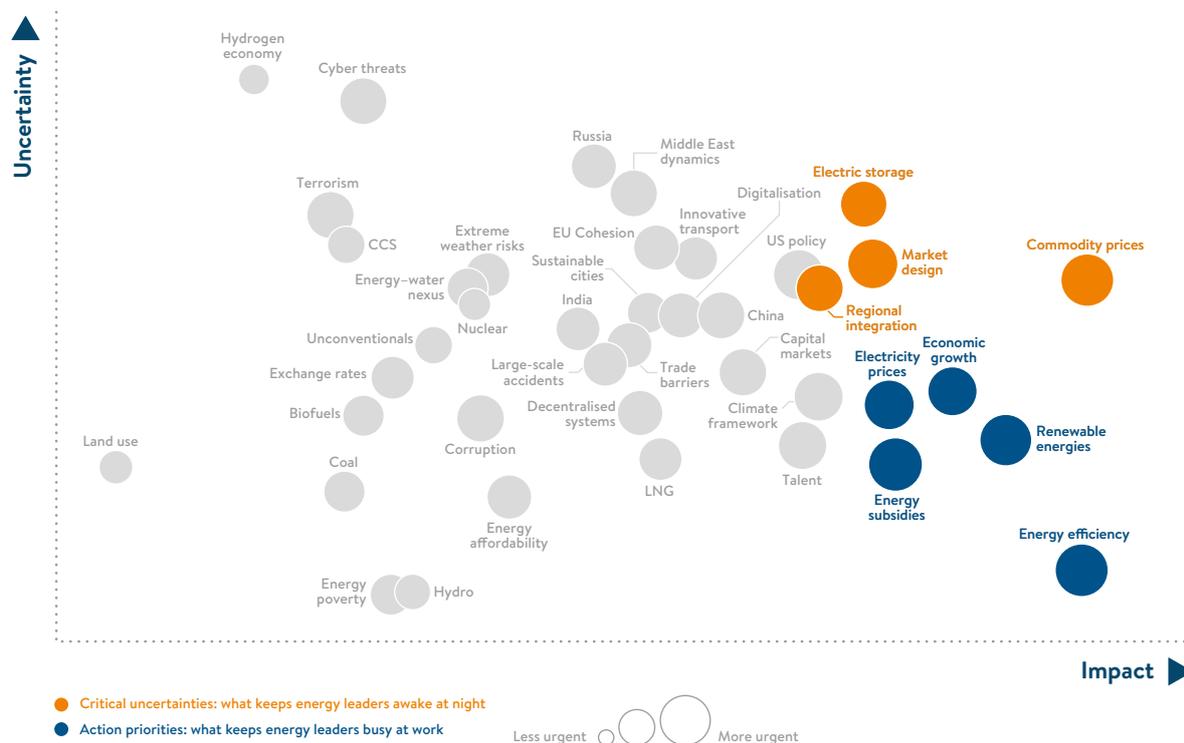
As one can observe from the previous comments, Mexico's energy situation is a complex puzzle of important issues of different nature. At present, the economic outlook perception is very dependent on the policies to be enacted by the new administration of a foreign country. Internally, the energy sector reforms apparently are being implemented successfully considering the global energy environment.

Other internal issues that affect investment as well as operations and maintenance of installations like the rule of law and corruption are being tackled with a new legal framework that hopefully in the near and medium term will reduce risks generated by the uncertainties involved in these issues.

# **Chapter eight**

## **Assessing the energy agenda for the future energy leaders**

## THE FUTURE ENERGY LEADERS' AGENDA



On October 13th, 2016 a group of young, talented and ambitious energy sector professionals declared their vision for the future of global energy, outlining their priorities and agenda items at the World Energy Congress in Istanbul. It is remarkable in that the context of the declaration was set by two crucial issues of the energy domain: one, an enduring legacy issue of price volatility, particularly of crude oil, and the other, representative of inevitable structural shift in the energy world, the growing relevance of renewable energy in mainstream discussions on energy. This next generation of Future Energy Leaders (FELs), equipped with knowledge and talents, is ready to rise up to the energy challenges and lead the transition by creating sustainable solutions that would shape the future energy landscape.

The Future Energy Leaders (FELs) issues monitor shows a significant overlap in the critical uncertainties and action priorities with the global monitor, and a continuation of key issues highlighted in the previous issues monitor.

**Commodity prices** have maintained their position as the monitor's most critical uncertainty, mirrored in the global monitor as well. Over the past two and a half years, energy headlines across the world were largely dominated by the prolonged slump in crude oil prices – a net effect of the surge in world liquids production led by US shale oil and the weakening demand in China, the primary contributor to energy demand growth over the past decade, as it restructured its economic growth objectives. This was further compounded by the slowdown or the relative lack of pace in recovery in the major advanced economies in the world such as Japan and the Eurozone. Once the price slide set, it was then sustained by the late-2014 OPEC decision to change its group strategy from one of price

support to one of market protection with no caps in individual member supplies. Although this has changed in recent times with the late-2016 understanding between OPEC and non-OPEC producers on curtailing output, marking another change in priorities, the current price recovery is still far from sustainable as most of the underlying fundamentals have not undergone any major change.

**Energy efficiency** slightly reduces its uncertainty and gains more impact than that of the global monitor and in comparison with the previous year, leading it to the action priorities zone in the latest FELs issues monitor. This is reflective of the FELs' viewpoint that **energy efficiency** is, indeed, the 'fifth' fuel (behind oil, gas, coal and renewables) and is among the most essential elements when it comes to framing a sustainable energy framework for the future with its emphasis on waste reduction, mitigation of the environmental costs of energy production as well as consumption, cost savings and process optimisation. By placing a greater importance towards energy efficiency, the FELs issues monitor also caters to the need for ensuring greater availability of energy for wider access and more energy independence. Furthermore, in importing countries like China and India where demand outweighs indigenous supply by a huge margin, energy efficiency can potentially become a critical mandate for sovereign policy making.

**Renewable Energy** and **energy subsidies** retain their previous year's position among action priorities in this edition of FELs' issues monitor as well as in the global monitor. **Renewables**, especially solar and wind, have become increasingly cost-competitive with fossil fuels in recent years. To accomplish climate targets and to build sustainable energy systems, FELs' emphasis on according a greater importance to the development of renewables within the energy mix is a clear statement of priorities to policymakers worldwide and forces them to reassess other important issues like fossil fuel subsidies and continued investments in capital-intensive fossil fuel projects.

In this current issues monitor, **electricity prices** is slightly reduced in its perceived uncertainty and gains more impact, forming one of the action priorities, resembling a similar position to that in the global monitor. The continuous decrease in renewable energy-based power generation costs across the globe can be assumed to have contributed to the decrease in uncertainty while strengthening the case for greater efficiencies in the legacy systems and incorporation of more non-fossil fuel based generation into the grid.

On the contrary, **regional integration** has declined in its impact and escalated in uncertainty, thus moving from being one of the action priorities to one of the critical uncertainties for the FEL community, similar to the global monitor. FELs understand the importance of this issue in order to boost the exchange of energy at a regional level in order to ensure secure flow of energy and economic growth. FELs believe that such integration ought to be facilitated and there is need for measures to be set and mechanisms to be realised. This is of special significance in light of recent developments in the global political and economic landscape marked by the rise of nationalistic tendencies in sovereign policymaking and diplomacy, scepticism towards free trade deals and regional trade partnerships and rise of a protectionist domestic market in exchange of a connected global marketplace. Brexit, the election of Donald Trump as US President and a strong emergence of right-wing politics in Western Europe are some of the examples that are a pointer toward this trend.

**Market design** continues to be one of the critical uncertainties in the FELs agendas with a lesser impact than the prior year but with a higher impact than the global monitor. In the FEL's vision, to embrace new frontiers, FELs urge the need to adopt new business models by means of modern technology and innovation, implementation of the right policies and greater collaboration and engagement with customers.

In the FELs issues monitor, **electrical storage** takes over the place of geopolitical issues (US policy, China and India). **Electrical storage** is perceived as an issue with higher uncertainty and an increased impact to be placed as a critical uncertainty. The FEL community believes that in order to realise the full potential of intermittency of renewables, effective energy storage systems must be developed.

**Talent** is an issue of focus for FELs in 2017 as they believe it has a great impact. The FELs vision places emphasis on its significance by inviting organisations and companies to provide an opportunity for enthusiastic, young energy professionals to engage and innovate.

**Climate framework** moves from its position of critical uncertainty in the global monitor to almost an action priority in the FELs issues monitor as the community believes that climate change is an undeniable fact and urgent actions and commitments are required to address its adverse impacts. The signing of the Global Climate Change agreement at COP21 in Paris in December 2015 and its subsequent ratification and coming into force in 2016 is ample proof of the global consensus on the need for effective and concerted action and collaboration towards managing climate change.

Other issues that have experienced a movement towards a lower impact are **coal** and **nuclear**. It is evident today that **coal** is being gradually replaced by natural gas in many power plants in various parts of the world due to its indisputable adverse impacts on atmospheric air quality and contribution to global warming. **Nuclear**, despite the fact that it does not contribute to greenhouse gas emissions, evokes a high level of environmental concerns due to perceived safety issues and lack of adequate public awareness which affects the support it garners in the wider community.

# Chapter nine

## Methodology and project contributors

The World Energy Issues Monitor is based on an annual survey, comprising 41 issues across four categories: macroeconomic risks, geopolitics, business environment and energy vision and technology. The survey is completed by ministers, chief executives and leading experts in nearly 90 countries that are part of the network of the World Energy Council. The 2017 monitor is based on insights from over 1300 energy leaders from 90 countries.

The data for the 2017 World Energy Issues Monitor is input and normalised using statistical software in order to enable direct comparisons across regions and for different years. The data is normalised by the mean to give a central weighting and standard deviations to give the spread. The resulting issues monitors are then further contextualised by the analyses of World Energy Council regional managers, national committees and their broader national networks. The resulting product is used as a report, an interactive monitor ([www.worldenergy.org/data](http://www.worldenergy.org/data)) for tailored results as well as for presentations in meetings and events.

### **HOW TO USE THE ISSUES MONITOR FOR YOUR OWN COMPANY OR EXECUTIVE TEAM**

Fully customised Issues Monitors can be used to benchmark your own understanding of the energy agenda against your regions of activity and to inform and engage executive boards and directors as well as government and policymakers, regarding the critical issues in your country. If your company or national committee are interested in looking at a bespoke monitor and debriefing, please contact John Bourne by emailing [bourne@worldenergy.org](mailto:bourne@worldenergy.org).

### **THE INTERACTIVE ENERGY ISSUES MONITOR OVERVIEW**

Tailor monitors with the issues most important for you; explore the evolution of critical issues across years and in different regions; and download the results in the interactive issues monitor on [www.worldenergy.org/data](http://www.worldenergy.org/data)

**TABLE 1: THE WORLD ENERGY ISSUES**

Macroeconomic Risks & Vulnerabilities	
Global climate framework agreement	Global climate negotiations and the implementation of COP21 agreements.
Large-scale accidents	Past and potential large-scale accidents and resulting implications, such as the Fukushima nuclear disaster and the Deepwater Horizon oil spill.
Economic growth	Effects of economic growth (or lack thereof) on energy markets.
Capital market access	Access to capital and the ability to deliver capital for energy infrastructure, in a context of high political, market and technology risks.
Energy & commodity prices	Price and volatility risks for energy and related commodities.
Electricity prices	Price and volatility risks for electricity.
Exchange rates	Exchange rate fluctuations and currency devaluation risks on energy operations and investments.
Energy-water-food nexus	Competition for water resources and water availability due to changing weather patterns and its effects on energy production and supply.
Land availability	Access to the required land for the supply, transport and distribution of energy and the social licence to operate value chain activities.
Talent availability	The availability of labour with the necessary skills, qualifications and experience.
Energy access	Lacking access to modern energy services including household access to clean cooking facilities and electricity.
Energy affordability – households	Share of household budget spent on energy including heating fuels, electricity and gasoline ('fuel poverty').
Extreme weather risks	Increased frequency and severity of extreme weather events (e.g. floods, storms, droughts) and the impact on energy systems and infrastructure design and resilience.
Cyber threats	Threats resulting from unauthorised attempts to access control system devices or networks within the energy sector and network providers.
Corruption	Slowing down the development of effective policies and distorting the competition.
Terrorism	Physical risks resulting from terrorism, affecting energy systems, infrastructure and markets.

## Energy Geopolitics & Regional Issues

China growth	China driven innovation and policy influencing global energy trade, market dynamics and global governance.
India growth	India as the next engine of demand growth.
Russian foreign policy	Russia's foreign policy effects on domestic investment and operations, key energy partnerships and global energy markets.
EU Cohesion	Convergence to a common energy policy (critical market design; ETS -emission trading scheme-, capacity and storage incentives).
Middle East / North Africa fragility	Political regime fragility and geopolitical tensions affecting energy markets.
US trade and policy influencing global energy markets	US driven innovation and policy influencing global energy trade, market dynamics and global governance.

## Energy Policies & Business Environment

Trade barriers	Constraining or enabling green growth (e.g. through technology transfer, tariffs on green goods and services, local content requirements, border tax adjustment).
Regional integration	Converging energy policy to overcome unequal distribution and ineffective allocation of energy resources (e.g. interconnectors, pipelines, trade platforms) between countries, sub-regions or entire regions.
Innovative market design & policies	New market designs and policies securing back-up and storage capacity in natural gas and electricity markets.
Energy subsidies	Subsidies within the energy sector affecting the energy mix, competition, technology development and energy affordability.
Decentralised Systems	Innovative business models for demand side innovation and management.

Energy Vision & Technology	
Sustainable cities and urban design	Delivering resource-efficient urbanisation at scale; relating to management of waste, water, energy and transportation.
Energy efficiency	The role of measures (designs/operations/technologies) to reduce energy consumption.
Carbon capture and storage (CCS)	CCS as a technology to prevent large quantities of CO <sub>2</sub> emissions from large scale fossil fuel power generation.
Smartgrid and big data	An electric power distribution network that includes two-way digital communication between consumer and producer, machines and the 'prosumer' as well as machine to machine.
Innovative transportation	Innovative transportation concepts, new modes and fuel sources including electric vehicles, hybrid and natural gas vehicles.
Electricity storage innovation	Price and scalability of batteries, 'power to gas' technology and storage as an enabler for greater integration of renewables.
Nuclear	The outlook for nuclear as part of the regional and global energy mix.
Large scale hydropower	The outlook for large scale hydro as part of the regional and global energy mix.
Unconventional fossil fuels	The outlook for shale gas, oil shale and other 'unconventionals' as part of the regional and global energy mix.
Liquefied natural gas (LNG)	The role of liquefied natural gas (LNG) in regional and global energy markets.
Coal	The role of coal (lignite, anthracite, sub-bituminous, bituminous) as part of the regional and global energy mix.
Renewable energy	Rapid growth of renewable energy sources, especially solar PV and wind, affecting energy markets.
Biofuels	The outlook for biofuels as part of the regional and global energy mix.
Hydrogen economy	A pragmatic build-up to establish niche markets.

# PROJECT PARTICIPATION

Regional breakdown of countries contributing to the World Energy Issues Monitor 2017:

## Africa

Botswana  
Burkina Faso  
Burundi  
Chad  
Congo (Democratic Republic of)  
Cote d'Ivoire  
Ethiopia  
Gabon  
Ghana  
Guinea-Bissau  
Kenya  
Mali  
Namibia  
Niger  
Nigeria  
Senegal  
South Africa  
Swaziland  
Tanzania  
Tunisia  
Zimbabwe

## Asia

Australia  
China  
Hong Kong  
India  
Indonesia  
Japan  
Kazakhstan  
Korea (Rep.)  
Malaysia  
Mongolia  
Myanmar  
Nepal  
New Zealand  
Pakistan  
Singapore  
Sri Lanka

## Europe

Austria  
Belgium  
Bulgaria  
Croatia  
Cyprus  
Czech Republic  
Denmark  
Estonia  
Finland  
France  
Germany  
Hungary  
Iceland  
Ireland  
Italy  
Latvia  
Lithuania  
Monaco  
Netherlands  
Norway  
Poland  
Portugal  
Romania  
Russian Federation  
Serbia  
Slovakia  
Slovenia  
Spain  
Sweden  
Switzerland  
Turkey  
United Kingdom

## Latin America and the Caribbean

Argentina  
Bolivia  
Brazil

Chile  
Colombia  
Dominican Republic  
Ecuador  
Peru  
Trinidad & Tobago  
Venezuela

## Middle East and North Africa

Algeria  
Egypt  
Iran  
Iraq  
Jordan  
Kuwait  
Lebanon  
Morocco  
Oman  
Qatar  
Saudi Arabia  
United Arab Emirates  
Yemen

## North America

Canada  
Mexico  
United States

## ACKNOWLEDGEMENTS

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