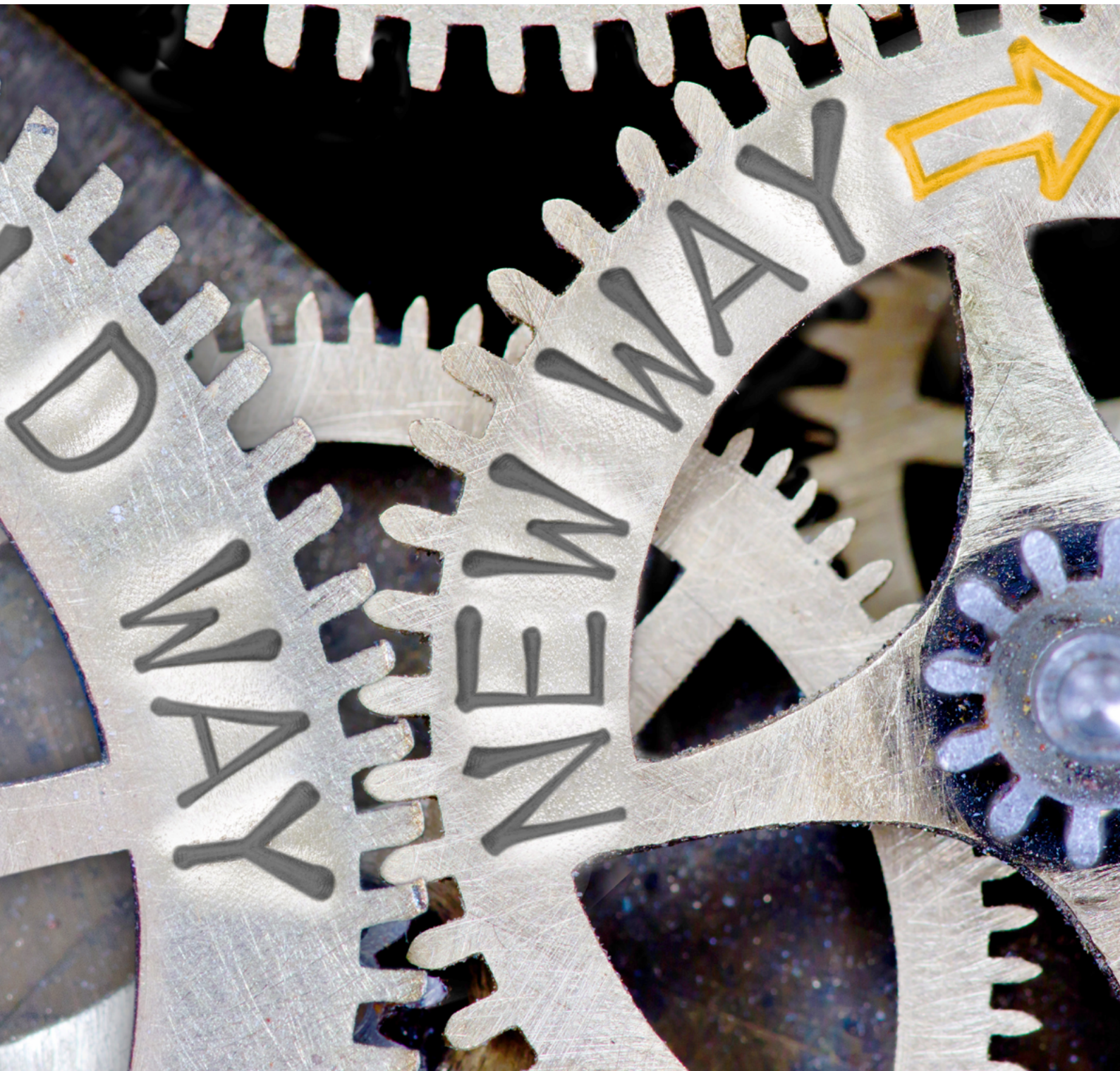
WORLD ENERGY COUNCIL

World Energy Issues Monitor | 2019



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, publishing authoritative studies and working through our extensive member network to facilitate the world's energy policy dialogue.

Further details at www.worldenergy.org and @WECouncil

Published by the World Energy Council 2019

World Energy Council
Registered in England and Wales
No. 4184478

VAT Reg. No. GB 123 3802 48

Registered Office
62–64 Cornhill
London
EC3V 3NH
United Kingdom

ABOUT 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 one's own assumptions on the key drivers within the energy landscape.

This tenth iteration of the monitor is based on insights provided by more than 2,300 energy leaders to provide 50 national assessments across six world regions.

In addition to this report, the interactive online Issues Monitor tool allows the visualisation of the data that underpins the Issues Maps. This tool has been developed in collaboration with our Project Supporter ARUP.

FOREWORD

In an era of fast and fundamental shifts in the context of the world we live in, where prosperity for all people and a healthy planet must more than ever be treated as a shared responsibility, it is paramount that we are provided with the tools to understand how changes and progress in the national, regional and global landscapes interact with and influence each other. For ten consecutive years, the World Energy Issues Monitor has been gathering the perspectives of energy leaders from public and private sectors across the six regions on 42 key issues that shape and drive our energy system. The Issues Monitor has become the energy leaders' foremost platform to identify, share and track critical issues surrounding the Energy Transition and assess which ones keeps them most awake at night or busy at work and how these change across time and space.

I am delighted that for the tenth anniversary of the Issues Monitor tool, a record number of nearly 2,300 world energy leaders from 86 countries has contributed to the survey.

As I reflect on this report and a decade of transition preceding it the following trends stand out:

1. The global Energy Transition is driven by **digitalisation, decarbonisation, decentralisation** which is illustrated by upward trends of innovation issues including storage, decentralisation, alternative transport, renewables and downward trends of traditionally centralised energy system components
2. Traditional **market design** is under pressure to reform to enable renewable integration, respond to resilience challenges and incorporate the growing decentralisation movement;
3. The accelerating pace of **electrification** via renewable energy sources is further shifting focus toward decentralisation and decarbonisation
4. **Global strategic competition** and the rise of nationalism illustrated by a sharp increase of concerns around trade barriers will impact the pace of the Energy Transition
5. **Commodity prices** that have been traditionally dominated by oil and gas seem to be incorporating key minerals such lithium and cobalt as they continue their rise in enabling integration of renewable energy and storage technologies
6. **Resilience** challenges and concerns around cyber threats, extreme weather and energy water nexus remain acute but with great differences in priority depending on the region
7. **Hydrogen** – although on global average still a weak signal – is moving up in a number of countries including Germany, Japan, Iceland, New Zealand signalling the quest for infrastructure repurposing and need for green liquids as complement to electrification

The report further outlines key trends that are unfolding at the global, regional and national levels based on the most recent survey results. In addition, the Issues Monitor's interactive online tool provides the possibility to track and compare issues' evolution over-time.

I would like to thank all energy leaders and the Council's Member Committees who have worked contributed to the 2019 Issues Monitor so that this resource can be provided to all energy shapers and I hope it can continue to inform decisions and actions towards our shared development goals.

Christoph Frei, Secretary General

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OVERVIEW

This is the tenth consecutive year of the World Energy Council's (the Council) annual survey of key challenges and opportunities facing energy leaders in managing and shaping Energy Transitions. This year's Issues Monitor report provides seven global maps[1], six regional maps and fifty national maps. These maps have been developed by analysing the responses of nearly 2,300 energy leaders, drawn from across the Council's diverse and truly global energy community[2].

The Council's Issues Monitor identifies the strategic energy landscape of specific countries and regions in the world, through an analysis of 42 energy issues and 4 digitalisation-specific issues affecting the energy system. It provides a **unique reality check and horizon scanning** of persistent and emerging concerns involved in whole energy systems transition. This year's report welcomes a significant increase in both the participation of global leaders (up over 75% from 1,300 to nearly 2,300) as well as the participation of 86 countries.

Each Issue Map provides a **visual snapshot** of the uncertainties and action priorities that energy policymakers, CEOs and leading experts strive to address to shape and manage successful Energy Transitions. Maps can be used in the following ways:

- To promote a shared understanding of successful Energy Transitions
- To appreciate and contrast regional variations to better understand differing priorities and areas of concern
- To follow the evolution of specific technology trends related to the energy sector

FIGURE 1: Visual Snapshot – How to read an Issues Map

1. Six of the maps are included in the global overview section while the Future Energy Leader's issue map is presented in the last section.

2. The Council received survey responses from 86 countries via its national Member Committee network. All of these responses have been incorporated into the Global map, but we have produced only 50 national maps, which correspond to the number of countries that were able to meet the minimum response requirements for the production of a national map.

Chapter one
Global Perspective

1. GLOBAL PERSPECTIVE

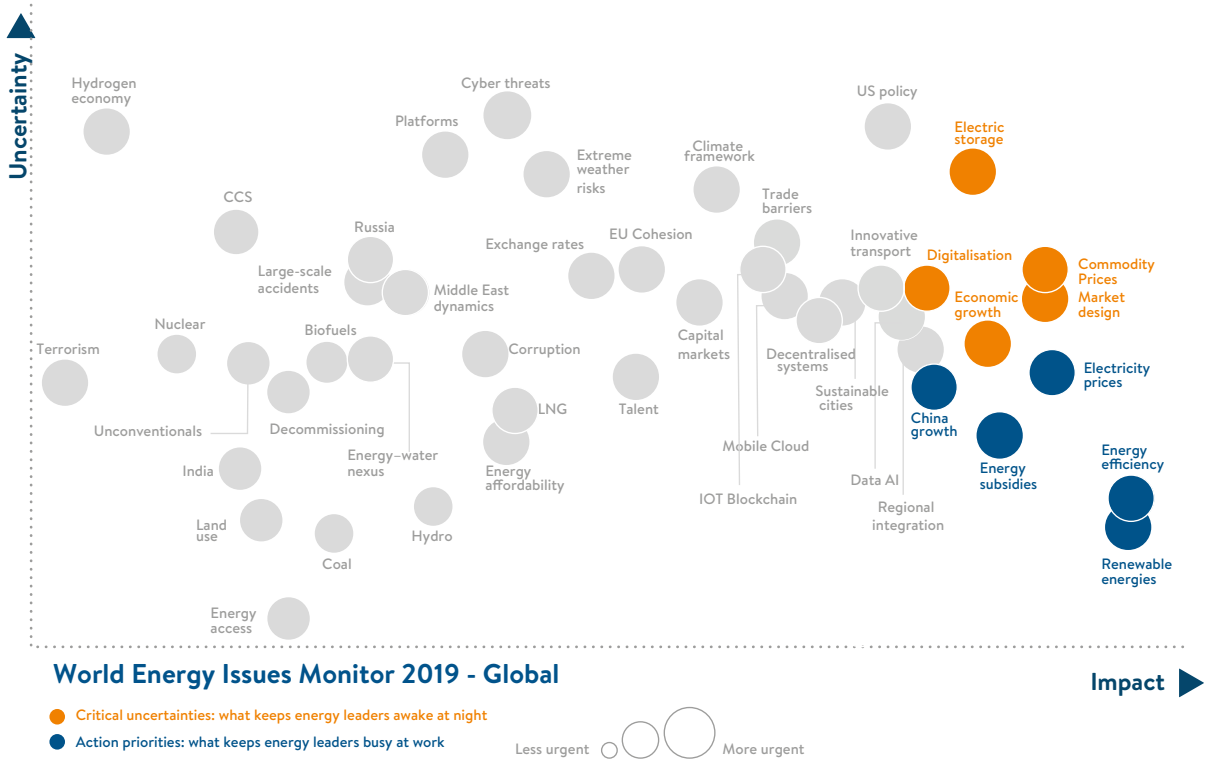
The global map and narrative are built from a synthesis of individual country analyses and commentaries. These provide an informed picture of five categories of transition challenges at national, regional and global levels:

1. macroeconomic risks
2. geopolitics
3. business environment
4. energy vision
5. technology

The 2019 global map incorporates all survey responses, representing the views of nearly 2,300 energy leaders from 86 countries.

In an era referred to by the Council as the Grand Transition[1], energy leaders must pay attention to many different signals of change and distinguish key issues from the noise. The Issues Monitor identifies shifting patterns of connected issues which are shaping Energy Transitions.

FIGURE 2: The Global Perspective on the Energy Transition



1. Since 1970, the world has seen rapid growth in energy demand, mainly satisfied by fossil fuels & centralised power generation. The future is expected to be different. Energy Transition does not happen in a vacuum. It is shaped by a much broader and fundamental shift in prosperity, progress, politics and planet. We call this faster & fundamental shift in context – The Grand Transition. https://www.worldenergy.org/publications/2016/world-energy-scenarios-2016-the-grand-transition

Over the course of the past six months the Council has evaluated nearly 2,300 survey responses, synthesized expert analyses from Member Committees and conducted supplemental research. The Council observes four key strategic priorities for energy leaders to consider in 2019. They are:

A. ***Market design*** rules will need to be updated to incorporate the growing move towards decentralisation
B. ***Electrification*** is being used as a means to decarbonise the energy sector
C. ***Global strategic competition*** and the rise of nationalism will impact the pace of the Energy Transition
D. ***Lithium and cobalt*** will play a growing role in commodity market risks, traditionally dominated by oil and gas price fluctuations

Market Design

The growing abundance of cost-competitive renewable energy technologies (especially solar) is accelerating transition towards decarbonised, decentralised and digitalised energy systems. **Market design** rules (from electricity trading to grid operation rules) will need to be updated to integrate a growing share of intermittent renewable energy supply (RES) from a diversity of zero and low-carbon sources. Maintaining investment in electrical supply security, grid reliability and resiliency emerges as a strategic priority.

> *Concerns are growing about electricity security and the adequacy of power supplies in some European countries and regions in the coming years. Closures of a significant number of thermal facilities are planned in the short to mid-term, while the current regulatory framework needs a robust overhaul in order to deliver the needed price signals to trigger investments in capacities and to enhance flexibility.*
>
> European Regional Commentary on page 87

This year's survey responses and follow-up commentaries indicate that **innovation in market design** is of significant leadership interest and key in realising new opportunities for integrating cost-competitive renewable energy at scale while also utilising existing centralised systems. How energy leaders face this new dynamic will determine the market design of the energy sector as it diversifies the supply mix with more RES. It is worth noting that survey results indicate that innovation is not just about new technologies shaping market design. The synthesis of commentaries clearly indicates that innovation in policy and regulatory reform are just as significant as technology innovation.

> **Policy Innovation:**
>
> *"Energy Efficiency is an action priority for Algeria ever since the Algerian government announced a new national programme on energy efficiency (EE) for the years 2015 to 2030. The EE programme mainly targets three sectors: the building sector, transport and industry. The objectives include the thermal insulation of 100,000 homes per year, distributing 10 million energy efficient lamps and switching 1.3 million vehicles to liquid petrol gas. Through the measures, 180,000 jobs are supposed to be created."*
>
> Algerian National Commentary on page 24

> "The national policy for energy efficiency is robust and well designed as it is based on a transparent financial support scheme. It is attractive for companies, which use opportunity to offer a complete service for energy efficiency engineering. In view of these facts, energy efficiency will remain as one of the action priorities for Slovenia."
>
> Slovenian National Commentary on page 138

Electrification

The accelerating pace of electrification remains the focus for energy leaders, with RES ranking highest in terms of impact (see Figure 2). Nevertheless, energy leaders remain concerned about the rapid scalability of renewables and perceive fluctuating oil prices and trends of nationalism as risk to successfully managing a global Energy Transition. Overall, as showcased in the national commentaries developed by the Council's Member Committees, the focus on global Energy Transition centres on four drivers – Decarbonisation, Decentralisation, Digitalisation, and Demographics as well as the disruptive potential of impacts from their interactions.

> *"Renewable energy coupled with energy efficiency and electrification of the end users is the area of focus for the policy makers in the country. The layering of information technology onto the energy sector results in new challenges and opportunities. Similar to the energy leaders around the world, commodity prices are of concern for long term planning."*
>
> UAE National Commentary on page 186

> *"Driven by strong demographic growth, electricity consumption in Burkina Faso grows by more than 8% every year according to the World Bank. In this context, several solar plants have been developed to both reduce the country's dependence on hydrocarbon imports and to produce electricity at lower cost to accelerate the electrification of the country."*
>
> Burkina Faso National Commentary on page 26

Global Strategic Competition

Survey responses indicate energy leaders are conscious of the political economy impact of large-scale RES development. Whilst strategic competition is focused on high tech ecosystems (digitalisation), rather than energy resources per se, the emphasis on commodity prices highlights current concerns about access to resources required for electrical storage. Furthermore, the new geopolitics of technology (data protection, cyber security) raises questions about the role of digitalisation in energy in the long term. Many national Member Committees identified the rising trend of global strategic competition and nationalism as critical uncertainties for the energy sector. Policy developments in China and the US, as well as trade tensions between them, are a source of uncertainty for energy leaders worldwide. In 2018, the United States imposed new tariffs and quotas on its imports (solar panels, steel, aluminium, etc.), to which China responded by imposing new tariffs on US imports of liquefied natural gas (LNG). More generally, for the survey respondents, the trade policy of the current US administration raises questions about the stability of US commitments.

> *"US policy is by far the most urgent Critical Uncertainty for Asia, not only given the impact this has on the mainly import-dependent countries in the region, but also due to the resulting effect on China's economic growth, which is now at its lowest level in ten years, and the knock-on effect for other Asian countries. A dip in foreign investment, particularly in China, coupled with slowing productivity and tightening monetary policies, will likely mean that Asian countries may need to turn to heavier reliance on available (and cheaper) domestic resources, such as coal."*
>
> Japan National Commentary on page 55

Commodity Prices

Oil and gas prices played a major role in 2018 influencing the tracking of commodity prices on the global map. They will continue to impact the speed and direction of the global Energy Transition. It is noteworthy to point out the emergence of other resources, such as cobalt and lithium, as key commodities which will have an ever-expanding role in price fluctuation concerns, which traditionally have been dominated by oil and gas prices.

> *"Commodity Prices is a critical uncertainty because of the region's economic dependence on oil. Crude oil price experienced an improvement, from around $60 per barrel to a high of $85 per barrel and a low by year-end of $50 per barrel. These fluctuations are deeply affecting the economies of LAC countries. South American countries budget depends on oil exports while many of the Central American and Caribbean countries are highly dependent on fuel imports to generate electricity."*
>
> LAC Regional Commentary on page 157

In February 2018, the US added cobalt to a list of 35 mineral commodities which are critical to the economy[2] and has begun mining for cobalt for the first time in decades. Clear market signals can be traced in the rising price of cobalt: $32,000 per tonne in 2017, $81,000 per tonne in 2018[3]. The market penetration rate of electric vehicles (EV) will be determined by the price of cobalt and lithium, as batteries represent up to half the cost of a purely electric vehicle.

Coupled with EV, the large-scale uptake of RES is intrinsically dependant on **new storage pathways**. For example, the general trend towards the electrification of smart vehicles relies on battery-intense applications which, in turn, increase demand for commodities such as cobalt and lithium. Consequently, non-energy **commodity prices** have become a critical uncertainty for energy leaders globally. For instance, the Democratic Republic of Congo, which has the world's largest natural supply of cobalt, recently tripled its tariffs in a move that could result in higher prices for EV producers[4]. This has a rippling impact on renewable energies, electric vehicles, electric storage and other battery-intense technologies.

2. https://www.federalregister.gov/documents/2018/05/18/2018-10667/final-list-of-critical-minerals-2018
3. https://www.chemistryworld.com/news/battery-builders-get-the-cobalt-blues/3008738.article
4. https://www.bloomberg.com/news/articles/2018-12-03/congo-triples-levy-on-cobalt-with-strategic-minerals-decree

Uncertainty about short and long-term oil prices makes it harder for some countries to plan and accelerate national Energy Transitions. Hydrocarbon producing countries such as Ecuador, Canada, Argentina and Russia have stated that they will continue to produce, export and consume fossil-fuels while also incorporating non-fossil fuel sources.

> *"Natural resource development is a significant component of the GDP for all three North American countries. Since both the production and use of fossil fuels plays a large role in the North American energy sector, the challenge of meeting emissions reduction targets is significantly greater than it would be for countries lacking fossil fuel resources. While greater electrification, using less-emitting generation sources remains a general policy objective across Canada, Mexico and the US, overall energy end-use remains primarily non-renewable, fossil-based sources."*
>
> North America Regional Commentary on page 188

> *"Russia remains at the forefront of hydrocarbon production and export. However, the country has taken important steps towards the development of renewable energy projects, reconsideration nuclear energy prominent impact and digitalization of the energy sector."*
>
> Russian National Commentary on page 133

The global narrative is not complete without mentioning decarbonisation. Commentaries provided by Member Committees note that climate commitments are shaping their action priorities and are central to the process of decentralisation. This stands out in the global map (Figure 2) with **renewable energies** and **energy efficiency** as the two main action priorities.

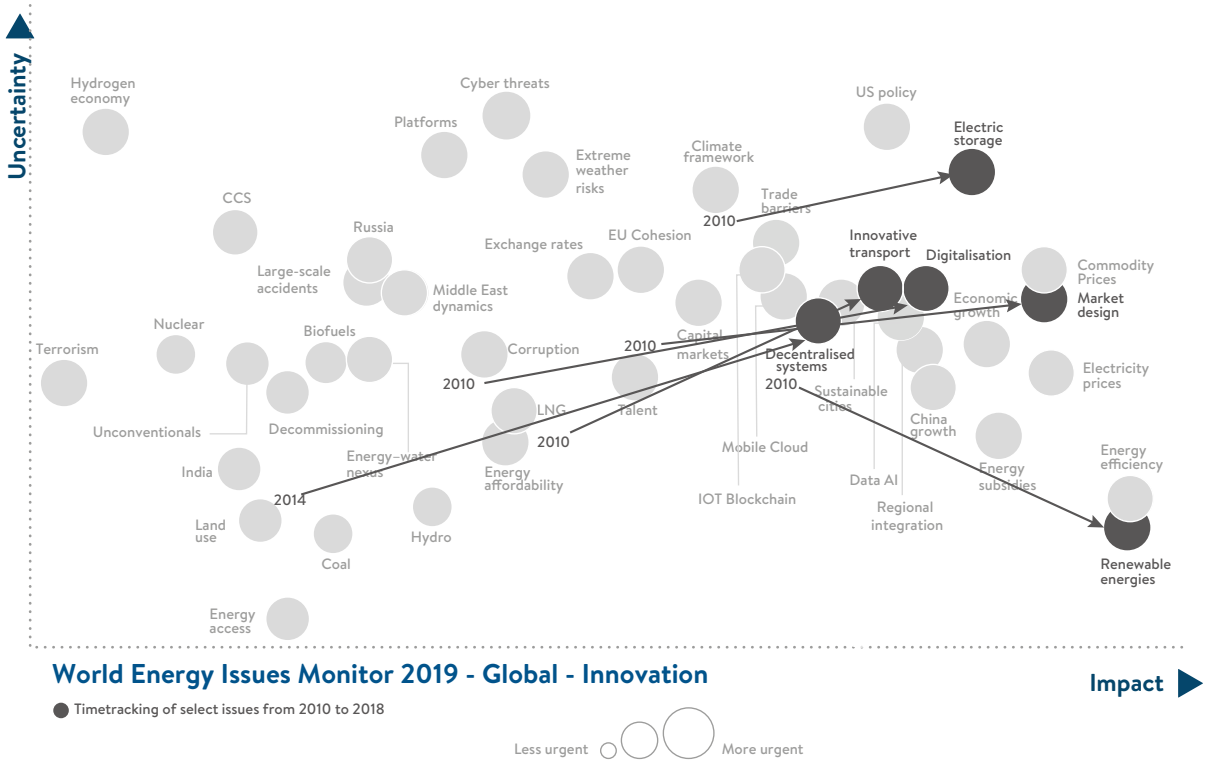
> *"The issue that keeps French actors awake at night is climate change. The sensitivity of French energy leaders is high, and their commitment is undeniable."*
>
> France National Commentary on page 101

> *"To help meet its Paris Climate Framework commitments, the Canadian Government has been negotiating policy actions with the Provinces. The Government has put in place an effective national price on carbon, beginning at $20 per tonne of CO2 from January 1 2019, rising by $10 per tonne annually to $50 per tonne in 2022. Provinces that do not implement plans to price carbon will have a federal backstop plan imposed upon them. This will remain a contentious national issue for the foreseeable future."*
>
> Canada National Commentary on page 192

TRACKING INNOVATION

Globally, as seen in Figure 3, the energy-transport-information nexus emerges as the key innovation cluster shaping global Energy Transition over the past decade - renewable energies, innovative transport, decentralised systems, digitalisation, and electric storage are the biggest movers since 2008.

FIGURE 3: Continued Rise of Innovation



Tracing the movements in global, regional and nation issues (spatial tracking) can reveal important shifts in perspectives on critical issues. For example, although **hydrogen** does not emerge as a leading indicator in the global map, some of the responses of energy leaders in the Council's Asia region, reflect growing interest in a "new" hydrogen economy.

> *"...uncertainty about US policy will create even higher pressure for more rapid development of viable alternatives, such as electric storage and affordable hydrogen, to meet rapidly rising energy demand."*

Asia Regional Commentary on page 55

> *"Hydrogen could play an important role in supporting 100% renewable electricity generation, potentially helping to solve New Zealand's dry year risk problem. However, today, hydrogen produced from renewable energy is about six times more expensive than hydrogen produced from natural gas, causing energy leaders headaches. Executives signal their concerns as hydrogen shifts dramatically towards the high impact high uncertainty zone."*

New Zealand National Commentary on page 79

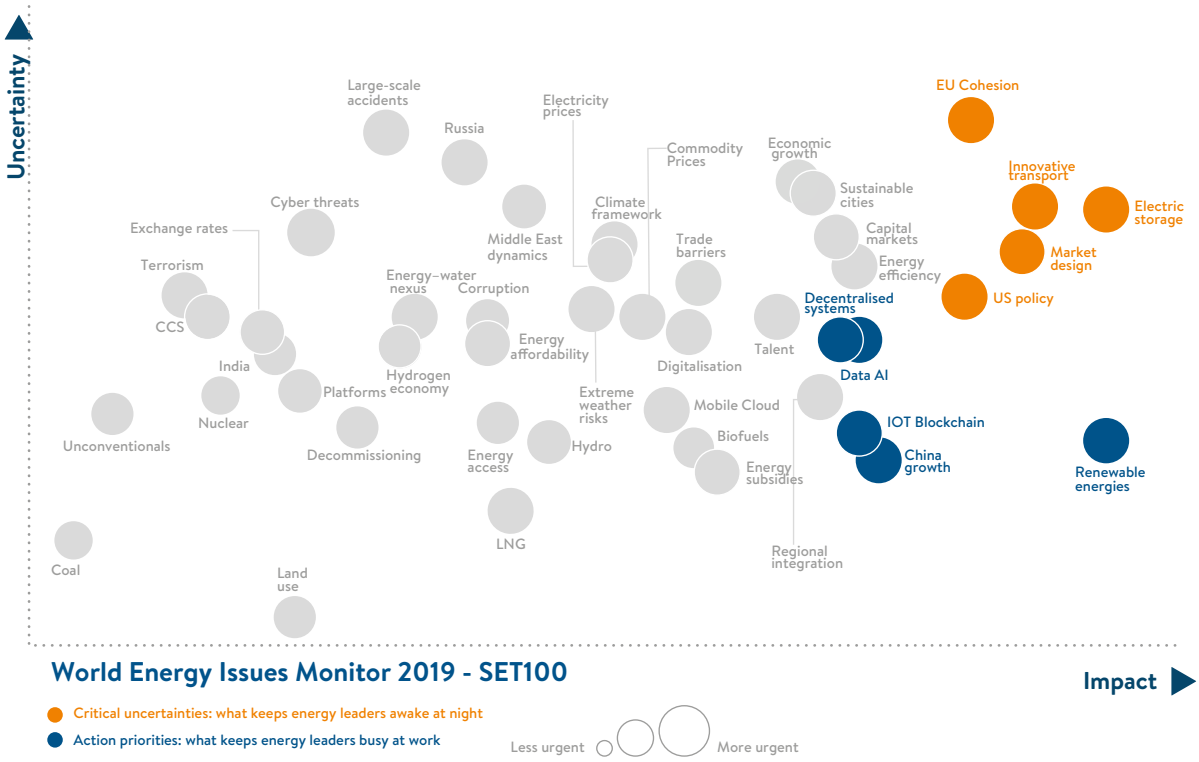
Since the energy crisis in the 1970s, hydrogen has been recurrently cited as a potential successor to oil, especially in uses that require very high energy density. In a 2018 report, the International Renewable Energy Agency (IRENA) described hydrogen as the possible missing link in the transformation of the global energy system[5]. Indeed, if produced from zero carbon power generation (renewables, nuclear or gas with CCS), hydrogen could be used to accelerate decarbonisation of industrial processes and transport systems and enable long distance trade in renewable energy[6].

Hydrogen is just one example of a weak signal on the 2019 global map – an issue gaining momentum as some individual countries view it with greater urgency, but globally it has yet to emerge as a leading indicator. Similarly, there are other technologies and policy issues that are of much higher priority for specific countries that may not be indicated with the same level of action and urgency at a global level.

THE START UP ENERGY TRANSITION AWARD – THE INNOVATORS AGENDA

Start Up Energy Transition (SET) is an international platform hosted by the Germany Energy Agency (dena) in collaboration with the Council supporting innovation in Energy Transition[7]. It is comprised of the annual SET Award and SET Tech Festival. This initiative brings together the 100 most outstanding international start-ups in the energy field with key stakeholders of the sector.

FIGURE 4: Survey of Innovators – SET100



5. https://www.irena.org/publications/2018/Sep/Hydrogen-from-renewable-power

6. The World Energy Council has a study underway on the role of hydrogen in global Energy Transition as part of its global foresight refresh and World Energy Scenarios update. In June the Council will host an Innovation Forum on challenges associated with production, storage, infrastructure, distribution, consumption and financial viability of hydrogen.

7. https://www.startup-energy-transition.com

It is the second year that the SET100 community has participated in the Issues Monitor survey. This is an important global perspective to understand, as innovators, much like early adopters, set the tone for what is to come. Figure 4 illustrates the views of energy innovators from around the world. The most common areas in which these innovators focused on in 2018 are;

- Decentralised systems and distributed generation
- Energy access
- Energy efficiency
- Solar
- Energy vision and technology

Last year's class of top 100 innovators identified **Blockchain** in energy as a key technology that would have a lasting impact on the energy sector. In 2018 blockchain appeared as a critical uncertainty, whereas this year the innovators have begun to better understand its scalability and viability and are piloting many different projects. Consequently, blockchain in this year's report appears as an action priority for innovators, reflecting the reduced uncertainty. This year's cohort has identified **electric storage** as the key technology that will shape the future of energy. It is a critical uncertainty because the impact of electric storage and its deployment is expanding beyond EV to base load generation and, of course, as a means to stabilise the increasing renewable generation supply.

MEETING GLOBAL VISIONS

Managing global Energy Transitions and enabling the benefits of sustainable energy to be shared by everyone is one, if not the, most pressing and urgent leadership challenge of modern times.

The Issues Monitor survey is a practical and flexible tool that can be used by energy leaders as a reality check to define and clarify the current state of global, regional and national Energy Transitions. It can also be used to forge a global energy leadership agenda that facilitates new and better collaborative innovation in meeting global visions and goals.

For example, decision makers within and beyond the energy sector can use the IM 2019 survey results and interactive online tool[8] to explore the links between energy systems transition and three United Nations proclamations:

1. UNFCCC – Climate Change
2. UN SDG7 – Universal Energy Access by 2030
3. UN CBD – Convention on Biological Diversity

In this year's Issues Monitor we illustrate links between the various agendas to highlight the potential for synergies. These maps were recently presented to delegates at COP24.

Managing Energy Transition to Avoid Climate Catastrophe

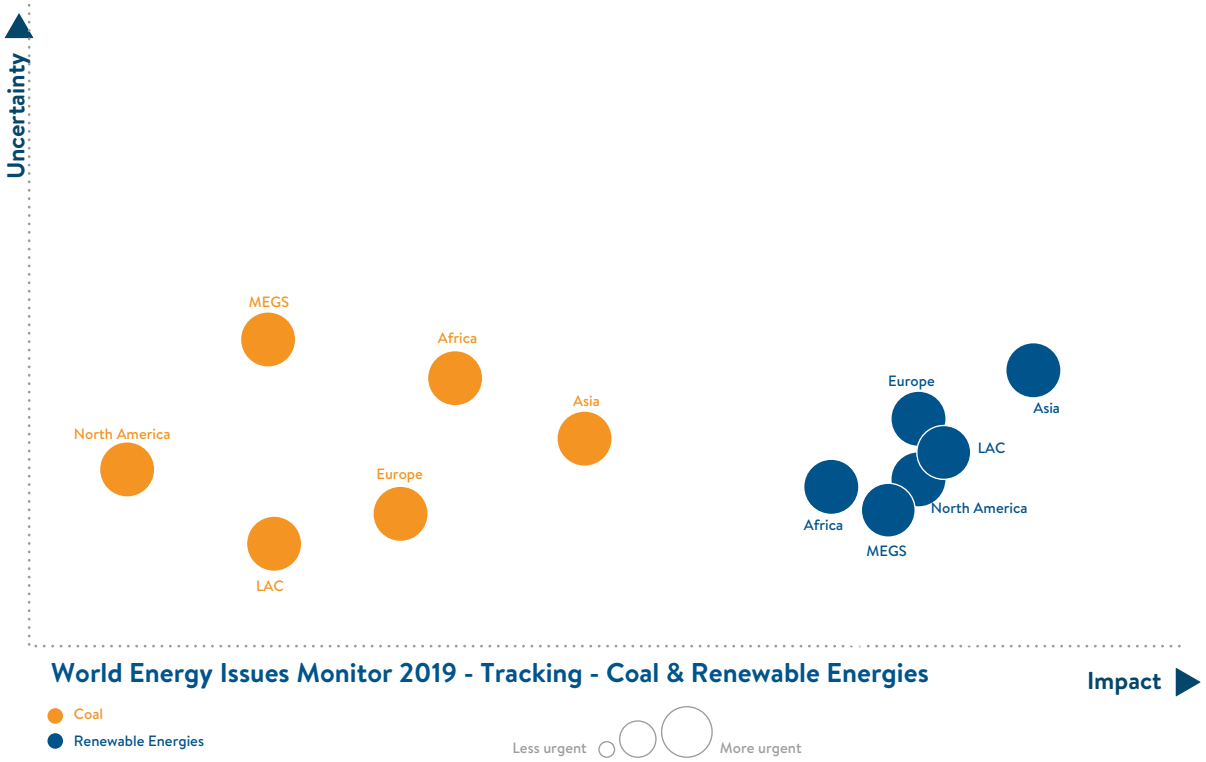
Greenhouse gas emissions from the global energy system continue to rise. Accelerating decarbonisation of the energy sector, by preventing and mitigating greenhouse gas emissions from

8. http://www.im.worldenergy.org/

energy production and use is a pressing challenge. Figure 5 illustrates that while energy leaders' daily decision making is highly impacted by new possibilities in renewable energies, a role for coal remains. World coal production in 2017 **increased by 3.2%**, the fastest rate of growth since 2011[9]. Commentaries highlight that coal is no longer just about energy and carbon – jobs and water use are also on the agenda.

Clearly, decarbonisation is a crucial, but not the only challenge in successfully managing a global Energy Transition for better lives and a healthy planet.

FIGURE 5: Tracking Coal & Renewable Energies



Managing Energy Transitions for Better Livelihoods

For decarbonisation to be successful, energy leaders around the world must also enable solutions to the challenge of improving livelihoods. A goal for sustainable development is improving affordable and reliable access to modern energy for enabling prosperity. According to recent statistics published by the IEA[10], nearly 1 billion people do not have access to any form of electricity. As embodied by the UN SDG 7, the challenge of decarbonisation is intrinsic to expanding affordable and reliable access, as these 1 billion people could resort to more carbon intensive sources of energy for access, if alternatives are not in place.

Figure 6 illustrates the progress different regions are making toward universal basic energy access. The survey and ensuing commentaries demonstrate that whilst Africa is the only region where

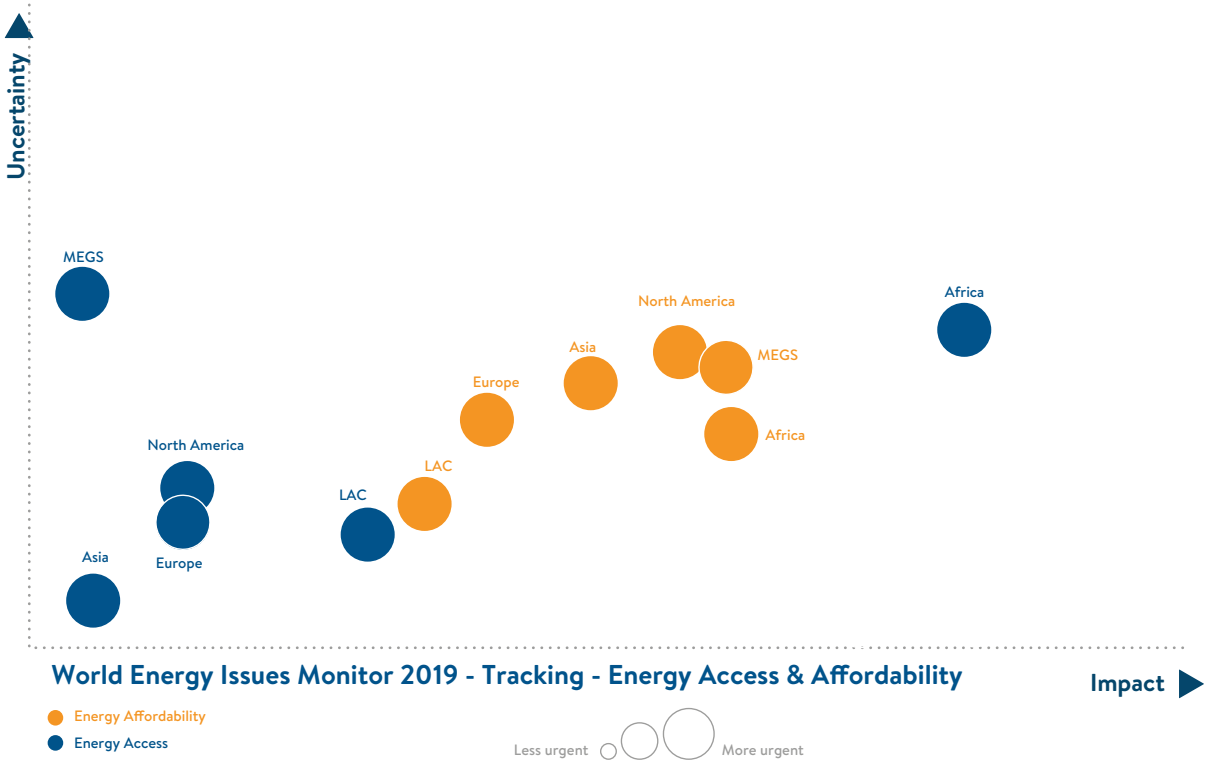
9. https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review/bp-stats-review-2018-coal.pdf
10. https://www.iea.org/energyaccess/

energy leaders are actively talking about solutions to problems of **basic** access, affordability is an emerging concern within and beyond OECD countries.[11]

> *"The cost of the Energy Transition is at the heart of debates and this is reflected in the importance given by many to the consequences on household purchasing power and business competitiveness with a central upcoming debate about burden sharing."*
>
> France National commentary on page 101

It is important that progress on basic access to electricity continues and does not detract attention from the need for all countries – developing, emerging and developed – to enable quality access[12] for better livelihoods.

FIGURE 6: Tracking Energy Access & Affordability



A Healthy Planet

Forests, watersheds, and oceans are impacted by Energy Transitions and vice versa. The links between land use, water, energy and food systems are already complex and variously impacted by climate change.

Whole societies and the modern energy systems on which they depend, are facing connected environmental challenges, including – non-energy resource scarcities, land use competition, increasing global water stress, forest fires and more frequent and severe extreme weather events.

11. https://www.oecdwatch.org/oecd-guidelines/oecd

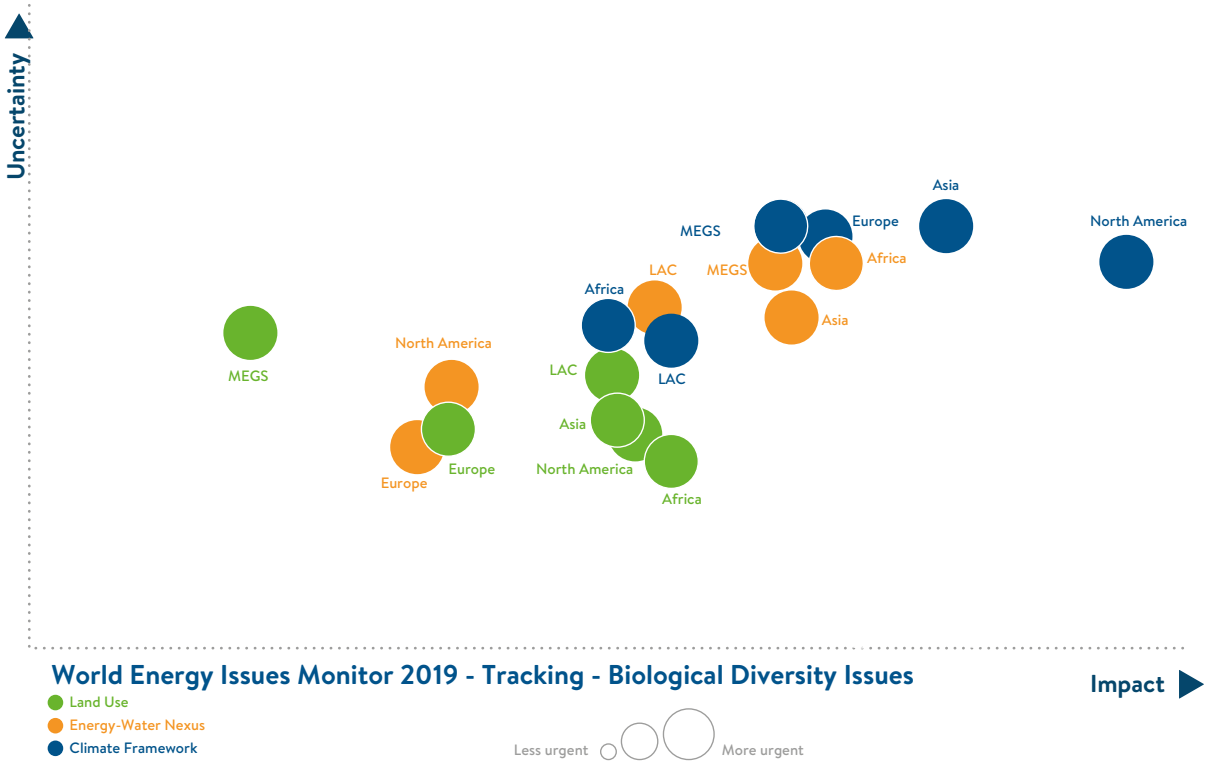
12. The Council is exploring the theme of quality access as part of its Innovation in the Energy Transition work programme.

"Niger is highly vulnerable to natural hazards, particularly droughts, floods, and landslides. Climate change is causing increasingly irregular rainfall, rising temperatures, and desertification which impacts agricultural productivity and food insecurity. Extreme weather risks will continue to create uncertainty for Niger's economic growth opportunities."

Niger National Commentary on page 44

Figure 7 illustrates how energy leaders and other decision makers can use the Issue Monitor 2019 to understand the impact of Energy Transition on ecosystems and communities as well as land (food)-energy-water nexus issues. For instance, to accelerate battery technology and support electric vehicles and resolve intermittency issues surrounding RES, lithium is critical. The production of RES technologies, including PV panels and wind turbines is also reliant on mined materials. The extractive industries, and specifically non-conventional methods like fracking, are reliant on a stable water supply for mining. Through survey responses and national commentaries that interpret those responses, the Issues Monitor tracks energy leaders' perspectives and perceptions on land used for energy production, the nexus between water and energy and the climate framework of a region. As illustrated in Figure 7, these are all intertwined. For instance, the biggest polluters seem to have their energy leaders actively planning and acting on climate issues while regions like Middle East and Africa are equally concerned about the water-energy nexus.

FIGURE 7: Tracking Issues Impacting Biological Diversity



NEXT STEPS - REGIONAL AND NATIONAL PERSPECTIVES

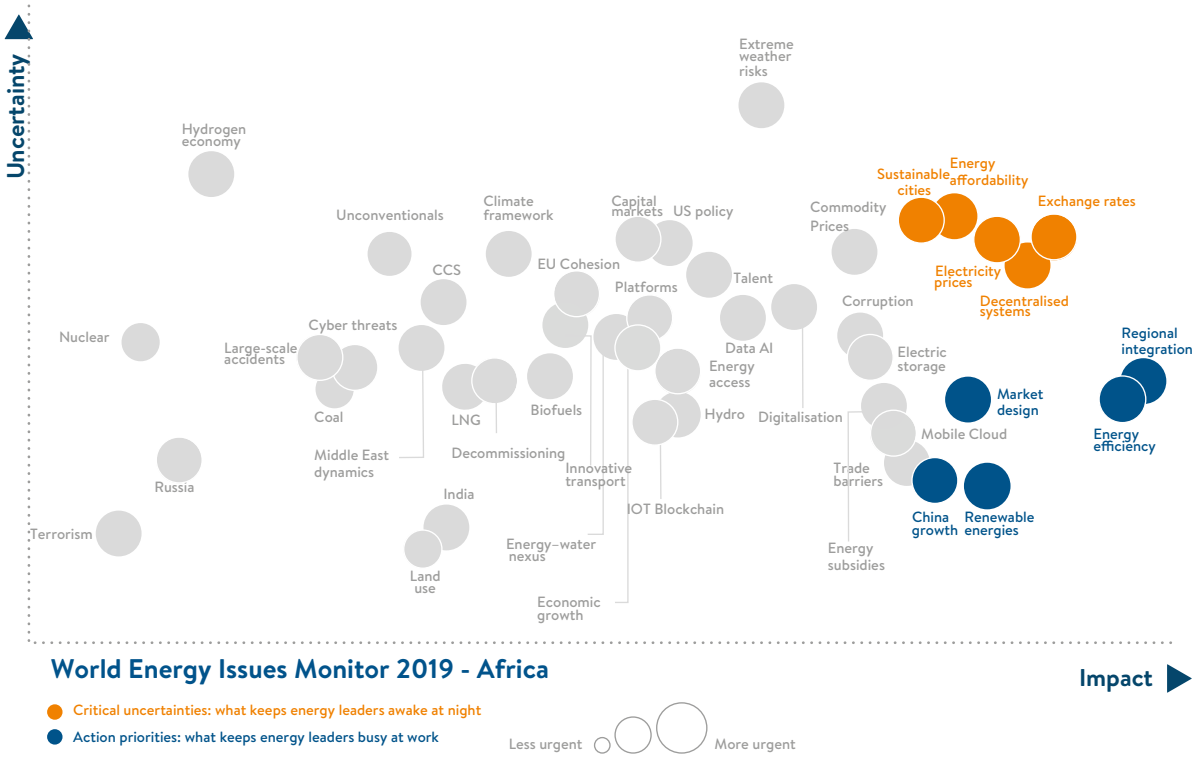
The remaining chapters of this report provide six regional outlooks followed by 50 national issues maps and commentaries. The national maps and specific commentaries are invaluable not only to energy leaders active in these countries, but also to the global energy community. The survey outcomes are a self-reflection of where the respective national leaders see themselves in the Energy Transition. They can be used by neighbouring countries and regions as a point of comparison and a way to learn from the experiences and policies of others.

In addition to the maps displayed in this document, the Council, in partnership with **Arup**, has built an **interactive tool**. This tool is a digital platform designed to coalesce dynamic map views of the decade of Issues Monitor data that has been collated by the World Energy Council. This interactive tool allows the preparation of different maps for comparison and allows the analysis of data by geography, over time, or in relation to specific energy issues.

> *"Imagining a better energy future is tantalising: realising it cannot be done all at once or by working alone."*
>
> Dr Angela Wilkinson - Sr. Director, World Energy Council

Chapter two
Assessing the energy agenda for Africa

2. AFRICA



REGIONAL OVERVIEW & CONTEXT

A historic step was taken by African Leaders in 2018 with the creation of the African Free Trade market. This move will definitively impact the trade of goods and services, including in the energy sector, and is expected to boost intra-Africa trade and, by extension, regional integration and industrial development. Another notable step in the region is the steady progress towards building the critical ingredients for sustainable and resilient societies. This is in line with the implementation of the 2030 UN Agenda for Sustainable Development (e.g. Goal 7) and the 2063 African Union Agenda. Energy infrastructure development and access to modern energy services are improving, but still challenging in most countries in Africa.

- Based on the 2018 World Energy Issues Survey responses, energy leaders in Africa recognise a number of critical uncertainties and action priorities.

- Comparing 2017 responses to 2018, key critical uncertainties such as **electricity prices** and **decentralised systems** continue to be uncertainties, while **market design and China** moved to the action priorities area.

- Action priorities keeping similar positions to previous years, but with higher degree of impact, include **renewable energies, energy efficiency and regional integration.** These issues have been stable in the African energy agenda over the past years.

- **Energy access** remains an overarching challenge, particularly in Sub-Saharan Africa where the electricity access rate is 35 % overall, and only 19% in rural areas.

- **Commodity prices** moved from action priorities to high uncertainties, around the same position the issue had in 2016. The fluctuation of commodity prices has led to the decrease in value of many export products. The high global uncertainty drives energy leaders to diversify their exports.

KEY ISSUES FROM THE REGIONAL MONITOR

Energy affordability remains a serious concern, due to high electricity prices and high connection fees. The issue has a special impact on low-income household budgets and limits the expansion of electricity access. With growing popular pressure, some African governments are resorting to subsidies to mitigate social concerns. Affordable electricity tariffs would improve living standards, and boost access to modern energy services (bringing electricity to a greater proportion of the population).

Decentralised systems continue to be considered a critical uncertainty. However, the 2018 survey responses show greater impact and urgency in this area. Decentralised systems are viewed as a solution to deliver socio-economic dividends faster and at lower costs than the conventional past solutions. They can offer an attractive option for closing the energy access gap in a faster way by contributing to meet the territorial energy demand, especially in remote and rural areas, through on-grid and off-grid systems. To further sustain their development, robust actions should be applied to their use for energy supply and distribution, with much focus on renewable energies supply. Policymakers need to evolve regulatory frameworks to integrate new opportunities and respond to evolving energy supply options to allow for their sustainable deployment.

Sustainable cities are now perceived as a greater critical uncertainty, while keeping almost the same level of urgency. The need of sustainable cities is particularly urgent, and most African cities are struggling to deal with fast-growing populations and widespread poverty, exacerbated by migration from rural areas. Consequently, the need for access to adequate basic services is dramatically increasing. Climate change is adding uncertainties, as Africa's urban environments are particularly susceptible to flooding and outbreaks of diseases such as malaria. The path to Africa's cities sustainability lies in improving urban planning, adequate urban policies and legislation, and adequate infrastructure financing.

Energy Efficiency maintains its position with high impact and great urgency because it is perceived as an indispensable and critical tool for the energy system, requiring pressing and bold actions to reap the benefits of this major but "hidden fuel". New lighting technologies, energy-efficient appliances, use of renewables, and improvement of energy efficient standards and labelling have all contributed to substantial reductions of energy use in residential and commercial sector; but there are substantial challenges remaining in the transportation, industrial and power sectors. Awareness, education, assessments, access to adequate financing, regulations and effective policies would contribute to make more progress and to encourage savings.

Renewable energies maintain a high impact role on the African agenda and are expected to increase roll-out (for power generation in grid-connected areas and remote communities) and to deliver on three critical goals: energy access, climate mitigation and lower air pollution. Substantial

developments have been recently made in leading countries forming the breakthrough of Renewable Energy Transition in Africa. Nevertheless, there are still some key challenges to address for the deployment of variable renewable energy sources, including enabling policy frameworks, adaptive regulations and access to adequate finance, as well as strong support from governments and other policymakers.

Market design has made a strong impact in the action priority area. This renewed and great interest is due to the fact that Governments and the Industry are keen to further expand access to markets to finance energy infrastructure. There is a growing acknowledgement that a market-driven investment environment is the best means to trigger investments and lower the cost of capital, while providing the right market signals to enable an affordable, secure and decarbonised electricity supply. Designing and implementing efficient electricity markets is key to the success of the African Union Free Trade Market and the achievement of the African Common Market by 2025.

Regional integration and power interconnection continue appealing for key priority actions, because offering huge opportunities to the African region and nations and expecting to deliver the three dimensions of the Energy Trilemma in a rapid and sustainable way.

China emerged as a privileged partner in the Action priorities area and is expected to sustain the development ambitions of many Africa countries. The recent Beijing Summit (September 2018) marked a strong new path of collaboration towards strengthening their partnership with Africa - the two sides engaging in concrete actions to enhance the synergy between their strategies and policies, advance cooperation under the Belt and Road Initiative and the Africa Union Agenda 2063.

Exchange rates moved up substantially along the uncertainties axis and gained greater impact. This is due to volatility of many African currencies and the subsequent implications of exchange rates on energy trade. Moreover, the strengthening of the US Dollar against many African currencies translates into strong prices disadvantage for export markets.

CONCLUSION

Closing the energy infrastructure gap of the region and adopting better project management policies are crucial to Africa's sustainability. To advance along the Energy Transition path and overcome the daunting challenge of energy access, countries in the region need to tackle inefficiencies in the electricity sector and related issues (power shortage, high tariffs and connection fees, huge backlog of investments, etc.). There is also a need to promote centralised and decentralised grids, and to adopt innovative and disruptive distributed generation technologies.

There is a growing push and adoption of renewable energies; and almost all African countries are now promoting renewable solutions. Solar and wind have increased markedly due to improved efficiencies and the falling cost of technologies, making these solutions competitive and suitable for energy decentralisation, as they can smoothly operate both on-grid and off-grid systems. Ultimately, there is an urgent need for action on all technologies, especially on renewables and energy efficiency, which are key for delivering on three critical goals – energy access, climate mitigation and lower air pollution. Some of these technologies are still in their infancy, so right approaches, policies and best practices are required to sustain their deployment and ensure their wider deployment and sustainable use.

ACKNOWLEDGEMENTS

Dr Elham Mahmoud Ahmed Ibrahim, Vice Chair of Africa, World Energy Council
Dr Latsoucabe Fall, Africa Regional Manager, World Energy Council

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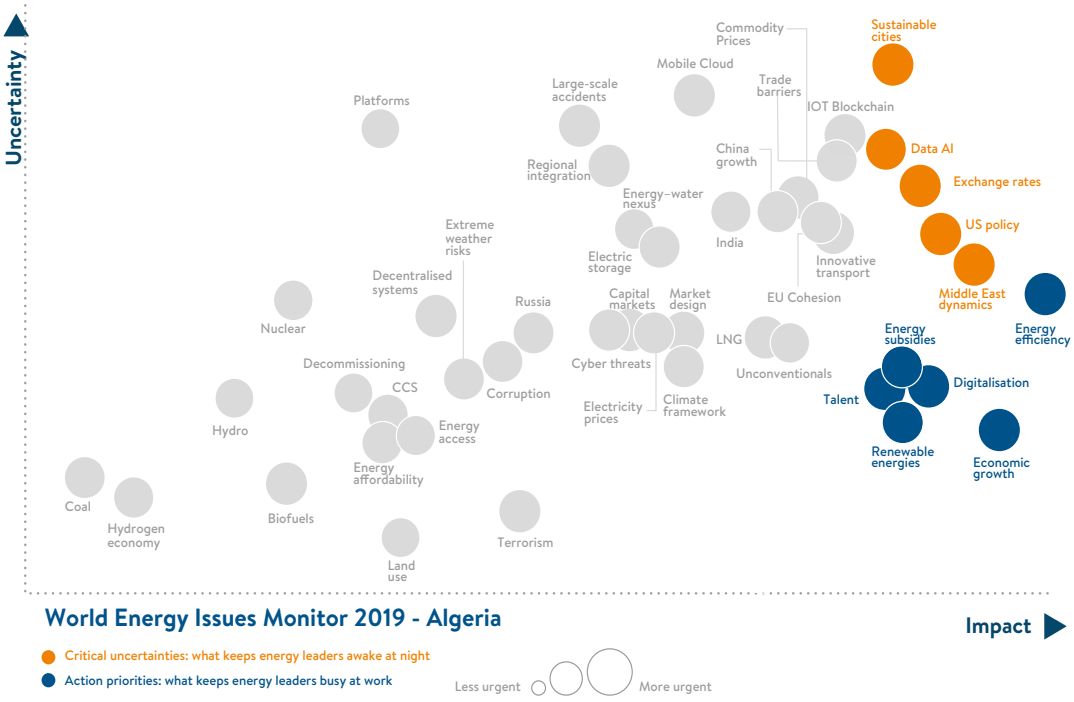
ALGERIA



NATIONAL OVERVIEW & CONTEXT

Algeria is the largest country in africa, with 5,500 km of complicated borders with Morocco, Tunisia, Libya, Mali, Niger, and Mauritania. The country holds a strategic position in the Western Mediterranean and, along with Morocco, was one of two North African countries to maintain political stability during the arab spring and its aftermath.

Algeria's economy is underpinned by the oil and gas sector, which accounts for more than 95% of export revenues, and 60% of government budget. Developing abundant shale gas has become a necessity for Algeria to reverse its declining domestic natural gas production and safeguard its economy.

Algeria's government is committed to shifting away from fossil fuels to renewable energy sources to preserve the declining fossil resources. This is also considered as the best long-term solution to achieve environmental objectives. Nevertheless, Algeria has been slow in implementing its renewable energy program. This is a consequence of its strong reliance on fossil fuels to support the economy, along with heavily subsidised energy products.

While the country is a major oil and gas producer, its economy is centralised and inflexible. Large chunks of hydrocarbon revenues are spent maintaining a wide range of state welfare and subsidy programmes. Mindful of the popular uprisings that shook neighbouring countries, the Algerian government is unwilling to risk ordering major reductions to these hand-outs. The authorities are seeking savings elsewhere, cutting public spending and freezing infrastructure projects. In march 2018, a plan to reduce imports by 15% was announced.

KEY ISSUES FROM THE NATIONAL MONITOR

Sustainable Cities are a critical uncertainty as Africa is the fastest urbanising region in the world. The "Algiers Smart City Project" has been delayed for three years due to delays in completing the construction of its facilities. The Algerian government is looking to make strategic investments that will improve the management of urban systems and ultimately boost the economy. The country is keen on growing a knowledge based economy, and smart cities are a key factor for this objective.

Middle East dynamics is one of the main critical uncertainties for oil-producing Countries. With its economy being largely dependent on the oil and gas sector and OPEC, the Algerian economy is not immune to this trend. Despite the geopolitical upheavals experienced in neighbouring countries, Algeria has been able to guard against any upheavals and ensure economic growth and social stability.

US Policy is a question mark at this point as the current administration's views could dampen US investment in Algeria and the rest of Africa. The US could miss investment opportunities in a region with the world's fastest-growing middle class, a continent that will account for half of global population growth by 2050.

Renewable Energies is an action priority for the government as it battles access. The Algerian Electricity and Gas Regulation Commission (CREG) in 2018 issued a tender for the construction of several PV power plants with a combined capacity of 150 MW in the southwestern part of the country. The tender is part of the Government's plan to deploy 22 GW of renewable energy power generation capacity by 2030, including 13.6 GW of PV.

Energy Efficiency is an action priority for Algeria ever since the Government announced a new national programme on energy efficiency (EE) for the years 2015 to 2030. The EE programme mainly targets three sectors: buildings, transport and industry. The objectives include the thermal insulation of 100,000 homes per year, distributing 10 million energy efficient lamps and switching 1.3 million vehicles to liquid petrol gas. Through these measures, 180,000 jobs are supposed to be created.

Economic Growth is an action priority for Algeria as the population expands and as a viable middle class is required to enable a sustained foreign investment. In order to achieve this, Algeria needs to promote investment by adopting policy measures to favopur the business climate.

CONCLUSION

In addition to its hydrocarbon resources, Algeria has considerable strengths in solar energy, which makes the transition to renewable energies a strategic alternative to sustain the country's energy security. It also allows the country to continue to honour its commitments to the Sustainable Development Goals and the global effort to combat climate change. Finally, this transition offers prospects in terms of R&D, innovation and the emergence of a local renewable energy industry that creates wealth and jobs.

ACKNOWLEDGEMENTS

Algeria Member Committee, World Energy Council

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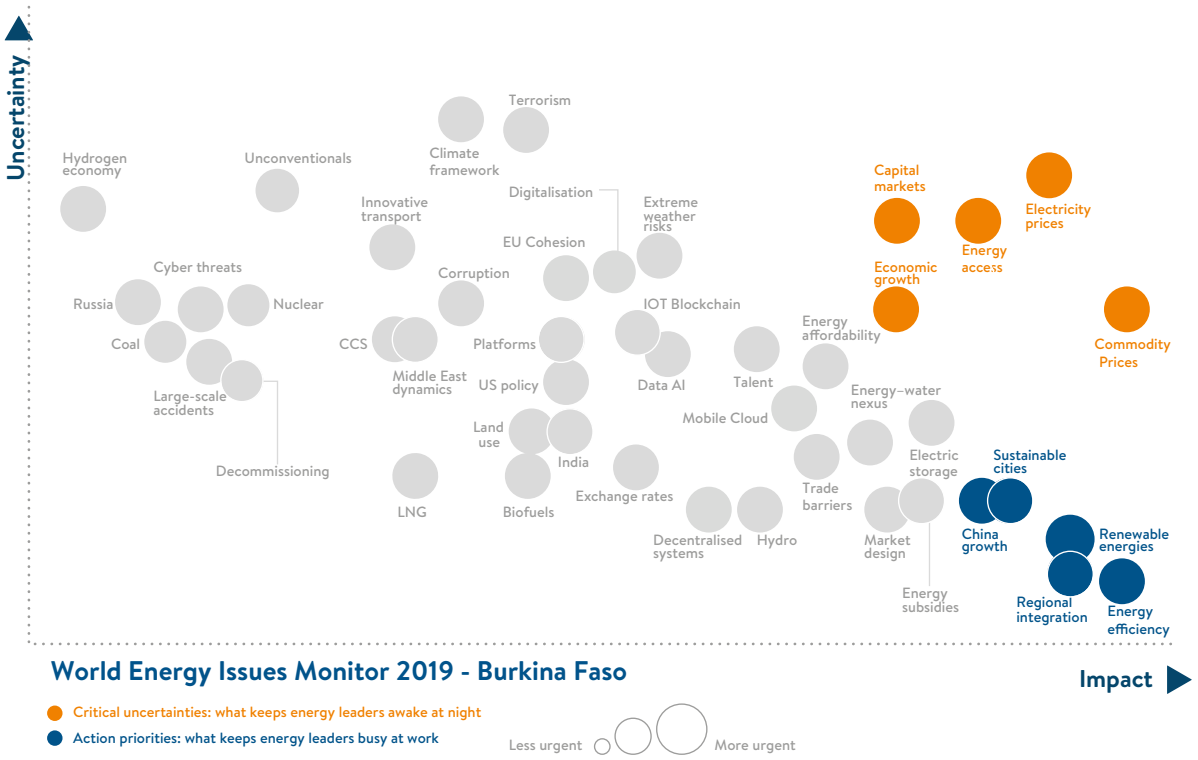
BURKINA FASO



NATIONAL OVERVIEW & CONTEXT

Burkina Faso is a landlocked country in sub-Saharan Africa, with low income and limited natural resources. In this year's iteration of the Issues Monitor, the critical uncertainties for Burkina Faso are: electricity prices, energy access, capital markets, economic growth and commodity prices. All five of these issues are key to Burkina Faso's development and economic growth, especially energy access. Indeed, although nearly 60% of the urban population has access to electricity, this percentage drops to less than 1% in rural areas. This makes energy access one of the country's top priorities. The five action priorities for this year are: renewable energies, sustainable cities, regional integration, energy efficiency and China.

As part of its National Plan for Economic and Social Development, Burkina Faso seeks to increase its electricity access rate from 20% to 80% by 2020. This would mean doubling the number of customers to 1 million and increasing installed capacity to 1,000 megawatts (MW). According to this same plan, by 2025, Burkina Faso aims to lower energy costs, reach 95% access rate to electricity and start exporting oil and gas to neighbouring countries.

Driven by strong demographic growth, electricity consumption in Burkina Faso grows by more than 8% every year according to the World Bank. In this context, several solar plants have been developed to both reduce the country's dependence on hydrocarbon imports and to produce electricity at lower cost to accelerate the electrification of the country.

KEY ISSUES FROM THE NATIONAL MONITOR

Capital Markets: The country has had limited experience with private sector development in the energy sector. Nevertheless, the government is working towards reforms to encourage investments and to liberalise electricity generation and distribution. A new law adopted in April 2017 removes market segmentation and the single-buyer model also including provisions relating to renewable energy and energy efficiency.

Electricity Prices: Burkina Faso has one of the highest electricity costs compared to its neighbouring countries. The government heavily subsidises the production of electricity. In 2017, it granted an annual subsidy of about 21 billion CFA Franc to the national electricity company, Sonabel. Sonabel's financial difficulties have hindered the rehabilitation and maintenance of power grids and the aging fleet of power plants. Despite these subsidies, electricity remains inaccessible to many households and SMEs.

Energy Access: The rate of access to electricity in the country remains one of the lowest in sub-Saharan Africa, a situation that strongly affects the industrialization of Burkina Faso. To date, manufacturing industries contribute only 4% of GDP. Moreover, the lack of access to energy is forcing millions of Burkinabe, women in particular, to resort to traditional biomass – which has important health implications. To make up for its energy gap, the government has embarked on a new approach, liberalising the energy sector and promoting solar energy.

Renewable Energies: Several programs have been set in motion to build photovoltaic solar plants with grid injection to reduce the cost of electricity per kWh. On-going projects include the 20 MWp solar power plants in Koudougou (Centre-West) and 10 MWp in Kaya (Centre-North). The extension of the 17 MW Zagtouli photovoltaic solar power plant is also underway, together with the European Investment Bank (EIB), as well as the construction of the Yeleen solar power plants with a cumulative power of 50 MWp. carried out with AFD, the ADB, the EU and the Green Climate Fund.

Sustainable Cities: The state must increase its funding to increase the availability and accessibility of energy to make cities more sustainable. There is a national plan that provides 90% coverage of the territory in 2025, which is executed by the public electrification companies in urban and rural areas (SONABEL and ABER) and by private actors. This plan is financed by the State, the donors and the private sector through the PNDES (National Economic and Social Development Plan) to reduce the coverage and accessibility deficit. Moreover, an energy efficiency project is ongoing with the aims to reduce the demand for energy.

Energy Efficiency: The segment of the population that has access to energy continues to use appliances which aren't energy-efficient. National policies for energy efficiency must be promoted to rationalise consumption and promote renewable energy technologies.

CONCLUSION

Burkina Faso's energy sector is struggling with a lack of energy infrastructure. Electricity production is 62.80% thermal power from imported oil, which makes it expensive. This consequently hinders access to energy, while curbing socio-economic development. Efforts are being made by the

government to increase supply sources through the energy mix for production of 1,800 MW by 2025 and reduction of the peak deficit of 71 MW (2018). The lack of financial resources is an obstacle that can be overcome with the support of international donors in the short-term, and by liberalising the energy market in the long-term.

ACKNOWLEDGEMENTS

Burkina Faso Member Committee, World Energy Council
Dr PALM Kalifa, Energy Researcher
SANOU Z. Kévin, Expert in Rural Electrification Policy
TRAORE Dramane, Energy Efficiency Specialist
YE Nazounou, Electromechanical Engineer
YAMEOGO Jean de Dieu, Electromechanical Engineer
Dr Coulibaly Ousmane, PhD in Energy Science
BILA Mohamadi, Economist
NABI Boureima, Advisor on Economic Affairs

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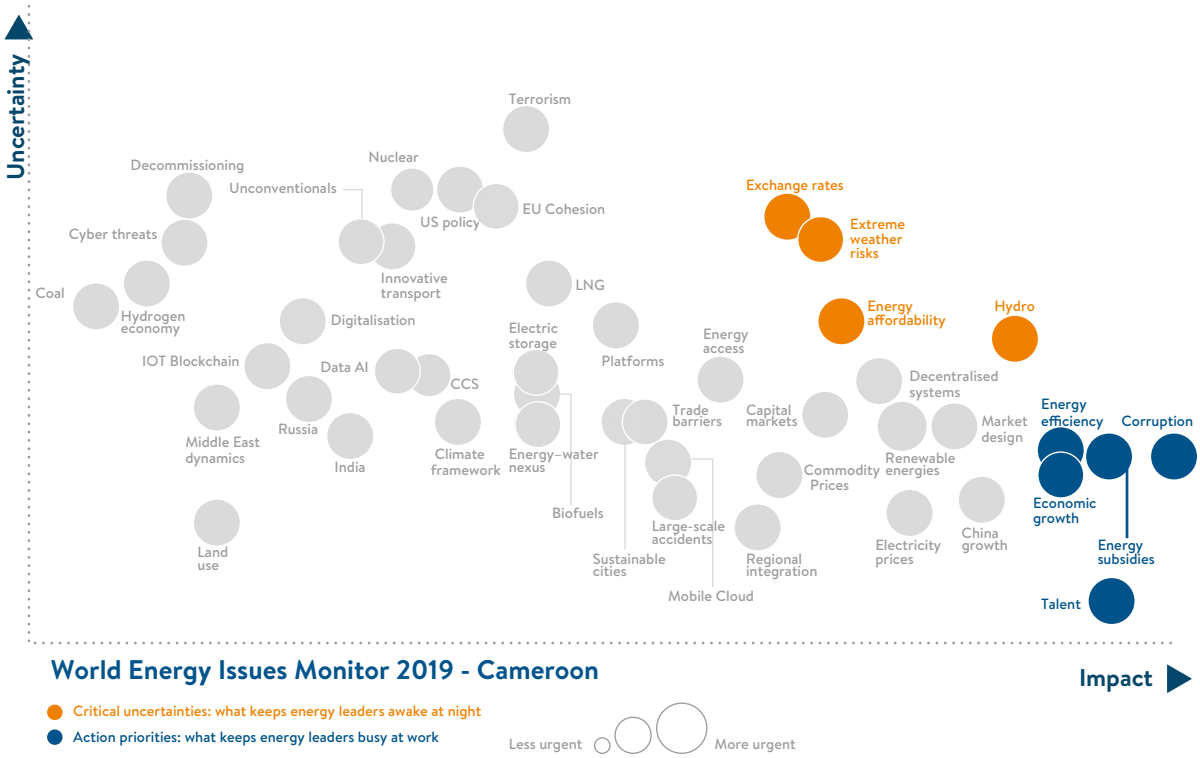
CAMEROON



NATIONAL OVERVIEW & CONTEXT

Major political events occurred in Cameroon in 2018, including the re-election of the country's president, in power since 1982. Cameroon is the largest economy in the Central African Economic and Monetary Community (CEMAC), a region experiencing an economic crisis triggered by the steep fall in oil prices.

The power sector is characterised by the gap in the demand and supply of power, resulting in frequent grid outages. Energy consumption is one of the lowest globally, at 342kg of oil equivalent per capita; electricity access has been assessed as 54% nationally (88% in urban and 17% in rural areas) [**Ref.1**]. However, the power sector must play a strategic role in the ambition of the government to make Cameroon an energy exporter by 2035. According to the energy leaders, the achievement of this ambition (which relies on heavy investments in hydropower) is tainted with much uncertainty. Uncertainty is on the one hand related to speculations over the exchange rates devaluation affecting the CEMAC and on the other hand linked to the risk of extreme droughts which could affect the hydropower capacity of the country.

The potential capacity of large hydro facilities to enable modern and affordable energy access for all Cameroonians seems uncertain for energy leaders. In addition, energy leaders seem to be struggling to secure the investments required to extend the grid across the territory. Cameroon's energy leaders' actions priorities include freeing the energy sector from corruption, boosting economic growth and promoting energy efficiency.

KEY ISSUES FROM THE NATIONAL MONITOR

Exchange rates represent a critical uncertainty regarding the development of the power sector of Cameroon due to its potential negative impact on energy projects which rely on imported equipment and services. In fact, debates and speculations over the devaluation of the local currency discourage external investment. The situation has been exacerbated over the past two years after the Economic Partnership Agreement (EPA), signed by Cameroon, came into effect in August 2016 [**Ref.2**].

Hydro is the main source of electricity in Cameroon as the country has the second largest potential in sub-Saharan Africa, (estimated at 115,000 GWh/Year [**Ref. 3**]), currently harnessed at less than 5%. In 2018, the 420MW Nachtigal hydropower project reached financial close and groundworks and civil engineering are to start soon. Other hydro projects are still in gestation as well as in maintenance. Nevertheless, energy leaders are uncertain that the investments required for large hydro facilities and grid extensions necessary to deliver 100% energy access by 2035 will be achieved.

Extreme weather risks represent an uncertainty expressed by energy leaders in Cameroon due to the vulnerability of the hydro capacity to extreme droughts. In fact, the drastic drop of the flow rate of the Sanaga River (which concentrates 75% of Cameroon's hydroelectric potential [**Ref. 4**]) during the dry season severely affects the generating capacity of the two existing hydropower plants, with resulting power outages. Energy leaders in Cameroon are worried that in the future climate change could worsen the intensity and frequency of droughts in the region.

Corruption is perceived by Cameroonian's energy leaders as a key challenge to be addressed and high in priority. In fact, from 2017 to 2018 Cameroon has been ranked 153 least corrupt (with 1 being the least corrupt) nation out of 180 by Transparency International [**Ref. 5**]. Corruption affects both private and public sectors and subsequently the energy sector which is jointly owned by the public and private sector. Although measures are undertaken by the government to eradicate corruption, it still represents a key barrier to overcome towards an effective development in all sectors, including energy.

Economic growth of Cameroon has long been steady averaging 5.8% from 2013 to 2015 before falling to 3.4% in 2017 [**Ref.6**]. However, it showed signs of increase in Q2 as it reached 3.9% while still facing considerable risks, including deteriorating security in its English-speaking regions. From the established relationship between energy consumption and economic growth, energy leaders (while recognising the strategic role to be played by energy in reaching the development goals) are expecting a stronger economic growth to create a more favourable environment for investments in energy projects.

Energy Efficiency is perceived by energy leaders as one of the most pressing challenge to be addressed. In December 2016, the World Bank invested $325 million to improve efficiency and reliability of the national electricity network [**Ref.7**], which is deeply affected by losses estimated at about 30% of total generation capacity. Also, campaigns have been undertaken by the electricity utility sector to grow awareness on good practices in terms of energy consumption and the

improvement of the demand-side management. Therefore, priority is set on energy efficiency as a means to reduce the gap between demand and supply of power across the country.

This year's Issues Monitor for Cameroon highlighted **Talent** as an action priority. The issue of talent scarcity is viewed as a hindrance and a cause of mismanagement [**Ref.1**]. Moreover, energy leaders are uncertain about **energy affordability** that is perceived as an additional deterrent to energy access in urban areas.

CONCLUSION

Cameroon's energy landscape has shown an overall stability in the last three years, with some significant issues remaining priorities. Currently, the government has embarked upon multiple parallel efforts to develop new hydropower infrastructure, but the energy sector remains slowed down by corruption and economic stagnation.

Other key aspects to watch in 2019 are the impacts of energy efficiency initiatives and the completion of new hydropower plants on the energy access rates. Exchange rates and extreme weather risks are key uncertainties darkening the long-term future of Cameroon's power sector.

ACKNOWLEDGEMENTS

Urbain NZOTCHA, Future Energy Leader (FEL), Cameroon, World Energy Council

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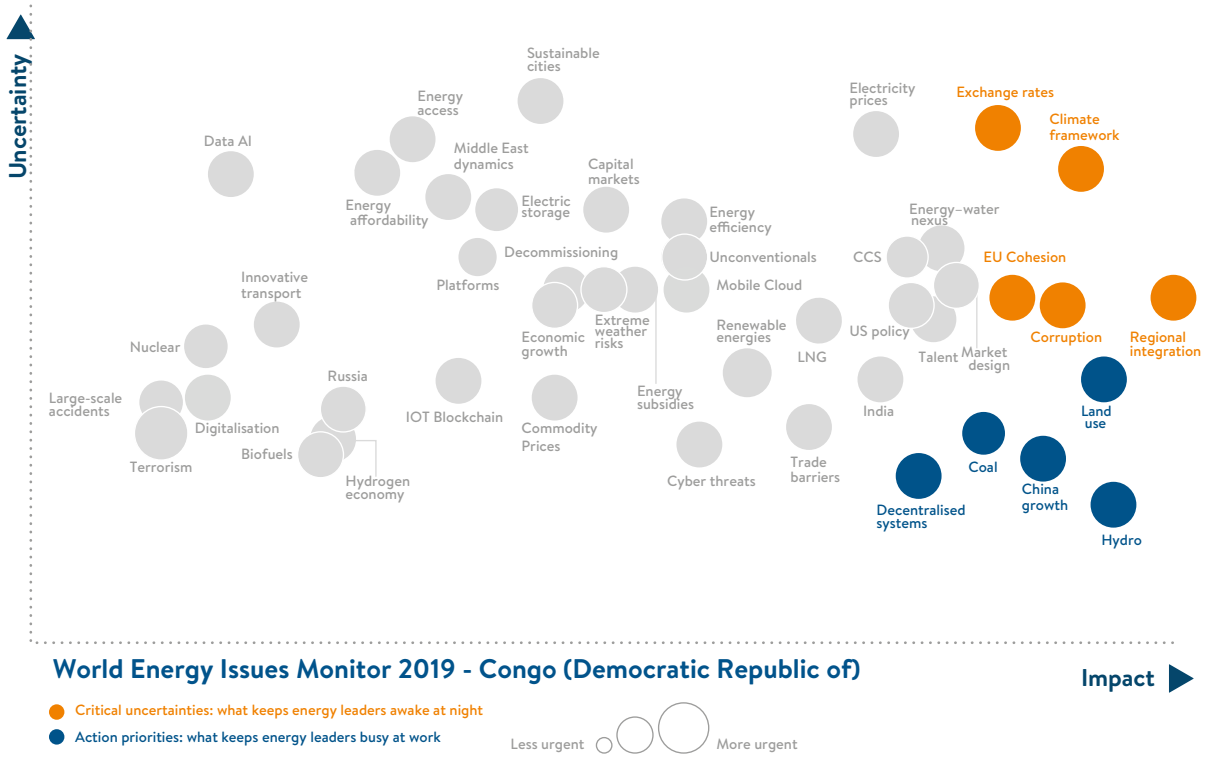
CONGO (DEMOCRATIC REPUBLIC OF)



NATIONAL OVERVIEW & CONTEXT

The Democratic Republic of the Congo (DRC) is the 11th largest country in the world, with a population of over 83 million. The DRC has one of the lowest electrification rates in the world at just over 9%, with 1% in rural areas and 19% in urban areas. The country hosts large reserves of mineral resources and has a potential to install up to 100,000 MW of hydropower capacity. With an ambition of providing 65% electrification in 2025 and universal access by 2050, the DRC is facing issues in governance, electric utility performance, effective policymaking and implementation of existing plans.

With 167 million hectares of forest and nearly 10% of the world's tropical forests, the Democratic Republic of Congo is the second largest tropical forest country in the world. The country is also endowed with abundant energy potential and resources: biomass, hydro, solid, liquid and gaseous hydrocarbons (including methane gas from Lake Kivu), mineral coal, oil shale, solar wind potentials, uranium ore, etc. While still very little of these resources have been developed, the conservation and sustainable management of these resources are major challenges for the Congolese government. The direction taken by the DRC in terms of the exploitation of its natural resources is most likely to have impacts at the regional as well as global level.

For this year's Issues Monitor, the energy leaders of Congo have identified climate framework, corruption and regional integration as the critical uncertainties and hydro, decentralised systems and coal as the action priorities for the country.

KEY ISSUES FROM THE NATIONAL MONITOR

Climate framework is the critical uncertainty number one for this year's Issues Monitor. The DRC is in the process of implementing the Paris Agreement. The country also has a high rate of deforestation, ranking within the top ten in the world. CO2 emissions nationally are around 3 million metric tons per year, equating to around 0.04 metric tons per person. The shift to modern energy services, electricity and improved cooking stoves will help decrease the use of diesel and kerosene for energy needs.

According to energy leaders in Congo, **corruption** is a critical uncertainty for the energy sector. The DRC's progress toward providing universal access to electricity is uncertain following claims of massive corruption. The recent bribery claims during one of the energy tenders is a big setback to the DRC, as the country is trying to attract foreign investors.

The issue of **regional integration** is the third critical uncertainty according to the DRC's energy leaders. In a bid to meet the energy demand of industries, households and businesses, electricity access can be improved by making the most of cross-border electrification projects. Combined efforts to improve energy access will most likely require developing power supply interconnections in the Central African region. The DRC, by working with neighbouring Central African countries, could tap into huge reserves of renewable energy resources such as hydro, solar, wind energy, geothermal as well as non-renewables like thermal, peat, and coal that are technically and financially viable. However, political instability and suspicions of corruption have affected regional collaboration.

Energy leaders in Congo highlight **hydro** as the first action priority for this year's Issues Monitor. The DRC hosts a potential to install up to 100,000 MW of hydropower capacity in the country. The government's primary focus is to develop large-scale hydropower solutions to supply increasing energy demands and export electricity to neighbouring countries. The DRC is a long way from achieving its original target of 65% electrification by 2025, let alone the new Sustainable Development Goals of universal electricity access by 2030. The utilisation of hydropower could contribute to the delivery of energy targets with environmental sustainability in sight. Nevertheless, the cost of these large-scale projects, the political instability of the country, and the suspicions of corruption, have slowed down their development.

The issue of providing **decentralised systems** is the second action priority for this year's Issues Monitor. With barely 16% of the population with access to electricity, the DRC government is working to improve rural electrification rates through off-grid solar kits and mini-grids. Small-scale projects around renewable energies are likely to significantly increase access to electricity, especially in rural areas.

The energy leaders in Congo consider **coal** as the third action priority for this year's Issues Monitor. According to its energy leaders, coal will play an important part in the energy mix to achieve the 65% electrification target by 2025 and the universal access target by 2050.

CONCLUSION

Congo's energy leader's concerns and actions are aligned with the developments for security of supplies, climate framework and regional integration concerns in the country. The road is still long and fraught before the DRC can provide modern energy access services to its entire population. To do this, it will be necessary to include not only large national projects but also smaller projects, allowing the country to develop the diversity of its energy sources, particularly renewable sources.

ACKNOWLEDGEMENTS

Congo Member Committee, World Energy Council

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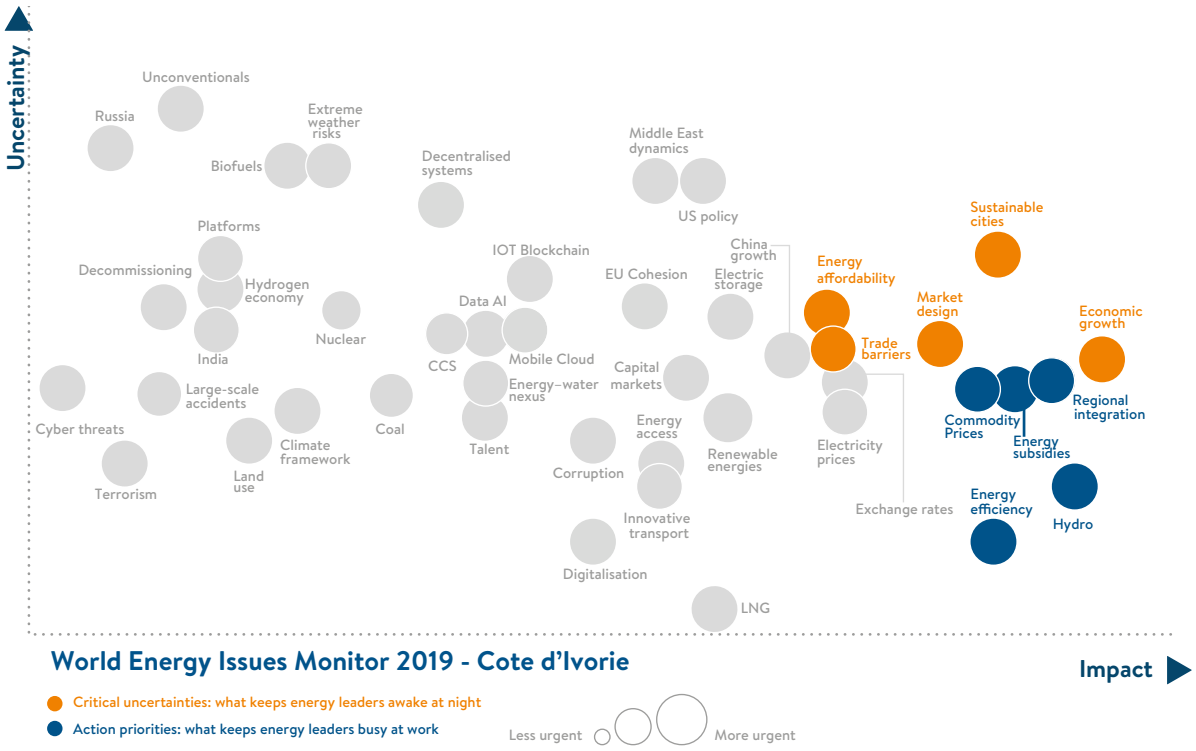
CÔTE D'IVOIRE



NATIONAL OVERVIEW & CONTEXT

Investments in the energy sector are at the centre of the strategy for Côte d'Ivoire to become an emerging market. Côte d'Ivoire's National Development Plan for 2016–20 aims to diversify the country's economy, boost oil revenues, make explorations blocks more attractive to foreign investors, promote renewables and reach 100% energy access.

Up until two decades ago, the country was heavily reliant upon hydroelectric power and fell into an energy crisis when the electricity output from its dams was drastically reduced due to droughts. Since then, Côte d'Ivoire became the first country in sub-Saharan Africa to turn to independent power producers (IPPs) to meet energy demand. Allowing private firms to operate in this sector gave Côte d'Ivoire the ability to respond rapidly to its growing energy needs.

The growing economy of Côte d'Ivoire puts the current power supply under pressure. The government thus set goals to increase its power production capacity by 2020 to about 4,000 MW and 6,000 MW by 2030 to meet the rising demand. In addition, the country aims to play a central role as a net exporter in the West African Power Pool.

In its Strategic Plan for the Development of the Electricity Sector by 2030, the government identified 66 projects that will require significant investment from the private sector, including public private partnerships with Independent Power Producers, aimed at expanding power capacity production and modernising the transport and distribution of electricity throughout the country.

The critical uncertainties for the nation are not only its economic growth, but to ensure that this growth is sustainable in the long run, focusing on managing its natural capital and taking immediate

action to mitigate the impact of climate change. On this front, regional integration and the use of hydro are action priorities that Côte d'Ivoire must continue to work on.

KEY ISSUES FROM THE NATIONAL MONITOR

Sustainable cities for Côte d'Ivoire means curbing deforestation. This remains a critical uncertainty and a priority as, in 1960, an estimated 37% of the national territory was forest cover; in 2010 it was less than 14% - one of the fastest deforestation rates in the world. Because of their carbon-storing abilities, tropical forests play a key role in combating climate change. These forests also meet essential local needs by regulating temperatures, helping generate rainfall, and purifying the air and water, and they are essential to the well-being of rural communities.

Energy affordability is a significant critical uncertainty, as in 2017 prices jumped up nearly 40%. This could negatively impact economic growth and potentially cause another political crisis. The country needs to ensure that energy affordability is addressed sooner than later.

Economic growth remains a critical uncertainty because Côte d'Ivoire relies in part on the use of its natural resource base for its economic development. The stock of natural resources is believed to have diminished by 26% between 1990 and 2014. Several visible phenomena attest to this degradation, such as deforestation, the depletion of water reserves, and coastal erosion.

Regional Integration or market connection is not only an action priority for Côte d'Ivoire, but for all of West Africa. Currently these countries are working to complete the physical interconnections to send power across borders. It is anticipated that by early 2020s the most critical cross-border links will be in place, making it possible for electricity to flow throughout West Africa from countries with cheaper, cleaner and more abundant energy resources to those lacking them.

An action priority for Côte d'Ivoire is increasing its **hydro** power share of generation. As of 2017, some 80 percent of total electricity generation was generated by natural gas, 19% by hydropower and around 1% by renewables, according to the Ministry of Petroleum, Energy and Renewable Energy Development. In terms of hydropower, a series of investments are supporting government aims to lift its contribution to the energy mix to 26% by the end of the decade.

Energy Efficiency is an action priority as the government has set a target to reduce energy consumption in industry by 25% in 2030. Tackling energy efficiency will also help reduce the impact on the country's natural resources and its expanding concern over deforestation.

CONCLUSION

Although Côte d'Ivoire power sector faces many challenges, including a poor transmission and distribution grid, soaring energy demands, gas shortages and an overreliance on an unreliable power source, it has been one of the most investor friendly countries in the sub-Saharan region. The government has actively sought to create a clear and robust legislative framework for private investment.

ACKNOWLEDGEMENTS

Côte d'Ivoire Member Committee, World Energy Council

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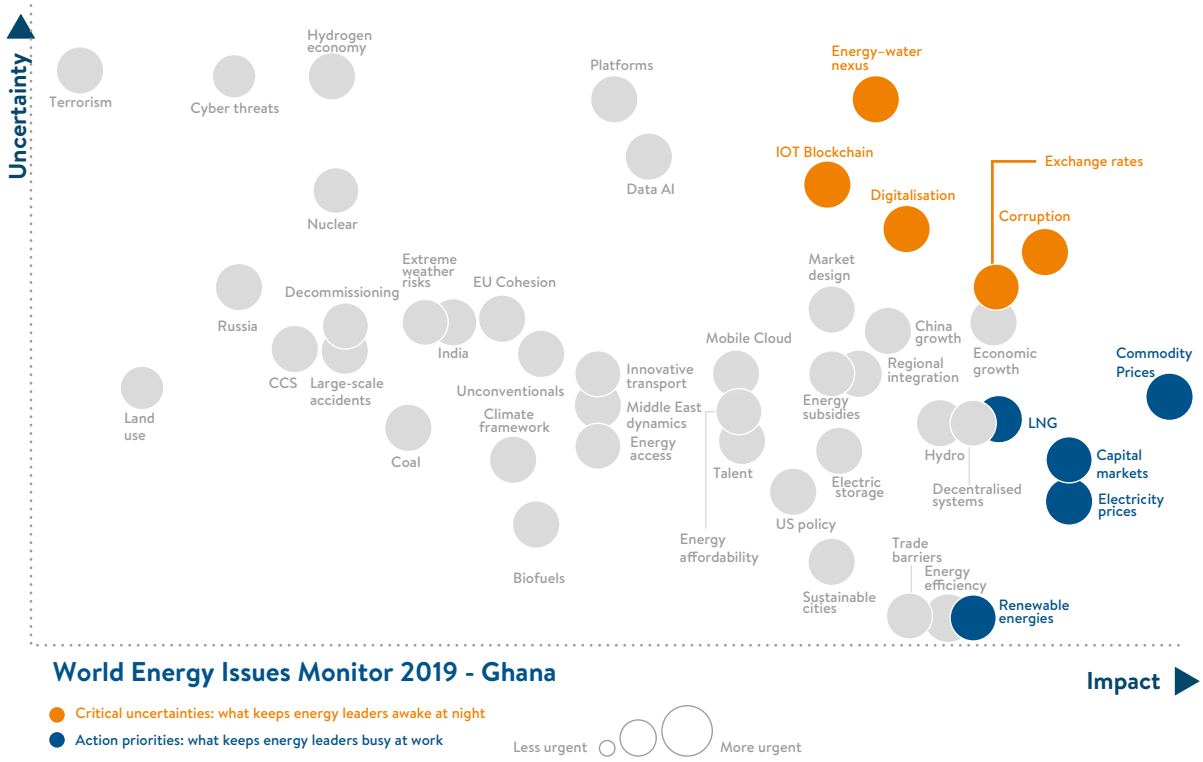
GHANA



NATIONAL OVERVIEW & CONTEXT

Demand for electricity in Ghana has increased by about 52% over the past ten years, installed generation capacity has more than doubled over the same period. Despite the increase in the generation capacity which has become more than the demand, there were few instances of power supply shortages due to fuel supply challenges.

In the 2018 Issues Survey, Ghana's energy leaders have identified the energy-water nexus, along with digitalisation and corruption as the key critical uncertainties faced by the sector. Commodity and electricity prices, LNG and renewable energies are perceived as the priorities which are driving businesses and policy makers' actions. Ghana's dependence on the Akosombo Dam for its power supply has put pressure on this source to deliver. These circumstances have been aggravated by a reduced stock of liquid fuels which are also responsible for the country's electricity supply. Digitalisation and grid optimisation are emerging as a strategy to address power shortage through greater efficiency. Progress in the sector has been relatively challenged with the former Energy Minister Hon. Boakye Agyarko being relieved off his position following a corruption scandal, which added uncertainty to the country's investment landscape.

The attention of sector leaders is focused on ensuring availability and reliability of supply. Fuel availability is seen as intrinsically related to affordability of electricity. As such, efforts are being made to diversify the energy mix with the enhanced participation of LNG, as well as solar and wind in the energy mix.

KEY ISSUES FROM THE NATIONAL MONITOR

Energy-Water Nexus: As of 2018, hydropower accounts for 39.2% or 5,616 GWh of Ghana's total electricity generation according to the country's Energy Commission. In the previous year, inadequate stocks of liquid fuels (LCO and diesel) at the thermal plants compelled the hydro plants to be operated beyond their capacity. The total hydropower reservoir was over-drafted to make up for power deficit, therefore putting in danger the integrity of reservoirs. As a result, the expected total annual electricity generation from hydropower in 2018 would not exceed 5000 GWh. A strict plan has been established for hydropower production to protect reservoir integrity for subsequent years.

In 2017, Ghana Grid Company (GRIDCo) has started a new phase of **digitalisation** with an agreement to build a new Computerised Maintenance Management System to improve maintenance and optimize grid operations. However, the country's transmission system is still in poor condition with frequent episodes of overloading during periods of high demand. Recent efforts towards digitalisation of the sector included the visit of Silicon Valley led by Ghana's Vice-President, H.E. Dr. Mahamudu Bawumia, aiming to accelerate sector digitisation as a means to boost Ghana's economy. Uncertainty around this issue is mainly led by the early stage of digitalisation projects.

The renegotiation of the controversial Ameri power deal in August 2018 by the then minister of energy, Hon. Boakye Agyarko, led to a major **corruption** scandal. The agreement had been originally signed at the height of the power outages that impacted Ghana from 2014 onwards. In 2018, it was found that the cost Ghana is expected to pay Ameri is much higher than the initial amount paid for the deal. This led to Hon. Boakye Agyarko being relieved off his position by the President H.E. Nana Addo Danquah Akuffo-Addo and to his subsequent replacement with Hon. John Peter Amewu from the Ministry of Lands and Natural Resources, leading to investors' uncertainty about the country's energy investment landscape.

Commodity Prices and Electricity Prices are seen by Ghana's energy leaders as an urgent action priority as fuel availability and gas pricing remain the major risks to reliable electricity supply in the country. Ghana's current installed capacity is of over 20,000 GWh - enough to meet the country's electricity requirement including suppressed demand. However, this can only be achieved with the availability of cost-competitive fuel. Lack of funds and debt towards fuel suppliers are the major challenges around these issues, and the priority areas for action.

Ghana, which already counted with the Jubilee and the TEN gas reserves, has started developing the Sankofa gas field in 2018 which is expected to add significantly to the level of domestic production. Although the prospects for gas development in Ghana are outstanding, the development of an **LNG** market has been challenging and analysts argue that there will be no room in the market for LNG until after 2020. Additionally, there have been a number of abortive attempts to develop Floating Storage Regasification Unit (FSRU) projects, with the lack of enforceable contracts, inability to put in place the necessary infrastructure and creditworthiness all being concerns.

2018 has seen a fast progress in the incorporation of solar and wind power in Ghana's energy mix. As at end of the first quarter, 113 Provisional Wholesale Electricity Supply Licences had been issued

to potential Independent Power Producers (IPPs) proposing to develop a total of about 6,698 MW of electricity from various **renewable energy** sources. 75 of the licences issued are for solar photovoltaic (PV) generation with a total capacity of about 4,243 MW. About 35 licensees have moved to the Siting Permit stage of the licensing process of which about 29 are for solar PV. In addition, in April 2018 the Ghana government announced that $230 million had been earmarked to promote the use of renewable energy, particularly in off-grid communities across the country. The funds are directed to the private sector to deploy over 35,000 systems in off-grid communities.

CONCLUSION

While main critical uncertainties in Ghana revolve around long-standing issues, the emergence of digitalisation as an issue perceived with high impact and high uncertainty suggests that Ghana's energy shapers are concerned about innovative ways to address the country's energy challenges. In turn, industry and government actions are focused on securing fuel and electricity supply by means of diversification, as they pave the way to a more resilient and dynamic energy sector.

ACKNOWLEDGEMENTS

Ghana Member Committee, World Energy Council

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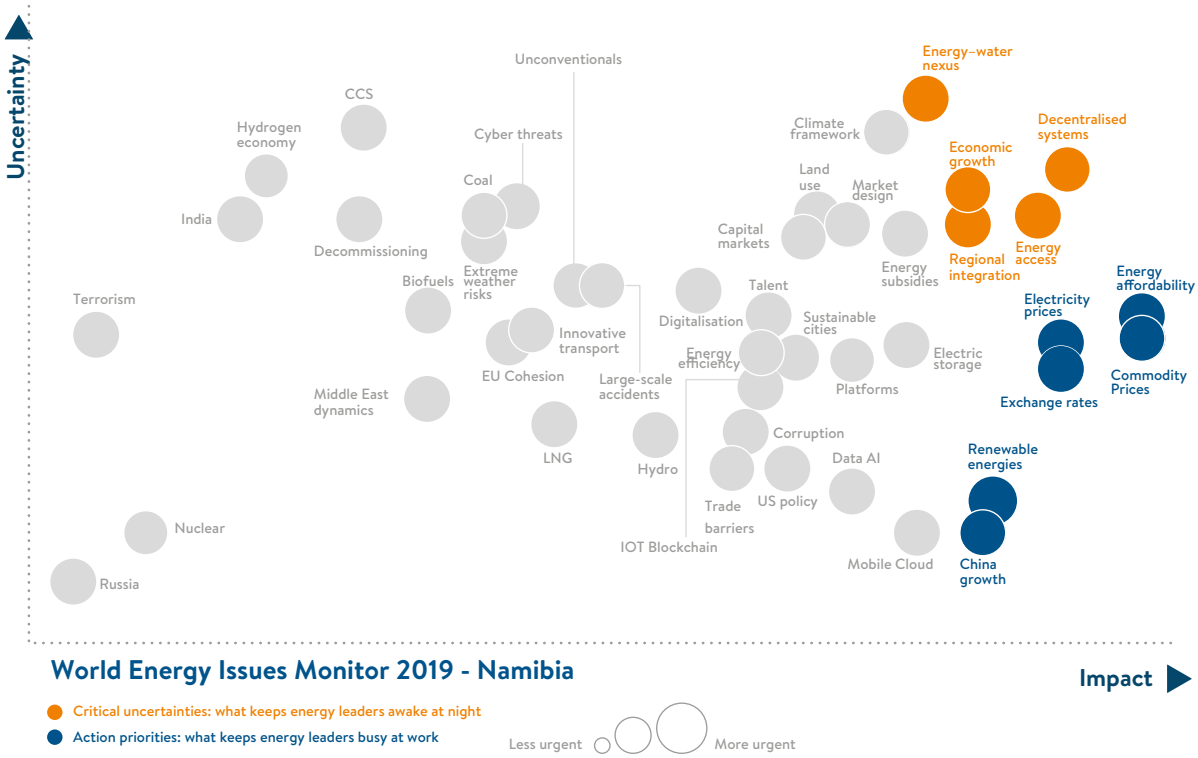
NAMIBIA



NATIONAL OVERVIEW & CONTEXT

Namibia is at a crossroad concerning the development of its energy system. The current reliance on imported electricity is clearly not sustainable as neighbouring countries also experience difficulties in securing their own electricity supply.

Energy challenges in Namibia are related to adding domestic generating capacity in an economically viable and environmentally sustainable way, increasing the share of renewables such as wind and solar PV in the power system, and increasing the country's energy self-sufficiency. Namibia imports most of its electricity from South Africa and other countries in the region, namely Zimbabwe. Several projects aimed at increasing electricity generation in the country are now on hold. Energy independence is thus a significant challenge to be tackled by the Namibian government. The other challenges are access and affordability of electricity. The objectives are to implement a transparent and supportive tariff system and to improve access to all urban, rural and peri-urban areas.

The power sector in Namibia has undertaken several reforms aimed at attracting Independent Power Producers (IPPs) by providing a stable investment environment. Such reforms include the horizontal consolidation of more than 70 distributors into five regional electricity distribution companies (REDs) and the establishment of transparent tariff setting procedures, all overseen by the sector regulator, the Electricity Control Board (ECB).

KEY ISSUES FROM THE NATIONAL MONITOR

As Namibia is faced with providing universal access to its citizens, **decentralised systems** offer a viable solution. The key reason being that solar PV has become the cheapest source of

electricity. The critical certainty, however, has to do with grid stability. Concern over the stability of Namibia's grid is valid since its population is sparse and its grid-lines widely dispersed. Studies have been conducted by the government and the national power utility, NamPower, to map out how much solar uptake can be allowed while keeping the grid stable.

Regional integration in Africa is a vital component to energy security. Collective action and cooperation in the areas of policy, infrastructure and expertise would ensure more effective and efficient exploitation of African energy resources while also safeguarding the continent's own energy needs. The Southern African Development Community (SADC) has recognized the importance of regional integration as a means to address the current energy issues, but the uncertainty is due to the pace of this integration.

Energy Access is a critical uncertainty and an action priority for Namibia, as only about one third of the population receives reliable access. The government continues to look for pathways to bring universal access by 2030, but the central uncertainty is around Namibia's significant need to import from neighbouring countries. Until viable projects are developed for Namibia to generate a sizable amount of power within the country, energy access will remain a critical uncertainty.

Importing most of Namibia's electricity demand is costly. It not only leaves the economy susceptible to the whims of other countries, but it also makes Namibia's energy supply insecure. The Electricity Control Board (ECB) of Namibia has recently approved 5% electricity tariff increase. The national power utility, NamPower, had proposed a 6.56% increase. Namibia is the only country in the region which is very close to achieving the cost-reflective tariffs. Unlike in other countries, electricity tariffs in Namibia are also not subsidised by the government, hence the higher price. The government is working to ensure that **affordability** does not turn into a crisis.

The central bank of Namibia who closely monitors **commodity prices** has observed that the main risks to Namibian economic growth include a weak recovery in the country's trading partners, and a slow recovery in international commodity prices, particularly for uranium. As such, commodity prices are an action priority for the country.

Since 1993, the Namibian Dollar has been pegged one to one to the South African Rand. **Exchange rates** are an action priority for Namibia, as it currently it imports about 60% of goods from South Africa. Separately, during the second half of 2018, Namibians saw the price of fuel and wheat increase due to the strength of the US dollar. The Namibian dollar would be highly vulnerable to external shocks if it were to break the link to the rand, due to Namibia being a small economy with highly concentrated industries and exports. The Namibian Central Bank is not looking to de-link the dollar at this point but is monitoring the situation.

CONCLUSION

Going forward, possibly the biggest obstacle to Namibia's economic potential is the fact that only approximately a third of all Namibians have access to electricity. Namibia must address the problem of inadequate access to electricity (especially in rural areas), affordability, self-sufficiency and energy independence. At the same time, Namibia needs to ensure that energy sector developments are

climate-resilient and able to assure energy access even in a non-stationary natural environment. The Namibian government is looking to renewable power as a solution to these challenges since the country has the world's second highest solar irradiation territory.

ACKNOWLEDGEMENTS

Namibia Member Committee, World Energy Council

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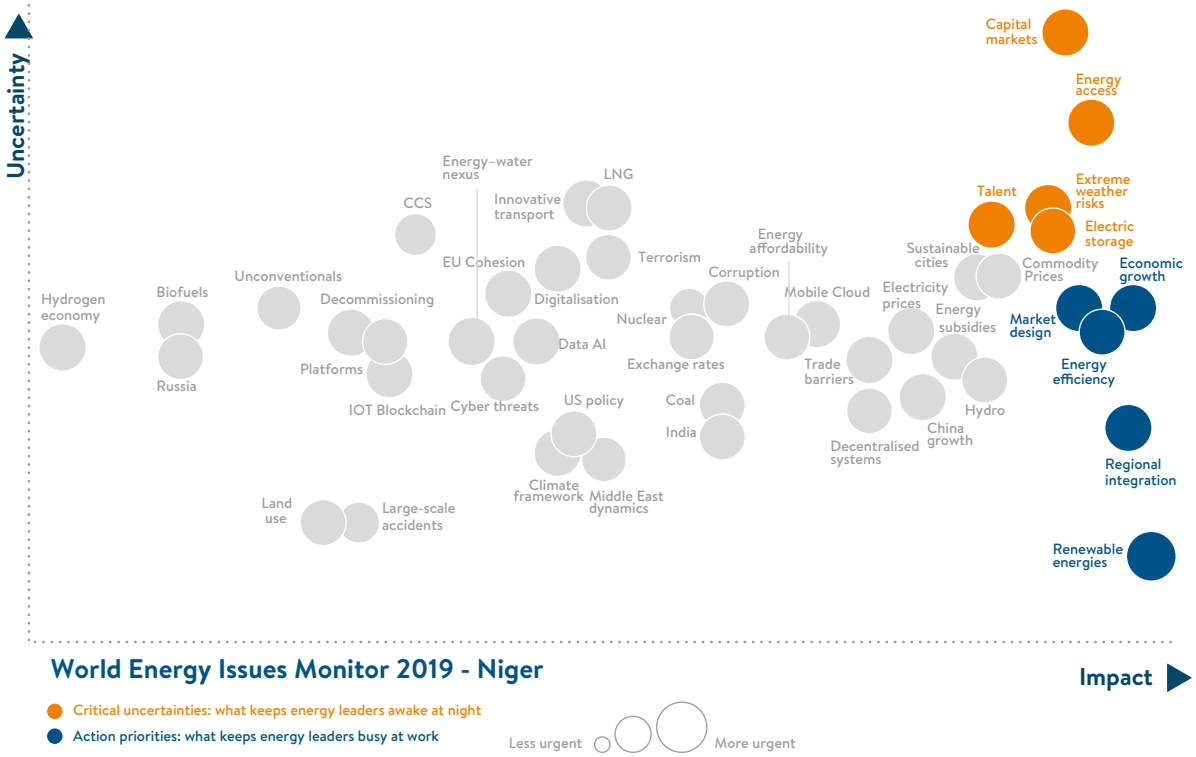
NIGER



NATIONAL OVERVIEW & CONTEXT

Niger's goal is to achieve universal energy access by 2035. Its ability to achieve this target is constrained by significant challenges. Niger's government is working to expand its electricity supply and encourage investment in the energy sector to stimulate the economy. The government is also taking critical steps to improve energy markets by creating a regulatory body ARSE (Autorité de Regulation du Secteur de l'Energie) to increase transparency and fair competition among numerous energy actors. Finally, the government also created ANPER (Agence Nigérienne de Promotion de l'Electrification en milieu Rural), which is mandated to design, implement, and monitor rural electrification programs throughout the country.

Niger's government is working to reduce its dependence on fuel imports by developing its resources. The country imports more than half of its needs from Nigeria. In order to increase its energy independence, Niger is considering, among other things, the introduction of renewable energies such as solar energy with the completion of the photovoltaic power plant Malabaza (centre) with a capacity of 7 megawatts; the construction of a 19 MW hybrid power plant planned for 2019 to Agadez (north); as well as other solar plants planned in independent production around the capital, Niamey, and inside the country.

The main issues to be dealt with over the next few years are the battle against deforestation (Niger loses 100 000 hectares of forest every year, mainly because of the use of wood for cooking), self-sufficiency regarding electricity and the development of electrification.

KEY ISSUES FROM THE NATIONAL MONITOR

Energy Access remains a significant uncertainty as Niger has one of the lowest consumptions of electricity in the world; only 14.3% of Nigeriens have access to the grid, and even those with a connection suffer from frequent brownouts and blackouts due to lack of adequate infrastructure and capacity. Niger is looking for assistance from foreign aid and international investors to help bring needed capacity to give its citizens access to energy.

Niger is highly vulnerable to natural hazards, particularly droughts, floods, and landslides. Climate change is causing increasingly irregular rainfall, rising temperatures, and desertification, which impacts agricultural productivity and food insecurity. Extreme weather risks will continue to create uncertainty for Niger's economic growth opportunities. Niger is looking to curb the effects of climate change in order to get a hold on such extreme weather risks by advancing disaster risk management (DRM) efforts. The government has focused on sustainable development and building resilience to natural hazards.

Electric storage is a critical uncertainty as Niger is moving to incorporate renewable energy into its supply mix, but battery technology is expensive and not yet widely deployed in large-scale projects. The gap is particularly acute in developing countries such as Niger, where wind and solar power have great potential, energy demand is growing, and where large populations often live without reliable, and affordable electricity.

Niger expects economic growth to rise to 6.5% in 2019 from 5.2% in 2018, owing in part to significant investments in the oil sector. Additionally, Niger is looking to economic growth as a means to resolve some of its long-standing problems with bringing energy access to all. Power supply is inefficient and unreliable, constraining economic growth.

Regional Integration is viewed by Niger's government as an important engine for economic growth, sustainable development and improving the living standards. It is also recognised as one of the key factors underlying the success of the fastest growing economies in Africa. According to the Africa regional integration index, Niger performs strongly in the dimensions of free movement of persons, financial integration and macroeconomic policy convergence.

Renewable energies are an action priority or rather a solution for Niger's business sector as it works to grow and keep its doors open in a country where energy access and reliability are scarce. Frustrated with the erratic power supply from the national grid and the strain caused by the use of diesel generators on a daily basis, small business owners are shifting towards solar-powered energy systems. Separately, teachers from different schools in the Niger Delta have developed a curriculum that would guide the teaching of renewable energy in secondary schools to raise awareness and increase the impact of this resource.

Investment plans announced by major energy players showcase the commitment in deploying natural gas and LNG, as well as bio-methane, as a flexible solution that could both foster the development of sustainable mobility and renewable energies.

Digitalisation of the country's economy and the development of energy chains are at the core of the government and businesses strategies. The penetration of IT within energy sectors is enabling new business models and more efficient asset management. This trend has also increased the awareness on cyber security measures as part of the efforts to guarantee resilience of energy infrastructures and services. Moreover, the main national energy actors are working on the greater integration of energy networks within Europe and towards a Euro-Mediterranean area aimed at increasing security and resilience of the national energy system.

CONCLUSION

Looking ahead, the country faces several important infrastructure challenges. Infrastructure services remain expensive and unreliable, hindering the competitiveness of the economy. Probably Niger's most pressing challenge lies in the water supply and sanitation sector.

ACKNOWLEDGEMENTS

Niger Member Committee

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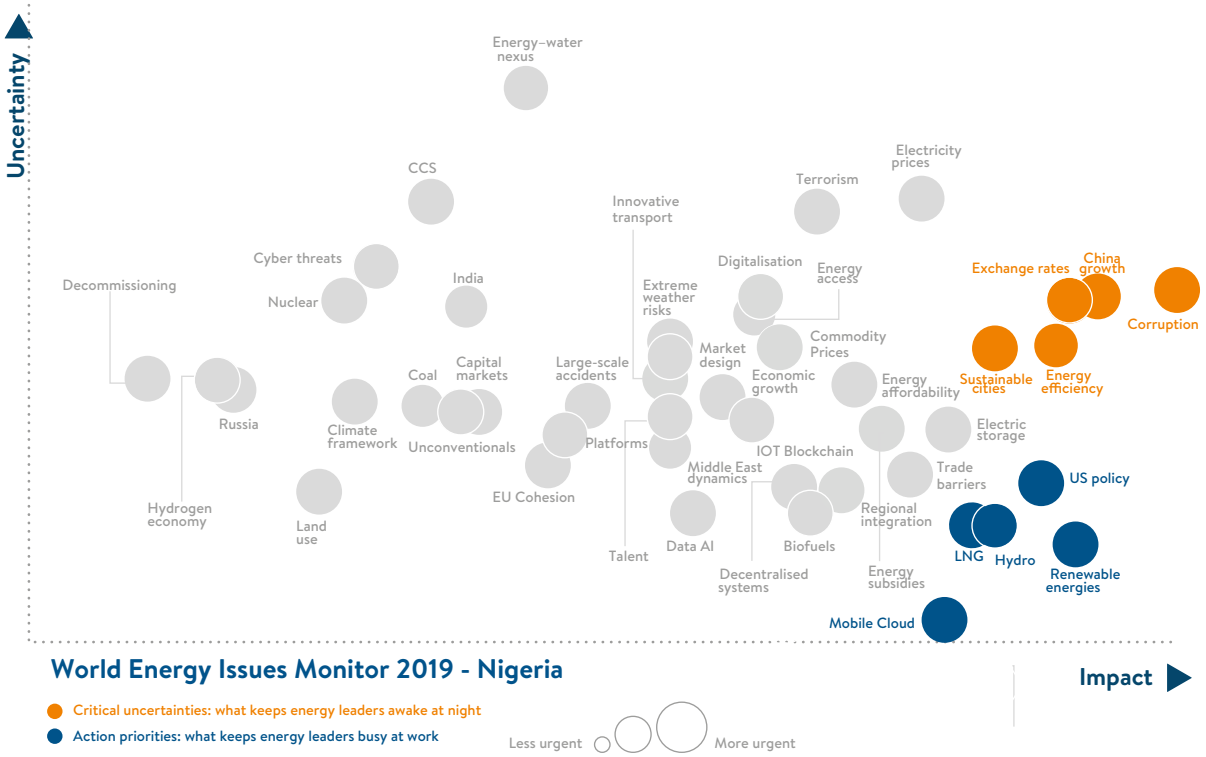
NIGERIA



NATIONAL OVERVIEW & CONTEXT

With a population of over 190 million and projected to reach over 350 million by 2050, energy is a crucial issue in Nigeria. According to the World Bank, 59.3% of Nigerian households have access to electricity. With the national population set to increase in the coming years, Nigeria needs to increase its electricity output by tenfold. Providing quality access to energy (including electricity) is a major concern and a method of tackling this is diversifying the energy market through renewables. Over the past year, Nigeria has invested more than $20 billion in solar power projects.

Corruption and the threat of terrorism hinder the effectiveness of the nation's energy infrastructure as well as international investment opportunities. New legal frameworks which promote financial openness and scrutiny are a potential means of tackling corruption. Terrorism is harder to resolve as the motives of different groups vary.

The United States' foreign policy is a major concern as they are one of Nigeria largest importers. If the US continues a path of isolation and high tariffs, Nigeria's economy could suffer.

Climate change and the process of mitigating and adapting to its effects is a major priority for Nigeria, as it is vulnerable to droughts and floods. Additional work is needed to make the energy infrastructure and the nation more resilient.

KEY ISSUES FROM THE NATIONAL MONITOR

Trade Barriers: The rate at which the naira has fallen against the dollar is of a great concern to energy leaders, although foreign reserves have been appreciating constantly after the recession.

There are also uncertainties with the newly introduced green bonds and their sustainability in the long-term.

US Trade & Policy: With the US being the largest buyer of Nigerian crude oil, stopping its importation has brought about uncertainties to energy leaders in Nigeria. With the US increasing tariffs on imports, oil exports might not be as profitable.

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

Corruption is still a major uncertainty to energy leaders in Nigeria. Efforts have been made by the government to minimise corruption through the enactment of laws and the enforcement of integrity systems. In addition, several high-powered individuals are currently being prosecuted by the present administration of President Muhammadu Buhari. It is expected that the issue will consequently lose importance and become an increasingly weak signal in the coming years.

Over the past year, **terrorism** has developed to be an action priority with a high impact on the country. The main drivers behind the impact of terrorism are the activities of the Boko Haram militants, which have staged several attacks in the northern part of the country, and also the Niger Delta militants. Terrorism impacts the energy sector directly as, for example, attacks have targeted petroleum pipelines in the oil rich Niger Delta region of the country.

Renewable energy is an action priority for the country as it is seen as a solution to tackle the power crisis in a sustainable manner. The country has huge renewable energy potential with solar PV topping the list with an estimated potential of 325 TWh if merely 1% of the available land is utilised. To put this into perspective - the current total electricity generation amounts to 5,000 MW with an electrification rate of 59.3% in 2017. The government has already introduced measures to further promote the deployment of renewable energy sources. The Electricity Regulatory Commission of Nigeria has, for instance, introduced feed-in-tariffs in 2012 to promote the renewable energy deployment (small / large scale hydro, wind, solar and biomass), with the largest tariffs being allocated to solar projects.

Energy Efficiency is an issue that has a particular importance in Nigeria. The country does not produce enough electricity for its growing population. To tackle this, it is vigorously pursuing efficiency measures in all sectors of the economy, focusing mostly on buildings, industry and transport. In collaboration with international partners such as UNDP, and GiZ, the Nigerian Government have come up with strategies in achieving improved energy efficiency.

CONCLUSION

Energy leaders in Nigeria expect that with the adequate policies and business strategies, the critical uncertainties affecting Nigeria will gradually lose importance and become weak signals in the coming years. It is also anticipated that the priority areas of terrorism, corruption and renewable energy

will receive the necessary attention from energy leaders and tackling these issues will contribute to building a more resilient energy system.

ACKNOWLEDGEMENTS

Nigeria Member Committee, World Energy Council
Prof. A. S. Sambo, Chairman NNC, World Energy Council
Engr. I. H. Zarma, Energy Commission of Nigeria
Mr. Abbas Musa, Energy Commission of Nigeria

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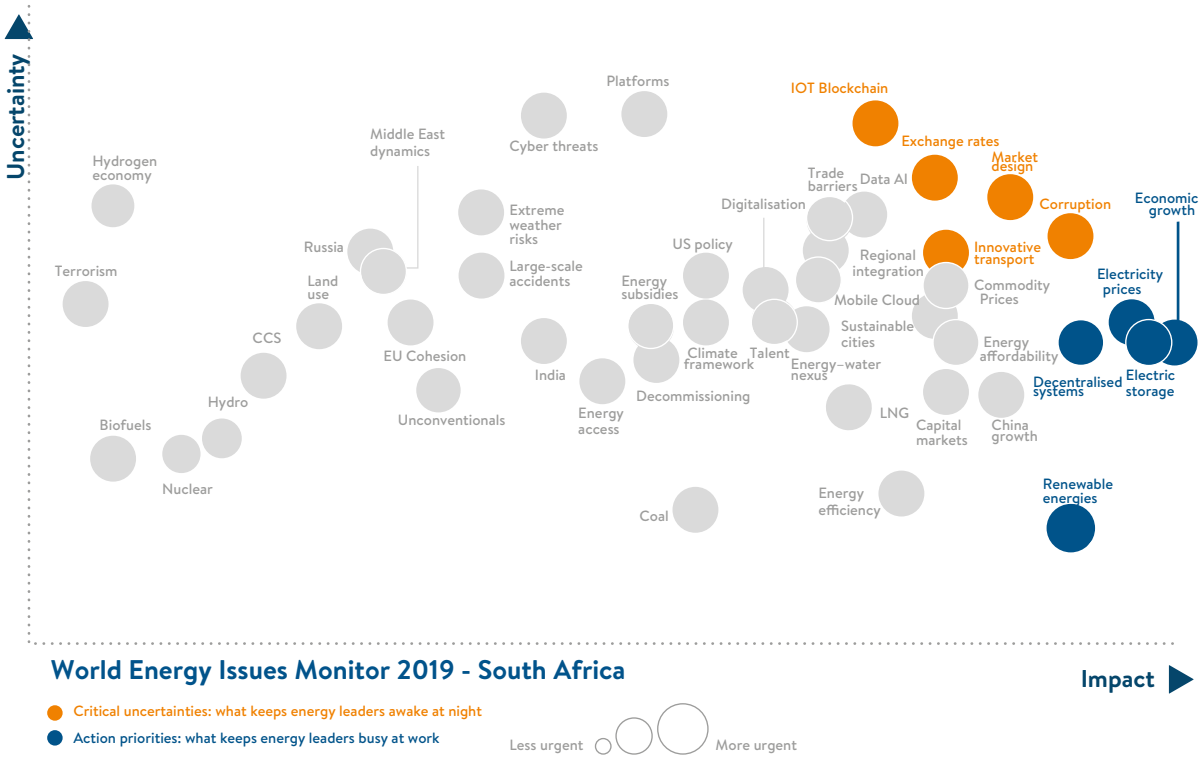
SOUTH AFRICA



NATIONAL OVERVIEW & CONTEXT

As in 2017, Economic growth has again been identified as the primary Action Priority. This is not surprising given the lack of economic growth in South Africa in recent years and the negative impact it is having on all South Africans. The role, functionality and improving costs of Electric Storage has moved this issue from a Critical Uncertainty in 2017 to an Action Priority in 2018, indicating that there is much more certainty on the application and use of this technology in addressing the intermittency of solar PV and wind. Electricity prices have continued to escalate and, together with the sluggish economy, they are seen as an issue that needs action. The response of consumers is a greater use of solar PV and storage to become self-sufficient, unfortunately initiating the utility death spiral.

Corruption has moved from an Action Priority in 2017 to the most important Critical Uncertainty in 2018. This uncertainty probably arises from the lack of clarity of the outcomes of the various initiatives that were launched in 2018 to tackle corruption. Market Design remains in the top three critical uncertainties due to the death spiral affecting the national utility, a concern which needs to be addressed. Exchange rates are always a concern in South Africa but there is very little that can be done on this issue. However, the issues of Innovative Transport and IoT/Blockchain are new Critical Uncertainties for South Africa - probably as not enough is understood about them and about their impact on the South African Industry and economy.

KEY ISSUES FROM THE NATIONAL MONITOR

In 2017, **Corruption** was an Action Priority and during 2018 several initiatives to address this issue in South Africa have started. However, the outcomes of these initiatives are still not clear. It is therefore an expected result that corruption is now perceived as one of the top Critical Uncertainty for energy leaders.

Increasing numbers of Independent Power Producers (IPPs), prosumers and large consumers want to be freed from trading with the national utility while the national utility is struggling to remain viable in the face of the competitive dynamics. Any **market design** will also need to ensure universal access to affordable electricity for the millions of impoverished citizens in both rural and urban settings. There is plenty of diverse opinion but no clarity on suitable market designs.

In recent years South Africa has experienced social and economic turmoil which has resulted in volatility in investor confidence. This, coupled with global market caution, means that as a developing country the South African currency is at the mercy of international **exchange rate** volatility.

Economic growth in South Africa has been poor for several years impacting on all sectors of society and business. During 2018, a number of new initiatives to kick start the economy have been launched. It will be interesting to see where this issue is rated in the 2019 survey.

In the 2017 survey, **electric storage** was one of the top Critical Uncertainties for South Africa. There is now a much better understanding of the technology and the costs have reduced making it more economically viable to include storage in solar PV and wind systems to manage the intermittency challenges. As a result, with the growing implementation of renewable energy systems, the issue is now a high Action Priority.

Electricity prices in South Africa have escalated at rates significantly above the inflation rate for several years. This high level of escalation is not expected to reduce in the near future. Consequently, it is an Action Priority as consumers find ways to manage large increases in cost. The popular response is to move to self-generation using mainly renewable energy solutions. Unfortunately, this response is likely to reinforce escalating electricity prices from the national utility as the demand it serves reduces.

Two Critical Uncertainties that have come to the fore in 2018 are **Innovative Transport** and **IoT/ Blockchain**. Both issues are relatively recent but are starting to impact on South African businesses. A lack of knowledge and experience related to these issues as well as their applicability is the reason for the high level of uncertainty that is shown in the survey. As more knowledge and understanding is achieved, the issues are likely to move into the Action Priorities.

CONCLUSION

Once again, the World Energy Issues Survey is useful in highlighting the Critical Uncertainties and Action Priorities that South Africa needs to focus on. Besides those issues that are ranked highest, there is useful knowledge to be gained by examining how issues ranked high in previous surveys have moved over time. One example is Energy-Water-Food nexus – last year, it was the second highest Critical Uncertainty; this year it has dropped back significantly even though it is still a critical issue to address and manage. Other issues are just perceived to be more important this year.

ACKNOWLEDGEMENTS

South African National Energy Association (SANEA)
Mr Brian Statham, Chairman, SANEA
Mr Dave Wright, Secretary General, SANEA

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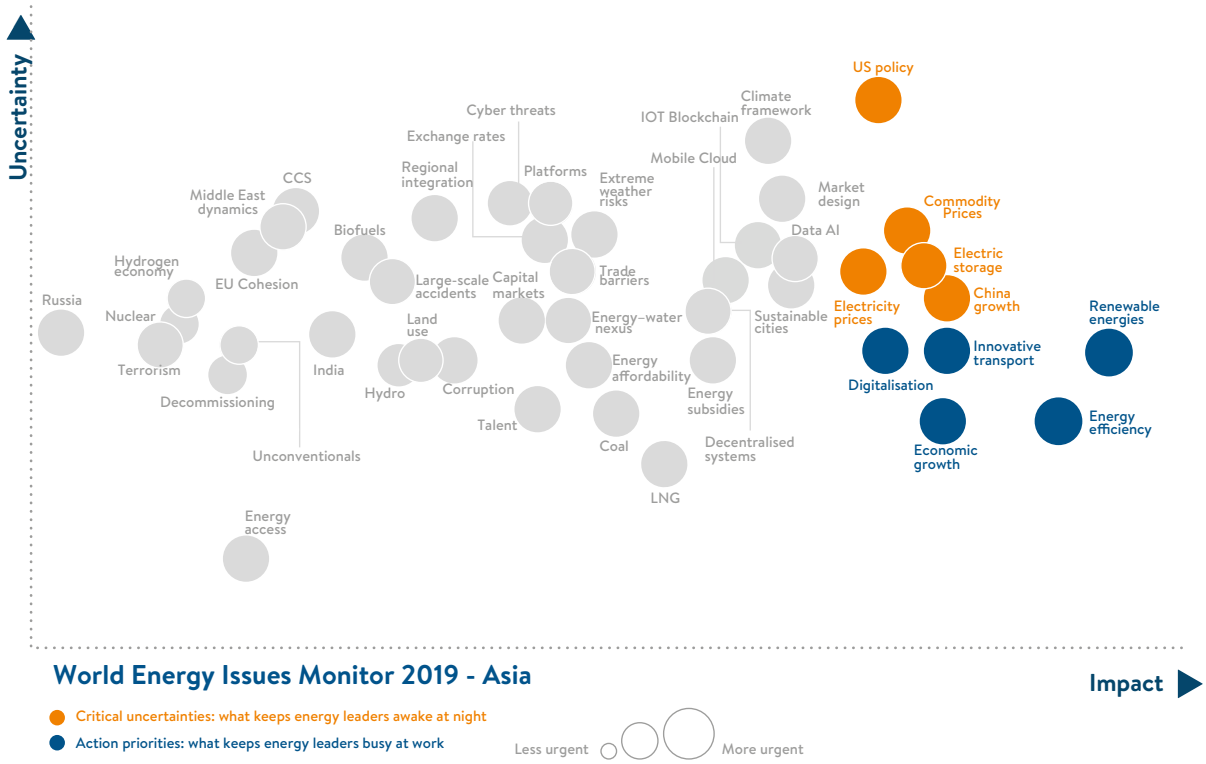
Chapter three
Assessing the energy agenda for Asia

ASIA



REGIONAL OVERVIEW & CONTEXT

A significant shift has occurred in the Critical Uncertainties in Asia over the past year. The 2018 report identified the top critical uncertainties as electric storage, IoT/Blockchain and digitalization, but for 2019, the biggest uncertainty is US policy, followed by commodity prices, with electricity prices, electric storage and China clustered in “third place”. Climate framework, which was an Action Priority last year, rose back into the Critical Uncertainty quadrant, although with less perceived impact than other issues.

The fact that many countries in Asia depend heavily on trade with the US, coupled with the recent slow-down in China’s economic growth – which has a trickle-down effect – has created high levels of uncertainty, not only for the region, but also for foreign businesses with operations in Asia and for foreign investors seeking to enter the Asian market.

Concerns about commodity prices is a natural result of uncertainty about US policy and is seen as potentially affecting the availability of foreign imports in a region which is highly dependent on imports. The urgent need to meet increasing demand for affordable electricity in the most populous region of the world and to make electric storage a feasible option is reflected in the positions of these elements in the map.

Under action priorities, renewable energies and energy efficiency are the most urgent issues, as countries seek to meet the ever-growing demand for electricity, manage air pollution levels and still meet their climate action goals. Digitalisation has moved from uncertainty to action priority as pressure on companies to make their operations more efficient increases. The shift of innovative

transport from Critical Uncertainty in 2018 to Action Priority in 2019 reflects concerns about the increasing number of vehicles on the road, especially in urban centres, and the urgent need to manage the emissions they create.

Finally, economic growth has become an Action Priority as countries seek to offset the potential impact of US trade policies, tighter financial policies, weaker earnings growth and global political challenges.

KEY ISSUES FROM THE REGIONAL MONITOR

US policy is by far the most urgent Critical Uncertainty for Asia, not only given the impact this has on the mainly import-dependent countries in the region, but also due to the resulting effect on China's economic growth, which is now at its lowest level in ten years, and the knock-on effect for other Asian countries. A dip in foreign investment, particularly in China, coupled with slowing productivity and tightening monetary policies, will likely mean that Asian countries may need to turn to heavier reliance on available (and cheaper) domestic resources, such as coal. In addition, uncertainty about US policy will create even higher pressure for more rapid development of viable alternatives, such as electric storage and affordable hydrogen, to meet rapidly rising energy demand.

It is not surprising that **commodity prices** are a Critical Uncertainty for Asia. The net-import dependence of the region and the potential volatility of global commodity prices created both by US President Donald Trump's opposition to imports into the US, and by his policies on trade and tariffs, impact the entire region. These also potentially create barriers to foreign investment while placing increased pressure on development of energy efficient technologies and a shift to renewable energy in a region where many countries struggle to meet the steadily increasing demand for electricity and high levels of stress on the system caused by rising use of vehicles and migration to cities.

Electric storage, China and electricity prices are closely grouped as critical uncertainties for Asia in 2019. Finding viable, reliable, affordable forms of electric storage is a critical priority for a region where energy demand is rising exponentially, but the economics and scalability make this a challenge. China's slowing economy and the impact of US trade policies and tariffs on that country have a significant impact on the region and create uncertainty for both domestic and foreign investment. Keeping electricity prices affordable is a key challenge in a region where dependence on imports and volatile commodity prices create significant obstacles for business and government.

Renewable energies are the most urgent action priority for a region where many countries struggle with high emission levels; widespread use of cheap, readily available coal; lack of access to electricity and population shifts to urban areas. Asia's highly developed economies are already progressing with development of renewables. Japan is exploring the potential of hydrogen and ammonia as carbon-free fuels and is developing ammonia utilisation technologies which have drawn strong interest from Europe, Australia, the US and Saudi Arabia. New Zealand aims to achieve a zero-net carbon economy by 2050 and 100% renewable electricity generation by 2035. But some of the rapidly developing Asia economies, such as India, Bhutan and Myanmar, must balance rapid economic growth and increased focus on renewable development with challenges of access and fragile infrastructure. Developing economies, such as Bangladesh and Nepal, need to balance basic human

and infrastructure requirements with rapidly growing energy demand and emphasis on sustainable energy systems.

Coupled with the urgent need to expand renewable energy in Asia is a strong focus on increasing **energy efficiency** at all stages of the energy value chain. In a region expected to become the world's largest energy consumer by 2025, energy efficiency measures are already being implemented in many countries to control the level of energy use and help extend the life of existing transmission and distribution systems. Distributed energy systems, smart grids, smart metering and blockchain are seen as viable options to increase efficiency in many Asian countries.

Innovative transport and digitalisation are also viewed as important action priorities for Asia. The increase in urban population, the growing number of vehicles on the road and limited transport systems have not only created traffic congestion but have also increased emissions levels at a time when emissions reduction is critical. Increasing the number of electric vehicles and investment in technology and urban transportation systems are therefore a priority for many Asian countries. While uncertainty about the cost, viability and feasibility of **digitalisation** still remains, businesses see that digitalisation is an important option for growing their business and improving both efficiency and service; it is not a question of "if" any longer, but "when".

China is not only experiencing its own Energy Transition away from coal and toward renewables, but also because of its economic power it is shaping the transition of the rest of the world. China is increasingly looking toward securing its future energy needs with sustainable alternatives. Much of its foreign energy supply comes from politically unstable regions and must travel through narrow straits and contested waterways before reaching the country. Securing guaranteed access to foreign sources of energy is vital for China's ongoing growth and development.

CONCLUSION

Trade policies, economic uncertainty, volatile commodity prices and China's economic slowdown are key elements in the thinking of Asian energy leaders for 2019 and are the issues most likely to keep those leaders awake at night. It is not possible to control either what happens or when it happens with respect to these issues. Asia is therefore focusing on areas where it can, at least to some extent, exert control and move ahead. These include increasing the share of renewables in the energy mix; using new technologies to drive improvements in efficiency and access; seeking economically viable alternatives to make energy both accessible and affordable; developing domestic markets and energy efficient systems to lower reliance on imports; exploring regional interconnection and integration options; and continuing to be committed to ensuring a sustainable energy future for its citizens. The challenges are significant, but in a region that is the largest, most diverse and most populous and which continues to be a global growth leader, there is no doubt that Asia can and must progress.

ACKNOWLEDGEMENTS

Shigeru Muraki, Asia Regional Vice Chair, World Energy Council
Emily Melton, Asia Regional Manager, World Energy Council

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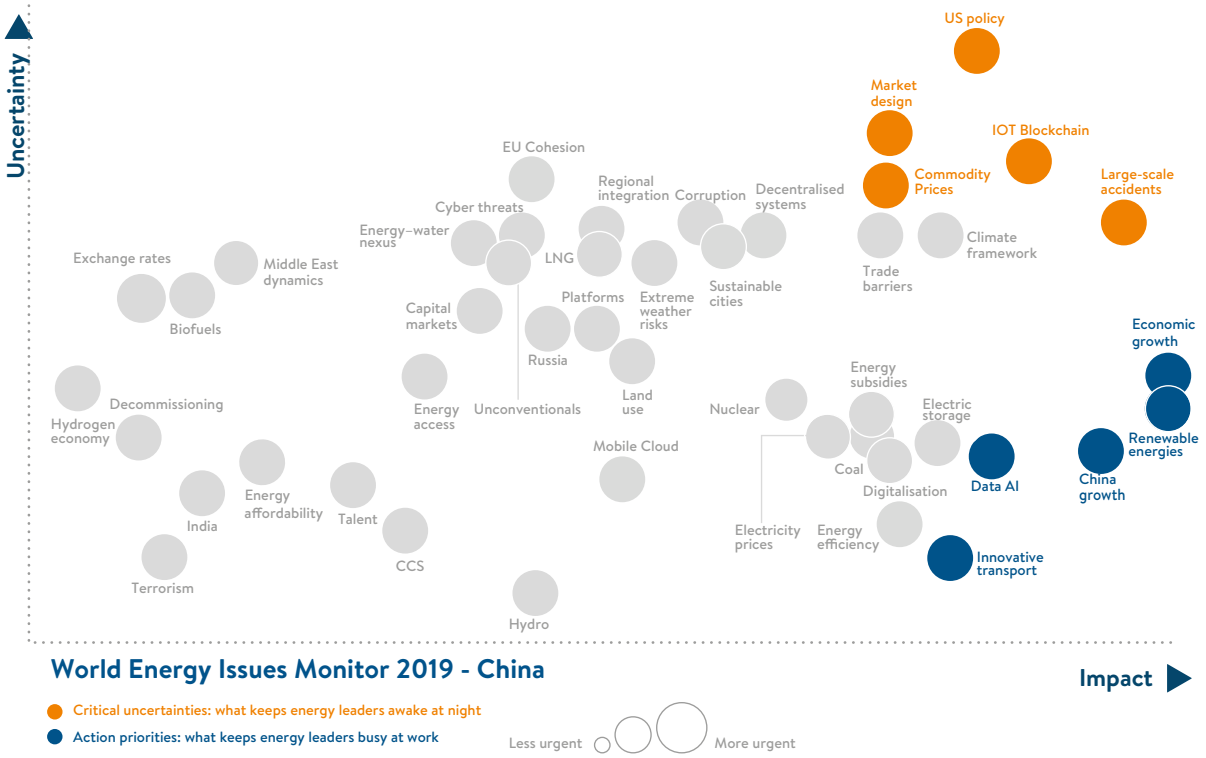
CHINA



NATIONAL OVERVIEW & CONTEXT

The US-China relationship has fundamentally shifted to one of strategic competition. In addition to the crucial issue of trade deficit, other issues including market access and intellectual property rights are sure to be negotiated and its impacts felt throughout the world.

A decade ago, the US was the largest consumer of primary energy. Today, China's energy market is now substantially larger than the US's. Assuming China continues to grow its economy at a mid-single digit growth rate, it will remain the single largest contributor to global energy growth. In 2018, China set another record by overtaking Japan to become the largest importer of natural gas.

In 2018, China continued to work on improving safety measures in coal mines. However, large scale accidents continue to be a critical uncertainty for the Chinese energy industry. Deadly mining accidents are common in China, where the industry has a poor safety record, despite efforts to improve coal production conditions and prevent illegal mines. Along with large scale accidents, China's energy industry views US policy and Blockchain as critical uncertainties that will have a measurable impact on the industry.

China continues its effort to increase renewable energy generation inside the country while investing in coal outside the country. Unlike other regions and countries, China will not require a gas bridge between coal and renewables. It is anticipating that renewables will become the core of the nation's energy system by 2050. Not only that, but electricity supply could be cheaper in the future than it is today.

KEY ISSUES FROM THE NATIONAL MONITOR

Large scale accidents remain a critical uncertainty as China continues to improve working environments. In October 2018, 21 miners died in eastern Shandong province after pressure inside a mine caused rocks to fracture and break, blocking the tunnel and trapping the workers. Having witnessed the biggest utility in Japan proved powerless to prevent a series of meltdowns in Fukushima, Chinese leaders are concerned that similar accidents could happen in China. Nuclear and coal are being phased out in favour of renewables.

Because of the US' protectionist policies, China sees **US Policy** as a critical uncertainty for its energy sector. China is not a market where US producers want to be excluded. It remains an important importer of oil and gas from the US. However, if trade wars continue, the situation will have a negative impact on both countries.

While China is planning to be one of the world's leaders in clean energy, it is looking at technology as a solution. **IoT/Blockchain** remains both an opportunity as well as a critical uncertainty because the technology is not yet proven. The Asia Pacific (APAC) subsidiary of Chinese energy firm Narada Power Source is teaming up with Singapore start-up Electrify to deploy blockchain and Internet-of-Things (IoT) solutions for energy trading and tracking across APAC.

After decades of sharp expansion, the Chinese economy is slowing down. Growth in 2018 is set to be the weakest since 1990. China's **economic growth** is an action priority for the government. The world's second largest economy is feeling the effects of a darkening trade outlook (mainly with the US and potentially Brazil) and government attempts to rein in risky lending after a rapid rise in debt levels.

Renewable energies appear as an action priority for China as it works to continue its push for the growth of clean energy solutions. China's National Energy Administration (NEA) is currently considering how to sustainably continue its support of renewables without feed-in tariffs. While this financing mechanism has been integral to the deployment of the country's over 100 GW of renewables over the past 10 years, China feels that it is time for a rethink of this strategy. China looks to continue to act on renewable energies which are planned to replace coal generation by 2050.

China is not only experiencing its own Energy Transition because of the growth of the role of renewables, it is also shaping the transition of world's countries and regions through foreign investment. China is increasingly looking toward securing its future energy needs with sustainable alternatives and to diversifying and reducing its dependence on energy imports.

CONCLUSION

China is looking to the future with an eye to be the leader in renewable energies. China is hoping to deal with this over-dependence on fossil fuels partly by rebalancing the economy away from energy-intensive industries. In recent years, through a combination of subsidies, policy targets and manufacturing incentives, China has spent more on cleaning up its energy system than the United Stated and the European Union combined. China is also upgrading its regulatory structure. The

government is using technology, innovation and power-market reform to break the monopoly of the grid.

ACKNOWLEDGEMENTS

China Member Committee, World Energy Council

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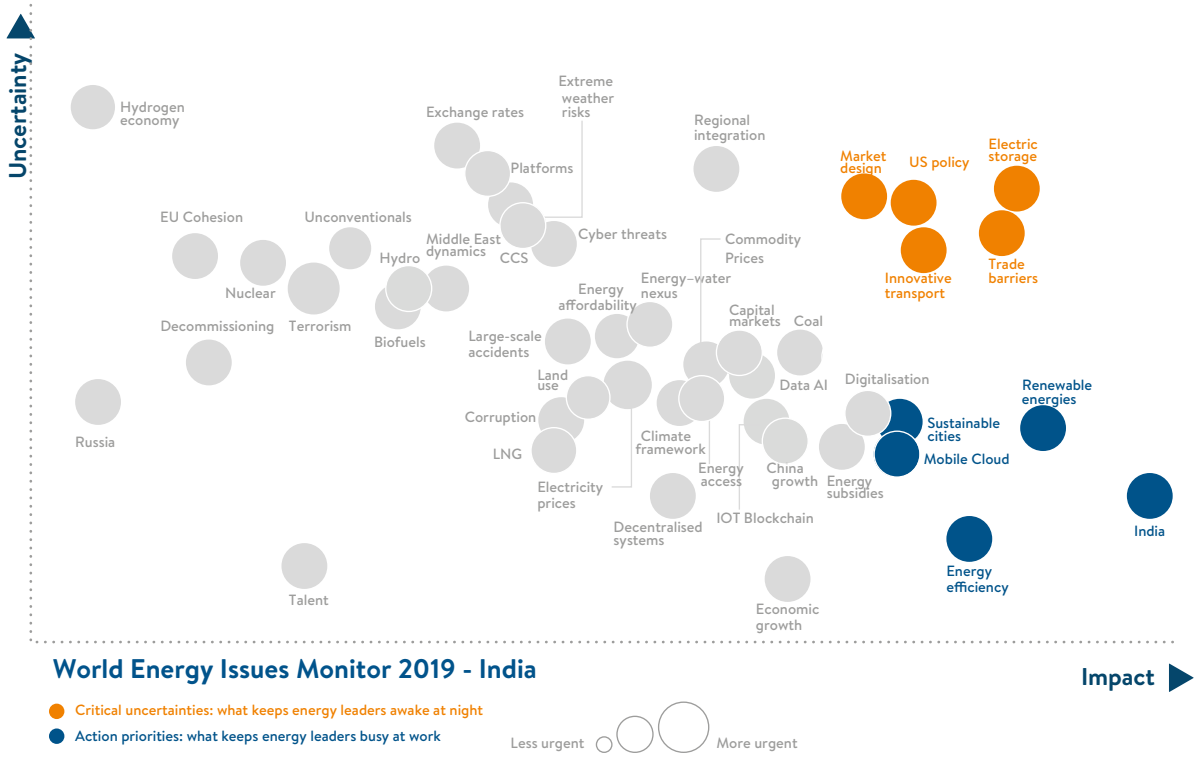
INDIA



NATIONAL OVERVIEW & CONTEXT

As one of the fast-growing economies and global demand centre, India places the achievement of sustainable growth as the main priority. Energy for growth needs to increasingly come from renewable sources while recognising the important role of coal in the Energy Transition. Renewable capacity growth needs to be accelerated by systematically addressing implementation hurdles. Energy Efficiency in the entire value chain is highly actionable and the country has success stories such as LED implementation. Success in turning around the electricity distribution segment will be crucial for the long-term achievements of the electricity sector, given that distribution is the weakest link in the electricity value chain.

Being hugely dependent on oil and gas imports, India gets adversely affected by upward price trends of commodities and sanctions imposed on exporting countries, such as the current US sanctions on Iran. Although endowed with abundant sunshine, the solar segment currently faces import dependence of solar panels. Capacity expansion in solar is strategic to achieving the desired energy mix and generating green jobs. However, current domestic manufacturing capacity of solar panels is limited. Import duties seem to have introduced uncertainties and act as a short-term dampener to capacity additions of solar. Balance must be met between creating robust domestic manufacture and reaching the required pace of capacity addition.

The ambitious renewables[1] (175 GW by 2022 and 275 GW by 2026-27) and electric vehicle targets[2] of India are significant in shaping the global market for batteries, driving down price and bring about market transformation. Policy visibility, demonstration projects, second life market, R&D and domestic manufacturing base must emerge. Charging infrastructure is pre-requisite for demand

creation for EVs. Given the urbanisation pace and air quality concerns in cities, Electric Vehicle answers India's quest for Sustainable Mobility. While the answer is clear, getting there begins with the creation of adequate charging infrastructure.

The national elections are scheduled for 2019[3] and continuity of policy directions is expected.

KEY ISSUES FROM THE NATIONAL MONITOR

Trade barriers: India is a major purchaser of Iranian crude oil and is also a major investor in Russian gas fields. US restrictions have forced India to decrease oil purchases from Iran and diversify its oil import basket at higher prices. In 2018, India began importing liquefied natural gas (LNG) from Russia as part of its strategy to diversify its supply sources and cater to the rapidly rising local energy needs. In the case of solar panels, India is caught between creating a domestic manufacturing base and the need to benefit from competitive prices available globally. India currently imports more than 90% of its solar panels. The Indian government has imposed a safeguard duty of 25% on solar imports from certain countries[4]. Introduction of the safeguard duty and issues surrounding it have introduced uncertainties. Such duties would increase project costs and tariffs. Reducing import dependence in a crucial sector to India's Energy Transition is required. However, domestic manufacturing capability at the water level is what would ultimately reduce import dependence. To build manufacturing capability, solar project tenders have also been floated with domestic manufacturing capacity built in. How the issue pans out is uncertain.

Electricity Storage stands out as one issue which cuts across areas such as Renewable Energy Integration, Electric Vehicles and Energy Access - all critical to India's Energy Transition. Therefore price, technology improvements, new technologies, manufacturing capacities, and R&D capabilities are all critical. Battery chemistry based on commonly available materials is important in the context of current technologies. These materials include lithium and ion which are import-dependent. The Government is working on a National Energy Storage Mission (NESM)[5] for India with an objective to strive for leadership in energy storage sector. This will be done with the creation of an enabling policy and regulatory framework that encourages manufacturing, deployment, innovation and further cost reduction.

Innovative Transport: The shift to electric vehicles (EVs) and the growth of shared mobility are seen as a single solution to combat import dependence on crude high at 80%[6], pollution and rapid urbanisation. The country aspires to have at least 15% share of EVs on the road in the next five years, and of 30% by 2030[2]. The FAME scheme[7] (Faster Adoption and Manufacturing of Hybrid & Electric Vehicles) provides the support for EV adoption. The task is enormous and encompasses electric vehicles manufacturing, battery manufacturing, setting up charging infrastructure, promoting electric vehicles in commercial fleets and public transport and utilising renewable energy in mass transport (similarly to Delhi Metro which sources significant electricity requirement from solar[8]). The volumes involved to make a difference and establishment of sufficient charging infrastructure puts the issue in the uncertainty zone. More targeted subsidies, better coordination within the Government, and considerable coherence between the government, public, and private sector participants in this area is set to bring about the rapid rollout of e-mobility infrastructure and solutions in many major cities of India.

According to the latest World Economic Outlook of the IMF, India will grow 7.3% in the Financial Year 2018 and 7.4% in the Financial Year 2019, and it is expected to be the fastest growing economy[9]. In addition, India is expected to be the largest **growth market** for energy by late 2020s, according to BP Energy Outlook 2018[10].

Universal access to electricity and commercial forms of heat are of high priority. Access to electricity is critical in reducing the wide discrepancy in living standards across various parts of the country. Hence, both federal and provincial governments are making all-out efforts to increase electricity coverage of households and large public and private sector companies are included in this process. This approach has had a greater measure of success and it is expected that India will achieve universal coverage of electricity quickly. Similarly, there has been a large increase in the consumer base for both piped natural gas as well as bottled compressed gas. As the second most populous country with a demographic dividend of young population, it throws immense opportunities arising from domestic consumption, employment generation both in manufacture and services across sectors. The price cycles of crude oil given the import dependence coupled with currency exchange rate continue to impact the economy. Environmentally sustainable growth is crucial and highly actionable.

Renewable Energy has shifted from the critical uncertainty zone to action priority probably indicating that it is more market driven. However, there are uncertainties due to import safeguard duty, unsustainable tariffs, and inadequate evacuation infrastructure. Successful state initiatives provide action windows for suitable adoption by other states. Recognising the challenges being faced in the solar rooftop segment[11], the central government has now prepared single window clearance. Thrust on exploiting offshore wind potential, developing the solar wind hybrid and realising pumped storage potential also provide further action areas. Achieving the renewable energy targets is crucial to meeting Paris commitments.

Energy Efficiency is clearly an action space for India. Considerable efficiency improvements are to be achieved in power distribution and utilisation. The draft Electricity (Amendment) Act 2018[12], which is an amendment to the Electricity Act, 2003 aims at being in line with the country's changing electricity markets and systems, with their large renewable capacities and the emergence of a smart grid network.

The principal cause of weakened investments in the electricity sector has been the extremely poor financial health of the electricity distribution companies across the country. The customer base is rapidly expanding through governments energy access programs and sustainable and cost-effective supplies need to be provided. The ongoing Ujwal DISCOM Assurance Yojana (UDAY)13 for turning around DISCOMs has yielded varied results. The solution lies in sharply decreasing the cross-subsidies between different consumer classes in the sector and improving both the sector's finances, providing correct economic incentives for competition, efficiency improvement and resolving the issue of stressed assets. The Electricity Act amendment is expected to improve efficiency and competition specifically in the distribution sector. The energy-intensive industries are covered under the Perform Achieve and Trade (PAT) a market-based mechanism, presently, in its fourth cycle covers 846 designated consumers14.

CONCLUSION

Sustainable growth is key to securing prosperity and well-being of citizens in India. The electricity sector reforms envisaged through amendments in the Electricity Act are expected to pave way for path-breaking reforms. Reducing import dependence whether it be in the conventional space or renewable is of strategic importance. As technologies converge, focus on innovation would shape every segment. The readiness of policies and regulatory framework is important. Capacity building and employment generation for its young population with sustainable growth in energy would be a top priority for the country.

ACKNOWLEDGEMENTS

Mr Seethapathy Chander, Advisor, India Member Committee, World Energy Council

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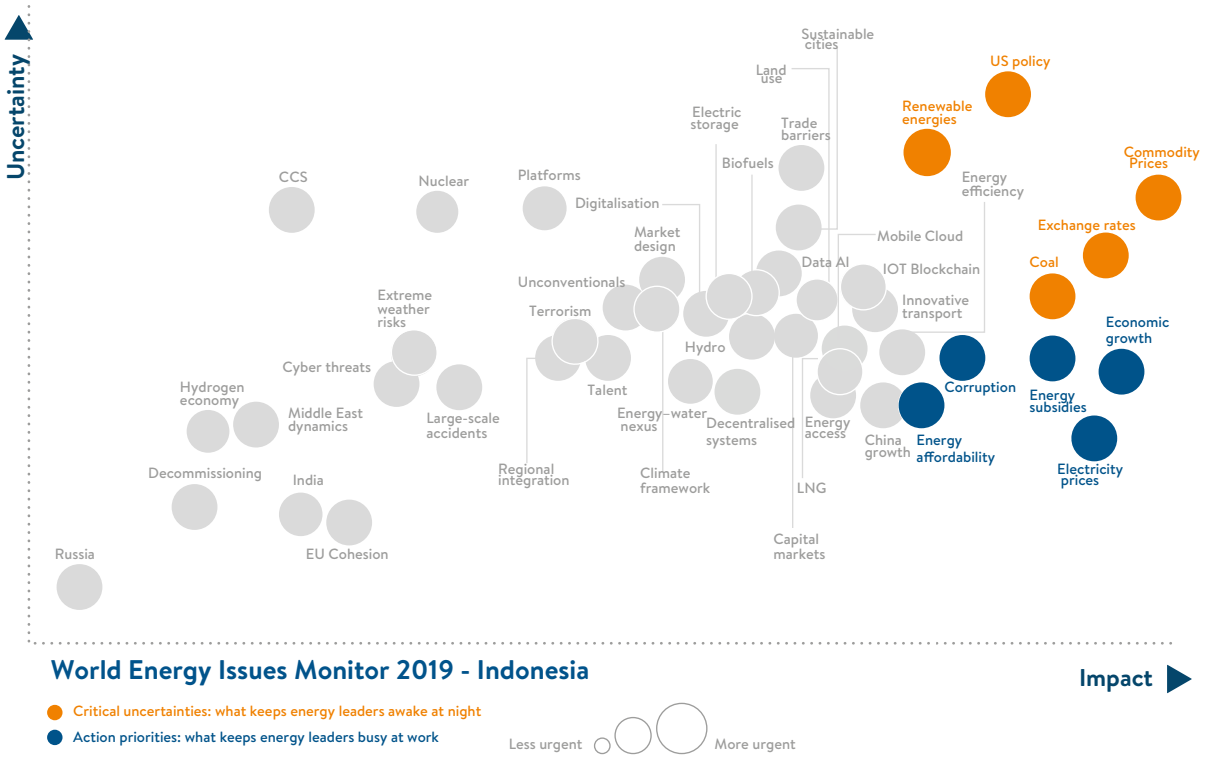
INDONESIA



NATIONAL OVERVIEW & CONTEXT

The issues related to commitment towards low-carbon development, Rupiah's exchange rate against the U.S. dollar, rapidly growing demand and fluctuating crude oil global prices have been identified as critical uncertainties and action priorities by the energy leaders of Indonesia.

The depreciating value of Rupiah against US Dollar and fluctuating global crude oil prices have raised the overall cost of production of energy in the country. In addition, coal has always been the most easily available and most abundant source of energy production in the country. With the government committed to keep energy prices constant, particularly the electricity prices in an affordable range, in this situation energy leaders see energy subsidies, exchange rates, and economic growth as the challenging issues in the year 2018.

With a rapidly growing demand and the pressure of keeping energy prices at an affordable level, coal will keep on playing a key role in the future energy mix for power generation in the Energy Transition period before changing into clean energy system. Consequently, it is no surprise that energy leaders in Indonesia consider electricity prices, energy efficiency as action priorities. Other action priorities include energy subsidies and economic growth.

KEY ISSUES FROM THE NATIONAL MONITOR

Energy leaders in Indonesia highlight **coal** as a key critical uncertainty for 2018. Hosting the tenth-largest coal reserve on the planet, coal remains the easiest solution to satisfying the growing energy demand in the country. In 2018, coal consumption for power generation was

91.1 Mt and the consumption will be increased to 162 Mt in 2027 in line with the increasing Coal Fired Power Plant (CFPP) development. CFPP is still used in this transition period to clean energy power system in order to get the low cost of power generation production so that the electricity tariff can be competitive in maintaining supply and demand balanced and also to fulfil requirements of the base load generations. The development of CFPP should be used Clean Coal Technology (CCT) with Super Critical (SC) and Ultra Super Critical (USC). In the National Energy Master Plan stipulates the targets for the optimal Primary Energy mix shall be achieved: 1). the role of the new energy & renewable energy at least 23% in 2025 and to be at least 31% in 2050 provided that its economical fulfilled; 2) the role of oil shall be less than 25% in 2025 and to be less than 20% in 2050; 3). The role of coal at least 30% in 2025, and 25% at the minimum in 2050; and 4) the role of natural gas at least 22% in 2025 and at least 24% in 2050. The government also encourages the development of mine-mouth based power plant, particularly in the region that has abundant potential such as in Sumatera and Kalimantan. The cumulative additional capacity of CFPP and Mine-Mouth based Power Plant from 2018 until 2027 is about of 26.8 GW. Until the end of year 2018, total power plants installed capacity in Indonesia is 62.9 GW, in which 28.3 GW CFPP (includes Mine-Mouth Based Power Plant). As effort to maintain the security of coal supply for power plant, the government has implemented the domestic market obligation for coal.

The issue of **exchange rates** also appears as a critical uncertainty for year 2018. The volatility of rupiah against the US Dollar was among main highlights. The depreciating value of rupiah, coupled with the fluctuating global prices for coal for crude oil, lead to a higher cost of production and reduced profit margins for the market players in the country. This issue got further intensified with the government's policy of maintaining the electricity prices fixed up (not increasing) till the end of year 2019 and impact the market progress of energy market players in the country.

The 2018 was a rather unfortunate time for emerging market. Acknowledging the experience of being in the so called 'vulnerable five' of the emerging market economies, back in 2013 the Fed tapering tantrum, the government of Indonesia has in deed reformed the economic management placing prudential at its core. By 2016, the law of financial sector safety net (Law No. 9 year 2016 on financial sector safety net) has stipulated a unified framework for mitigating and managing against risks on banking and financial sectors, including installing the bail-in policy and standard operating procedure for coordination among Ministry of Finance, Bank Indonesia, Financial Sector Authority and Deposit Guarantee Cooperation. The law effectively placed a firewall separating real economy from any financial monetary economic shocks.

Complementary to financial sector safety net and paramount to the management of macro economy are bounded non-negative budget primary balance, budget deficit limit to three percent of gross domestic product (GDP), macro prudential policy managing domestic liquidity, low foreign denominated currency debt stock to GDP and stable steam of foreign denominated currency revenue and free capital flow policy. These measures ensure the rupiah to float safely against market fair value for other major currencies, including USD, within certain manageable bands. Higher cost of production and reduced profit margins for the market players in the country were surely within tolerable and foreseen standard deviation against the country's longer horizon economic performance of stable five percent GDP growth, low inflation and current account deficit to GDP of around three percent.

The policy direction of the development of electricity supply in line with the national development objectives in the electricity sector is to ensure the availability of sufficient quantity, good quality, and reasonable price to improve the welfare and prosperity of the people in a fair and equitable and to encourage an increase in sustainable economic activities. With the government focusing to keep the electricity prices in an affordable range, the energy leaders in Indonesia see this as an action priority for the year. The average price of electricity around 0.08 US Dollar per kWh (1,124.60 Rupiah per kWh or 7.89 cent US Dollar per kWh with the exchange rate 14,246 Rupiah per US Dollar) in Indonesia, which is lower than the average price of electricity in the world i.e. about 0.14 US Dollar per kWh. The government is committed to maintaining low electricity prices & not increasing the electricity prices until the end of year 2019, and to keep a competitive tariff in the country. This was done as an effort to ensure electricity affordability for all.

Energy subsidy is also seen action priority for this year's Indonesia Issues Monitor. According to the Energy and Mineral Resources Ministry, the total energy subsidy spending crossed $10 Billion in the year 2018, which was a lot more than the budgeted subsidy of $ 6.6 Billion for the year. This increase is seen as a result of increase in the cost of subsidy due to the increased in 2018 global crude oil prices, and strong US Dollar in 2018 as the Fed hiked the US policy interest rate four times.

Yet, the higher energy subsidy spending was counterpoised by higher revenue from oil and gas in the 2018 budget. In this sense the central government's budget gained from the increased in 2018 global crude oil prices. The government policy on fuel subsidy is never to keep the energy prices constant in any situation. Yet it has the constitution's mandate to manage the fuel price volatility so that it does not pass to domestic inflation erratically at real time. It is part of macroeconomic policy to smooth out inflation, providing anchor for economic growth while fostering the under-privileged citizen.

The Indonesian Government has maintained its approach to provide high oil subsidies, did not cut domestic oil subsidies in order to reduce the overspendings, looking to address citizens' concerns about the country's economic growth. As a result of sticking with subsidy plan, the state-owned energy holding company "Pertamina" sold its fuel below the market prices throughout the country. The oil and gas sector shortfall contributed to the 2018 current account deficit through trade account in a more transparent way from the balance of payment management than otherwise. The increasing current account deficit of 3.37% of GDP in third quarter 2018, yet Bank Indonesia (BI) has projected that the country's current account deficit will be at around 2.3 percent in 2018.

Additionally to the key critical uncertainties and action priorities highlighted above, it is worth mentioning that during COP24, the government claimed to be fully committed to steer the economy for low carbon development by mainstreaming a low carbon framework in their medium-term development plan. This development would involve improving environmental quality and attaining **energy efficiency**. Energy efficiency improvements in Indonesia have reduced by 9% of energy use in 2017 since the year 2000 and in the energy efficient scenario the overall energy consumption can be reduced by 670 PJ with savings mainly coming from the industry and services, passenger transport, followed by residential buildings sector (IEA 2018). Some efforts to improve energy efficiency included the application of energy management in the industry, the application of codes to commercial building, the application of MEPS and labeling to household appliances and the

application of more efficient passenger transport. Efficiency improvements also prevented 65 Mt CO_2-eq in emissions in 2017.

CONCLUSION

Indonesian energy leader's concerns and actions are aligned with the developments for security of supplies, affordability and environmental impact posed by the current energy mix. The government is taking measures to ensure that consumers have access to affordable and reliable & secure supply of energy by providing subsidies and keeping the energy costs constant. The government is also committed to steer the economy for low-carbon development by mainstreaming a low-carbon framework as a medium-term development plan and by increasing the roles of low-carbon & zero-carbon energy technologies, moving the energy system towards using low-carbon energy sources (fuel switching), improving environmental quality and enhancing the work on energy efficiency.

ACKNOWLEDGEMENTS

Indonesia Member Committee, World Energy Council

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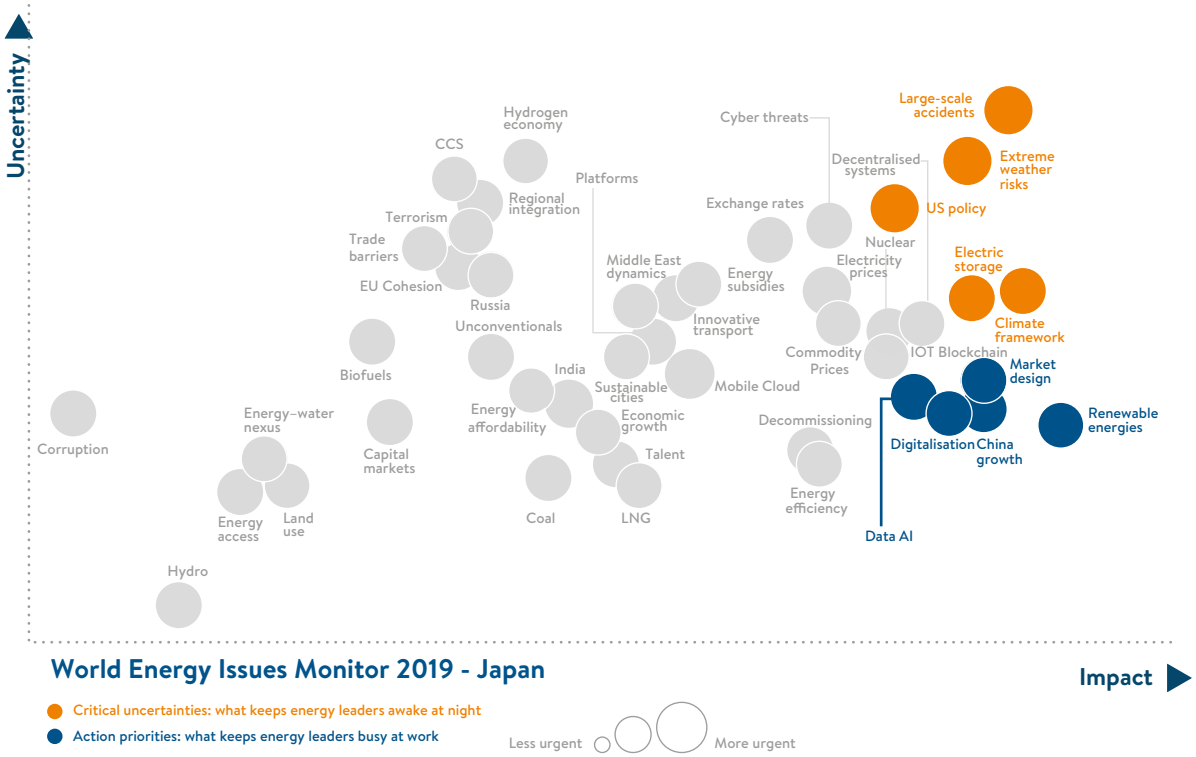
JAPAN



NATIONAL OVERVIEW & CONTEXT

In 2018, natural disasters such as heavy rains, typhoons and earthquakes have caused enormous damage in Japan, and uncertainty about large-scale accidents caused by future large-scale earthquakes and volcanic eruptions is still high. There is growing awareness that extreme weather caused by climate change, may further increase the damages caused by heavy rains and typhoons.

As trade and tensions between the United States and China become obvious, the decisions taken by the US Administration are a source of concern for Japanese companies. On the other hand, the Japanese government is required to maintain a tight alliance with the United States and build a new balanced relationship with China. In addition, the need of responding to the political situation of the Korean Peninsula, which is still urgent, has a complicated effect on building such relations.

While expansion of renewable energy as a main electricity source is being planned as a way to address climate change, many problems caused by a rapid increase in levy burden by feed-in tariffs (FiT) and massive flow of PV electricity into grids have arisen.

Some of Japan's major energy challenge today include utilising nuclear power proactively, notably through the re-activation of nuclear power plants, and balancing the market design while considering the 3Es + S (Energy Security, Economic Efficiency, Environment + Safety).

KEY ISSUES FROM THE NATIONAL MONITOR

Large-scale Accidents: Similarly to last year, large-scale accidents have been prominent in the minds of Japan's energy leaders. The high possibility of large-scale earthquake occurrences in the

metropolitan area and the Pacific coast, along with the possibility of large-scale volcanic eruption, contribute to enhancing uncertainty. Therefore, ensuring resilience of the energy sector is an urgent need.

Extreme weather risks present a higher degree of uncertainty this year. This is due to severe damages caused by heavy rain and typhoons which occurred this year, and the growing concern of many people on the impacts of climate change.

As last year, **U.S. Policy** also presents high uncertainty. Japanese energy leaders are worried about the shift in Trump Administration's position via-a-vis China and North Korea, and the potential impacts this can have in the region. Energy leaders consider it is necessary to build closer relations between Japan and the United States.

The revision of the Strategic Energy Plan 2014 positions **renewable energies** as the main source of power supply and is aiming for further development by 2050. Nevertheless, Japan is facing several challenges in the development of its domestic solar PV industry. The costs of system installation and generation are still too high. Grid constraints and land availability are also expected to be impact the country's solar PV market in the medium-term.

China Growth is also considered as an action priority, as the world's largest market continues to develop at a fast pace. Earlier this year, the Centre for Global Development found that more than ten recipients of the Belt and Road Initiative are at serious risk of not being able to repay their loans. Japanese energy leaders worry that this may cause tensions in the region in addition to the ones it is already witnessing with the United States.

Market Design including the establishment of new electricity markets is progressing in both the electricity and gas sectors. The main challenge is how to successfully develop the market design while taking balance of the 3Es + S (Energy Security, Economic Efficiency, Environment + Safety).

It is required for the energy industry to provide new business and services by making full use of **digitalisation, big data and AI**. Various attempts are being made for collaboration with IT companies including start-ups.

CONCLUSION

With an energy self-sufficiency ratio of about 6%, promotion of nuclear energy is indispensable to Japan's energy industry. In addition to finding ways to reduce its dependence on imports, Japan energy leaders must keep a close eye to shifting domestic energy consumption structure. It is also crucial that leaders focus on decarbonising their energy mix, digitalising and preparing for potential large-scale accidents.

ACKNOWLEDGEMENTS

Japan Member Committee, World Energy Council

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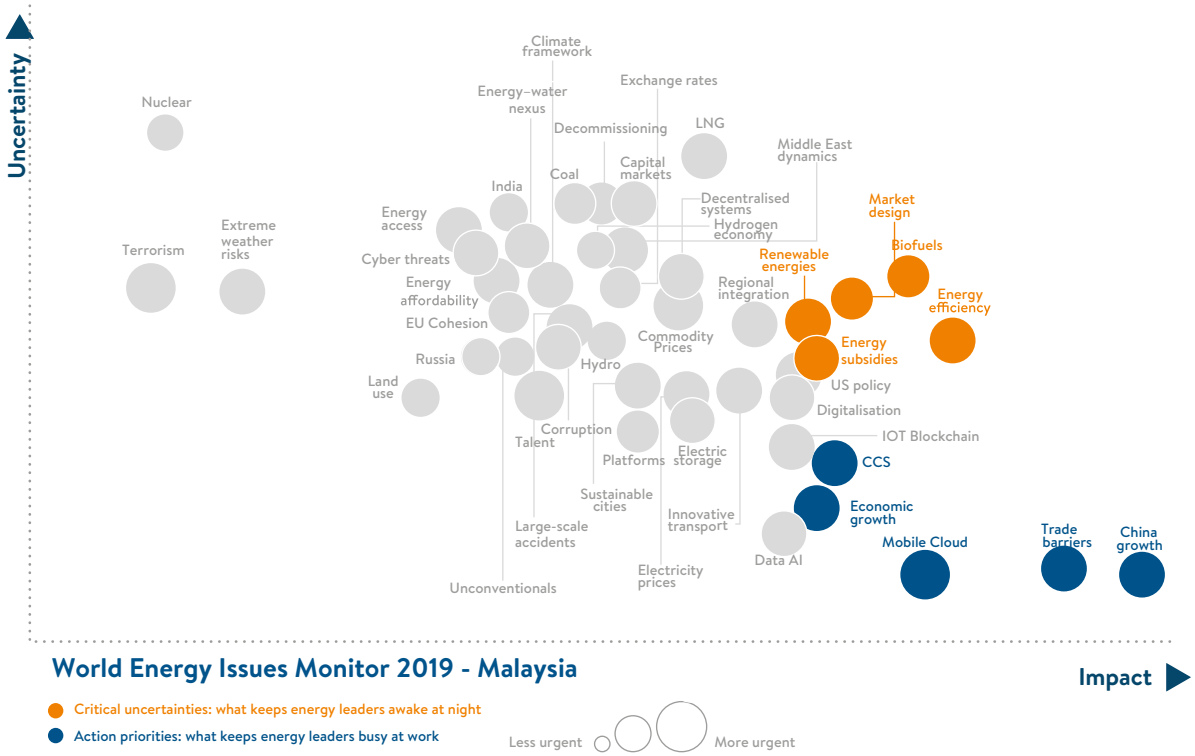
MALAYSIA



NATIONAL OVERVIEW & CONTEXT

The recently elected Malaysian government is committed to enhancing good governance and transparency. The current focus is on creating green markets, enhancing demand side management (DSM) for energy, increasing the renewable energy (RE) share in the generation mix, encouraging low carbon mobility and managing waste holistically. In this regard, the Ministry of Energy, Science, Technology, Environment and Climate Change was established to ensure better coordination of energy, environment, climate change and green technology-related matters. Measures to address climate change will be further intensified through reduction of GHG emissions in the key emitting sectors, namely energy, transport, waste, industrial processes and product use as well as Agriculture, Forestry and Other Land Use (AFOLU). These measures will include greater use of renewable energy, optimisation and demand side management (DSM) for energy, encouragement of low-carbon mobility and construction of green buildings. The adoption of the Sustainable Consumption and Production (SCP) concept in expanding green market and better waste management towards circular economy will contribute to the reduction of GHG emissions.

As an open economy, Malaysia continues to face challenges related to external economic risks. These challenges include the moderation of commodity prices, US protectionist trade policies, economic rebalancing of China and geopolitical uncertainties. The digitalisation agenda will be actively pursued for higher digital adoption in the public service. Various digital tools will be utilised in undertaking the government's digitalisation agenda.

KEY ISSUES FROM THE NATIONAL MONITOR

Malaysia is amply endowed with Renewable Energy (RE) and **biofuel** sources. The Green Technology Policy was launched to promote the utilisation of low carbon energy and technology of which RE has

been identified as the promising low carbon option. Malaysia is looking to rely on more sustainable sources of energy as the cost of fossil fuels increases every year. Under the National Biofuel Policy plan, biofuels were to be produced for transport, industry, and export, while the government would develop home grown biofuel technology and second-generation biofuels.

Market design is an important focus area for the adoption of the Sustainable Consumption and Production (SCP) Concept and the creation of a green market. A proactive approach has been adopted to catalyse the creation of green markets by implementing the Government Green Procurement (GGP), and by focusing on green products and services. Malaysia is focusing on green buildings in a bid to reduce carbon emissions in the construction industry. The country aims to quantify and lower the carbon footprint of construction projects, by guiding the design, construction and operation of buildings in a low-carbon and sustainable manner. These approaches show government efforts and commitment towards reducing GHG emissions.

The electricity subsector relies heavily on fossil fuel sources, particularly coal and gas, resulting in over 50% of carbon emission in the national GHG emissions profile. The utilisation of **renewable energy** sources such as solar, micro and pico-hydro, as well as biomass, will be encouraged. The exploration will include a study on technical viability and potential commercial application of new renewable technologies such as micro grids and energy storage. Efforts will be undertaken to promote the generation of electricity from biomass and biogas, especially from palm oil waste and municipal solid waste. The emphasis on renewable energies is in tandem with the national commitment to reduce GHG emissions intensity to GDP by 45% by 2030.

China is Malaysia's largest trading partner. In 2013, the trade volume between the two countries reached US$106 billion, making Malaysia China's third-largest trade partner in Asia. Discussions held during visit of Malaysia's Prime Minister Dr Mahathir Mohamad to China in August 2018 can illustrate the approach Malaysia may wish to take towards China in the future. The Prime Minister visited Alibaba, the largest e-commerce company in China, and Da-Jiang Innovations, a producer of drones and aerial photography systems. In addition, Mahathir witnessed the signing of an MoU (Memorandum of Understanding) on exporting Musang King durians to China, and also visited the Chinese Academy of Agricultural Sciences.

Malaysia is an active participant in the World Trade Organization (WTO) negotiations and continues to endeavour so that **trade regulations** and trade measure can be in line with the countries development goals. In January 2018, the government suspended the 5 percent export tax for three months when crude palm oil prices were dropping, to prevent stockpiling and the decline in price and exports.

Malaysia has a strong potential to become a regional hub for data centres. According to Malaysia Digital Economy Corporation (MDEC), the data industry in Malaysia is expected to more than double to RM2 billion (US$ 483.85 million) by 2020. This growth was seen as a result of the increase in the use of big data analytics, **cloud computing** and data recovery. With emerging technologies, the atmosphere is good for Malaysia to become a regional data hub.

Taking into consideration the aspirations of the new Government, new priorities and emphases are being set to reform existing policies and outline the country's socioeconomic targets for 2018-2020. Efforts will focus on stimulating **economic growth**, while ensuring greater benefits for all segments of society. Malaysia will balance economic growth objectives and fiscal consolidation initiatives to ensure continuous and inclusive development without impairing growth prospects. More measures will also be undertaken to raise the income and purchasing power, especially for the bottom 40% of the household income group.

CONCLUSION

Green growth will not only ensure achievement of Malaysia's sustainable development objectives, but also sustain economic growth, enhance environmental sustainability and promote greater wellbeing. Stronger governance will allow the expansion of green growth in all economic sectors, including green market. A resource and energy efficient economy will be able to minimize GHG emissions, pollution and waste as well as enhance water, food and energy security. Meanwhile, intensified mitigation and adaptation will increase resilience of the nation against climate change impacts and natural disasters.

ACKNOWLEDGEMENTS

Mrs. Zurina Amnan
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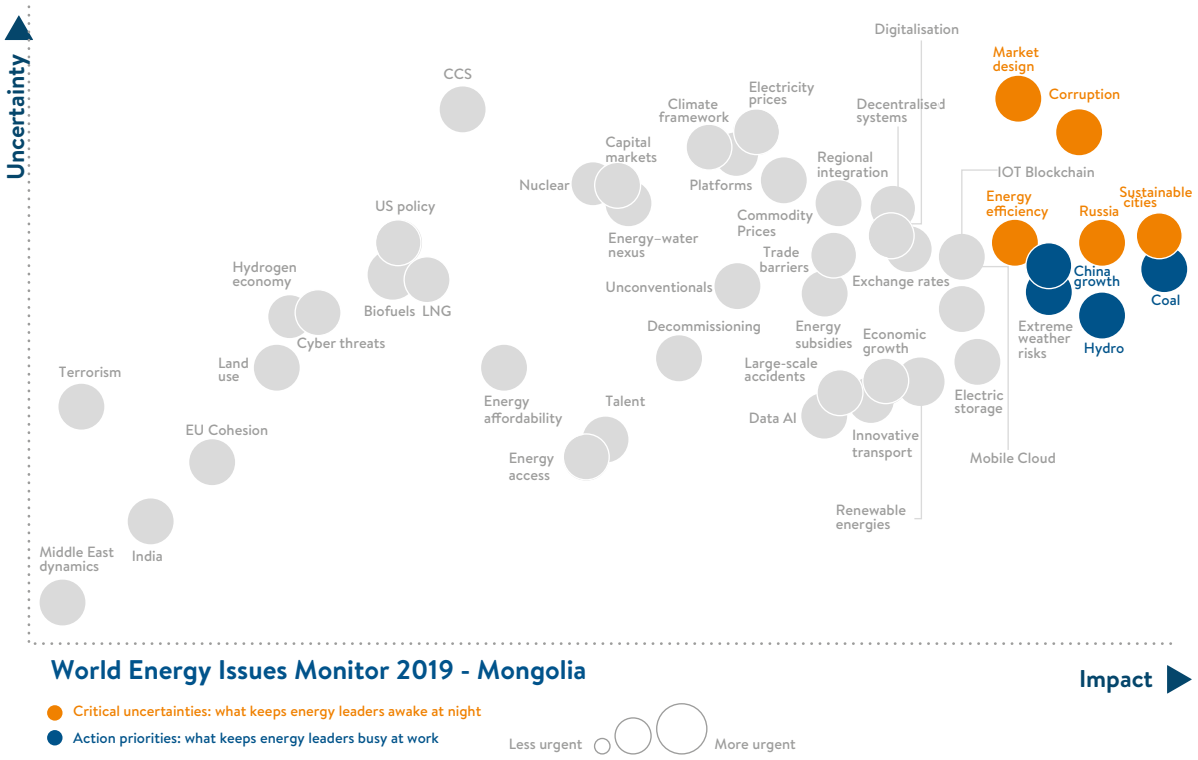
MONGOLIA



NATIONAL OVERVIEW & CONTEXT

Mongolia relies heavily on agriculture, mining copper and coal for economic growth, but is trying to diversify its economy. In the past few years, Mongolia has experienced an economic slowdown due to corruption, commodity prices and foreign direct investment.

In terms of Climate Change, Mongolia is a low emitter of greenhouse gases, but it is disproportionately affected by climate change. Over the past two decades, temperatures rose at more than twice the average annual global rate, leading to hotter summers, droughts, advancing desertification and melting permafrost. These changes have contributed to the degradation of forests and grassland ecosystems on which traditional nomadic livelihoods depend.

The power system of Mongolia consists of the three unconnected energy systems (Central, Western and Eastern Energy System), diesel generators and heat-only boilers in off-grid areas.

Mongolia aims to complete a railway from its Tavan Tolgoi coal project to the Chinese border by 2021. The rail link would have the capacity to deliver 30 million tons of coal a year to China.

In the past two years, several wind and solar power plants have been installed. New challenge emerge as these new resources are integrated. These include regulation for excess renewable energy management, grid stabilisation and night time electricity supply.

At the national level, private and public actions are needed on innovative transport, smart grid, electrical vehicles and learning of best practices.

KEY ISSUES FROM THE NATIONAL MONITOR

Corruption is a critical uncertainty in Mongolia which affects especially private companies. Key anti-corruption legislation includes the Criminal Code and the Anti-Corruption Law, which prohibit active and passive bribery and the abuse of functions. Investors question the ability of the state to deal with the conflict of interest which arises from its role as both a regulator and an owner-operator.

Mongolia's growing dependence on neighbouring **Russia** and China for fuel and power poses a major risk to its booming mining sector. Specifically, Russia is a critical uncertainty according to the Mongolian survey respondents, as reliance on essential energy supplies makes Mongolia vulnerable to supply shocks and price increases. This is especially relevant given Russia's past actions to turn off supply taps, for example during price disputes with Ukraine.

Sustainable Cities is a key critical uncertainty, as Mongolia is disproportionately impacted by Climate Change. In January 2018, all cities in Mongolia joined the "Making Cities Resilient Campaign". In April 2018, Ulaanbaatar City conducted the Disaster Resilient Scorecard with all its 9 districts and in August 2018 and Ulaanbaatar City developed its local disaster risk reduction plan. More recently, the Western provinces reunited in Ulaangom to attend the training on MCR Campaign tools.

Even though climate change has substantially impacted Mongolia, **coal** is perceived by energy leaders as an action priority. The volume of raw coal production increased by 63.1 percent from 2017 to 2018. Mongolia is working on a railway infrastructure to connect with Southern China to deliver 30 million tons of coal a year.

Extreme weather risk is another action priority as climate change increases the risk of natural disasters, including droughts and the extreme winter weather known as "dzud" in Mongolia. As a result, rural-to-urban migration in Mongolia are causing other problems such us over population of the capital city. City planners must find solutions to ensure living conditions are not compromised.

China is considered an action priority on multiple fronts. A key issue is Russia's intentions to build a pipeline through Mongolia to deliver energy supplies to China. China is also Mongolia's biggest trading partner, a relationship that is likely to maintain China an action priority in the long term.

CONCLUSION

Mongolia has adopted a national air pollution mitigation plan in March 2017 in response to its severe air pollution. The plan aims to reduce the current levels of air pollution by 80 percent by 2025. However, the Mongolian government is also planning more than six new coal power plants over the next decade in the absence of a coherent national energy strategy. The dominance of coal in the Mongolian energy plans for new power facilities in Ulaanbaatar, together with the country's ageing power plants, transmission and distribution networks, have contributed to the creation of a highly inefficient energy sector.

ACKNOWLEDGEMENTS

Mongolia Member Committee, World Energy Council
Tovuudorj Purevjav, Ulziilham Uuganbayar, Zayabaatar Baljinnyam.

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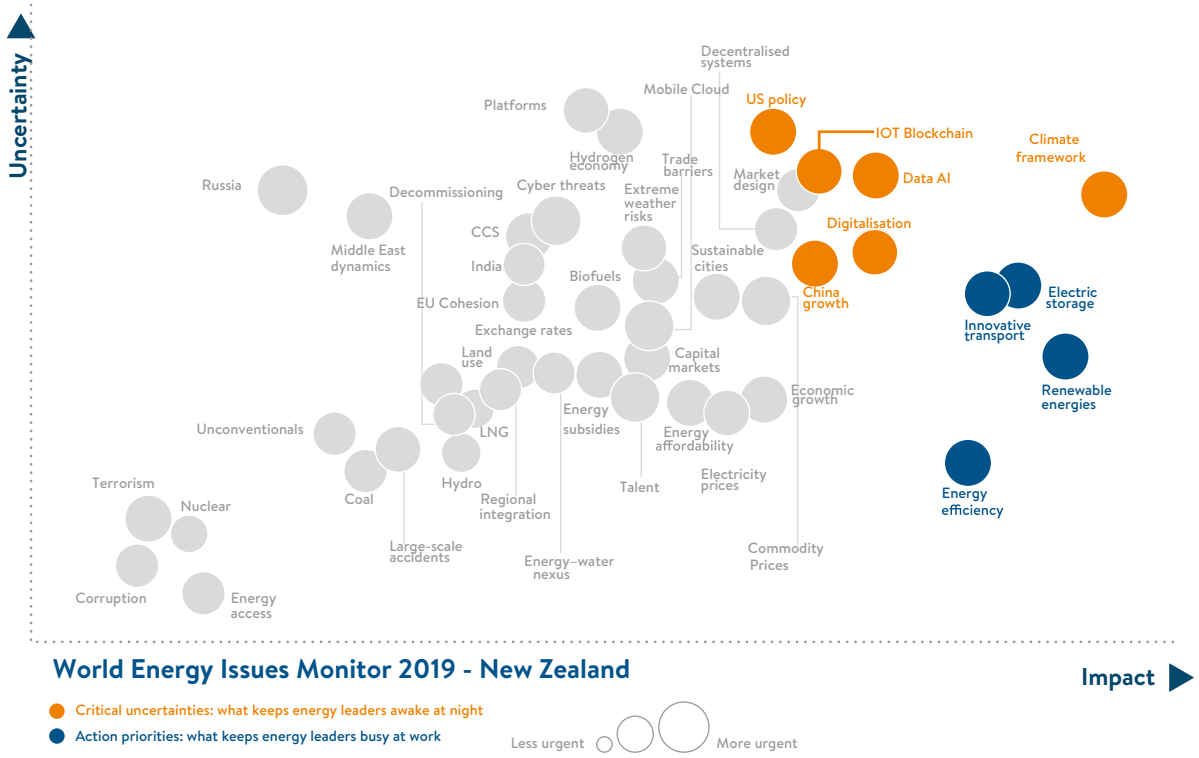
NEW ZEALAND



NATIONAL OVERVIEW & CONTEXT

A year has passed since New Zealand's government was elected and its energy and climate change work programme is in full swing. The Government is in the middle of an electricity price review focused on delivering fairer prices to consumers. It is drafting a Zero Carbon Bill (broadly based on the UK's 2008 Climate Change Act) to achieve a zero-net carbon economy by 2050 and is about to update its Emissions Trading Scheme. Work is also underway on how to aim for 100% renewable electricity generation by 2035, as reflected in this year's Issues Map. Some changes are the result of a clearer signalling of direction, while others anticipate the need for more to be done.

Energy executives remain concerned about the impact of digital technologies. Still, as we look ahead to 2019, we see the re-emergence of economic issues such as New Zealand's climate framework, policy signals coming from the US and China. The emergence of geopolitical concerns weighs heavily on the minds of energy executives and reflects New Zealand's trade-dominated economy and the end of a period of relative stability in world trade. The strong climate change agenda, while giving energy executives growing confidence to act, is also throwing up some substantial implementation questions.

On the other hand, New Zealand's energy leaders are showing they are simply getting on with energy efficiency, energy storage and innovative transportation. Energy efficiency has always been, and continues to be, a valuable contributor to New Zealand's overall market-based energy system. This year, energy efficiency is joined by transport and storage solutions as businesses increasingly have the confidence to bring these to the market in light of the stronger signals from government.

KEY ISSUES FROM THE NATIONAL MONITOR

The risk of a trade war weighs heavily on the minds of New Zealand's energy executives. As the **US and China** face off, with strongly nationalistic policy settings from the US and the perception that China's economy is slowing, the risk of a domestic economic slowdown increases. The Issues Map reflects this as both a geopolitical and an energy issue. US policy and China are now closer to the right top hand corner of the map than they were in previous years.

Following the Paris Agreement, the **climate framework** had become more and more mainstream, something energy leaders were simply getting on with. However, that perception is clearly reversing with the climate framework shifting from an action priority back to an issue keeping energy leaders awake at night. Drivers for the shift are not only coming from the overall global climate framework (especially from the US) but also from the lack of a policy framework to accompany the Government's greater climate ambitions for New Zealand. While the clarity around direction is welcomed, energy executives are increasingly asking "how do we get there?" – a question which to date remains unanswered.

Last year, for the first time the energy issues map showed the strong emergence of the 'innovation cluster', the **Internet of Things (IoT), data and artificial intelligence (Data AI) and Blockchain**. These issues can still be found on executives' list of worries but seem to have dropped in importance a little, as the issues map signals a shift from uncertainties towards action priorities. In 2018, New Zealand's energy sector kicked off a couple of pilot projects looking into different user cases for AI and IoT. At the moment, energy leaders are interested and are exploring how these technologies might benefit their businesses and customers.

On a positive note, energy leaders are signalling more clarity around energy issues such as **electricity storage and innovative transport** solutions and adding these to their to-do list. In previous years, there had been concerns about the life cycle of EV batteries as well as the range limitation of EVs in general. These worries have abated. Concerns are decreasing as technologies are now familiar and technicians are focusing on finding ways to integrate them rather than reasons to reject them. Also, the growth of ride-sharing schemes that can help to cut transport emissions appears to be affecting executives' confidence positively.

Finally, **renewable energies** warrant a mention. A regular action priority given New Zealand's 85%+ renewable electricity base, this year we see them in the context of the fast-moving **hydrogen economy** as energy executives think about how to extend our renewable advantage to the heavy vehicle fleet and the production of green liquids. **Hydrogen** could play an important role in supporting 100% renewable electricity generation, potentially helping to solve New Zealand's dry year risk problem. However, today, hydrogen produced from renewable energy is about six times more expensive than hydrogen produced from natural gas, causing energy leaders headaches. Executives signal their concerns as hydrogen shifts dramatically towards the high impact high uncertainty zone.

CONCLUSION

A great deal is going on and there are many moving parts to New Zealand's energy market that need to crystallise. Overall, executives seem to have gained more confidence in respect to energy

innovation issues. Finding new energy supply and consumption opportunities keeps energy leaders busy during the day. However, there are heightened concerns not only regarding foreign policy but rather more in connection with New Zealand's imbalance between energy targets and actual action plans. As a result, energy issues such as the climate framework and renewable

energies are now reverting from political uncertainties to technical challenges for business. Without careful management, this could dampen rather than enhance future green investment.

ACKNOWLEDGEMENTS

John Carnegie, BusinessNZ Energy Council
Tina Schirr, BusinessNZ Energy Council

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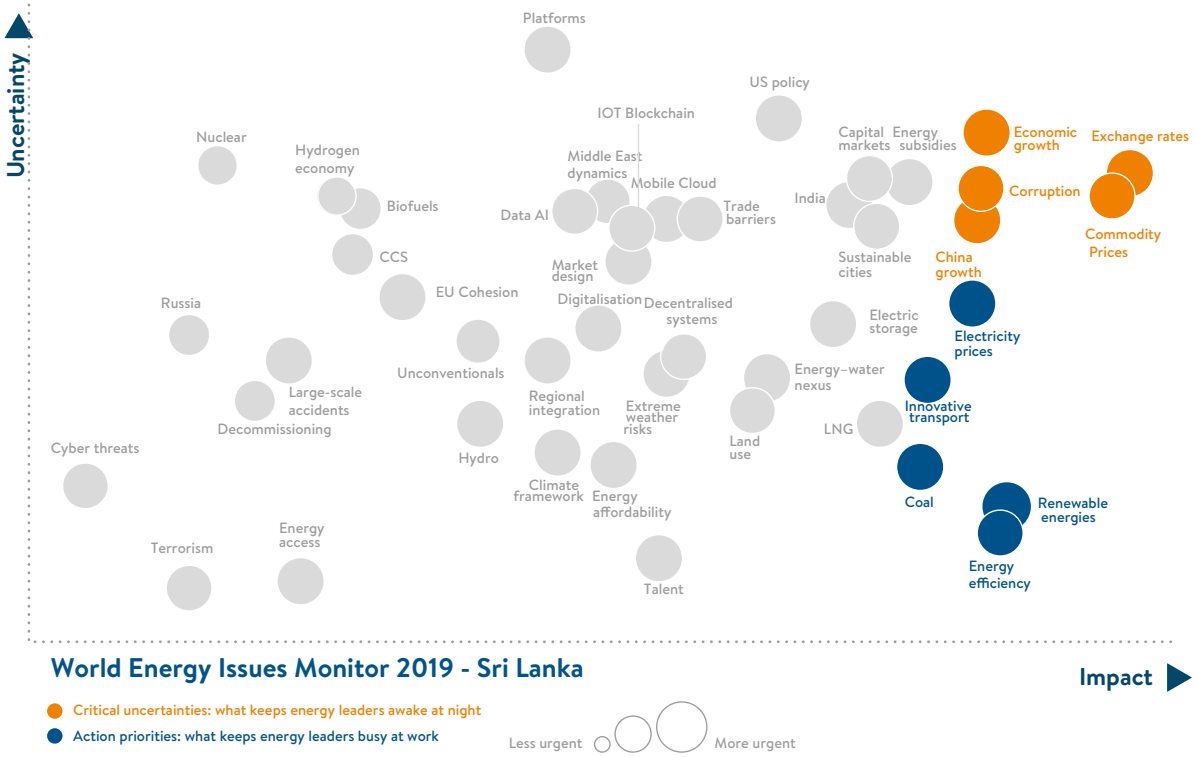
SRI LANKA



NATIONAL OVERVIEW & CONTEXT

Energy costs and pricing, the fuel-mix in electricity generation and energy sector governance have been the key uncertainties affecting the energy sector in 2018 in Sri Lanka. These uncertainties are likely to dominate the energy sector development and growth strategy into 2019 and beyond.

Action priorities for 2018 have focused on building more electricity generation capacity, building oil and gas facilities, rationalising energy pricing and implementing renewable energy initiatives.

Sri Lanka's energy policy requires energy pricing to be cost reflective. The country has so far not been able to achieve this objective for either costing or pricing. With oil and electricity utilities largely owned by the government (directly or indirectly), the gap between costs and prices is financed with taxes on other goods and services. Like many countries in the region, the fuel options to produce electricity, namely coal, imported LNG, oil or renewables, continue to be a subject of intense debate. The all-encompassing regulatory structure for the electricity industry, the Public Utilities Commission of Sri Lanka (PUCSL), has still not reached its full potential and the due recognition. On the other hand, the oil and gas industry remain unregulated or loosely regulated under arrangements initiated more than 50 years ago without oversight by any modern regulatory structure.

Actions to build more conventional electricity generating capacity to serve the base capacity requirements have not been successful, while limited progress has been observed with renewable energy development. Initiatives to rationalise pricing of oil products and electricity remain a major challenge. Significant developments of renewable energy and a rational arrangement to enable both utility and distributed generation to co-exist would remain an action priority for 2019 and beyond.

KEY ISSUES FROM THE NATIONAL MONITOR

Commodity prices: Energy imports in Sri Lanka cost USD 3.7 billion in 2017 and represented 18% of total imports. Increasing costs of energy imports in the face of lower economic growth and exports raises serious concerns about the sustainability of the present energy mix. The inability of governments to adjust administered prices of oil and electricity to meet costs and utility overheads has caused serious burdens on the treasury, which manages finances of state-owned utilities.

Corruption: Energy sector governance cross-cuts across policy-making, regulation, ownership and safety. Sri Lanka's energy policy declaration 2008 is outdated and awaits revision since 2011. Ad-hoc or implied policies have been attempted in the intervening period with little success. There is no established policy review or compliance review mechanism. The government's role as policy-maker is often mixed-up with that of regulator and owner of energy utilities. Independence of the electricity regulatory agency has been questioned, while the petroleum industry remains unregulated, as Sri Lanka plan major oil and gas investments.

Electricity prices: State-owned electricity and petroleum utilities have shouldered the burden and blame owing to administered prices, while being expected create profit. Pricing methodology (electricity) and formulae (petroleum) have been implemented from time to time, with little transparency, sustainability and public confidence. Deficits owing to administered prices are financed by state banks, at times exceeding USD 500 million per year. Implementation of periodic product pricing revisions with regulatory oversight needs to build public confidence, allowing utilities to be vigilant for costs within their control.

Primary energy for 75% or more of electricity production originated from **renewable energies** up to 1995. The growing economy required sourcing between 25% and 70% of annual electricity needs from fossil fuels. Balancing the supply and demand for electricity amidst seasonality, intermittency and higher investments on renewable energy, along with fleets of smaller oil-burning power plants, has been a daunting task. A weak decision-making process despite a strong legal framework in electricity industry, caused implementation of both conventional and renewable-based power generation to be delayed.

New bulk power generating capacity to serve the growing demand and to support renewable energy capacity to overcome seasonality and intermittency has been delayed. The last major power plant was completed in 2014. Major generation projects have not commenced since 2010. The 50-year-old refinery is inefficient and inadequate, and the natural gas terminal project has not been implemented since the decision to build it in 2014. In 2017, 35% of electricity was produced from oil. Delays in key power plants, new refinery and gas imports will need short-term solutions, raising oil share in power generation to 50% by 2020.

On a more positive note, Sri Lanka has pioneered feed-in tariffs and standardised agreements to enable private investments on renewable energy projects, and net metering for existing customers. As renewable technologies mature, feed-in tariffs also require moving to competitive pricing in fairness to customers. Capacity costs of utilities must be paid by customers with distributed generation. Absence of a clear procurement policy on next phases of renewable energy

development along with utility/private share, hinders accelerated development of renewable energy, especially wind and solar resources.

Innovative transport: In Sri Lanka, people are decreasingly using public transport, as incomes are increased, and quality and reliability of public transport is declining. Good quality electric public transport is yet to be deployed to encourage commuters to use cleaner and more energy efficient modes of transport.

CONCLUSION

Major impediments for Sri Lanka to achieve desired levels of energy supply at the quality and price desired by the society originate from weak sector governance. External impacts of high fuel costs and limitations of renewable energy may be managed with strong and consistent regulatory oversight devoid of administered prices and strengthened management of electric and petroleum utilities. The transport sector, the largest energy end-user ahead of households, commercial and manufacturing, require significant investments and policy change to ensure that an energy efficient mobility can meet demands of a growing urban population.

ACKNOWLEDGEMENTS

Sri Lanka Member Committee, World Energy Council
Dr Tilak Siyambalapitiya

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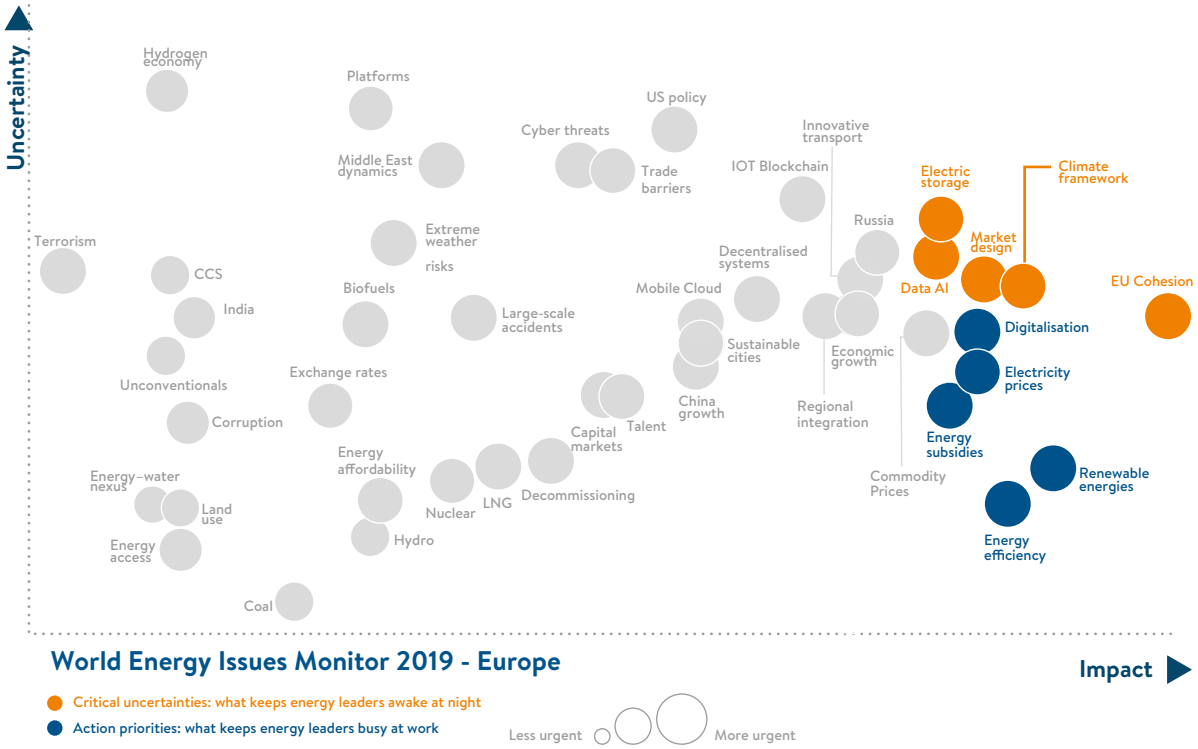
Chapter four
Assessing the energy agenda for Europe

EUROPE



REGIONAL OVERVIEW & CONTEXT

The 2019 European Issues Monitor outcomes are largely influenced by technology developments, geopolitics and regulatory frameworks. While the general level of uncertainty among all issues has significantly decreased in Europe over the last year, a lack of confidence remains on a series of technological and political topics.

Key Critical Uncertainties in Europe are associated with the technology cluster – developments in electric storage, Internet of Things and Artificial Intelligence are followed with interest, but their applications are still facing doubts among legislators, consumers and companies. Intriguingly, the perceived levels of risk around digitalisation are varied between European states, showing lower levels of uncertainty in countries that have made more progress in the field.

Concerns about Market Design remain high despite the progress of new EU energy market regulations being processed in the European Parliament. This highlights the persistence of uncertainties regarding the financing of future energy investments, electricity prices and increasing commodity price volatility. In terms of geopolitics, while the uncertainty about Russia has significantly reduced since last year, the potential impact associated with EU cohesion has increased in importance, in the context of Brexit negotiations and upcoming European Parliament elections. It is also notable that the potential impact of US Policy has considerably increased during the year in Europe.

Key Action Priorities have remained current for Europe for number of years. Energy Efficiency and Renewables become even stronger investment priorities, supported by increased energy and carbon prices in the EU and new regulatory frameworks developed under the new EU energy package.

In parallel, energy and electricity prices have gained steam during 2018, delivering more financial confidence to EU market players while raising political issues in some European countries.

KEY ISSUES FROM THE REGIONAL MONITOR

Electric Storage: Battery developments in the mobility sector are followed with great interest as they can also potentially provide breakthrough solutions for electricity systems, and impacts for the building and heating sector. There is potential for changes in the management and design of power networks. However, regulatory frameworks may not yet be suited in all countries to implement such solutions, and consumer confidence must be built up for these new technologies.

Data and Artificial Intelligence: It is recognised that data management and services based on artificial intelligence (AI) can have a great potential for the energy sector. Many solutions are currently being developed or tested. Nevertheless, the concerns regarding upcoming new regulations in the EU about cybersecurity and data protection as well as uncertainties concerning associated business models may reduce the appetite for fast and massive application of these solutions.

EU Cohesion: While the 26 Members of the EU have shown a significant level of cohesion, risks remain high about the future outcome of Brexit negotiations and its potential impact to both sides. The upcoming elections of the European Parliament in May 2019 may lead to political agenda and priority changes in the coming years in Europe. Given the importance of Europe for energy regulation, this may have also a significant impact on the energy and climate frameworks.

Energy Efficiency: Economic conditions for investments into energy efficiency have strengthened due to the increase of prices of commodities, power and heat. This trend has also been supported by the new directive of energy efficiency of buildings that has been introduced into the European Union legislation. Keeping in check the costs of energy efficiency measures remain a key objective in order to ensure affordability in the long run.

Renewable Energies: The decrease in prices of photovoltaic (PV) panels and wind turbines has boosted the attractiveness to invest into these technologies. In several European countries, these prices have reached a point where no direct subsidies are needed anymore for some utility-scale projects to be competitive in the power market. Supported by political objectives, price reduction has led to the significant investments into renewables raising the questions of grid development and of the remuneration of flexibility. Significant uncertainties remain regarding the development of renewables in buildings or transportation.

Electricity Prices: The prices of electricity have increased in Europe, driven by higher commodity prices, tighter offer-demand balance in some countries and increased CO2 prices. Stronger integration of the European power markets has also enabled the coupling of power prices across regional markets. These short-term trends have enhanced the trust towards power markets and has triggered political concerns about affordability of electricity in many European countries.

High level of concern and significant impact level of **Market Design** reflect the number of challenges that the European energy system still must face and the needed regulatory framework

changes. Concerns are growing about electricity security and the adequacy of power supplies in some European countries and regions in the coming years. Closures of a significant number of thermal facilities are planned in the short to mid-term, while the current regulatory framework needs a robust overhaul in order to deliver the needed price signals to trigger investments in capacities and to enhance flexibility.

CONCLUSION

Technology developments, geopolitics and regulatory frameworks are the keywords to understand the evolution of the energy landscape in Europe and its perception by European stakeholders. Energy efficiency and renewable energies are clearly prioritised to deliver a decarbonised, affordable and secure energy supply. This has the potential to set European countries and the whole region into a forefront in the Energy Trilemma Index. However, concerns remain high today regarding the necessary evolutions of the market design, especially in the electricity sector, to secure the significant investment levels ahead to ensure electricity security. The jury is still out on concerning the pace of Internet of Things (IoT) and Data AI developments in the European Energy sector as business models are being built up and tested.

ACKNOWLEDGEMENTS

Cedric Lewandowski, Vice Chair for Europe, World Energy Council
Dr Einari Kisel, Regional Manager for Europe, World Energy Council

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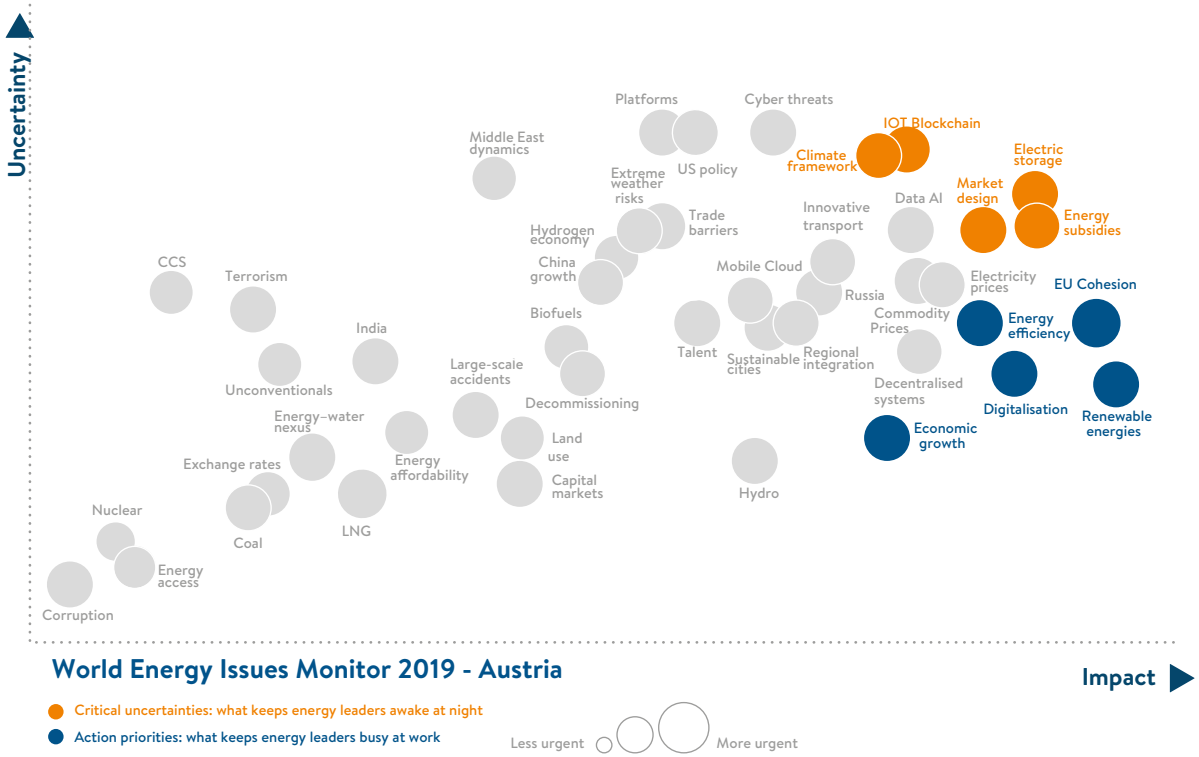
AUSTRIA



NATIONAL OVERVIEW & CONTEXT

Austria's internal energy supply is based on a balanced mix of energy sources. In 2017, energy consumption came from approximately 36% oil, 33% renewables, combustible waste and others, 22% gas and 9% coal. The production of nuclear energy has been banned since 1978 according to the Federal Law for a non-nuclear Austria.

36% of Austria's energy needs are produced locally and the country relies on energy imports to satisfy its energy demand. Austria's energy supply is of high quality and at affordable prices, making energy poverty less stringent than in many other EU countries.

Energy policy developments in Austria and targets for 2020 are well-matched and are in line with EU policy, including a plan to increase the share of renewable energy consumption 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 by 21% from 2005 levels for sectors included in EU-ETS; and a 20% improvement in energy efficiency until 2020.

Austria is already close to achieving its 2020 renewable energy target of 34%, while it is at risk of missing its 2020 target for energy efficiency. The GHG-emission target will be missed without further efforts.

The Austrian government unveiled its new energy and climate strategy on April 3rd, 2018. The paper called "#mission2030" is to help Austria reach the EU climate goals. The Austrian government is aiming for all electricity to come from renewable sources by 2030 (2017: about 70%) and for a fully decarbonised energy system by 2050.

To achieve the 100% green electricity target by 2030, an Energy Expansion Act is currently being drafted. The key points are to be adopted by the end of 2018, and the draft law is to be presented in the first quarter of 2019. The core element of the Energy Expansion Act is the reorganisation of renewable subsidies. This is to incorporate both the requirements of the EU Energy and Environmental Aid Guidelines and those of the Renewable Energy Directive (including a switch from feed-in tariffs to market premiums). In addition, the Energy Expansion Act is intended to address the issues of system responsibility, market design and sector coupling.

With regards to the Austrian electricity market, the separation of the German-Austrian price zone has recently been the predominant issue. The combined German/Austrian bidding zone was separated on 1 October 2018. Effects of the separation of the German/Austrian bidding zone could already be observed on the futures markets before 1 October 2018. The future prices for the front years 2019 - 2023 in Austria were on average almost €3/MWh higher than in Germany during 2018. The effects on the spot market can be observed since 1 October 2018. This shows that prices on the spot market in Austria are also significantly higher than in Germany. Between the beginning of October and mid-November 2018, the average price difference was just under €7/MWh.

KEY ISSUES FROM THE NATIONAL MONITOR

Innovation is the biggest critical uncertainty, with **IoT/Blockchain, Data AI and Digitalisation** being on top of the agenda of Austrian energy leaders. These innovations have the highest potential to disrupt the energy sector and re-write the energy sector story.

The established energy sector is affected by these changes and first start-ups show that electricity trading between private individuals is feasible without a participating energy company. Blockchain can also be used to integrate storage technologies into decentralised energy systems, to simplify the balancing of supply and demand, to automate charging and billing in the field of e-mobility and so on.

The Energy Transition could unfold a new dynamic using these new technologies. But they also have the potential to change existing structures and roles in the energy sector landscape. These innovations open opportunities and risks.

The chance of capping global warming at “well below” two degrees Celsius are becoming less likely. With one degree Celsius of warming so far, the Earth has seen a crescendo of extreme weather, including heatwaves, droughts, floods and deadly storm surges made worse by rising seas. Even taking into account voluntary national pledges to slash carbon emissions caused by burning fossil fuels, the planet is currently on track to warm by an unliveable 3 °C to 4 °C by century’s end. This makes it all the more important, not to regard Paris as the end of the discussion, but as the starting point for an ambitious global **climate protection framework** for the future.

Electric storage is a further critical uncertainty of Austrian energy leaders. Electric storage is mostly connected to the development of renewable energies and electric mobility, two areas of great interest for national and local energy stakeholders. Austria has a large number of hydro storage and pumped storage power plants. To achieve the goal of 100% renewable power by 2030, even more storage capacity will be necessary. Unfortunately, the operation and expansion of these power plants is under considerable economic strain due to the present market distortions. For

instance, a significant barrier for pumped storage capacity expansion and operation is the currently implemented regulatory regime (such as transmission grid charges defined and quantified in the corresponding paragraphs of the "EIWOG" Electricity Management and Organization Act). Among others, a significant impediment affecting the economics of the pumped storage technology is a transmission grid charge, having to be paid in both modes: generation and pumping.

Austria plans to increase the ratio of **renewable energy** (gross final energy consumption) to 45-50% by 2030. The interim target of 34% by 2020 is already in sight. Another objective is to cover 100% of total electricity consumption (national balance) from national renewable energy sources by 2030. This increase takes into account the anticipated increase in electricity consumption. Electricity from renewable sources in Austria will be used in the mobility, building and production sectors to replace imported fossil fuels. This increase relies on future trends in digitalisation, decentralisation and participation.

The heat market still depends heavily on imported fossil fuels. In order to mitigate that dependency, the use of biomass, solar heat and ambient heat will be developed between now and 2030. The details are set out in a National Heat Strategy in liaison with regions in Austria. A large proportion of natural gas will be replaced in the future by renewable methane. Cleaning gas by using biomethane from biogenic waste, hydrogen and synthetic methane. This is taken from renewable power sources based on a significantly improved system, proof of origin are key components in the development of a sustainable energy system.

A constant absolute quantity of sustainably produced biofuels will account for a relatively higher percentage compared to fossil fuels, at least in the period up to 2030, due to the increasing market penetration of e-mobility. The protein fodder produced as a by-product of biofuels will make an important contribution to the Austrian protein balance.

There is little the **European Union** today needs more urgently than cohesion, unity and solidarity. From this perspective, it is almost surprising that cohesion (earlier known as regional) policy has existed for over 60 years, an exercise in solidarity, building on the financial resources of the EU Structural Funds. Now, going into a new programming period 2021-2027 and with Brexit, revived nationalism and general unrest among some member states shaking the very foundations of the European Union, it is time to think about how to further adjust and thereby sustain this element of European unity.

Digitalisation of the Energy Transition can play a key role in meeting the challenges of the decentralisation, flexibilization and efficient use of energy and mobility. For example, it can function as an enabler for the progressive expansion of renewable energies. Control and regulation using digital technologies will become increasingly important during the course of the Energy Transition and will give rise to new sustainable business models. In the long term, the link between the power, heat and mobility sectors will become the key to ICT-supported optimisation of the energy and mobility system. The introduction of smart meters will improve demand-side management across the entire population. Digitalisation of the Energy Transition will be one of the driving forces behind the decarbonisation of developed economies.

Analyses show that in the European context there is already considerable reform potential for climate policy instruments in the short term, but especially in the medium and long term. In the long term, the CO2-market should be the guidance system to achieve the Energy Transition and it should support the development of renewable energies and manufacturing technologies, which have low levels of CO2. 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.

CONCLUSION

Austria has a mission. It is determined to safeguard prosperity and the high standard of living. Global climate change has a major impact on the economy, on society and on the environment. The Austrian federal government will find answers to these major questions. That means taking an ambitious approach to climate protection while at the same time ensuring sustainable development. Economic growth and environmental protection need to go hand in hand. Clean growth is not an option, it is a necessity.

ACKNOWLEDGEMENTS

Dr. Kobau Robert, General Secretary, Austria Member Committee, World Energy Council

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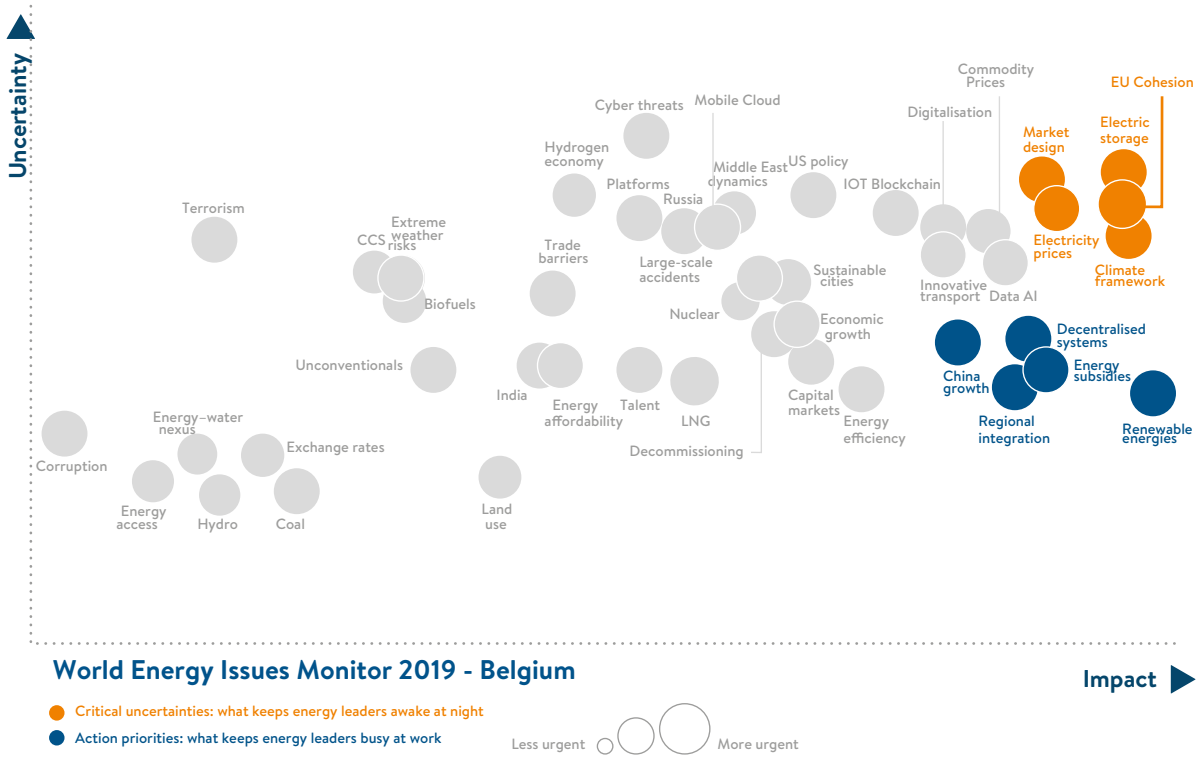
BELGIUM



NATIONAL OVERVIEW & CONTEXT

2018 was characterised by great concerns around the security of electricity supply. With just a few weeks before the start of the winter, Belgium has faced the unexpected unavailability of multiple nuclear power stations, a situation that has severely tested the balance between generation and consumption. A taskforce has been created by the Federal Minister of Energy and different options have been examined. Both the supply and demand side options have been considered. However, the risk of load shedding for the beginning of 2019 is not completely excluded.

At the moment of the Energy Issues Survey, a few key issues were on the table of the Federal Minister of Energy: the reform of the offshore subsidy system, the introduction of a Capacity Remuneration Mechanism to ensure that gas power plants are available after 2025 (as the Parliament has decided by law to close all nuclear power plants by this date) and the introduction of a so-called Energy Norm. This bill is aimed at ensuring that energy prices, in particular electricity and natural gas, are no longer superior to those of neighbouring countries. Due to the country's political situation, no decision has yet been taken by the Federal Government.

KEY ISSUES FROM THE NATIONAL MONITOR

Electricity Prices, in particular those for large industrial consumers, are still a concern, especially when lower industrial prices of neighbouring countries are taken into account. Large consumers call for the application of an "energy norm" so that energy prices in Belgium, and in particular for electricity and natural gas, are no longer superior to those of neighbouring countries.

EU Cohesion is a concern for the respondents in Belgium as at the time of the survey the negotiations about Brexit were still going on and the consequences for Belgian industry are most uncertain.

The **Climate Framework** is also identified as a critical uncertainty. At the moment of the survey, Regional and Federal Authorities were preparing the National Climate and Energy Plan as requested by the Regulation on the Governance of the Energy Union.

Renewable energy sources (RES) are identified as the biggest action priority for Belgium. The production of renewable electricity has seen a sharp rise in the last decade. Thanks to the offshore wind turbines, wind is the main RES for electricity production, although the installed solar PV capacity is also substantial.

Regional integration is an action priority for Belgium as the country participates in different regional initiatives such as the Pentalateral Energy Forum to increase regional cooperation and to improve market integration.

The fact that **China** has been identified as an action priority can be explained by Chinese state energy companies interest in acquiring stakes in the Belgian grid operators (DSO and TSO). Both acquisition attempts have been unsuccessful.

Half of Belgian gas users consume lean **gas**, imported from the Netherlands (Groningen - Slochteren). However, these gas reserves are close to being exhausted. The Dutch authorities have therefore announced intention to reduce gas exports until complete interruption by 2030. A conversion plan to rich gas has been set up. The conversion operations have started in 2018 and will continue until 2029.

CONCLUSION

The position of most energy issues in this year's map does not come as a surprise, except perhaps the perception around the Nuclear issue, which is expected to have an impact "without uncertainty". This may come as an unexpected result, since there is still a large uncertainty as to the effective date of a complete phase out (note that in "normal years", more than half of the Belgian electricity is generated by nuclear means). The position of nuclear in the map is therefore to be interpreted that the respondents are certain that the "yes-or-no" nuclear phase out will definitely have an impact.

ACKNOWLEDGEMENTS

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Berenice Crabs

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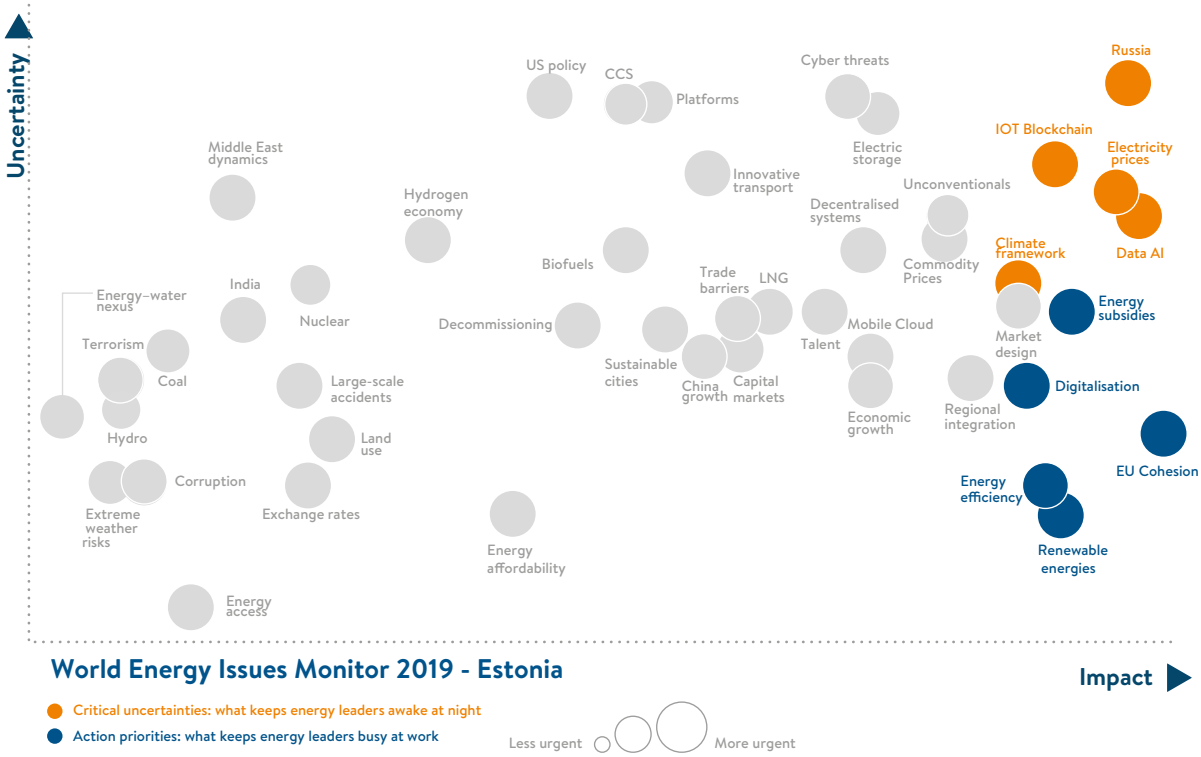
ESTONIA



NATIONAL OVERVIEW & CONTEXT

2018 saw steady and continuous efforts towards a more environmentally friendly, secure and technologically advanced energy system in Estonia. However, a rapid increase in the electricity prices has raised concerns and it is clearly reflected in the Estonia 2019 Energy Issues Map.

From a geopolitical aspect, Russia has kept its position as a critical uncertainty, leading to the actions of desynchronizing the Estonian grid from Russian grid and connecting it with the Central Europe by 2025.

Digitalisation continues to be a strong action priority for the Issues Monitor 2018. With 100% smart meters for electricity showing hourly consumption data and enabling supplier switching digitally, a momentum has been created which flows to sectors other than electricity, i.e. gas, district heating and water supply. At the same time, the subthemes of digitalisation like Data AI and IoT/ Blockchain are constantly under discussion and pilot projects are being run but regarded as Critical Uncertainties presently.

As a Critical Uncertainty in the previous Issues Monitor map, the issue of energy subsidies has dropped because of a law amendment. The new subsidy scheme, based on renewable energy auctions, was enacted by the Parliament in 2018. This amendment will pave the way for further development of the renewable energies, as an action priority, for the next decade.

KEY ISSUES FROM THE NATIONAL MONITOR

2018 has brought about a rapid increase of **electricity prices** in Estonia. The annual average price for electricity on the “Nord Pool power market Estonian price region” in year 2017 was €33,20/MWh,

whereas in 2018 the average electricity price was €47,07/MWh. This issue is further intensified by the high network charges, which will also be affected by the uncertain cost of desynchronization of the Estonian grid from Russia by 2025, coupled with high national taxes and subsidies for renewable electricity.

Uncertainties concerning **Russia** have resulted in all Baltic States Prime Ministers declaring the need to desynchronise the Baltic electricity grid from Russia and to connect it to Central Europe. This uncertainty has raised debates about the actual need to desynchronise, the risk of blackouts and the impact on network tariffs.

Data AI and IoT/Blockchain are constantly under discussion and pilot projects are already running. With digital advancements like full transition to smart meters in electricity, data hubs with hourly consumption data, demand side response, and consumption tracking applications, it is easier to understand the potential value of these digital issues. The full potential, however, is unclear and requires further exploration.

Energy Efficiency, specifically concerning buildings, has been a continuous action priority for the Estonian Government. With subsidies of up to 40% of the reconstruction cost of old buildings, it has enabled old buildings to get renovated and insulated with the overall monthly costs for the residents remaining the same as prior to renovation works. The proportion of subsidies depends on the energy efficiency results achieved with the subsidised construction works.

Energy Subsidies related to renewable electricity have long been debated. In 2018, a new subsidy scheme based on renewable energy auctions was introduced by the Estonian Parliament and it is paving way for further development of renewable energies. In addition, a new subsidy scheme for the use of biomethane has been introduced with the main purpose of increasing the consumption of biomethane in the transportation sector and it will be provided by the end of November 2020.

EU Cohesion: In 2018, 4 out of 8 legislative acts of the “Clean Energy for all Europeans” package have been agreed between the European co-legislators. With the implementation and application of the new rules at the national level, there will be a strong shift towards a more resilient and environmentally sustainable future.

In Estonia, 60% of the electricity distribution network of the largest distribution system operator (DSO) delivers only 5% of the overall consumption. It is expensive to maintain a grid that is hardly used, and the expenses reflect on the network tariffs. The largest DSO in Estonia has started to use **off-grid solutions** based on Solar PV, **electric storage** and diesel generators to avoid the reconstruction of long electricity lines. With the further development of decentralised systems and electric storage, the efficiency of the distribution grid could be improved at a bigger scale and help in lowering the tariffs.

CONCLUSION

Renewable energies are capturing the attention of Estonian energy leaders as the main area of action. Energy efficiency and the EU Clean Energy Package indicate the direction of the country’s energy system for the next few years, with a strong focus on environmental sustainability and energy security.

ACKNOWLEDGEMENTS

Priit Mändmaa, Secretary General, Estonia Member Committee, World Energy Council

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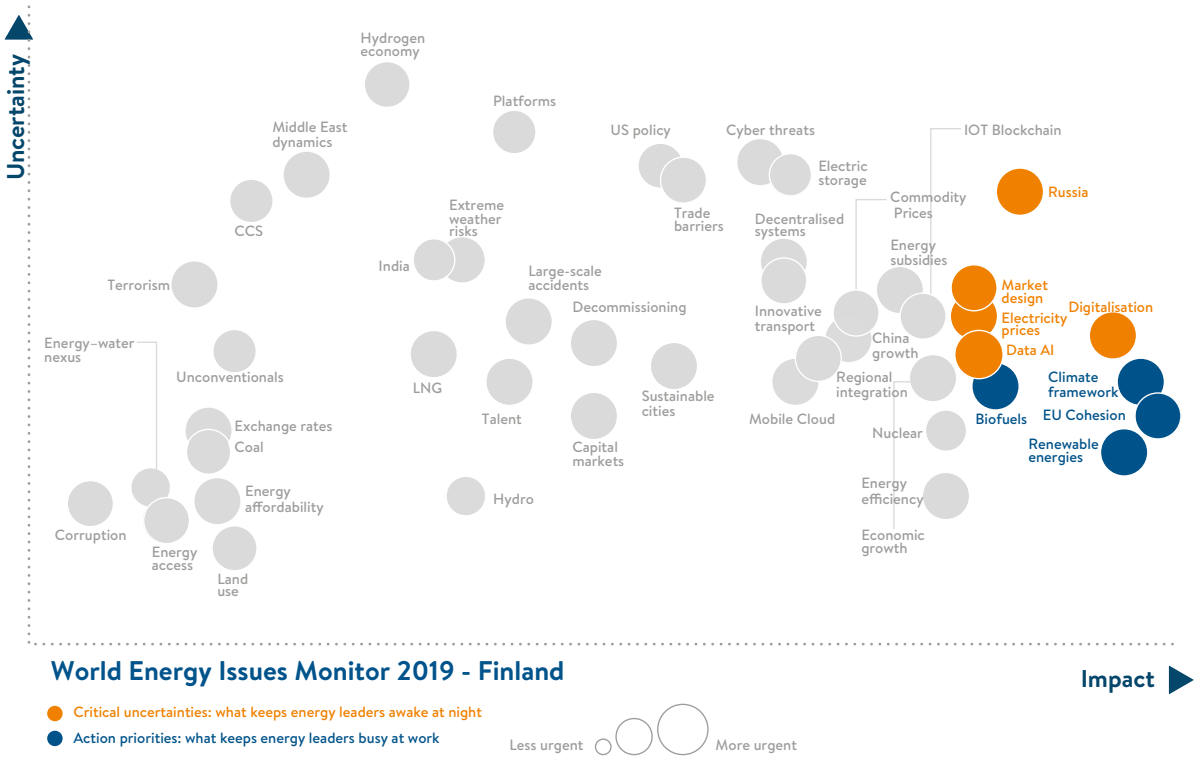
FINLAND



NATIONAL OVERVIEW & CONTEXT

The Finnish energy sector has been working for years to combat global warming. Finland's concerns about this issue have increased significantly year-on-year. Over 60% of Finnish citizens consider climate change to be a real and an extremely serious threat that the whole world should combat immediately.

This concern can be seen in the Critical Uncertainties and Action Priorities of the Finish 2019 Energy Issues Map. The key Critical Uncertainties are digitalisation, market design and electricity prices. The three Action Priorities are climate framework, EU cohesion and renewable energies, all related to climate change.

Russia has been one of the top uncertainties over the past years. However, Russia has been a reliable supplier of gas, coal, oil and electricity to Finland for decades without interruptions. Indeed, Finnish energy supply is characterised by strong reliance on Russian energy imports.

The Finnish Energy Industries estimate that energy production in the country could be carbon neutral in the 2030s, which is earlier than the official Finnish government plan of seeking carbon neutrality by 2045. Electricity and district heating emissions will halve from the present level during the next decade and will decrease to a margin in the 2030s. However, this requires, among other things, EU's emission target be set at the level determined by the Paris Agreement.

It is possible to eliminate greenhouse gas emissions from the transport sector by 2045 with zero- and low-emission cars, renewable energy, mileage reduction of passenger cars and sustainable forms

of transportation. Transport produces one fifth of the greenhouse gas emissions in Finland. The measures of reducing transport emissions would be covered by increasing the taxes and fees for activities that produce most of the emissions.

KEY ISSUES FROM THE NATIONAL MONITOR

Digitalisation represents a major development in Finland's ongoing Energy Transition and it is high on the agenda of every energy leader in the country. New technological innovations are profoundly changing the industry on its way to a smart energy system. Asset-intensive energy production is turning into service-oriented and digitalised, decentralised businesses. New players and aggregators will emerge and take a new service provider role in this development enabled by digitalisation. Finnish energy companies argue to be the world's most advanced users of smart energy systems and energy markets. Still, Finnish energy leaders see digitalisation drivers such as internet of things, artificial intelligence, blockchain and big data as action priorities rather than as uncertainties.

Russia has persisted as a critical uncertainty for Finland's energy leaders over the past years. Russia has been a reliable supplier of gas, coal, oil and electricity to Finland for decades without interruptions. However, the country is seen to have a large impact and to produce high uncertainty in Finland, which might be due to the economic sanctions imposed by EU and US. Finnish energy supplies are characterised by the European wide reliance on Russian energy sources. In the year 2018, most energy products were imported from Russia, accounting for about 63 percent of the value of imports.

Electricity Prices and Market Design are perceived with a similar level of uncertainty and impact. Both of these are critical for climate change policy and for future prospects of energy companies.

Non-household electricity prices in the EU were highest in Germany (€0.15 per kWh) and lowest in Finland (€0.07 per kWh) during the first half of 2018. However, the wholesale price of electricity rose by an average of 41 per cent last year, setting it up at the highest mark since 2011.

Finland has been an active party in the EU debate on the development of the electricity market model and renewable energy rules during the year 2018. With regards to the development of retail electricity market, Finland is seen to be ahead of most of the European countries. The Finnish Energy Industries welcomed completion of EU negotiations in December 2018. However, there is a need for a National legislation on smarter energy system, which is currently under development and creates an uncertainty to some degree.

Climate Framework is the Action Priority number one, but it overlaps with EU Cohesion and is very close to **Renewable Energies**, which last year was profiled as the key Action Priority. The transition towards carbon neutral energy generation is currently happening and it keeps Finland's energy leaders busy at work. A progress can be seen in the fact that CO2 emissions of the energy sector have halved during the past ten years in Finland.

Curbing climate change requires political decision-making to look at energy system as a whole. By strengthening the interaction between electricity, district heat and gas through policy action,

low-emission energy can be provided in a cost-effective manner. The customer's role will change from a consumer to a prosumer, because smart energy system encourages investing in one's own energy production and storage.

With reference to the earlier Issues Monitor, **EU Cohesion** has moved from a critical uncertainty to action priority number two. This might be caused by the fact that the regulation considering the energy use of forest biomass was discussed at the EU-level when the previous Issues Monitor questionnaire was delivered. Forest biomass is the most significant local renewable energy source in Finland.

Previously, there was a significant difference in the level of uncertainty of EU Cohesion between Finnish and other European leaders. Now the EU climate and energy policy 2019-2023 should continue enabling the Energy Transition consistently. However, the rapid development in the sector also makes it necessary for policy to evolve and it keeps the energy leaders busy at work. The future should be embraced by complying with the Paris agreement, securing the EU energy supply while empowering customers and supporting competitiveness.

The use of **renewable energy** sources has continued to grow in the year 2018. The share of renewables in energy production is now the second highest in Europe. In 2018, the share of renewables in district heating production rose to almost 38%, with recovered heat adding another 9% and raising the total to 47% of carbon neutral production of district heating.

The construction and maintenance of wind power plants were at a turning point in the year 2018. With decreasing technology costs, new wind power capacity started to be more cost-effective than maintaining the conventional power plants. The old feed-in tariff scheme to support renewable energy production expired in November 2017 and wind power investments halted in 2018. In the new renewables subsidy system, launched in November 2018, companies offer a premium for which they are willing to produce renewable electricity and the lowest bids are selected for the system.

Biofuels in transportation are high on the agenda of energy leaders. Finland has set an ambitious goal for biofuels. The objective is to increase the share of liquid biofuels to 30% of all liquid fuels in domestic transport by 2030 and to 100% by 2045. The absolute volume of liquid biofuels in road transport will not, however, increase after 2030. In addition to liquid biofuels, the use of domestically produced biogas will be strongly increased. A prohibition on the sale of fossil -based transport fuels in 2045 would promote the shift to renewable fuels and alternative sources of energy.

CONCLUSION

The Finnish energy system is in transition towards carbon neutrality, which has an impact on business models and revenue generation. It also appears that due to technological development and rapid decrease in the cost of renewables, climate action will not become as expensive as it was previously thought. This change will bring threats and opportunities simultaneously.

ACKNOWLEDGEMENTS

Helena Kivi-Koskinen, Executive Officer, Finland Member Committee, World Energy Council

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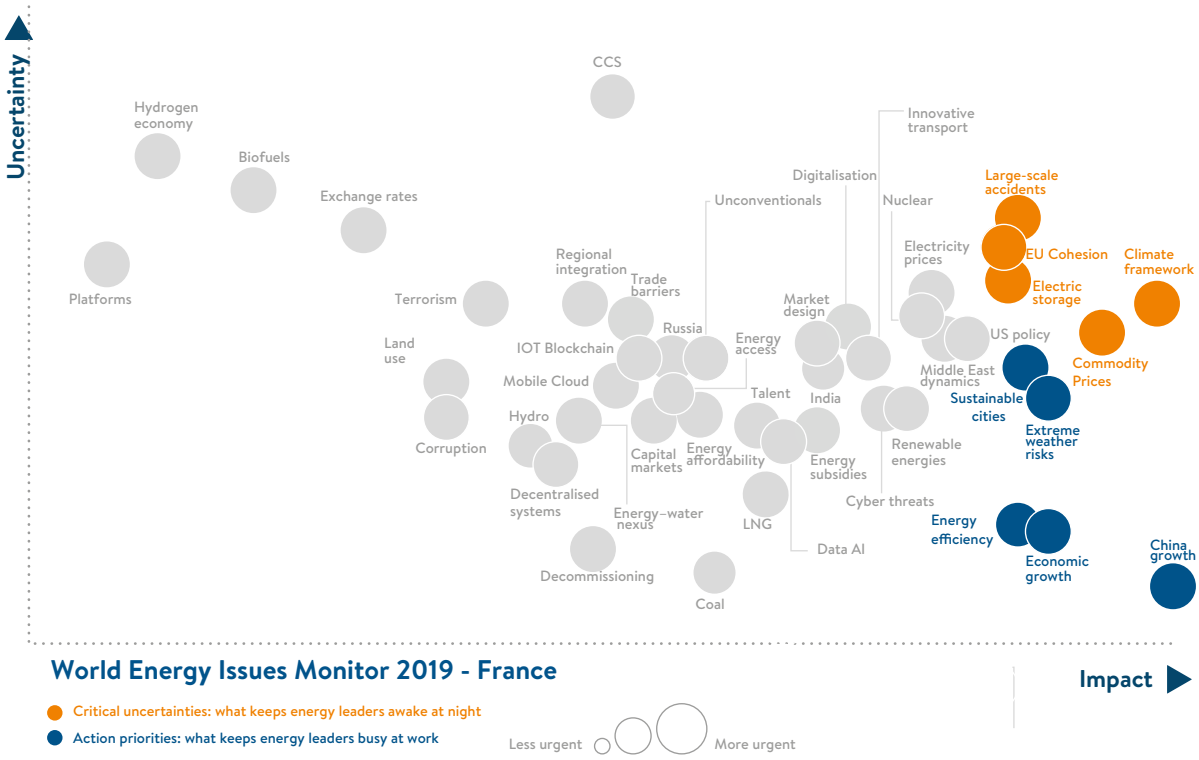
FRANCE



NATIONAL OVERVIEW & CONTEXT

In the last weeks of 2018, France was shaken by the movement of the « gilets jaunes » (yellow jackets). The survey which feeds into this 2019 Issues Monitor was conducted before the protests began, and it is tempting to look for early signs of this unprecedented movement. It will also be interesting to see in the next survey if this movement caused significant changes in the appreciation of certain issues. It is interesting to note that protests began in November as a revolt against a fuel tax decided as part of France's climate policy. That is at the intersection of two causes of insomnia that are detailed below: climate change and prices. One of the consequences of this movement is the decision taken by the President of the Republic to organize a major national debate where the green transition will be one of the four themes.

KEY ISSUES FROM THE NATIONAL MONITOR

The issue that keeps French actors awake at night is **climate change**. The sensitivity of French energy leaders is high and their commitment undeniable. This issue, which was popularized in France by COP21 and the Paris Agreement, is now shared by the clear majority of stakeholders; it is one of the fundamentals of policies, particularly energy policies, and can be found as a guideline for multi-year energy programming, published at the end of 2018 by the government. Nevertheless, the events of the end of the year - the yellow jackets - show the difficulty of implementing these policies.

The importance given to the **price of commodities** and the **price of electricity** conveys a similar message. The choices associated with the Energy Transition and their economic relevance are the subject of much discussion: the cost of the Energy Transition is at the heart of debates and this is reflected in the importance given by many to the consequences on household purchasing power and business competitiveness with a central upcoming debate about burden sharing

The third issue to be distinguished, among those that cause insomnia, is the question of **Europe**. The year 2019 is an important year for Europe, as the European Parliament elections will take place in May. Even if this movement is weaker than in other European countries, there is undoubtedly a rise of several political parties critical of the European Union as it appears today. European cohesion has been shaken several times and Brexit only exacerbates this trend. Many of the energy issues are located at European level and this justifies the importance given to this issue.

Finally, three **technologies** are located in this same part of the graph: 1) **electricity storage**, which refers to the deployment of electric vehicles and, to a lesser extent, to the **penetration of variable renewable energies**; 2) **nuclear energy**, which is specific in France and which, while remaining a major asset in the fight against climate change, does not find consensus about the level of its participation in the electricity mix, and 3) **urbanisation**, as this issue concentrates a large number of major concerns (energy efficiency of buildings, sustainable mobility, etc.).

In the area of action, one issue holds a special place, far to the right and at the bottom: China Growth, which is therefore a high-impact issue but without uncertainty. It is true that beyond the consequences directly related to its size, China's choices are sometimes decisive on the energy directions of other countries, as shown by the deployment of technologies supported by this country.

In the same area of the map, **energy efficiency** now appears to be an area in which we have moved on to the time of action and implementation of energy policies. In France, this mainly concerns housing and transport, even if all sectors are concerned by this effort.

It is also very interesting to look at issues that have opposing positions; thus, the three most uncertain and long-term issues are three technologies: hydrogen, biofuels (two low-impact issues) and carbon capture and storage (associated with medium impact). It is interesting to note that these three technologies are, for some actors, key technologies in the Energy Transition.

CONCLUSION

The evolution of the issues assessment is also very interesting and can be done by comparing the raw data relating to two successive surveys: the published one and the one of the previous year. The first message, deduced from the superposition of the two graphs, is that, "on average", the clouds are relatively stable. This has not always been the case. In early 2010, for instance, the Issues Survey identified significant shifts in energy leaders' perceptions, revealing an increase in uncertainty. If we look more closely at the main categories of the survey, we see a horizontal shift to the right of geopolitical issues, which are therefore perceived as increasingly important: this is the case, for example, with US policy. Still compared to the previous year, the examination reveals, with few exceptions, an increase in uncertainty related to technologies with sometimes significant developments, for example for carbon capture and storage, LNG or urbanisation which, as we have seen, is becoming a cause of insomnia. The issue of renewable energies is considered to have a lower impact but is more uncertain. Among the relatively stable issues are nuclear and storage, but also coal. Finally, some issues such as digitalisation, non-conventional hydrocarbons or sustainable transport are considered more uncertain for an unchanged impact.

ACKNOWLEDGEMENTS

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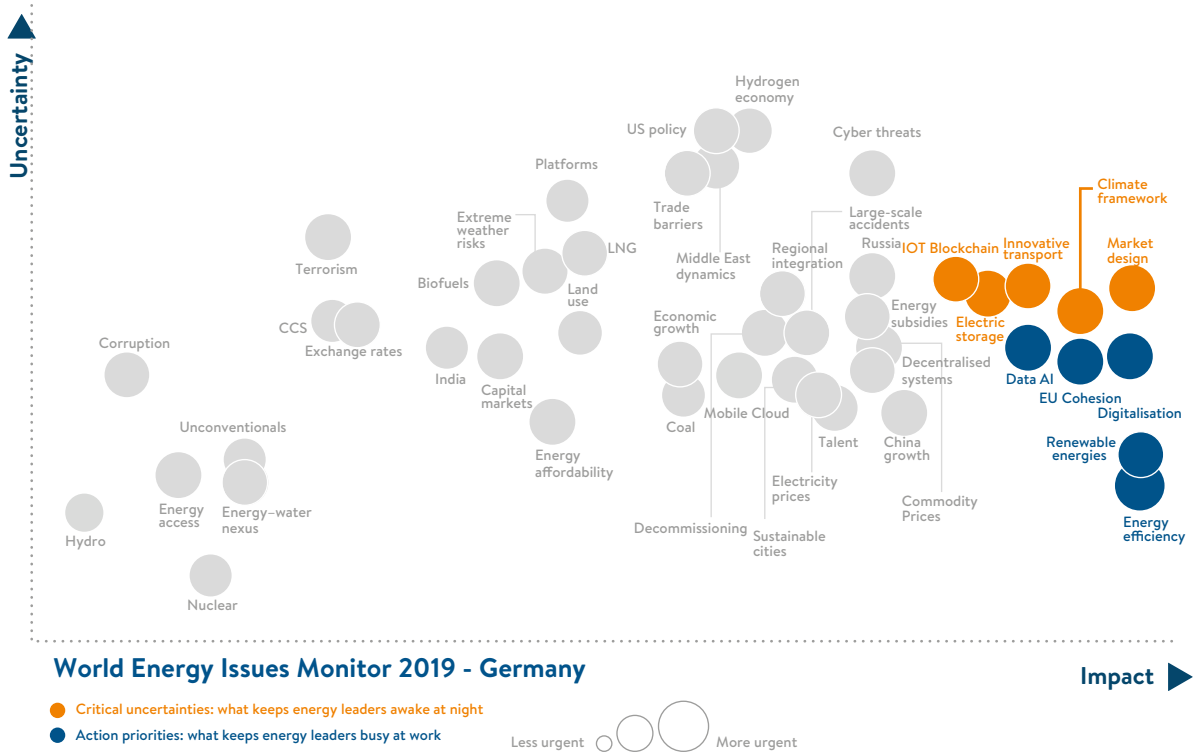
GERMANY



NATIONAL OVERVIEW & CONTEXT

With Germany having the most diverse political spectrum since the 1930s, EU Cohesion is one of the most discussed topics. Much focus has been given to Brexit and its consequences, as well as the impact of national policies on the climate challenge. In this context, a (single) market design is not expected to be achieved soon.

Digitalisation and Artificial Intelligence moved from being a Critical Uncertainty to become an Action Priority. This is a clear signal that the sector has gained more experience in making use of this technology and the implementation is now of high interest. In 2018, renewable energies have reached again a new record and are expected to continue growing. It is important to note that the four Transmission System Operators (TSOs) in Germany are facing challenges to integrate additional capacities into the grid. While some are strongly focusing on expanding the grid, others are investigating opportunities to digitalise the grid and increase its efficiency.

In a highly renewable electrified energy system, long-term storage opportunities are still an issue and market designs are constantly evolving to accommodate different stakeholders. The overarching climate framework has gradually evolved into a socio-economic topic. Germany has understood that the transformation in the energy sector calls for new economic structures. There is currently a strong ongoing discussion on the phasing out of lignite coal. In addition, the German government has formed the commission of “Growth, Structural Change and Employment” in June 2018, to envisage a transformative plan for the lignite coal regions within the dimensions of the Energy Trilemma.

IoT/Blockchain has a lower uncertainty in comparison to 2017, however business models are still not competitive when based exclusively on Blockchain. Currently, the technology is used when integrated into existing processes such as RPA (Robotic Process Automation). Furthermore, one of the key uncertainties is the implementation of EU data regulations.

KEY ISSUES FROM THE NATIONAL MONITOR

Market Design must be understood in the context of the German Energiewende and the different market designs within the European Union. Despite the challenges of integrating a growing share of renewables and phasing out nuclear and lignite coal, the national focus of Energiewende inherits socio-economic issues as well. At the same time, the EU's Clean Energy Package will be passed in early 2019 to harmonise 27 different energy systems via interconnectors and to create a common framework for generation capacity. A critical debate on bringing these aspects together is the main challenge for the upcoming years.

IoT/Blockchain is acknowledged by the sector as a critical uncertainty, mainly on how and what processes and services it will affect. Some use cases such as maintenance or automated trading exist but are not yet fully implemented. In order to reduce uncertainty, more time is needed to further explore specific challenges and use cases of this technology.

In Germany, the Climate Framework discussion for the power sector falls under the Energiewende. Other sectors like transport, have had a slower progress in this aspect and therefore remain uncertain. Environmental concerns around vehicles powered by fossil fuel are increasing, as the automotive industry is the single largest sector of the German economy. Today, the diesel debate addresses the fuel type we would use in future and discusses new concepts of transport. While the public is calling for low emission cars, e-vehicles have only reached a market share of 1.9% in Germany so far.

With more than 36% shares of the power market, renewable energies will reach a new record in 2018. With all four TSOs in Germany facing challenges of integrating additional capacities into the grid, this is an important Action Priority for energy leaders. While some TSOs are focusing on expanding the grid, others are investigating how to digitalise and increase the overall grid efficiency, which ideally would lead to a lower need of expanding the infrastructure. Therefore, energy efficiency is well captured in the power sector, while transport and the building sectors are still searching for adequate measures to improve efficiency rates to support lower emission targets.

Grid infrastructure is one of the cornerstones of the Energiewende. It is expected that digital technologies will become enablers of flexibility of power generation, balancing a higher share of volatile renewable energy sources (RES). Digitalisation is highly accepted in the sector for internal processes, but it is slowly starting to be accepted in customer-related processes such as smart grids. This acceptance is high for industrial customers and modest-low for retail customers. Therefore, connected devices are expected to increasingly enable automation and optimisation.

With Germany having the most diverse political spectrum since the 1930s, EU Cohesion is one of the most discussed topics. It mostly focuses on Brexit and its consequences, as well as the impact

of different national energy strategies on climate challenge. In general, there is more distrust from society towards the institutions of the European Union. Market participants understand the concepts like a (single) market design, but there is a lack of understanding among the broader public. Also, the willingness to cooperate on energy subjects varies strongly among neighbouring countries.

Cyber threats show currently a low impact, but this may change with increasing numbers of incidents associated with the increased use of IT solutions. Consequently, this is a looming threat with a potential to "explode".

The most discussed topic in the second half of 2018 is Power-to-X and the idea of a synthetic fuel economy. First pilot projects are aiming to prove large scalability of the technology to bring costs down. The use cases are widely spread among all sectors, but still need support to be ready for the market.

CONCLUSION

The 2019 Germany Energy Issues map focuses on the political framework (EU Cohesion, Climate Framework, Market Design), energy technologies to enable decarbonisation (Renewables, E-Storage and Innovative Transport, and Energy Efficiency) and also innovation (IoT/Blockchain and Digitalisation). Energy leaders in Germany emphasize a strong reduction of critical uncertainties in comparison with recent years. Therefore, action priorities are currently the focus of the sector, which is a clear signal of an ongoing transition, which addresses obstacles and works on improvements.

ACKNOWLEDGEMENTS

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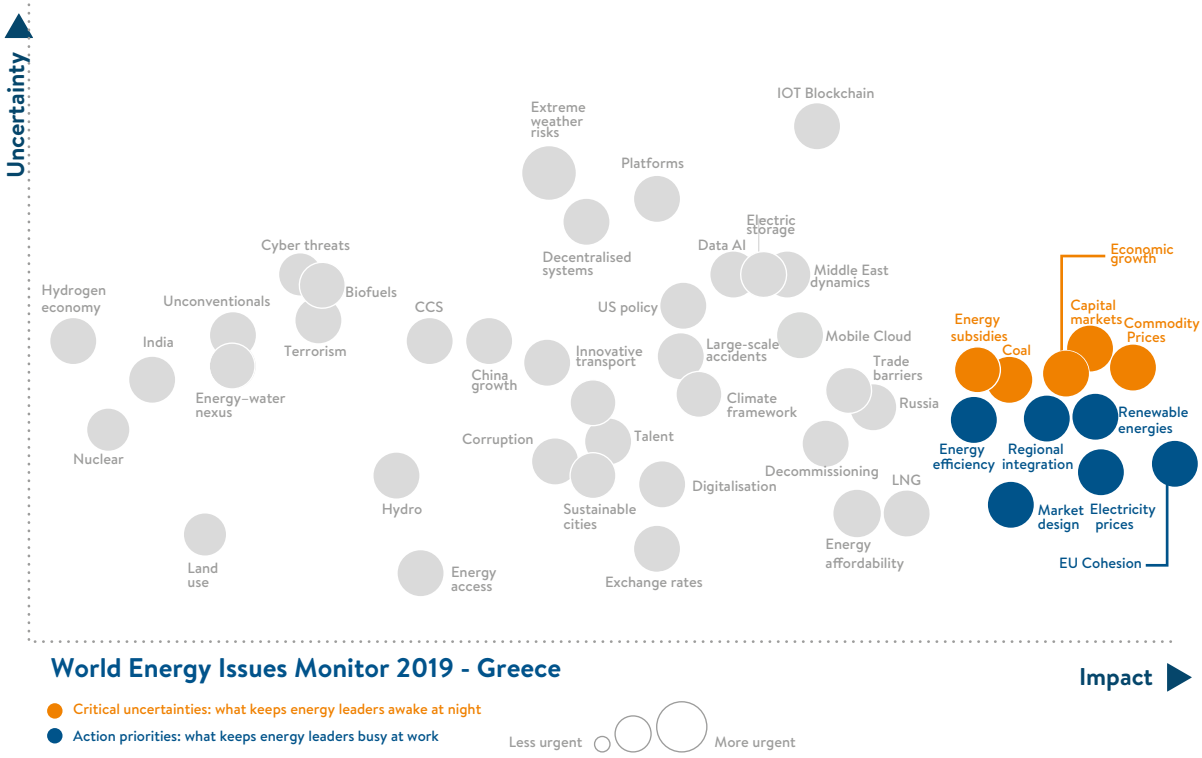
GREECE



NATIONAL OVERVIEW & CONTEXT

The Greek energy market is undergoing fundamental reforms with requirements arising from the European Union as well as various intergovernmental agreements shaping up its energy market's outlook. The focus lies on the liberalisation of the electricity and natural gas markets, increased competitiveness and the extension and enhancement of the domestic and cross-border electricity.

For this year's Issues Monitor, the energy leaders of Greece have selected Coal, Commodity Prices and Capital Markets as the critical uncertainties and Renewable Energy, Energy Efficiency and Regional Integration as the action priorities for the country.

KEY ISSUES FROM THE NATIONAL MONITOR

Coal is the critical uncertainty number one for this year's Greek Issues Monitor. Greece is the 12th largest producer of brown coal in the world. In contrast with most EU countries, Greece's decarbonisation process is lagging. There is a lot of pressure on Greece to reduce its coal consumption as many are now calling out for an up-to-date Energy Transition roadmap focusing on renewable energy and green gas.

According to the energy leaders of Greece, the issue of **commodity prices** is a critical uncertainty the Greek energy sector. With the prices for energy commodities including oil, natural gas, and coal significantly increasing, it becomes more and more difficult for Greece to deliver reliable and affordable energy.

The issue of **capital markets** is the third critical uncertainty according Greek energy leaders. Greece has launched its energy stock exchange as "Hellenic Energy Stock Exchange SA". The exchange

will organise and operate Greece's new electricity, natural gas and environmental markets through providing access to new energy markets and introducing new products on the domestic market. The overall objective is the gradual convergence of energy prices of the single European market for future.

Energy leaders in Greece highlight **renewable energies** as the first action priority for this year's Issues Monitor. With a huge potential for renewable energy and ongoing large-scale infrastructure projects, Greece can play a key role in the formulation of the EU energy mix. In 2018, the Greek government hosted auctions for renewable energy projects to the reach the 2020 target of 18% renewables in the energy mix.

The issue of **regional integration** is the second action priority for this year's Issues Monitor. As recognised by the Greek government in its growth strategy, it is important for the country to develop energy trade and investment relations with neighbouring countries. The Greece-Bulgaria gas interconnector project (IGB) is a key project that connects Bulgaria to Southern Gas Corridor and the initiative is facilitated and supported by the European Commission. In addition to this, the launch of Greek energy exchange will help in reaching out to the neighbouring countries and encourage power trade between them.

The energy leaders in Greece consider **energy efficiency** as the third action priority for this year's Issues Monitor. The energy efficiency index for Greece (including all sectors) decreased regularly by 33%, from the years 2000 to 2016. The 'Saving at home II' programme, funded by the European Union, involves the implementation of interventions to improve the energy performance of residences belonging to low-income owner's category. However, there is a need to pace things up increase the efforts to achieve set targets.

CONCLUSION

The Greek energy policy aims to safeguard and manage energy resources to secure an affordable and reliable supply for the nation's energy needs. A great effort is being currently put into alternative energy sources and routes to ensure the supply of the domestic market and protect consumers in the case of emergencies. However, to ensure a secure future for the Greek energy sector, there is a need to work on sustainable development of the energy sector from the stage of production to the end-use while protecting nature and safeguarding the environment.

ACKNOWLEDGEMENTS

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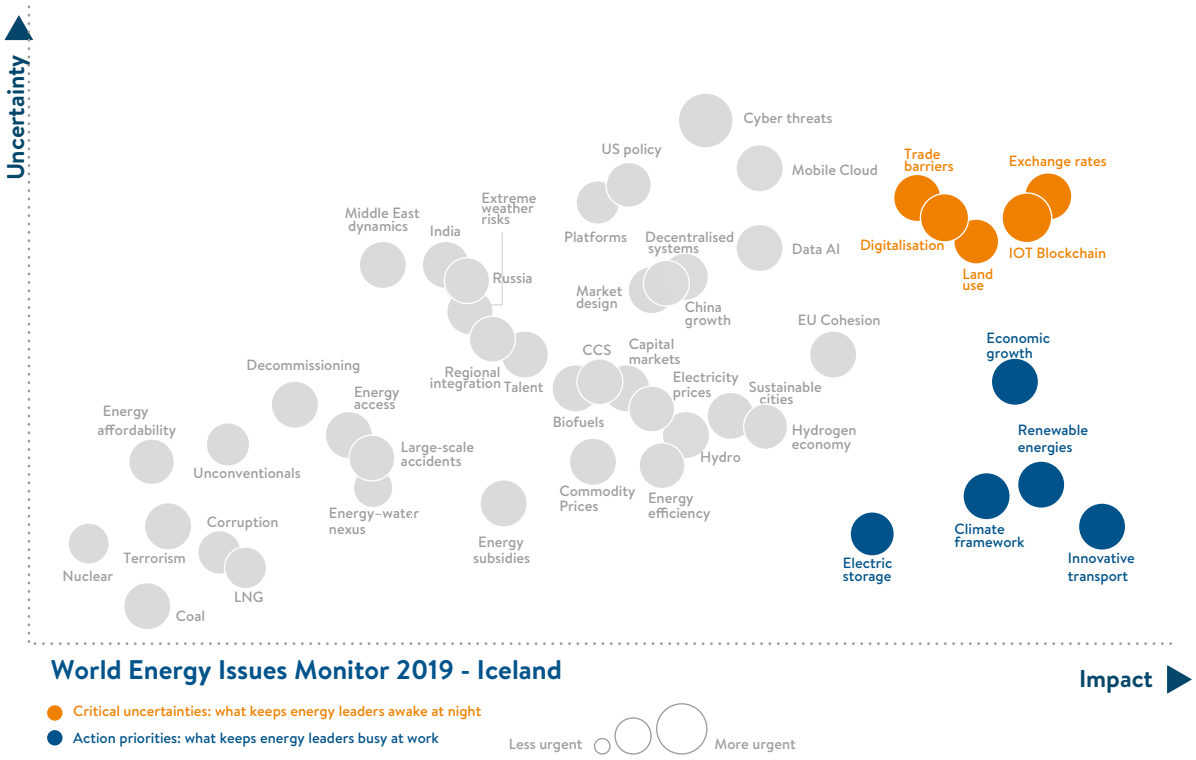
ICELAND



NATIONAL OVERVIEW & CONTEXT

Boreal land rich in geysers, hot springs and fumaroles, Iceland is one of the most geologically active countries in the world. It is one of the only countries that count with 100% renewable electricity: 25 % coming from geothermal energy and the rest coming from hydroelectric dams. The decision to massively use geothermal energy goes back to the 1970s and the oil shocks, on which it heavily depended until then. Despite a conversion to green energy, Iceland still needs efforts to meet international targets for reducing greenhouse gas emissions.

For this year's Issues Monitor, the energy leaders of Iceland have identified exchange rates, IoT/ Blockchain and land use as the critical uncertainties and innovative transport, renewable energy and climate framework as the action priorities for the country.

KEY ISSUES FROM THE NATIONAL MONITOR

Exchange rate is the first critical uncertainty for Iceland's energy leaders. This is related to the volatility of the Icelandic krona, which has appreciated about 30% since 2015. In the energy sector, this is mostly important in the area of export of consulting services and energy products, which are traded in foreign currencies, while the operational costs are in local currency. The effects are also felt around financial risk and cost of investors in Iceland.

IoT/Blockchains is the second critical uncertainty, which reflects internet of things (IoT), smart grids and blockchains. This in turn means direct and low-cost transactions, smart appliance driven by smart contracts, smart grids, supply chain tracing and labelling. Uncertainty regarding IoT/Blockchain can reflect technical and economic uncertainty elements in the global market such as regarding the

bitcoin sector and how it is developing. There is uncertainty about when, and to what extent, these technologies will become effective instruments for managing business in the energy sector, but their potential is recognized.

The third critical uncertainty is **land use**, which has increased dramatically in comparison to previous years, when it classified as an action priority. The change is perhaps a reflection of a stronger national debate on land conservation as an environmental issue and the possibility of new national parks in Iceland. It can also reflect sometimes unbalanced discussions on sustainable utilisation on renewable energy, where the debate focuses more on land protection, than benefits related mitigating climate change, or economic and social issues, related to concerning projects.

The first action priority is **innovative transports**, which are 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 ranges and quality. This development will require more challenges of supply of electricity to the consumer and new infrastructure to provide supply of electricity to those vehicles, and other issues.

Renewable energies is the second action priority. Renewable energies have moved slightly from the uncertainty area into the action priority. Renewable sources are in general seen as one of the big contributors towards less CO2 in Iceland and globally, aiding climate change mitigation. This is perhaps reflecting the national debate in Iceland regarding hydro and geothermal projects, where the attention is often focused on land protection issues but less on benefits related mitigating climate change and national economic and social issues.

The third action priority for Iceland is the **climate framework**. After the Paris COP21 agreement, most energy leaders acknowledge that climate issues, renewables and decentralised systems will get a major boost and will play an important role towards mitigating climate change. Renewable energy is one of the big contributors towards less CO2 in Iceland and globally, mitigating climate change, which is one of the biggest global challenges today. Climate framework has been one of the action priorities in Iceland for several years, by focusing on renewable energy development.

Economic growth has moved towards more critical uncertainty, largely due to the slower growth in the airline and tourism industry, currency fluctuation of the Icelandic krona and more uncertainty regarding wage negotiations on the labour market. Concerns regarding trade **barriers** have also risen which could be due to issues such as Brexit, as the UK is one of Iceland's largest trading partners. Concerns for digitalisation have also risen from last year, which perhaps reflects that Iceland is lagging behind in utilising this technology and at the same time more demand from new technology like electric vehicles.

CONCLUSION

The key area of critical uncertainty for energy leaders in Iceland are exchange rates, followed by IoT/ Blockchain, land use, digitalisation and trade barriers. In the area of action priorities, of Icelandic energy leaders this year have place innovative transport, renewable energies, climate framework,

economic growth and electricity storage. Both in the area of uncertainty and impact, the exchange rate and financial market in Iceland is ranked riskier than in Europe and in the Globe, while it finds most similarities with African countries.

ACKNOWLEDGEMENTS

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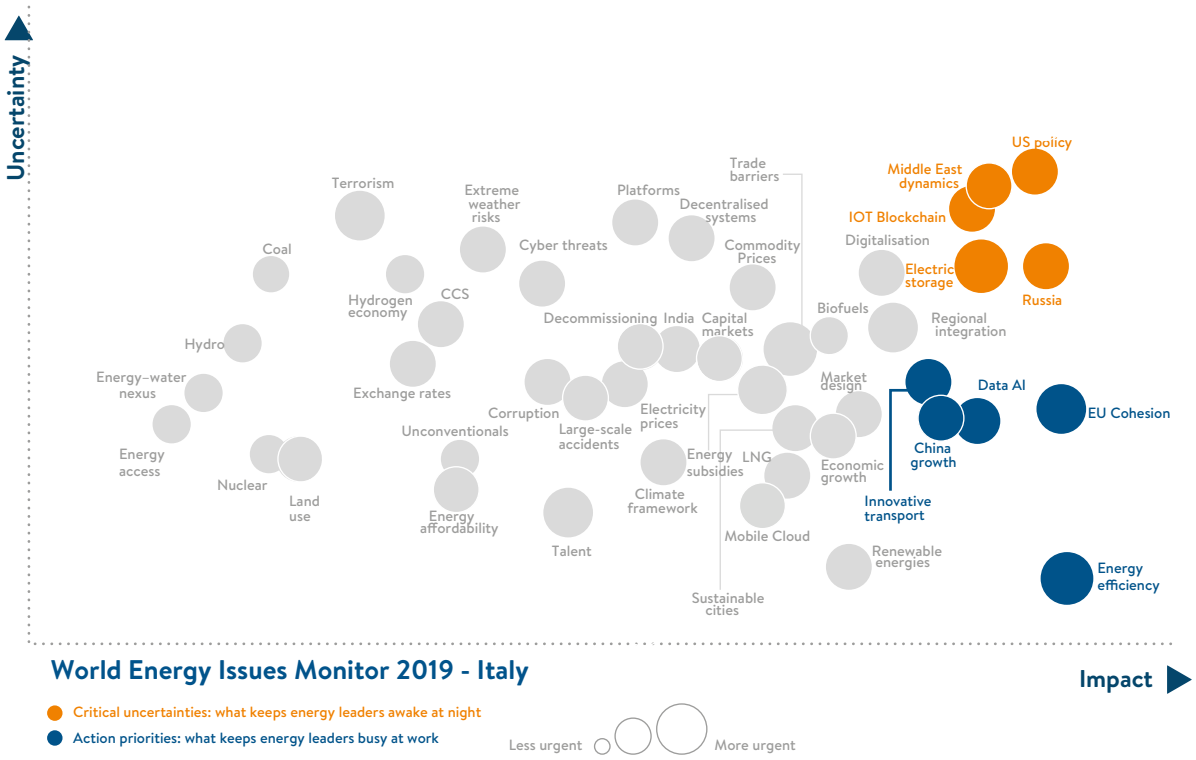
ITALY



NATIONAL OVERVIEW & CONTEXT

Energy supply balance, institutional framework and technology developments are key to understanding the 2019 Italian Issues Monitor.

Geopolitical and political issues are both in the Critical Uncertainties (Russia) and in the Action Priorities (EU Cohesion). In fact, Italian energy supplies are characterised by the same European reliance on Russian gas, making EU Cohesion crucial to address diversification and improve resilience. In addition, the historical industrial and commercial relationship between Italy and Russia make geopolitical issues related to Russia critical for the Italian energy sector. At the same time, technology developments bring along the need for a policy and regulatory framework that can enable the development and deployment of new solutions and technologies. This is the case of IoT/ Blockchain, as its deployment is still facing consumers' scepticism and the lack of a clear regulatory framework.

Electric Storage also continues to be perceived as a critical issue mostly due to the evolving regulatory and technological framework. This issue, is generally connected to the development of both renewable energies and electric mobility - two areas of great interest for national and local energy stakeholders.

At the national level, private and public actions on Innovative Transport are not only related to electric mobility, which is more suited to the urban context. The replacement of traditional vehicles for improved emission performance, the development of biofuels and the deployment of natural gas and bio-methane (CNG and LNG) for buses, heavy vehicles and maritime transport, are important pathways in the evolving landscape of sustainable transport in Italy.

Energy Efficiency is once again confirmed among Action Priorities. Indeed, it will play an essential role in pursuing the triple objective of energy competitiveness, de-carbonization and energy security. In this framework, the Italian Government has confirmed tax deduction for the installation of efficient technologies in buildings.

KEY ISSUES FROM THE NATIONAL MONITOR

Italy strongly depends on imports from **Russia** to meet its natural gas demand, almost 43% of the country's total gas demand. Consequently, Italy is working on diversification of its suppliers (Algeria, Iran, Qatar, Canada, USA) and on the implementation of new infrastructures: the most recent one is the Tran Adriatic Pipeline - TAP aimed at improving the security and diversification of the EU energy supplies by bringing natural gas from the Caspian region. In addition, historical industrial and commercial relationships between Italy and Russia make the evolution of geopolitical issues very important for Italy.

The **IoT and Blockchain** wide spread still faces obstacles in the energy sector, mainly due to consumers' scepticism, the lack of a clear regulatory framework and, in the case of blockchain, the need for the technology to mature further. However, Italy is proceeding in this direction, as proven by the Ministry of Economic Development's 2019 Simplification Decree which presents a package of rules to recognise the legal value linked to the blockchain and a single fund on venture capital. The decree foresees also a call for proposals for 30 high-level experts who will study the national strategy on blockchain-based technologies.

Electric Storage continues to be perceived as a critical issue mostly for the evolving regulatory and technological framework. The critical uncertainty perceived on this subject is linked to the possible impacts on utility business models and the electricity system, especially due to Variable Renewable Energies (VREs) integration to the grid, and electric mobility - two areas of great interest for national and local energy stakeholders.

To pursue the triple objective of competitiveness, de-carbonisation and security, the role of efficiency is essential. The policies and good practices in **Energy Efficiency** are in fact capable of grasping these three objectives at the same time and in the meanwhile limiting the energy expenditure of families and businesses. To this effect, the budget law approved in 2018 provides tax deductions (IRPEF and IRES) for those who will invest in energy efficiency measures, in particular for the redevelopment of buildings in line with the last European policies adopted.

Innovative Transport: The replacement of traditional vehicles for ones with better emission performance, the development of advanced biofuels (from waste and non-food crops), the growth of electric mobility in the urban context and the promotion of natural gas (CNG/LNG and bio-CNG/LNG) for buses, heavy vehicles and maritime transport, prove the dynamism of the Italian transport sector towards sustainability. In line with the Legislative Decree n. 257/2016 for the deployment of infrastructure for alternative fuels, the main network operators and big Italian energy players are developing programs and investments to increase the number of charging stations for electric cars and refuelling stations for natural gas at a national level.

EU Cohesion: Italian energy policies are aligned with the European directives and policy decisions agreed at European level. The National Energy Strategy 2017 and the production of the new National Climate and Energy Plan in 2018 move forward along the three pillars of the Clean Energy Package: renewable, efficiency, emission reductions, integration of energy infrastructures and a more integrated governance. The discussions and agreements on energy and environmental objectives within the European institutions are crucial to the evolution of the Italian energy sector that can already count on important legacies in renewable energies and natural gas technologies implementation.

Investment plans announced by major energy players showcase the commitment in deploying natural gas and **LNG**, as well as bio-methane, as a flexible solution that could both foster the development of sustainable mobility and renewable energies.

Digitalisation of the country's economy and the development of energy chains is at the core of the government and businesses strategies. The penetration of IT within energy sectors is enabling new business models and more efficient asset management. This trend has also increased the awareness on **cyber security** measures as part of the efforts to guarantee resilience of energy infrastructures and services. Moreover, the main national energy actors are working on the greater integration of energy networks within Europe and towards a Euro-Mediterranean area aimed at increasing security and resilience of the national energy system.

CONCLUSION

Italian energy leader's concerns and actions are aligned with technological developments, environmental awareness, security of supplies and geopolitical issues. In the same way, Italian public and private energy actors are implementing actions to support the strengths of the important Italian legacy on efficiency, natural gas and renewable energies along with the resilience and security of the energy sector.

Furthermore, in the context of the Energy Transition, natural gas, bio–methane, electric mobility and the development of "green fuels" (biofuels from non-food crops) technologies are increasing the portfolio of actions towards sustainable mobility. Moreover, the digitalisation of energy chains is at the core of businesses' strategies, empowering more efficient and flexible asset management along with new business models.

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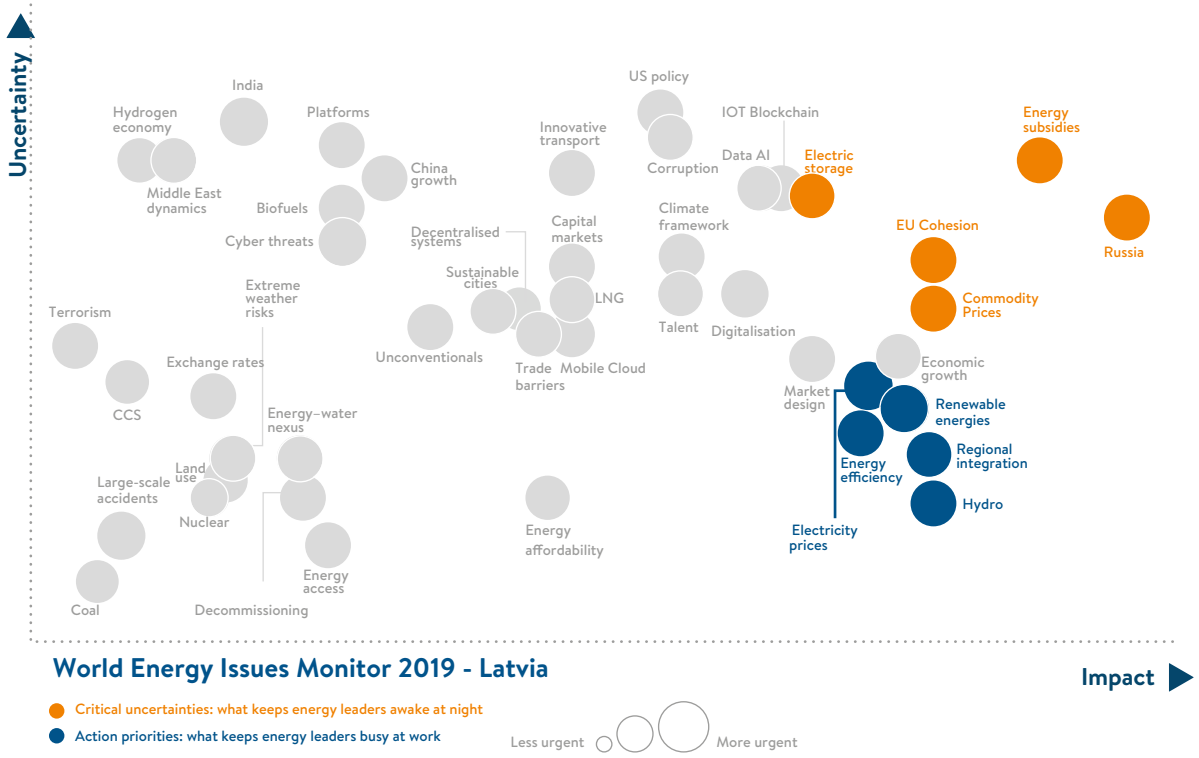
LATVIA



NATIONAL OVERVIEW & CONTEXT

The structure of primary energy consumption in Latvia is based on three main components: oil products, fuel wood and charcoal, and natural gas. The Latvian Energy Long Term Strategy 2030 sets a target of 50% energy from renewable energy sources and a 50% reduction in energy imports by 2030. An ongoing renovation of Latvia's hydroelectric power plants as well as the reconstruction of natural gas CCGT plants have allowed the country to sustain its low level of GHG emissions in the power sector. CHP projects using biomass are also in progress and wind projects are awaiting renewable energy sources (RES) support schemes.

Through membership of the European Union and NATO, Latvia is an independent country with ties to the West. National monitoring of Latvia is strongly influenced by geopolitical uncertainties, such as cooperation among countries and regions. Latvia is strongly influenced by EU Cohesion and Russia. In the economic sphere, the country remains under significant Russian influence, which includes restrictions on Latvian natural gas imports.

The most important instrument of the EU policy on the promotion of renewable energy is the RES Directive. Action priorities taken to achieve the renewable energy target include evaluation of existing RES potential and additional possibilities offered by the Directive, like improvement of the net accounting system of electronic energy, introduction of statistical transmission of RES, joint projects and harmonised state support schemes.

Energy efficiency plays an important role in improvement of heat supply and development of the industrial sector.

KEY ISSUES FROM THE NATIONAL MONITOR

Natural gas plays an important role in Latvia's structure of primary energy resources. The Latvian natural gas supply system is not directly connected to the systems of other EU Member States, except Lithuania and Estonia. Since the Klaipeda LNG terminal is in operation, it has been possible to diversify LNG import from **Russia**. Still, Russia remains a significant issue for the Latvian energy sector due the historical cooperation.

The main political challenges are to prevent market failures, achieve energy policy neutrality and avoid improperly promoted uneconomic incentives for ensuring RES development. The new RES-E support scheme was drafted by the Ministry of Economy. The phasing-out of tax for **energy subsidies** was expected from 2018.

EU Cohesion complements and promotes the development of energy policy by supporting research and innovation. Cohesion policy provides the necessary investment framework and strategy to meet the growth targets.

Latvia is interested in active participation in the implementation of international cooperation activities and **regional integration**. By engaging in cross-border activities, Latvia has a better chance of successfully defending national interests in developing joint solutions with other member states in the region.

Climatic conditions make heat supply an important part of the energy sector in Latvia. Improvement of heat supply processes is important both in terms of **energy efficiency** and efficient use of resources and environmental protection. Energy efficiency plays an important role in EU energy policy. Raising energy efficiency in the industrial sector is closely linked to the implementation of the EU sustainable development strategy and a balance between economic growth and cleaner production

The most common **renewable energy** sources in Latvia are biomass and hydropower, where significant R&D capacity has been developed to maintain a sustainable growth of domestic industries and to assist the country's partners abroad. Opportunities to develop wind and solar energy are still open. To achieve the target set for Latvia in the EU Renewable Energy Directive, it is necessary to use the existing potential for the development of RES and to evaluate the additional possibilities offered by the Renewable Energy Directive, such as the improvement of the net accounting system of electronic energy, the introduction of statistical transmission of RES, joint projects and harmonised state support schemes.

CONCLUSION

The structure of energy supply in Latvia can be considered as balanced and sufficiently diversified. Energy efficiency plays an important role in EU energy policy. To ensure Latvia's energy supply system integration in the regional and EU energy markets, Latvia needs a long-term vision for the development of the energy sector.

Critical Uncertainties such as Russia, Energy Subsidies and EU Cohesion remained relevant and changes are not expected in 2019. Russia remains a significant factor for Latvian energy sector due

the geopolitical and historical context. Action priorities should still include solutions for renewable energy, energy efficiency, regional cooperation and integration and stable commodity prices.

ACKNOWLEDGEMENTS

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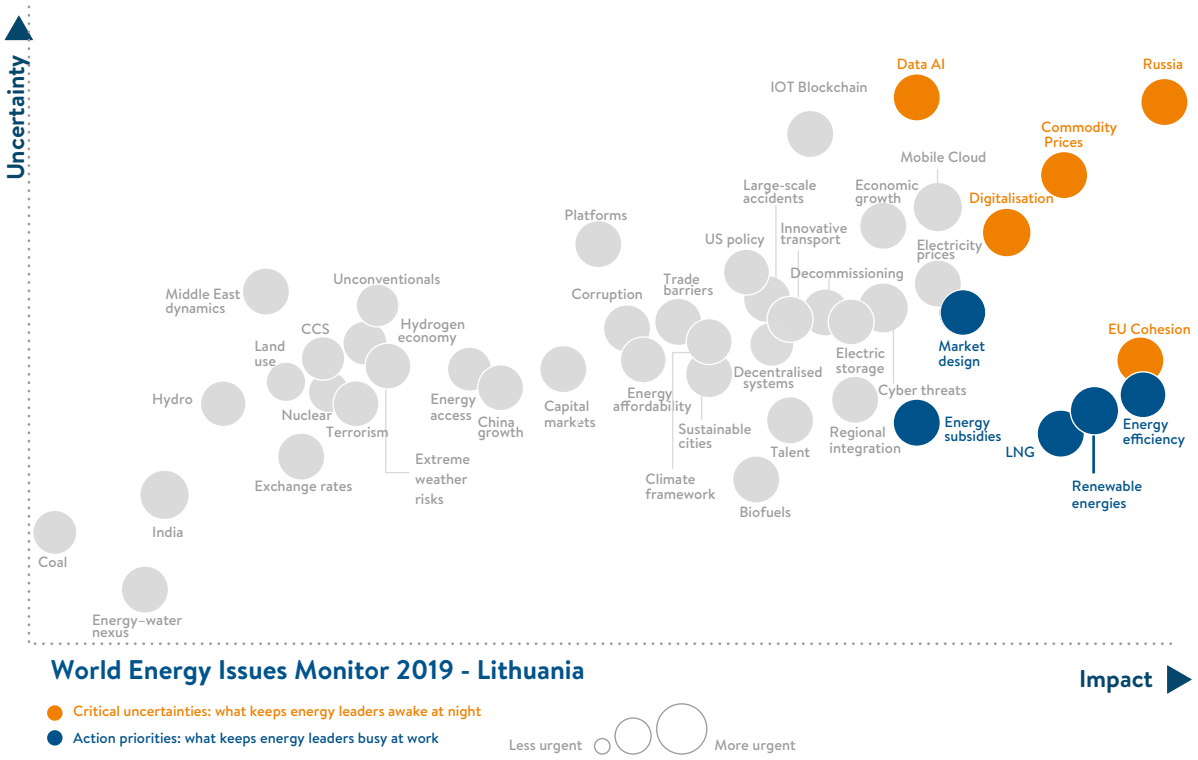
LITHUANIA



NATIONAL OVERVIEW & CONTEXT

Energy leaders in Lithuania identify Russia as the country's main Critical Uncertainty. This is related to the fact that Lithuania has recently been working on enhancing its energy security in response to Russia's energy pressures. Indeed, Lithuania has been paying some of the highest prices for natural gas in Europe, until the construction of an LNG terminal in Klaipeda.

EU cohesion helped to finance most of the energy projects. As a result, new uncertainties have emerged towards funding, increasing uncertainties for the implementation of new projects.

As Lithuania continues its steps towards energy independence, the increase in electricity import poses a serious challenge. The 2018 National Energy Independence Strategy intends to increase local electricity generation from 35% to up to 45% in 2020-2030 and to generate 100% of its electricity demand by 2050. The increase in electricity generation is expected to be achieved using renewables, which are expected to increase their share in the energy mix gradually and reach 100% by 2050. The production capacity is planned to increase of 300MW with large wind farms and of about 200MW with small solar power plants, installed on prosumers houses by 2022.

Artificial intelligence and data, as well as digitalisation technologies, are driven by the private sector. Nevertheless, regulation is currently not favourable to their full commercialisation and wider implementation.

One of the priorities in the National Energy Independence Strategy is to increase energy efficiency by further accelerating the renovation of multi-dwelling and public buildings as well as the replacement of street lighting with energy-efficient solutions.

KEY ISSUES FROM THE NATIONAL MONITOR

Lithuania has significantly reduced energy imports from **Russia** and has secured alternative gas supply through the LNG terminal in Klaipeda. Crude oil supply has been enhanced with the marine terminal in Būtingė, and electricity supply has been reinforced with Lit Pol link and NordBalt. The electricity system will be fully disconnected from Russia and Belarus after synchronisation of the Baltic electricity system with Continental Europe. Consumption of natural gas has significantly reduced after the implemented fuel shift of district heating from natural gas to biomass and waste.

Data AI and digitalisation are sceptically perceived by managers and consumers. Nevertheless, energy companies are reaching high digitalisation levels due to newly acquired digitalised equipment and are paying high attention to cyber security issues.

A significant share of district heating has been converted from natural gas to biomass, supported by **EU cohesion** funds. EU funds were used to build electricity connections between LitPollink and NordBalt. EU financial support is also expected for the synchronisation of the Baltic electricity systems with continental Europe. If funds are reduced or questions about their appointment arise in future, there may be additional uncertainties regarding the implementation of projects.

One of the priorities in the National Energy Independence Strategy is to increase **energy efficiency**. Investments in modernisation and replacement of worn out electricity networks will allow to reduce the number and duration of interruptions by one-third by 2022. The efficiency of biomass consumption will be increased through the replacement of old inefficient boilers. In addition, energy-saving agreements will be implemented with energy companies.

The share of **renewable energy** sources (RES) in the final consumption balance will be increased to 30% by 2020 and to 80% by 2050. The share of RES and local resources in the district heating sector will grow to 70% by 2020 and to 100% by 2050. In the transport sector, RES participation will be increased to 10% by 2020 and to 50% by 2050.

Further efforts will be made to increase **LNG** consumption to reduce the cost of maintenance of the LNG terminal in Klaipeda. The terminal will be purchased by the state after the lease expiration in 2024, with the aim to reduce maintenance costs. Costs will then be calculated for the terminal's entire lifetime rather than for a shorter rental period. The Lithuanian Parliament, Seimas, has adopted the decision to purchase LNG terminal in 2018.

Investment plans announced by major energy players showcase the commitment in deploying natural gas and LNG, as well as bio-methane, as a flexible solution that could both foster the development of sustainable mobility and renewable energies.

Digitalisation of the country's economy and the development of energy chains is at the core of the government and businesses strategies. The penetration of IT within energy sectors is enabling new business models and more efficient asset management. This trend has also increased the awareness on cyber security measures as part of the efforts to guarantee resilience of energy infrastructures and services. Moreover, the main national energy actors are working on the greater integration of

energy networks within Europe and towards a Euro-Mediterranean area aimed at increasing security and resilience of the national energy system.

CONCLUSION

One of the main tasks for Lithuania's energy sector is to implement the Baltic electricity system's synchronisation with continental Europe by 2025. Prior to this step, the country will have the task to develop its own electricity generation capacity. For this purpose, the Lithuanian Ministry of Energy plans to use a capacity market model. To inform the process, the Ministry is collecting information from companies intending to build electricity generation capacity in Lithuania.

ACKNOWLEDGEMENTS

Lithuania Member Committee, World Energy Council

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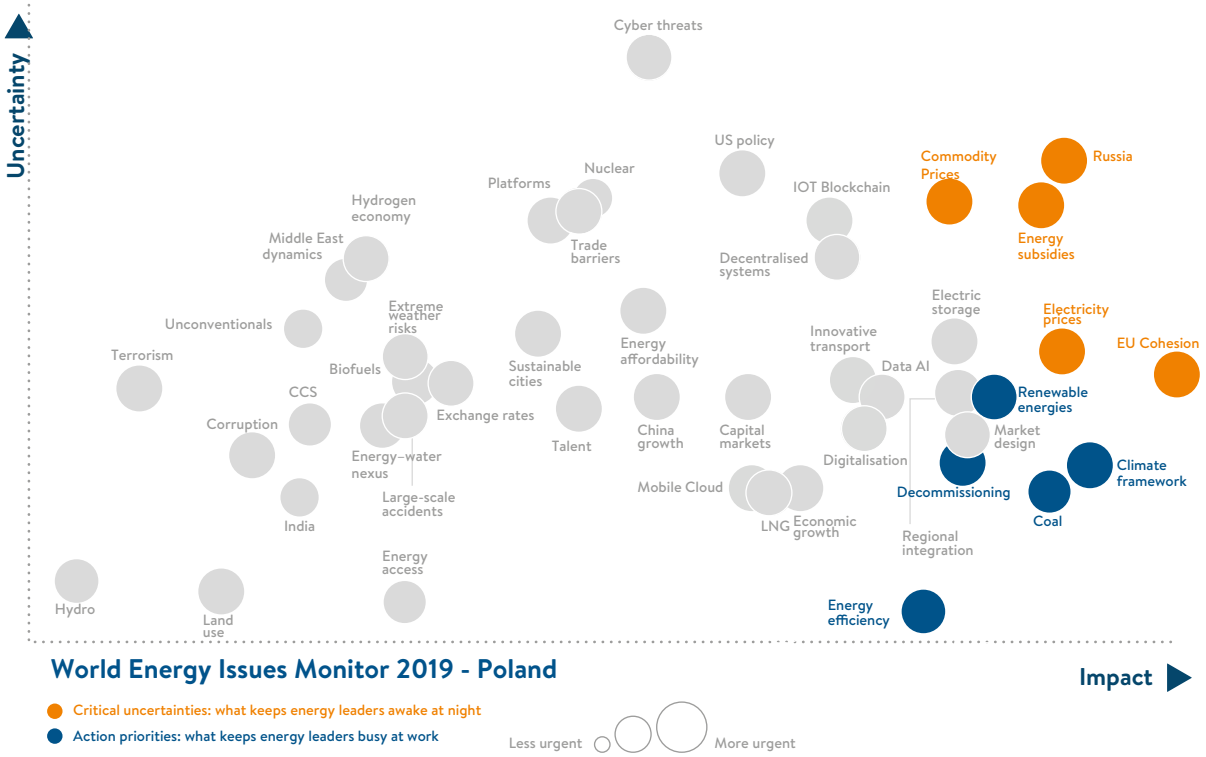
POLAND



NATIONAL OVERVIEW & CONTEXT

The Polish government's energy strategy is focused on guaranteeing the security of supply of energy and gas, while taking measures to avoid significant increase of prices.

Above 75% of electricity in Poland is produced by thermal power plants: about 20% is produced in brown coal power plants, more than 48% in hard coal plants and about 2% in gas plants. Only slightly over 13% of Poland's electricity is supplied by renewable energy sources. For this reason, energy leaders are concerned about the increasing prices of CO2 emission allowances.

To guarantee the security of supply, Poland has adopted a capacity market mechanism, with the main goal to introduce incentives for construction of new generation capacity, as well as the modernisation and longer operation of the existing capacity. This mechanism is also aimed at securing development of RES installations by using stable capacities. The rules of how the capacity market and other capacity mechanism may operate will be determined by legal acts which are a part of the Clean Energy Package (CEP). There is a risk that adopted regulations will significantly impede the effectiveness of the Polish capacity market.

In the gas sector, the main uncertainty is the Nord Stream 2 pipeline, which will connect Russia to Germany going through the Baltic Sea and Poland. To ensure its supply of gas, Poland plans to build a Baltic Pipe from the North Sea to Poland in cooperation with Denmark.

Plans and measures to counteract the main risks to the country's energy security have been included in Polish Energy Policy, published by the Ministry of Energy in the end of 2018.

KEY ISSUES FROM THE NATIONAL MONITOR

Energy subsidies: In 2018, Poland adopted a mechanism dedicated to secure long-term power supplies to final customers during emergency periods, called capacity market. This fully market-based mechanism can also introduce incentives for construction of new generation capacities, as well as the modernisation and longer operation of the existing capacities and to secure development of renewable energy sources (RES) installations by using stable capacities. The first auctions for capacity took place in November 2018. At the same time, the Polish TSO is working on the development of cross-border connections and preparing analyses of new market design that can be suitable for RES development and decentralisation of generation.

EU Cohesion: The Clean Energy Package (CEP), which was discussed by European institutions throughout 2018, will determine several key areas for the Polish energy sector. It will set new rules for capacity mechanisms in Europe, which may create obstacles to the effective functioning of the Polish capacity market. CEP may also set new obligations for transmission system operators in electricity (e.g. obligation to share 75% of cross-border connections for trade), which can be challenging to fulfil in the context of Poland's energy system.

Russia: Built directly from Russia to Germany, the "Nord Stream 2" pipeline bypasses Poland and other transit countries. The pipeline will be installed at the bottom of Baltic Sea. Despite crossing the European Union, this pipeline will not respond to European competition rules, such as the Third-part Access Rule. Moreover, energy leaders fear that the pipeline may impact Polish investments in offshore wind farms.

Climate Framework: More than 70% of Poland's electricity is produced in coal-fired power plants. The Polish government is taking measures to reduce the share of coal in the energy mix, but currently energy production is closely related with need to the purchase of emission allowances. The increase of price of this allowance translates directly on the increase of wholesale energy price. In 2018, prices increased from €5 per allowance in January, to €25 in September.

Renewable Energies: In November 2018, the Ministry of Energy has published the Polish Energy Policy to 2040. Among the main points of focus of this document are: (i) the gradual reduction of share of carbon generation, (ii) increasing share of photovoltaic panels in energy mix, (iii) development of offshore wind farms, and an enhanced focus on (iv) decentralised generation. The document is currently subject to public consultation.

Regional integration: The Baltic Pipe is a main gas projected to connect the Polish transmission system with the Danish one. The connection to Denmark links the Baltic Pipe to the European and the Skanled gas systems, enabling the transportation of natural gas from Norwegian fields (in which a Polish company, PGNiG, also own resources). This project is a way to diversify Poland's gas supply (with support of LNG Terminal in Świnoujście). The agreement for the construction of this pipeline has been concluded between Poland and Denmark in November 2018.

CONCLUSION

Polish energy authorities are aware of necessity to gradually reduce the share of CO2 emissions in the country's energy mix. At the same time, they are taking measures to guarantee security of supply during this transition while also enhancing the diversification of the country's fuel supplies.

ACKNOWLEDGEMENTS

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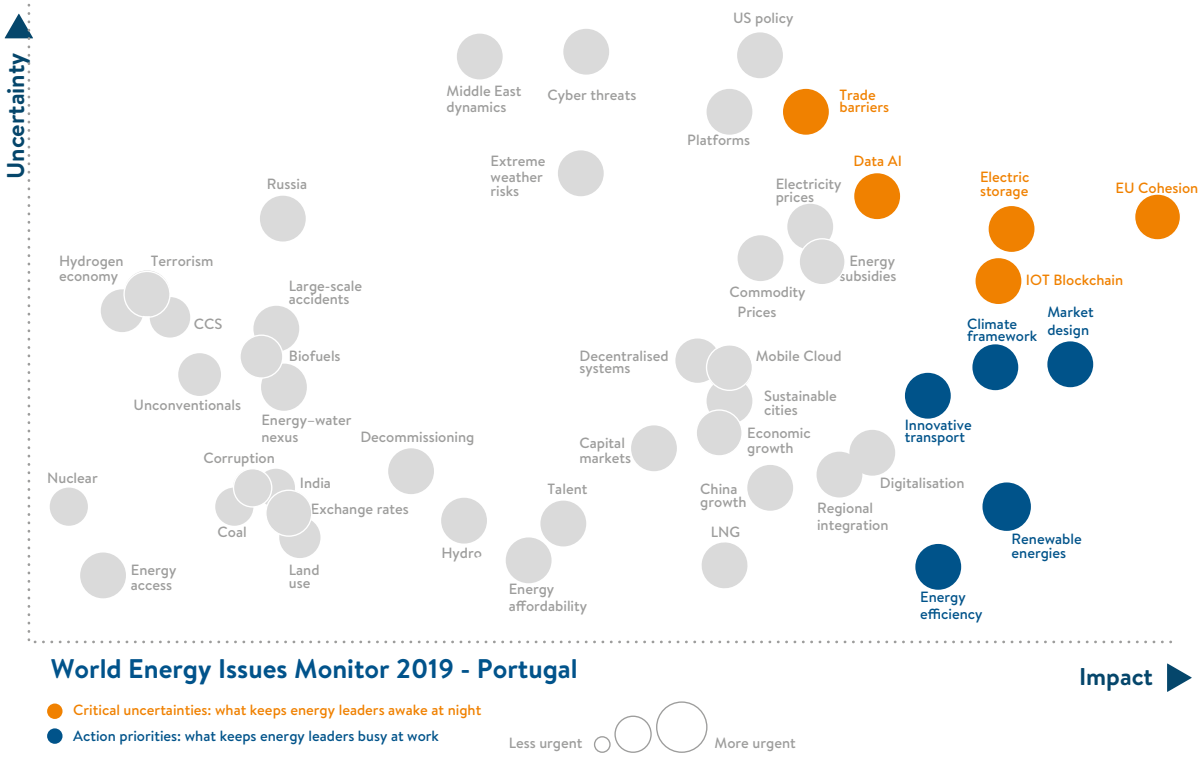
PORTUGAL



NATIONAL OVERVIEW & CONTEXT

In this year's Portuguese Issues Monitor map, energy leaders gave particular importance to critical issues of three kinds: political (EU Cohesion); operational (Electric Storage); and digital (IoT/ Blockchain).

Political changes in Europe put stress on EU Cohesion, the most obvious one being Brexit, which impacts trade and adds uncertainty to investments. Energy leaders are worried about slowing economic growth in the European region, potentially affecting trade and reducing energy demand.

The increasing share of variable renewable sources and distributed generation will require an increase of energy storage capacity to cope with both high and low generation periods. In addition, the emergence of prosumers is bringing the need of storage to the distribution and low voltage network level. Hydro storage is not available everywhere, and there is public resistance to new projects due to ecological and social impacts. Other storage technologies still face economic challenges. Therefore, decisions on storage investments still look out on high uncertainty.

Similarly, the Portuguese energy system is undergoing a digital transition and companies are adapting systems, equipment and operations to accommodate increasing data volume and to add interactive functions to their services. However, the extent and size of impact of these processes remains uncertain.

In the Action Priorities domain, Renewable Energies and Energy Efficiency appear with very low uncertainty, showing that these two issues are already considered as stable business investments.

Innovative Transport has moved from the critical issues to the action priorities quadrant. This reflects the government's electrification policies, the development of the recharging network for electrical vehicles that is expanding to petrol stations in the main road itineraries, the new business opportunity for the power suppliers and the participation of the manufacturing industry in the innovation of related equipment.

KEY ISSUES FROM THE NATIONAL MONITOR

EU Cohesion is the issue which gets the highest attention in this year's map and appears particularly isolated in the Critical Uncertainties quadrant. It is interesting to note that in relation to last year's map, EU Cohesion has shifted significantly to a greater uncertainty and a greater perceived impact. This may reflect existing concerns, particularly in relation to the impact of Brexit on business, investment and on economy drivers, such as tourism.

The **IoT/Blockchain** issue is felt as becoming less uncertain, but it remains a Critical Uncertainty. There is a perception that this technology is on its way to become a management instrument for the energy system and businesses; but the transition is being gradual and not as sudden as expected.

Electric Storage remains in the same position as in last year's map. Storage is a tool which has been utilised for a long time, mostly for hydro power. Hydro storage is a conventional and proven technology, but it is also subject to rainfall variability, environmental and social impacts. Other energy storage technologies need to become economically viable to cope with the increasing share of renewable generation, including solutions at low distribution voltage level.

Renewable Energies and Energy Efficiency show a similar behaviour in relation to their positions in last year's map. Both remain very certain, but their impact has reduced in comparison to last year. This must not be interpreted as a decline in their importance. Indeed, these issues have become a part of the system and are no longer considered as new factors affecting the system.

Innovative transport appears with a lower uncertainty rating in comparison with last year's map, but it has maintained approximately the same impact. This may be interpreted as the recognition that electric vehicles (EV) will become dominant, but at a pace that will not cause a sudden impact in the medium term. In fact, the share of the EV remains low, the charging infrastructure and the vehicles' autonomy are still limited, and the price is still high. In this context, the transition is expected to be gradual.

CONCLUSION

Portugal is well positioned in its Energy-Climate agenda policy and aiming to meet the ambitious 2030 and 2050 targets. Portuguese companies and research centres are responding to the Energy Transition, adapting processes, investing in innovation and supporting start-up programs.

ACKNOWLEDGEMENTS

Portugal Member Committee, World Energy Council

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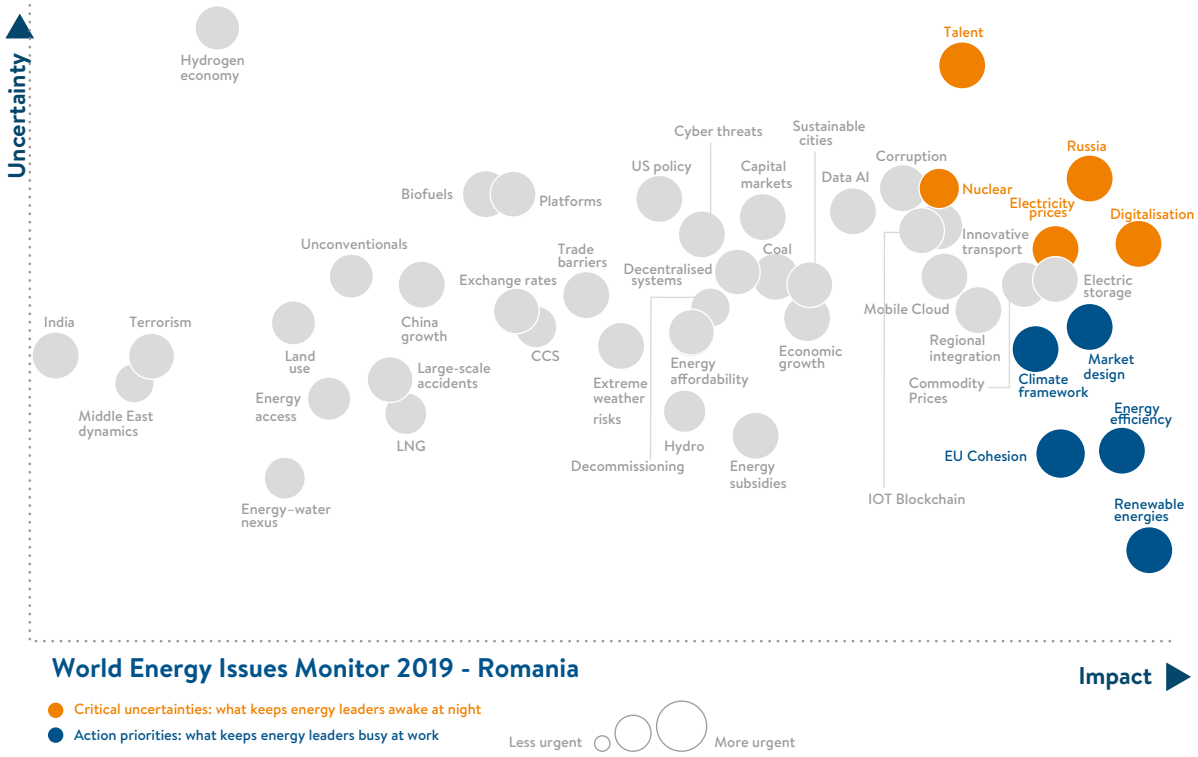
ROMANIA



NATIONAL OVERVIEW & CONTEXT

Endowed with abundant energy resources and a relatively balanced mix, Romania can hope to achieve energy independence and even become a significant player in the European energy market. Romania is a complete player in the European energy scene with a relatively balanced energy production mix: 31% of natural gas, 15% of oil, 17% of coal (63% of fossil fuels), 24% of renewable energies and 12% nuclear. As a producer of gas and oil, Romania enjoys a relative energy autonomy since it produces locally 78% of the energy it consumes.

The significant share of coal in the Romanian energy mix has brought a lot of attention to alternatives such as natural gas to reduce environmental and health impacts. Currently, replacing coal as an energy source is a priority for Romania's energy industry. Nuclear resources represent a part of the energy mix, having an important role in the Romanian energy balance. At the moment, Romania has a nuclear power capacity of 1,400 MW via 2 reactors, constituting about 18% of the country's national power generation. The Romanian Energy Strategy 2018 – 2030 plans for the further development of nuclear power [1].

Talent in the energy field and affordability of energy for customers have both been identified by Romania's energy leaders as Critical Uncertainties. Indeed, the population's purchasing power is decreasing, especially in rural areas. Russia represents an uncertainty, even with the country's low dependence of Russian gas resources. The geopolitical situation involving Russia must be taken into account due to Romania's geographical position.

The role of energy efficiency and digitalisation are essential to pursue the triple objective of competitiveness, de-carbonisation and security of supply. Furthermore, based on reports issues

by Romania's Ministry of Energy [1, 2], the country's action priorities include energy efficiency, renewables and climate change.

KEY ISSUES FROM THE NATIONAL MONITOR

Electricity Prices are perceived by Romania's energy leaders with great uncertainty and high impact on the sector and its consumers. This uncertainty can be related to the new targets pledged by the Romanian government aimed at increasing the share of renewables in the energy mix. In addition, they include a future mandatory reduction in GHG emissions and the expected new investments in the sector. The government is considering protecting the vulnerable consumers through a well-established social aid programme.

The uncertainty around **Nuclear** power in Romania relates to the trend of some EU countries to renounce to this form of energy. About 42% of the country's energy demand is supplied by coal-fired power plants, about 18% from nuclear power plants and about 40% from renewable sources. To replace the coal-based generation in the country, building further nuclear capacity is seen as a necessity. Although Romania has all the conditions to feed the nuclear cycle, uncertainties persist due to the investment costs.

The brain drain of Romania's energy specialists to other EU countries is considered a critical issue, with special regards to the impact of **talent** absence on utility businesses.

Limiting the environmental pollution in Romania by reducing the amount of CO2 in the atmosphere in accordance with the **Climate Framework** involves the development of a clear plan for the replacement of coal-based power plants in the country. This will be done through the development of two new nuclear units and through measures to promote the development of solar photovoltaic sources on rooftops. The increase on the prices for CO2 emissions certificates generates high costs and contributes to a significant distortion in the Romanian electricity market. This also raises social issues, both for the lignite-mining sector as well as for the electricity sector's employees. The development of a transportation system based on electric cars will require an appropriate set of regulations which currently does not exist.

Romania has significant potential to improve its **energy efficiency** as the country's energy intensity figures are higher than the EU average. The Romanian Energy Strategy for 2030 focuses on policies and good practices in the Energy Efficiency domain. The two main directions in Romania's energy strategy are as follows: (i) thermal insulation of buildings through modern methods and techniques, and (ii) switching the source of heating from wood to natural gas for rural dwellings.

Romania has a total of 40% participation of **renewable energies** in the total electricity mix, with 16% coming from wind and solar and 24% coming from hydropower. A further increase in the share of renewable energies requires a set of clear regulations on the development of prosumer systems, energy transmission and the support mechanisms for the development of these systems. The support scheme for renewables must be changed to reach the established EU targets.

Romania has sufficient energy resources and a balanced mix of energy generation that makes it less dependent on imports. A good interconnection with energy systems from Europe and a

stable national energy system with sufficient resources ensures a high level of safety in the energy supply for consumers. Modernising the country's energy system by increasing **digitalisation** and implementing of new technologies in energy storage can speed up the process of increasing **energy efficiency** and raising the level of security of supply.

CONCLUSION

Romanian energy leaders consider that the Romanian energy system can provide for the country's energy needs in the coming years. However, as the country decarbonises its energy mix, the focus will be on developing nuclear power plants, using natural gas as a transition fuel and working on energy efficiency improvements with a special focus on the insulation of modern buildings. Supporting decentralised renewable generation through the growth of prosumers and developing appropriate access regulations to the public energy system can further increase the share of renewable energy sources in the country's energy mix.

ACKNOWLEDGEMENTS

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Gheorghe Indre

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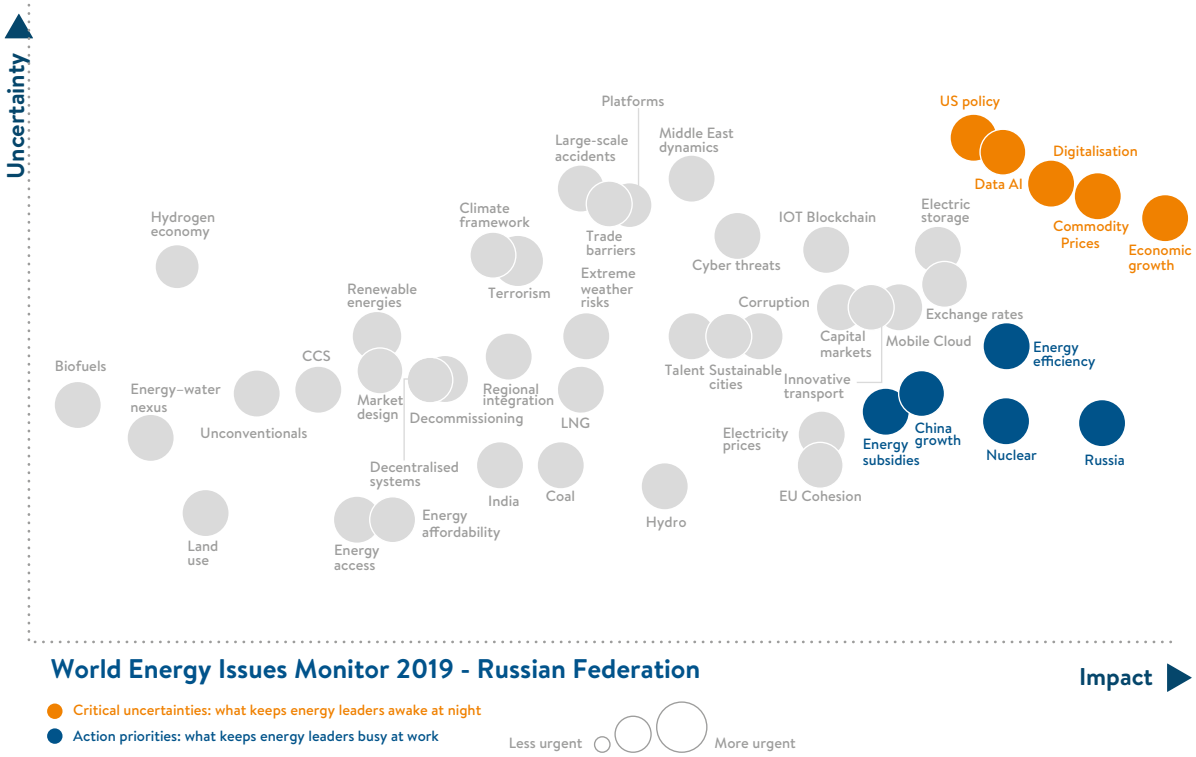
RUSSIAN FEDERATION



NATIONAL OVERVIEW & CONTEXT

In this year iteration of the Issues Monitor, the three key critical uncertainties for Russia are: United States Policy, Digitalisation and Economic Growth. Russian energy leaders consider that the continuing growth in US oil and gas production could be detrimental to the Russian economy due to its dependence on fossil fuel exports. In terms of Digitalisation and Artificial Intelligence in the energy industry, Russian oil and gas companies are developing their own digital technologies due the sanctions. Moreover, Russian energy leaders are concerned that due to a highly competitive environment, lower than estimated demand from Asian countries may affect Russian gas projects.

The three key action priorities for Russia are Energy Subsidies, Nuclear Power and China. Subsidies still play an important role in the Russian electricity market. There are 8 types of premiums that commercial and industrial consumers pay in addition to their electricity bill. Some of them are aimed at developing new technologies such as renewable energy, innovative nuclear stations. But the mechanism itself requires more precise and targeted approach. In terms of nuclear power development, Russian explorations and achievements are at the forefront of nuclear power technologies. As a feasible energy source providing sustainable, affordable and safe generation, Russian nuclear cutting edge solutions stand its ground on a global scale with a current portfolio of 36 nuclear power plants under construction worldwide which sets an ambitious unrivalled challenge to tackle in the 21st century.

KEY ISSUES FROM THE NATIONAL MONITOR

US Policy and Commodity Prices: The US continuing growth in oil and gas production will likely keep oil and gas prices low in 2019 as the result of low-cost reserves. The oil production growth in the

US (avg. 6.3 mmbbl/day in 2018 (+1.4 mmbbl/day y-o-y)) alone will cover the increase in global oil demand. It can be detrimental to the Russian economy due to its dependence on exports of fossil fuels. In this context, Russia became an active member of the OPEC Plus in 2015 to contribute to the stabilisation oil prices. Moreover, rising shale gas production and LNG export capacities of the US will most likely provide tough competition to Russian gas on the European market.

Digitalisation: Digital technologies are expected to positively impact US and Chinese GDP growth. Nevertheless, in the case of Russia, due to international sanctions, Russian companies are developing their own digital technologies. The investments in the energy sector are not still determined. However, the total investments in Russian digital economy are estimated at RUB100 bln (USD1,5 bln) annually.

Economic Growth: For the Russian energy sector, the Asian market is a major export destination. China topped the list of oil importers from Russia in 2017 (59,7 mm tons) and together with South Korea and Japan – made up to a quarter of Russian export. The new "Power of Siberia" gas infrastructure facility will open Chinese gas market as well. The "Yamal LNG" project is also aimed at covering growing Asian demand for energy resources. Russian energy leaders are concerned that due to a highly competitive environment, lower than estimated demand from Asian countries may affect Russian gas projects.

Energy Subsidies: Cross subsidisation still plays a significant role in the Russian electricity market. In addition to the business-to-households' mechanism, other mechanisms have been developed to support the electricity systems of Kaliningrad, Crimea and Far Eastern regions. Additional mechanisms focus on technology, aiming at supporting renewable energy, new generation construction and maintaining safety standards at the nuclear stations. In 2018 the overall cost of such subsidies was estimated to reach RUB480 bln (USD7 bln) and made up to 30% of the end-user bill. These subsidies send false market signals and provoke market participants to sacrifice the long-term vision for short-term benefits.

Nuclear: Nationally, nuclear energy is one of the key actors to meet 2030 national determined contribution (NDC*) target on the basis of the reconsideration national energy mix by reducing fossil fuel share; the state focus on the nuclear sector development in the long term; the traditional general public support of nuclear energy; the low CO2 emissions level. Globally related milestones included in the Russian energy strategy 2030: active technological development, modernisation and upgrade of present nuclear power plants (NPP) with a certain focus on the global market; technological verification, completion and deployment of closed fuel cycle as a transition towards two-component nuclear energy system (based on Fast Neutron and PWR reactors' combination) with an underlying solution of SNF global stockpiling; further elaboration of prospective technologies providing an expansion of nuclear capacity range to ensure small modular reactors technology (SMRs technology) commercial supply to meet emerging market demand; active international collaboration in nuclear fusion global development projects; R&D dynamic scale-up is expected on the listed directions with a solid groundwork formation..

CONCLUSION

Despite the dominance of fossil fuels in Russia's energy mix, energy leaders have been increasingly focusing on greater renewable energy investment. Companies such as Rosatom and Rostech are investing in RES development. The government's official energy policy document up to 2035 is likely to see RES share growth by 2-3% of installed capacity by 2030, with the exclusion of hydro. Russia remains at the forefront of hydrocarbon production and export. However, the country has taken important steps towards the development of renewable energy projects, reconsideration nuclear energy prominent impact and digitalisation of the energy sector. Moreover, existing renewable energy capacity agreement mechanism is oriented to locate production of main equipment and the development of local technologies and R&D in the field.

ACKNOWLEDGEMENTS

Russia Member Committee, World Energy Council

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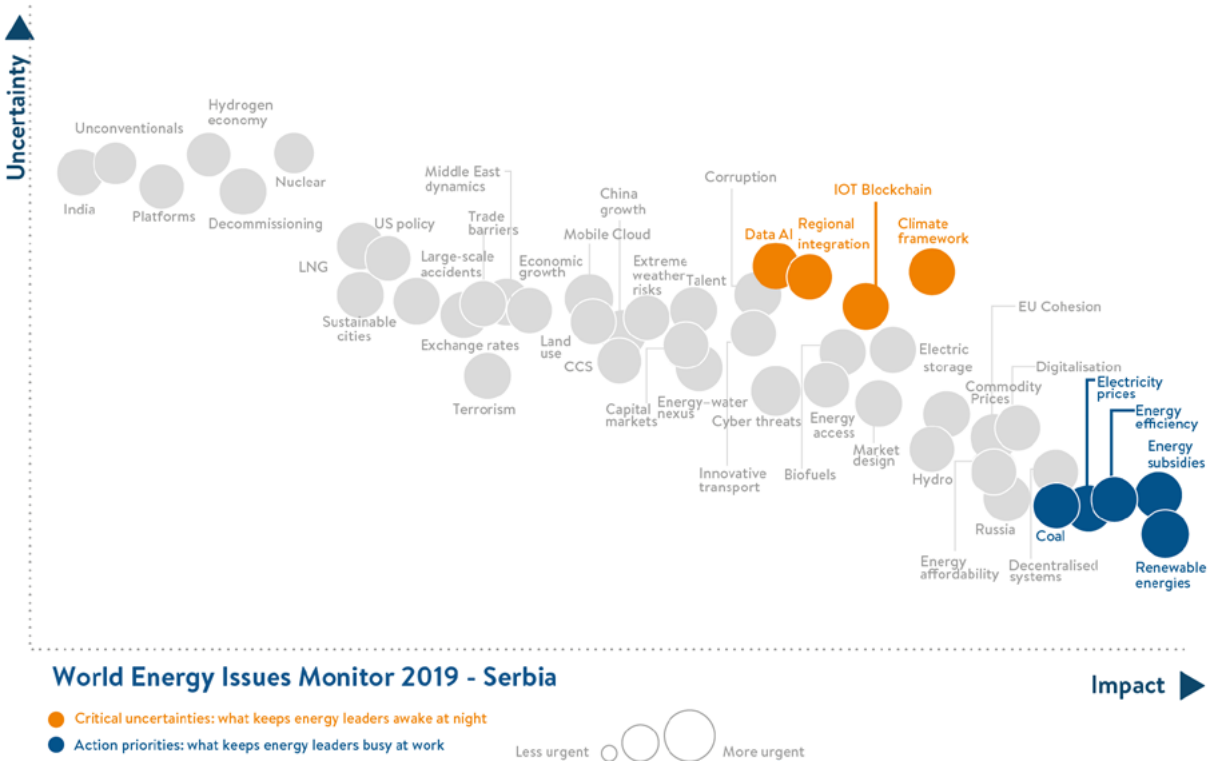
SERBIA



NATIONAL OVERVIEW & CONTEXT

Energy is one of the largest sectors of the Serbian economy, consisting of oil and natural gas, coal, the electric power system, a decentralised municipal district heating system and industrial energy. Serbia is self-sufficient in electricity due to its lignite reserves and hydropotential. However, Serbia relies at about 90% dependence on imports of liquid and gaseous fuels (the overall import dependence is of the order of 30%). Domestic lignite keeps the major share in the Serbian primary energy mix and it is the major contributor towards CO2 emissions.

Although in decline, the share of lignite in the primary energy consumption will remain dominant according to the Serbian Energy Strategy to 2030. The share of oil is also expected to decline, while the share of natural gas, biomass, hydropower and other renewables are expected to rise. In the final energy consumption, oil derivatives are the primary supply, followed by electricity, heat energy, firewood, coal and natural gas. Households consume more than a third of energy (almost a half of electricity), followed by industry and transport. Energy intensity in Serbia is about four times higher when compared to European Union (EU) countries. As such, it offers potential for energy efficiency improvements.

As Serbia is a signatory country of the Energy Community, and as it is currently in the accession process to the EU, the country is requested to considerably improve energy efficiency, environmental protection and increase the share of renewable energy sources. A great part of these processes is already in progress, according to the adopted action plans and the Program for Implementation of the Energy Strategy to 2023. To enhance the investment in renewables, the Government has recently extended the validity of the existing Decree on feed-in tariffs for

subsidising electricity until the end of 2019. The Government also continues to negotiate with neighbouring countries for new pipeline connections to ensure security of gas supply. The low carbon strategy and action plan are under development and the draft law on climate change is expected to be passed by the Parliament by the end of 2018.

KEY ISSUES FROM THE NATIONAL MONITOR

Regional Integration is one of the priorities for Serbia to increase security of energy supply for consumers, but there is still great uncertainty around this issue. The electric power transmission interconnections with neighbouring systems are rising and getting stronger, but this is not the case with natural gas pipelines. Serbia is 100% dependent on a single gas supply from Russia via Ukraine, and this exposes the country to a constant worry of the risk of the "gas transition contract" (due to expire in 2019) not being extended. To find other means of gas import after the "South Stream" project was abandoned, Serbia is negotiating new gas pipeline connection to the "Turkish Stream" via Bulgaria.

With its traditional forms of energy generation and use, Serbia is not proving resilient to Climate Change. This puts a particular uncertainty on the coal fired electricity generation as the largest CO2 emitter in the country. Through its Intended Nationally Determined Contribution submitted to the United Nations, Serbia declared its commitment to reduce greenhouse emissions by 9.8% (compared to 1990 emissions) by 2030. To comply with the goals of the **Climate Framework** on preventing global warming, Serbia is currently developing its strategy and action plan on low carbon economy, while the Law on climate change is ready for adoption by the end of 2018.

With the growing decentralisation in energy sector, the use of **IoT/Blockchain** technology in Serbia is in delay. Although the technology is well understood, its implementation is uncertain due to ambiguity about future distributed energy supply and behavioural changes. The use of IoT/Blockchain in distribution network lags behind the rate of use of small-distributed units, particularly small hydro and PV solar. The uncertainty in this case comes from the lack of investment and low regulated price of electricity for existing residential customers, who use about a half of the total national electricity consumption.

Serbia's economy is highly energy-intensive, consuming 2.7 times more energy per unit of output than an average OECD country or nearly four times as much as the EU average. Serbia adopted National Energy Efficiency action plan with the goal to achieve 9% of savings in the energy consumption in 2018 as compared to 2008. However, the incentives to save energy are limited due to low regulated electricity price, which does not reflect the costs of generation and delivery. The priority is to separate social policy from the prices and to implement EU directives on end-use efficiency, energy services and energy labelling.

Electricity production in Serbia relies around 70% on **coal**. To comply with the European standards, some of the coal powered thermal power plants will have to be shut down in the near future, while the rest will all have environmental protection systems installed to continue operation. Some measures for reducing harmful emissions from coal plants have been taken and others are being planned. However, there remain concerns about climate change issues related to burning coal.

Serbia has planned to increase the share of **renewables** in the energy mix to 27% by 2020. The bulk of renewable electricity will come from wind (planned 500 MW, half of which will be on line in 2018), while solar potential remains under-utilised (10MW). However, no new large hydropower plants have been built, while some small hydropower plants start to cause concerns regarding their location. The country's commitment to have 10% of biofuel in transportation remains questionable, but biomass use is gradually increasing as a waste-to-energy cogeneration facility has recently been contracted and as a number of heating plants are incorporating biomass as a fuel.

The last months of 2018 have been marked by uncertainty about the Serbian regulatory framework and incentives for renewable energy sources. The existing Decree on feed-in tariffs for electricity produced from renewable energy sources and efficient cogeneration was set to expire at the end of the year. The issue is being treated as an Action Priority as the Energy Community Secretariat reported possible delay in reaching the 27% share of renewables in 2020. The Secretariat requested that Serbia changed regulations to enable introduction of auctions instead. The Government has extended the existing Decree until the end of 2019 to allow ongoing renewable energy projects to complete and encourage investment in new ones.

CONCLUSION

Serbia must increase security of gas supply by extending its regional connections. In the power generation sector, the country needs to refurbish and increase efficiency of its coal fired power plants which will remain in operation after 2023, including the incorporation of due environmental protection systems to meet the EU standards. To address the global warming issue, Serbia will enact the Law on Climate Change and implement the low-carbon strategy in energy and other sectors. Efforts are needed to increase energy efficiency and to achieve the 27% share of renewables in gross final energy consumption by 2020, including 10% share of biofuels in transportation.

ACKNOWLEDGEMENTS

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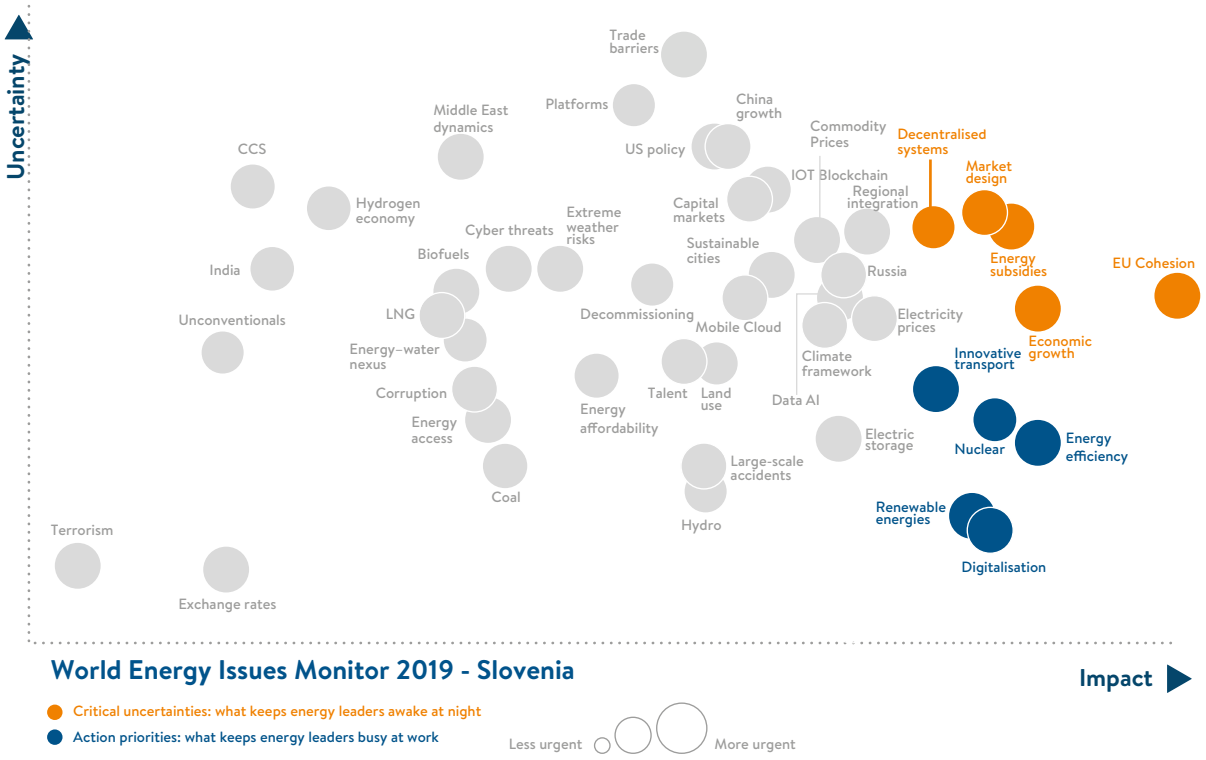
SLOVENIA



NATIONAL OVERVIEW & CONTEXT

The former Slovenian government, which resigned in March 2018, presented a material for public consultations on a National Energy Concept – the energy policy strategy. This complex strategy was strongly debated but there was no real agreement on a final framework.

Numerous reactions and responses to the public consultation process expressed the support and ambitions towards a low carbon energy sector and a low carbon economy. However, the questions about related costs and adequacy of natural resources needed for renewables were raised, placing future Slovenian Market Design, Energy Subsidies and EU Cohesion in the Critical Uncertainty domain.

In addition, the favourable subsidies for renewables and energy efficiency encourage energy self-sufficiency, small scale private and public energy projects, and new technology. Project on smart energy are in gradual ascent, especially in power distribution and transmission. Nuclear energy is consistently present in the energy mix as an important pillar of the near future energy mix, which could include natural gas as an alternative in decarbonisation of all sectors. In view of above, the new government expresses great interest to continue with balancing the country's energy development.

KEY ISSUES FROM THE NATIONAL MONITOR

Market Design: The energy market in Slovenia is as lively as the overall European energy market and it promptly adapts to the needs and challenges of consumers. The market is slowly leaving the traditional frameworks and adapting to the changing regulations and to the new rolls of the energy networks and system's needs.

Energy Subsidies: Under the umbrella of the national scheme for subsidies (support scheme), state aid is provided to promote the generation of electricity from renewable energy sources (RES) and combined heat and power plants (CHP). This strategy is producing a positive impact on renewable energy production as well as the endorsement of new energy services and technologies in the entire sector.

EU Cohesion: The Slovenian energy policy is fully aligned with the European energy policy. Despite the fact that the national energy program was not adopted, national policy follows the Clean Energy Package i.e. renewable energy, energy efficiency, emission reductions, integration of energy infrastructures and a more integrated and effective governance. The lasting discussions in Slovenia over the years have shown consents and agreements on energy and environmental objectives within the European policy.

Energy Efficiency: The national policy for energy efficiency is robust and well designed as it is based on a transparent financial support scheme. It is attractive for companies, which use opportunity to offer a complete service for energy efficiency engineering. In view of these facts, energy efficiency will remain as one of the action priorities for Slovenia.

Renewable Energy: One of the top priorities of Slovenian energy sector is the growth of renewables participation in the energy mix and the utilisation the available natural resources in the country. Even though one third of electricity is produced from hydro, the future utilisation of hydro potential is under public debate and constitutes a government priority. The exploration of wind potential has started, although it requires additional efforts.

Nuclear energy is present in the Slovenian energy mix since 1980. The nuclear power plant Krško, was constructed as a result of a bilateral partnership with Croatia. The operation of the Krško nuclear plant is considered as one of the safest, which contributes to public acceptance of nuclear energy in the country. Despite this, the issue of radioactive waste deposit remains stumble between Croatia and Slovenia. Nuclear energy is the candidate to remain on of the future pillars of energy mix in the country.

CONCLUSION

With an evolving energy market, Slovenia has aligned its approach with the EU Clean Energy Package and provides subsidies for generation with renewable sources and CHP. The key priorities for the country are energy efficiency in all sectors, renewable energy, advanced energy projects as well as an accepted presence of nuclear power generation. Although one third of the electricity is generated from hydropower, there is a debate about its further utilisation in the future. Decarbonisation process in all sectors is underway; the natural gas is an option in this Energy Transition process.

It is important that the Slovenian Energy Transition process keep a balance despite absence of a formal energy strategy. One of the methods for gauging the progress of Energy Transition is the World Energy Council's Trilemma index, which helps to navigate national energy sector's performance in relation to energy security, sustainability and equity.

ACKNOWLEDGEMENTS

Slovenia Member Committee, World Energy Council

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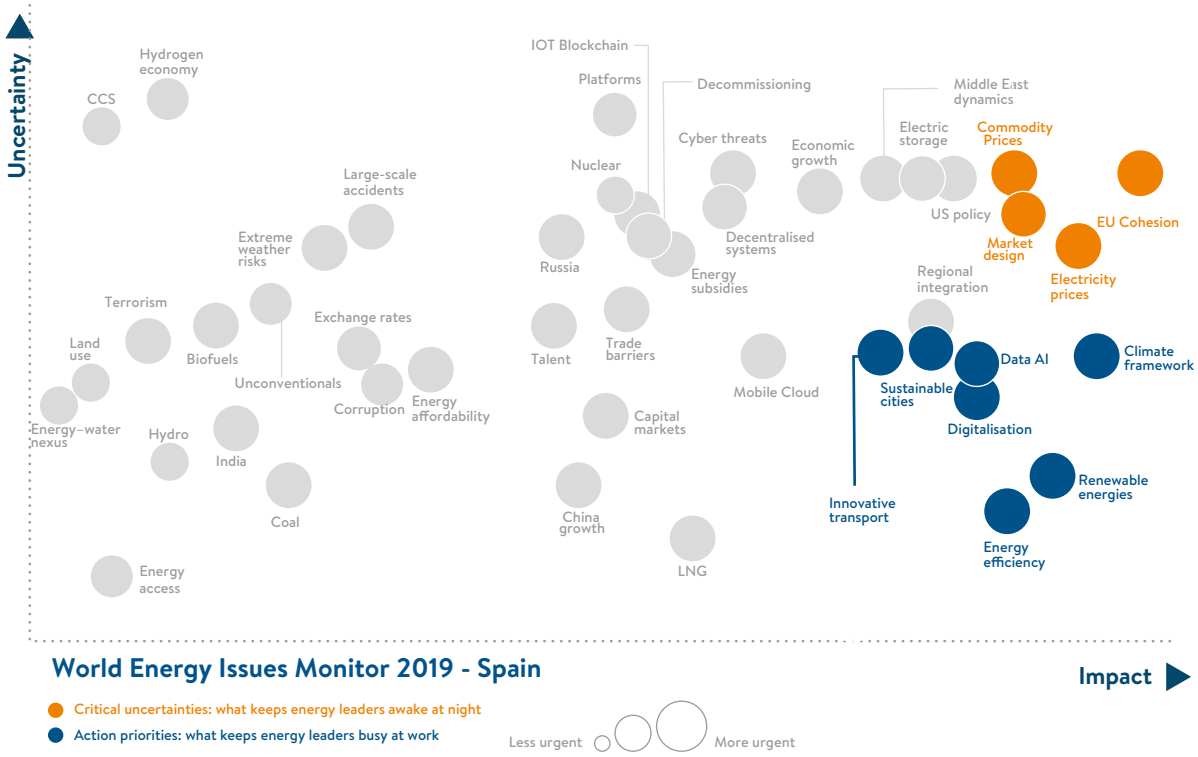
SPAIN



NATIONAL OVERVIEW & CONTEXT

The main highlights for the period in Spain's energy context, affecting energy leaders concerns are:

- The negotiations to approve the legislative proposals of the EU Clean Energy Package regarding renewable energy, energy efficiency, governance, market design, customer orientation, etc.
- The development by the Government of the "Integrated National Energy and Climate Plan" and the proposal of a "Climate Change and Energy Transition Bill".
- The development of a transition strategy to protect the most vulnerable regions, sectors and workers from the potential adverse effects of the transition.

Spain's energy leaders have been paying close attention to the European and national legislative framework which sets the long-term objectives and signals needed to advance the Energy Transition. This development took place in a complicated political scenario, both at European Level with the Brexit process, and at national level with the unexpected government change through a motion of no confidence.

The new government has created the new Ministry for the Ecological Transition, combining the Ministries of Environment and of Energy Affairs. In addition to the aforementioned plans and bill in process, the Energy Ministry has approved the Royal Decree-Law 15/2018 of urgent measures for the Energy Transition and consumer protection. This legislative document is aimed at decreasing the current high electricity prices through temporary fiscal measures and introduces initiatives related to the protection of the most vulnerable consumers, the impulse of self-consumption, and mobility.

The general context has affected how energy leaders perceived issues such as Electricity prices/ Commodity prices, Market design and EU Cohesion, which are in the critical uncertainty area, and issues such as Innovative transport, Climate Change, Sustainable cities and Digitalisation which appear as action priorities for Spain in 2018.

In 2018 once again, Spain has experienced an increase in wholesale electricity prices. The main causes are the increase of gas and coal prices (due to the rise in oil price throughout the year) and the price of CO2 emissions rights, which has tripled since the last year. These came on top of a heat wave during summer and nuclear capacity outages in France.

KEY ISSUES FROM THE NATIONAL MONITOR

Electricity/Commodity Prices: Spanish energy leaders perceive this issue as one of the main critical uncertainties, similarly to previous years. The increase in electricity prices in 2018 and the crude oil price fluctuation experienced this year have had a great impact on the Spanish energy sector and society. The national government has approved in 2018 the Royal Decree-Law 15/2018, establishing an electric and heating social grant to protect vulnerable populations.

Market Design: The proportion of renewables in the electricity mix keeps growing and is expected to continue to do so in the future. This has a direct impact on the wholesale market price. Consequently, having a market designed to ensure a fair return of investment for traditional and new facilities has become a priority. One of the last proposals from the Winter Package, pending approval, concerns the redesign of the electricity market, including the appropriate capacity mechanisms. With the Spanish government having recently proposed an objective of 70% renewable energies for 2030 and 100% for 2050 in power generation, the EU's recommendations for this issue are of great importance and considered as a critical uncertainty.

EU Cohesion: Once again, EU Cohesion is identified as a critical uncertainly with great impact. 2018 has been a year marked by Brexit negotiations and has been characterized by the rise of social movements around EU Member States with general elections in different countries and regions. At the national level, the political scene has been complicated, mainly due to the Catalonia independence movement and the unexpected change in the Spanish government through a motion of no confidence with subsequent election for a new prime minister in June 2018. All these changes and movements generate uncertainties in the economy in general, including the energy sector.

Climate Framework: Mitigating Climate Change has been a priority in the European energy agenda for a while. Having to send the Integrated National Energy and Climate Plans by the end of 2018 with national objectives and targets for 2030 has accelerated the need to determine what measures will define the future of the energy sector for the EU Member Countries. These measures will define companies' strategies for the upcoming years. During 2017, all energy stakeholders have been reflecting on the best way to meet the different climate objectives. The Spanish government has started to provide guidance on the main changes to be made in the Energy System, mainly through the Climate Change and Energy Transition Bill. A draft document has been in public consultation and includes objectives for 2030 and 2050, in areas such as emission reduction (carbon neutral in 2050), renewable energies, efficiency, as well as for the transport and buildings sectors. In addition,

the European long-term strategy for a 2050 climate-neutral economy, presented in November, will shape all national initiatives in the region.

Innovative transport has moved this year from the critical uncertainty to the action priority space. Transport is at the core of discussions regarding climate change and air quality policies in Spain. The way in which these national policies are drafted will have a big impact, not only in the energy sector, but also on the automotive sector, consumers, overall economy, as well as the country's employment scenario. On the other hand, the Government is developing a Climate Change and Energy Transition Bill, where measures affecting the transport sector are at focus. At the local level, in Madrid, circulation restrictions and parking measures have been established, based on car labelling with environmental criteria.

Digitalisation is bringing new business models, based on the integration of new technologies, where consumers are becoming the centre of energy systems. Changes are happening faster than it seemed some years ago, and companies are developing solutions to meet customer's needs. The impact of digitalisation is making a substantial difference not only in the commercial activities, but also within internal processes, energy management and the whole energy system. Issues like Cyber Threats that are related to digitalisation have declined in severity due to the reduction in attacks relevant to the sector.

CONCLUSION

This year's Spanish Issues Monitor map positions issues such as EU Cohesion, Electricity and Commodity Prices in the same place as last year, showing a continuous perception that these are the most critical uncertainties affecting the energy sector. Market Design appears with greater uncertainty this year.

There is a special concern regarding climate change, which is reflected in issues that appear in the action priority space. This concern is driving all legislative and regulatory actions taking place in the country during this period.

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Spain Member Committee (CECME), World Energy Council

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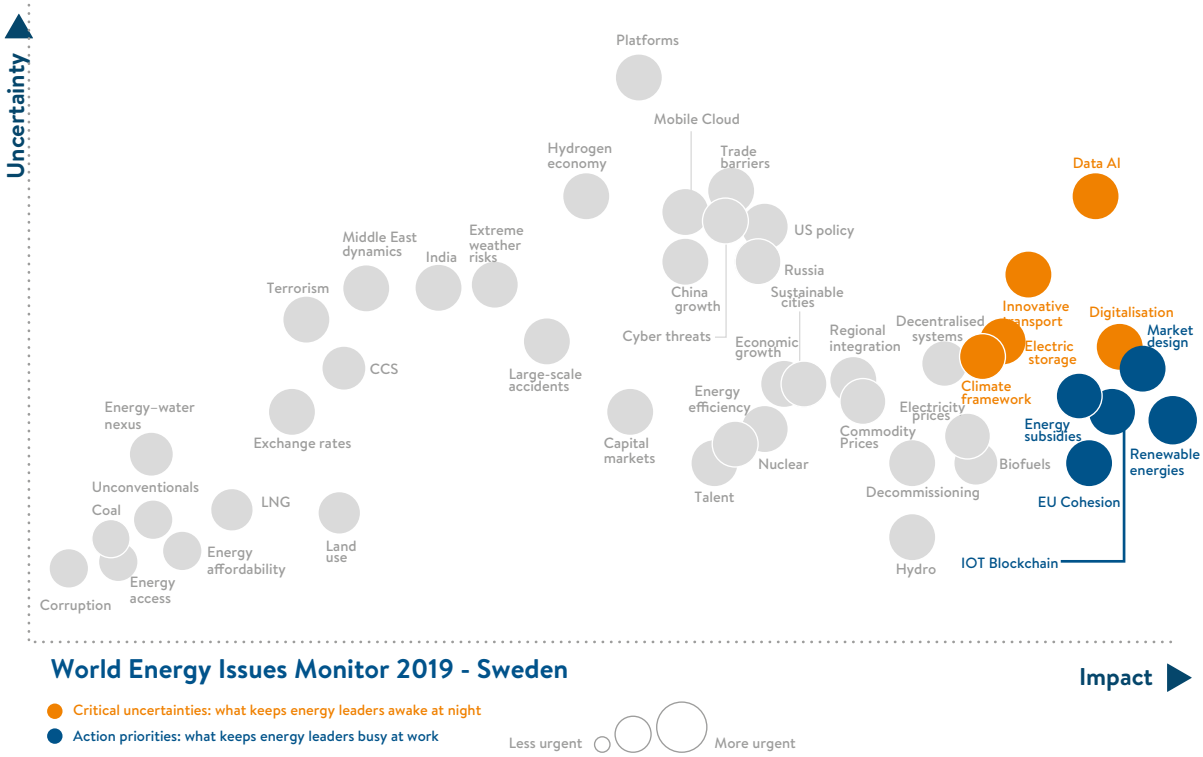
SWEDEN



NATIONAL OVERVIEW & CONTEXT

The most important development in Sweden's energy policy in recent years is that five political parties have supported a broad energy policy settlement, laying the long-term targets for the country's energy supply. One important issue is the vision of a 100% renewable energy system by the year 2040. There is a growing discussion about the electricity market and security of supply. This concerns both the power grid capacity and the question of generation capacity when demand is highest. In a report released during the summer 2018, the Swedish grid operator has shown that during cold winter days, the country becomes dependent on imports to cope with the demand of electricity due to weak winds.

The transport sector's development has a high political focus. A bonus malus system has been introduced to ensure that cars with good climate performance receive a maximum reduction of approximately €6,000 at the time of purchase, while cars with higher emissions will pay an increased car tax. In addition, a bonus malus system has a requirement for fast incorporation of biofuels into gasoline and diesel. By the year 2030, the goal is to achieve a share of 50% of biofuel.

Internet of Things (IoT) and Artificial Intelligence (AI) will be of great importance to society. It is difficult to predict how the impact of these issues will affect the energy sector, but these issues are expected to play a very big role in the future.

KEY ISSUES FROM THE NATIONAL MONITOR

Sweden's energy leaders see D**ata AI, Digitalisation and Cyber Threats** as a cohesive block that will affect the whole society, how we live and how business and industry in the future will be organised. This is a fast-moving area, which will also affect both energy supply and the energy market.

We can see a risky future, possibilities and great opportunities for controlling both energy usage and industrial processes. Here, Sweden hopes to develop important tools/services for a smarter energy use.

Energy storage and increasing shares of decentralised electricity generation are two issues that are closely linked. There is the necessity of a successful development of storage systems to secure future electricity supply against weather challenges.

Storage solutions will be needed to handle short-term variations in demand and supply of electricity. A more challenging issue is to be able to store energy over seasons in order to meet seasonal demand variations. “Power-to-X” – the use of electricity to produce a gas that can be stored and used when needed – appears as an interesting solution.

The international regulations on **Climate change** are of the utmost importance in terms of content, of how it is followed up and of how it is being managed by the countries around the world. Necessary measures to reduce emissions and climate impact can be costly. Countries that take early action must be able to rely on a worldwide compliance with the agreement’s commitments. Otherwise, competitiveness can be jeopardized for those countries that are at the forefront of climate work.

The Paris agreement and future climate agreements are important only if they are followed by action. We must go in a direction where all countries are attracted and committed to be at forefront of activities to handle the climate threat.

Increasing investment to increase the share of **renewable energies** and climate-friendly fuels is a central part of a successful future. If that development is to come, it must be economically advantageous to invest in such a development as compared to investing in the “old” fossil solutions. Such development will require policy decisions on a framework of markets, taxes and other instruments that create the right conditions so that the renewable path will be profitable for investors.

Market Design is of utmost importance for development. It is paramount a well-functioning market be the place for investors to rely upon when it is time to make decisions on investments in new capacity. The fast and extensive Swedish wind power expansion over the last five to ten years has been achieved with boosted competitiveness for wind power through the ability to obtain electrical certificates. Now it’s time to return to a market without a support system. We can see a coming discussion on market design concerning capacity elements on the market to handle peek-load situations.

Innovations for the transport sector are a very important part in reaching the target of emission from heavy duty vehicles. We see that electricity solutions are growing rapidly for passenger cars, but it still remains unclear what are the solutions for heavy duty vehicles. Pilot projects are ongoing, there is little clarity around EU’s policy the development for heavy transport. In general, we see a great need for investments in electricity infrastructure to cope with passenger cars’ electrification and we believe that electricity will play an important role even for heavy duty vehicles. With extensive transport volumes between nations it is important to find common solutions.

To meet the climate change challenge, it is important to adopt a broad approach where no possibilities are ignored. Therefore, a link from CCS to heavy industrial production will be necessary. The cement industry, steel manufacturing, vehicle manufacturing, among others, are areas where CCS solutions should be developed. We need the ambition to find areas where we can achieve "negative emissions" with CCS technology.

CONCLUSION

The issue of climate change is dominating the Swedish public debate and it has been for a long time. Sweden has adopted sectoral ambitious targets to reduce the overall Swedish carbon footprint. We can see that ambition in the Swedish answers given on this year's Issues Monitor Survey.

At the same time, there is frustration that the success of the global climate work is too limited. The world has taken positive steps in tackling climate change, but more must be done to keep the momentum and hopefully increase it. We need a stronger global commitment to follow the Paris Agreement and need countries to take actions.

ACKNOWLEDGEMENTS

Sweden Member Committee, World Energy Council

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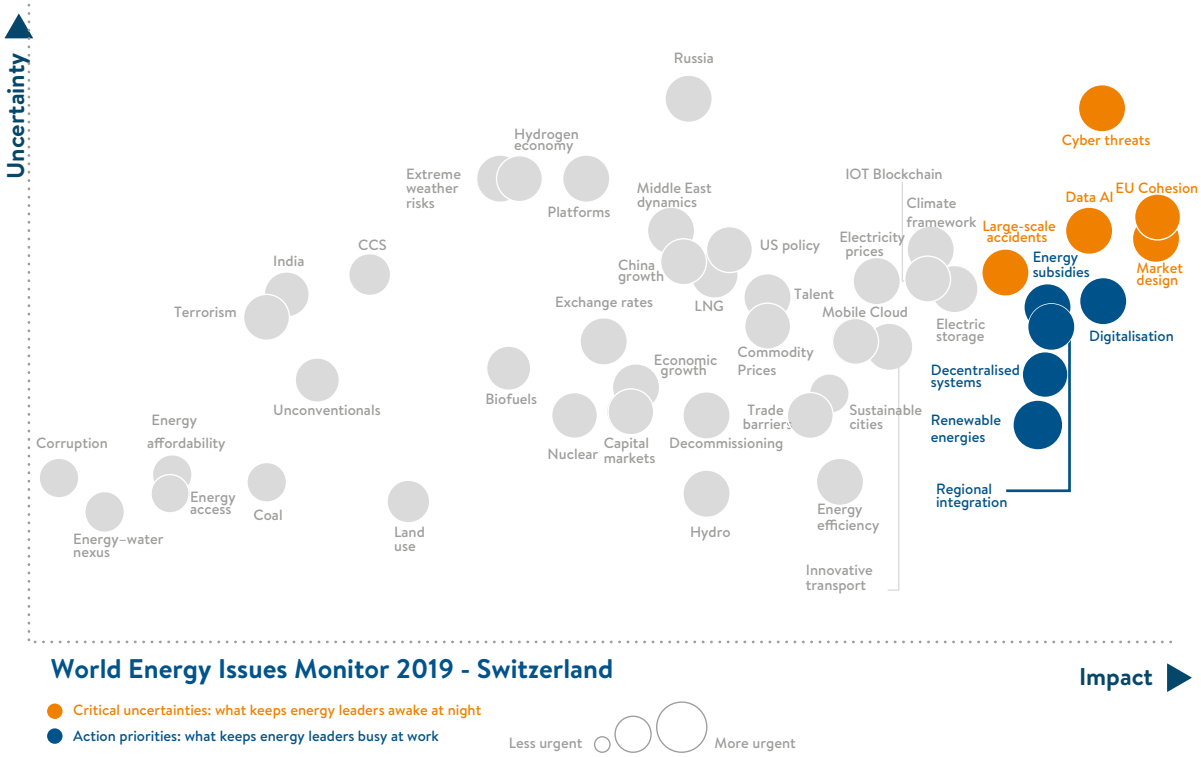
SWITZERLAND



NATIONAL OVERVIEW & CONTEXT

Recent developments and discussions in the Swiss energy sector are closely related to the Energy Strategy 2050. This strategy includes the phasing-out of nuclear power plants, a discussion around the full liberalisation of the electricity and gas sectors, the impact of new technologies onto the current business. The strategy also covers the ongoing negotiations with the European Union (EU) on several political topics, including an electricity agreement between Switzerland and the EU. These factors have changed the economic reality of market players but also increased uncertainty around several questions, which include: what share of the domestic electricity demand will be generated in Switzerland and with which technology? Will the current commodity market price levels be enough to regain profitability with domestic power plants in the long run? What risks come with new technologies? What effect could come from a situation where there will be no agreement with the European Union? At least not short-term?

These topics are very well reflected in the outcome of the current Issues Monitor for Switzerland, which ranks Cyber Threats, EU Cohesion and the options for a new Market Design as the biggest critical uncertainties. Key action priorities in Switzerland have been Renewable Energies, followed by Decentralised Systems and Digitalisation. Most likely, these items will remain the same throughout 2019, if there won't be a dramatic change in commodity prices or a significant step forward in discussions around market design or EU cohesion.

KEY ISSUES FROM THE NATIONAL MONITOR

Keeping in mind recent incidents, **cyber security** is no longer a challenge limited to less developed countries. Internet and operational technologies are converging and need to be jointly addressed to

prevent, detect and cope with critical situations. This is not only relevant for critical infrastructures but also to ensure the functioning of entire businesses.

The unclear pathway towards **EU Cohesion**, along with potential regulatory changes, is another uncertainty that keeps energy leaders awake at night. A clear regulatory framework that gives Switzerland access (not only physically, but also politically) to the European system is seen as absolutely necessary by many market players. The increasing physical flows through Switzerland from a coupled European grid system have shown first effects already.

The **market design** for the electricity and gas sector is currently being discussed. The Swiss energy market is not fully liberalised and does not grant private consumers the option to choose from different energy suppliers, as they are bound to be connected to their local utility. The effects of liberalisation onto churn rates and the growing competition are keeping many industry leaders awake at night, as the use of modern technology, products/services and platforms could become more relevant.

Switzerland relies to a large part on **renewable energy** resources in the electricity market. The high acceptance of renewable resources underlines essential investments into domestic Solar PV and hydro capacities as well as into solar PV, wind and hydro capacities abroad. The investment activities of Swiss actors in the European market show that this is a key action priority, both from a financial and strategic point of view.

Decentralised energy systems are seen as an essential part of the future system. The current regulatory framework already allows for certain decentralised generation and consumption communities that operate locally. As this trend will further materialise, solutions to offer decentralised systems and integrate these communities into the entire distribution grid are being sought.

Digitalisation offers a variety of use cases, both for internal applications within companies and external interfaces/services with clients. As these technologies support operational excellence and efficiencies as well as increase convenience for clients, their relevance is greatly accepted and constitutes a key action priority on the agenda of many market participants. This covers developments such as the automation of internal business processes, the creation of digital platforms and the real-time steering/monitoring of devices.

CONCLUSION

Although some use cases for the action priorities are visible and implemented in Switzerland, the business case behind them still needs to be demonstrated. Crucial for their profitability will be a wide availability of smart devices, an efficient and cost competitive service offering and a large number of clients that will have to see a benefit in it.

As for the critical uncertainties, unclear situations in the market design and with the integration into the European market will most likely lead to a postponement of necessary investment decisions.

ACKNOWLEDGEMENTS

Switzerland Member Committee, World Energy Council
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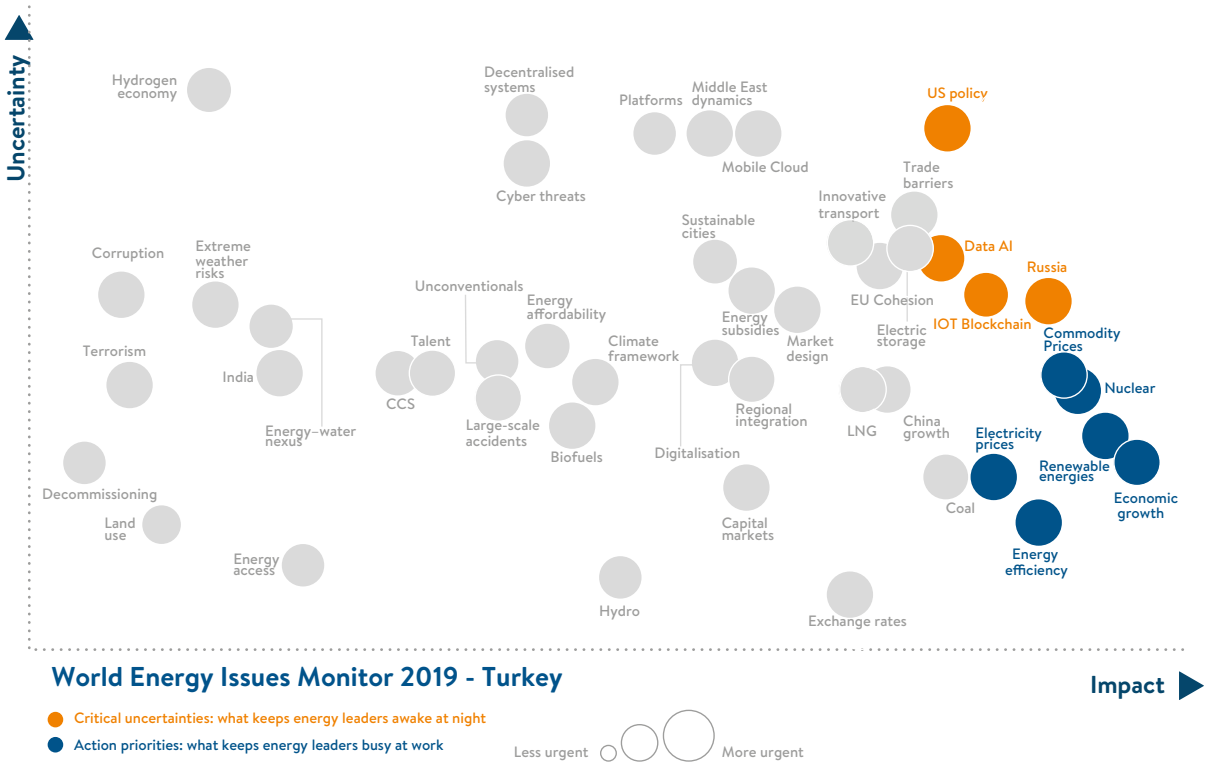
TURKEY



NATIONAL OVERVIEW & CONTEXT

In line with global trends, Turkey is shifting priorities in its energy agenda towards technology-oriented areas. Innovative technologies namely Blockchain, Internet of Things, Big Data and Artificial Intelligence come to forefront on the critical uncertainties for energy leaders in Turkey. Moreover, the Exchange Rate's impact on the energy sector remains to be a critical uncertainty for Turkish energy leaders. In line with an increasing impetus towards decarbonisation, renewable energy, energy efficiency and nuclear energy have become top action priorities for the country's energy leaders.

KEY ISSUES FROM THE NATIONAL MONITOR

Digitalisation: The Turkish energy market has gained maturity due to market reforms carried out since 2002. According to the EU's Turkey 2018 Report, "Turkey has continued to align with the EU acquis. Regarding the internal energy market, good progress has been achieved on the electricity sector and good progress can be reported on renewable energy and energy efficiency." However, these developments bring their own difficulties such as utilising systems and managing the grid while increasing the share of small and large-scale renewable. To solve these problems, the realisation of Blockchain, IoT, AI and other big data solutions becomes inevitable, at the local and global levels. But uncertainties remain due to technological, regulatory and other practical challenges.

Exchange Rate: Turkish energy markets can be described by two main characteristics which are also the sector's major challenges: import dependency and growing demand. For a country with a high current account deficit, mainly driven by energy imports, the implications of exchange rate movements are particularly important. In this regard, Turkey has comprehensive strategies to decrease import dependency while meeting increasing demand.

US Policy: Turkey, with its increasing LNG import capacity and a high utilisation of its regasification terminal, has started to source LNG from various suppliers. Turkey's LNG imports has recently exceeded its historical 15-16% share in gas supply mix and reached 23% in 2018. It was reported by the Energy Market Regulatory Authority (EMRA) that Turkey imported LNG from 12 different countries during 2017. In this regard, as a potential supplier, competitiveness of US LNG policy remains to be a critical uncertainty for the Turkish natural gas market.

Renewable energies feature as a high impact issue on Turkey's energy agenda. The installed capacity of renewable energy sources, excluding hydro, has reached 13,328 MW, representing 15 percent of the total installed capacity by the end of August 2018. Currently, the installed capacity for wind and solar is around 7,000 MW and 5,000 MW, respectively. Turkey is planning to add 1,000 MW additional capacity for each solar and wind, annually, adding 20,000 MW of wind and solar capacity in total within 10 years. To promote renewable energy, Turkey announced a first of its kind tender mechanism: Renewable Energy Resource Zone (RE-ZONE). The strategy encourages investors not only to build power plants but also to manufacture renewable energy equipment in Turkey. Two RE-ZONE competitions of solar and wind for 1,000 MW each have been completed with historic low prices. Turkey plans to launch new RE-ZONE tenders in the coming ten years.

Energy Efficiency continues to be perceived as a top action priority. Turkey announced its National Energy Efficiency Action Plan in January 2018 which sets out actions to implement a reduction of 14 percent of primary energy consumption by 2023. The Action Plan aims to save 23.9 mtoe, from Turkey's primary energy consumption, through a strategy which includes USD$10.9 billion of planned investment. The return of total projected investment is expected to be USD$30 billion until 2033. Sectoral measures set out in the plan include buildings and services, energy, transport, industry and technology, agriculture, and cross-cutting areas. The Action Plan is due to be finalised in 2019 and the implementation under each category is expected to be clarified during the same year.

Nuclear: In line with policies aiming to ensure energy security while sustaining transition towards a low carbon future, Turkey has also firm plans for adding nuclear power to its energy mix. The country's first nuclear power plant named Akkuyu, is planned to have 4,800 MW total capacity with four units. The construction license of power plant was granted, and the first unit is due to become operational by 2023. A new regulatory authority was established to regulate the nuclear energy sector.

CONCLUSION

Developments in IoT/Blockchain and Data AI are at the epicentre of Turkey's energy concerns. In addition, policies toward a low carbon future are gaining importance and driving energy leaders' action priorities. All the critical uncertainties and action priorities are in line with energy policies of the country. Many of Turkey's ambitious energy strategies prioritise energy security, reducing adverse economic impacts of increasing energy imports, increasing market competitiveness and investment on renewable energy and energy efficiency.

ACKNOWLEDGEMENTS

Turkey Member Committee, World Energy Council
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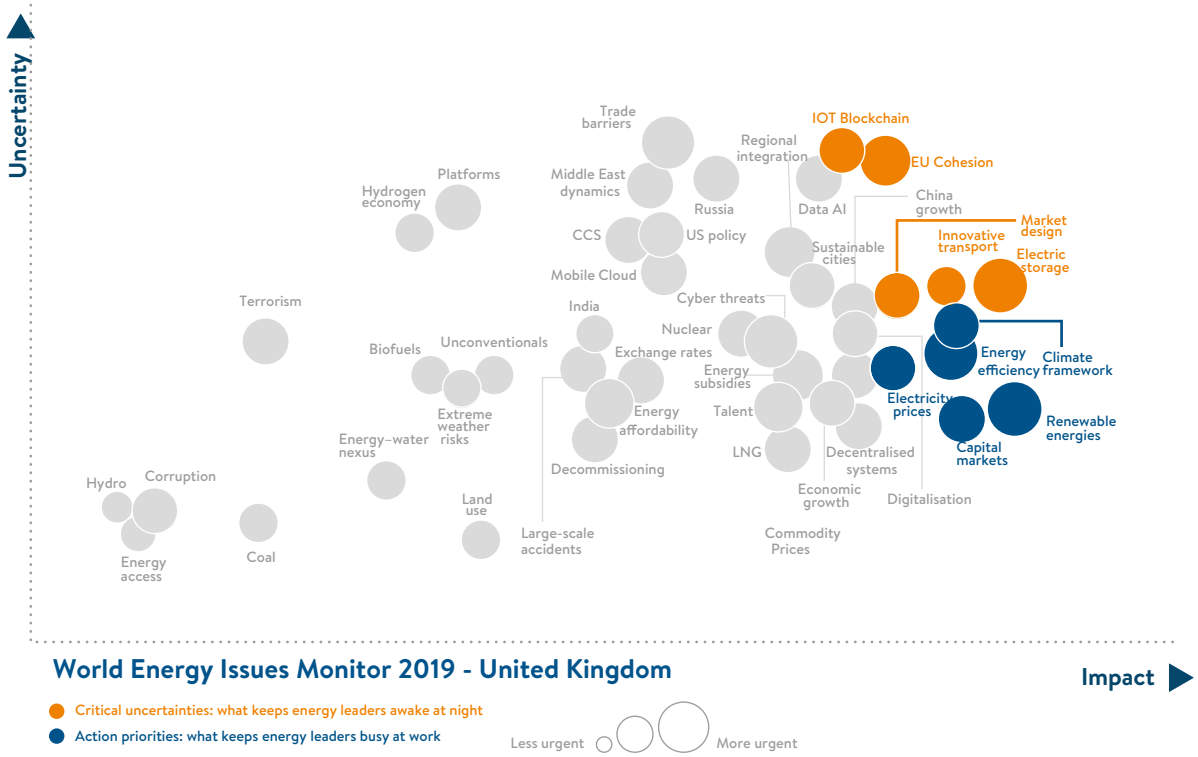
UNITED KINGDOM



NATIONAL OVERVIEW & CONTEXT

The UK government's energy policy aims to play a key role in limiting greenhouse gas emissions, whilst meeting energy demand. The energy sector in the country involves many actors, supports various functions and comprises many complex dynamics between commercial, policy and technical landscapes, amplifying the difficulty of the task. UK energy leaders identify the status of Brexit and the UK's relationship with the EU as the number one concern. Together with electric vehicles (EVs) charging infrastructure and ongoing energy storage developments, this means the key areas of concern for the UK are EU Cohesion, Innovative Transport and Electric Storage as the critical uncertainties for the year 2018.

The UK's commitment toward reduction of emission levels in the 2008 Climate Change Act and the growing developments in the renewable energy sector and energy efficiency field make Renewable Energy, Energy Efficiency and Climate Framework as the primary action priorities for the country in this year's Issues Monitor.

KEY ISSUES FROM THE NATIONAL MONITOR

EU Cohesion is the critical uncertainty for this year's Issues Monitor according to the UK's energy leaders. With the growing concerns around the nature of the Brexit deal, the UK has experienced a marked slowdown in clean energy investment ahead of the planned departure from European Union. lack of clarity and/or a failure to secure an appropriate Brexit deal could lead to an increase in uncertainty for UK's power sector.

According to energy leaders in the UK, the issue of **innovative transport** emerges as a critical uncertainty for this year's Issues Monitor. EVs are expected to become more price- and

performance-competitive but this has increased uncertainty about how quickly EVs will displace internal combustion vehicles and how the necessary charging infrastructure will evolve. With charging infrastructure recognised as the biggest barrier to the uptake of EVs in the UK, the "Enhanced Capital Allowance Scheme" for businesses investing in Electric Vehicle Charging points has been extended until the year 2023 to accelerate the development of charging stations.

The issue of **electric storage** is the third critical uncertainty identified by UK's energy leaders. The electric storage market has demonstrated significant growth in terms of both regulatory and infrastructure development in the country, yet it remains of concern. The increasing share of renewable energy has enhanced the need for the role of storage on the UK electricity grid. With the approaching implementation of blockchain-facilitated trading within digitised community power grids, the use of artificial intelligence at energy installations and the increasing use of electric vehicles, the importance of electric storage continues to increase. Today however, storage development in terms of both costs and technology maturity serve to add uncertainty to the issue.

Energy Leaders in the UK highlight **renewable energies** as the first action priority for this year's Issues Monitor. Renewable energies are expected to play a key role in replacing the energy void created by the elimination of coal-based power generation from the mix. In 2018, the UK set new "clean tech" records as renewables and low-carbon power* generation hit new highs, with the overall electricity use falling to its lowest level since the mid-90s. There is a planned investment of more than £2.5 billion in low-carbon innovation by 2021, helping this booming market to thrive, creating jobs, delivering clean energy and tackling climate change.

The issue of **energy efficiency** is the second action priority for this year's Issues Monitor. Energy efficiency will be crucial for ensuring the future energy security of the UK by reducing demand for energy. This will therefore play a key role in tackling emissions and cutting costs at the consumer end. Generation in 2018 was about 63 TWh (16% lower than in 2005), despite the UK population increasing by 10 per cent from 60 million to 66 million people. In the Clean Growth Strategy, the government has declared a statutory target that by the year 2030, as many fuel poverty households as reasonably practicable should achieve a minimum energy efficiency rating of a Band C energy performance certificate.

The UK's energy leaders consider the **Climate Framework** as the Country's third action priority. The Climate Change Act has been instrumental in advancing climate action over the past decade and it has provided a framework through which the UK has led the way in reducing emissions world-wide, while continuing to strengthen its economy. However, with the country falling short of the targets set in the act, there is a need for more drastic action to accelerate the low-carbon transition if these legislative climate targets are to be achieved. The focus needs to encompass not only transport and power, but everything from services to heavy industry.

CONCLUSION

UK energy leader's concerns and actions are aligned with the developments for security of supplies, climate action, innovation as well as the threats Brexit presents to these issues. There are actions being taken at all levels to accelerate the supply of clean energy, demand reduction and innovation in transport in order to maintain security of energy supply, whilst retaining the commitment to minimising the impacts of climate change.

ACKNOWLEDGEMENTS

United Kingdom Member Committee, World Energy Council

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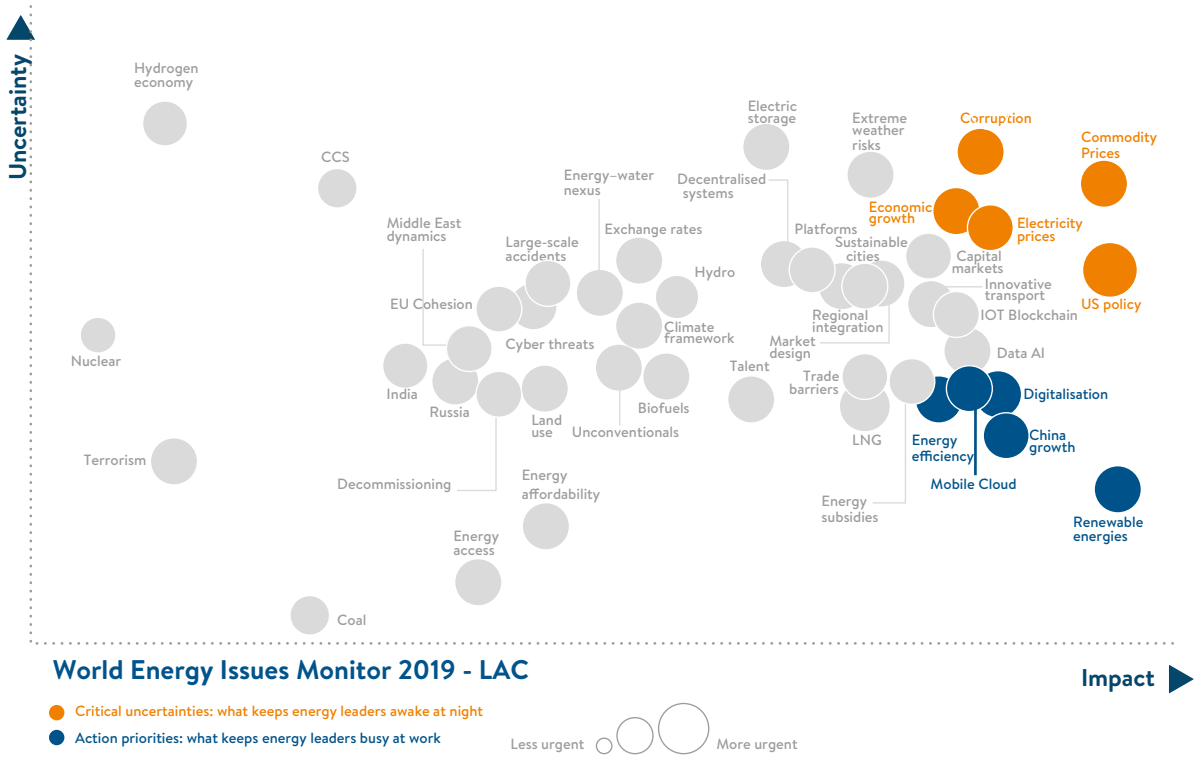
Chapter five

Assessing the energy agenda for Latin America and the Caribbean

LATIN AMERICA AND THE CARIBBEAN



REGIONAL OVERVIEW & CONTEXT

In 2018, Latin America and the Caribbean countries (LAC) signed the Escazú Agreement. The objective of this important agreement is for protection of the right of every person of present and future generations to live in a healthy environment. 16 of the 33 countries in the region have signed the agreement (a minimum of 11 signatures were needed for it to be ratified). The agreement allows access to environmental information, public participation in the environmental decision-making process and access to justice in environmental matters.

The LAC region has large endowments of hydrocarbons reserves, a massive hydroelectric potential, as well as wind and solar energy potential. The strong sunshine in Bolivia, Peru and Chile, with the latter's 38,000 square mile-Atacama Desert, provides huge solar potential. Meanwhile, Brazil has major wind capacity at night that could perfectly complement its Andean neighbours' daytime sunshine, potentially providing vast quantities of free energy for all four countries on a 24-hour basis the necessary international transmission lines were available. This comparative advantage allows the countries in the region to utilise available resources, transforming the energy mix and incorporate new technologies for the development of renewable energies.

On the other hand, the LAC region is still dealing with the fluctuation in commodity prices as it is shown in the last two years' Issues Monitor Maps. This uncertainty and dependence on the oil price highly affects national budgets and investments. Further consequences include instability, inflation, devaluation and rising unemployment.

In 2018 survey respondents identified corruption as a critical uncertainty in the region, but in the prior year's survey, this issue was seen an action priority. The corresponding national commentaries discuss the negative impact of corruption affecting the region's economic growth.

KEY ISSUES FROM THE REGIONAL MONITOR

Infrastructure constraints and **markets design** are being affected by the political and economic crisis in the region due to political upheavals and the fluctuation in oil prices. There is a growing tendency to open economies, but the regulatory framework is still weak for private investments, making market design a critical uncertainty. In some countries, the state-owned companies, integrated electricity monopolies failed in the end to manage the electricity prices which is another critical uncertainty based on survey responses. In Bolivia, Peru and Ecuador governments failed on raising their budgets for the electricity sectors but, at the same time, the tariff is subsidised for low-income consumers.

Commodity Prices is a critical uncertainty because of the region's economic dependence on oil. Crude oil price experienced an improvement, from around $60 per barrel to a high of $85 per barrel and a low by year-end of $50 per barrel. These fluctuations are deeply affecting the economies of LAC countries. South American countries budget depends on oil exports while many of the Central American and Caribbean countries are highly dependent on fuel imports to generate electricity.

Corruption continues to be a critical uncertainty and is undermining the economic growth and generating political instability. Stemming from this, corruption is the lack of legal security which delays the development of large energy projects, interrupting discussions and discouraging investments that directly affect local markets, and therefore regional growth. On a larger scale, corruption is undermining public institutions.

Renewable Energies has been an action priority in the region as it has been prioritised in the governmental plan of most of the countries in order to take advantage of its large endowment on hydro, wind and solar energy potential. Chile, Colombia, Ecuador and Uruguay are examples of big efforts towards the change of the energy mix to replace the use of fossil fuels. Governments and companies continue to invest in this area with innovation and new technology but remain concerned about the effects of climate change that can affect the generation of energy from renewable sources.

Energy Efficiency is not an uncertain issue but requires focused attention and action to realise its potential. The region must work on critical aspects such regulatory frameworks, tax incentives and dissemination on good energy efficiency practices among the entire population. Colombia and Chile are moving forward to improve the use of energy efficiency mainly on what refers to electric vehicles. The Colombian Member Committee of the World Energy Council develops an annual event on e-mobility that promotes sustainable mobility, through the use of clean technologies in transport. In the same line, Chile has replaced the vehicles from some governmental institutions to electric vehicles which reduces the GHG and improves the use of this technology from the public perspective.

Digitalisation is viewed as a key action for energy leaders as companies need to adapt to an increasingly complex supply chain. The growth of renewable resources is increasing daily variability. This lack of predictability creates a big challenge to match the energy supply and demand in a very complex way. Brazil has shown that to withstand this complexity, the use of smart meters, remote

controls, automated systems, real-time simulators, and other new technologies will allow energy companies to be able to respond to the challenges brought on by renewable sources.

Economic growth and its interlinkages with corruption will define the pace of transition in the energy sector in the LAC region. Also, **US Policy** and **China's** presence in the region are key issues to understand some of the large-scale projects being developed.

CONCLUSION

The slight economic growth experienced by the region in 2018 from the rise in the price of oil allowed South American countries to slightly recover. However, addressing uncertainties remains critical to achieving the stability needed to take action on new issues that are priorities at the global level, especially those related to the use of technology, new business models, digitalisation and innovation.

The LAC region needs to focus its efforts on dealing with the uncertainty of extreme weather events through investments in resilient infrastructure, risk prevention management and systems that allow recovery after an extreme weather event, as indicated by Colombia, Ecuador and Peru, affected by the El Niño phenomenon, Central America with hurricanes and tornadoes, and some countries of South America with seasons of extreme drought.

ACKNOWLEDGEMENTS

Andrea Arrobo, Latin America and Caribbean Regional Manager, World Energy Council

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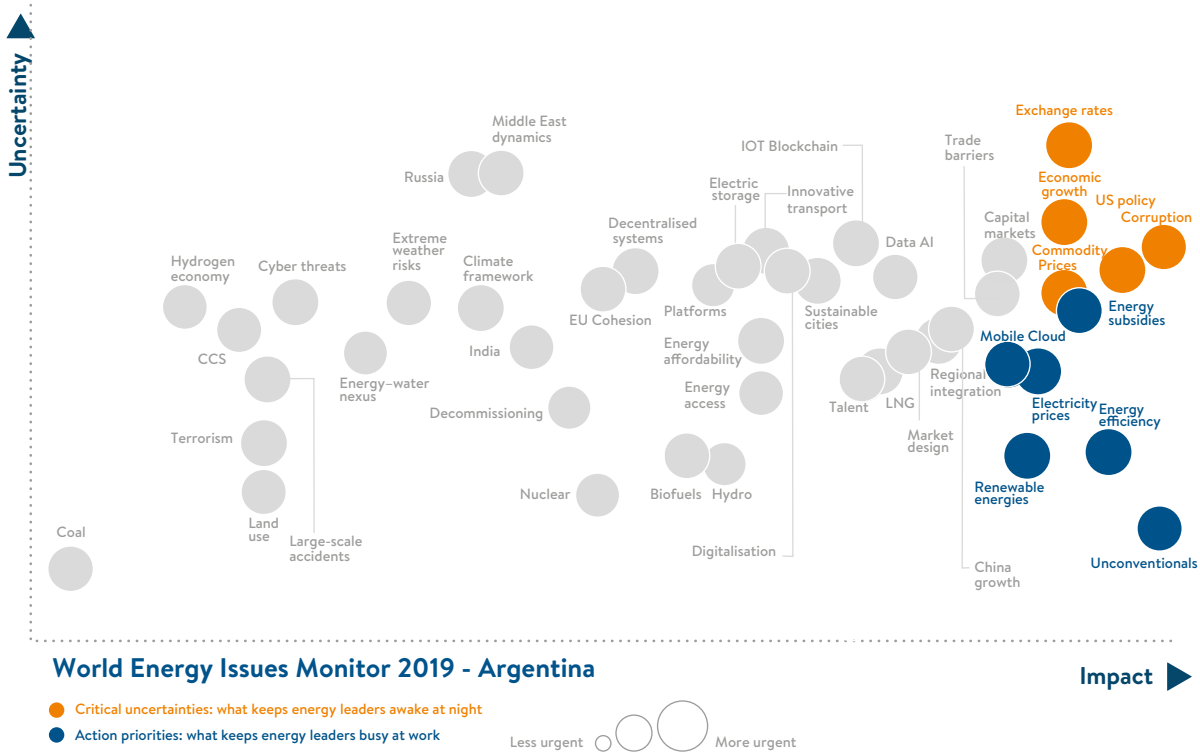
ARGENTINA



NATIONAL OVERVIEW & CONTEXT

2018 was a difficult year for Argentina as it experienced a severe drought, faced the collapse of the peso, along with suffering from recession and an over 40-percent inflation. Currently, the country faces a 35% increase for electricity prices. In addition, 2018 ended with an abrupt resignation of the Country's Energy Secretary.

However, there is room for optimism as Argentina has a very high potential for the development of unconventional hydrocarbons. Recent focus has been on Vaca Muerta: one of the largest deposits of shale oil and gas in the world and the biggest reason why unconventional appear a top action priority for Argentina in 2018. Resources are estimated at 16 billion barrels of oil and 308 trillion cubic feet of gas. If exploited, the proven reserves of the country would increase more than eight times, securing for the next 150 years our gas consumption and 85 years for oil consumption.

Additionally, with Lithium batteries developing fast, Argentina is in a position to capture a large chunk of the growth in demand as part of the so-called lithium triangle with Bolivia and Chile. The area holds by far the largest reserves of the metal on the planet.

On the renewable energy front, Argentina mid-way into 2018 was generating about 2% of its electricity from renewable power (excluding large hydro). The country failed to meet its 8% renewables share goal, however, it is said to be on track to meet a goal of 20% renewable energy by 2025.

KEY ISSUES FROM THE NATIONAL MONITOR

Alongside inflation, the **exchange rate** is a key critical uncertainty in Argentina. After the more than 100% devaluation of the peso, the national currency has now accumulated three months of stability against the dollar, but it remains very vulnerable. The current administration hopes to control the exchange rate through tight Central Bank monetary policy and a new disbursement of funds from the International Monetary Fund (IMF).

Under the administration of current President Mauricio Macri, foreign investors have started paying more attention to Argentina, in part because he promised to crack down on **corruption** and money laundering. With the notebook scandal on one side, and Odebrecht on the other, prosecutors and judges have the tools to go all the way in pursuit of public-private corruption.

Argentina's economy will recover some of its lost ground over 2019 – but the path ahead for **economic growth** will be a critical uncertainty. The energy sector is expected to continue expanding in 2019, linked to the exploitation of hydrocarbons in the Vaca Muerta shale area, the growth of renewable energy and the expansion of mining – mainly lithium in the north of Argentina. The uncertainty surrounding economic growth is tied to Argentina lifting itself out of recession and the peso recovering.

Unconventional fuels are an action priority as Argentina is endowed with large amounts of shale oil and gas. Shell Argentina will begin the first phase development of a project aimed at increasing its output of unconventional fuel sources off of the Vaca Muerta basin, which is touted as the world's second-largest shale gas deposit. The initial phase of the project is aimed at gradually increasing the company's current production and processing capacity to 12,000 barrels of oil equivalent per day (BOE/D) to more than 40 kboe/d in 2021.

Decentralised energy systems are seen as an essential part of the future system. The current regulatory framework already allows for certain decentralised generation and consumption communities that operate locally. As this trend will further materialise, solutions to offer decentralised systems and integrate these communities into the entire distribution grid are being sought.

Energy efficiency remains an action priority since 2015, when he current administration established a national target to reduce final energy consumption by 11% by 2030. Since then, the government has deployed a number of new energy efficiency measures across various areas. In Industry, for example, the government aims to fulfil the sector's energy savings potential by building skills and raising awareness.

Renewable energies remain an action priority for Argentina as it works to reach its goal of 25% renewable energy by 2025 (excluding large hydro). Argentina has some of Latin America's most abundant renewable energy resources—steady winds in southern Patagonia, year-round sunshine in the remote northwest, and hydropower and biomass fed by rivers and expansive farmland. Its biggest challenge is to attract investment to give this sector the boost it needs to flourish. The administration is targeting at least $35 billion dollars in foreign investment for this sector.

CONCLUSION

Argentina has set a target of doubling its oil and natural gas production over the next five years and increasing its renewable generation to 20% by 2025. However, it may take longer as political instability threatens to slow investment. Vaca Muerta is clearly an export project for Argentina, and it seems to have the potential to be a key factor to mobilize other resources. It can be a driver for picking up the growth in the country and a way to increase productivity for the whole economy by lowering the cost of energy. The challenge is that Argentina has a benchmark interest rate of 60%, the highest in the world and this is a key factor to lack of investment.

ACKNOWLEDGEMENTS

Argentina Member Committee, World Energy Council
Jorge Bacher
Horacio Fernandez
Mariana Irmer
Francisco Imperatore
Mariana Aguilar
Francisco Galtieri

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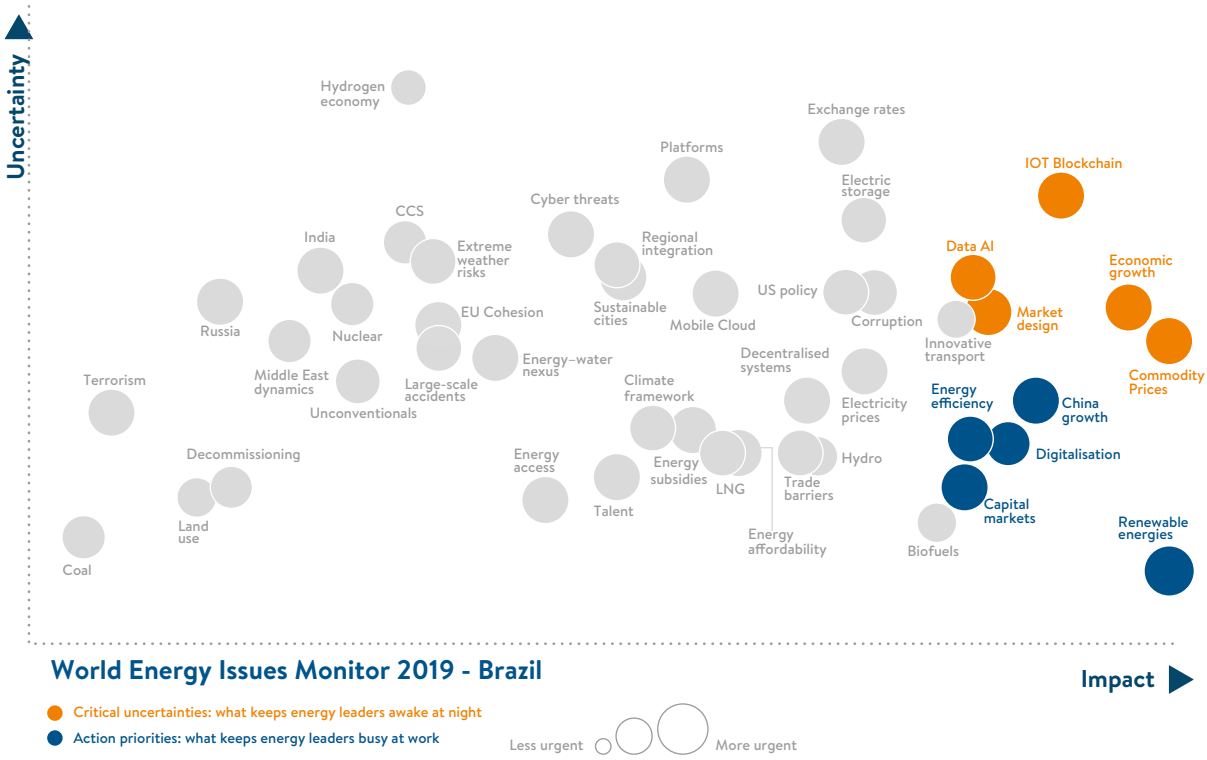
BRAZIL



NATIONAL OVERVIEW & CONTEXT

Three critical uncertainties identified by Brazil's energy leaders in this year's Issues Monitor are (i) IoT/Blockchain, (ii) Economic Growth and (iii) the Market Design of the power sector. Those issues show the effects of the three-year economic recession faced by the country from 2013 to 2016. These issues also illustrate the slow recovery from recent events such as the 2012 power sector reform, the critical hydrological period and the of liquidity crisis in the wholesale market. This crisis compromised the government's funding capacity to play a strategic role in the development of new power generation capacity and transmission lines projects. Unfortunately, the electricity market structure was not prepared to deal with the sudden removal of the state's financial support and, at the same time, to mitigate the effects of demand downturn related to the economic recession. This context led to uncertainties among energy stakeholders and investors and forced the new government to adopt an emergency plan in 2017/2018. The political effects of the recent impeachment process and new corruption investigation cases against some new government members have eroded the government's capacity to succeed in approving the proposed sector's adjustments in the Congress.

The position of IoT/Blockchain as one of the key critical uncertainties is emblematic of the existent gap between the Brazilian and other developed countries' energy markets. Energy leaders in Brazil are concerned about the emergence and dissemination of new disruptive technologies without previous planning and changes in the market's regulatory framework. There are also uncertainties related to the Economic Growth issue and to the implementation of a new Market Design.

On the other hand, three action priorities are highlighted in the Issues Monitor: (i) Renewable Energies, (ii) China and (iii) Digitalisation. Those issues reflect how stakeholders from the private

sector are reacting to the crisis through the improvement of investments in new renewables electricity sources that can be funded by private capital markets as wind and solar sources, mainly considering the likely subsidy reduction. This is also closely related to the raising participation of transnational players in the marketplace, specifically with Chinese investors playing an important role in the adoption and dissemination of digital technologies and efficiency improvement.

KEY ISSUES FROM THE NATIONAL MONITOR

IoT/Blockchain technology promises a disruptive future in the business model of energy trading. The fine tracking of the electricity flows, when associated with the Internet of Things – IoT, will boost the alternatives for trading and give new dimensions for electricity as a product. To secure all benefits from this new environment, it will be necessary to adjust regulation and consequently to change the business model of the electricity distribution and trading companies. The lack of a clear policy framework for this transition raises the uncertainty about the impacts of the application and dissemination of this set of technologies.

The recent Brazilian economic crisis was a result of a combination of economic policies that reduced the country's potential **economic growth** and of a fiscal crisis that led to unsustainable growth of public sector debt. Brazil will only be able to resume its growth once it solves the fiscal problem. The country's current huge overcapacity will sustain an initial recovery and boost development during the first years. However, in order to increase long-term GDP growth, the Brazilian economy requires productivity-enhancing policies.

The current regulatory framework of the Brazilian electric sector comes from the last reform made in 2004. After that, several changes have affected the market environment: the electrical sector reform accomplished in 2012, the critical hydrological period, the liquidity problem in the wholesale market, the inclusion of wind power in the electricity generation matrix, the adoption of new and more restricted environmental requirements for hydropower plant and dam constructions and the rising the penetration of distributed power generation in the grid. Energy leaders tend to agree that the existent **market design** cannot cope with all those changes and assure a good performance in the future considering the emerging disruptive events, such as the massive dissemination of electric mobility and distributed generation and the adoption of IoT/Blockchain

Renewable energies offer a range of options to meet the growing demand for energy, particularly in the context of the pursuit of economic development, which takes into account social and environmental issues. Brazil has abundant natural sources of renewable energy, such as wind and solar power, hydraulic energy, small hydroelectric plants, ethanol and bio-diesel. These sources form part of the Brazilian strategy aimed at satisfying the growing demand related to the economy recovery. As such, their development may be sensitive to subsidy reductions.

Investments made by Chinese companies in Brazil over the last 10 years amounted to US$55 billion, according to a survey conducted by the Brazil-**China** Business Council (CEBC). Chinese investment in Brazil's electrical system is being done by big companies including State Grid, Three Gorges, Shanghai Electric and Spic Pacific Energy. These companies bring new elements to the local market as new technology providers. Access to Chinese capital market and new entrepreneurial practices that will contribute to improving the efficiency as a whole.

Fast-paced innovations have been disrupting several industries over the last decades. Despite having changed little in the last century, experts agree that on the next few decades it will be the energy sector's turn. Companies will have to adapt to the increasingly complex supply chain, as variable and decentralised energy sources will become more relevant. The new generation sources (wind and solar) provoke the biggest impact on the sector, as they increase daily variability and reduce predictability into levels never seen before. In Brazil, growing relevance of wind and solar power also raises the challenge of aligning several new decentralised plants spread across the territory. Matching supply and demand has never been so complex. Fortunately, to withstand this complexity, **digitalisation** is also changing the operations landscape. Smart meters, remote controls, automated systems, real-time simulators, and other new technologies have increased their capability to predict, track, and respond to changes.

CONCLUSION

The election of a new Brazilian government provided the political conditions to address the energy sector's critical uncertainties and action priorities. It has also laid the ground to developing publics polices that are expected to drive the Brazilian energy sector to a new era of higher efficiency and greater benefits to the society.

The recovery of the Council's Brazilian Member Committee and its participation on the discussions, studies, workshops, seminars and Congress will be very important for Brazil develop its energy sector, improving its safety, equity, environmental sustainability, governance and management.

ACKNOWLEDGEMENTS

Brazil Member Committee, World Energy Council

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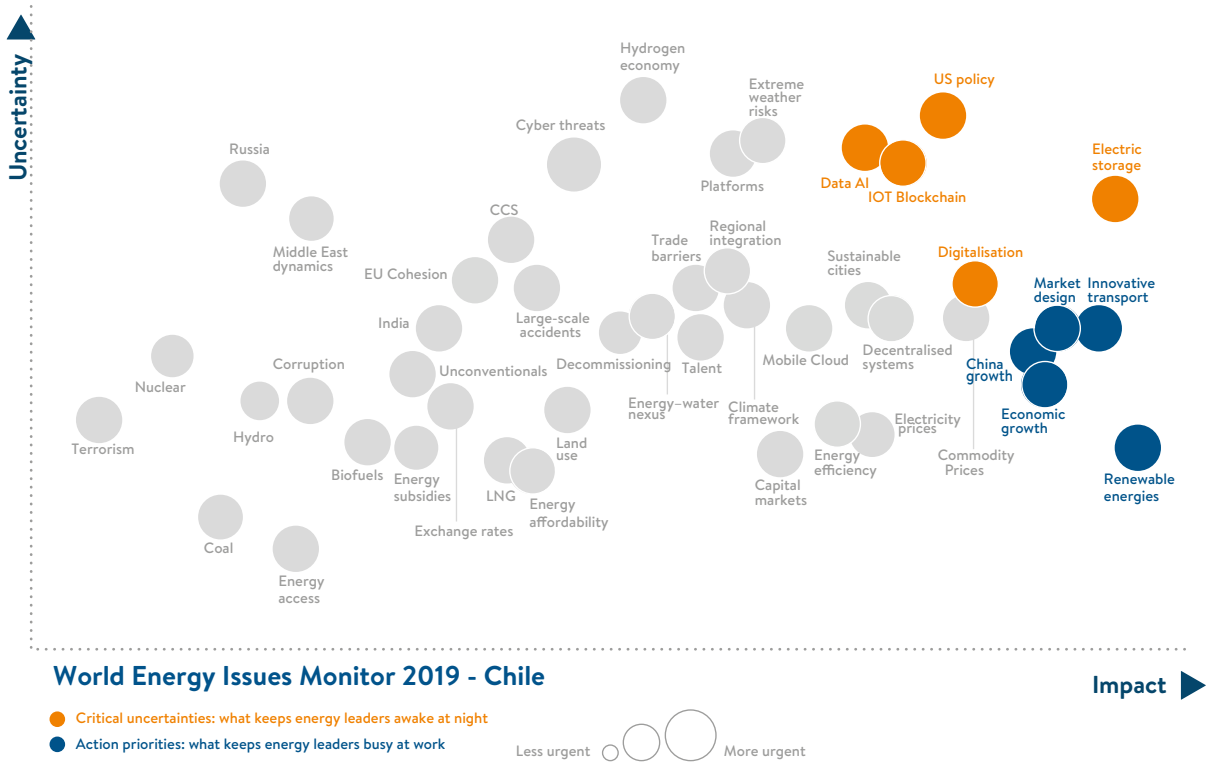
CHILE



NATIONAL OVERVIEW & CONTEXT

The 2019 iteration of Chile's Issues Monitor reflects the country's energy leader's efforts to modernise their energy system and prepare the way to take advantage of new opportunities and solutions linked to innovation and technological development. These opportunities include: new sources of electricity generation, distributed generation and storage solutions, e-mobility, management of energy demand and a number of options that will be at the service of the economic and social progress of the country.

It is essential that modernising efforts do not only focus on digitalisation but also on universal access to energy services and decarbonising the energy mix. The first point requires a focus on the thousands of people who still do not have electricity in their homes, affecting their quality of life and development prospects. The second point drives the sector towards the gradual but definitive construction of a clean energy mix that allows green and low carbon growth for the Chilean economy.

KEY ISSUES FROM THE NATIONAL MONITOR

Energy Modernisation has been identified as relevant as it is focused on the country's citizens. According to Chile's energy leaders, it is necessary to promote innovation. Efforts in this direction include a technological surveillance unit which allows Chile to look ahead and follow what is being done internationally. This will in turn allow Chile to implement better solutions to the requirements of the country through new technologies such as data AI, blockchain and digitalisation.

The geographical characteristics of Chile offer significant **renewable energy** potential. The country is endowed with abundant water resources, high levels of solar radiation in the north and good

wind conditions in certain areas. On the other hand, the development of renewables has allowed to adequately satisfy the energy demand and has quadrupled the supply of electricity in the last 25 years.

Energy access appears with a high impact in comparison with last year's results. The Ministry of Energy of Chile has integrated this issue on its action plans and is focusing on achieving universal access and developing an energy vulnerability national map. It is estimated that more than 15,000 families do not have access to electricity in rural and/or isolated locations, and another 15,000 have partial or dependent supply of diesel. Additionally, 12% of the population does not have access hot water, which increases to 31% in rural areas.

At the beginning of 2018, Chile began to apply **blockchain** technology to the energy sector to improve the data records. One of the benefits is being able to manage data and access it easily, in a secure manner. Information was included on the capacity of the national electrical installation, average market prices, marginal costs, among others.

Chile is considered as South America's most stable and prosperous nation, leading Latin American nations in competitiveness, income per capita, globalisation and economic freedom. Inflation is expected to stabilise due to the rising of the oil prices. Although **economic growth** is gradually accelerating, global market pressures have had a significant impact on the country. During 2018, political and economic uncertainties had decreased with the end of the electoral cycle. Based on the above, the work on a Map of the Energy Vulnerability in Chile (Mapa de Vulnerabilidad Energética), takes strength with the development of a survey and diagnosis of families that do not have electricity and other relevant energy services in their homes. This is expected to inform the actions of the Ministry of Energy and public institutions which are aligned around this challenge. By developing actions focused on reaching the population that do not have basic energy services, it will be possible to increase the levels of productivity and dynamism of the economy through investment that will improve the economic growth.

The electricity market is experiencing profound technological changes, which is why it is necessary to develop a **market design** that enables the efficient development of distributed energy resources, such as distributed generation, management of the demand and energy storage distribution. It is necessary to improve the regulatory framework associated with distributed generation, based on the findings and evaluations obtained from monitoring the market through improvements to the regulation of the generation legislation.

Innovative Transport: 35% of final energy consumption in Chile corresponds to the transport sector. From this, 98% corresponds to petroleum derivatives, making it responsible for about 20% of the total GHG emissions in the country. Current forms of transport also have an important local impact due to the pollution produced by consumption in urban areas. In this context, there is a need to implement public policies aimed at an efficient and sustainable use of energy in the transport sector, in line with the trend of the Energy Transition towards low-carbon and more sustainable economies. This will directly reduce GHG emissions, while diminishing Chile's dependence on imported fuels. On this regard, the Ministry of Energy has developed a public policy to replace the vehicles of some

governmental institutions to electric vehicles which reduces tare more environmentally efficient and improve the use of this technology from the public perspective.

CONCLUSION

The relevance and the constant transformation that Chile's energy sector is undergoing forces us to have a strategic and long-term view, with a country vision on the direction energy policy must take. This challenge implies understanding the current energy reality, which represents a completely different scenario from what Chile has experienced some years ago.

The challenges presented to us today are framed by the current logic of the accelerated development of the sector, making them increasingly complex. It becomes therefore imperative to look for innovate solutions with a participatory and decentralised approach. Energy leaders in Chile are increasingly focusing on working on solutions with respond directly to Chilean' evolving needs.

ACKNOWLEDGEMENTS

Chile Member Committee, World Energy Council

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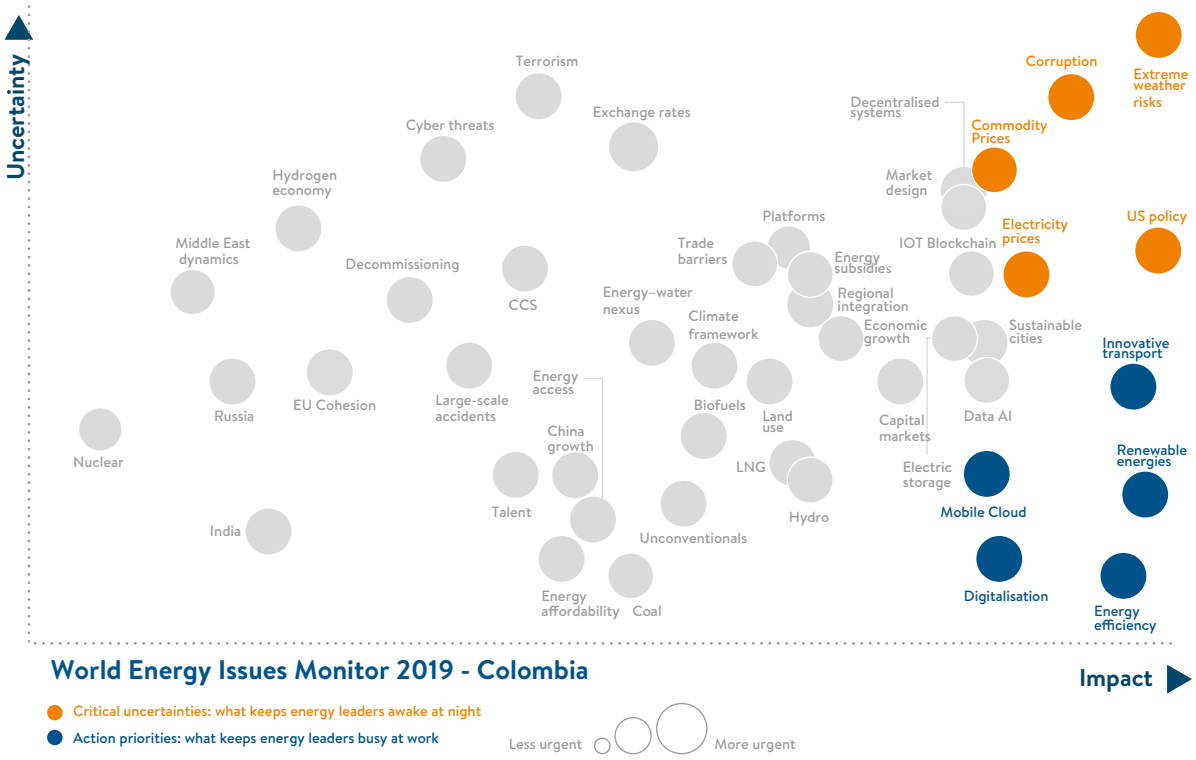
COLOMBIA



NATIONAL OVERVIEW & CONTEXT

This year, uncertainty remains regarding the impacts of El Niño on the Colombian energy system. Colombian energy leaders expect that the lessons from previous years as well as the advances in meteorological forecasts will allow Colombia to build a more robust roadmap to mitigate the negative effects of the phenomenon in 2019.

In 2018, civil society promoted a referendum to impose rules and sanctions on corruption. This has translated into legislative and regulatory actions, inducing higher transaction costs and discouraging foreign investment in the country. In addition, the policies of the United States on issues such as interest rates (commercial and environmental) created in 2018 a high degree of uncertainty for the Colombian energy sector in terms of investment and volatility of commodity prices.

Significant penetration of technologies in transportation has not been achieved. Regulation in this area is very complex and the incentives for the promotion of electric mobility move very slowly. The Council's Colombia Member Committee has proposed measures to be included in the 2018-2022 Development Plan and in the financing law for 2019.

KEY ISSUES FROM THE NATIONAL MONITOR

Extreme Weather Risks: The Global Climate Risk Index (2017) listed Colombia as one of the most affected countries by weather events, with losses estimated at US $ 315 million. Indeed, between 2015 to 2017, El Niño directly impacted over 719 municipalities Colombia through floods and landslides. Electricity generation is one of the most affected sectors due to the high vulnerability of its source mix.

Corruption: The 2018 Issues Monitor map identifies corruption as an issue with great uncertainty and great impact, displacing terrorism. The signing of the peace accord seems to be the key factor shaping this perception. The national referendum against corruption confirms the interest of Colombians to eliminating corruption and its negative impacts on the economy, politics, justice and everyday life. The transparency of contracting in the public sector will promote external investments by reducing the number of transaction contracts associated with corruption.

US policy: The United States is the main trading partner of Colombia as part of an agreement to fight drug trafficking in the region. This situation makes Colombia vulnerable to the direction of US foreign policy. Colombian energy leaders are worried that the current US Administration's foreign policy may hinder international efforts necessary to deal with climate change, corruption and problems with global impacts.

Renewable Energy: The main objective of Colombia's energy sector is to diversify its supply mix and reduce vulnerability to extreme weather events. Renewable energies are key for achieving this goal. Law 1715, enacted in May 2014, focuses on the development and use of non-conventional sources of energy within the Colombian energy system. This law gives tax incentives to companies that execute all kinds of renewable energy projects. This initiative goes in the right direction but not at the required speed.

Energy efficiency is key to the energy sector and the Colombia's competitiveness. The Indicative Action Plan, 2017 - 2022 of the Ministry of Mines and Energy promotes the rational use of energy through actions in the transport and industrial sectors and large energy consumers. It includes a new institutional arrangement highlighting, among others, the evaluation of the creation of an-Energy Efficiency (EE) Information Manager - GIEE and the promotion to agents that provide energy services for the execution of EE projects. The increase in EE for 2022 of 9.05% stands out.

Innovative transport: The growth of urban cities in Colombia entails great challenges in the provision of services to large and dispersed populations. In addition, poor air quality in cities is an important health concern for local governments. The objective is to achieve sustainable mobility through the penetration of clean technologies in transport, such as electric vehicles. The Colombian government is pushing the use of electric vehicles and the Council's Colombia Member Committee has developed recommendations on the topic. The Member Committee is also currently coordinating a taskforce on the subject.

The current situation of the Colombian electricity market is characterised by its low competitiveness, reduction of the quantities of energy offered in conditions of tight supply and high demand, lack of standardisation of contracts and high exposure to climatic phenomena. Solutions to this situation imply the diversification of the energy matrix by developing storage capacity, increasing the competitiveness of the sector, promoting technological reconversion and encouraging energy efficiency. Other action priorities include replacing liquid fuels and encouraging self-generation in areas which are not interconnected.

Digitalisation keeps its low uncertainty and is located in the priority actions section as it has a greater impact than previous years. The Colombian Member Committee holds events to promote

technological innovation in the sector. **Biofuels** move from a weak signal to priority actions. This can be attributed to the increase in gasoline blends and their contribution to reducing emissions. **Electricity prices** grow in uncertainty and maintain their perception of impact, which relates to the increase in the costs of restrictions (physical limitations or network operation) that go directly to the tariff.

CONCLUSION

According to the Colombia Issues Monitor map, in 2019, Colombian energy leaders will be busy focusing on extreme weather risks, renewable energy, corruption, energy efficiency and innovative transport. Dominated by fossil fuels and hydropower, the Colombian government has recently been working to encourage the development of non-conventional renewable energy sources. To this end, it has set a goal of increasing the capacity of these sources to 11,113 MW in 2018 (compared to 9,893 MW in 2013) and in adopted Law 1715, which provides for the integration promoting these sources and promoting both energy efficiency and demand-side measures.

ACKNOWLEDGEMENTS

Colombia Member Committee, World Energy Council
Jairo León García, Academic Secretary, Colombia Member Committee, World Energy Council

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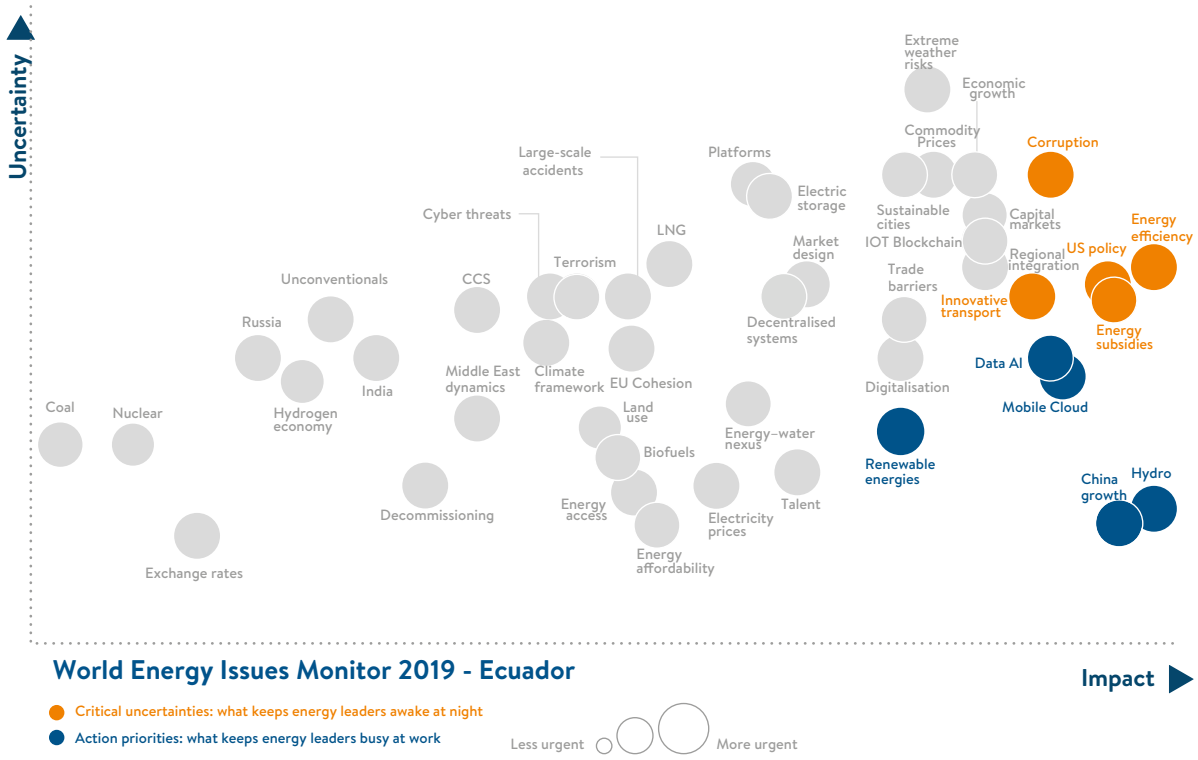
ECUADOR



NATIONAL OVERVIEW & CONTEXT

As an OPEC member, Ecuador counts with substantial oil reserves which provide for a major part of the country's revenue. Although oil provide for both power and other energy uses in the country, Ecuador's electric sector is increasingly incorporating hydropower as a major resource. In early 2018, a presidential austerity measure led to the merger of the Ministry of Electricity and Renewable Energy, the Ministry of Mining and the Secretariat of Hydrocarbons into the Ministry of Energy and Non-Renewable Resources. The new Ministry is tasked with recovering and attracting a diverse range of investment in the nation's power and mining sector.

In this year's Issues Survey, Ecuador's energy leaders have identified Corruption, US Policy and Energy Subsidies as the key uncertainties and sources of vulnerability for the national energy sector. All three issues determine the investment landscape and the ability of the country to attract the desired level of international investment. In turn, action priorities are focused around renewable energies and hydropower, in line with the government's objectives to diversify the national energy mix. China is also perceived by energy leaders as an action priority due to the high participation of Chinese enterprises in energy and infrastructure projects, and due to the country's high dependence on Chinese loans.

KEY ISSUES FROM THE NATIONAL MONITOR

Corruption scandals involving the state oil company Petroecuador and investigation over allegedly overpriced hydro and oil projects have been a major cause of contention over the past years. Large amounts of cash are unaccounted for and projects completion have been delayed due to unavailability of funds. In 2018, Argentinian, Brazilian, Chinese and American firms have been

associated with bribery cases in exchange for oil and infrastructure contracts fed further into the high uncertainty environment created by corruption in the country.

Investments in energy projects in Ecuador are made in US dollars, and investors' decisions are strongly influenced by the US government perception over Ecuador. In addition, the US is a key export market for Ecuador's oil and oil-related products. As a consequence, **US policy** has a strong impact on the performance of Ecuador's oil sector as it determines both government and private sector's relations in the country. In 2018 Ecuador resumed diplomatic relations with the US after 10 years of complicated relations. This has contributed to an improvement in investors' perception, but the landscape remains uncertain as the relations continue to depend on political decisions.

Total **energy subsidies** have fallen significantly in recent years, introducing significant cost changes to both energy investors and consumers used to operate in a traditionally subsidised sector. According to Interamerican Development Bank (IDB), after the sharp decline in prices for oil and oil derivatives from 2015 onward, energy subsidies in the country are estimated to have fallen to between 0.8% and 2.6% of GDP in 2016. At the same time, subsidies to the electricity sector have been lowered significantly as a result of initiatives in recent years aimed at increasing the share of hydroelectricity, reducing the volume of diesel and fuel oil used in thermal generation, and substituting GLP subsidies through the Energy Efficiency Program for Induction Cooking and Water Heating Using Electricity.

The Ecuador Electricity Masterplan for the period 2016-2025 places the focus on **renewable energies** a resource to optimise power generation. This strategy drives the reduction of reliance on fossil fuels to nearly complete self-sufficiency through renewable energies – particularly hydroelectric power. An important change for the management of the country's renewable and conventional energy resources took place in May 2018, with a government austerity measure that put all agencies under or attached to the former ministries of electricity and renewable energy, hydrocarbons and mining to be part of the new Ministry of Energy and Non-Renewable Natural Resources.

The Ecuador government is carrying on a strategy of diversification of the energy matrix and is allocating significant amounts of national resources to the financing of **hydroelectric generation** projects. Electricity generation capacity has doubled over the period 2006-2016. This increase was achieved through substantial public investment in nine flagship projects, eight of which are hydroelectric. The most notable of these is the Coca Codo Sinclair hydroelectric plant, which was completed in 2016 and is the largest hydroelectric project in the country's history. Investment in hydroelectric plants has helped to reduce the consumption of oil derivatives in grid-connected electricity generation, and, consequently, the imports and subsidies associated with this consumption.

Several Chinese companies – mostly state-owned – are present in energy development areas in Ecuador such as oil extraction and hydropower. Most recently, **China's** participation in the country's mining sector has expanded. China's presence is also enhanced by Ecuador's dependence on Chinese loans. Commitments have been made to use oil as an advance payment for credit, as the nation's

debit increase. One of the main concerns for private investors is the high interest rate required for such loans and the unequal competition environment in relation to Chinese companies.

CONCLUSION

Investment increase and energy mix diversification have been the main focus of attention of Ecuador's energy leaders as highlighted by the 2018 World Energy Issues Survey. As action is being taken to ensure the country is less depended on oil for its energy needs, a sustainable progress will depend on Ecuador's ability to create an attractive investment landscape and to reduce uncertainty on the political and economic fronts.

ACKNOWLEDGEMENTS

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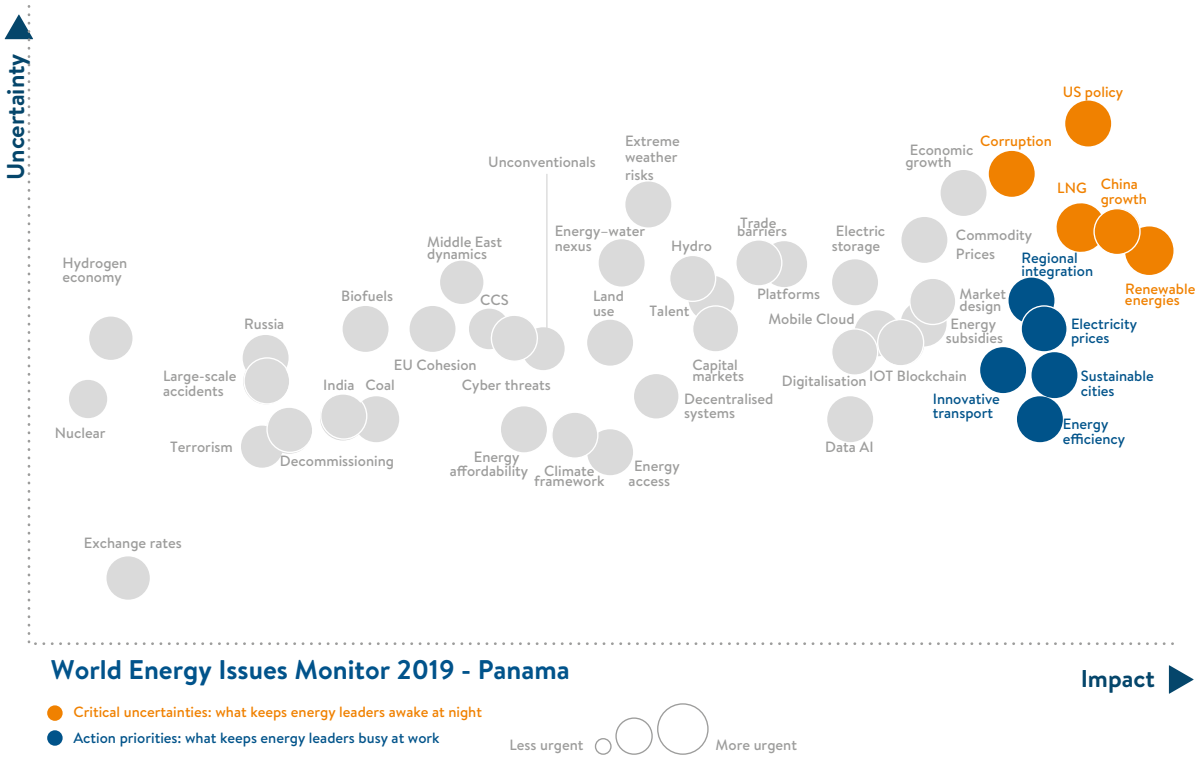
PANAMA



NATIONAL OVERVIEW & CONTEXT

Three critical uncertainties highlighted in the 2019 Issues Monitor of Panama are (i) corruption, (ii) the introduction of LNG in the generation matrix and (iii) the impact of diplomatic and commercial relations with the Peoples Republic of China (PRC). Unfortunately, corruption is still a topic that causes discomfort among Panamanians. After the international scandal of the “Panama papers” and the revelation of several acts of corruption by members of the past governments, there is a feeling of mistrust on the current government; consequently, affecting the execution of high-profile projects. Another important issue is LNG. Even though Panama is not a gas producer, the country can import it and is benefiting from LNG trade due to the expansion of the Panama Canal. Panama is currently betting on various LNG-related projects, starting on several electric power plants and aims to be the hub for distributing LNG to other countries of the region. Laws governing this issue are still being debated in the National Assembly. Finally, new diplomatic and strengthening of commercial relationships with China are of great concern. The government has signed several treaties, commercial agreements and memorandums of understanding with China, and it is unclear how the set of treaties and agreements will impact the country and the costs of the new projects to be built under such agreements.

Action priorities highlighted in the Issues Monitor include: (i) innovative transport, (ii) energy efficiency and (iii) electricity prices. Currently, the energy efficiency aspect is the most advanced stage in terms of the development of policy and regulations, even though implementation is still undergoing. Innovative transportation is still at the early stages. Dialogue involving academia, private and public sector is undergoing, to create a framework that allows an integration of policy, regulations and implementation of the new electric-based technologies. Finally, the cost of Energy

Transition and disruptive technologies needs to be assessed, including the changing the role of the consumer to become a prosumer, as well as the introduction of more renewable energies to the bulk energy system. These developments have brought challenges on how to set fair electricity prices. Members of the electricity sector are asking regulators for a set of clear policies.

KEY ISSUES FROM THE NATIONAL MONITOR

According to the Global Competitive Index 2017-2018 of the World Economic Forum, Panama is still one of the 50 most competitive countries worldwide. However, **corruption** is one of the critical issues. Panama scored 37 points out of 100 on the 2017 Corruption Perceptions Index reported by Transparency International [1]. Unfortunately, the energy sector does not escape the public perception that some aspects of its management and actions, specially at the state-owned transmission company, have doubtful or unsound reasoning. Nevertheless, this has not been proven and, at most, poor decisions by the past administration are to blame for delays and cost overruns of major projects led by said entity.

LNG may become a major driver for the economy of Panama. Part of the reasons are the possibility of the expanded Panama Canal of handling super-sized LNG tankers which can now navigate from the East Coast of the United States to the West Coast of North and South America, and even Asia. Panama could therefore become a natural gas hub for the area. LNG also has become a topic of interest for the energy sector, due to the starting operations of one natural gas fired power plant and plans for two additional power plants with commercial operation dates due in 2020 and 2023. This creates uncertainty in the electricity generation business, due to the excess of contracted capacity of one single power source.

In 2018, Panama openly started diplomatic relationships with the People´s Republic of **China**. It also signed several treaties, agreements and initiatives for projects. Moreover, the government is envisioning various infrastructure projects in part arising from the initiatives of the PRC and PRC based companies. This is creating uncertainty about the commitment of the government to projects and the feasibility of said projects.

Panama has historically had a close diplomatic and trade relationship with the United States of America. Trade into and from the USA is the main purpose of use of the Panama Canal. Due to the looming trade war between the US and China, and the reaction of the US government to China's increasing trading in the region, there is significant uncertainty in Latin America and Panama on the effects of **US policies** and actions.

Panama does not have fossil fuel sources of refining capacity of its own; therefore, its dependency of importing fuel for transportation is always a topic of discussion due to the price variation and costs of fuels, dependent on the international market. Public transportation is an issue leading to most of the Panamanians having their own vehicles, creating terrible traffic jams into and in Panama City. Various **innovative transport** alternatives have been implemented, from constructing a rapid transit system (Panama Metro) to promoting the introduction of hybrid and electric transportation. However, a regulatory framework is needed for the introduction of other energy sources for transportation. Said framework is currently under study.

Energy Efficiency is one of the key issues on which the National Secretary of Energy has been focusing on since the launch of the UREE law in 2012. Various policy and regulatory frameworks have been studied and established. However, the implementation of rational use programs is still underway. Educational campaigns on energy efficiency have been introduced in schools and to society through different media. Changes in the market on selling residential equipment to more efficient ones have been evident during the last couple of years. More complex projects such as the Guide for Sustainable Construction and Energy Efficient Labelling are pending proper governmental issuance.

Electricity prices is always of concern for Panamanians. This year, there was an uproar due to the government announcing an increase in the electricity prices for the end users of approximately 8%, mainly to cover for additional costs related to delays of the third transmission line. New bulk energy projects, as well as the expansion of the transmission lines and change in paradigm at the distributed level (distributed generation) are of concern in terms of electricity prices.

CONCLUSION

Panama is an emerging country characterised by its economic growth, which is still recognized as one of the best of the Latin American region. Nevertheless, Panama is still affected by corruption and the lack of government transparency, although efforts are underway to amend this by digitalising government processes.

Panama seems to be adapting to global trends, including the introduction of technologies such as LNG, renewable energies, and the inclusion of innovative transportation and energy efficiency systems. The challenge lies in how to achieve a fair but competitive market for the conventional technologies and the new ones.

ACKNOWLEDGEMENTS

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Marta Bernal
Jose Brenes.

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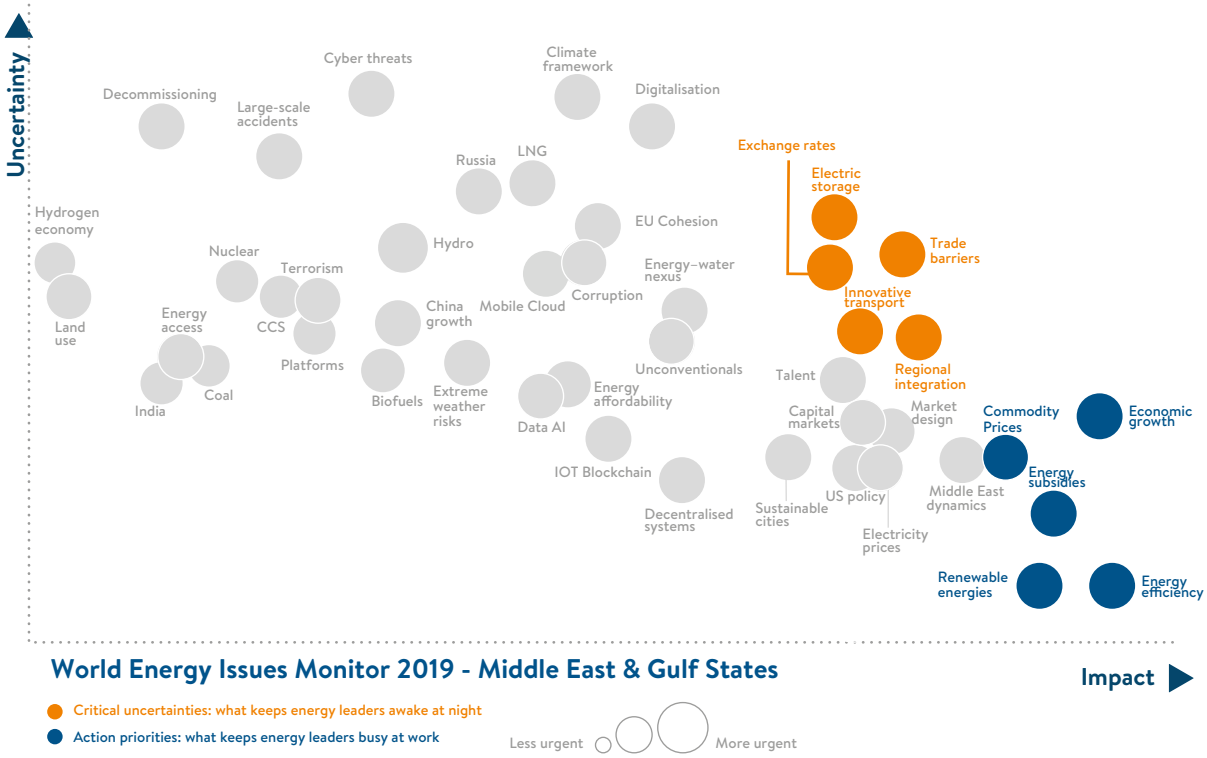
Chapter six

Assessing the energy agenda for the Middle East and Gulf States

MIDDLE EAST AND GULF STATES



REGIONAL OVERVIEW & CONTEXT

The Middle East grappled with a highly volatile oil market in 2018 as the region's largest oil producers, led by Saudi Arabia, the UAE and Kuwait, were forced to cut production to prevent oil prices from sinking under the weight of excess supply as they did by the end of last year. The surplus was caused largely by the relentless rise in US shale oil output, making the US the world's largest producer of oil ahead of Middle Eastern kingpin Saudi Arabia. This changing dynamic has eroded the power that the Arab members of the Organization of the Petroleum Exporting Countries (OPEC) once wielded over the oil market and the price of a commodity that is the mainstay of their economies, which remain highly dependent on oil revenues. That is why Commodity Prices have been identified in the 2018 Issues Survey as an action priority for the Middle Eastern states. The region's oil importers such as Jordan, Lebanon and Israel, are affected positively by lower oil prices while for governments in the oil producing nations, a lower oil price provides an opportunity to remove remaining subsidies on fossil fuels and electricity without the risk of a public backlash while boosting revenues and curbing domestic consumption.

The Gulf states, including Saudi Arabia and the UAE, began introducing subsidy reforms when oil prices collapsed in late 2014 and are in the process of lifting remaining subsidies that previously ate up a large chunk of state budgets and allowed for rampant energy consumption. Energy Subsidies remain an action priority and success in implementing planned price reforms are crucial as the Middle Eastern nations have begun to diversify their energy sources, particularly in power generation, where oil and gas are dominant.

Demand for electricity in the Middle East is growing in line with economic growth and an expanding industrial sector, coupled with high demand for energy for air conditioning during the summer

months and for desalination of water. According to the Arab Petroleum Investments Corporation (APICORP), electricity demand in the Arab world has increased 10-fold since 1980 due to population growth, industrialisation, urbanisation and subsidies. APICORP says that although growth rates have slowed because of slower economic growth and the partial removal of subsidies, the MENA region will need to add capacity at 7.4 percent annually until 2021, which corresponds to additions of more than 130GW and would require investments of approximately USD180 billion.

Governments continue to meet this challenge by expediting new projects and upgrading their infrastructure while also encouraging the private sector to join as partners and financiers. Most Arab countries are struggling to meet increasing electricity demand and thus experience frequent blackouts, as has been the case in Kuwait. Iraq is a special case due to the damage to its infrastructure after decades of war and internal conflict, a situation that has led to constant power shortages and social unrest. In Lebanon, subsidies on petroleum products and the state electricity utility are making it difficult for renewables to compete with fossil fuel powered generation despite the rapid decline in the cost of wind and solar technologies, which are being introduced gradually. Although the global trend is toward more decentralised power systems in much of the developed and developing world, in Lebanon, the government is trying to recentralise the power sector given the heavy reliance on higher cost private diesel generators.

KEY ISSUES FROM THE REGIONAL MONITOR

The introduction of variable energy sources such as wind and solar means that **Electricity Storage** is a critical uncertainty though not one of overriding concern. It may become a bigger concern as the share of renewable energy technologies increases across the region. In many of the countries of the region, energy efficiency has not kept pace with the deployment of renewable technologies.

Both **Energy Efficiency and Renewable Energies** are identified as action priorities in this year's Issues Monitor, but there appears to be a two-track approach by many governments, which need to apply stricter energy conservation and efficiency measures to go hand in hand with the expansion of clean energy technologies. As the Middle East and Gulf regions are at risk from the impact of climate change and CO2 emissions, partly emanating from the energy sector, and fossil-fuel based transport sectors, urgent mitigation action is needed sooner rather than later.

Innovative Transport is identified as a critical uncertainty in the latest survey because there has been little done to encourage the use of electric or hybrid vehicles except perhaps in the UAE. UAE has also taken the regional lead in introducing technologies such as Carbon Capture Storage and Utilisation (CCSU) and is set to have the region's first nuclear power plant operational soon.

These action priorities are coupled with Energy Efficiency and Renewable Energy policy actions that are still lagging in much of the region except in the UAE, where solar power has now been integrated into the energy mix to lessen reliance on natural gas (natural gas accounts for more than 90% of the energy mix in power generation). This has forced the UAE to become an importer of LNG. The same applies to Kuwait, which is building a permanent LNG receiving terminal to cope with rising power demand. The UAE and Oman are still importing pipeline gas from Qatar through the Dolphin pipeline though the continued diplomatic rupture between Abu Dhabi and Qatar after the UAE, Saudi Arabia

and Bahrain imposed a trade embargo on Qatar, makes an increase in volumes from Qatar to the UAE unlikely. The crisis with Qatar, where there has been no sign of progress toward a resolution, has complicated efforts to achieve broad **Regional Integration** which looms large as a critical uncertainty.

CONCLUSION

The Middle East and Gulf States regional energy commentary would not be complete without mention of Iran and the impact of the US' withdrawal from the nuclear agreement known as the JCPOA and the imposition of new sanctions against Tehran's energy, banking and shipping sectors by Washington. The sanctions have introduced a new level of volatility to oil markets, at one point forcing oil prices to rise above USD80 per barrel for benchmark Brent Blend in late 2018. This and the threat of slower global economic growth due to the still ongoing trade dispute between the United States and China, added to oil market volatility. That is why Trade Barriers are included as a critical uncertainty for the Middle Eastern states, which export the bulk of their oil and gas to the Asian market with China in the lead as the largest consumer of energy.

ACKNOWLEDGEMENTS

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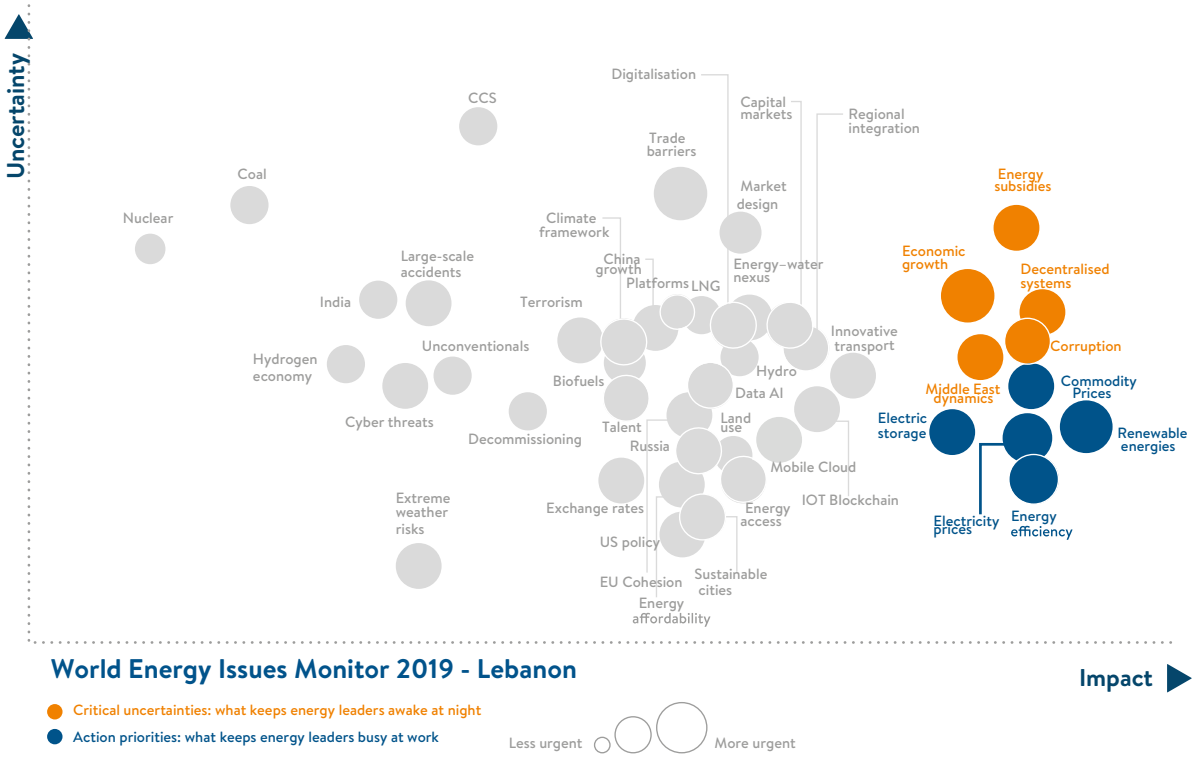
LEBANON



NATIONAL OVERVIEW & CONTEXT

Critical uncertainties and action priorities for energy leaders in Lebanon have evolved since the last Issues Monitor. Looking ahead to 2019, slower economic growth and the delay in forming a government are the main challenges facing Lebanon, while for energy leaders, key concerns are energy subsidies and decentralisation. These issues were previously marked as “Action Priorities” in the 2017 Issues Monitor. In the late 2017’s, the Lebanon Central Bank, Banque du Liban, suspended loans for subsidised housing due to unprecedented demand, which affected all subsidy schemes, including energy loans. The economy is flat lining, partly due to political uncertainty but also due to regional turmoil. The spill over of the conflict in Syria has strained the budget and infrastructure of the country. Lebanon is hosting around 1 million Syrian refugees and, according to UNHCR, the UN Refugee Agency, the 2019 budget forecasts the cost of supporting the refugees at 0.56 Billion USD, compared with 0.46 Billion USD in 2018.

An important shift was seen in commodity prices, previously an issue of the highest uncertainty, it has now become an action priority. A new action priority is electric storage, particularly in view of the move toward recentralisation and a more diversified energy mix. Renewable energy, energy efficiency and electricity prices remain action priorities. The predominant source of renewable energy in Lebanon and the one with the highest installed capacity is hydropower. The government is working actively to increase the share of solar and wind energy through Public-Private Partnerships (PPP). Once the Solar PV and wind farms under Power Purchase Agreements are operational, total installed capacity will rise to around 1 GW, divided almost equally between solar PV and wind. It is important to note that one of the solar PV farms under PPA includes a battery energy storage system for more grid stability, hence the heightened interest in electric storage.

KEY ISSUES FROM THE NATIONAL MONITOR

The Lebanese economy has taken a hit because of domestic political instability as well as regional turmoil. GDP growth dropped from 1.5% in 2017, to 1% in 2018. The World Banks forecasts a GDP growth of 1.5% in 2019 and a population growth rate of 1.3%. **Economic Growth** is associated strongly with energy security. While the Lebanese government is taking strong action to narrow the gap between energy supply and demand, Lebanese consumers still rely on privately owned diesel generators for electricity supply. Having access to continuous and affordable energy is a key challenge due to its impact on growth in other sectors of the economy.

The energy sector in Lebanon is highly subsidised. **Energy Subsidies** are applied directly to oil products for final consumption and given to the national energy utility, Electricité du Liban (EDL), as a way to cut costs for the consumer. Subsidies were intended to benefit low-income groups, but higher income groups, which consume more energy, are the biggest beneficiaries. The highly subsidised fossil fuel prices are competing with renewable energy technologies, which is why the cost-competitiveness of renewables remains a topic of utmost importance for decision makers and energy leaders. Following BDL's decision to suspend loans for subsidised housing due to unprecedented demand, all subsidy scheme have been negatively affected, including subsidised energy loans.

The issue of **decentralised systems** has moved from being an action priority to a critical uncertainty. Electricity shortage is an ongoing dilemma in Lebanon; outages are frequent all over the country. Despite the fact that Lebanon is moving towards more utility scale projects, specifically in Solar PV, the grid capability and stability is still impeding this development. The national electricity utility (EDL) is working towards upgrading the grid infrastructure to handle this extra capacity and maximize its use. As for the rooftop solar PV installations, they are coupled with either generators or battery storage, which make this application less critical.

Renewable energies in Lebanon lead the action priorities. An increase in investments in renewable energy technologies is expected due to efforts from the public and private sectors. Lebanon's target is to reach 12% of renewable energy by 2020 and 15% by 2030. Renewable energy strategies are laid out in the National Renewable Energy Action Plan 2016-2020 (NREAP), an official document prepared by the Lebanese Centre for Energy Conservation (LCEC). State subsidies are helping to boost the deployment of renewable energy technologies by the private sector. The government has also launched several solar PV and wind energy projects under PPA agreements to help attain national goals.

Lebanon is keen to improve **energy efficiency** at the national level to reduce imports of petroleum products and to mitigate the impact of climate change. This is reflected in the National Energy Efficiency Action Plan 2016-2020 (NEEAP), also developed by the LCEC. NEEAP 2016-2020 targets demand-side management and specifies energy conservation measures and strategies in the different economic sectors. The implementation of energy efficiency measures will allow Lebanon to reach the INDC target of a 10% reduction in power demand by 2030.

In 2017, the economic viability of **electricity storage** was still debatable. However, it is now receiving greater attention from energy leaders, within the context of increased renewable energy

penetration and the need to ensure a stable and secure grid supply. In the world Energy Issues Monitor 2019, electric storage is of great importance because it expands the role of renewable energy in the generation supply mix. This role of electric storage was further endorsed by the government when it launched an Expression of Interest (EOI) for solar PV farms with battery energy storage systems with a total capacity of 210-300 MWp.

CONCLUSION

Lebanon's energy sector is improving thanks to the diversification of the energy mix. While the economy is growing at a slower pace, investments in renewable energy technologies are increasing at a remarkable rate. In parallel with private projects, the government is also providing enabling policies and is showing determination to reach national targets and combat climate change. Lebanon is also determined to diversify further its energy mix by including technologies such as Concentrated Solar Power (CSP) and bioenergy.

ACKNOWLEDGEMENTS

Lebanon Member Committee, World Energy Council

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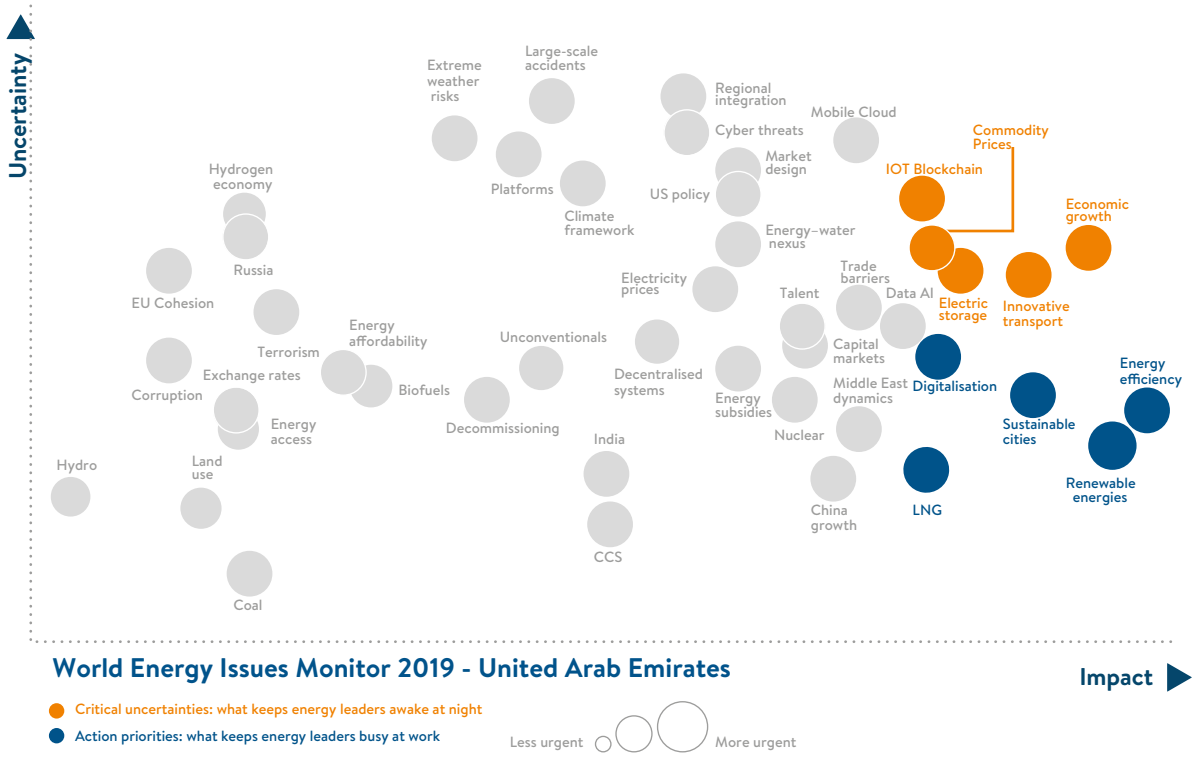
UNITED ARAB EMIRATES



NATIONAL OVERVIEW & CONTEXT

Oil and gas have historically been the dominant sources fuelling the United Arab Emirates' (UAE) economy. In 2012, the sector contributed to nearly 40% of the UAE's GDP. However, over the last few years, that has decreased making up only 19% in 2016. Sustainability is a critical component of federal and emirate-level plans in the UAE. Innovation and sustainability are given significant importance and play a role in tying the country's future to the vision of its leaders. The UAE Vision 2021 has set indicators to measure non-oil GDP and the share of clean energy in the country on an annual basis. In January 2019, the UAE leadership launched the National Expert Programme to develop a diverse base of national cadres and consultants who will help advance the UAE development progress.

The UAE was the first in the region to pursue steps toward energy diversification, introducing the country's first unified national strategy in 2017 called the Energy Strategy 2050. The plan aims to deliver clean and affordable energy to decrease carbon emissions, maximize energy productivity to stimulate further economic growth. While economic diversification is underway, the UAE economy is sensitive to commodity prices. The transition of the economy resulted in embracing innovative technology which brings uncertainty. The UAE Energy Strategy 2050 sets an ambitious target for renewable energy technologies and the onset of cheap and affordable electric storage and electrification of the transport sector will be essential to achieve the same.

KEY ISSUES FROM THE NATIONAL MONITOR

The top uncertainty for the sector is how **IoT/Blockchain** technologies will revolutionise the traditional energy sector. The supporting regulatory framework, which is to be developed, will

decide if this challenge can be turned into an opportunity. The recent restructuring of the federal government of the UAE addressed this concern through the appointment of a Minister of State for Artificial Intelligence.

While **economic growth** and diversification is a priority for the UAE, there is still a dependence on the oil rents to power economic development. Therefore, commodity prices continue to be an uncertainty that requires attention in the planning processes including the energy sector.

The integration and dispatch of must-run plants, especially renewable energy and nuclear power plants are also an important challenge. As the share of intermittent renewable energy technologies increases in the generation mix, power systems will be exposed to greater levels of uncertainty, variability and risk. Therefore, the uncertainty around **electric storage** prices will change the modus operandi for the sector.

The country's energy consumption has slowed in recent years compared to the jumps in 2014 and 2015, but demand continues to increase in line with population and economic growth. Along with the 50% target for clean energy by 2050 the demand side improvement of 40% was also set in 2017. There are individual Emirate level demand side management strategies as well as the latest Demand Side Management program under development on the federal level to implement the set target. In the Emirate of Dubai there are efforts underway to explore **digitalisation** and the use of blockchain technology through the Dubai Blockchain strategy which aims to make Dubai the first city fully powered by blockchain by 2020.

Renewable energies continue to be a priority area and large-scale plants are based on the build-own-operate model using project finance based on long term take off agreements. The 350MW of PV in Sweihan Abu Dhabi has an LCOE of 2.42 US$ cents/kWh by a Jingo Solar and Marubeni Corporation consortium. There is also focus on exploiting the potential for rooftop solar in the UAE. The Emirate of Dubai launched their rooftop solar net metering program Shams Dubai. There are also several applications such as the rooftop solar calculator Shuaa was launched at the federal level to promote the uptake of the technology.

The design of **sustainable cities** is also an action area on which the UAE has been focusing. The Sustainable City in Dubai is a residential and mixed-use development located in Dubailand. Covering 46 hectares (5 million square feet), the development applies sustainability principles to achieve social, economic and environmental outcomes. Completed in 2016, Phase 1 of the development has become an international case study for sustainable living, work, education, and wellness, and aims to become the first operational Net-Zero Energy development in the region. Additionally, Dubai is among the cities part of the C40 initiative.

The **energy-water nexus** continues to be part the energy agenda and efforts to reduce the consumption and decouple from the fossil fuel-based cogeneration and more towards reverse osmosis. This will be complementary to the higher uptake of renewables in the country. The peaceful nuclear program in the UAE has become a benchmark for the world in terms of the public acceptance. Nuclear energy is defined as clean energy in the UAE context and will be 6% of the total installed capacity by 2050.

CONCLUSION

The uncertainties raised by the sector in the UAE are reflective of the narrative around the future of the energy systems. Renewable energy coupled with energy efficiency and electrification of the end users is the area of focus for the policy makers in the country. The layering of information technology onto the energy sector results in new challenges and opportunities. Similar to the energy leaders around the world, commodity prices are of concern for long term planning.

ACKNOWLEDGEMENTS

Ministry of Energy and Industry
H.E. Eng. Fatima Al Foora Al Shamsi, Assistant Undersecretary Electricity & Water & Future Energy Affairs
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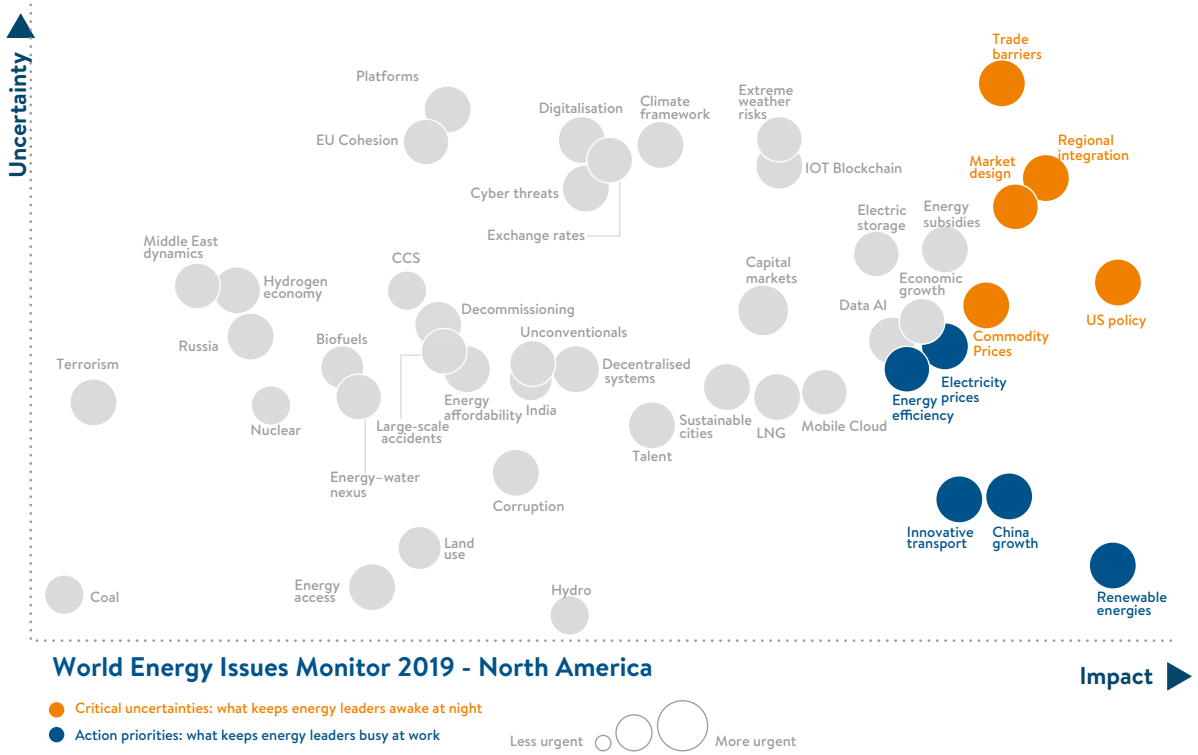
Chapter seven
Assessing the energy agenda for North America

NORTH AMERICA



REGIONAL OVERVIEW & CONTEXT

Natural resource development is a significant component of the GDP for all three North American countries. Since both the production and use of fossil fuels play a large role in the North American energy sector, the challenge of meeting emissions reduction targets is significantly greater than it would be for countries lacking fossil fuel resources. While greater electrification, using less-emitting generation sources remains a general policy objective across Canada, Mexico and the US, overall energy end-use remains primarily non-renewable, fossil-based sources.

On the economic front, the US-initiated renegotiation of the North American Free Trade Agreement presented a degree of inevitable uncertainty for the North American energy sector in 2018. Tariffs and countervailing tariffs in the steel and aluminium sectors present negative cost effects on energy projects in all three countries. Despite some areas of cooperation, disparate frameworks continue to hinder the optimal effectiveness of a North America response to the global issue of climate change.

North American energy professionals remain keenly aware of the fast-paced disruption, and enhancement opportunities, that big data, artificial intelligence, and the internet of things (IoT) are presenting to established business models. The advent of blockchain technology in particular is of special interest for those involved in electricity distribution and trade. Increased energy efficiency continues to be one of the most common and cost-effective ways to reduce greenhouse gas emissions across North America. The widespread deployment of new renewables is also helpful in this regard however, but they can present both physical and operational challenges.

KEY ISSUES FROM THE REGIONAL MONITOR

For the North American region, **US policy** poses a continued uncertainty. Strong and sometimes threatening rhetoric characterised talks between the US, Canada and Mexico during the renegotiation of the North American Free Trade Agreement in 2018. Trade wars and tariffs, both real and threatened, added additional uncertainty as different sectors of the economy, including energy, worried how they may be directly or tangentially affected. US federal reductions in taxes and regulations have Canada and Mexico reviewing their competitiveness, particularly in the energy sector.

The ever-increasing gathering of real-time **data**, combined with the growing deployment of **artificial intelligence** to analyse and act upon it, presents challenges and opportunities to the energy sector. It also produces a persistent and potentially growing new source of uncertainty in decision making. While this evolution may promise significant new energy sector efficiencies, it will also disrupt established business and economic models. It also necessitates persistent vigilance in the domain of cyber-security.

Canada, Mexico and the US are all constitutional democracies and federated countries with unaligned and frequent elections. They each face persistent challenges in aligning their own internal **climate change frameworks** at national, sub-national and municipal levels, let alone pursuing a consistent continental approach. Yet, without greater continental policy alignment, concerns such as carbon leakage and competitiveness issues persist. Frequent sub-national and national changes in climate policy directions in all three countries produce collective uncertainty for the energy sector.

International wisdom says that the least expensive and most environmentally benign unit of energy, is the unit that is not consumed or produced in the first place. Since no form of energy comes without cost or impact, it is not surprising that North American respondents rank **energy efficiency** as their primary action priority. Notwithstanding any relative strengths or weaknesses in energy production or distribution, increased energy efficiency is equally beneficial and important to all consumers in all countries.

While reducing the use of energy through conservation and efficiency remains the best method for cutting costs and emissions, energy demand generally continues to grow. Canada, Mexico and the US have experienced significant emissions reductions by deploying **renewable energies**. Technological improvements, reductions in equipment cost, and economies of scale achieved through larger scale adoption, have made renewables increasingly viable and attractive. Better integration of North American renewables may offer additional advantage.

Energy **blockchain** straddles Critical Uncertainty and Action Priority as the energy sector monitors developments and attempts to discern how profound or potentially disruptive advancements in this area may be. Greater automatic communication between people and their houses, devices, appliances, vehicles etc. offers opportunities for more precise, tailored, peer to peer management and trade of energy. Pilot projects and experimentation has occurred, the North American energy sector will need to remain watchful in this area.

CONCLUSION

Despite any uncertainty from the renegotiation of the North American Free Trade Agreement, the free and fair trade of energy between Canada, the United States and Mexico continues to enhance the three economies. Prior preoccupations with energy self-sufficiency are ceding to new conversations about greater energy trade both within North America and with the rest of the world. Significant new supplies of North American oil and natural gas are looking for new domestic, continental and international markets. Meanwhile, all three countries on balance, will likely seek to continue reducing emissions through national and sub-national policy initiatives. Collaboration around climate policy offers a significant area of opportunity for achieving emissions reductions while enhancing North American economies.

ACKNOWLEDGEMENTS

Jacob Irving, President, Energy Council of Canada

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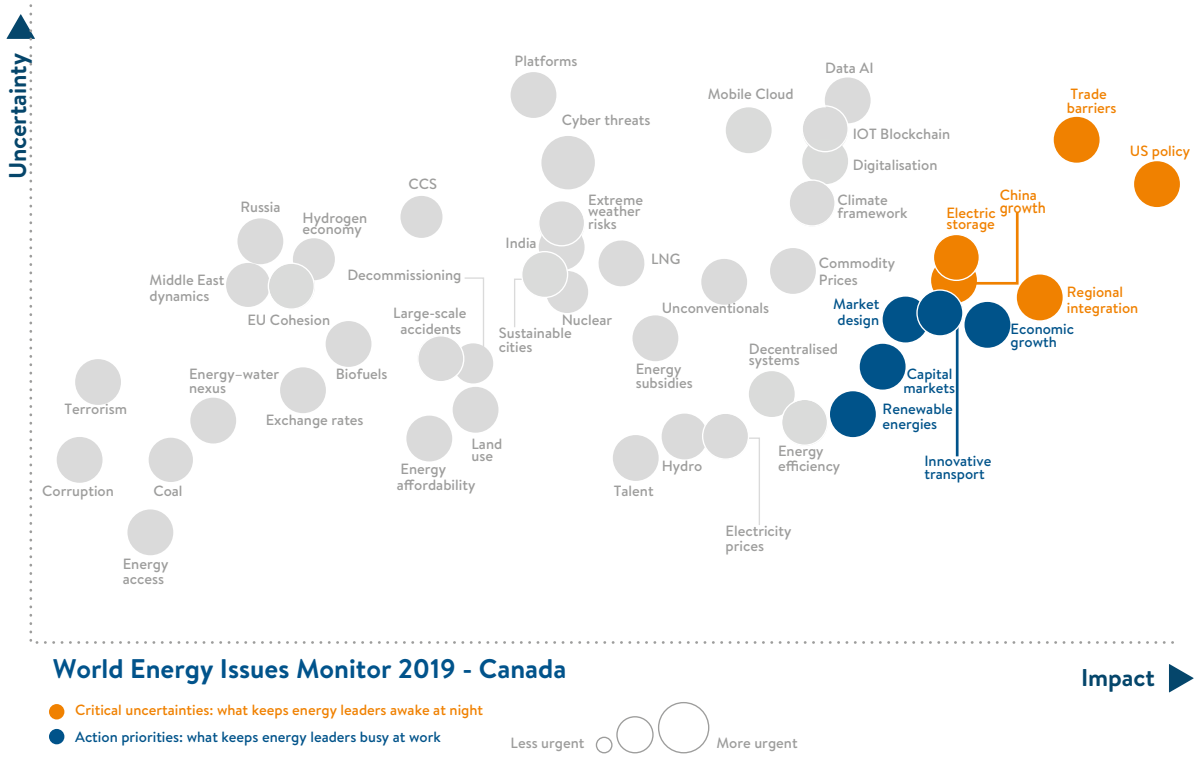
CANADA



NATIONAL OVERVIEW & CONTEXT

In the 2018 iteration of the Issues Survey, Canadian energy leaders identified US Policy, Trade Barriers and Climate Framework as their top three Critical Uncertainties. On the other hand, energy leaders identified decentralised systems, economic growth and renewable energies as the top three Action Priorities.

The renegotiation of the North America Free Trade Agreement posed persistent uncertainty to the Canadian economy in 2018. As a net exporter of energy, access to existing and future markets in the United States remains a paramount priority for Canada. The only issue that received greater attention was Canada's efforts to access new global markets beyond the USA for its energy products. Climate policy remains a critical uncertainty as policy directions by the federal government and provincial governments evolve.

KEY ISSUES FROM THE NATIONAL MONITOR

The renegotiation of the North American Free Trade Agreement (NAFTA) in 2018 was volatile and, at times, acrimonious. While early indications were that energy would not face great difficulty in the re-negotiation of NAFTA, nothing was certain. Fears persisted that energy could be used as leverage related to other, more contentious areas of negotiation. Inflammatory rhetoric combined with unprecedented action across the policy spectrum in the United States, ensured that Canadian leaders within and outside the energy sector, took nothing for granted.

While the free and fair trade of energy persists across the Canada/US border, concerns remain. Steel and aluminium Tariffs imposed against Canada by the United States, justified as National Security

measures, are making energy projects unnecessarily more expensive in both Canada and the United States. US Threats of further **trade barriers** and trade wars could negatively affect Canadian energy.

To help meet its Paris **Climate Framework** commitments, the Canadian Government has been negotiating policy actions with the Provinces. The Government has put in place an effective national price on carbon, beginning at $20 per tonne of CO2 from January 1 2019, rising by $10 per tonne annually to $50 per tonne in 2022. Provinces that do not implement plans to price carbon will have a federal backstop plan imposed upon them. This will remain a contentious national issue for the foreseeable future.

Canada is a pioneer and leader in High Voltage Direct Current transmission which underpins its regional electricity grids. Canadian utilities, governments and consumers are closely monitoring distributed generation and other unconventional approaches to the generation, transmission and trade of electricity. Many jurisdictions have adopted smart meters and related technology. **Decentralised energy systems** are of particular interest to Canada's many remote, off-grid communities.

Canada is a net exporter of energy and energy investments lead the Canadian economy. Traditionally, the United States has been a dependent customer. With new oil and gas supply technology, the US has become more self-sufficient and a competitor. Canada must find new export markets and build infrastructure to reach them if energy is to continue its traditional level of contribution to **Economic Growth**. Delays in major pipeline approvals are causing severe frustration, adding unprecedented political and economic uncertainty.

Over 80 percent of Canada's electricity system is non-emitting and the **renewable energy** sector, based on hydropower, wind, solar and biomass, is growing significantly. With the majority of its electricity coming from nuclear power, the Province of Ontario is the largest jurisdiction in the world to have eliminated coal-fired electricity generation. Renewable energies represent growth potential as Canada seeks to reduce its emissions. With large Canadian renewable potential remaining and a significantly more emitting electricity system to the south, there is great opportunity for the export of low emission electricity from Canada.

Indigenous relations remain central to the success of Canadian energy. True consultation, cooperation and partnership with affected people, based on mutual trust and respect, are necessary preconditions for any energy project to be built. Optimising the sharing of business opportunities and community benefits while minimising impacts on the air, land and water, especially in indigenous territories and areas of traditional use, remain paramount. While full agreement may not always be achievable on every project, every feasible effort must be made to achieve it.

CONCLUSION

Canada is an energy exporter with massive undeveloped potential that could do much more toward better satisfying global energy demand. Canada will continue to be a major energy provider to its closest neighbour and ally, the United States. Still, the country can do more by supplying other export markets. Canadian energy can not only become less emitting domestically, but it can also

significantly reduce emissions in other countries around the world. With enviable strength in both emitting and non-emitting energy sources and systems, it is incumbent upon Canada to grow its contribution to responsible energy development at home and globally.

ACKNOWLEDGEMENTS

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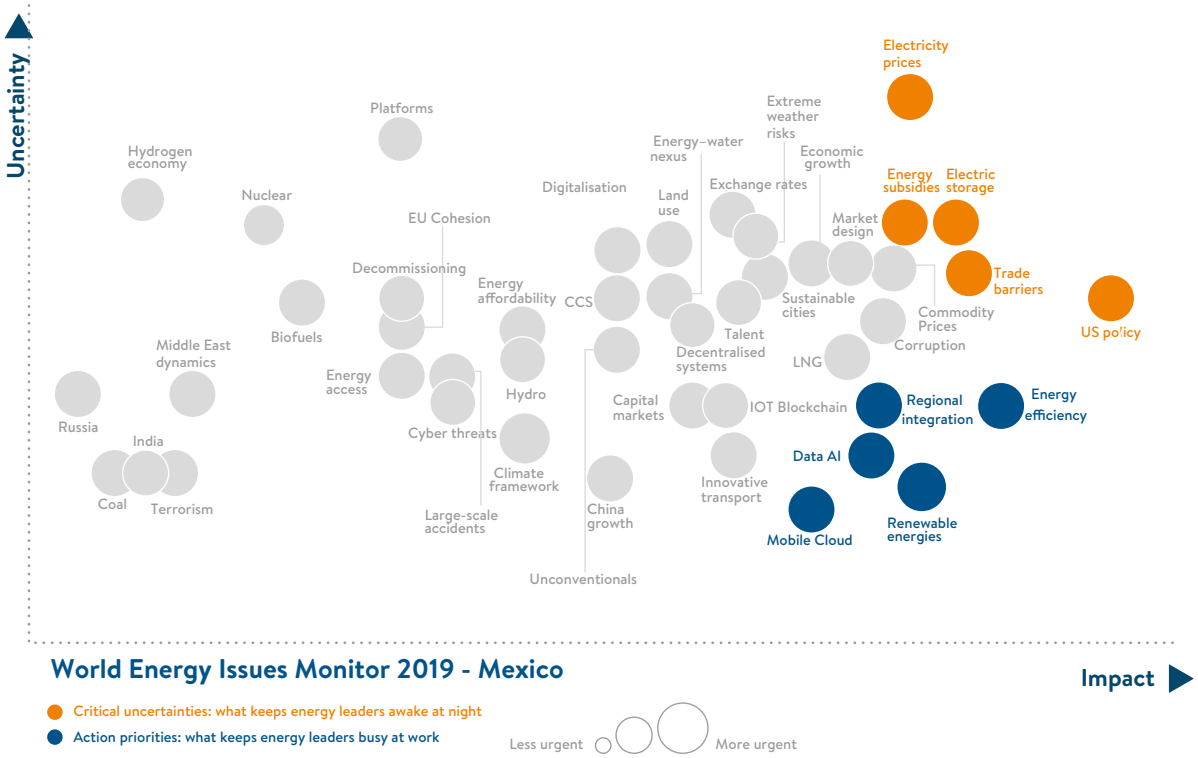
MEXICO



NATIONAL OVERVIEW & CONTEXT

At the time of the 2018 issues survey, Andrés Manuel López Obrador (AMLO) had recently been elected as the 58th president of Mexico. AMLO's campaign put the oil and gas industry on edge, with the promise to overrule the energy reforms passed under president enrique pena nieto. AMLO suggested he would reduce crude oil exports, diverting supplies for domestic refining. Mexico's aging refineries operate below capacity, and it has become increasingly dependent on imported fuel from the united states.

Uncertainty around U.S. Policies, which could impact oil products and gas exports to Mexico as well as trade barriers, have characterised the dynamics of Mexico's energy sector in this period. Concerns surrounding electricity prices, mainly industrial tariffs that increased of the order of 80% in 2018, have also led to major uncertainties among industrial sector leaders. On the other hand, 2018 saw positive developments in the energy efficiency and renewable energy spaces. A report carried out by the national commission for the "efficient use of energy" by the Economic commission for Latin America and the Caribbean (ECLAC), which assesses the country's progress in energy efficiency, has praised Mexico regarding its actions and programs. Some of the main factors behind the energy intensity decline include the outsourcing of the economy, structural changes, the substitution of fuels, and actions for energy efficiency in response to higher electricity prices. The integration of renewable sources onto Mexico's energy mix is also progressing positively, although financial and social aspects have created some obstacles to project development. In addition, energy leaders' perceptions around regional integration have gained certainty following inclusion of clauses concerning the energy sector onto the recently signed united states-Mexico-Canada agreement (USMCA) and with the connection of Mexico's electricity system with the north american reliability system.

It is also worth mentioning that the new administration has ratified Mexico´s ambitious goals for clean energies and international commitments related to climate change.

KEY ISSUES FROM THE NATIONAL MONITOR

Recent **U.S. Policy** towards Mexico has been characterised with volatility and unpredictability, causing concerns and raising uncertainty in the energy industry due to large amounts of US natural gas and oil imported to Mexico. Indeed, gas alone accounts for over 60% of Mexico's electricity fuels, nearly 65% of which is imported from the US. This increased reliance on US gas imports raises uncertainty, especially on prices, as the US plans to substantially increase exports to China and India, among other countries.

At the time of the Issues Survey (August-October 2018), the U.S., Mexico and Canada were discussing the termination of the North American Free Trade Agreement (NAFTA) and the creation of a new trade deal. The risk of heftier **trade barriers** was a primary concern for business and policy leaders as there was no certainty around the terms of the new agreement. In November 2018 the United States-Mexico-Canada Agreement (USMCA) was signed (although not yet ratified). The agreement includes an investor-state dispute resolution (ISDS) protection for oil and gas, infrastructure, energy generation and telecommunications among other rules that are expected to impact the energy sector.

In 2018, the implementation of a new formula to calculate **electricity prices** for the industrial and business sectors has raised uncertainty as the resulting tariff increase has led some small businesses to close. Increased electricity costs are expected to impact public water utilities who may be forced to increase the prices paid by consumer. The issue is on the agenda of the new government administration and is an ongoing concern.

According to the recently published National Report on Monitoring **Energy Efficiency** 2018, Mexico's residential sector has reduced its energy consumption by 45.9% from 1995 to 2015. The progress is due to stricter national efficiency standards and targeted public policies, which treat energy efficiency as an action priority and a means to maintain the country's productivity and competitiveness in the international and domestic market. An interesting point highlighted in the document is that the decoupling of economic growth and energy consumption is apparently underway.

In 2018, Mexico's market for clean energy certificates (CECs) have been activated as a fundamental resource in the country's ambition to increase the amount of electricity generated from clean energy sources, including **renewables** and nuclear energy, to 35 percent by 2024 and to 50 percent by 2050. A system of auctions for energy, capacity and CECs that offer long-term contracts has been designed to capture relative values of different generation technologies by both location and production profile. The clear investment framework and the resulting development of the renewables industry have placed Mexico among the world leaders in integrating climate change objectives into policy making.

The North American Foreign Ministers' Meeting which took place in Mexico in February 2018, reunited the governments of Mexico, the United States and Canada to discuss energy and the

renegotiation of NAFTA. During the same year, the main developments around **regional integration** has been determined by the replacement of NAFTA with the USMCA. An additional progress was achieved with the participation of the Mexican electricity system into the North American Reliability System.

CONCLUSION

The new U.S. Administration and the election of AMLO as the new Mexican president have determined most of the discussions leading to emerging uncertainties in Mexico's energy sector. At the same time, progress has been achieved around issues which count with a long-term action plan such as renewable energy and energy efficiency. While the discussions on the replacement of NAFTA raised uncertainties, the successful signing of the USMCA added a level of clarity to regional energy relations.

ACKNOWLEDGEMENTS

Mexico Member Committee, World Energy Council

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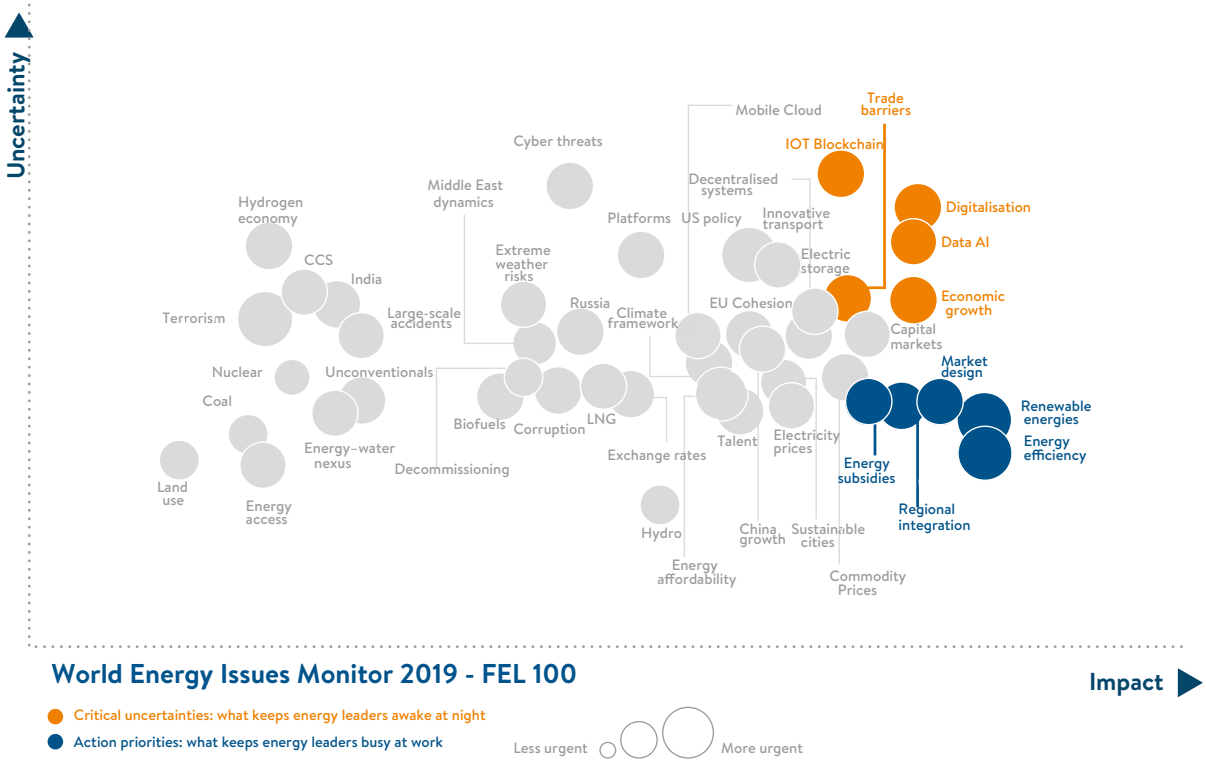
Chapter eight

Assessing the energy agenda for the Future Energy Leaders

FUTURE ENERGY LEADERS (FEL100)



OVERVIEW & CONTEXT

In the FEL100 2019 Issues Monitor, the three key critical uncertainties are IoT/Blockchain, digitalisation and Data AI. This is no surprise given how prominent these technologies are becoming in all economic sectors. These technologies have the potential to completely change the way we produce, consume, and trade energy. But uncertainties remain – how will these technologies evolve? What will consumers think of the technologies? How will regulators and utilities deal with them? How will the market adapt to promote their intrinsic value? The uncertainty might be high but so is the potential positive impact of these technologies.

The three key action priorities identified by the FEL100 community are renewable energies, energy efficiency and market design. It is worth noting that all three areas were ranked with low uncertainty, meaning that their impacts are well known. The FEL100 community found that these three areas could offer the greatest impact to the energy sector. Energy efficiency and renewable energies go hand in hand and are the primary tools we will use to decarbonise our economy. However, only with the right market design will we be able to cost-effectively and efficiently implement such solutions.

KEY ISSUES FROM THE FEL100 MONITOR

Historically, many countries felt that **economic growth** came first, and climate change and other social issues were secondary. However, we are now seeing economic growth suffering from our lack of sufficient action on climate change - many countries are beginning to feel the impacts, and decarbonisation is not a luxury. At the same time, new leaders are emerging. For instance, China has become a leading proponent of global action to tackle climate change and new developments in renewables are enabling wind and solar developers to be able to compete with conventional electricity generation often without subsidies.

The FEL100 represent the younger generation of energy professionals and we have grown up using digital technology – and thus more in tune with how digital technologies are transforming the energy sector. Many FEL100 members work for energy companies that see themselves more as technology providers rather than energy providers. It is therefore no surprise that the FEL100 have identified **digitalisation** as an area with high impact and high uncertainty. Furthermore, it is a mission of the FEL100 to develop strategies to explore, promote and anticipate these trends, understanding their impact on the scenarios for the Energy Transition and even considering more disruptive area for action.

Trade barriers can act as a significant obstacle to the update of new technologies. While some may argue that this may help encourage local manufacturing of energy technologies, the risks of climate change are too big to allow for the existence of barriers for the transfer of innovative energy technologies.

Renewable Energies are without a doubt, the vehicle to a more sustainable future. Future Energy Leaders are more certain than ever of the critical role. Renewable energies play a role in combating climate change and providing clean energy to future generations. The question is no longer 'shall we build renewables?', but instead, 'how we integrate renewables into our energy systems to ensure we deliver secure, equitable and environmentally sustainable outcomes?'.

To meet the goals set by the Energy Trilemma, we need the right policies and regulations to incentivise investment in renewable energy, in energy efficiency and new, innovative business models. As demonstrated in the 2019 Issues Monitor, FEL-100 believes that the proper **market design** is critical to facilitating low cost solutions while maintaining the principles of sustainability and social conscience.

The North American Foreign Ministers' Meeting which took place in Mexico in February 2018, reunited the governments of Mexico, the United States and Canada to discuss energy and the renegotiation of NAFTA. During the same year, the main developments around regional integration has been determined by the replacement of NAFTA with the USMCA. An additional progress was achieved with the integration of the Mexican electricity system into the North American Reliability System.

CONCLUSION

The Issues Monitor is an excellent tool to gauge through the landscape of the most pressing energy issues for the FEL100 community. It is clear is that future energy leaders are most concerned about new technologies on the one hand, and on policy measures such as the market design on the other hand. These issues are strongly related to the creation of a right market design that can adequately encourage the use of innovative technologies to tackle the problems of the energy trilemma.

ACKNOWLEDGEMENTS

Andreas Formosa
Andrei Covatariu
Bennet Tucker
Nuno Silva
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Methodology and Project Contributors

METHODOLOGY AND PROJECT CONTRIBUTORS

CONCLUSION

The World Energy Issues Monitor is based on an annual survey, comprising 42 energy issues and 4 digitalisation-specific 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 that are part of the network of the World Energy Council. The 2019 monitor is based on insights from over 2,300 energy leaders from 90 countries.

The data for the 2019 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.

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 Talita Covre by emailing covre@worldenergy.org.

THE INTERACTIVE ENERGY ISSUES MONITOR TOOL

The World Energy Issues Monitor provides unique global, regional and national perspectives which can be used in combination with our other tools such as the Energy Trilemma to enable countries to bring equity, security, and sustainability to all their citizens through the development of their national energy systems.

The World Issues Monitor Tool presents in one place dynamic map views of the decade of Issues Monitor data that has been collated by the World Energy Council. The maps convey a narrative of the key energy issues, regional and local variances and how these have changed over time. The tool allows the preparation of different maps for comparison and allows the manipulation of data by geography, over time, or by highlighting of specific energy issues.

- The geographical views can now be broken out into a country level
- The time view allows you to see how specific issues have developed, whether globally, regionally or by country.
- Issues can also be viewed according to certain categories such as OECD, non-OECD, G20 countries, innovators, etc.
- Where specific narratives explaining the country data exist, they are included in the tool.
- Customised maps can be downloaded and shared on Twitter.

THE 42 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)	Carbon capture and storage (CCS): CCS as a technology to prevent large quantities of CO2 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 hydro-power	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

Africa
Algeria
Benin
Botswana
Burkina Faso
Cabo Verde
Cameroon
Central African Republic
Chad
Cote d'Ivoire
Democratic Republic of Congo
Egypt
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Ghana
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Kenya
Liberia
Malawi
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ACKNOWLEDGEMENTS

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