

WORLD
ENERGY
COUNCIL

World Energy Issues Monitor | 2018

EXECUTIVE SUMMARY



PERSPECTIVES ON
THE GRAND ENERGY
TRANSITION

World Energy Issues Monitor | 2018

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OVERVIEW

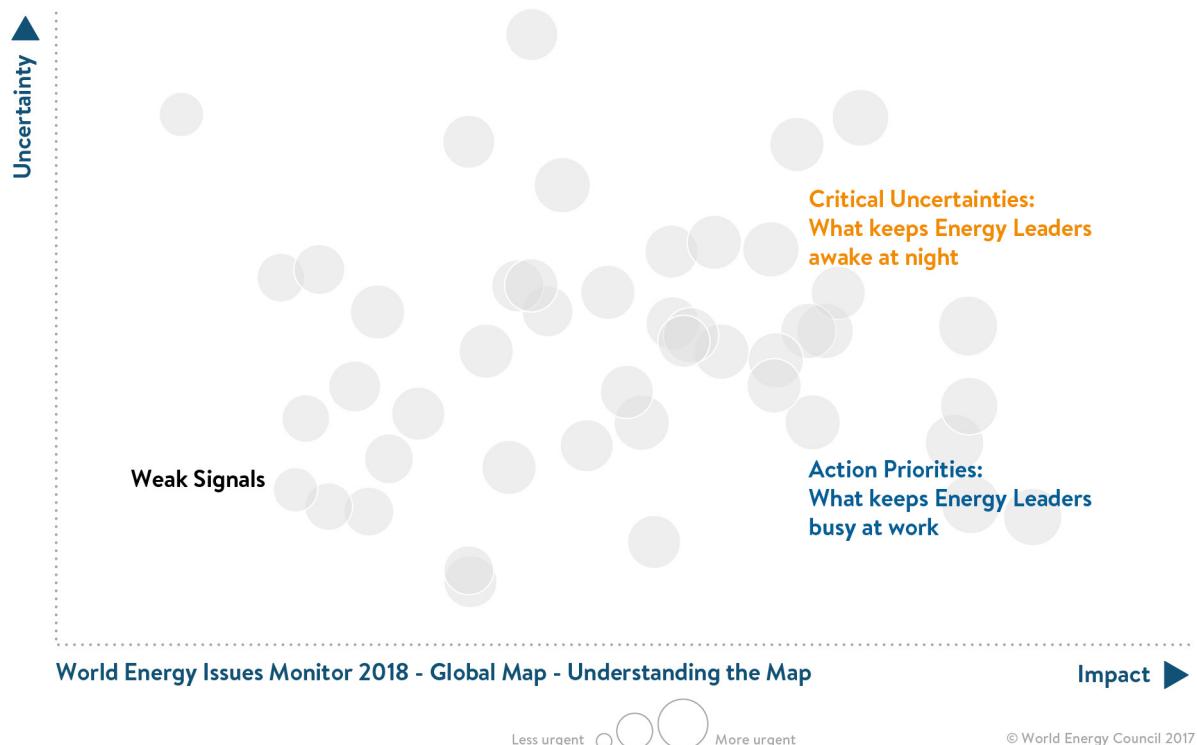
This is the ninth consecutive year of the World Energy Council's (the Council) annual survey of key challenges and opportunities faced by energy leaders in managing a robust energy transition. This year's report provides nine global maps, six regional maps and 38 national maps illustrating issues impacting the energy landscape in the different geographical contexts. This report also includes input from the Start-up Energy Transition Award community, which every year identifies 100 top innovators and start-ups in the global energy scene.

These maps have been developed by analysing the perceptions of key issues from over 1,200 energy leaders across the Council's national member committee network. The World Energy Council's Issues Monitor is the only instrument that identifies the energy context of specific countries and regions in the world, through an analysis of 42 issues affecting the energy system.

By providing a common platform for diverse actors and different countries to voice their concerns on the level of urgency, uncertainty and impact of key issues, this powerful tool offers unique insights into the pace and shape of energy transitions which are occurring at local to global levels.

An Issue Map is a visual snapshot of the uncertainties and action priorities faced by energy leaders. Using these maps, decision makers can develop a global perspective, appreciate regional variations, and identify key trends. The maps can also be used to monitor trends relating to specific technology solutions.

FIGURE 1: Graphical snapshot - Understanding the Issues Maps



The Council's Issues Monitor is one of the five main tools forming the **Transition Toolkit¹**, which are being used by the Council's members to appreciate the challenges of energy transition. The Council has developed these tools because navigating a robust transition requires new approaches to flexible cooperation across many and more diverse energy system actors. There is no right or best place to start with – the most important thing is to try to learn more about the state of the energy system and try to make change happen. Any one of these tools can be used by energy leaders and energy innovators across the many parts and levels of the energy system, to engage in conversation, forge new common grounds and develop new collaborative actions aimed at managing timely and robust energy transitions.

¹ Issues Monitor Report, World Energy Scenarios, Energy Policy Trilemma Index, Dynamic Resilience Initiative, and Innovation

HOW TO READ THE MONITOR

Categories and individual issues

The World Energy Issues Monitor assesses 42 issues in a high-level overview, covering four categories

(see figure 1 – Graphical snapshot - Understanding the Issues Maps):

- » Macroeconomic risks
- » Geopolitics
- » Business environment
- » Energy vision and technology

Dimensions/Axes

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

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

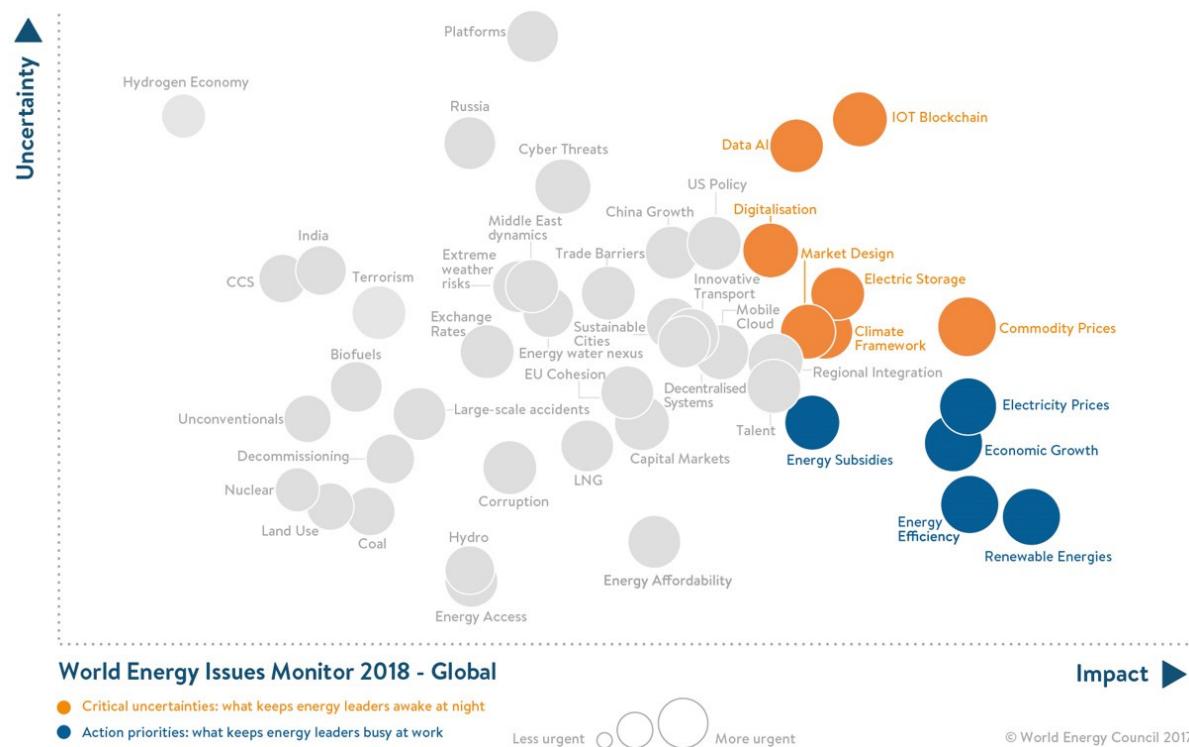
Zones within the Monitor

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

GLOBAL PERSPECTIVE

This ninth iteration of the Monitor provides a total of 53 maps across six regions to highlight differing regional and national priorities and the resulting global perspective on the energy transition. The resulting Global Map is built from the sum of national responses and it's shown below.

FIGURE 2: The Global Perspective on the Energy Transition



This global map provides a unique perspective which enables energy leaders to distinguish the signals of change that matter. The 2018 Global Issues Map indicates that innovation is the key area of concern. Issues such as digitalisation, electric storage, market design, decentralised systems, and renewable energies are receiving greater attention as their impact grows across the energy industry. The Global Issues Map also shows a decrease in attention around centralised technologies and greater certainty around electricity prices and energy affordability. We also see that increased impact of digitalisation is facilitating a rapid convergence of alternative technologies such as renewable energies, blockchain and data AI.

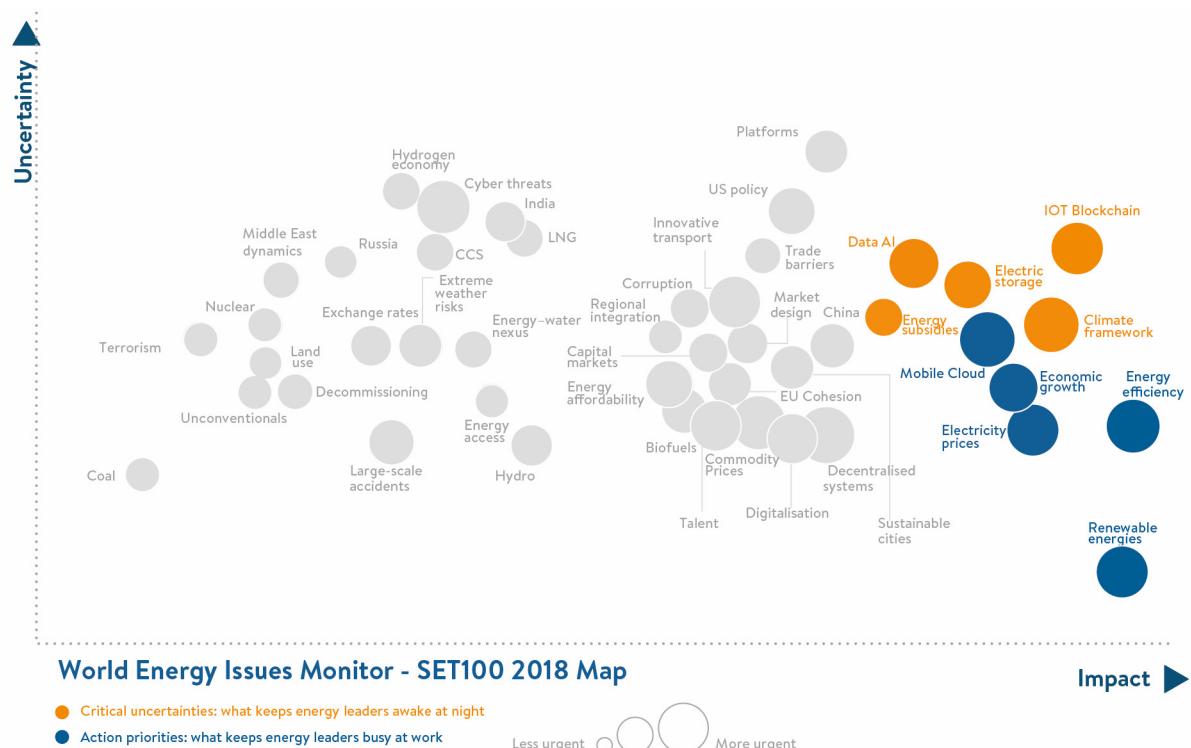
THE SUSTAINABLE ENERGY TRANSITION AWARD – THE INNOVATORS AGENDA

For the first time, the Issues Monitor has gathered input from the Sustainable Energy Transition Award (SET100) community, which every year identifies the 100 top innovators and start-ups in the global energy scene. This is an important global perspective to understand, as innovators, much like early adopters, set the tone for what is to come. Figure 3 shows how energy leaders compare with

energy innovators throughout the world. **Blockchain²** appears with the same level of high impact and high uncertainty in both SET100 and Global Perspective Maps. This suggests that the increasing pace of innovation is difficult for both start-ups and Energy Leaders to understand. Whilst we expect that innovators will focus on nascent technology and work to maximise its utilisation, it is fascinating that this new technology has also seized the imagination of the energy leaders around the world.

Renewable energies are also positioned with high impact but there is greater confidence about their increasing role. Other issues in the map such as electric storage are also gaining attention from energy leaders and innovators.

FIGURE 3: The SET100 Issues Map



² Blockchain is a digital platform technology that is being used to enable secure smart grid transactions – It is referred to as a distributed ledger technology. Distributed ledger technology platforms enable identical copies of recordings of transactions to be shared and viewed by all members of the network in real time, in the consensus process is used to agree on additions. The database itself can be used to confirm identities, apply time stamps, conduct transactions, and create records. For more information: https://www.worldenergy.org/wp-content/uploads/2017/11/Full-White-paper_the-developing-role-of-blockchain.pdf

OECD AND NON-OECD – COMPARISON OF THE AGENDAS

Figures 4 and 5 illustrate how OECD and non-OECD countries are defining their respective energy transition agendas and the underlying issues involved. These maps help reveal how issues are perceived differently between the two groups. For example, within the energy security dimension, the level of impact of **digitalisation** and **cyber threats** are perceived as substantial among OECD countries, whilst it's not a priority for non-OECD. Among the latter, economic growth is higher on the agenda and is strongly associated with energy security³ concerns. **Economic growth** is the differentiating priority energy concern between these two groups, as it frontloads and drives the action on all other issues in non-OECD countries while OECD countries are able to prioritise action on implementing new technologies and exploring the potential of digitalisation.

This difference can be also seen within the energy equity dimension where, even though **electricity prices** are similarly positioned between the two groups, the issue for non-OECD is highly impacted by energy affordability with a level of dependence on energy subsidies, while with the OECD it is more related to market change, with the influence of digitalisation, integration of new energy technologies and the conditions imposed by climate regulations.

As non-OECD countries develop, digitalisation and cyber threats will increase in impact for this group as well. This already creates new opportunities for cooperation around strategic learning about these ‘future’ issues, which can positively impact the transition by reducing the learning time for the non-OECD and contributing to further accelerate energy development.

Finally, a point of synergy exists around the environmental sustainability dimension which is similarly led between the two groups by actions on **renewable energy** and **energy efficiency**, even though the impact of **climate change** is higher among OECD countries. Still, the **energy water-nexus** has a much higher impact in non-OECD. This can be attributed to challenges faced by water management programmes which are severely by the impact of a fast-growing population and lack of natural disaster resilience infrastructure among these countries.

FIGURE 4: The Trilemma Dimensions in OECD Countries

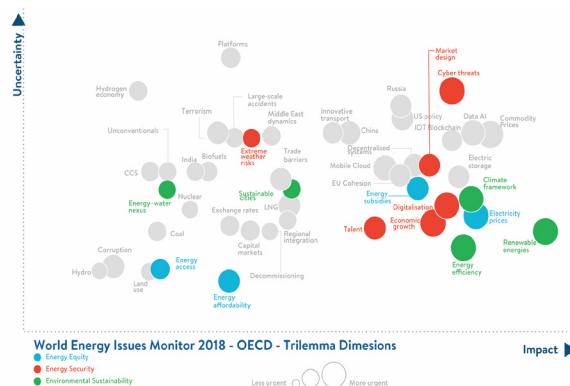
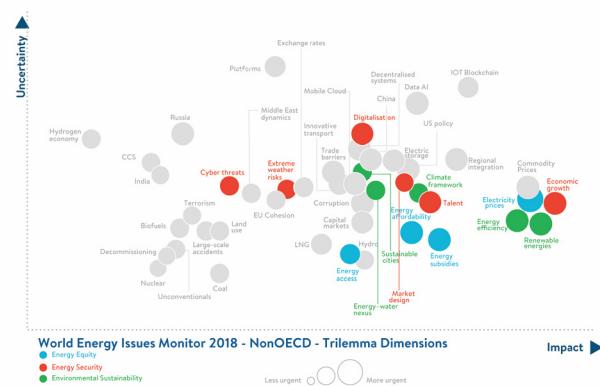


FIGURE 5: The Trilemma Dimensions in Non-OECD Countries

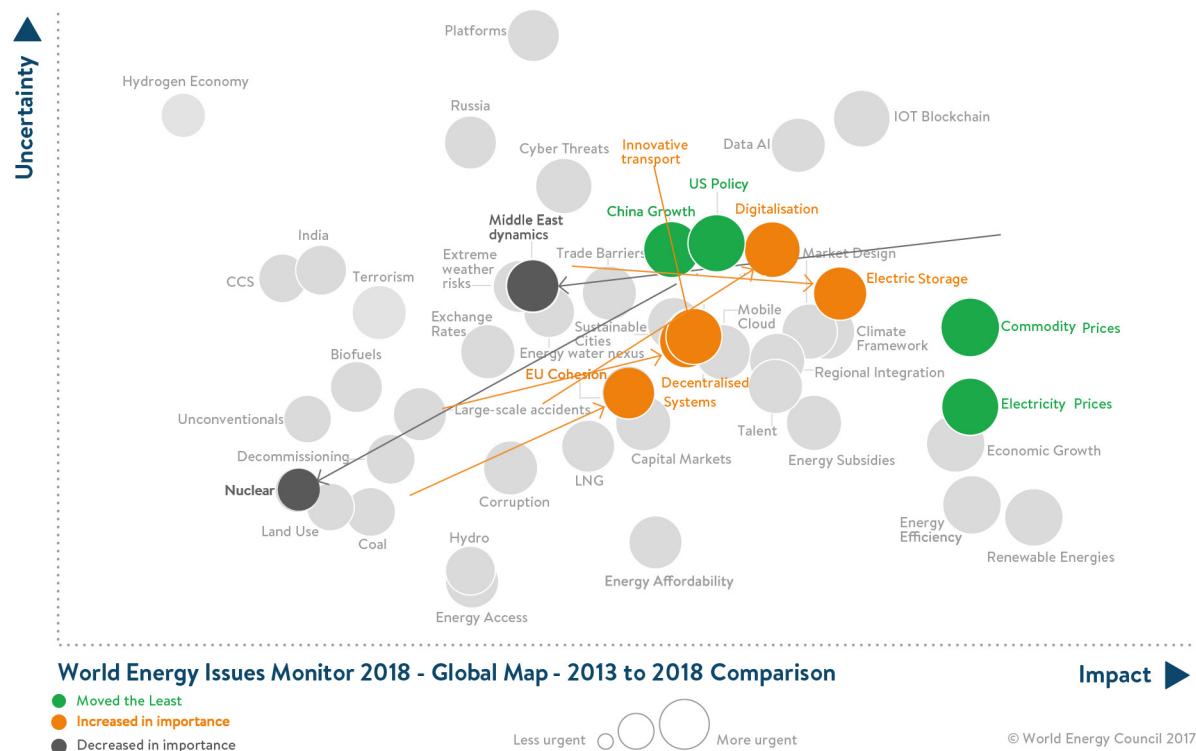


3. Energy Council’s definition of energy sustainability is based on three core dimensions – energy security, energy equity, and environmental sustainability.

TRACKING TRENDS

Figure 6 tracks how different issues have changed position over the last five years from a Global perspective. Issues such as digitalisation, and electricity prices are tracked since 2013. The map reflects the ongoing transition towards a decentralised system based on renewable energies, and continued digitalisation. What has stayed constant with the least amount of movement over the years are **electricity prices**, **US policy** and **China growth**. These issues have significant impact on all countries. On the other hand, the issues that have increased in importance show that the energy transition is moving in the right direction. **Digitalisation** and **electric storage** have greater importance, showing their expanding role in transforming renewable energies from a niche resource into one with consistent participation in the generation supply mix. Lastly, this year's analysis identifies **nuclear** as one of the issues that has decreased in importance as Europe works to phase out nuclear power from their supply source and Japan is hard at work to do the same, if possible.

FIGURE 6: The Issues Monitor 5-Year Tracking



Reviewing the first five Global Issues Maps in this section, it is evident that there has been continued evolution of the global energy sector towards a more diversified global energy mix with greater penetration of renewable technologies; there has also been a shift away from centralised and towards more decentralised systems to accommodate this; and growing interest in technology innovation, digitalisation and use of data.

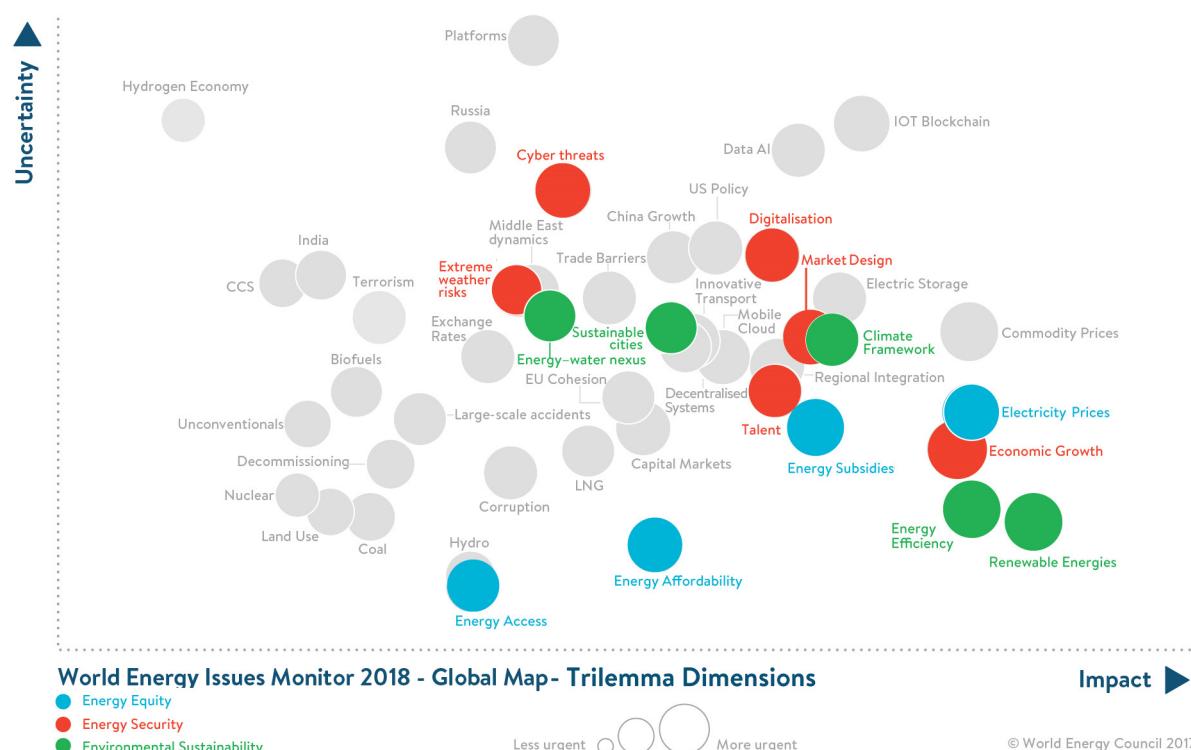
LINKING THE TRILEMMA WITH THE ISSUES MONITOR

The Council's definition of a robust (i.e. timely, well managed and global) energy transition reflects the challenge of balancing: energy security, energy equity, and environmental sustainability.

Balancing these three goals constitutes a 'policy trilemma' and is the basis for the long-term prosperity and competitiveness of individual countries. To aid the dialogue on improving energy policy and to illustrate potentially conflicting policy drivers, this section brings a fresh analysis of global energy issues through the three dimensions of the Energy Trilemma, as illustrated in Figure 7. Moreover, when associated with a long-term analysis, this tool can provide a powerful representation of the directions that the energy transition is taking and the resultant opportunities and challenges that arise.

In the **energy equity** dimension, energy access and affordability are surprisingly not seen as an urgent global action priority. According to the latest data published by the World Bank, 100% of high income world citizens have access to electricity while only 35% of the low income does. Technology and decentralisation is expected to address this continued divide. As fast as the world is embracing technology and decentralisation, several countries with a total population of over one billion people are still working towards universal electricity access delivered reliably and affordably. At today's stage of the transition, however, concerns are much more focused on the impact of subsidies and electricity prices as new technologies are being added to the mix, and as traditional and new energy resources redefine their space in the global energy economy.

FIGURE 7: The Global Energy Issues and The Energy Trilemma



The next dimension of the Trilemma is **energy security**, where Market Design is seen with greater uncertainty than clean energy-related issues. This is shaping an energy security environment that is mostly impacted by the urgency of adaptation to the rapid changes brought by the integration of new energy technologies. Indeed, Market Design permeates all trilemma dimensions, where the critical uncertainties coincide with early market processes (including IoT/Blockchain and Data AI) and action priorities are associated with issues such as Renewable Energies and Energy Efficiency. These issues, in turn, already benefit from a more developed market structure in many countries.

Finally, the **environmental sustainability** dimension suggests that new market structures first need to be developed to enable successful integration of supportive technologies. Energy efficiency and renewable energies processes will need to evolve before Sustainable Cities, the Energy-Water Nexus and even the Climate Framework challenge becomes more certain from the perspective of global energy leaders. It should be noted, however, that even though many countries are increasingly developing and incorporating clean energy policies, fossil fuels are still an important part of the globe's energy mix. The Council's *World Energy Scenarios*⁴ show that fossil fuel share of primary energy has shifted just 5% in the last 45 years from 86% in 1970 to 81% in 2014. According to the Scenarios' 2016 research, the momentum of new technologies and renewable energy generation results in the diversification of primary energy. Fossil fuel share of primary energy falls to 70% by 2060 in the *Hard Rock* scenario, 63% in the *Modern Jazz* scenario, and 50% in the *Unfinished Symphony* scenario. While the incorporation of clean energy is evident, it is crucial to understand the stage of development of each energy resource for a well-informed transition planning.

It is worth noting that although there is high uncertainty around innovation issues such as Data AI, IoT Blockchain, Electric Storage and Innovative Transport, this cluster is just lightly reflected in the Trilemma trade-off framework, where resilience issues are not heavily influenced by the role of technology and policy innovation. This will be one of the most exciting spaces to observe as to what extent innovation will be transforming and overcoming the trade-offs for energy equity, security and sustainability.

THE RISE OF DECARBONISATION, DIGITALISATION, AND DECENTRALISATION

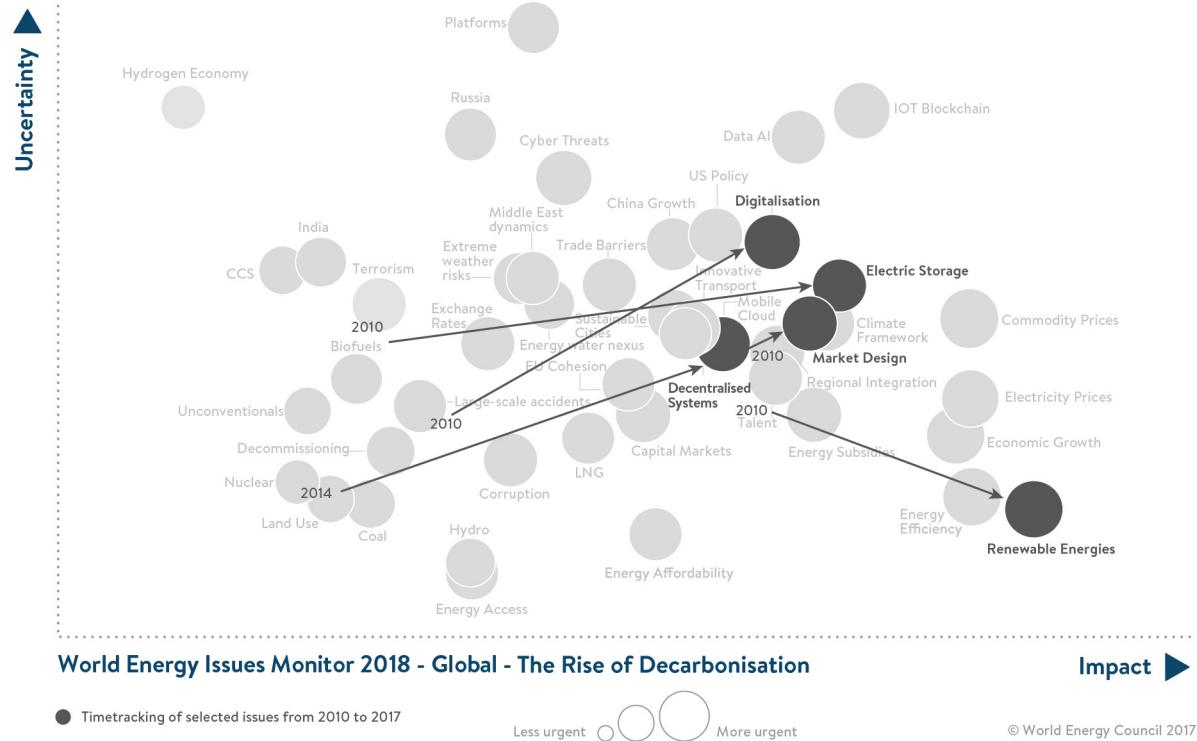
In the next series of maps, we review how the global energy landscape continues to shift toward decarbonisation, digitalisation, and decentralisation. Renewable energies and other technologies that will help it become more reliable will continue to drive energy innovation. This is not to say that demand for fossil fuel is reducing: fossil fuel installed capacity through 2030 is on an upward trajectory.

Since 2010, the Monitor has tracked a steady and significant increase in energy leaders' attention to the path of **decarbonisation**, as illustrated in Figure 8. This is not surprising considering the contributing role of digitalisation, electric storage and market design in the transition towards a robust energy future. It becomes therefore crucial to improve clarity around the strategy and value of innovation as we move forward. Across the 6 regions covering the global agenda for this year's report, renewable energies appeared as the utmost action priority issue, showing a high impact and much less uncertainty than the results of 2010. The dramatic fall in prices of renewable energies

4 - <https://www.worldenergy.org/publications/2013/world-energy-scenarios-composing-energy-futures-to-2050/>
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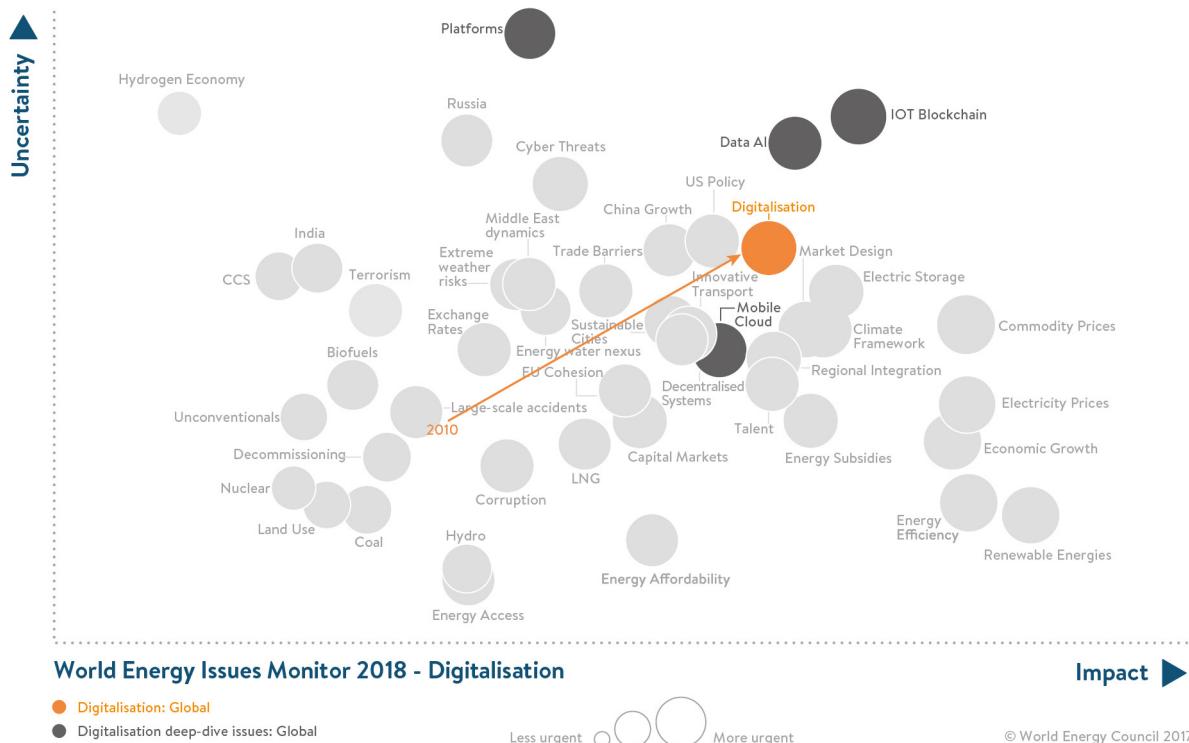
explains this movement. However, it is also important to track the concerns related to electric storage for a more comprehensive picture of the evolving renewables context.

FIGURE 8: The Rise of Decarbonisation



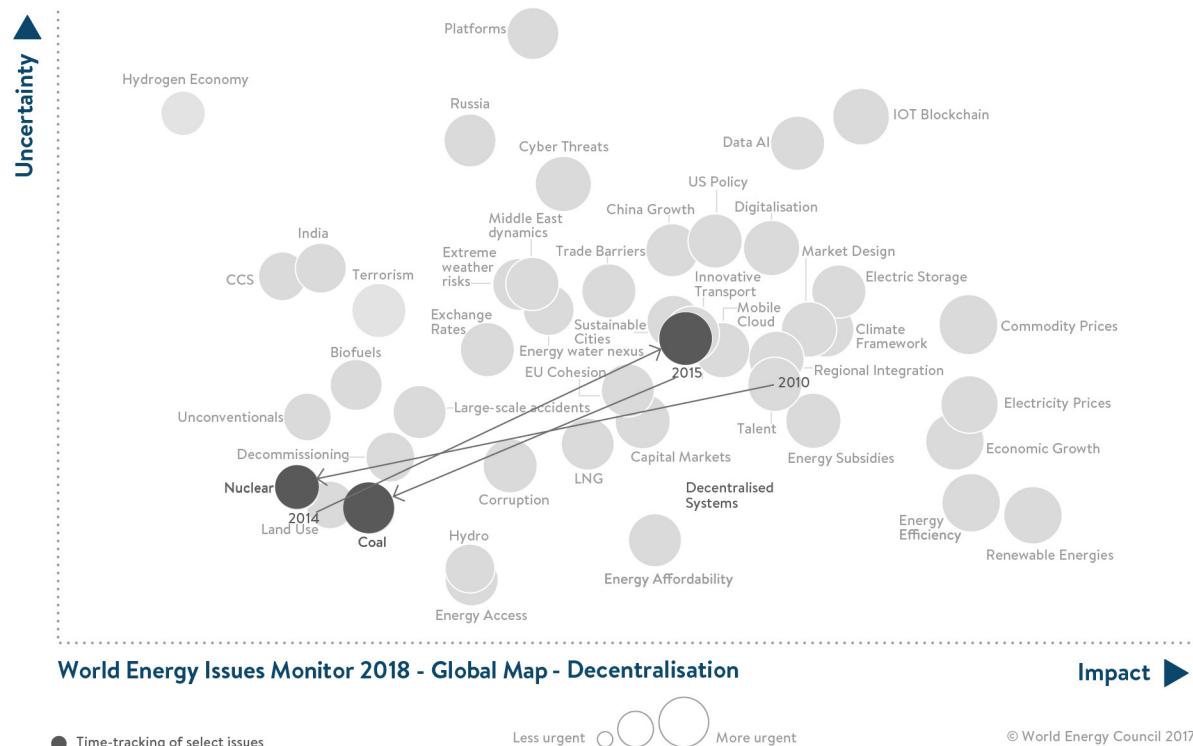
As the innovation cluster rises in the energy leaders' agenda, there is a key focus on issues linked to **digitalisation** (Figure 9: The Rise of Digitalisation) and the action needed to facilitate the convergence of new energy technology including Data AI, Mobile Cloud and Blockchain. These developments are bringing new actors into the energy system such as tech companies and software developers, and enabling the rise of the prosumer. Countries such as China, Japan and Italy are at the forefront of the digitalisation process and differentiate from many countries by having this issue as an action priority with a very low level of uncertainty. These experiences will be instrumental to aid the digital transition by showcasing success stories and technology integration strategies.

FIGURE 9: The Rise of Digitalisation



Finally, in line with the digital evolution process and the changing role of consumers as active contributors to the energy industry, centralised technologies such as nuclear and coal have decidedly dropped in attention and priority, as seen in Figure 9. In turn, decentralised systems, including innovative business models for demand side innovation and management, move progressively in the opposite direction, as markets start to be designed to allow for behind-the-meter generation and for structured prosumer-grid operator communication. Germany, Belgium, Portugal, Canada, Colombia, Namibia and Nigeria, are among the countries that have highlighted progress towards incorporation of decentralised energy solutions and an enabling market design in this year's Issues Monitor.

FIGURE 10: The Rise of Decentralisation



NEXT STEPS - REGIONAL AND NATIONAL PERSPECTIVES

In the full Issues Monitor publication we provide regional perspectives followed by national issues maps and commentaries based on each country's own survey results. The national maps along with specific commentaries are invaluable not only to energy leaders active in these countries, since the survey's outcomes are a self-reflection of where the respective national leaders see themselves in the Grand Energy Transition, but also to neighbouring countries and regions as a point of comparison as well as a way to learn from the experiences and policies of others.

The Council is therefore delighted that 2018 is seeing the inauguration of the **World Issues Monitor Tool**, a digital platform designed to gather 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 in relation to specific energy issues.

As an active stakeholder in the global energy transition, the Council invites you to explore these analyses and to take advantage of the Energy Transition Toolkit and the wealth of innovative information it provides in support of the transition process.

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

This report is uniquely positioned to support intergovernmental organisations, governments and companies to broaden their understanding of global, regional, and national energy issues. The Issues Monitor provides an impartial perspective by including all the world's economic areas, every kind of energy ranging from renewables to fossil fuels, and every kind of organisation.

We have all six regions of the world represented in this year's edition. Currently, 38 countries provide the basis for the global issues map. In the near-term, we are striving to include all member countries in future publications. We are also committing ourselves to broaden the survey participation to include new voices of new energy shapers within and beyond the energy system.

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