

THE 24TH WORLD ENERGY CONGRESS PREVIEW

March 2019 | Edition III

WORLD ENERGY COUNCIL |  24th CONGRESS
ABU DHABI | 9 - 12 SEPTEMBER | 2019
ENERGY FOR PROSPERITY

Managing Energy Transition Through Dynamic Resilience

Energy transitions are not new, with modern societies flourishing thanks to previous technology-led energy transitions, including steam-power and electrification. However, managing a global-scale energy transition is an unprecedented recent phenomenon, which presents new risks and opportunities for societies across the world. Some of the risks could manifest in disruptions of current arrangements, and some incumbents may be abruptly and very negatively affected. Developing resilience ahead of potential regime shifts could help them recover, rebound and adapt.

At the same time, the risk space that energy market players manage is evolving into a broader landscape of systemic and emerging risks - such as increasing price volatility, cybersecurity and extreme weather events - due to a combination of urbanisation and climatic variability, and in some cases increasing evidence of the impacts of global climate change.

The unfolding and evolving risk landscape is fast-moving and unpredictable, which is likely to leave some energy system players unsighted on emerging threats and less prepared if they continue to rely on passive system. The new risk landscape requires a more agile and adaptive response framework, with a greater emphasis on resilience and rapid recovery. In this environment, energy stakeholders are starting to experiment with responsive, networked and innovation-rich strategies as energy leaders shift their focus from better risk management to building new dynamic resilience capabilities. The shift reflects a gradual recognition that the traditional risk management approaches to control risk are no longer sufficient, and that greater systematic resilience is required to enable more agility, adaptation and regeneration by energy firms, sectors and communities.

The World Energy Council's new Dynamic Energy Resilience (DER) framework aims to help enable energy firms and communities to improve their approach to resilience to endogenous or exogenous shocks and

disruptive innovations. Working in conjunction with our partners at Swiss Re and Marsh and McLennan Companies, the Council is evolving from risk-centric approaches to energy security and building integrated and dynamic capabilities for resilience, by identifying and sharing best practice from within and beyond the energy community. It integrates three previously separate systemic and emerging risk themes

i) extreme weather or natural hazard, ii) digital or cyber risks and iii) food-energy-water nexus, with a practical focus on risk identification and assessment, situational awareness and prevention-mitigation plans.

The Dynamic Energy Resilience framework identifies a combination of four capabilities: i) situational awareness of all risks (current/potential); ii) agility (speed); iii) adaptive capacity to prevent or mitigate impact on performance (flexibility/optionality); and iv) regenerative development i.e. the evolution/self-transformation of energy organisations and systems to promote synergies in human-centric wellbeing, planetary health and socio-economic flourishing.

We aim to develop the DER framework thorough engagement with the emerging global community of practice, to draw on the new and different experiences and new solutions firms within the energy sector and beyond are using to improve their organisational and energy system resilience - agility, adaptability, regenerative capabilities. We want to use the DER framework to

highlight systemic risks that emerge between the interfaces between conventional risk categories or policy silos, and impact before significant trends are fully visible. This suggests new capabilities for horizontal learning, improvisation in crisis, and integrated innovation are needed, which are enabled through a "team of teams" culture and connect risk appetite with context and capability.



Currently the World Energy Council's Dynamic Resilience workstream is looking at extreme weather and cyber resilience. We are using extreme weather case studies to identify key broader issues within the Dynamic Energy Resilience framework, with the aim of launching the relevant interactive tool at the 24th World Energy Congress. For cyber-resilience we are developing a program using the scenarios to explore best practice.

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Dialogue with Siemens' Lisa Davis

We were lucky enough to have the chance to ask one of our Congress speakers **Lisa Davis, CEO, Gas and Power, Siemens AG** a couple of questions recently:



Which will be the most critical innovation areas now when the grand energy transition is rapidly accelerating?

Sector coupling, or Power-to-X, is definitely one of the most critical and interesting innovation areas. The industrial, building, or mobility sectors offer significant opportunities to shift energy allocations by better integrating their high demand and storage capacities. Hydrogen technology, along with biofuels, are also heading in the same direction - emerging as one of the indispensable conversion and storage technologies for balancing demand and supply in an increasingly renewables-based energy system. They are presenting a sustainable alternative

to oil and gas, given the long-term goal of decarbonising the energy sector.

Another opportunity for innovation lies in how we manage the complexity in the grid and seamlessly integrate traditional and new elements across generation, distribution and consumption. There is a real need to address this to ensure continued reliability and also to realize the untapped potential of our power generation and delivery ecosystem.

Finally, advances in the energy sector will, without a doubt, depend to a great extent on the degree to which we fully leverage the power of digitalisation. By increasing automation and intelligence in the system, rich data can be translated into better and faster operational decisions and leverage major efficiency and safety gains across the entire value chain. In the oil and gas sector, for example, service digitalisation can provide seamless monitoring of real-time conditions for optimising the uptime and performance of an installation and extending the life of mission-critical equipment.

Innovative approaches like these are critically important and are transforming the industry at a speed that was unimaginable just a few years ago.

What are your expectations from the 24th World Energy Congress?

As technological opportunities evolve and diversify, the energy sector needs to adjust its focus towards the right investments and innovations that accelerate sustainable progress from a systemic view. Operators need to discuss how they want to secure flexibility and supply; how they create suitable infrastructures; and how they want to enhance new possibilities to connect and turn consumers into dynamic actors. The World Energy Congress in Abu Dhabi gives us all an opportunity to enhance our understanding of political, economic, and technological forces and trends shaping the energy industry. That's why we look forward to connecting with our customers and thought leaders from across the globe to discuss and collaborate on providing energy solutions for today...and tomorrow.

Siemens AG is the World Energy Council's Partner.

Global energy scenarios – a reliable tool?

- **Can they unlock a sustainable energy future?**
- **Do they support users in designing an accelerated and successful energy transition?**

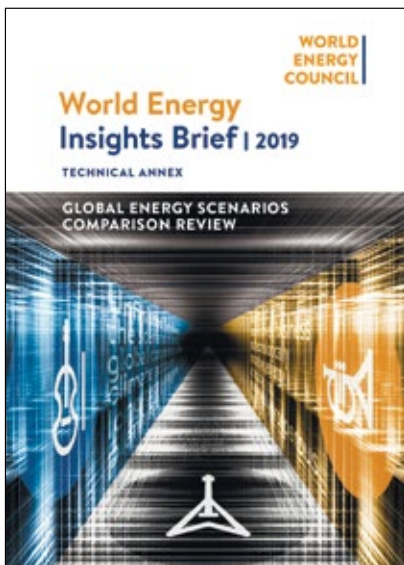
The stakes are high in the race to achieve a successful energy transition. Energy is embedded in every aspect of modern life. An energy transition that will meet the demands of a growing global population without an increase in emissions that harm the environment is an unprecedented and immeasurably complex challenge. The energy transition can be derailed by misguided policies or actions, or it can be enabled and accelerated by innovation and new ways of flexible cooperation.

Relying only on better energy modelling and forecasting as drivers to a successful transition would be a mistake, even in a data-rich era. Instead, a new leadership approach is required, one that includes alternative methods with top-down, bigger-picture strategic thinking combined with bottom-up, agile, and adaptive innovation.

As part of its core mission, the World Energy Council employs a multi-stakeholder engagement process to develop actionable, technology- and resource-neutral scenarios.

World Energy Scenarios are among the five tools in the Council's new Energy Transition Toolkit. These scenarios help users to anticipate, better prepare for, and collaborate in delivering a successful energy transition.

The Council's comparative review has validated the relevance and plausibility of its existing archetypal framework, and the benefits of continuing to work with the plausibility-based, narrative-led methodology. It also helped identify a series of insights, including:



In anticipation of the 24th World Energy Congress in Abu Dhabi in September 2019, the Council is preparing a global energy foresight stocktake and refresh. As a part of this project, it has undertaken a comparison of the assumptions, narratives, and numbers found in a peer group of global energy scenarios of interest to its members. The review has also been analysed in relation to the Council's ongoing horizon-scanning processes, including its annual Issues Monitor as well as interviews and leadership dialogues conducted in 2018.

- All scenarios are grappling with the complexity of energy systems that are diverse, dynamic, and adaptive, with supply increasingly driven by changes in demand and developments beyond the energy sector.
- The broader landscape of innovation, with its uneven pace and disruptive potential, is seen as a critical uncertainty. The wider implications of the energy-information nexus are emerging, including energy innovations coming from adjacent sectors, the role of finance, new consumer logic, and shifting societal needs.
- All global energy scenarios highlight the role of more internationally-coordinated action, aligned on both local and global scales, and supported by agile regulatory frameworks that create pathways towards a successful transition.
- The economics of the energy transition used in long-term energy scenarios modelling is out of touch with the realities of non-linear energy systems transition. Whilst decarbonisation pivots on the price of carbon, the costs of whole energy systems transition include

A successful global energy transition involves more than accelerating decarbonisation. The Council is refocusing its long-term energy scenarios storylines to dig deeper into disruptive innovations including technological, economic, social, and regulatory, which are already emerging within and beyond the energy system, coming from beyond, not just within, the energy system and utilities. A new set of global scenario storylines are in development for launch at the 24th Abu Dhabi World Energy Congress.

wider sustainability challenges (e.g., global water stress and climate change impacts and adaptation), social benefits (e.g. job losses), and increased system resiliency.

- A wide range of assumptions about demand exist within the different types of global energy future, including the slowdown in global population growth, rapid urbanisation in new economies, female education, rapid efficiency gains enabled by electrification of transport and cooking, and recycling in industry (Graph 1).

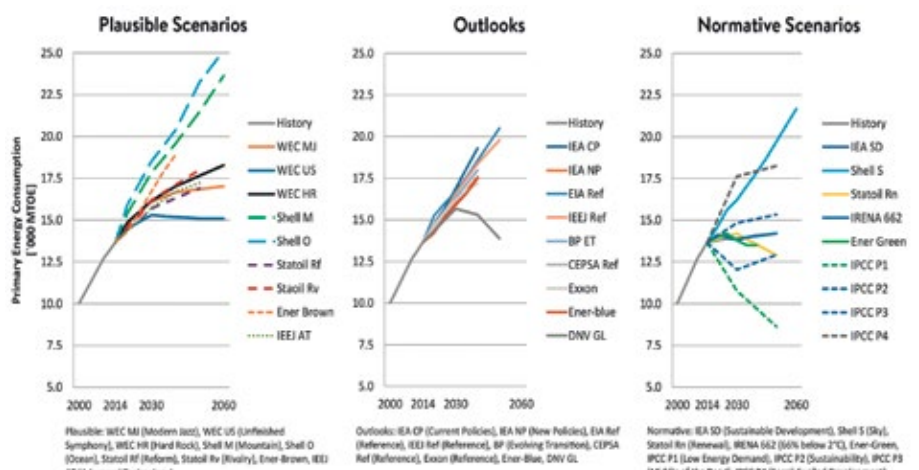
The Council also recognises that finding ways to better use global scenarios is far from straightforward. This often involves facilitating a successful energy transition in response to

global and national visions, which are not just about energy. We support our members to make use of our World Energy Scenarios as a platform for leadership dialogue, to forge new common ground and catalyse and sustain collaborative innovation.

To request the full version of the global scenarios comparative review, please email insights@worldenergy.org

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Graph 1: Primary Energy Demand



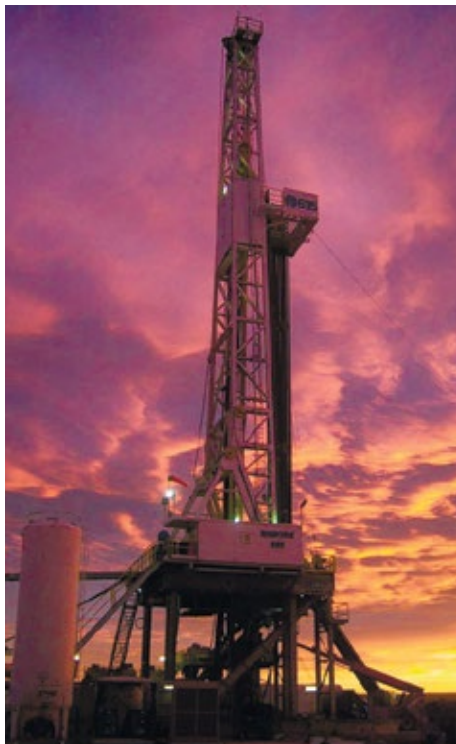
Regional Perspective: The Shale Revolution in South America

What is driving the successful development of shale gas and shale oil in Argentina? The petroleum industry in Argentina has allowed this South American nation to attain hydrocarbon self-sufficiency after over 110 years in operation. Now, the emergence of a world-class shale resource opens up exciting new prospects.

The Vaca Muerta shale play, the main source rock of the prolific Neuquen Basin, was identified as a prospect in the late 1920s but drilling did not begin until 2012. YPF, the state-controlled oil company, led the charge through a partnership with Chevron for the development of the Loma Campana block. Other companies such as Dow, Petronas and Schlumberger came in later and formed partnerships with YPF. Major players such as ExxonMobil, Shell, Total, Wintershall and Pan American Energy (a JV between BP and Bidas) entered the game with their own pilot projects. More recently Tecpetrol, the oil and gas division of global steelmaker Techint, undertook the development of a large-scale project in the Fortin de Piedra block, where there had been no previous production.

Output from Vaca Muerta today accounts for 15% of the gas and 10% of the oil produced in Argentina. This helped to reverse a 15-year decline in national gas production. Natural gas accounts for more than 50% of the country's primary energy consumption and there had been plans in the 1990s, when production was growing, to turn Argentina into a regional supplier of gas. Seven export pipelines were built and commissioned (five to Chile, and the other two to Brazil and Uruguay).

However, an economic crisis in 2002, restrictive policies and low domestic prices discouraged investment and encouraged demand, rendering those export pipelines idle as export surpluses faded away. Argentina had to resort to LNG imports to meet this demand, a development that had a negative impact on its trade balance.



Now, thanks to rising shale gas production, seasonal exports to Chile have begun, and the goal of restoring energy self-sufficiency is within reach. More than 1,000 wells have been drilled in Vaca Muerta to date. Most of the current activity consists of multi-pad horizontal drilling, with laterals reaching 3,000 metres. Production growth has been impressive. As of January, shale oil production was 74 mbod, an 85% increase year-on-year. As for shale gas, production exceeded 1bcfd, a 235% y-o-y increase, driving a 5% increase in overall national production.

But the promise of Vaca Muerta goes far beyond the national goals of self-sufficiency or energy security. A report from the U.S. Energy Information Agency has ranked Argentina's shale gas resources as the world's second largest at some 800 tcf, and shale oil resources as the world's fourth largest at some 27 bbl. Most of these vast resources

are concentrated in the Vaca Muerta shale play, with the rest spread over the other Argentine sedimentary basins. Among the key strengths of Vaca Muerta is its location in an area that is not considered environmentally sensitive, the availability of water and its proximity to the oil-producing Neuquén Province, where there has been upstream activity for 100 years. All these factors will help to secure the necessary operating licenses.

Argentina has a good chance of becoming a regional exporter of natural gas, considered a clean fuel in the transition to a lower-carbon energy mix. Argentina is known mainly as a large exporter of agricultural goods but it may soon join the league of energy exporters. Achieving this goal will involve overcoming various challenges: logistical costs, availability of abundant and technologically updated oilfield services, labour productivity and, last but not least, competitive pricing and fiscal terms.

The Vaca Muerta session at the World Energy Congress in Abu Dhabi will bring together top executives of the most relevant players of the South American shale revolution, who will share their experiences and their strategies aimed at overcoming these challenges to deliver the promise of abundant clean fuel for Argentina and its neighbours.

Article contributed by the **Argentina World Energy Council Member Committee**

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