Managing Energy Transition Through Dynamic Resilience

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Energy transition in a new era of emerging and systems risks

Energy transitions are not new with modern societies flourishing through 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 with 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. "With accelerating energy systems integration, resilience is no longer just about returning single assets to full operation after a disruptive event. When interdependent parts of a system are blacked out, the system as a whole is at risk of being deadlocked" (WEC 2016a).

The Grand Transition described by the World Energy Council (WEC 2016b) is not restricted to energy with faster and fundamental changes becoming apparent. Energy challenges emerge from an interplay of global megatrends – digitalisation, decarbonisation, and decentralisation – and combine with regional and local developments to transform energy demand, services and systems. A new era of digital economic productivity and emerging artificial intelligence is raising big questions about the role of energy and the outlook for human-centric well-being / flourishing.

Recent progress in aligning international action on reducing energy-related carbon emissions are not sufficient to guarantee a successful and timely low carbon global energy transition. And other energy-related challenges are evident in enabling a next era of global productivity, inclusive prosperity, human-centric wellbeing and peace.

Successfully navigating energy transitions presents a wicked situation, rather than a simple problem (Rittel & Webber, 1973). Defining and driving successful and well-managed energy transitions requires attention to the socially messy, multi-scale, and multiple dimensions of the connected challenges of better lives for all and a healthy planet. The diversity of regional energy systems and national energy security contexts has led to increasing recognition that 'one size fits all' solutions are ineffective to the common problem of global energy transition. Each country will have its own unique energy transition dependent upon its culture, natural resource endowment and policy capabilities.

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Energy systems themselves are becoming more diffuse, due to market fragmentation and technological change with a more diverse cast of energy actors that are also dividing responsibility for energy security and grid reliability.

The global energy transition is not just about managing new types of emerging and systemic risks but also realising new opportunities for energy systems to evolve faster than ever before. This introduces two new imperatives for action beyond conventional competitive strategies and better risk management – improvisation, cooperation – and, in turn, shifts the emphasis from better risk management tools to building dynamic resilience capabilities to sudden or unpredictable changes. The resilience of energy firms to specific events or systemic shifts is not in their direct control but can be enhanced by situational awareness of different types of risk and preparedness for new future developments.

Integrated risk management and the search for dynamic resilience capabilities

The risk space that the energy market players manage is evolving into a broader landscape of systemic and emerging risks - such as increasing price volatility, cyber security, and extreme weather events - due to a combination of urbanisation and climatic variability, and in some cases increasing evidence of 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 blind to emerging threats and less prepared if they continue to rely on passive system buffers to provide energy security, such as strategic reserves or grid integrity. New risks such as cyber security challenges to operation systems can overwhelm the unprepared where existing response strategies are not necessarily useful.

In parallel with the evolving risk landscape, a new opportunities agenda for global energy systems transition is being emphasised, which aims to deliver deep decarbonisation and other goals. Achieving the UN Sustainable Development Goals and Paris Climate Agreement will require flexible cooperation across energy- and policy domains and adjacent sectors (e.g., transport, finance, and industry).

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. This 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.

An energy-focused framework

The World Energy Council has been developing a Dynamic Energy Resilience (DER) framework for the purpose of helping energy firms and communities improve their approach to resilience to endogenous or exogenous shocks and disruptive innovations. 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 (WEC 2018).

Extreme Weather / Natural Hazards

Extreme weather event impacts on energy systems can be associated with i) repeating patterns or ii) shifting weather regimes due to climate change. Energy systems are already impacted by extreme weather events such as flooding, drought, hurricanes etc. as well as weather patterns (e.g., El Niño, Monsoon) **but** climate change is anticipated to increase the frequency and severity of extreme weather events.

Digital / Cyber Risks

Digital risks are a novel and evolving challenge that is difficult to assess using conventional risk analysis methods. Cyberattacks are expected to increase with the shift from mechanical and centralised energy assets to the new operational-plus-digital systems implied in the digitalisation-decentralisation transition. The key interface between operational and digital elements can mismatch and increase the risks for human error or malicious attack (Ciborra, 2001). Energy firms and others are highly sensitive about discussing cyber risks and their impacts so a different approach is required where a dialogue between leaders in digital and energy sectors could be useful.

System Risks – Food-Energy-Water Nexus

Systemic risks of increasing connectivity, like the food-energy-water nexus when managing global value chains, requires attention to interdependencies between the different sectors and levels. Systemic risk emerges from within the complex adaptive systems characterised by the many-to-many interests and needs. Energy players need to anticipate how they can prepare for systemic risks emerging from the dynamic interactions of multiple systems and global supply chains, particularly in the drive to "circularity".

The DER 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.

The framework is being developed 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 – including:

- Governance and culture
- Financial mitigation
- Operating through crisis
- Short vs. long term energy security
- Diversification/pricing in redundancy

Comparing approaches to risk governance and dynamic resilience

The Council's Dynamic Energy Resilience framework and the IRGC's Risk Governance Framework (IRGC 2017) overlap with each other although they focus on differing aspects and derive from different approaches.

The academic-led IRGC framework provides greater delineation of the differing tasks for risk identification, categorization and evaluation while the practise-led DER framework reflects more on the organisational capabilities for agile risk management, adaptive capacity, and ability to self-transform, i.e., on strategic renewal.

The IRGC Risk Governance Framework challenges the linear, predictive and control-based approach of identify, assess, manage, communicate risks and highlights the need for a more integrated, learning-based approaches to risk management.

Similarly, the DER framework highlights systemic risks that emerge 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 connects risk appetite with context and capability.

An iterative, four capabilities framework, in turn, can help develop double -and even triple-learning loops which involve systems thinking and futures framing about the co-evolution of context and capabilities, and avoid the trap of looking only for expected performance. Dynamic resilience is not a theory-led risk-based tool, it is a practice-led, organisational capability which is supported by a culture that does not rely on either the numbers to speak the truth or winning through competitive strategies.

Dynamic resilience adopts a stance of learning with multiple futures, rather than the conventional risk-based approach of reducing uncertainty to enable control of the future. The emphasis is on anticipating, appreciating and addressing disruptive changes, which are characterised by novelty and uncertainty, by triggering improvisation and accelerating experimental, interactive and collaborative responses.

Barriers and facilitators of dynamic resilience

Knowledge sharing across diverse energy firms and communities has already highlighted the following insights about progressing dynamic resilience:

1. Energy players need to move beyond passive security measures and develop capabilities in dynamic resilience, working across different realities of weather, water, cyber, price volatility, and other systemic and emerging risks. Dynamic resilience also involves creativity – improvisation through crisis.

2. Regional integration can enhance energy systems resilience but is not straightforward. Political economy risks such as politicians exposed in event of national shocks, and lack of mutual trust between diverse energy actors and systems can constrain regional interconnectivity.

3. Digital technologies provide many new opportunities but may also expose the energy system to new risks such as cyber-attacks. Substantial technological coordination is required to avoid regionally integrated and physical-digital interfaces suffering catastrophic cyber failures, whether from malicious or unintentional causes.

4. Regulation can empower resilience by encouraging energy systems to plan for resilience and counteract the tendency to focus on economic efficiency alone that can remove shock absorbers from the system and accelerate path dependency towards a crisis from 'lock in'. But energy system resilience cannot be achieved without economic efficiency, and regulation can be slow.

Some level of productive or regenerative redundancy is beneficial although how to create buffers that are economically productive is poorly understood. Moreover, the opportunity to enable system circuit breakers has yet to be considered where policymakers and regulators could do more to promote policies to encourage dynamic resilience. More secure systems are costly and while those costs will fall with time, it is unclear if countries are evaluating the cost of security in terms of resilience by assessing energy system risks against affordability.

5. Mutual aid schemes can help and there are mutual resilience fund clusters in the nuclear sub-sector which also has peer reviewed security policies and a common insurance fund. This approach could benefit other sub-sectors.

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