

# World Energy Trilemma | 2017

EXECUTIVE SUMMARY  
IN PARTNERSHIP WITH OLIVER WYMAN

## CHANGING DYNAMICS – USING DISTRIBUTED ENERGY RESOURCES TO MEET THE TRILEMMA CHALLENGE

The global energy sector is being transformed by three trends that are impacting demand and supply at an unprecedented pace: decarbonisation, digitisation and decentralisation. These trends are reinforcing each other and helping to facilitate the growth of empowered consumers. This is happening at a time when we are seeing a shift in final energy consumption with demand for electricity doubling globally by 2060. There will be new opportunities and challenges for policymakers to navigate the Energy Trilemma. This will require managing a greater diversity of market actors and technologies without fragmenting the energy system. Provided governments and regulators allow and plan for it, empowered consumers can play a key role in the grand energy transition. While the transmission system will remain important, the potential changes support the increasing significance of the distribution level to the optimal operation of energy systems.

### KEY FINDINGS

**Distributed energy resources are becoming increasingly important to the global energy system,** particularly in the context of the energy transition. Improved efficiency and falling technology costs are expected to further accelerate this trend, with distributed generation, particularly renewables, playing a key role. In many countries, regulatory frameworks are trying to catch-up with technology options and shifting energy users demands. **Policymakers must move quickly to seize new opportunities in meeting their countries energy needs.**

**More than 50% of energy leaders surveyed for this report expect a rapid increase in distributed generation to a share of 15% or higher of the installed generation capacity in their country by 2025.** This represents a significant shift in the generating mix but there are large regional variations based on countries' current electricity structures and how their regulatory systems impact the pace of change. Policymakers, energy utilities, innovative new entrants and consumers are the driving forces behind the increase in distributed generation, pursuing electricity access, affordability and competitiveness as well environmental goals. Small-scale industry-level off-grid and household level on-grid are the most common forms of distributed generation in many countries.

Along with the increase in distributed generation, **energy storage, including batteries, are becoming a key element of the grid of tomorrow,** helping to support flexibility to enhance system efficiency and cost stability. Over the past decade, storage installation projects have sharply increased and that trend is expected to continue over the coming years. Global energy storage capacity along with revenues from utility-scale applications are expected to increase dramatically over the next 5-10 years. But without dynamic policy frameworks this growth could stall.



The electricity sector is undergoing change at an unprecedented pace, with the growth in distributed generation (DG) enhancing trends in decentralisation, decarbonisation, and digitisation. This is opening new opportunities and challenges for countries to balance the energy trilemma.



**DG EXPECTED TO INCREASE RAPIDLY**

Energy leaders are predicting a major increase in the amount of DG in their countries' installed electricity supply by 2025.

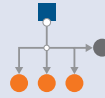


**CHANGES IN ELECTRICAL SUPPLY STRUCTURE 2017-2025**

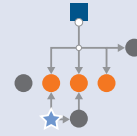
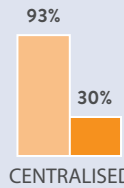
Countries' electricity supply structure is expected to shift from a centralised model to a hybrid model between 2017-2025.

- Central large scale electricity generation
- Consumers
- Prosumers (households, communities, industries)
- ★ Distributed energy resources (DERs)

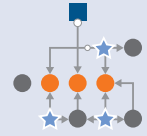
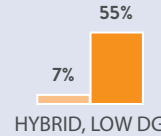
■ Current  
■ In 2025



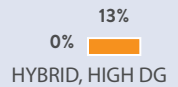
Central utilities hold majority market share, supplemented by DG



Central utilities to lose market share with increasing uptake of DG



DG has majority market share, supplemented by central utilities for reliability



**DG POSES SEVERAL CHALLENGES AND OPPORTUNITIES IN ACHIEVING ENERGY TRILEMMA GOALS**

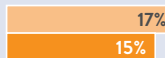
Perspectives on which energy dimension will be under greatest strain with increased DG.

Increasing energy access is current driver for DG but ensuring environmental sustainability and security will rise in importance by 2025

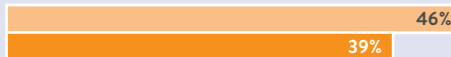
44% **ENERGY SECURITY**



30% **ENERGY EQUITY**



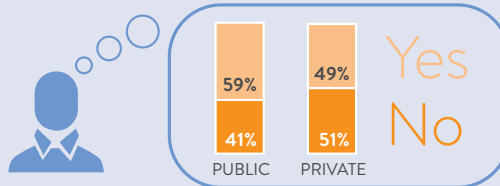
19% **ENVIRONMENTAL SUSTAINABILITY**



**UNCERTAINTY WHETHER REGULATIONS CAN KEEP PACE WITH CHANGE**

Increasing DG will require fundamental changes to regulations and who can participate in the energy market. Energy leaders worldwide are sceptical as to whether current regulatory frameworks can accommodate the shifting energy supply structure.

Can the current energy regulatory regime accommodate the shifting energy supply structure?



Decentralisation not only adds new resources to the system, but can also create new actors in energy markets, provided governments and regulators are prepared to allow access to them. Market entrants such as large energy ‘prosumers’, energy service aggregators, and rural energy entrepreneurs offer new sources of generation, supply and demand management. As countries transition to hybrid systems, the policies and regulatory frameworks governing who can participate in the energy markets and how, need to evolve.

**Countries that do not take the necessary steps to integrate distributed energy resources will face heightened energy security risks, potential infrastructure redundancies and investment challenges that will adversely affect their Energy Trilemma performance.**

## RECOMMENDATIONS

Evolving technology and customer demands are two key drivers of a transition of the electricity system at an unprecedented pace. Policymakers should develop their own in-depth analysis of the potential opportunities and challenges that may arise in their own countries or regions from adopting distributed energy resources. Regulatory frameworks must evolve to integrate new opportunities to balance the Energy Trilemma effectively. The 2017 World Energy Trilemma research has identified three key focus areas for policymakers and industry leaders to consider in order to build a resilient energy system of tomorrow:

- 1 Enable a dynamic and resilient market framework** with the agility to adapt with the transitioning system. The market framework must be responsive and resilient to the future changes that will arise from new consumers and evolving customer needs and technological advances, as well as changing roles and responsibilities of market participants. Within this dynamic environment, regulators will need to enable adaptable funding mechanisms for rates and charges to support the necessary continued investment in the energy system.
- 2 Establishing robust technology-neutral regulations** supported by agreed standards with all stakeholders will be key to building a more dynamic and resilient market framework that supports transitioning energy systems. This includes standards for project development and financing to reduce cost and inefficiencies. Technical interoperability and service harmonisation, as well as standards to promote uptake and integration of distributed generation and distributed energy resources, are critical.
- 3 Allow and plan for aggregator services to empower consumers** to be more proactive by ensuring that the market framework can adapt to their evolving and shifting needs. Technology will provide new options to access and consume energy so the framework design will need to enable consumers to make those choices. This will require a different approach of considering what consumers may want and ‘reverse engineering’ a market framework to facilitate new market entrants while keeping the trilemma goals in balance.

The energy transition is an unstoppable phenomenon. There will be leaders, learners and laggards, and adapting to this new reality with innovative policy responses and new business models will require an enormous effort. The ability of companies and policymakers to respond rapidly, creatively and collaboratively will determine the pace and shape of the global transition and, in turn, affect the ability of societies across the world to navigate the Energy Trilemma of security, sustainability and equity successfully. Governments and regulators need to plan for the transitions and anticipate its likely impacts on energy systems and market actors.

## ABOUT THIS REPORT

The World Energy Council's definition of energy sustainability is based on three core dimensions: energy security, energy equity, and environmental sustainability. Balancing these three goals constitutes a 'trilemma' and is the basis for the prosperity and competitiveness of individual countries.

The World Energy Trilemma Report 2017, prepared in partnership with global consultancy Oliver Wyman, along with the Global Risk Centre of its parent Marsh & McLennan Companies, tapped into the global insights of the traditional and emerging players in the electricity sector – including policymakers, regulators, traditional utilities, large consumer/ prosumers, and technology providers – to capture a wide range of views on the evolution of the energy sector.

The report identifies key focus areas for regulators and policymakers in the context of balancing the energy trilemma and driving forward progress on each dimension of the energy trilemma.

## 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.

We are the UN-accredited global energy body, representing the entire energy spectrum, with member organisations in over 90 countries.

Further details at [www.worldenergy.org](http://www.worldenergy.org) and [@WECouncil](https://twitter.com/WECouncil)

The full report can be found at [www.worldenergy.org/publications](http://www.worldenergy.org/publications)

The interactive online tool for the World Energy Trilemma Index can be accessed at <https://trilemma.worldenergy.org/>

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### **Registered Office**

62–64 Cornhill  
London EC3V 3NH  
United Kingdom