

KEY INSIGHTS

WORLD ENERGY WEEK, MILAN

1. *Climate change* action pivots on the price of carbon, but the full costs of transition are more complex

Energy systems are absorbing the rapid rise of renewables, but markets need to adapt to avoid energy shocks and create new jobs. Renewables need to be able to provide grid services which is possible with better forecasting and smarter regulation. Some potential solutions are being held back by confusion about data ownership: regulatory reforms will help.

Global cooperation, regional integration, political will and a global carbon price can enable better targeting of reductions: the cost of abating 1 tonne of carbon now equates to 40 times the cost in 30 years.

Climate change impacts on the food-energy-water resource stress nexus. It cannot be addressed in isolation of energy access, water stress or urban air quality; disruptive solutions are emerging from adjacent sectors such as transport. There are half a million electric buses on the road worldwide. 99% of them are in China. The total number of electric buses in just Shenzhen is greater than the total number of all buses in the North American cities with the five largest bus fleets.

2. Infrastructure insecurity raises the stakes on *resiliency*

Everybody can be a target of cyberattacks. The malware to launch them is increasingly available. With increasing prosumerism, generation points will multiply, from hundreds to millions. Exchanging data will be essential; cybersecurity is fundamental.

Decentralisation, decarbonisation and digitisation trends are combining and present a social nexus of market volatility-job scarcity-cyber insecurity. There is also the social risk about whether large-scale deployment of renewables or big infrastructure projects will be accepted by local communities. It is important to engage communities not just consumers.

A dynamic approach to energy systems resilience is possible if firms, cities and governments cooperate in sharing best practices for addressing the systemic risks emerging from the accelerating pace of transition. It is important to monetize risk to motivate investment decisions.

3. There is unfinished business on energy poverty and the need to *rethink access*.

Energy poverty is linked to increasing inequality within OECD. India and China are making tremendous progress in increasing energy access. In Africa, decentralised technologies and micro-grids have been effective at increasing electricity access without grid connection. These are no longer seen as temporary solutions, rather leapfrogging opportunities. Energy for prosperity cannot stop at basic access to lightbulbs but needs to enable better livelihoods in every country.

4. Financing is on its way but there are big *global investment* gaps.

While economics is helping to drive change, the picture on investment can be mixed. Technology costs for renewables and clean energy are falling so that it may no longer make economic sense to build new coal or nuclear plants. What is being invested continues to flow to fossil energy development. On start-ups European investments in energy tech start-up are one-tenth of US levels and one-fifth of Asian levels.

5. *Innovation* is key but not all about new technologies or start-ups.

There is considerable technological and financial inertia built into existing energy infrastructures and challenges of maintaining their effective operation. There are powerful synergies between old and new: incumbent energy businesses are engaging with start-ups to realise opportunities to develop new business models and accelerate energy transition.

6. New energy *geopolitics* is shaped by economics and new opportunities for trade in *clean liquids*.

China is actively developing green energy products and services to follow up on its 'solar energy' export success. Japan is working with Saudi Arabia and others to explore alternative pathways for its Hydrogen 2050 strategy. US energy abundance is enabling new markets for its oil and gas. Coal producers and makers of coal-fired power generation equipment are competing to capture markets to shore up demand. It is important to end the cold war between electrons and molecules. The plausibility of the materiality of RE revolution and (Li) battery storage is raising new security concerns in some countries and pushing development of alternative storage pathways.

7. All forms of *storage* are likely to be increasingly important.

New technologies such as flow batteries look promising for grid scale use while innovative regulations can also help storage to be used to reduce the carbon footprint of the grid. There are multiple storage pathways:

- a. Thermal;
- b. Chemical (clean liquids; H₂, ammonia, formic acid);
- c. Electrical (pumped hydro, grid storage before and beyond meter; Li and non-Li/alternative to batteries).