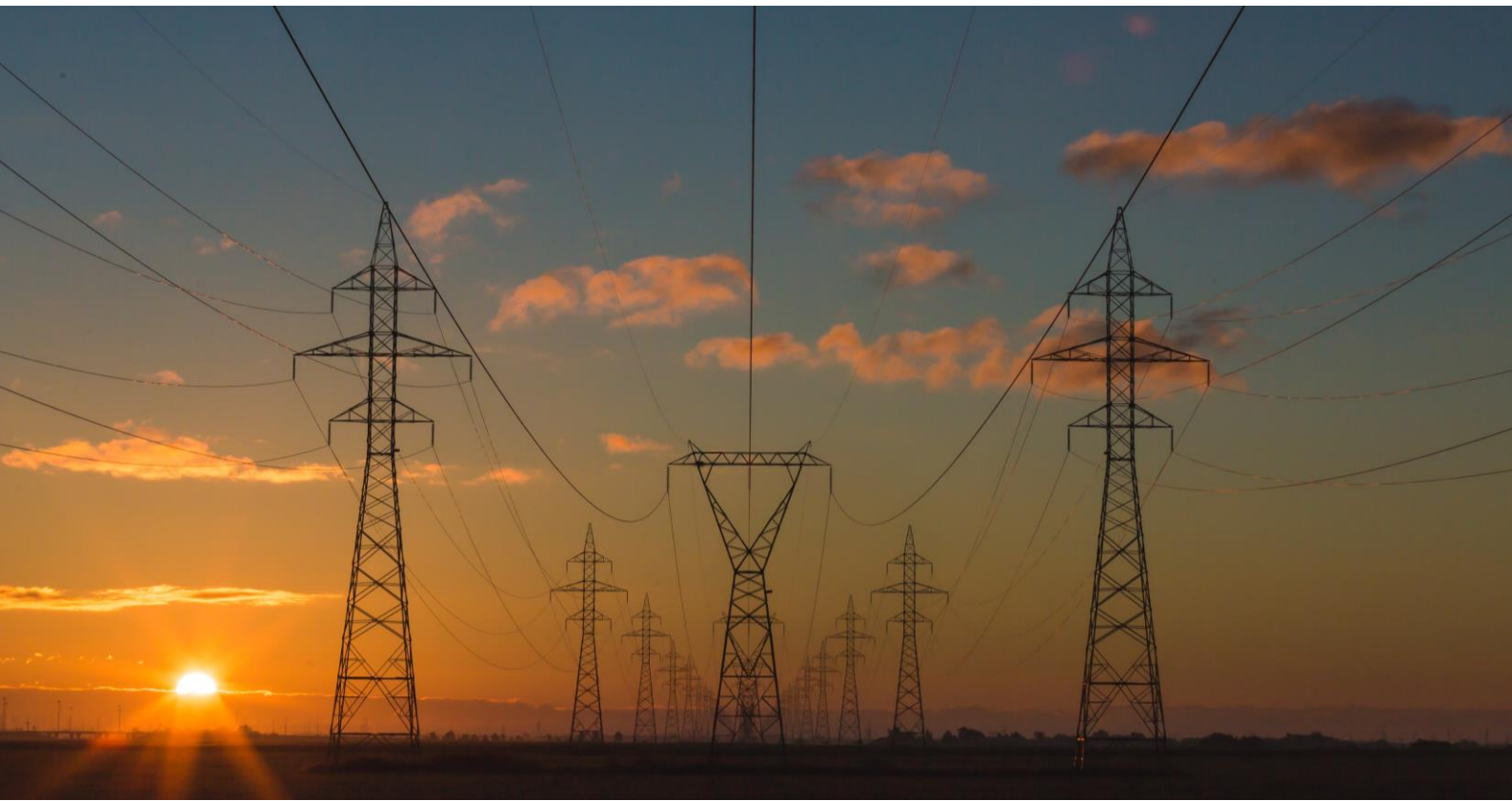
Energy, Environment and Resources Department
Roundtable Summary

CHATHAM HOUSE
The Royal Institute of International Affairs

Power Sector Transformation, New Market Dynamics and Geopolitical Implications

7 November 2018

*This is the first event in a four-part series, co-hosted with AIG, on **The Future of Energy: Risks and Opportunities During the 4th Industrial Revolution***



Introduction

This is a summary of the discussion at a roundtable event held at Chatham House on 7 November 2018, at which participants explored the transition to a sustainable power system dominated by renewables. The event was held under the Chatham House Rule.[1]

Over the past few decades, there has been a shift in the sources used to generate electricity as the costs of renewable energy have declined and investment in renewables has increased. While attention has been primarily focused on changing generation, greater consideration must now be given to increasing system flexibility and demand management, and to the role of, and opportunities for, new markets and players.

Landscape of renewable energy: solar and wind

The cost of renewable energy has fallen with increasing technology deployment, and these renewable power sources are now routinely outcompeting traditional fossil fuels and other energy sources.[2] Previously, renewable energy was subsidized by governments and/or consumers. Yet it is increasingly recognized that, in certain geographies, solar and wind can be among the cheapest sources of energy and that they will no longer always need subsidies or guaranteed prices to be financially competitive. Although the role of other renewables – hydropower, landfill methane, biogas, etc. – are important in supporting the transition to a low carbon power sector, solar and wind have been the decisive drivers in transforming energy systems worldwide over the last decade.

Regional overviews

China

China is the world's largest investor in renewable energy, and is the leading country for the installation of new electricity production capacity from renewables. It now has more solar and wind installed capacity than any other country.[3]

Recent reports suggest that a total of 34.5 GW of solar capacity was installed in the first nine months of 2018, and it is expected that over 40 GW will be deployed over the full course of 2018.[4] While this would be a decrease from the record 53 GW installed in 2017, this figure would still be greater than previously forecast by many analysts. In early 2017 the government put a cap of 10 GW on the distributed generation market, and a cap of 13.9 GW on utility-scale projects for 2018. Therefore, it appears that considerable capacity – up to 10 GW of utility-scale solar – is being built without the support of feed-in tariffs. If this assessment is accurate, this will be a landmark development for solar both in China and globally.

[1] When a meeting, or part thereof, is held under the Chatham House Rule, participants are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed.
[2] IRENA (2018), Renewable Power Generation Costs in 2017, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENA_2017_Power_Costs_2018.pdf (accessed 21 Nov. 2018).
[3] BP (2018), 'Statistical Review of World Energy', https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html (accessed 21 Nov. 2018).
[4] Enkhard, S. (2018), 'China may raise 2020 solar target to more than 200GW', 5 November 2018, PV Magazine, https://www.pv-magazine.com/2018/11/05/china-may-raise-2020-solar-target-to-over-200-gw/ (accessed 21 Nov. 2018).

Factors influencing China's shift away from fossil fuel sources and towards a low-carbon industrial strategy include:

- Worldwide concerns regarding the negative consequences of climate change, which given China's large landmass and population are all the more pertinent. It is therefore rational to invest in renewables to prevent rapid climate change.
- Concerns for human health, as high levels of air pollution in Chinese cities have been adversely affecting citizens and causing premature deaths.
- Rising electricity demand requiring increased use of renewable energy (especially when the costs are equal or lower to fossil fuels).

Germany

The expansion of renewable energy in Germany was driven by government subsidies. Although this led to the rapid and large deployment of solar and wind on the German grid, it has had less success in supporting domestic industrial strategy. This is linked to Germany losing its leadership in technology development as well as a large proportion of its manufacturing of renewable technology to China, decreasing its influence on the global supply chain.

Power sector transformation

Generation and electricity transition

It is expected that renewable energy will dominate the energy sector of the future. The transition has begun in the electricity sector, facilitated through the development of transmission infrastructure and smart technologies. The higher generating costs of electricity using oil and gas as against those for renewables will be another factor driving this transition.[5] Despite coal still being considered the cheapest source of electricity in many cases, it would be subject to a considerable increase in price if the cost of carbon was included.

Efforts to electrify the transport sector have already begun, with examples ranging from ferries, trucking and aviation to the use of electricity to develop other fuels such as hydrogen. This will lead to the emergence of new players on the market who could also compete with traditional electricity suppliers. In conjunction with falling power prices often driven by the greater deployment of renewable energy, this has resulted in the loss in value of major power plants. For instance, 16 power companies in Europe suffered a combined loss of €5.8 billion in 2016, from a profit of €33.3 billion in 2010.[6] This has resulted in some governments raising prices and modifying current legislation to support traditional and baseload generators. Consequently, combined power plant profits rose to €27 billion in 2017.[7]

Demand management and flexibility

Greater deployment of variable renewables has increased the need for flexibility in the system and has also affected pricing. In Germany, for instance, the large-scale deployment of solar energy has lowered the peak price for electricity during the day (during periods of high demand), thus reducing and in many

[5] IRENA (2018), 'Renewable Power Generation Costs in 2017', https://cms.irena.org/publications/2018/Jan/Renewable-power-generation-costs-in-2017 (accessed 21 Nov. 2018).
[6] Data taken from speaker's presentation. For further information, please contact Catherine Hampton at champton@chathamhouse.org.
[7] Ibid.

cases removing the economic case for pumped hydro storage. The falling costs of other balancing options – such as batteries – is also putting pressure on traditional means of flexibility.

With increasing renewables being brought on to the grid, challenges of flexibility and intermittency will increase. As a result, the need for investment in the grid's infrastructure increasingly outweighs the need for investment in generation. Greater deployment of electric vehicles and electric heating can help system balancing if smart charging and meters are used. The further deployment of these distributed energy sources, together with increasing balancing of the distribution system (through batteries and demand-side measures), will therefore increase the importance of the distribution system operator.

Several northern European countries, such as Iceland and Norway, are good examples of countries that have localized and electrified their power sectors, and that have also successfully modified their industrial processes towards renewable energy generation. A number of countries in the Middle East and in Latin America see the global shift towards renewables as an opportunity to reshape their energy supplies and become green energy hubs while also reducing their economies' reliance on fossil fuels.

Hydrogen: a new energy fuel?

Hydrogen can be produced at a relatively low price through steam reformation, although this process has a high carbon footprint. A possible alternative would be to produce hydrogen from electrolysis, which is better from an environmental perspective. For the technology to be economically viable, however, the costs of the input energy will need to fall significantly, to about $0.01/kWh for solar and wind.

Producing hydrogen and/or alternative fuels could have important implications for the penetration of renewables, as it has the potential to enable seasonal energy storage.

Environmental considerations

Innovation and investment in renewable energy have accelerated the decarbonization of the power sector in Europe, but not without some negative environmental impacts – in particular for developing countries, who are the main importers of solid and e-waste from Europe. Although the renewables industry is still in its infancy, regulation should be implemented to ensure that companies introduce environmentally appropriate waste disposal and effective recycling practices. Another example is the electric automotive sector, where control and transparency is needed throughout the supply chain to ensure that environmental standards are being followed, and that recycling of battery cells are being carried out by suppliers.

Role of the government and geopolitical risks

While the rapid shift to renewable energy has led some countries to rapidly decarbonize their power sectors, this is not happening fast enough; nor is it happening globally. Governments have a critical role in fostering investment in renewables and to safeguard the economic frameworks that can enable the industry to flourish.

As the industry expands worldwide, geopolitical risks could emerge. Governments have an important role to play in supporting the development of supply chains and the development of critical materials such as cobalt, which is a key element in batteries.

Conclusions

- The power sector has seen transformative changes in the last decade, with the introduction of renewable energy on an unprecedented scale. Initially, new solar and wind capacity was driven predominantly by the need to decarbonize, but falling costs are now leading the way to their unsubsidized deployment.
- The use of renewable energy is increasing the need for flexibility within the power system. This is already raising new opportunities for demand-side management and batteries. In the longer term, the use of electricity to create fuels such as hydrogen would further aid renewable integration.
- China remains the global leader in the use and manufacturing of renewable energy; and with increasing awareness of climate change issues such as air pollution, there is likely to be even greater deployment of solar and wind.
- The transformation of the power sector has already impeded the economic performance of traditional utility companies. Alongside this, the electrification of transport – and eventually of heating – will further encourage new actors to enter the power sector.

About the Future of Energy series

This series of meetings explores the key risks and opportunities for the private sector of the ongoing and rapid transformation of the energy sector and the new industrial revolution. For further information, see https://www.chathamhouse.org/about/structure/eer-department/future-energy-risks-and-opportunities-during-4th-industrial-revolution-project or please contact:

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*AIG Energy, co-host with Chatham House of the **Future of Energy** series, addresses risk management and transfer throughout the energy industry, from upstream exploration and production to downstream petrochemical processing and refining, utilities and power generation.*

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