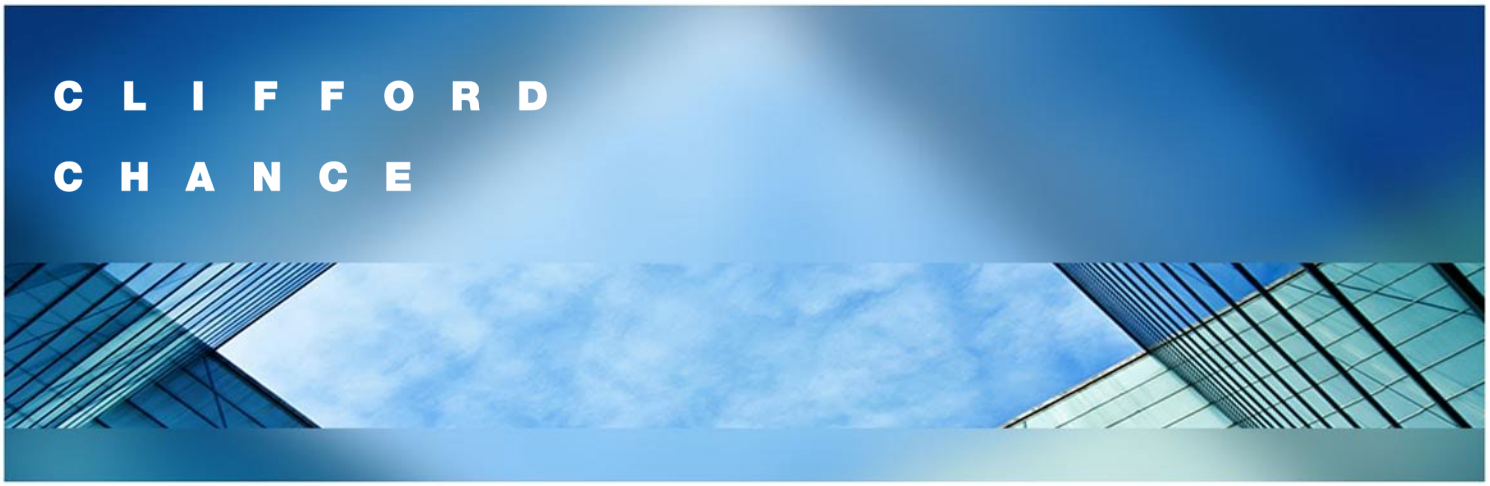

THE RENEWABLE ENERGY TRANSITION AND SOLVING THE STORAGE PROBLEM: A LOOK AT JAPAN

The rapid growth of renewable energy in Japan raises new challenges regarding intermittency of power generation and grid connection and stability. Storage technologies have the potential to resolve these issues and help advance Japan into the next stage of its renewable energy transition. This briefing examines the regulatory framework for energy storage in Japan, draws comparisons with the European markets and seeks to identify the regulatory developments necessary to attract private sector investment in utility-scale energy storage.

Summary

- The rising share of intermittent renewable power generating capacity accentuates frequency response management and grid capacity constraints as critical challenges facing the electric power system in Japan. Energy storage can provide solutions to these issues.
- Current Japanese laws and regulations do not adequately deal with energy storage, in particular the key question of whether energy storage systems should be regulated as a "generator" or "consumer" of power, placing energy storage in a regulatory grey area.
- Enhanced policy and regulation, drawing from experience in other jurisdictions, may help accelerate investment in energy storage and facilitate the renewable energy transition.

JAPAN'S RENEWABLE ENERGY TRANSITION

Since 2012, the Japanese government has actively championed renewable energy as an environmentally friendly power source, resulting in renewable energy comprising an increasingly larger proportion of Japan's overall power supply. According to the latest figures published by the Ministry of Economy, Transport and Industry (METI), in 2019 approximately 18.0% of overall power resources was renewable (hydropower: 7.7%, solar: 6.7%, biomass: 2.6%, wind: 0.7% and geothermal: 0.3%) compared to 10.4% in 2011. The Japanese government is targeting a further increase to 22-24% renewable energy capacity by 2030. Achieving this goal will require strong policy and legal and regulatory support.

In addition, with the growing domestic and international consensus on the causes and threat of climate change, the tide of public opinion is firmly against thermal power generation, and in particular coal-fired power plants. METI has announced the Japanese government's intention to phase out all of Japan's inefficient coal-fired power plants (comprising 16% of overall power resources in 2018) by 2030. Furthermore, Prime Minister Suga declared in October 2020 a new target of reducing greenhouse gas emissions to net zero by 2050.

The stage is therefore set for further investment in the Japanese renewable energy sector. To date, solar photovoltaic (PV) power has proven particularly popular with investors, surging from 0.4% of overall power generation in 2011 to 6.0% in 2018. However, the generous early feed-in tariffs for solar PV power have gradually been scaled back and phased out and suitable land sites for larger solar PV power plants have become more scarce, while onshore wind continues to present technical and financial challenges

(approximately 70% of Japan is mountainous, so suitable sites are difficult to access and construction costs are relatively high). As a result, attention has shifted to offshore wind (for more information see our previous briefing on offshore wind in Japan here), which promises to sustain the renewables boom with several port area projects already underway and the first auction round for open water offshore wind projects taking place later this year.

While these developments are positive, as other countries have discovered, renewable power's growing share of total generating capacity is not without issues. The optimal locations for solar PV power plants and offshore wind farms are often far from major power consumption hubs posing a grid connection and transmission challenge. In regions such as Kyushu and Hokkaido available grid capacity at peak generating hours is constrained leading to curtailment risk for renewable power producers. In Kyushu, the regional utility company and grid system operator has requested that solar PV power plant operators limit the amount of electricity dispatched to the grid due to over-supply. Some developers have been refused grid connection for proposed solar PV power plants due to such capacity constraints.

Another issue accentuated by renewable power is grid frequency management. The electrical output from renewable power plants is inherently intermittent (solar PV power plants do not generate at night), complicating grid system operators' crucial task of ensuring a stable system frequency at all times. Failure to do so can lead to grid shutdown and blackouts, something both England and parts of Australia have experienced in recent times.

Left unaddressed, these issues could in time materially constrain the pace of growth of renewable energy. Storage technologies hold promise as part of the solution to these issues and present a potentially significant new business opportunity for energy investors in Japan.

ENERGY STORAGE IN JAPAN

Some of the more recent new-build renewable power plants in Japan include an energy storage component. The two largest solar PV power plants in Hokkaido, commissioned in July and October 2020, respectively, both include lithium ion batteries. One plant has generating capacity of 64.6MWp and battery output of 19.0MWh, while the other has generating capacity of 102.3MWp and battery output of 27.8MWh. Installation of the batteries was specifically required by the local utility company to reduce the intermittency of the electrical output from the plants.

From a different angle, one of the utility companies has announced a partnership with a clean energy technology company to repurpose refurbished battery packs from old electric vehicles into modular battery systems that can be "stacked" to create units of different sizes. Small systems based on this technology can be retrofitted to existing renewable power plants at significantly lower cost than larger bespoke systems.

While encouraging, these examples are the exception and there remains a distinct shortage of reliable battery and other energy storage solutions as part of the regional electrical power systems in Japan. New installations are being promoted by utility companies on an ad hoc basis and without the benefit of a specific or comprehensive governmental policy and regulatory framework for energy storage.

The Electricity Business Act of Japan (Act No. 170 of 1964, as amended) (the Act) is the key piece of legislation for the regulation of the electricity sector in Japan and covers activities relating to (i) generation, (ii) transmission and distribution and (iii) retail sales. Under the Act, anyone supplying more than 10MW of capacity to the grid (and satisfying other detailed requirements) is considered an "energy generator" and subject to the Act's regulatory regime, including obligations to file certain information with the authorities.

Since the Act does not specifically refer to energy storage as a separate regulated activity, any operator of an energy storage facility supplying more than 10MW of capacity to the grid could, in principle, be categorised as an energy generator and subject to the regime. This is likely to be problematic because the regulations were not designed with energy storage specifically in mind and do not address, from an energy storage operator's perspective, issues such as the application of wheeling charges or eligibility for forming a "balancing group" with other power generators.

Moreover, there are no other Japanese laws and regulations specifically governing energy storage, other than with respect to basic safety requirements. Although the separation of electricity generation activities and electricity transmission and distribution activities has been mandated since 1 April 2020 pursuant to an amendment to the Act, the opportunity was not taken at that time to clarify the legal and regulatory framework for grid-connected energy storage.

In our view, a more coordinated approach at a national level, including a supportive policy and regulatory framework, will help to unlock more significant investment in energy storage in Japan.

ENERGY STORAGE – LESSONS FROM EUROPE

Regulation of energy storage in the EU

The Clean Energy for all Europeans Package (CEP), a suite of EU energy legislation passed in 2018 to facilitate the renewable energy transition, includes new rules relating to energy storage to ensure energy market laws keep pace with technological developments. While most regulations on energy storage, including in relation to licensing, system charges and levies, are dealt with at a national level, the CEP aims to set certain common standards at an EU level.

In relation to storage, the CEP contains provisions that seek to clarify the regulatory treatment of storage in electricity markets and to remove certain barriers to potential participation in wholesale electricity and balancing markets by operators of energy storage systems. The key changes include:

- the introduction of a definition of "energy storage" and a confirmation that energy storage should be treated as "generation" rather than as consumption or a new asset class. This is important for a number of reasons including unbundling (see below), the applicable grid charges and levies and the ability to participate in organised markets;
- the prohibition on transmission system operators and distribution system operators directly owning, managing and operating storage facilities as they are now considered generation and therefore the unbundling rules (i.e. the separation of network operation and generation/supply of energy) apply. There are exceptions to this rule such as where the storage facilities are fully integrated network components and the national

regulatory authority has granted a derogation from the unbundling rules; and

- the removal of barriers to the uptake of energy storage. This includes a requirement that storage facilities are not subject to double charging for using the network or disproportionate fees and licensing requirements. It also includes a right to a grid connection within a reasonable amount of time and for storage facilities (where feasible) to be given access to wholesale and balancing electricity markets.

Europe has a comparatively mature energy storage market both in terms of regulations and deployment. Investments in storage have been driven so far without direct subsidies or mandates on utilities. Storage facilities have relied on "revenue stacking", where different revenue streams are combined to make a project commercially viable (and, if financed, bankable). These revenue streams include contracts with transmission system operators for balancing services (such as frequency response), power offtake agreements as well as trading in intra-day and real-time electricity markets (where prices are higher than in the day ahead markets).

One of the defining characteristics of the storage market to date in Europe is that it has generally been used to satisfy short term electricity requirements rather than as a longer duration solution as is more typically seen in the USA (where battery storage competes in merchant power markets with "peaker plants" that only generate at times of peak power demand).

CONCLUSION

Energy storage has an important role to play in Japan's renewable energy transition and broader shift towards becoming a carbon-neutral economy. By balancing grid systems and saving surplus electricity for later use, it has the potential to enhance energy efficiency and allow more renewable power generating capacity to be integrated into the electricity system. Wider deployment of energy storage also promises benefits in terms of increasing Japan's domestic energy security and lowering energy prices for consumers by fostering a well-functioning internal electricity market.

The Japanese government is evidently aware of this, as reflected by its "Green Growth Strategy Towards 2050 Carbon Neutrality" published on 25 December 2020, which acknowledges the necessity for a specific policy and regulatory framework to accelerate further investment in grid-connected energy storage. For these purposes Japanese regulators can draw upon lessons learned in other markets, including borrowing appropriately from Europe's CEP in relation to matters such as the categorisation of energy storage as "generation" rather than "consumption".

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