

An Analysis on How DC-Coupling ESS Solution Increases Renewable Energy Ratio



In the past few years, the energy storage industry has seen a booming development driven by the joint impacts of the falling LCOE of renewable energy and breakthrough of energy storage tech-

nology - especially the rapid development of EV battery technology. Energy storage is a vital driving factor to facilitate the energy climate-neutral transition. It can be combined with

multiple technologies to improve the flexibility of a growing proportion of renewable energy power systems.

Issues and countermeasures

China is one of the world's largest energy hubs. The rapid growth of renewable energy spurs the demand for flexibility in traditional power plants and the entire power system. In addition, the impact of PV volatility on the grid is also scaling up with the substantial increasing installed capacity. The country is now witnessing clipping loss, a huge challenge of solar power segment, espe-

cially in China's northwestern region where the solar resource is abundant but cannot be fully utilized. In addition to this, the PV industry is facing with the challenges of a lower LCOE and the wider range of volatility of output.

In fact, Chinese governments and National Grid have begun to set up requirements on this issue. Since 2020,

more than a dozen provinces including Shandong, Shanxi, Xinjiang, Inner Mongolia, Anhui and Tibet have successively issued policies mandating energy storage systems (ESS) being added to the renewable energy power plants.

Coincidentally, Germany sees similar problems in renewable energy development. The electricity generation in Ger-

many from November 2019 to August 2020 is shown in Figure 1, where the volatility of onshore PV can clearly be seen. Renewable energy accounts for 43% in the national energy mix, and this proportion is expected to exceed 65% by 2030. By 2050, the power system will be 100% of renewable energy. As one of the key driving forces in renewables, PV segment is hiking.

In addition to fluctuations in power supply, hourly electricity demand also changes. Therefore, not only power supply needs to be predicted, but power demand should also be predictable, ensuring a balance between the supply and demand. As new technologies such

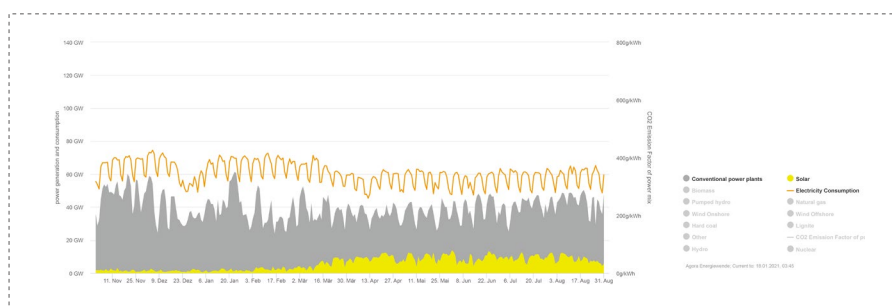


Figure 1: Power Generation and Consumption of Germany (11.2019-08.2020)

as electric vehicles or heat pumps will gradually replace fossil fuel, we see a growing demand on electricity, which makes the improvement of energy efficiency a main concern. Therefore, the regional annual electricity demand and hourly demand pattern will also update.

Moving forward, ESS is becoming a widely-recognized solution to the volatility and clipping loss of renewable energy. Especially with the LCOE going down continually, energy storage will be more accessible and flexible.

Issues and countermeasures

As we are at the cusp of energy transition, renewables, such as PV is required to be more grid-friendly. Energy storage is one of the most effective solutions to address the issue. Likewise, as the cost of PV modules continues to fall, and batteries follow a similar downward trajectory, solar-plus-storage application is in growing demand among industry players. As one of the typical solutions among the solar-plus-storage markets, the DC-coupling solution can maximize the utilization of renewable energy and smooth the power output, ensuring a more reliable and stable power landscape.

The DC-coupling solar-plus-storage design means that an energy storage system connects to a solar system via DC side (as shown in Figure 2). In this solution, a pre-assembled energy storage interface of a PV inverter will be necessary. Inverter suppliers represented by Sungrow

have launched more product portfolios with this function.

There has been experienced track records on the DC-coupling solution in a multitude of markets covered by market-oriented power transactions, such as Europe, the US and Japan.

The US is leading the trend, where electricity generated by clean energy projects are becoming more competitive than gas plants', especially considering other revenue streams from grid services. Aimed at further

lowering the LCOE of solar-plus-storage installations and maximizing the power generation that can be fed into the grid, energy suppliers and developers are turning to DC-coupling solutions.

Europe witnesses an even evident trend. In countries like the UK, the DC-coupling BESS is under development by local companies. It will help improve overall energy output of the hybrid system while also optimizing the costs and increasing system reliability and flexibility.

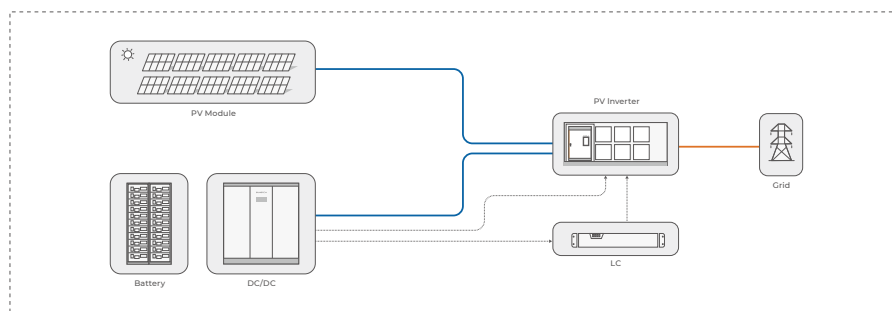


Figure 2: DC-Coupling ESS Solution Diagram

Break through solar bottleneck

In view of the growing PV penetration, the possibility of clipping loss will also increase. Especially in areas with ample solar resources, DC-coupling solution is an ideal match for local decarbonization.

Amos Liu, a senior technical manager of Sungrow, explained that the DC-coupling system can solve the problems of clipping loss and curtailment. It absorbs the surplus electricity generated during the daytime and feeds it to the grid at night or when there are dispatching needs. Compared with the AC-coupling solar-plus-storage solution, DC-coupling system can be more profitable. With less restriction on DC/AC ratio, the advantages will become more prominent.

Taking Japan's Akita Odate FIT (Feed-in Tariff) project as an example, a typical case of solving solar clipping loss and grid volatility by installing energy storage on the DC side. The limited AC capacity of the project which received FIT subsidies is 49.5kW, and the DC side is of 350kW, which features a striking DC/AC ratio of 7. Sungrow supplied a 1.1MWh ESS to automatically store excess power to avoid clipping loss and significant output fluctuations, guaranteeing 24 hours of continuous power yields.

Likewise, Sungrow's DC-coupling solution has been applied in China a few years ago. Back in 2016, a 100MW PV plant in Jinchang, Gansu adopted solar-plus-storage solution to solve the problem of solar electricity clipping loss. A turnkey 1MW/1.1MWh ESS was offered to carry out relevant analysis, accumulate data and experience, and pave the way for future applications.

Notably, Sungrow's newly launched DC-coupling solution has made innovations in the power electronics and control

algorithms. The PV inverter can be used for bidirectional charging and discharging applications. Sungrow is one of a few inverter manufacturers that can provide bidirectional charging and discharging solar-plus-storage solutions.

"DC-coupling system can be used for storing excess energy during the day and continue to meet the electricity demands at night. After that, it can also play a role in peak-shaving and absorption of wind power and multiple energy sources from late night to early morning," said Amos.

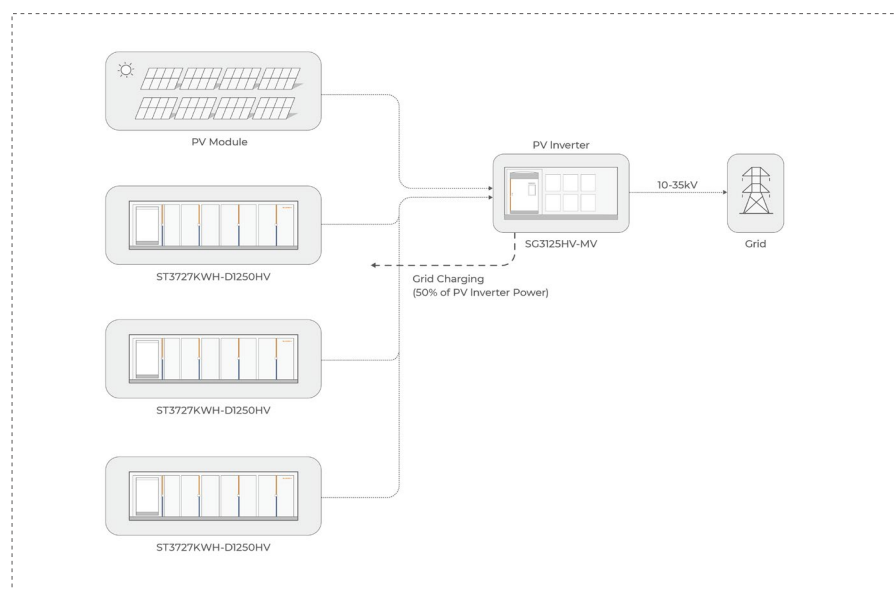


Figure 3: Sungrow DC-coupling ESS Solution

Call for future actions

With the goal of carbon neutrality by 2060, renewable energy in particular PV and wind power will assume the responsibility of energy transition. The problems aforesaid like volatility and clipping loss of solar do still exist. Although many countries have introduced policies for an energy storage system to be added along with renewable applications, the current design and implementation methods of the solution are uneven,

partially due to the lack of relevant standards and specifications.

Accordingly, policies should be made to clarify the technical standards and business models, making renewable energy a grid-friendly source. Besides, PV manufacturers also need to spur the development through technical innovations and comprehensive services. As an

early entrant in the energy storage market, Sungrow has a robust track record across the globe. Apart from DC-coupling solution, Sungrow is a pivotal player in 1500V AC-coupling solution as well. With an untarnished fire safety record on over 1000 energy storage projects, Sungrow is pioneering more ventures teaming up with global partners to make energy more profitable, accessible and sustainable.



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