Microgrid Solutions

DEMAND CHARGE REDUCTION WITH MICROGRIDS

In many countries, grid costs for large-scale consumers are set with reference to their maximum peak load. Microgrids are one way to cut peak loads and thereby significantly reduce electricity bills.

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Lowering peak loads can be beneficial for both end-consumers and grid operators. On the one hand, reducing peak loads allows end-consumers to save money by lowering demand charges. Additionally, it enables them to prevent costs for bigger transformers. On the other hand, decreasing peak loads stabilizes the grid, deferring the necessity for grid operators to reinforce the network and bear supplementary costs. Furthermore, atypical grid usage of large consumers brings more flexibility into the system, better utilizing the grid. This enables suppliers to integrate higher shares of renewable energy at moderate costs. This white paper highlights two main customer groups that can benefit from using microgrid technology for demand charge reduction.

A Rolls-Royce solution

Industrial manufacturing

Demand charges can make up to 70% of industrial manufacturers' electricity bills in Germany or the US. Industries that use for instance rotating machinery experience recurring events of high peak loads during power intensive start up times. This is especially the case during summer when electrical AC creates an additional base load. Peak loads can be demanded every day or only few times a year but create the same capacity need for the grid, which is based on the maximum peak load it must transport. Due to working times and highest requirements of production efficiency, industrial manufacturing companies can hardly address their peak demands by load management (e.g., using power intensive machinery only in low load hours). The installation of microgrid components, such as battery energy storage systems (BESS), helps to shave the peaks by resorting to stored energy when peak loads occur. This allows to reduce demand charges without interrupting production processes. The BESS controller learns from the companies' behavior when and how long the maximum of power is required and charges the battery optimally to cover the energy needed.

Demand Charge Reduction
Cutting peak demands by using energy storage in addition to the grid when current load is higher than the base load. This avoids demand charges which are typically charged per kW for the highest peak per year.

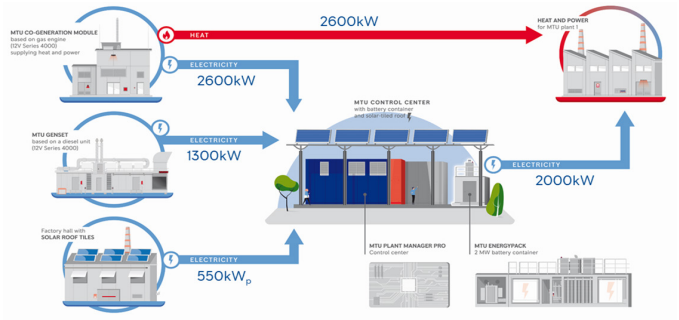
Microgrid Validation Centre, Friedrichshafen, Germany

One example is the Microgrid Validation Center at Rolls-Royce's manufacturing facility in Friedrichshafen, Germany. The Microgrid Validation Center is designed to enable the simulation and validation of computer simulated scenarios, including customer-specific requirements, in a real environment with real hardware. However, it is not just for validation and simulation. In fact, the Microgrid Validation Center also adds real benefits for the local facility, like providing peak shaving of its load profile. The installed BESS can reduce occurring peaks in the system to a max. of 2MW for 30 mins or 1MW for an hour. Peak shaving is especially interesting in Germany as a large share of electricity bills is based on the yearly peak demand. Reducing the highest peaks throughout a year therefore results in significant cost savings.

Additionally, the Microgrid Validation Center includes a 2.6MW gas combined heat and power unit, which provides heat and electricity to the manufacturing facility, a 1.3MW diesel genset, which is used for emergency backup power, and a 550kWp PV plant installed on the roof of the Validation Center and on a nearby factory building. Over the weekend, the excess energy from the PV can be stored in the batteries, resulting in improved utilization of clean energy and reduced costs.

EV-charging integration

The second main customer group results from the increasing number of electric vehicles (EVs) which need to be charged and preferably charged fast. EVs are considered to have a big impact on saving emissions and transforming the transport sector from a fossil fuel-based mobility to a renewable electricity-based mobility. The growing number of EVs naturally increases the demand for EV charging stations, which is often enough accompanied by a necessary expansion of the network infrastructure. Switching to electricity-driven cars increases not only the total electricity consumption but also produces peak loads particularly in areas of high-power chargers, causing high grid fees to the charging station operators. The trend of ever larger batteries, which can handle longer distances, and the drivers´ requirements to charge EVs as quick as possible, intensify peak loads even more. Microgrids can be beneficial in the coming years to support the transition of the transport sector to e-mobility. By installing a BESS, immediate peak loads from high-power charging are covered by the storage. Hence, the BESS is leveling the load, avoiding grid expansion, enabling higher utilization of the grid and saving demand charges for operators of charging stations.



Validation Centre
Friedrichshafen

Public transport system in Germany

The city of Münster is one early adopter of electric buses. Starting already back in 2015 with five electric buses and the installation of several fast chargers with 350kW charging power at bus stops, it now ranks under the top three German cities by number of electric buses.

The introduction of the emission free bus line initially caused voltage issues at the bus stop located at the end of the distribution cable, due to the high peak power demand required. As previously mentioned, in fact, EVs or electric buses can trigger peak loads and put pressure on the network infrastructure when charged with high power at once. With the introduction of a BESS from Rolls-Royce, the voltage was successfully stabilized, ensuring the delivery of a reliable energy supply for electric buses that are being charged and preventing the municipality to bear potential costly demand charges.

Rolls-Royce provides world-class power solutions and complete lifecycle support under our product and solution brand mtu. Through digitalization and electrification, we strive to develop drive and power generation solutions that are even cleaner and smarter and thus provide answers to the challenges posed by the rapidly growing societal demands for energy and mobility.

We deliver and service comprehensive, powerful and reliable systems, based on both gas and diesel engines, as well as electrified hybrid systems. These clean and technologically advanced solutions serve our customers in the marine and infrastructure sectors worldwide.