



Power Generation

BATTERY ENERGY STORAGE SYSTEMS FOR CHARGING STATIONS

Enabling EV charging and preventing grid overloads from high power requirements.

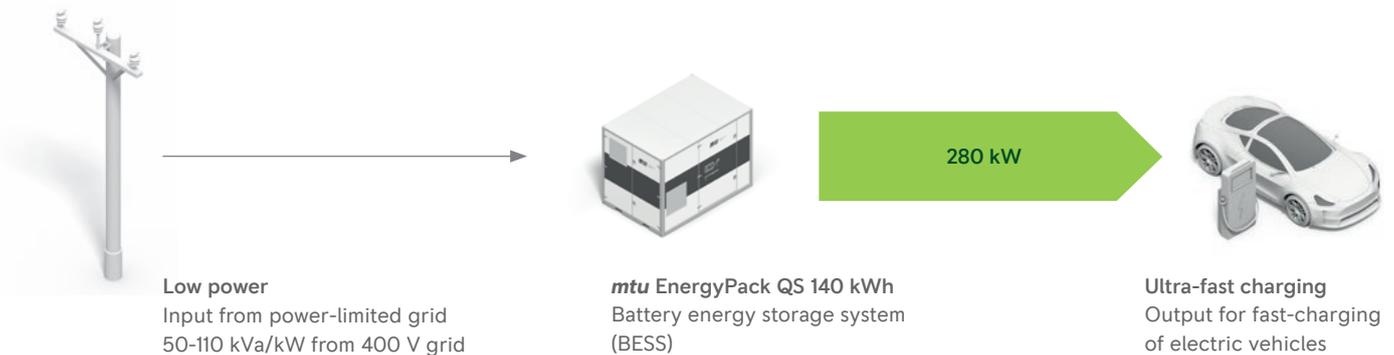


A Rolls-Royce solution

OVERCOMING GRID LIMITATIONS AND ENABLING FAST CHARGING

Charging station operators are facing the challenge to build up the infrastructure for the raising number of electric vehicles (EV). A connection to the electric power grid may be available, but not

always with sufficient capacity to support high power charging. Battery buffered charging bridges that gap by providing power for EVs at any given time, even on low-power grids.



The rise in electric driving causes an enormous increase in the demand for electric power, often in places where there was originally very little demand. Thereby, the public grid can quickly reach its limit.

Reinforcing the grid takes many years and leads to high costs. The delays and costs can be avoided by buffering electricity locally in an energy storage system, such as the **mtu** EnergyPack.

Four arguments for **mtu** EnergyPacks:

Avoid need for grid connection reinforcement

When several EVs are charging in parallel or fast chargers are installed, they require a lot of power and energy at short notice. Not all grids can deliver the power needed. By installing a **mtu** EnergyPack a transformer or cable expansion can be avoided, which is associated with time and cost-intensive work and permits.

Integrate renewable energy

mtu EnergyPack combines perfectly with renewables, enabling 24/7 self-consumption. Our intelligent Microgrid Controller manages the fluctuating energy supply and demand.

Charge in minutes, not hours

EV charging is putting enormous strain on the capacities of the grid. To prevent an overload at peak times, power availability, not distribution might be limited. By adding our **mtu** EnergyPack, ultra-fast charging output power can be carried out even on a low power grid connection.

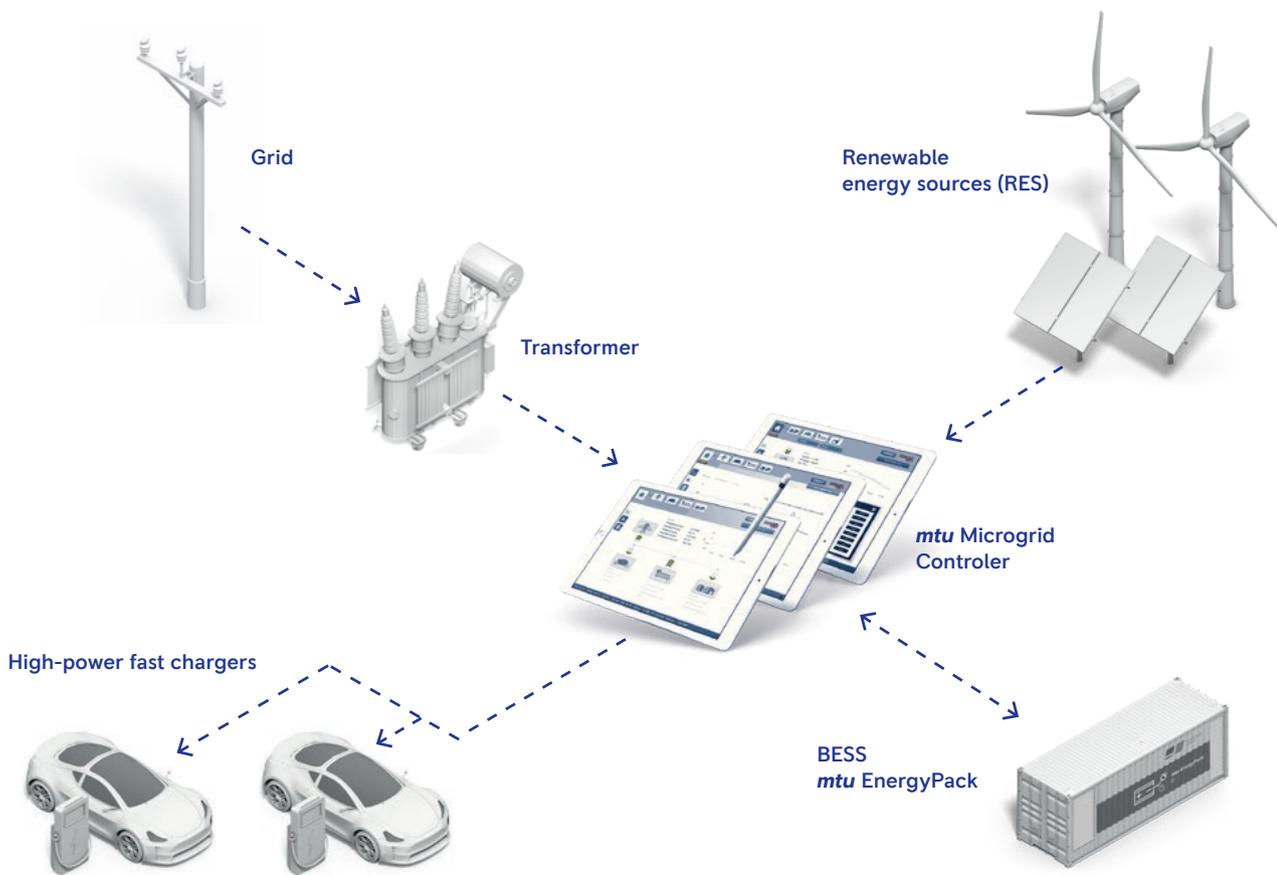
Reduce grid fees with peak shaving

Charging stations have an intermittent energy load profile. In many countries grid operators apply demand charges to commercial and industrial electricity consumers on the basis of their highest peak load per year or month. An **mtu** EnergyPack can help to cut charges by supplying energy in peak load hours and flattening the load profile when absorbing energy in low demand hours.

Highly flexible connection capacity reduces site-specific restrictions

Today, an existing and sufficiently robust electricity grid at the planned location is a necessity for the economic operation of charging infrastructure. If this grid capacity is not available, the additional costs minimize the prospect of economic operation or repayment. While some grid expansion will be desirable and

necessary, it is unlikely that the grid will be upgraded at all locations to provide the power needed for the growing EV market demand. The scalable **mtu** EnergyPack enables a quick charge, even on a low power grid connection.



PIONEERING THE POWER THAT MATTERS

We at Rolls-Royce provide world-class power solutions and full life-cycle support under our product and solution brand **mtu**. By utilizing the potential of digitalization and electrification, we strive to develop climate-neutral power delivery and power generation solutions that are even cleaner and smarter, thus providing answers to the challenges posed by climate change and by society's rapidly growing demands for energy and mobility. We supply and maintain comprehensive, powerful and reliable systems based on customer needs, including power storage systems, natural gas and diesel engines, and renewable energy solutions.

We are gearing our product portfolio towards greater sustainability – by means of electrification, hybridization, system integration and alternative fuels. From 2023, our main engine series will be ready for sustainable fuels. From 2025 onwards, we will provide our customers with CO₂-free energy supply with fuel cells. By 2030, we aim to reduce the CO₂ emissions of our new products and solutions sold by 35% compared to 2019. By 2050, the entire Rolls-Royce Group will be carbon neutral.



Learn more about mtu EnergyPack solutions on www.mtu-solutions.com or scan the QR-Code.



USE CASE: EV-CHARGING STATION WITH LIMITED GRID ACCESS

Investment in grid connection reinforcement versus *mtu* EnergyPack QS

- What:** Charging hub with two fast chargers (150 kW) and six slow chargers (22 kW). Approximately 40 cars per day, requiring, on average, 30 kWh per car.
- Where:** Highway 7 in Germany
- Challenge:** The low-voltage grid at the charging station cannot provide the high charging power of 22 kW. The charging station operator must decide whether to invest in grid reinforcement or opt for a quickly installed energy storage system.

Grid reinforcement vs. *mtu* EnergyPack QS 250 kW, 1C (267kWh)

CAPEX

<i>mtu</i> EnergyPack		€ 160,000
Grid reinforcement		€ 321,050

OPEX (per year)

<i>mtu</i> EnergyPack		€ 23,300
Grid reinforcement		€ 25,700

€ 161,000

CAPEX saving

10 %

OPEX savings per year

RESULTS OF THE USE CASE

CAPEX grid connection reinforcement

Grid connection reinforcement means expanding the network from a low voltage (400 V) to a medium voltage (1,000 V) grid by installing a corresponding transformer and cables. The distance to the nearest medium voltage substation is 5 km. Grid connection, transformer and cables suppose an investment of: € 321,000.

CAPEX grid reinforcement: € 321,000

CAPEX *mtu* EnergyPack QS

A quickly installed *mtu* EnergyPack QS with 250 kW, (267 kWh) means an investment of: € 160,000.

CAPEX *mtu* EnergyPack QS: € 160,000

CAPEX savings total: € 161,000

CAPEX

	Grid connection reinforcement	<i>mtu</i> EnergyPack QS
Connection costs	€ 16,800	€ 5,000
Cable	€ 275,000	-
Transformer	€ 29,250	-
BESS costs	-	€ 155,000
Total CAPEX	€ 321,050	€ 160,000

OPEX

Operating costs comprise energy consumption charges (generation and grid costs, taxes and levies) as well as demand charges. Adding a *mtu* EnergyPack enables significant savings on grid demand charges, achieved through peak shaving. EVs not only raise the total electricity consumption but also produce peak loads in areas of high-power chargers. Many grid operators apply demand charges based on their highest peak load over a billing period.

OPEX per year in €: € 25,700

For the *mtu* EnergyPack QS solution costs of:

OPEX per year: € 23,300

OPEX savings total per year: € 2,400

OPEX per year

	Grid connection reinforcement	<i>mtu</i> EnergyPack QS
Demand charges	€ 12,300	€ 10,000
Consumption charges	€ 13,400	€ 13,300
Total OPEX per year	€ 25,700	€ 23,300

Maximizing savings by adding renewables

The business case can be optimized by integrating renewables (such as solar and wind), thus producing ample power for self-consumption, which can be stored by the *mtu* EnergyPack. This sustainable

development lowers your carbon footprint and reduces consumption charges even further.

FAST ACCESS TO POWER

Wide range of solutions

- Relocatable, plug & play system for immediate deployment
- Completely pre-installed (incl. battery modules) and factory tested
- Ultra-fast response and 100% instantaneous load acceptance
- Direct AC connection to distribution grids at 400 V level
- Symmetrical charge- / discharge capability
- Multiple units in parallel possible with galvanic isolation
- Blackstart capability shift
- Charge / discharge setpoints or multiple applications if combined with microgrid controller

mtu EnergyPack: easy to install, scalable, versatile



mtu EnergyPack QL1

400 kVA – 2,000 kVA
Up to 2,200 kWh
0.5C/1C/(2C)2 50/60 Hz

Large and powerful

- Frequency regulation services
- PV and wind park integration
- Size: 40 ft



mtu EnergyPack QM1

400 kVA – 800 kVA
Up to 800 kWh
0.5C/1C/(2C)2 50/60 Hz

Mid-sized and versatile

- Off-grid energy supply
- Demand charge reduction
- Size: 20 ft



mtu EnergyPack QS

60 kVA – 400 kVA
Up to 550 kWh
0.5C/1C/(2C)2 50/60 Hz

Small and sturdy

- Off-grid energy supply
- PV self-consumption
- Compact size: 3.3 m x 2.2 m x 2.4 m

mtu Microgrid Controller

The microgrid solution handles both the **mtu** EnergyPack and the charging station, with one set point for all charging points. It also protects the grid from overload by sending maximum total power commands to the CSMS (Charging Station Management System), which oversees distribution at individual level.

Advantages:

The **mtu** Microgrid Controller enables seamless integration of generation from renewables, energy storage, participation in regional power markets, cloud connectivity (local and remote monitoring), and energy demand commands, e.g.:

- Load limitation commands
- Active/ reactive load sharing
- Reserve capacity management
- Renewable curtailment
- Load shedding
- Grid limit control



REFERENCES

Promoting the future of e-mobility

We are working with local authorities, charge point operators, fleet managers and others to support the energy transition and provide enough charging capacity. Our solutions provide customers in the retail, fleet, utility, and municipal sectors a flexible and fully-integrated

solution that lowers costs, optimizes electric vehicle charging, and unlocks energy services to lower energy bills and increased resiliency.



What: Six fast-charging hubs with energy storage for peak shaving and grid services.
Six *mtu* EnergyPacks QM, each delivering 500 kVA / 550 kWh
Who: Verbund, Austria's largest utility
Where: Austria and southern Germany
Why: Optimize energy costs, new revenue streams



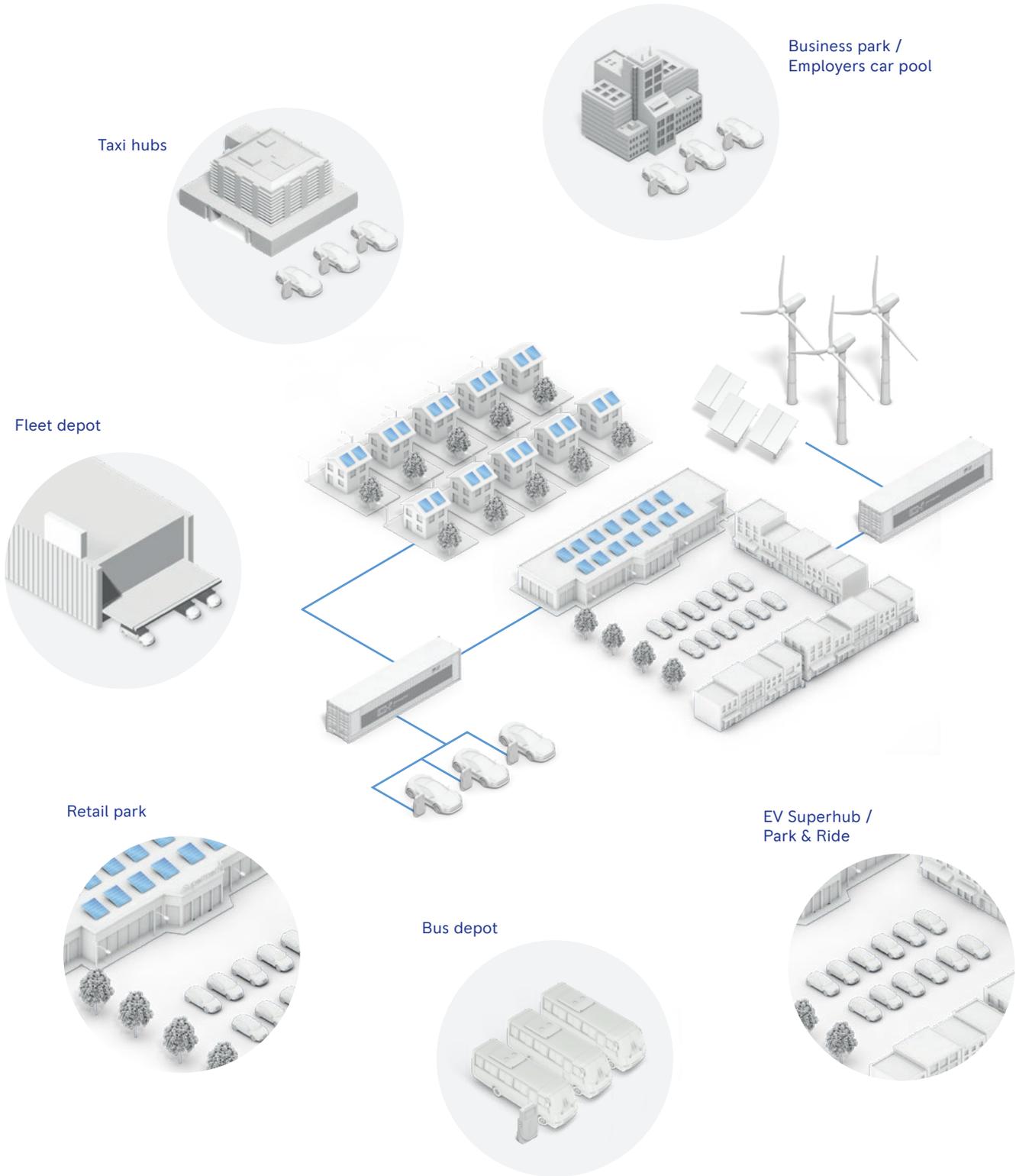
What: A bus stop with fast charger for e-buses.
mtu EnergyPack QS, delivering 55 kVA / 112 kWh
Who: Stadtwerke Münster, the local utility and public transport operator
Where: Münster, Germany
Why: Optimize energy costs, grid support



What: PV self-consumption for workplace and fleets.
EV charging at 14 charging points.
mtu EnergyPack QS, delivering 60 kVA / 194 kWh
Who: ABO Wind, develops and builds wind and solar farms as well as battery and hydrogen projects worldwide
Where: Wiesbaden, Germany
Why: EV charging integration, self-consumption

A proven record of success –
100+ energy storage installations
delivered worldwide

Wide range of use cases for charging stations



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www.mtu-solutions.com/powergen

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