



Use case I Germany EV-Charging

Configuration for best case (Case 2)



On-grid

312 kW



BESS

750 kWp



PV

27%



Renewables

Benefits: microgrid vs. initial

CAPEX (k€)

Microgrid	960k
Initial	N/A

OPEX (k€/p.a.)

Microgrid	501k	-24%
Initial	655k	



Cost of Electricity (CoE)
(€/kWh)

6

Years

Break even compared to
initial (within)

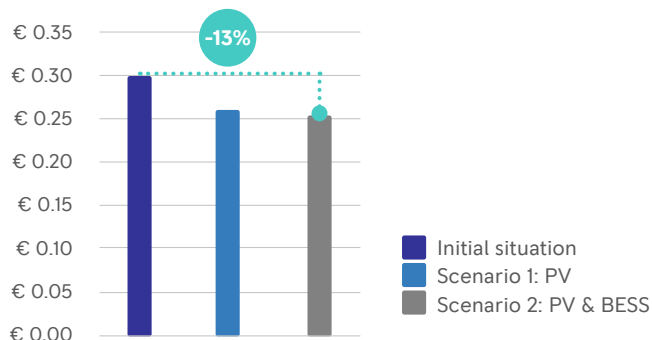
INCREASE YOUR GRID INDEPENDENCE

Two scenarios for lowering EV charging hub energy costs by up to 24%

Executive summary

Sustainability is a key driver for electric mobility. Given the opportunity, drivers would rather charge their cars with renewable energy. Fast charging hubs along the highway equipped with photovoltaics (PV) and an battery energy storage system (BESS) allow more cars to fuel up with renewable energy while also reducing costs.

Levelized cost of energy (€/kWh)



What:

Charging station for electric vehicles (EV) with ten fast chargers along the highway

Where:

Germany

Why:

Germany has among the highest rates for on-grid energy in the world. The use of renewable energy solutions enables increased grid independence and reduces costs. It also supports sustainable, climate-smart development.

Main benefits:

- Energy cost optimization
- Reduction of CO₂ emissions
- Provision of sufficient high-power charging power
- “All-Day“-Charging



A Rolls-Royce
solution

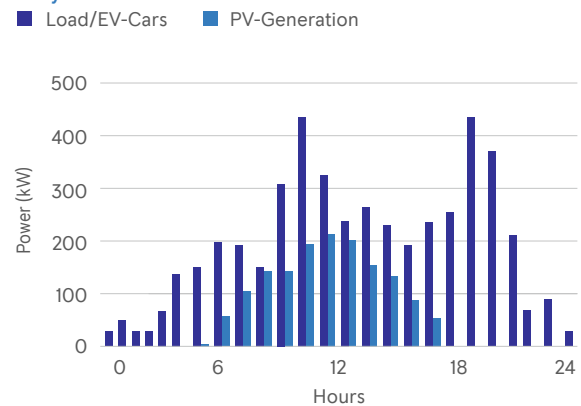
OPTIMIZING ENERGY COSTS WITH MICROGRIDS

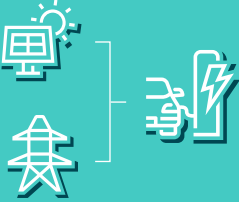
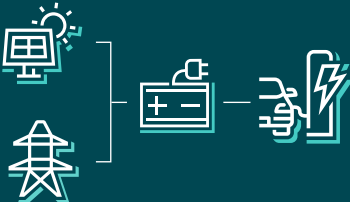
To demonstrate the savings potential for electric vehicle (EV) fast charging hubs along the German Autobahn with renewable energy systems, we have calculated two scenarios using HOMER Grid® simulation software.

Making full use of solar power

EV charging hubs have an intermittent energy load profile. High loads during the day when multiple cars need charging alternate with periods of little to no load at night and in the mornings. A photovoltaic (PV) system produces ample power for self-consumption during daylight hours. For full utilization, however, the addition of a small battery energy storage system (BESS) plays a key role. It enables self-consumption to be further increased and makes sure that no energy is wasted.

Daily Load Profile



Initial situation An EV charging hub in Germany with ten fast chargers. All of the power is obtained from a conventional grid.	Scenario 1: Reduced Energy Cost A PV system enables cost savings through energy self-consumption.	Scenario 2: Lowest Energy Cost This combined PV and BESS setup enables even more solar energy to be used on site, thus optimizing cost savings.
Grid Power: 100% Annual Electricity Demand: 1.600 MWh Peak Electricity Demand: 0.45 MW	Grid Power: 73% PV Plant: 0.75 MWp	Grid Power: 73% PV Plant: 0.75 MWp BESS: 200 kW / 312 kWh
		
Levelized Cost of Energy* € 0.29 per kWh Costs per year: € 655k per year	Levelized Cost of Energy* € 0.275 per kWh Costs per year: € 538k Savings: € 117k per year	Levelized Cost of Energy* € 0.26 per kWh Costs per year: € 501K Savings: € 154k per year

Numbers are indicative based on simulation in Homer GRID software

* Levelized cost of energy (LCOE) – the average, discounted cost of electricity (including CAPEX, OPEX and inflation, discounted at 8%) over 20 years

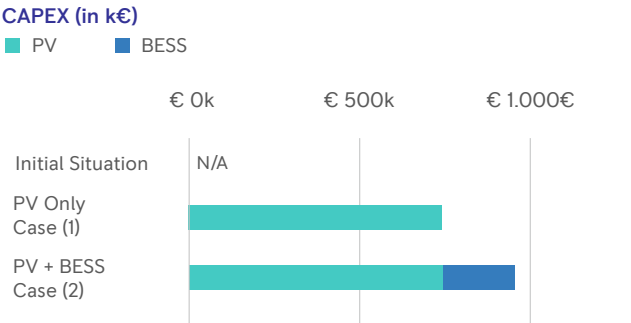
RESULTS OF THE USE CASE

As the comparison illustrated, electric vehicle (EV) fast charging hubs using renewable energy systems enable significant reductions in energy costs.

Maximizing savings with a combined PV and BESS setup

Roadside locations for fast charging hubs generally have plenty of space for ground-mounted solar panels, allowing for a nondisruptive, low-cost installation. With an available area of approx. 6000 m², as in our use case, a photovoltaic (PV) system is limited to 750 kWp. By adding an energy storage system (ESS), self consumption of solar energy can be increased to maximize energy costs savings. Costs for the chargers itself as well as grid connections are not considered at this stage.

CAPEX Assumptions:
Case1: 750 k€ Case2: 960 k€

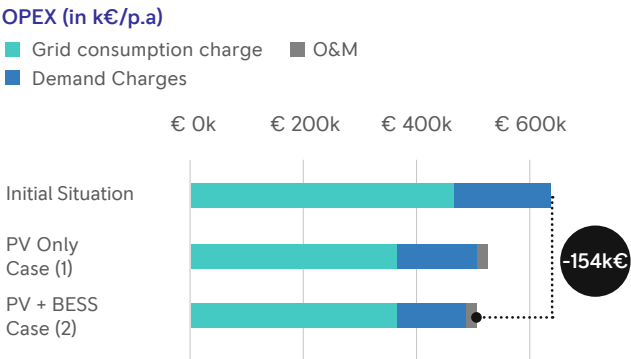


Scenario 1 & 2 savings summary

The initial situation's costs are comprised of energy consumption charges (generation and grid costs, taxes and levies) as well as demand charges.

In scenario 1, self-consumption of PV power enables significant savings on grid consumption charges – by 26% or € 122k per year. Further savings could be possible through feed-in tariffs depending on the daily production and the load demanded. These savings are slightly offset by the PV system's operational and maintenance (O&M) costs of approx. €5k, resulting in total reduced energy costs of € 117k per year.

In scenario 2, grid energy usage can be reduced even further – by up to 27% or € 136k per year. Additional savings of € 30k are achieved through demand charge reductions. After factoring in the O&M costs for PV and ESS of € 12k, total savings still amount to € 154k per year.



Payback period

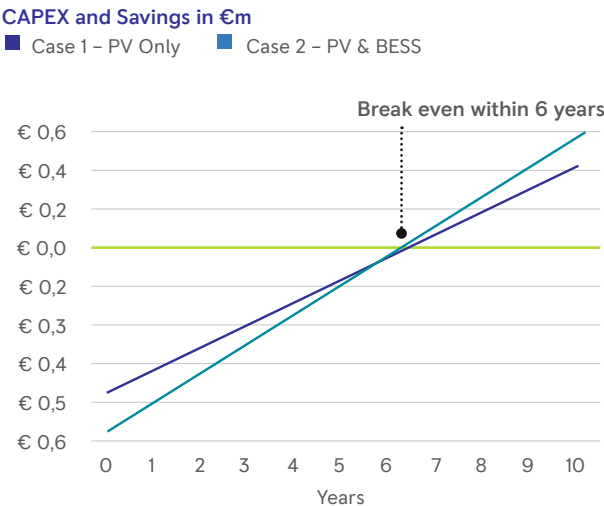
In scenario 1, the investment in a PV only system for an EV charging hub enables energy costs savings of €117k per year with a **payback period of 6.6 years**.

In scenario 2, investing in a combined PV and energy storage system can lead to savings of €154k per year, thanks to optimized self-consumption of renewable energy. **The payback period is 6.3 years***.

Additional to the financial advantages of Case 2, it has the following benefits for operators:

- Sufficient buffer for high-power-charging (HPC)
- Provision of “all-day”-charging

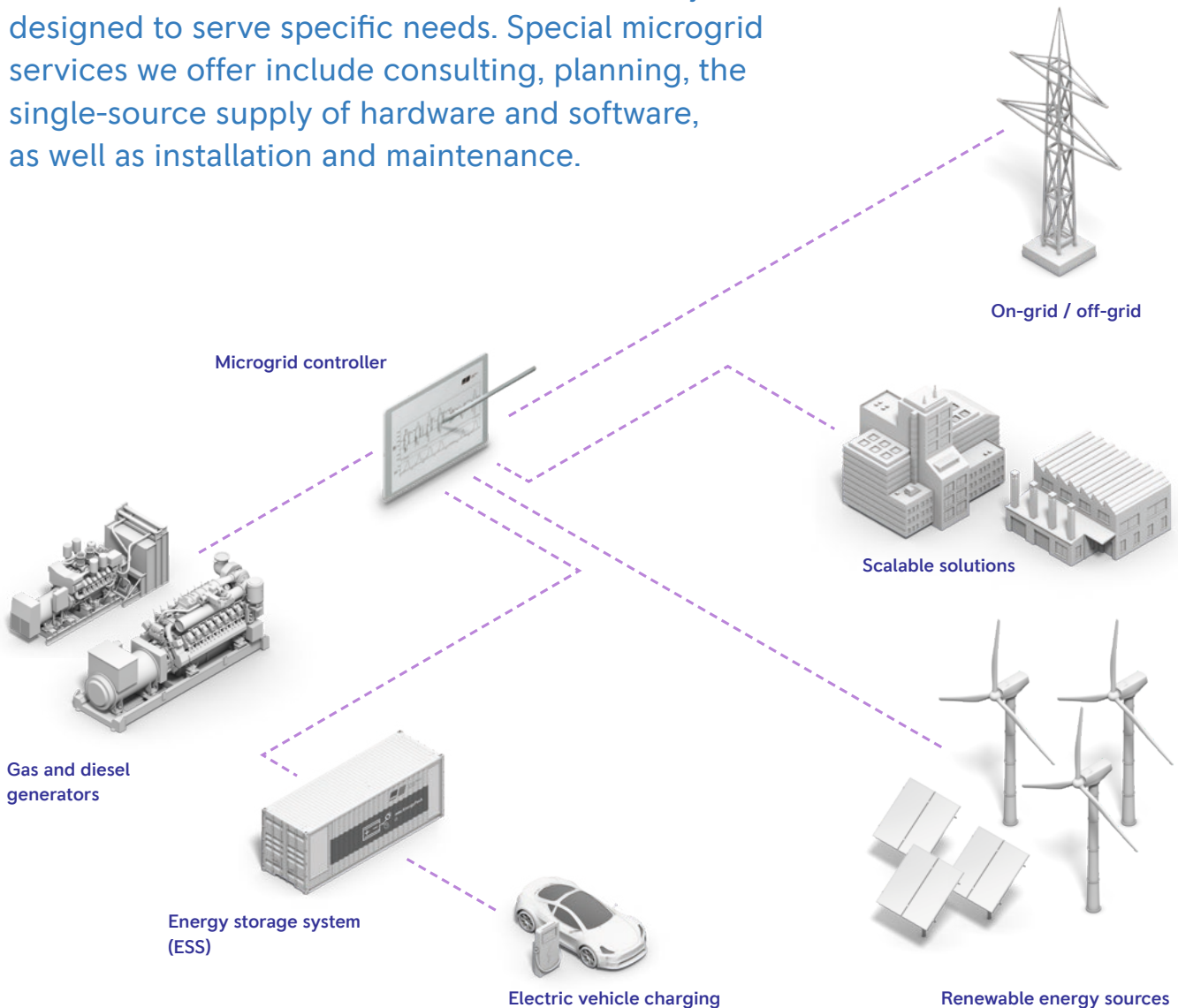
Case 2 could even be further improved using advanced value stacking (e.g. adding trading or grid services).



*both cases show a similar IRR of approx. 15%

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