FACTSHEET- Flexible GRID ACCESS
PHOTOVOLTAICS

FLEXIBLE GRID ACCESS FOR PHOTO-VOLTAIC SYSTEMS: CASE STUDY

When connecting photovoltaic (PV) systems to the power grid, the system's nominal power is typically used as a reference for the grid load, even though this maximum output rarely or only very occasionally occurs (optimal conditions and no on-site consumption). If no approval or only a reduced power approval is granted for grid connection, this means that feeding electricity into the grid would only cause problems during these brief periods of the year. However, this approach deprives the public grid and the Austrian energy system of many valuable kilowatt-hours of electricity from photovoltaics, which could be generated, for example, in winter or during off-peak times. Due to these limitations, PV systems are increasingly being designed smaller or not implemented at all.

To feed energy into the power grid, PV systems usually need to increase the local grid voltage. The more power that is fed into a section of the grid, the greater the voltage increase. Particularly with low local consumption and sunny weather, this can lead to a critical rise in grid voltage beyond normative limits (e.g., EN 50160), depending on the local grid situation. Other grid load issues, such as excessive current or other electrical parameters, must also be considered when integrating PV systems into the power grids.

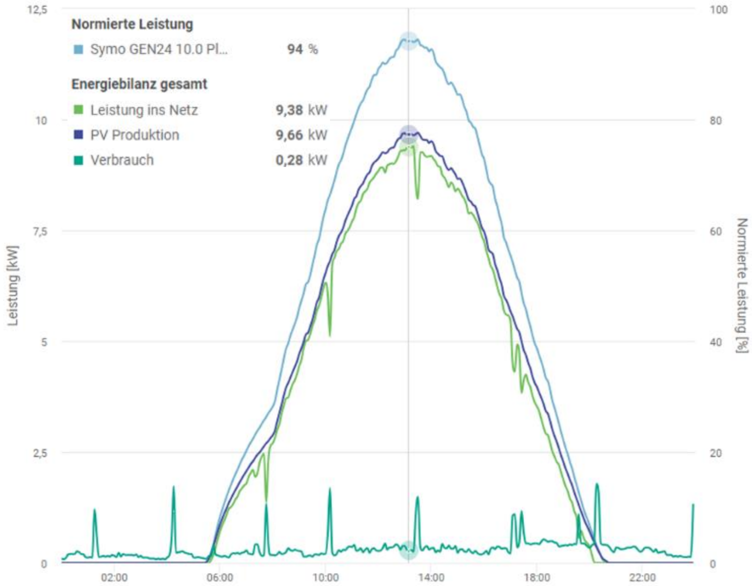


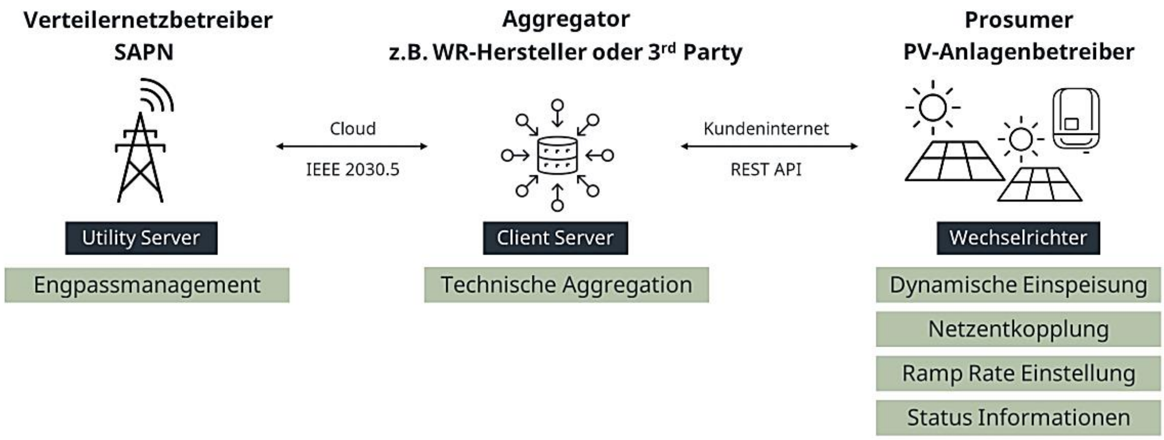
Fig. 1: Course of PV generation and feed-in on a sunny day. The difference between nominal power (light blue) and the actual generation of the PV system (dark blue), as well as the grid feed-in (green, reduced by self-consumption), is clearly visible. Source: Fronius

A SOLUTION TO THIS PROBLEM

... has been implemented in practice in Australia since July 2023. The "Flexible PV Export Model" provides photovoltaic system owners with a dynamic feed-in capacity. When sufficient grid capacity is available, full feed-in is possible. If there is a bottleneck in the grid, such as high voltage or high current, the allowable feed-in capacity is temporarily reduced.

HOW DOES THE "FLEXIBLE PV EXPORT MODEL" WORK IN AUSTRALIA?

- **The grid operator offers a dynamic feed-in capacity of up to 10 kW per phase if the inverter is controllable. If this is not desired, the feed-in is permanently limited to a maximum of 1.5 kW per phase.**
- **With available grid capacity, which is the case for the majority of the time, the model allows for the maximum output (currently up to 30 kW) to be fed into the grid. In the event of grid bottlenecks, a reduction is implemented by the aggregators appointed by the grid operator, limiting the feed-in to a maximum of 1.5 kW per phase.**



Source: Fronius

WHICH DATABASE IS NECESSARY FOR REGULATION?

- Current measurement data at the grid connection points or generators
- Static information about the systems
- Operational information: Current availability details and any error messages
- Network connection: Communication takes place over the Internet; technical aggregators handle the communication. In the event of a fault, the feedin is limited to a static threshold.

WHAT MEASURES ARE REQUIRED TO OPTIMIZE OPERATIONS?

- Grid modeling: Knowledge of load flow in each grid section.
- Forecasting: Predictions for load, PV generation, and temperature.
- Safety factors: Additional safety mechanisms such as Q(U) are always active to protect the grid locally from overload.
- Cybersecurity: Risks are addressed through strict guidelines and audits for service providers (hardware and software, aggregators).
- Training for installers: Ongoing training for installers to ensure correct settings onsite.

ADVANTAGES OF THE MODEL?

- Higher feed-in: This increases the motivation to install (larger) private PV systems.
- Efficient grid utilization: The grid is used efficiently while ensuring grid reliability.
- Direct action by the grid operator: Unlike other models like P(U), the grid operator acts directly.
- No individual compensation assessment: The need for individual compensation assessment is eliminated.
- Use of existing infrastructure: No expensive new infrastructure is required for communication. The customers' Internet is used, and no additional hardware needs to be installed.
- Quick implementation: The solution can be implemented quickly.
- Even feed-in regulation: Systems in the same grid section are fed in uniformly.

WHAT CHALLENGES DOES THE MODEL FACE?

- Power limitation during peak times: Up to 5% of the "best" feedin times (equivalent to up to 2% of the generated energy) are subject to power restrictions. However, local load management can reduce losses through local selfconsumption options, especially with larger PV systems, such as home storage, electric vehicles, heat pumps, etc.
- Digitization of the power grid required: Creating a data basis and modeling requires comprehensive digitization of the power grid.
- Solidarity compensation for system operators in case of exceeding maximum curtailment times: Fair compensation for system operators is necessary when the maximum allowable curtailment times are exceeded.

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