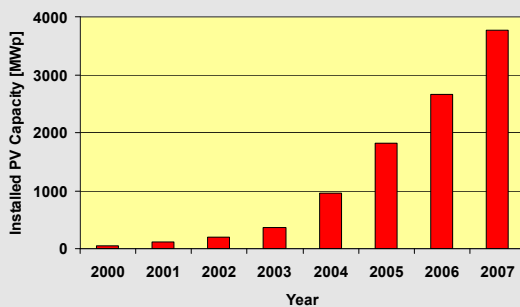


Grid Integration of Photovoltaic (PV) Systems

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Installed PV Capacity in Germany



Source of Data: BSW-Solar (www.solarwirtschaft.de)



Source: BSW-Solar/SMA

→ considerable size in the electrical power supply (3% of installed power generation capacity)

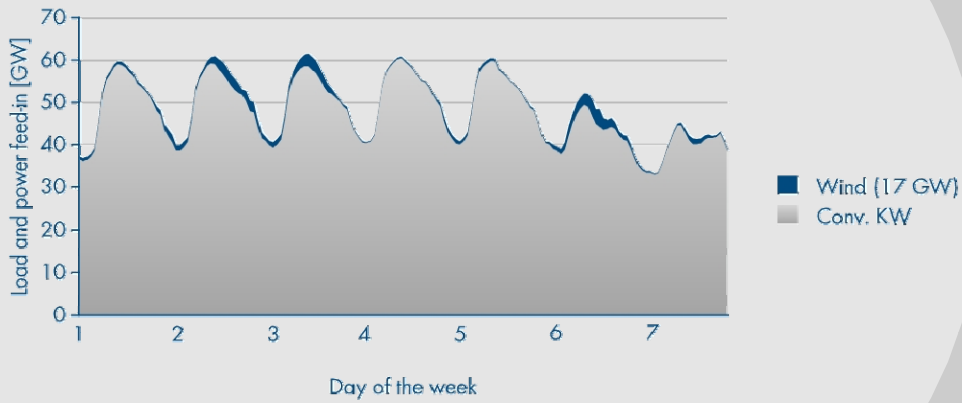
Correlation of PV Power Generation with Load Consumption

→ Up to 30 GWp PV can be Integrated with few Constraints

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Grid Integration

Week of maximum PV yield in Germany 2005



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3

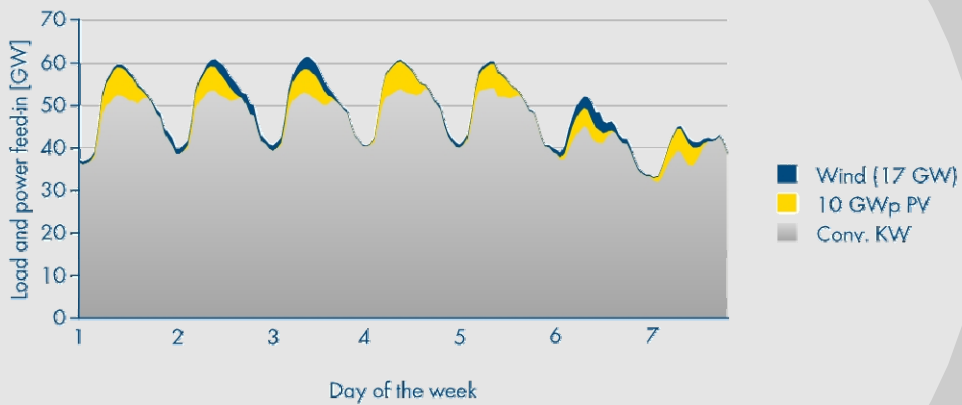
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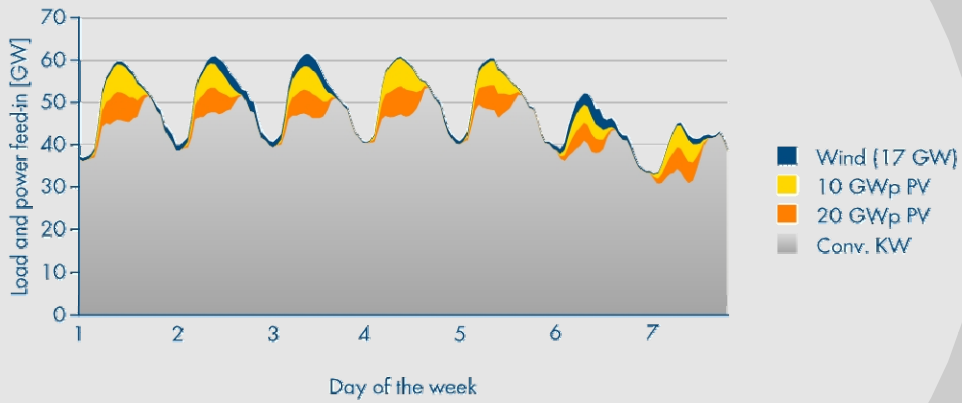
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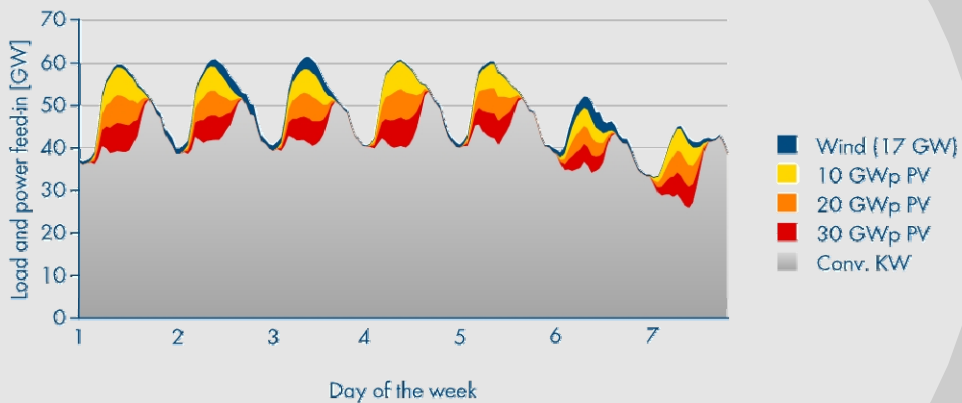
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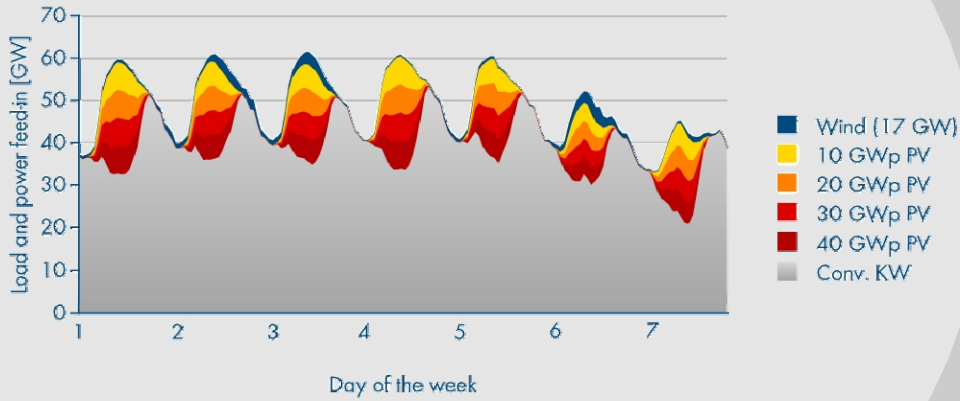
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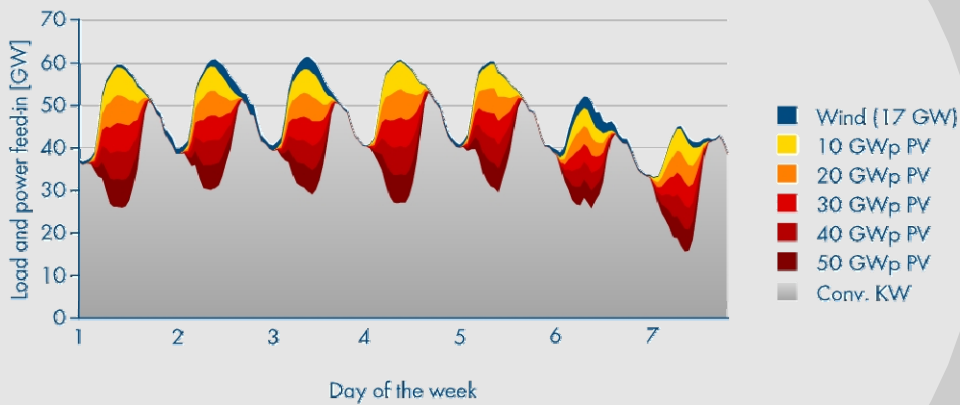
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8

Particular Characteristics of PV

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Substitution of conventional controllable medium/peak load power plants

Local Power Generation

- Near to the load
→ increases reliability of power supply
- Distributed
→ can provide system services where required
- In the distribution network
→ reduces the loading of the transmission network and
→ transmission losses

PV can not only substitute power generation but also provide system services for network operation (where reasonable)

- Inverter-Coupled Power Generation
→ „**Inverters can do everything**“



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9

Contribution to Network Stability by PV

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Stability of Network Operation supported by

Keeping Frequency limits

Keeping Voltage limits

Fault-Ride-Through Capability

- Keeping Connected during Faults in the transmission network
- Supplying fault current to support the voltage

Solving Congestions



Grid Integration

New guideline for parallel operation with medium voltage grid feeding

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10