Bring Energy to Life

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Energy Storage- A Tool in the Toolbox

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Drivers for Energy Storage

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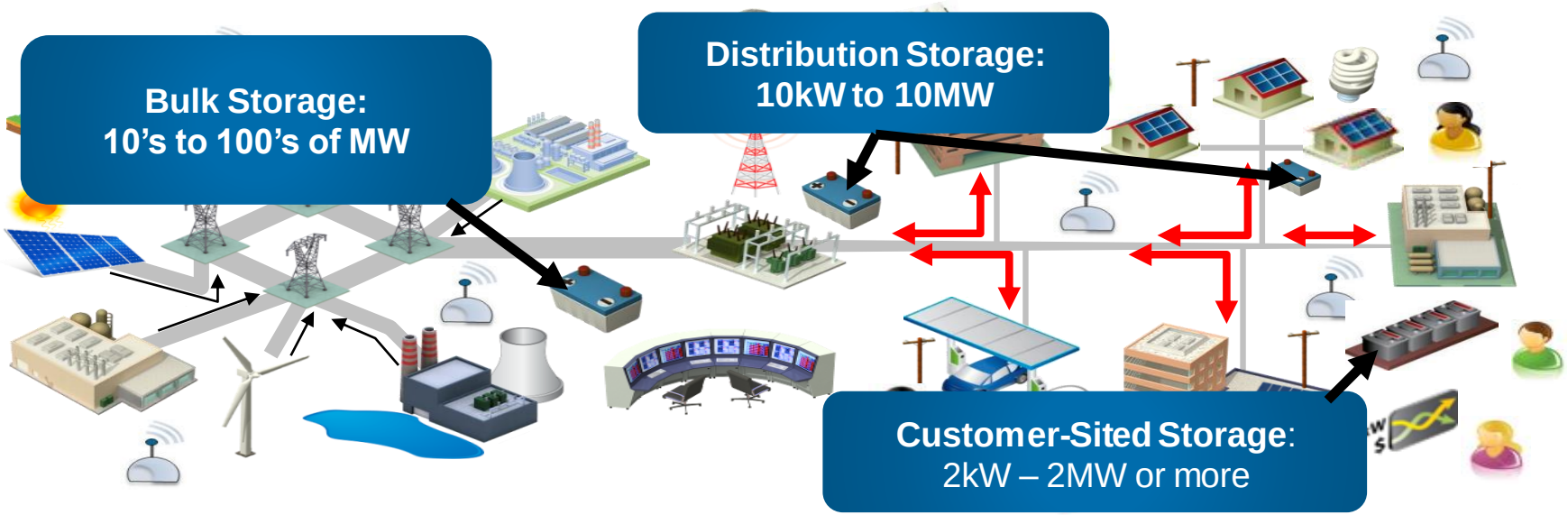
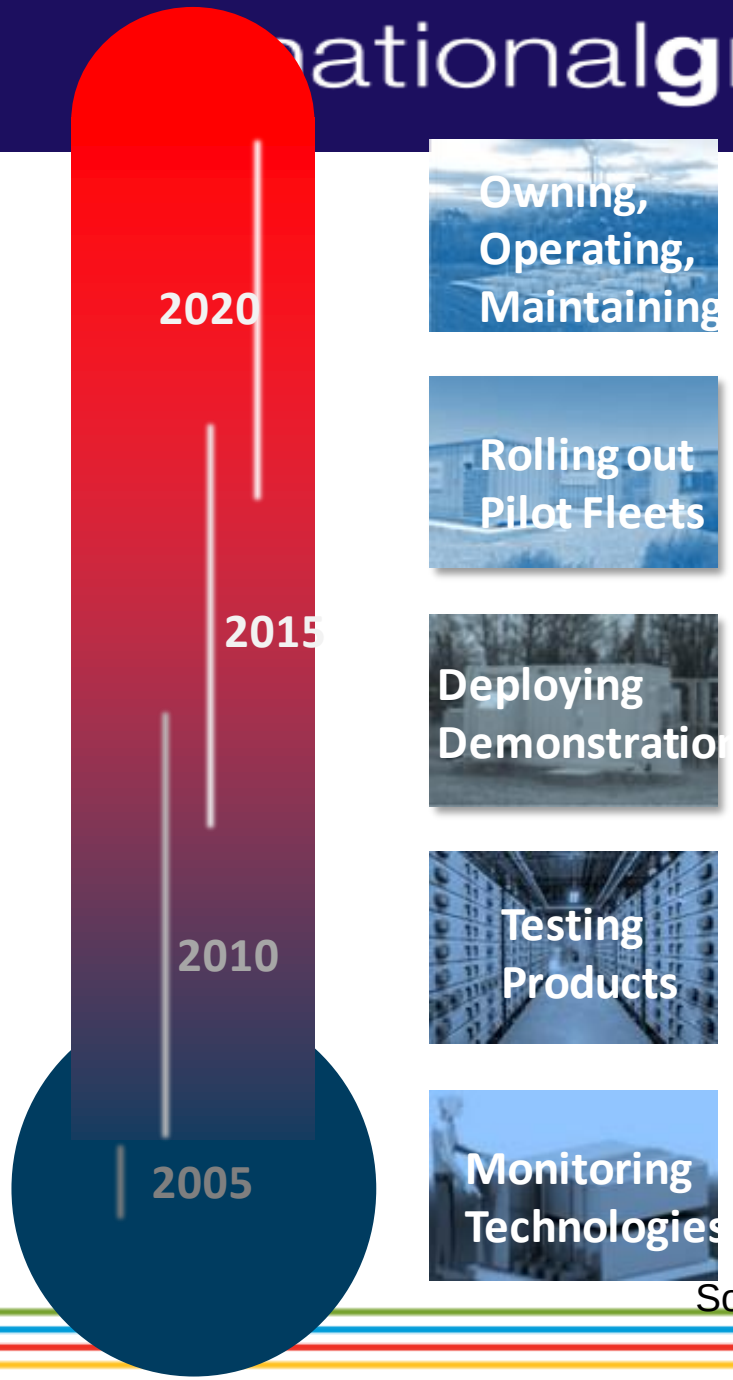
- Change in generation resources
- Decrease in energy storage technology costs
- Utility needs
- Policy



Source: EPRI

How are utilities responding?

- Utilities have moved with varying speeds to invest in storage opportunities
  - In 2005, most utilities were simply watching technologies
  - By 2015, many utilities have demonstration projects
  - By 2020, some utilities anticipate owning and operating substantial amounts of storage
- This movement is highly dependent on regulatory and policy drivers



Source: EPRI

Generation and Transmission-Sited / Bulk Energy Storage

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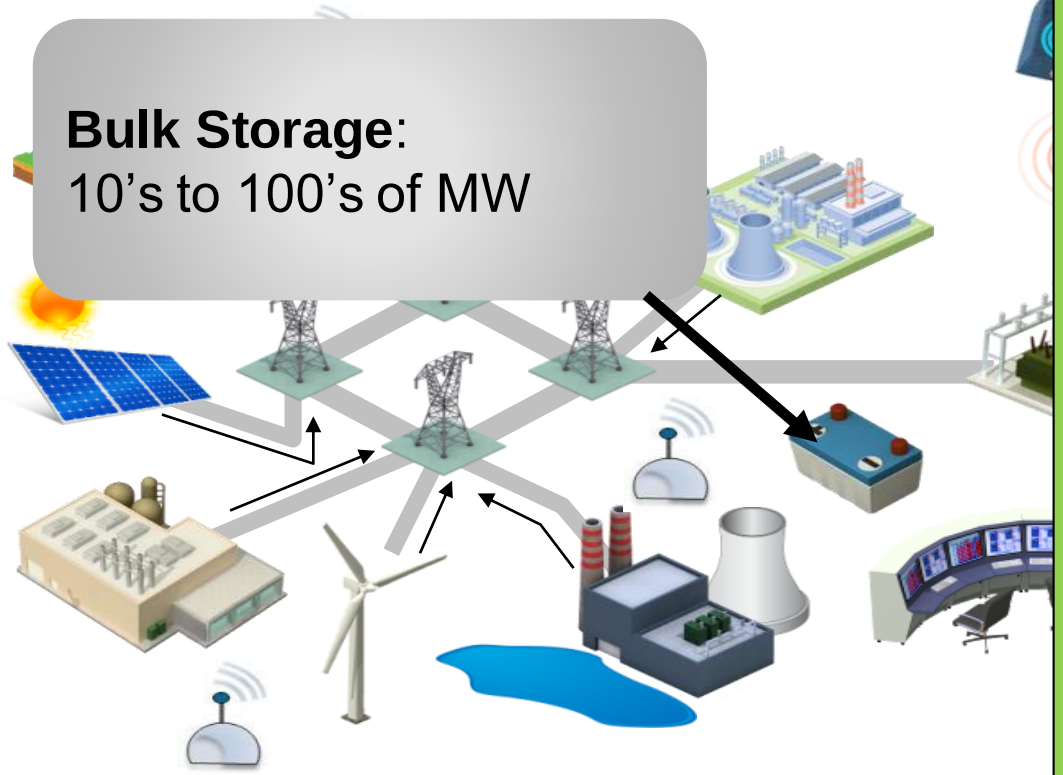

Transmission-Level Grid Services

- Long-term planning / resource adequacy/peaking generator replacement
- Transmission upgrade deferral
- Day-ahead/real-time energy shifting
- Frequency regulation
- Frequency response
- Contingency reserve (spin/non-spin)
- Ramping reserve

Bulk storage may serve as alternative for generators or transmission assets

Source: EPRI

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National Grid Deploys Energy Storage

Large Scale Battery Energy Storage Solution

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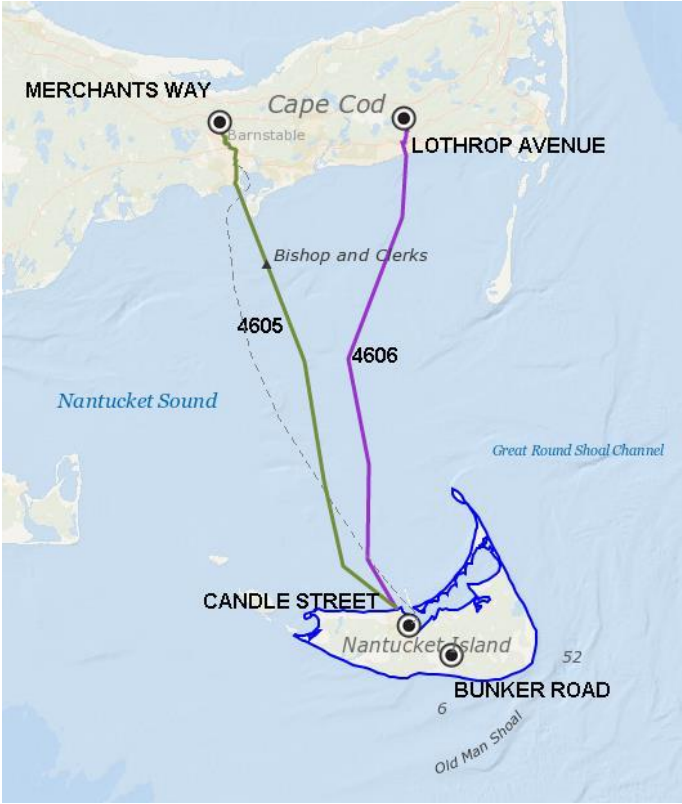
Meeting Nantucket's energy needs over the long term, and helping to defer the need for a third undersea cable, IslandReady is a holistic plan to upgrade the Island's electricity infrastructure.

Energy Storage Project

- Two supply cables serve the island, if one cable fails during the peak days of summer, there is insufficient supply to meet energy demand
- Deploying both a new combustion turbine generator and Lithium ion battery energy storage system to ensure energy supply
- The project is able to provide a capacity of 48 MWh, providing 6 MW of electricity for up to eight hours



4605 (40.2 MVA) & 4606 (38.7 MVA) Supply Line Routes

A range of possible options were considered to meet Nantucket's future energy needs.

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Third Cable Option

Hybrid Option: Gas Combustion generator+ Storage

+

Large Gas Combustion Generator Option

Large Battery Option

Pictures are indicative, and do not show specific products

Large Scale Battery Energy Storage Solution

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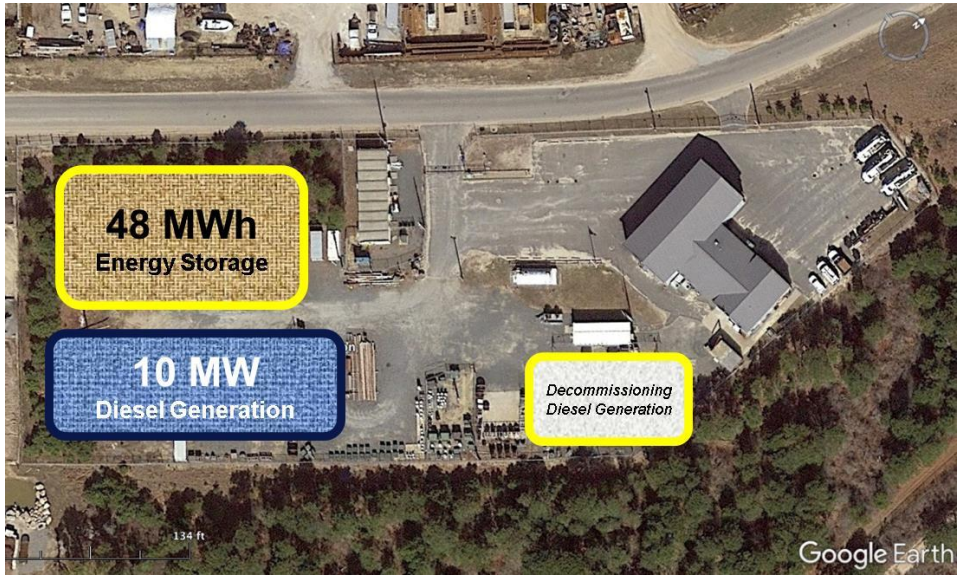
Hybrid Option: Combustion Engine+ Storage

- Deploying both a new combustion turbine generator (CTG) and Lithium ion battery energy storage system to ensure energy supply.
- The energy storage will be able to provide 48 MWh of capacity, 6 MW of electricity for up to 8 hours.
- The load shape in the island determined the 8 hour duration
- The generation size is picked for 100 % reliability reasons first, markets second, if available.

Supports the other Non-Wires Alternative pilots being considered

- Energy Efficiency initiatives
- Renewable energy
- Distributed energy resources



Storage Study: Scope and Methodology

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- A feasibility study was performed to propose BESS to mitigate needs seen on the transmission system in the NE and NY areas.
- The analysis first identified the thermal and voltage violations seen on the system resulting from Load growth and high DER penetration.
- An N-1 and an N-1-1 steady state analysis was performed.
- Next, the battery MW and MWh size and optimal location required to mitigate these thermal and voltage violations was computed.

Storage Study: results

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- For some thermal and voltage violations, the battery MWh sizes calculated were found to be too large to implement. This is because the thermal violations are seen round-the-year because of the shape of load duration curves.
- Some thermal and voltage violations can be solved with storage. These are the cases where storage has enough time to charge and discharge i. e. overload due to high PV penetration.
- Storage in conjunction with power flow controller devices like Smart Wires' Smart Valve can be considered as a good solution for large thermal overloads on the lines.

Questions

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Appendix

Distribution-Sited Storage

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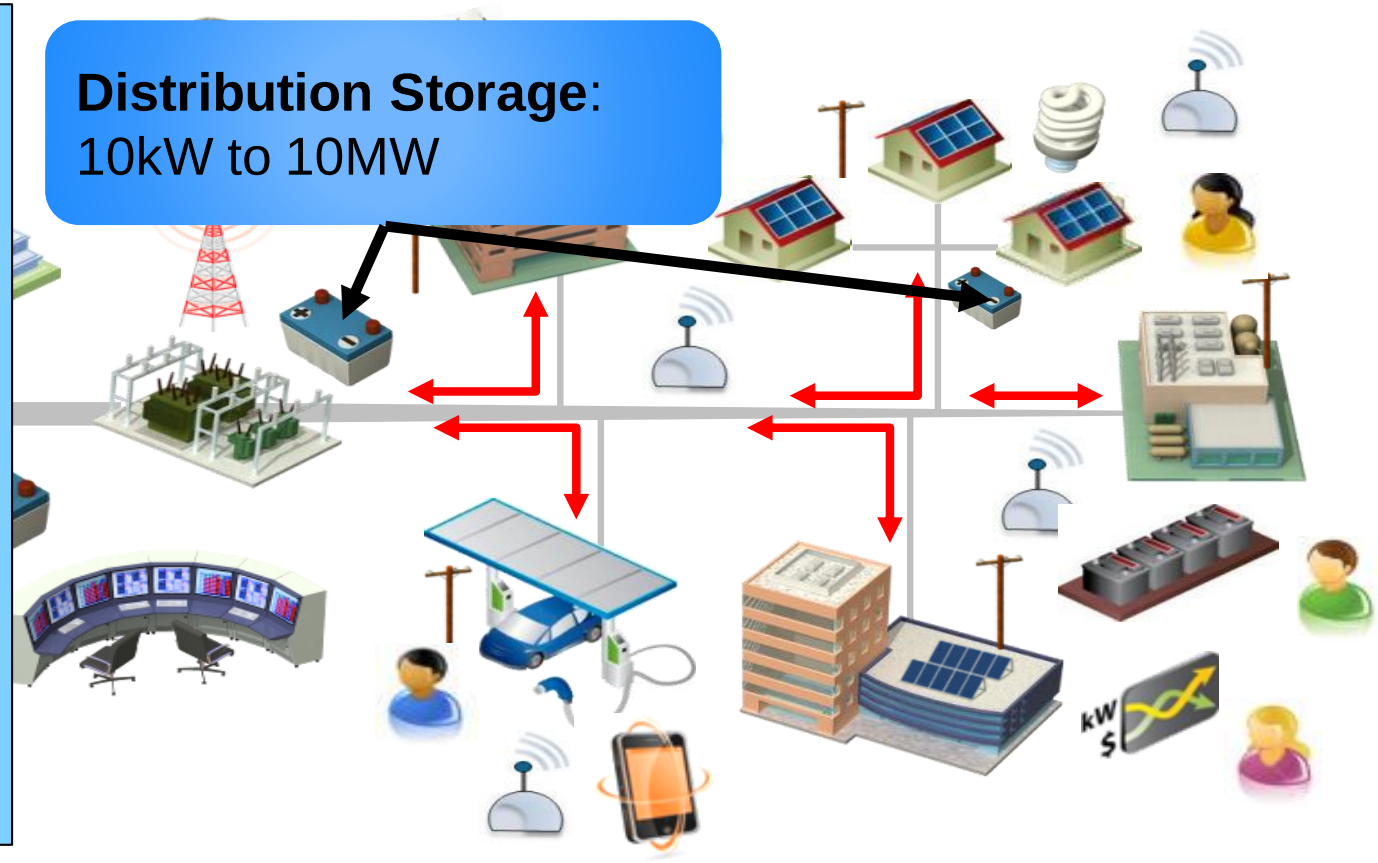
Distribution-Level Grid Services

- Peak shaving / Distribution upgrade deferral
- PQ/ voltage control
- Phase balancing
- Backup/ Microgrid



May be able to stack distribution and upstream transmission services

Source: EPRI

Customer-sited Storage

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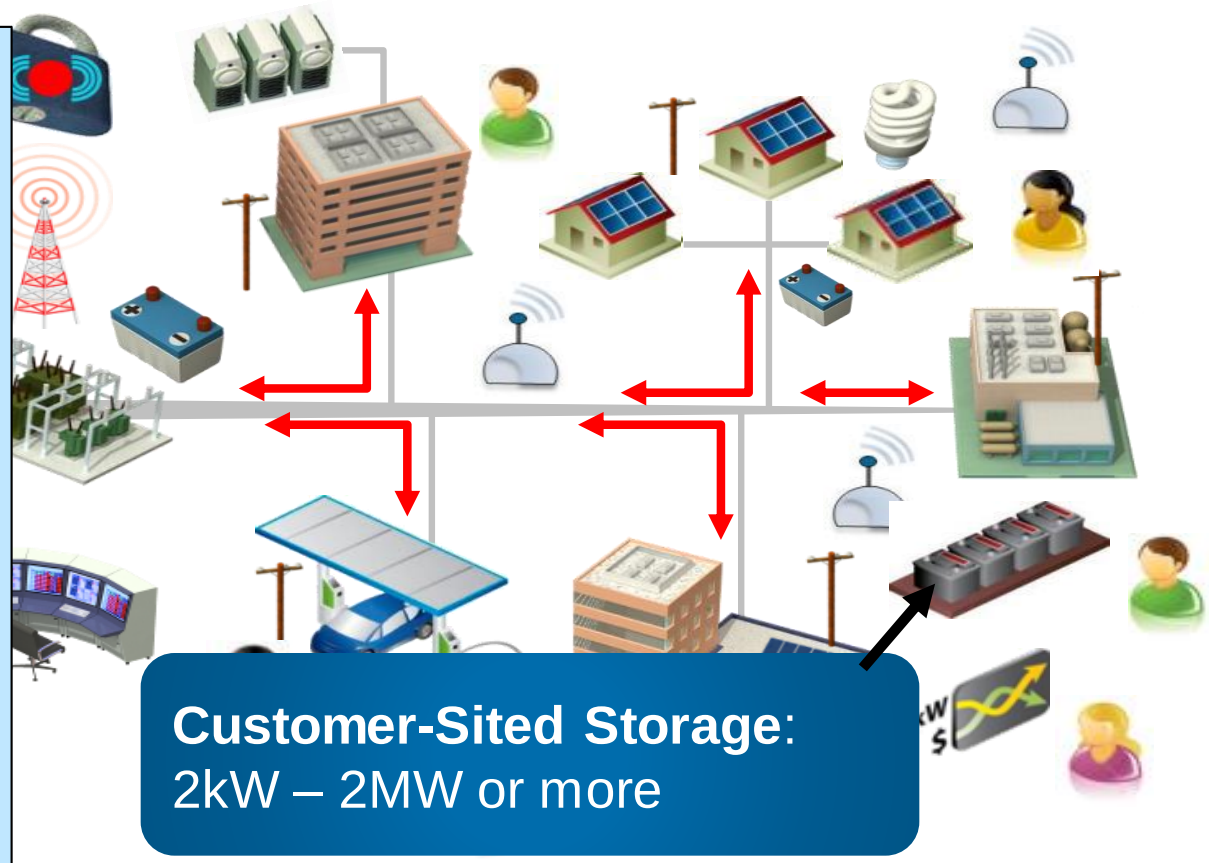
Customer-Level Services

- Demand charge reduction
- Time-of-use tariff energy time-shift
- Backup power
- Renewable self-consumption
- Policy incentives – federal ITC, state



May be able to stack distribution and transmission-level services to some degree

Source: EPRI

Renewable Generation is Driving New Flexibility Needs

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- Impact on the transmission system, i. e. line overloads
- Distribution feeder overloads
- Impact on system protection
- Need for voltage and frequency regulation in addition to the PV capabilities
- PV ramp rate reduction