Impacts of Distributed Generation (DG)

April 11th, 2019 - Trent Miller & Brian Dale

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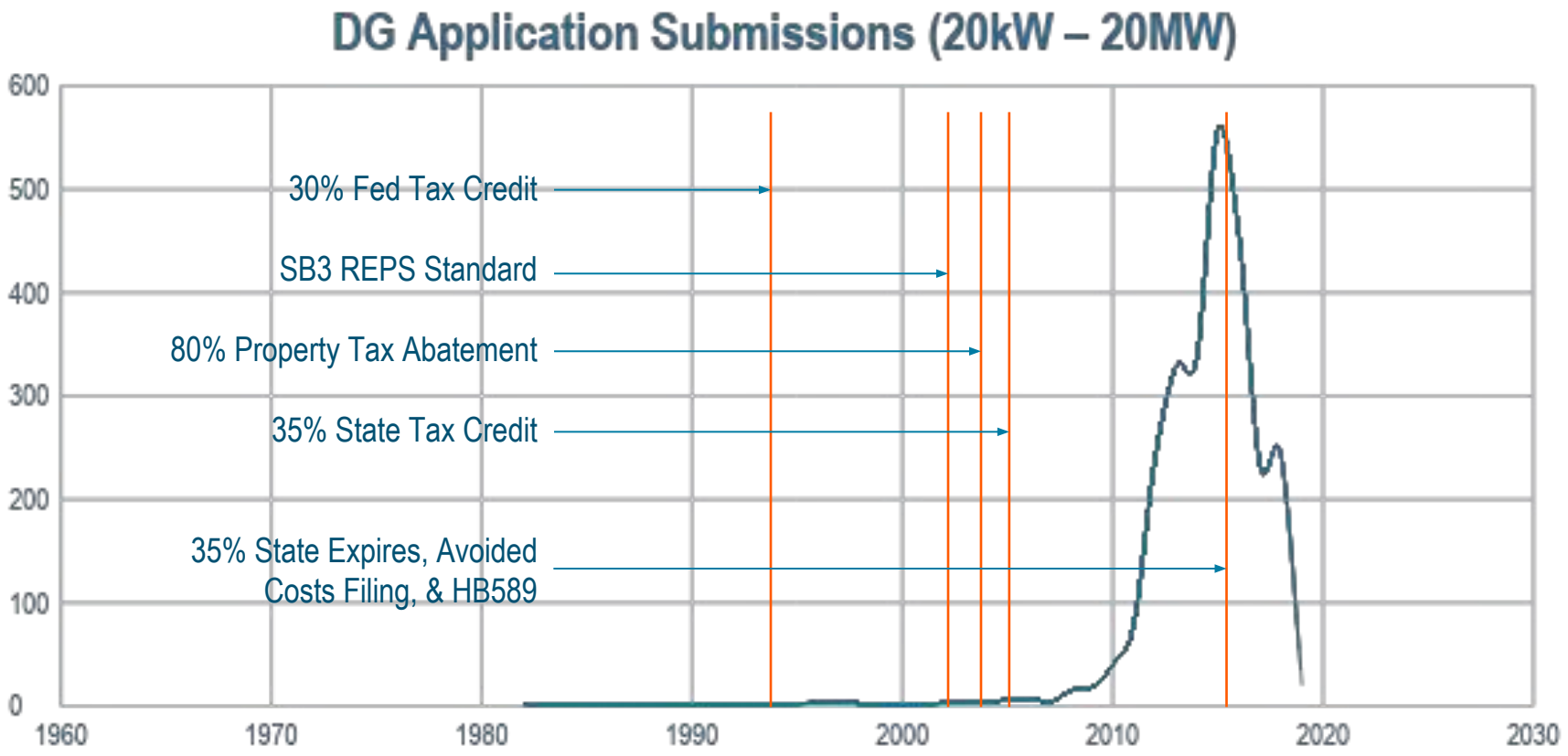
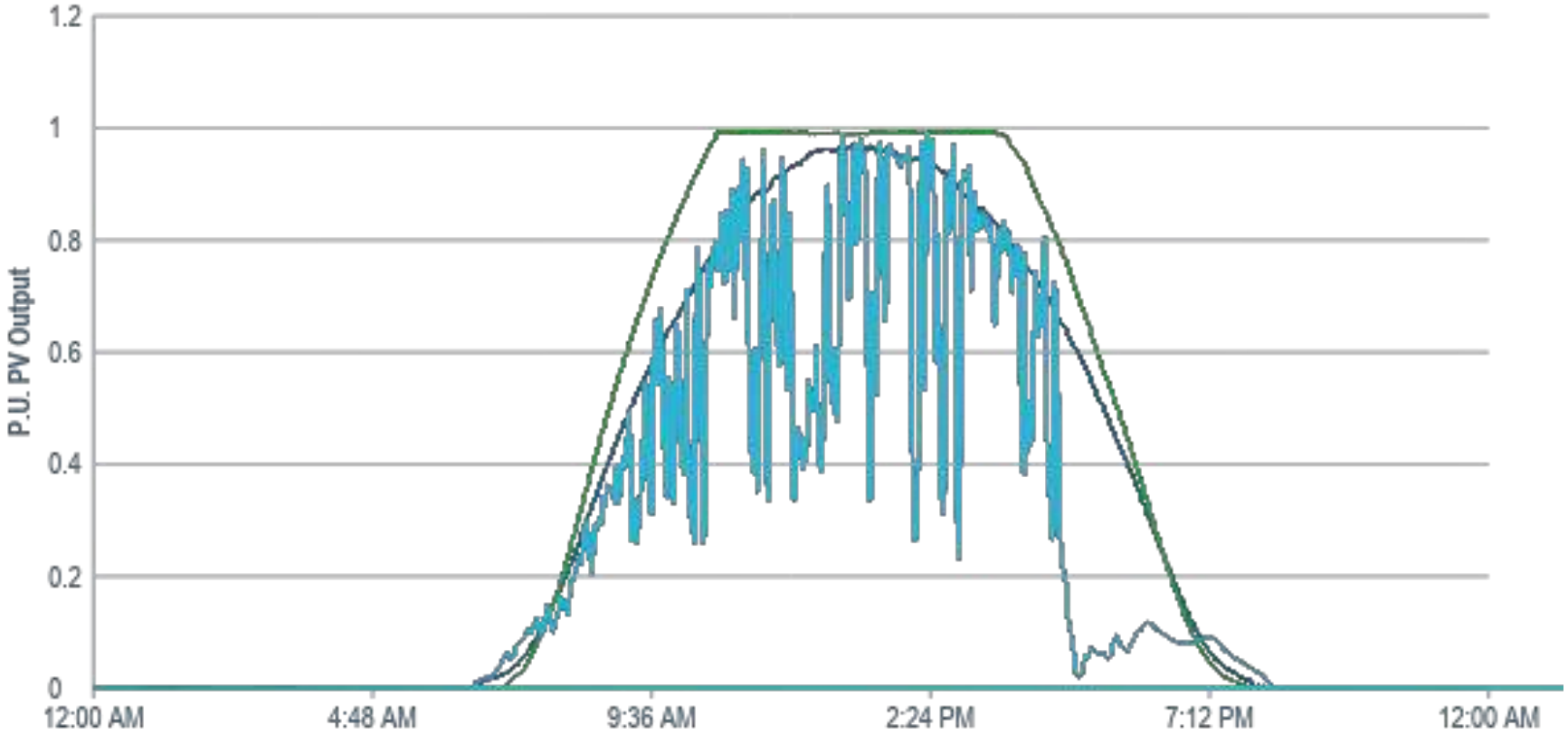
History of the Distribution Queue



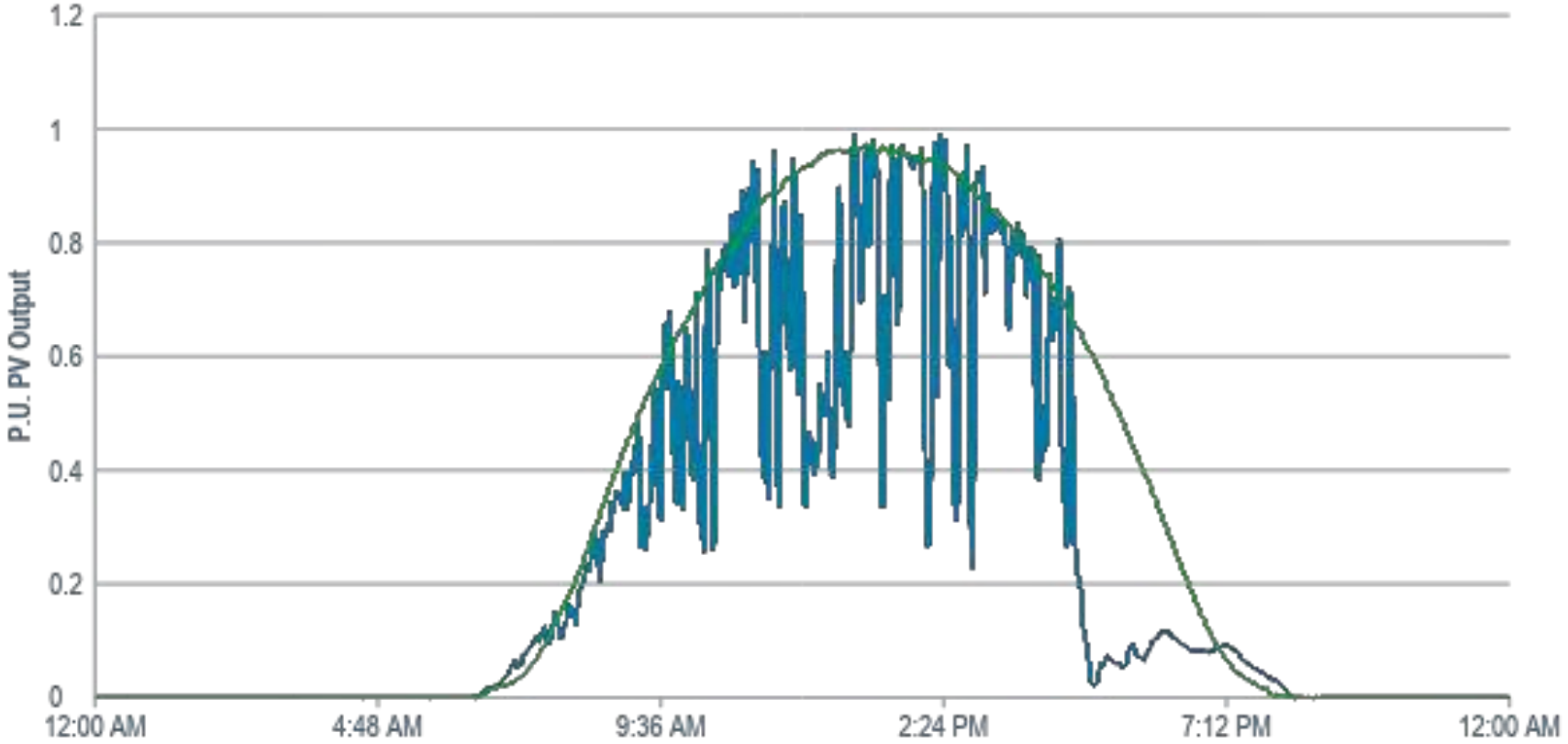
History of the Distribution Queue Cont.

- Distribution has seen more than **7 GW** of applications
- **94%** of which are solar applications
- Over **2 GW** are currently generating on distribution
- **2.1 GW** in study or construction
- Equates to more than **4** Sharon Harris nuclear power plants **just on distribution**

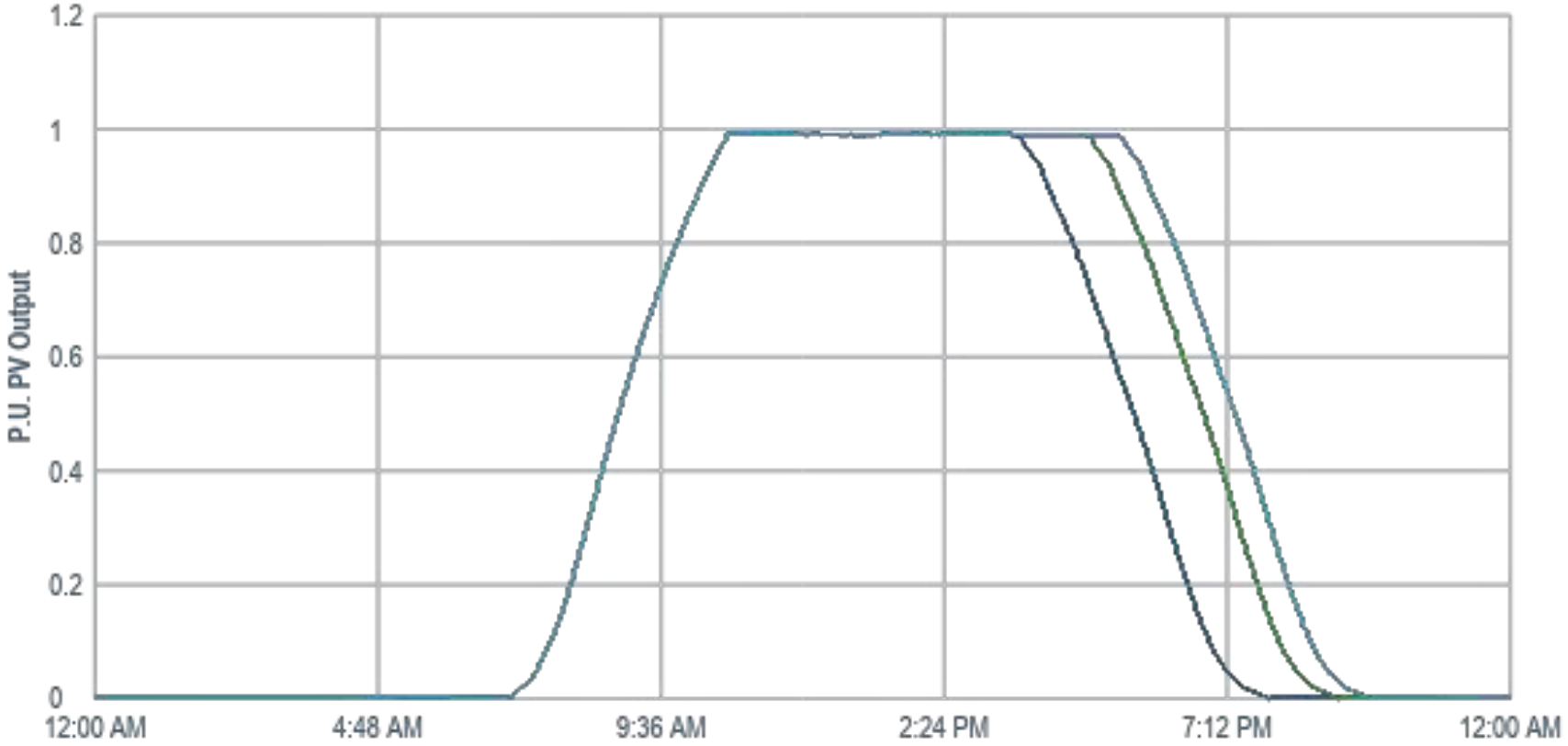
Common Daily PV Output



Possible Battery Storage Uses



Possible Battery Storage Uses Cont.

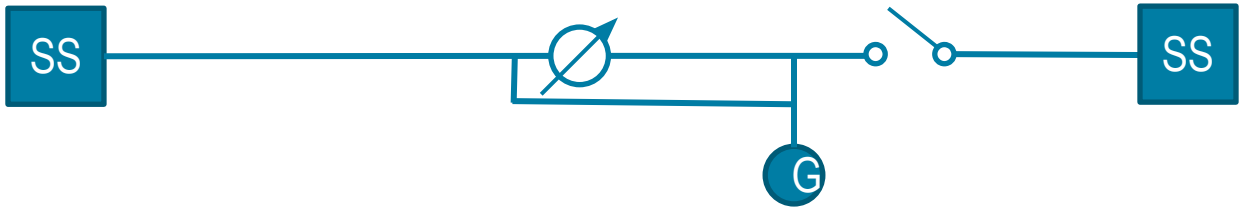


Possible Battery Storage Uses Cont.

- How will the batteries be charged?
  - Excess DC power? Charged from the grid? Controls to dictate when?
- How will the batteries be discharged?
  - Cycling output to optimize battery life
  - Impact seen by retail customers
- Still not dependable for constant power output
  - Still have to generate power assuming they are not connected

Interconnections Beyond Voltage Regulators

- Existing regulator controls used by Duke Energy can either support switching operations (Bi-Directional) or support downstream DG (Cogeneration), but not both
- In order to maintain our ability to support switching, Duke Energy requires DG sites to be in the first zone of regulation
- Any DG interconnection requests beyond voltage regulators build new facilities to “move” their injection point



New IEEE Standards

- Introduces Ride Through capabilities for inverters
- Contradictory to typical distribution protection and coordination practices
- Creates concerns regarding the additional arc flash
- Potentially inhibiting islanding detection
- Rooftop versus Utility Scale installation differences?
- State interconnection procedures not up to date with latest technologies

Unintentional Islanding

- DG supplies generated power to its point of interconnection with the utility
- DG can partially, or completely, offset the kW demand from a feeder, and even a substation
- Multiple site locations, multiple brands of inverters, multiple outputs
- Ride Through capabilities added to the mix
- No proven study methodology for islanding potential
  - Sandia Report 1365 (2012) provides a “screening” methodology for when a study is needed
  - Updated Sandia report to soon be published

Recap On Areas Of Research Needed

- Incorporating battery storage technology
- Ability to maintain switching AND apply generation beyond regulators
- Implementation of new IEEE 1547
  - Ride through capabilities and their effect
- Unintentional islanding risk

Questions?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Brain Teaser