

Renewable Generation Challenges on SMUD's Distribution Systems

David L. Brown P.E.
Principal Distribution System Engineer

May 14, 2012



Renewable Programs

- Net Metering
- Feed-In Tariff
- Utility Scale Projects

*We need more
multi-family PV
projects*



Significant Interconnection Costs

- Connectivity
- Telemetry (SCADA ≥ 1 MW)
- Equipment operations impacts and offsite modifications

SMUD Distribution System Interconnections

Observations:

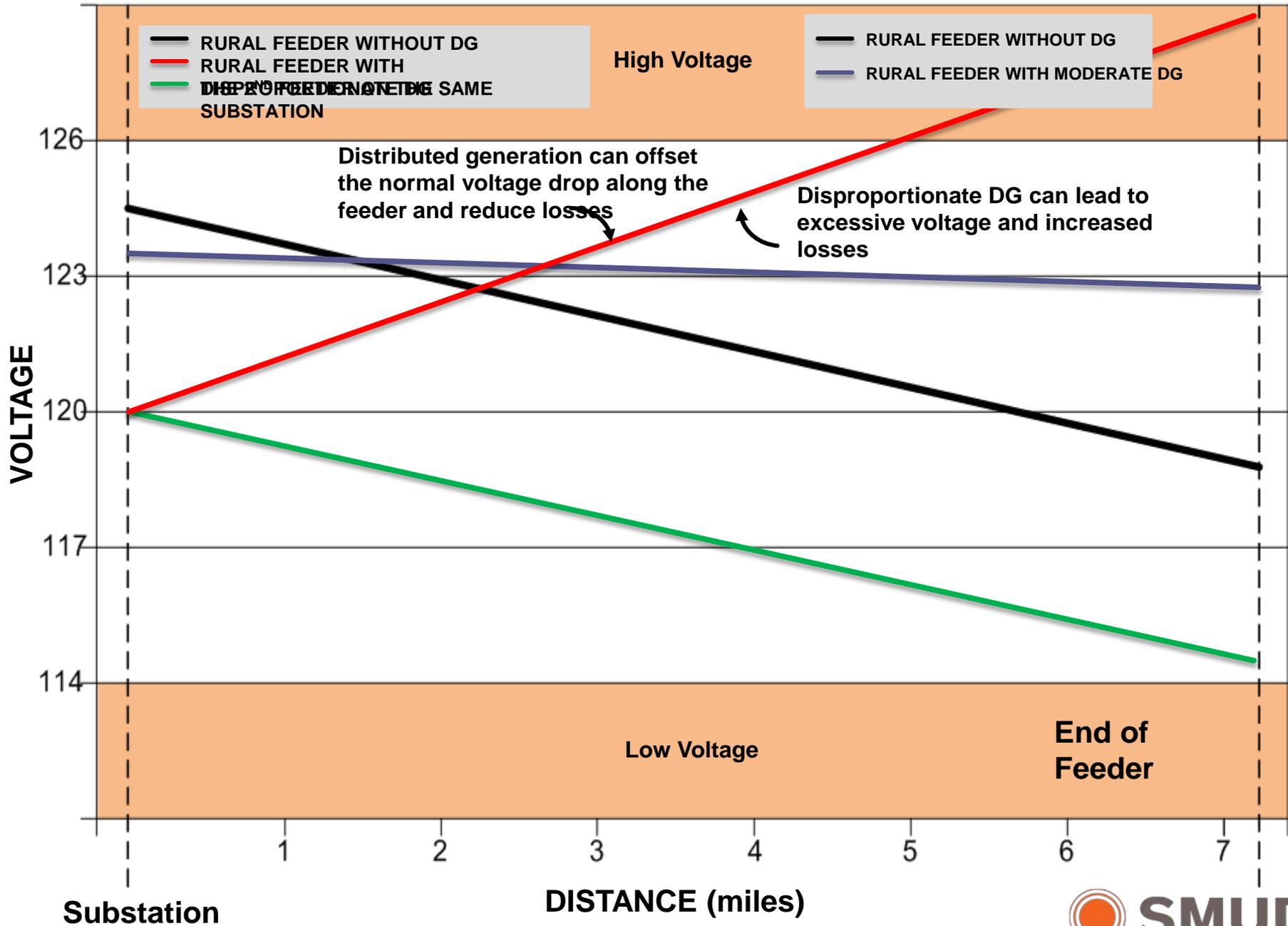
- Wherever the local load is well in excess of the generation few technical challenges arise.
- Distribution system reliability has not been degraded or improved by DG.
- Inverter based technologies have less impact on Voltage, Flicker, and Protection, compared to rotating machine (Synchronous, and Induction) generation.
- Substations with voltage regulators or LTC's are not compatible with reversed power flow, and DG is best limited to the substation's minimum load.
- DG's are rarely "beneficial" to the local distribution system.
 1. 40% of PV rated output is available at system peak
 2. Residential PV contributes little to the local peak (6-8PM)
- When a distribution system has connected all of the DG it can readily accommodate, a way of dealing with additional requests is needed.
- When Net-Metering targets are met, what happens next?

SMUD Distribution System Interconnections

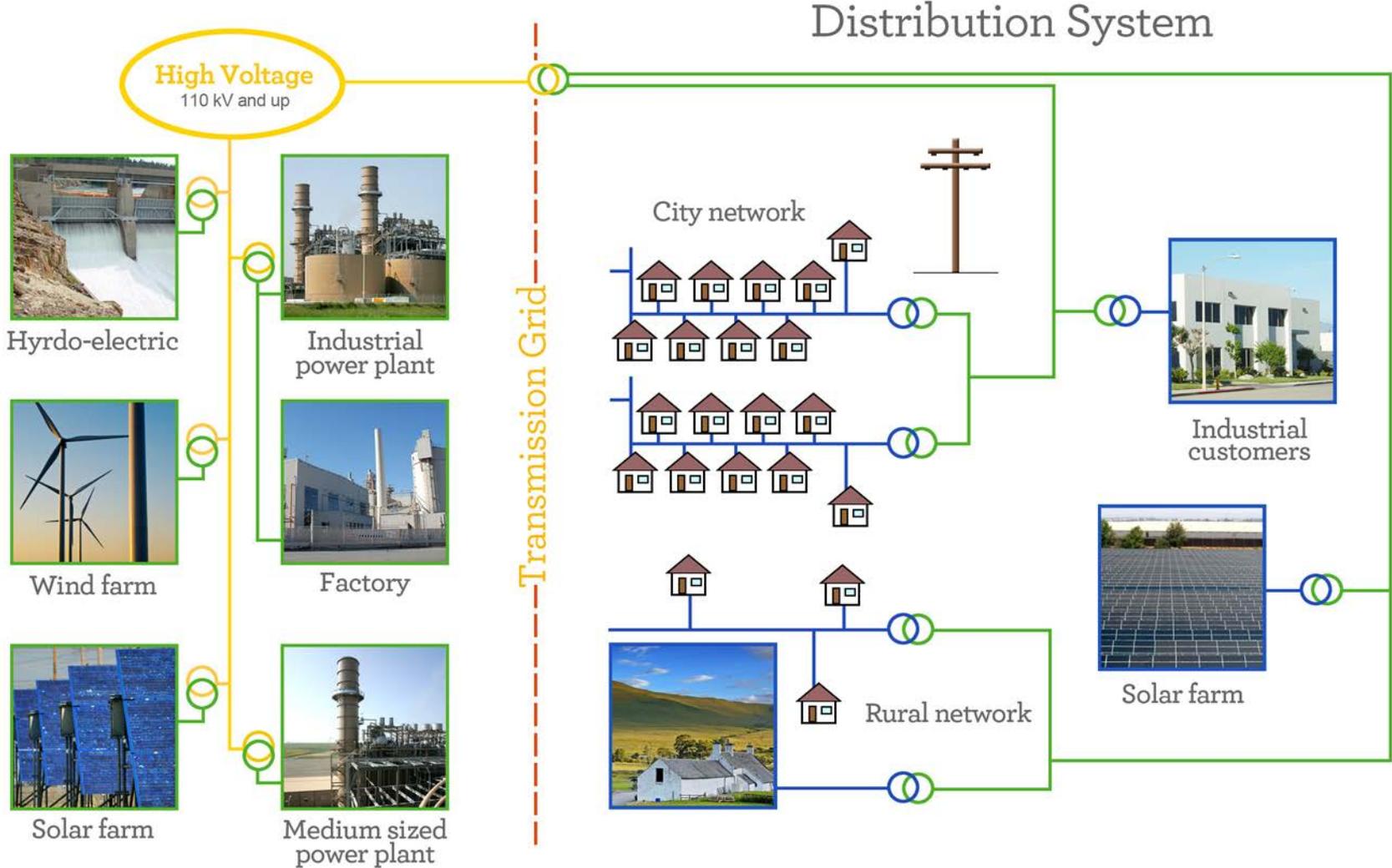
Mitigation:

- *When a proposed DG becomes a tail that can wag the dog; find a bigger dog.* The FIT program redirected numerous projects from 12kV connections to 69kV connections.
- Transfer Trip (substation Breaker – generator breaker) is a good solution for large projects but is too expensive for projects under 500kW
- When substation bus voltage regulation (LTC) cannot produce a voltage that meets the diverse needs of generation and load feeders, tapped transformers, capacitors and line regulators can be used to balance the voltage needs.
- Employing reverse power flow (or minimum import) relaying can avoid complicated relaying on non-exporting DG sites.
- Transferring load from adjacent feeders to avoid reverse power flows at the substation can be used in limited situations but is not a suitable long term solution
- Generator load following, and generation curtailments during low load periods can be used to alleviate reverse power flows where reliable communications is available. Load following batteries could help, as well.

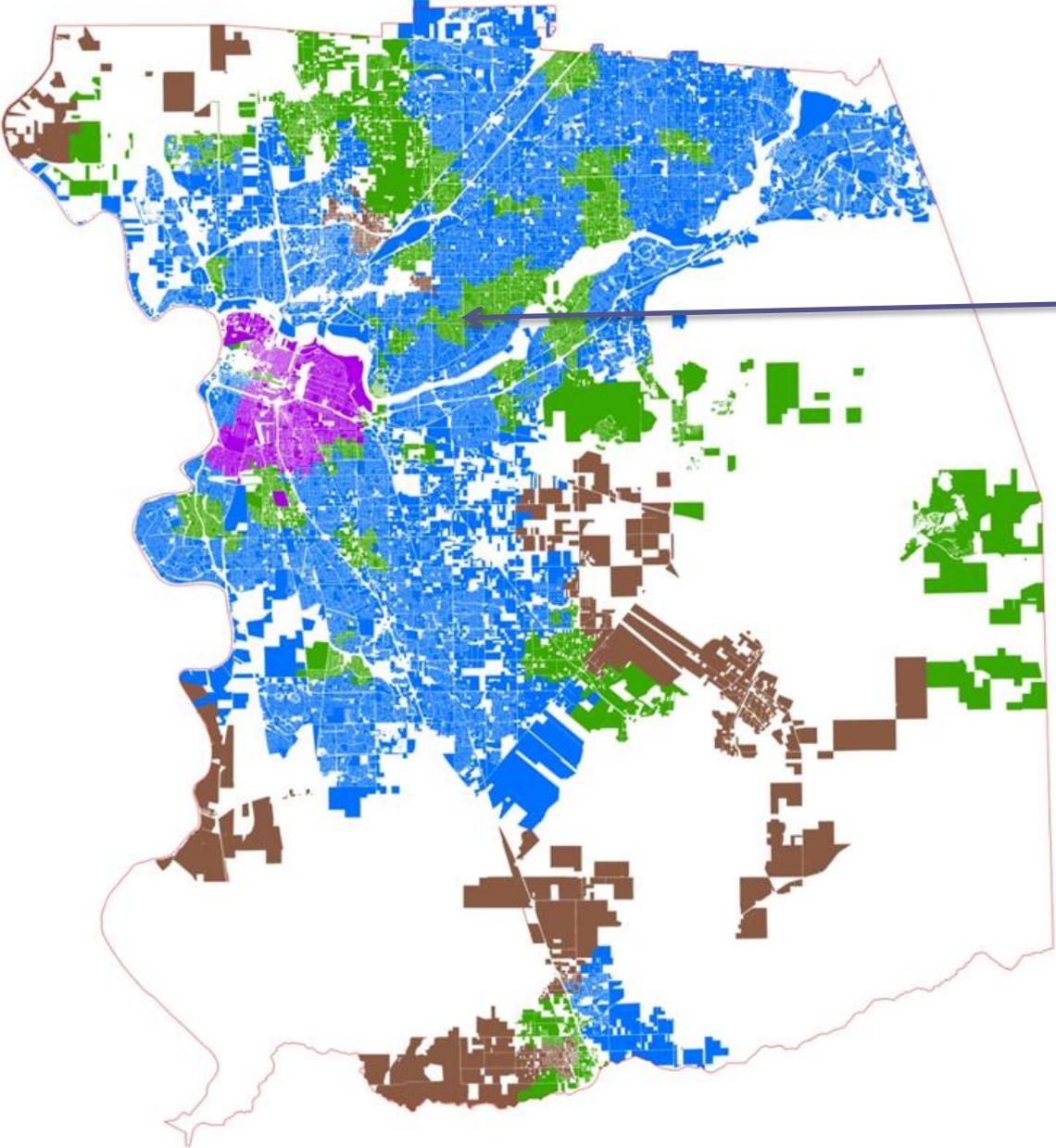
Questions?



What is a Distribution System?



SMUD Interconnection – Opportunities Map



RENEWABLE PROJECTS	> 5MW	
ESTIMATED LOW COST	≤ 5MW	
INTERCONNECTION BY	≤ 3MW	
SUBSTATION CAPACITY	≤ 2MW	
(Based on 100% of daytime annual minimum load)	≤ 1MW	