



Western
Area Power
Administration

North American Power Symposium

September 20, 2016

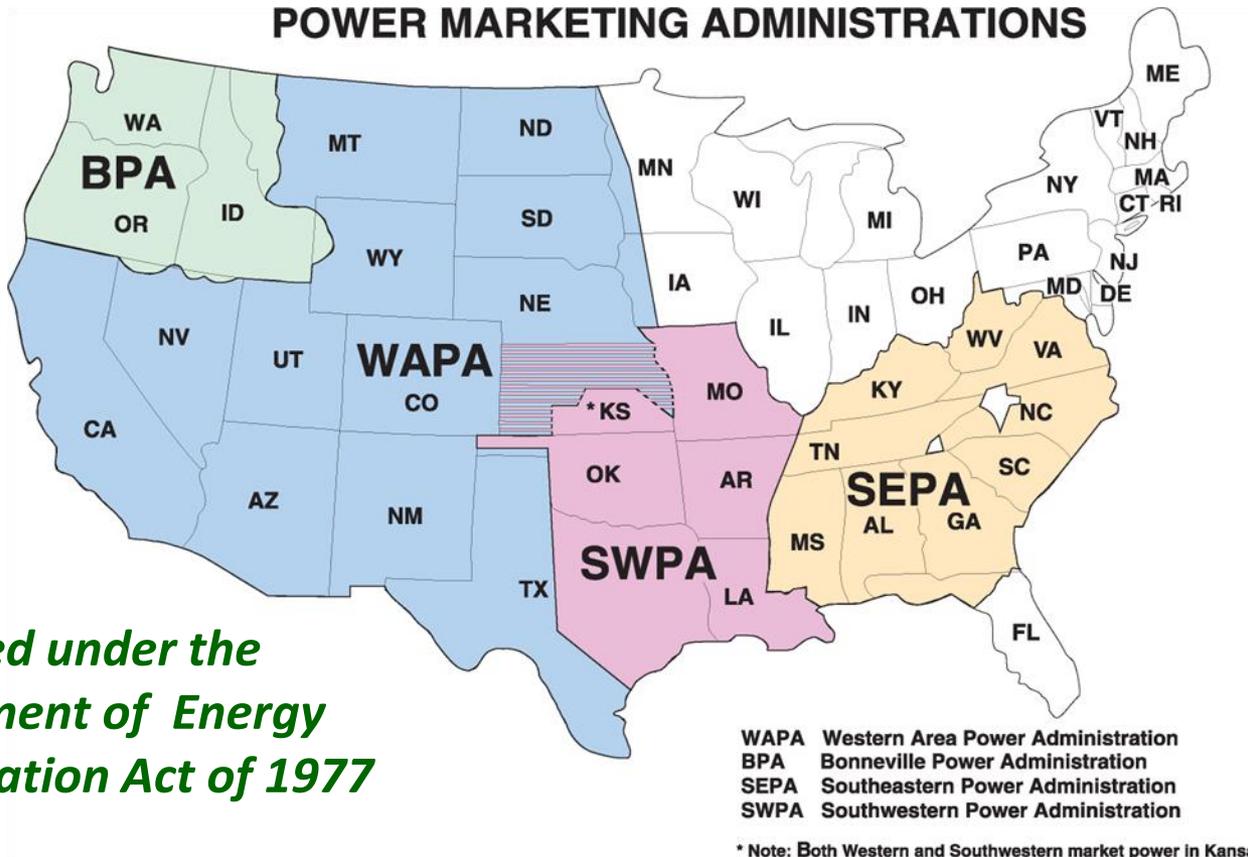


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A Little About Western...

A Federal Power Marketing Administration

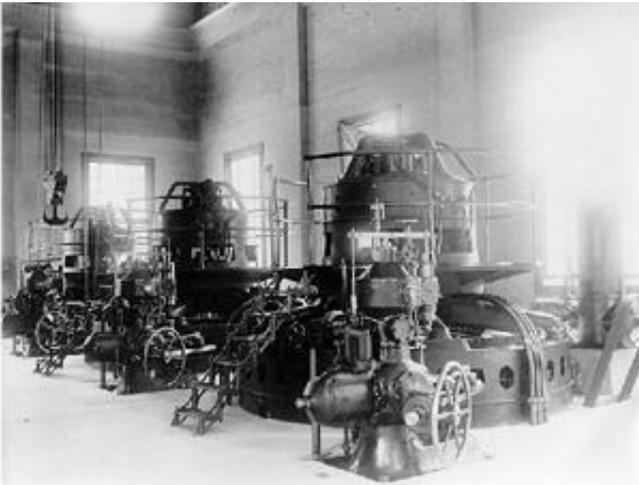


*-- Formed under the
Department of Energy
Organization Act of 1977*



Past: Reclamation Origins

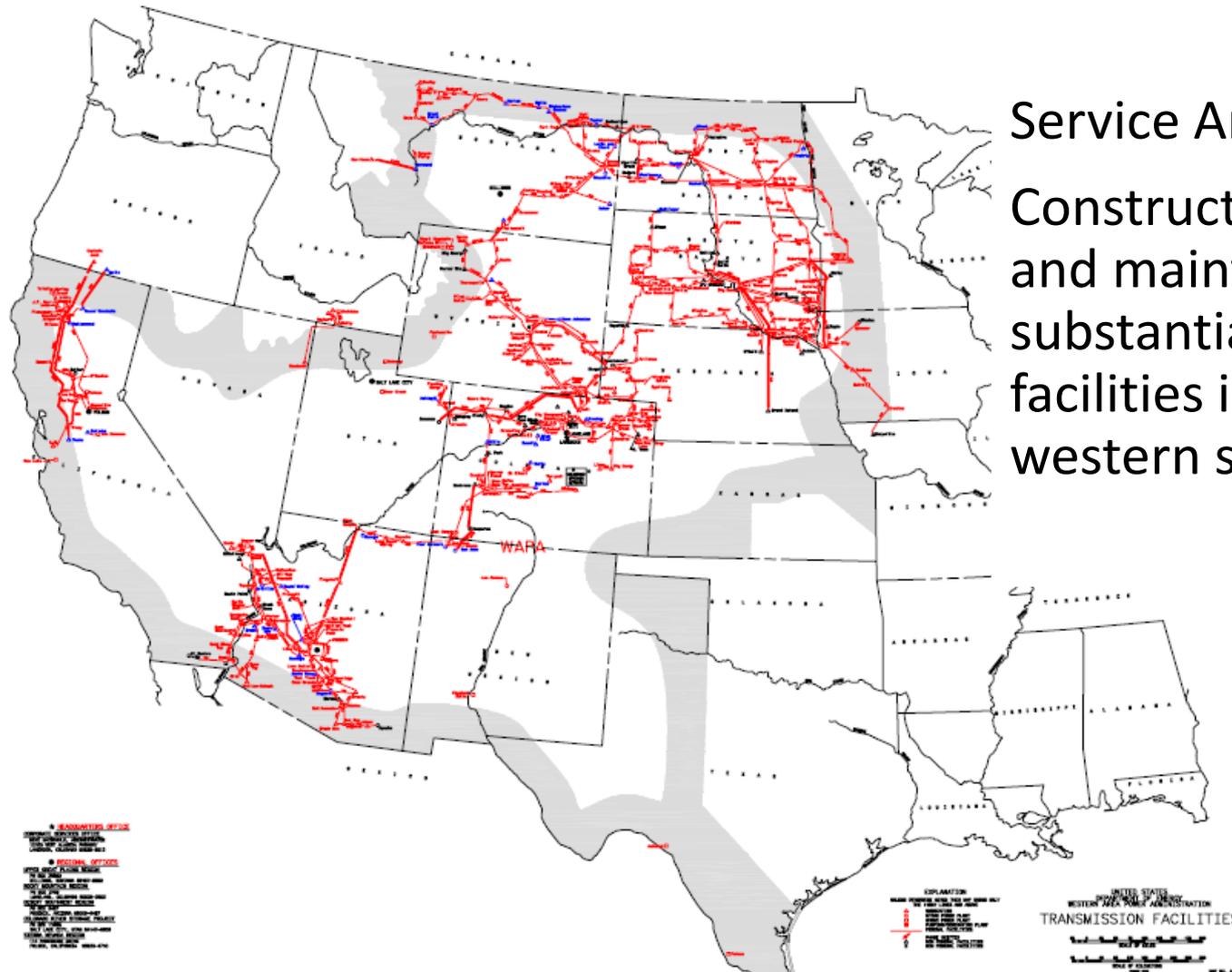
Reclamation Act of 1906



- Authorizes development of power at reclamation sites when necessary for irrigation of project lands.
- Authorizes lease of any surplus power or power privilege.
- Gives preference in leases of surplus power to municipal purposes.



A Little About Western...



Service Area:
Construct, operate,
and maintain
substantial electrical
facilities in 15
western states



A Little About Western...



17,000 miles of high and extra high voltage transmission lines.



A Little About Western...



Market power from
57 power plants,

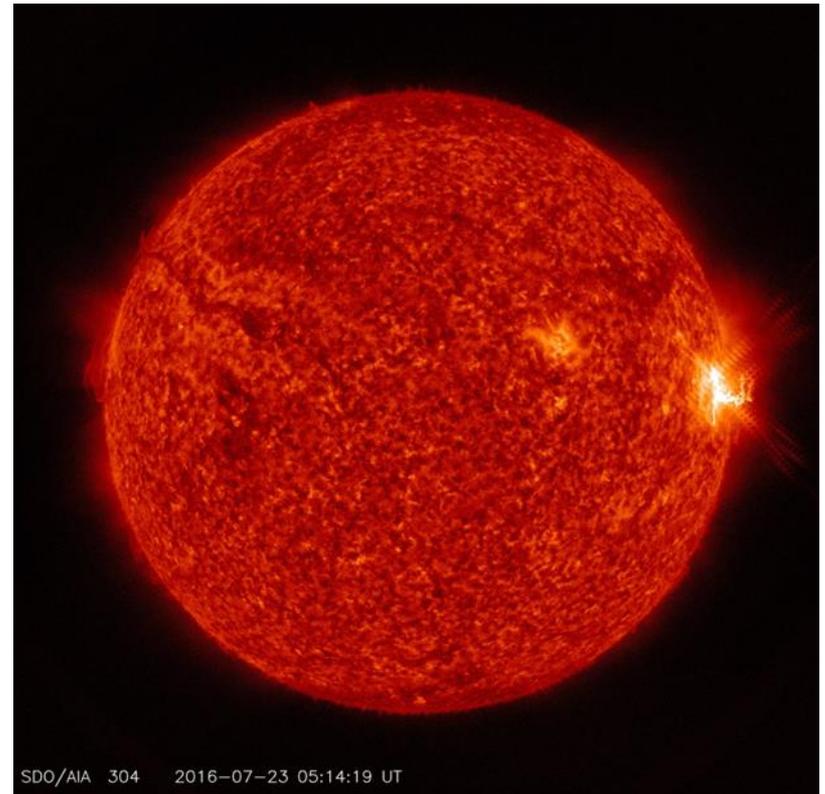


consisting of 10,400 MW
of generating capacity
from 181 generators.



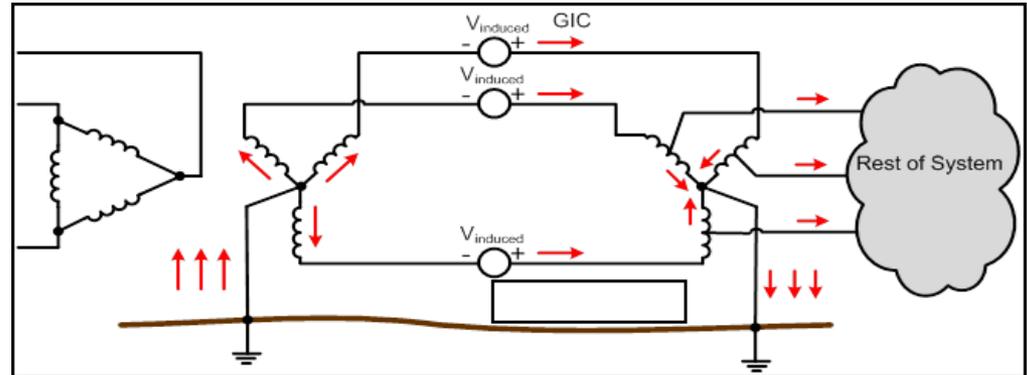
Geomagnetic Disturbances (GMD)

- Solar flares can create coronal mass ejections (CMEs)
- CMEs can interact with the earth's magnetic field
- Geomagnetically induced currents (GICs) can be developed in long transmission circuits



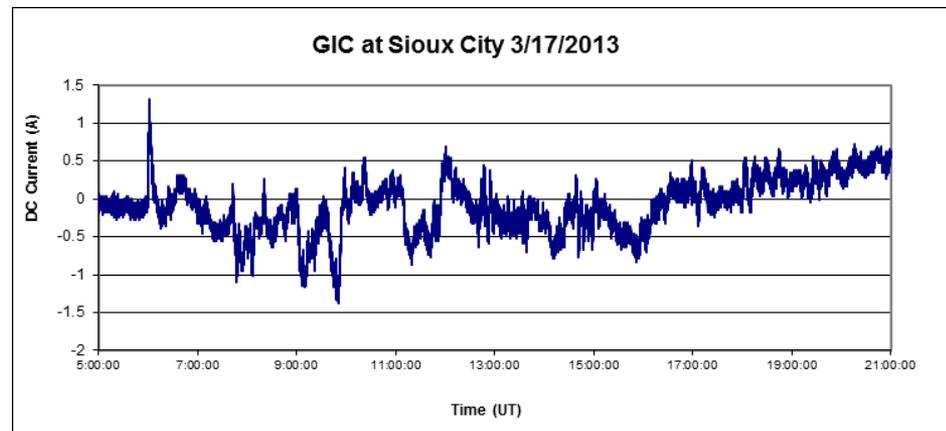
Geomagnetic Disturbances (GMD)

- Quasi-DC nature of GICs can cause half-cycle saturation in power transformers
- May lead to transformer overheating, harmonics, and voltage instability



Geomagnetic Disturbances (GMD)

- Monitoring GIC
 - EPRI Sunburst Program
- Mitigating effects of GIC
 - Operating procedures
 - Neutral current blocking device in neutral of transformer
 - Series capacitors to block DC in transmission circuits



VARIABLE SHUNT REACTORS

Need for reactive power compensation

- Stability on long line transmissions
- Voltage control during light load conditions



Variable Shunt Reactor

50-100 MVAR, 242 kV

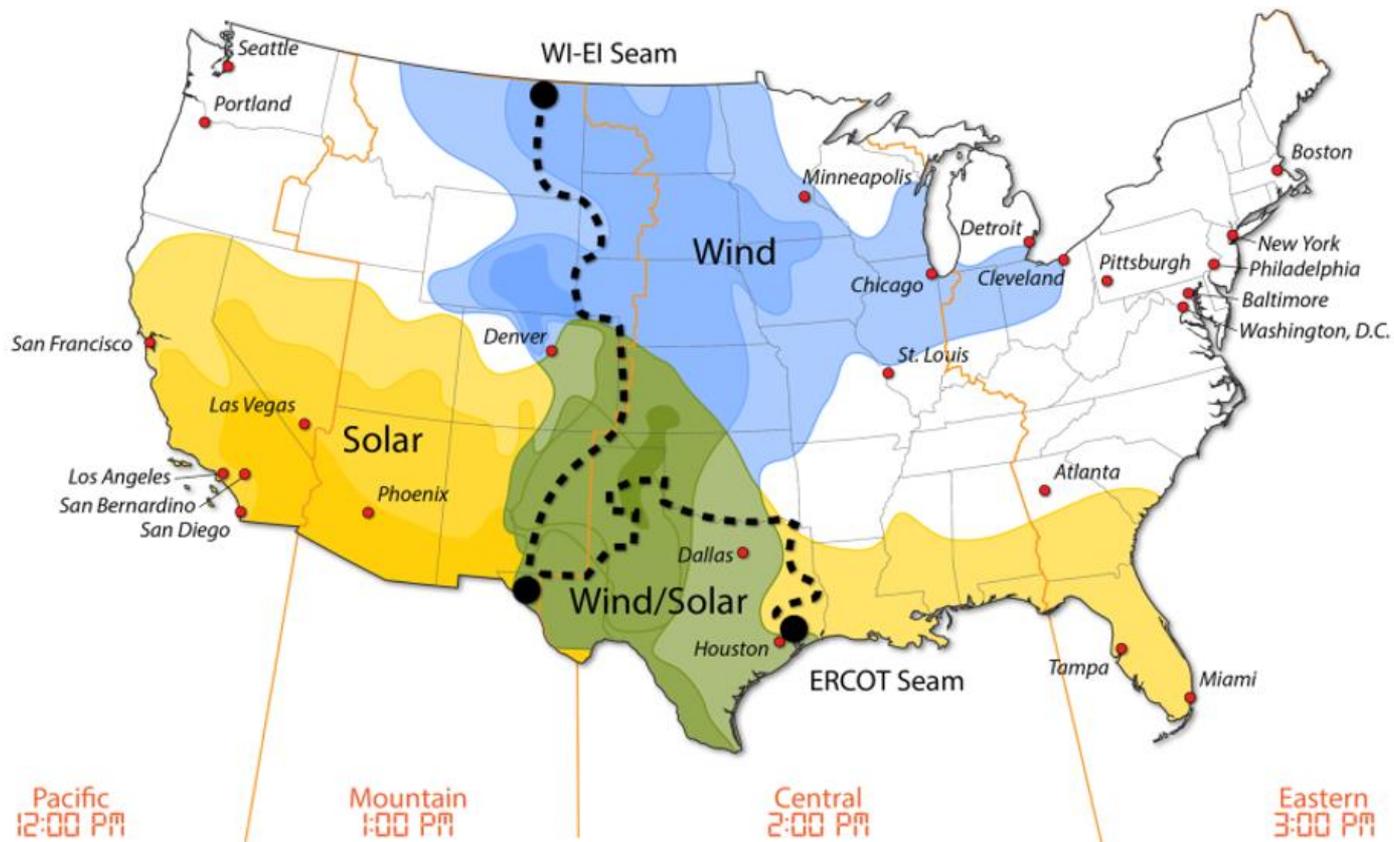


DOE Interconnection Seams Study

- Funded by the Department of Energy's Grid Modernization Initiative
 - \$1.2 million project
 - Launched in April of 2016 and is scheduled to conclude in September of 2017
- The study seeks to understand what economic and reliability opportunities could be realized through better coordination and increased capacity along the transmission seams between the Eastern and Western Interconnections.
- Scenarios will include combinations of upgrades to AC-DC-AC Converter Stations and HVDC line additions. The 18-month project will involve co-optimized generation and transmission expansion at the seams, sub-hourly production cost model simulations, and power flow analyses.
- Study team:
 - National Renewable Energy Laboratory, Pacific Northwest National Laboratory, Oak Ridge National Laboratory, and Argonne National Laboratory
 - Iowa State University
 - Southwest Power Pool, Midcontinent Independent System Operator
 - Western Area Power Administration



Geographic and Temporal Diversity of Generation Resources



AC-DC-AC Converter Stations in the U.S.

Station	Owner	Operator	Capacity	Year Built
Rapid City, SD	Black Hills Electric	Black Hills Electric	200 MW	2003
Miles City, MT	Western Area Power Administration	Western Area Power Administration	200 MW	1985
Stegall, NE	TriState G&T/Basin Electric	Western Area Power Administration	100 MW	1977
Sidney, NE	Western Area Power Administration	Western Area Power Administration	200 MW	1988
Lamar, CO	Xcel Energy	Xcel Energy	210 MW	2005
Clovis, NM	Public Service Company of New Mexico	Public Service Company of New Mexico	200 MW	1984
Artesia, NM	Public Service Company of New Mexico	Not currently operating	200 MW	1983



Strategic Transformer Reserve (STR)

- Technical study of severe events that exceed reasonable utility contingency planning.
- The studies assumption is that after such an event there will be a shortage of LPTs preventing restoration of the grid to a minimum tolerable level of performance in a timely manner.
- The study will provide guidance on whether a LPT reserve is required and the size of the reserve (numbers and sizes) as well as potential regional distribution correlated with threat/risk mitigation.



STR Logistics

- Coordination with utilities, operators, reliability organizations, manufacturers, and other federal agencies.
- Identify Critical Substations (simulations)
- Identify System needs/ requirements (simulations and system modeling)
- Address all (major) possible events and outcomes
- Identify LPT needs (temporary)
- Determine options for number & type of additional provisional replacement LPTs
- Identify Siting for STR staging (favorable to transport, security, maintenance req.)



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