
REGIONAL COORDINATION



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Presentation Overview

- Obstacles to Renewable Integration in the West
- Need for Regional Coordination
- Benefits of regional coordination
- Markets Optimize Use of the Grid
 - Lower costs, More Renewables

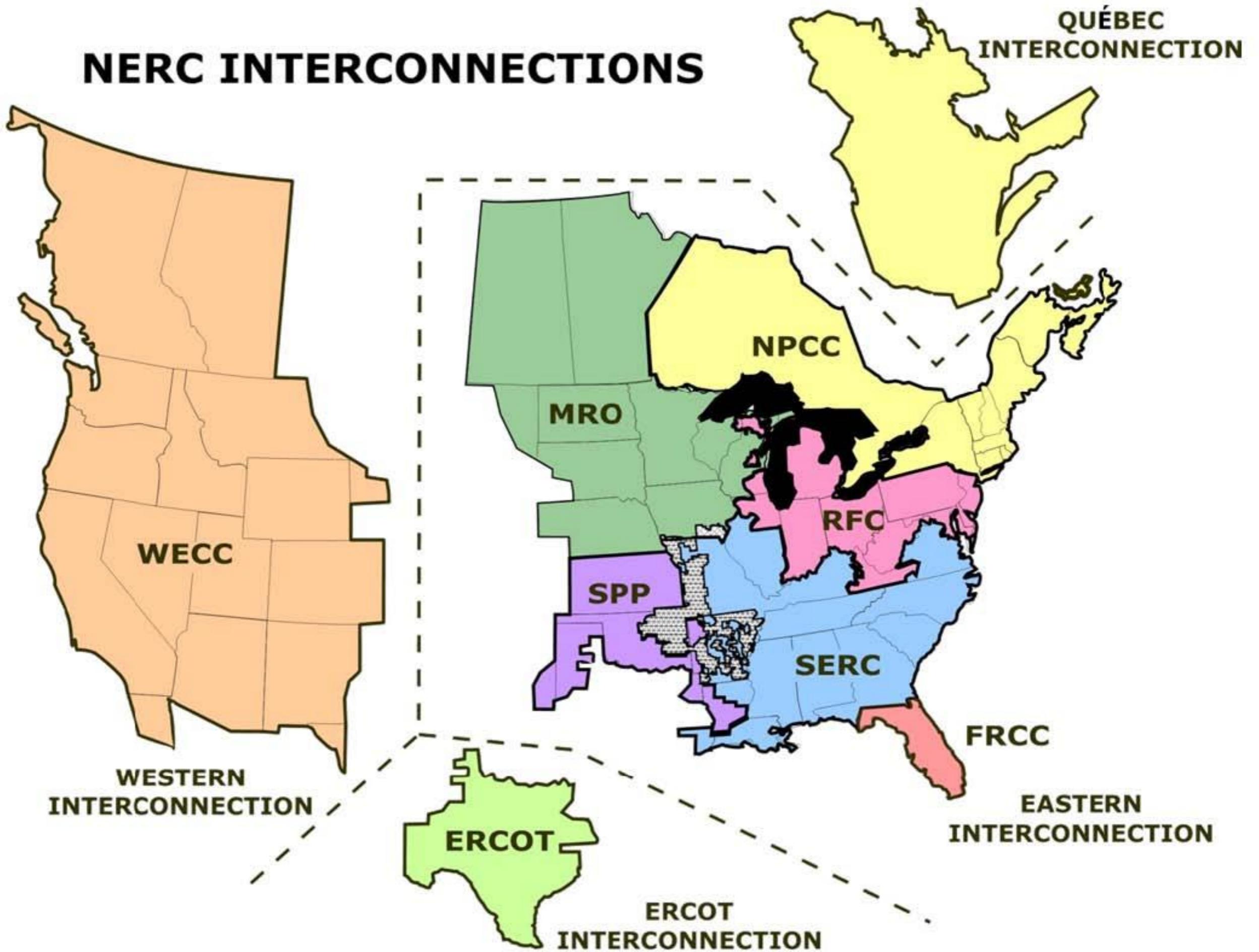


Obstacles to Renewable Integration

- Balkanization of the Grid
 - Inability to exploit geographic diversity
- Inefficient Use of Transmission
 - Artificial congestion (contractual)
- Duplicative Infrastructure and reserves
 - Unnecessary flexibility reserves
- Artificially high integration and transmission costs
 - “Pancaking”

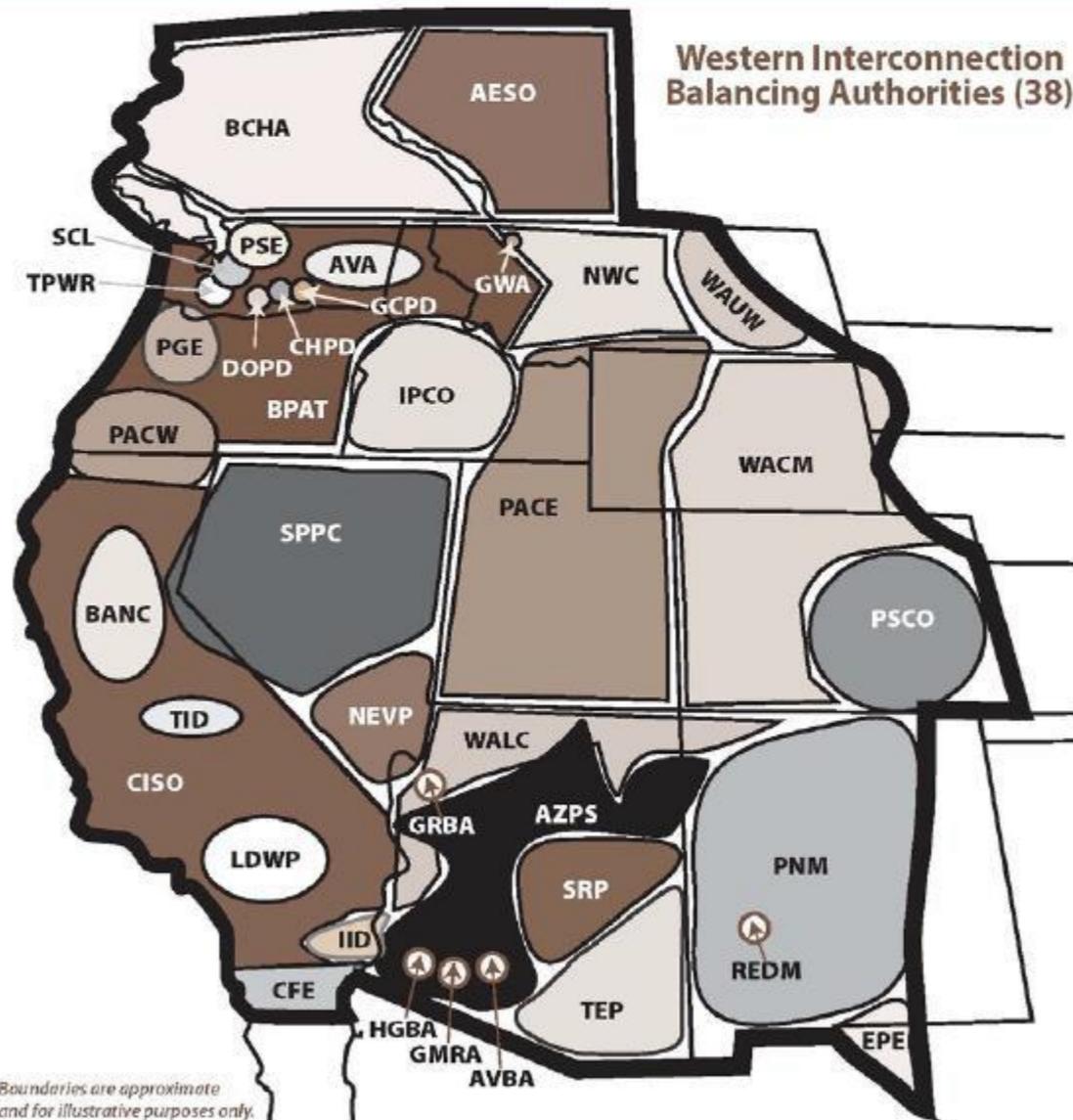


NERC INTERCONNECTIONS



Imagine a Bus with 38 drivers

WECC Balancing Authorities



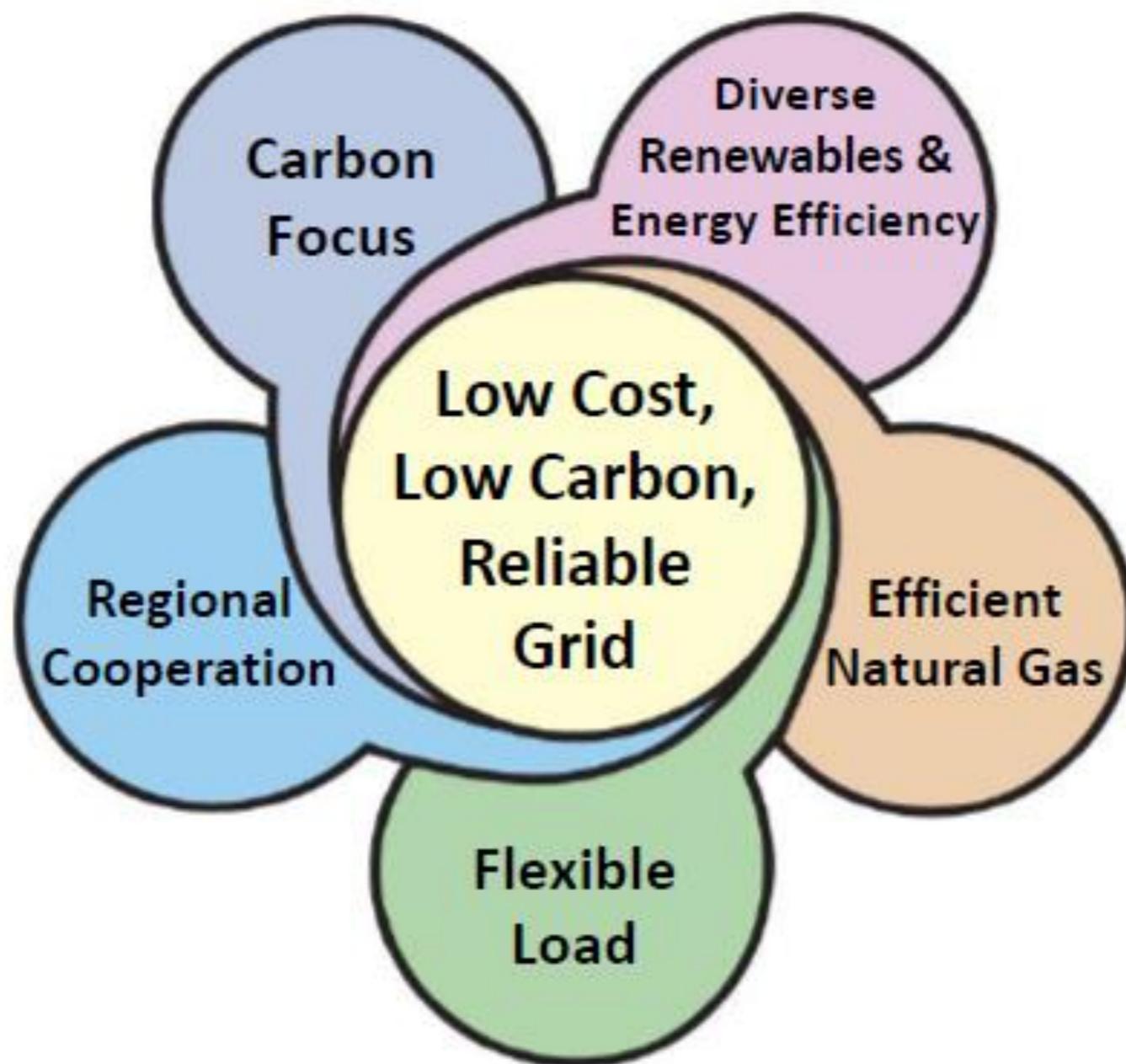
Revolution in Grid Operations

Work by NREL, PNNL, WGA, WECC, Western Grid Group, and consultants like E3, as well as operating changes being implemented by PMAs and new rule changes by FERC show the benefits of change can no longer be ignored.



The LCGS Approach

The LCGS, with a diverse portfolio of energy generation and resource flexibility, demonstrates the feasibility of deep, low cost emissions reductions in California.



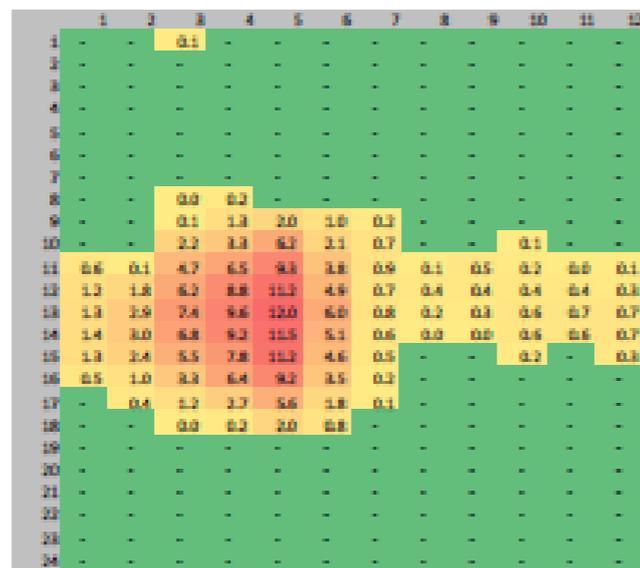


Regional Coordination is a key renewable integration strategy

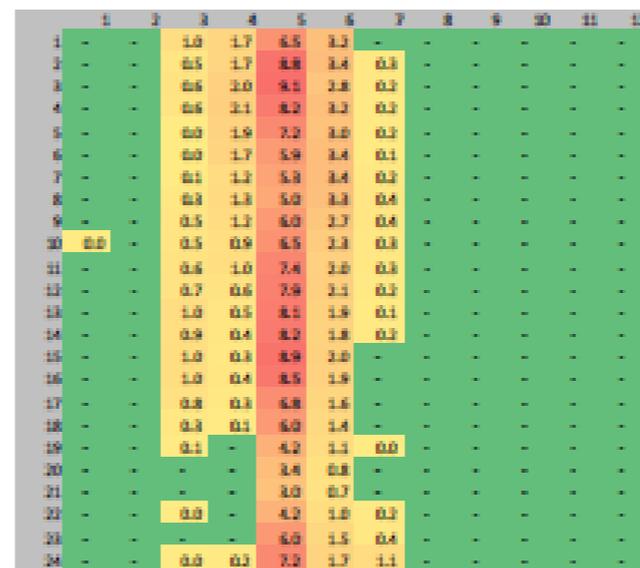
+ Increasing exports can significantly reduce curtailment

Average Curtailment by Month-Hour (GW)

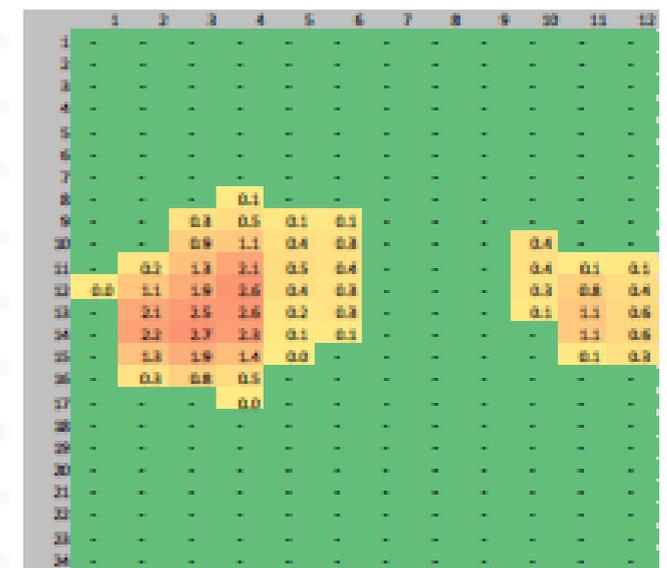
California



Northwest



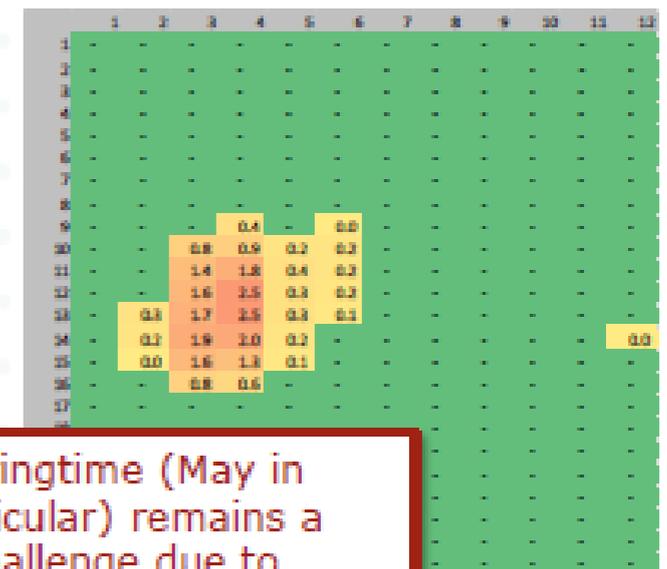
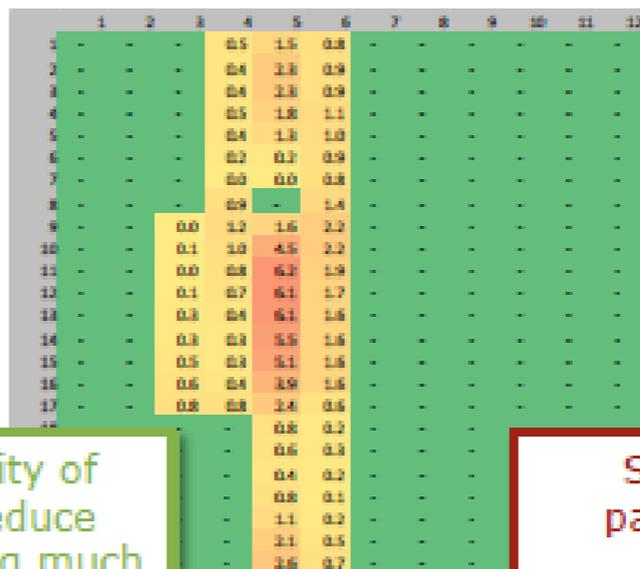
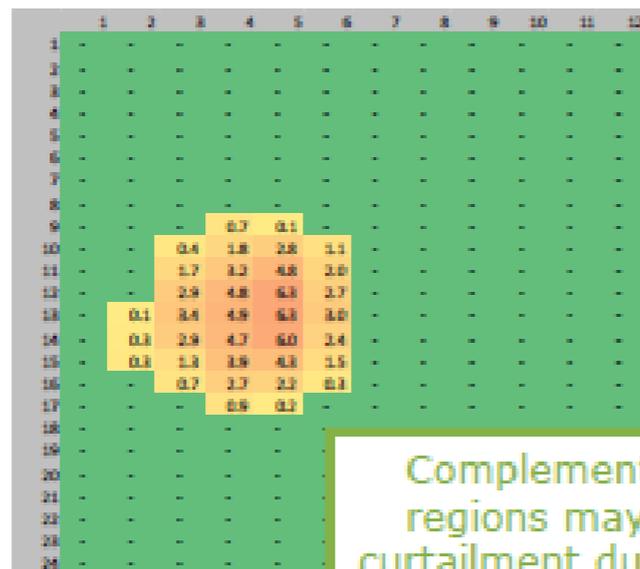
Southwest



Historical
Import/Export
Limits



Physical
Import/Export
Limits



Complementarity of
regions may reduce
curtailment during much
of the year

Springtime (May in
particular) remains a
challenge due to
coincidence of oversupply



NREL recommendations

In addition to transmission, greater operational flexibility will be needed to support high levels of renewable generation. Means to provide this include the following options, some of which are already emerging in practice:

- Enhanced balancing authority cooperation, coordination, or consolidation (as has occurred in Texas, PJM, and MISO)
- More efficient markets with shorter clearing periods, down to 5–10 minutes (as is the case already in MISO, PJM, and other regions)
- New ancillary service markets covering a wider range of needs (e.g., flexibility—faster ramp rates) beyond regulation and reserves markets already operating in much of the United States
- Unit commitment adjustments within the day
- New conventional generation technologies or modifications to existing generators that allow faster ramp rates, lower minimum output levels, quicker start times and shorter minimum-off times



NREL Recommendations, Continued

- Improved wind and solar forecasting—along with efficient use of forecasts (as is now occurring in many regions)
- Increased connectivity among neighboring and distant regions
- Expanded electricity flow across the Eastern, Western, and ERCOT Interconnections
- Increased use of demand response (as is occurring now in PJM, ERCOT, California, and other regions)
- New, manageable electrical loads such as electric vehicle charging
- Increased use of storage options.

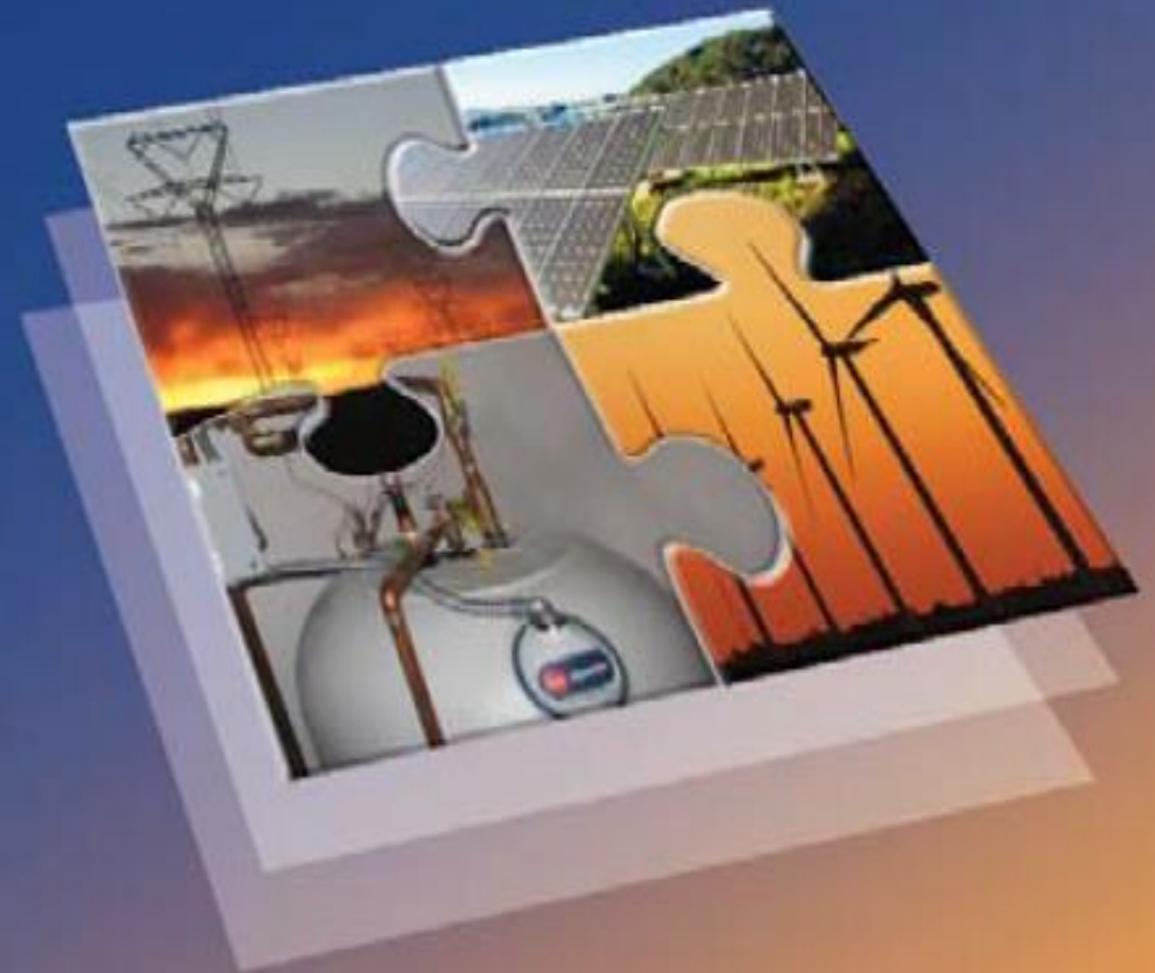
WGA Study on Low Cost Integration

1. Expand sub-hourly dispatch and intra-hour scheduling
2. Dynamic Transfers btw. BAAs
3. EIM
4. Improve forecasting
5. Geographic Diversity
6. Reserves management
7. Retool DR for integration
8. Flexible dispatch for existing plants
9. Flexibility in new generation



Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge

Executive Summary



June 10, 2012
Western Governors' Association

Requirements for integration of renewables

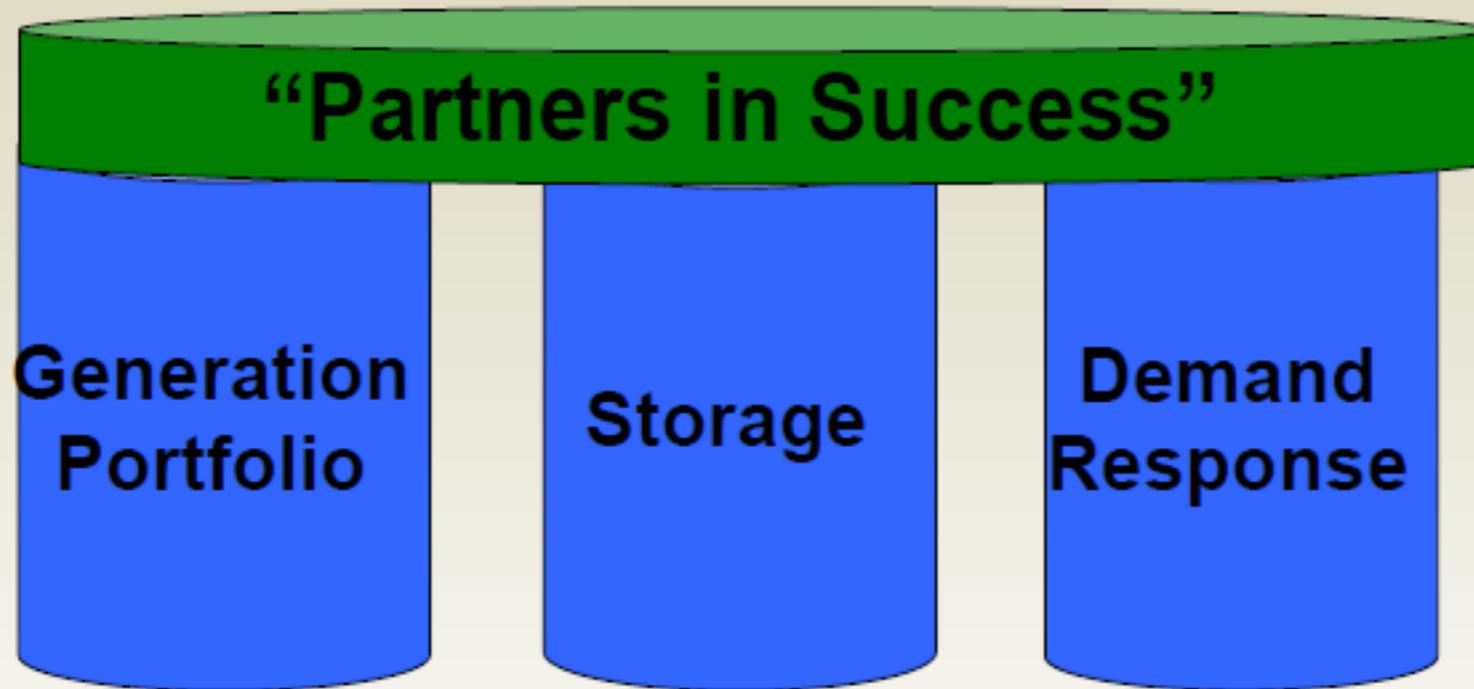
Resources Required for Renewables Integration



Wind Generation



Solar Generation



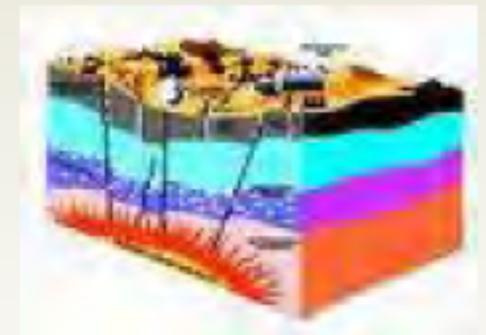
- Quick Start Units
- Fast Ramping
- Wider Operating Range (lower P_{min})
- Regulation capability

- Shift Energy from off-peak to on-peak
- Mitigate Over Generation
- Voltage Support
- Regulation capability

- Price sensitive load
- Responsive to ISO dispatches
- Frequency Responsive
- Responsive to Wind Generation Production



Hydro



Geo-thermal Generation

Benefits of Regional Coordination and Markets

- Rapid GhG reductions
- Avoided Curtailment
- Faster Fossil Retirements
 - Coal plants cannot compete
 - Experience in MISO-PJM
- More Rapid Renewable Integration
 - RE with low to no marginal costs dispatch first



ZONING AND MASTER PLANNING



Planning for Present and Future Needs

- Goals long term/ Plan Long Term
- Orderly development over time
- Renewable Resource Zoning
 - Low Impact Lands (ex. Parts of Central Valley)
- Scalable Infrastructure
 - Avoid unnecessary ROWs
 - Reduce costs

Transmission Planning

- Plan together with Generation
 - RETI-style Zones
- Scale Transmission to meet expected needs
- Use Risk Methodology to avoid conflicts
- Realign Transmission Planning
- Prioritize Transmission that meets System Needs

FOR MORE INFORMATION



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QUESTIONS?