Creating Solutions for the Western Grid

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Western Interstate Energy Board

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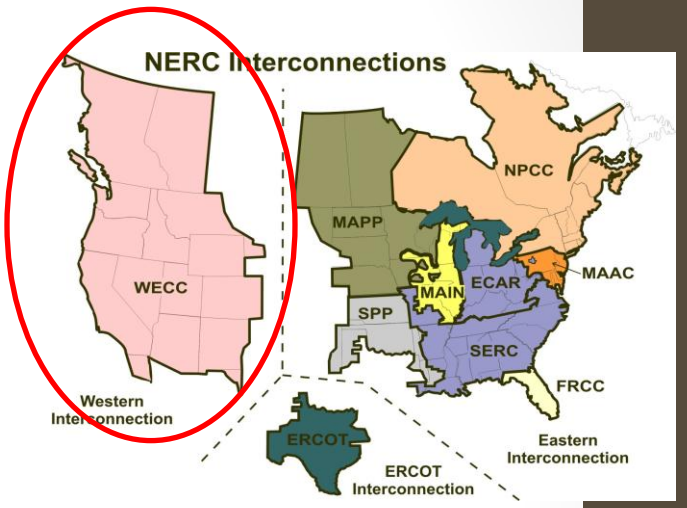
Western context

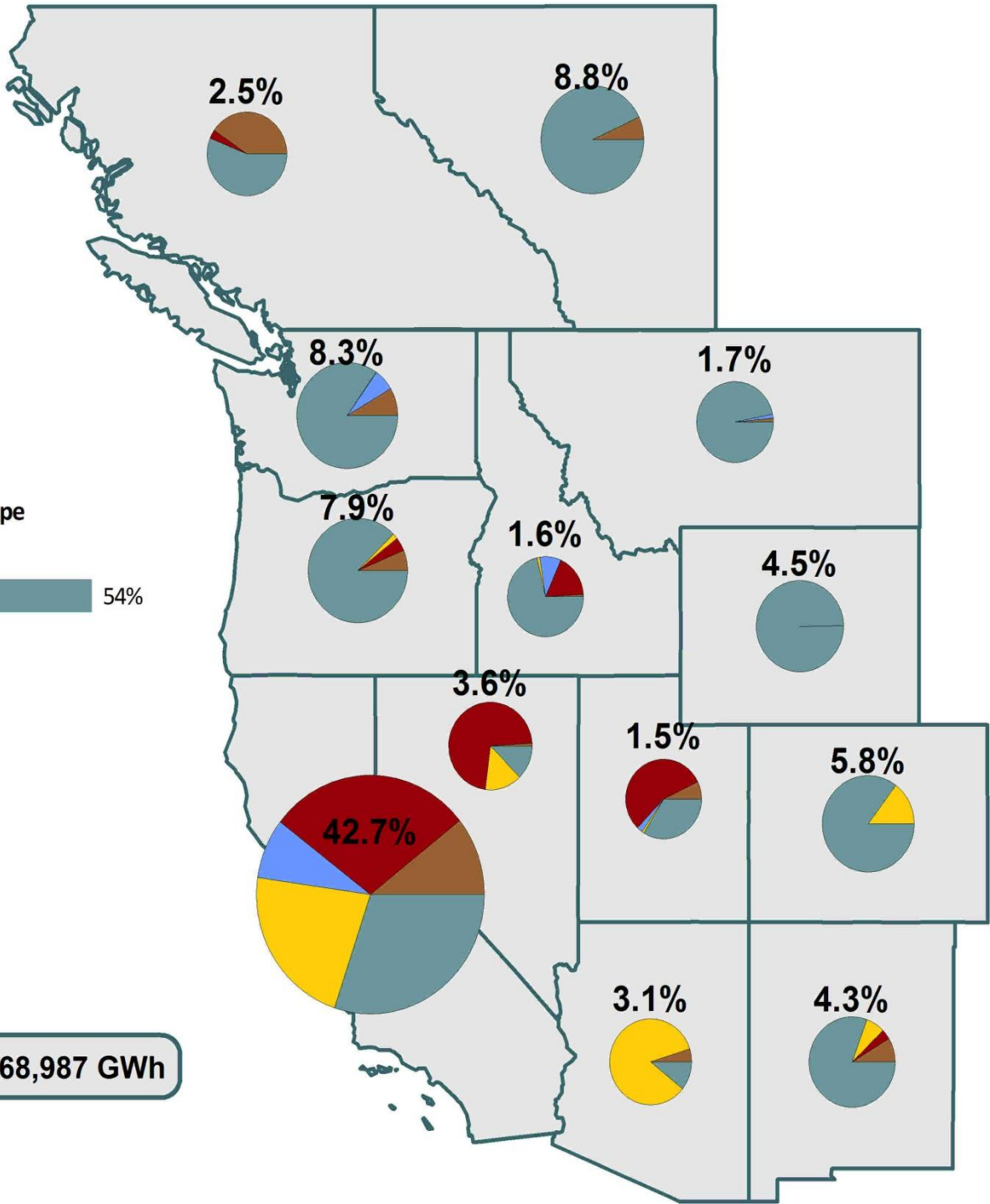
- Rocky Mountains are in the Western Interconnection
- Significant renewable generation additions expected in the West over the next 10 years
- Trends in the location of variable generation preferred by utilities
- Challenge the West faces in integrating large amounts of renewable resources
- Actions that can help the West meet the integration challenge, while keeping the cost to consumers low



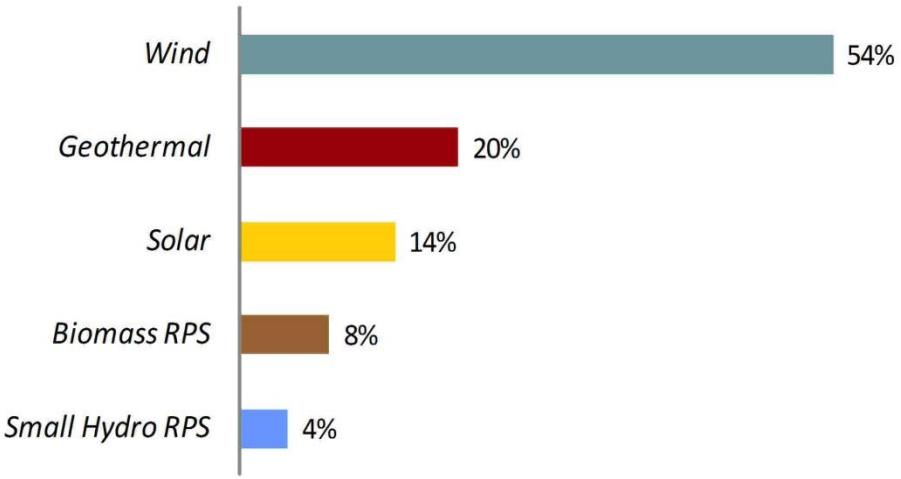
Percentage of 2022 Total Renewable Energy Generation by Type and State/Province

- Biomass RPS
- Geothermal
- Small Hydro RPS
- Solar
- Wind

Note: Mexico (CFE) = 3.7%
Texas (El Paso) = 0%



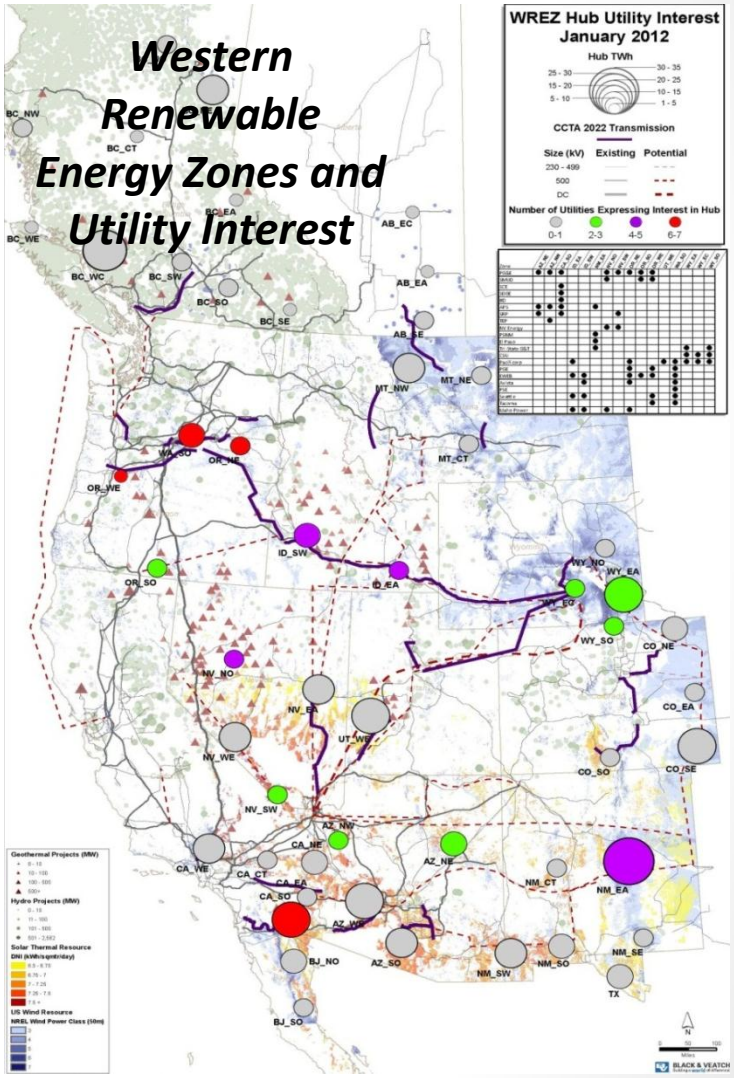
Percentage of Renewable Generation by Type



2022 WECC Renewable Generation: 168,987 GWh

Grid Expansion for VG

- Utilities finding lots of renewables in their backyards
  - Resulting in lower interest in high quality distant resources and reduced need for long-distance transmission
  - Current trends
    - More solar (near load)
    - More gas (near load)
    - Local wind

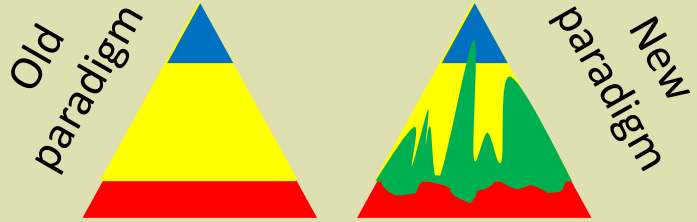


Source: [Renewable Resources and Transmission in the West: Interviews on Western Renewable Energy Zones](), WGA 2012

Near-Term Challenge: Integrating VG

WHAT WE NEED

✓System flexibility

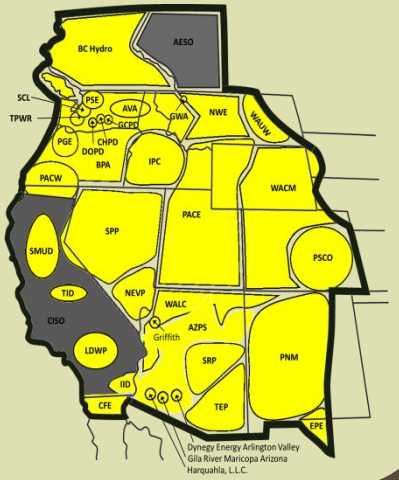


WHAT WE HAVE

✓Failure of institutional innovation

✓Balkanization

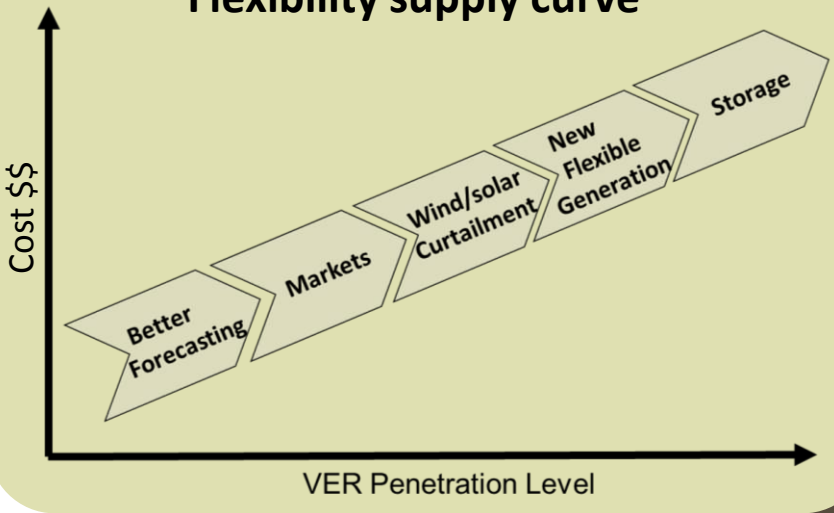
38 Balancing Authorities (fiefdoms)



THE ANSWER

✓Adoption of flexibility-enhancing measures

Flexibility supply curve



Doug Larson, 8/7/2012

How Can Flexibility be Increased?

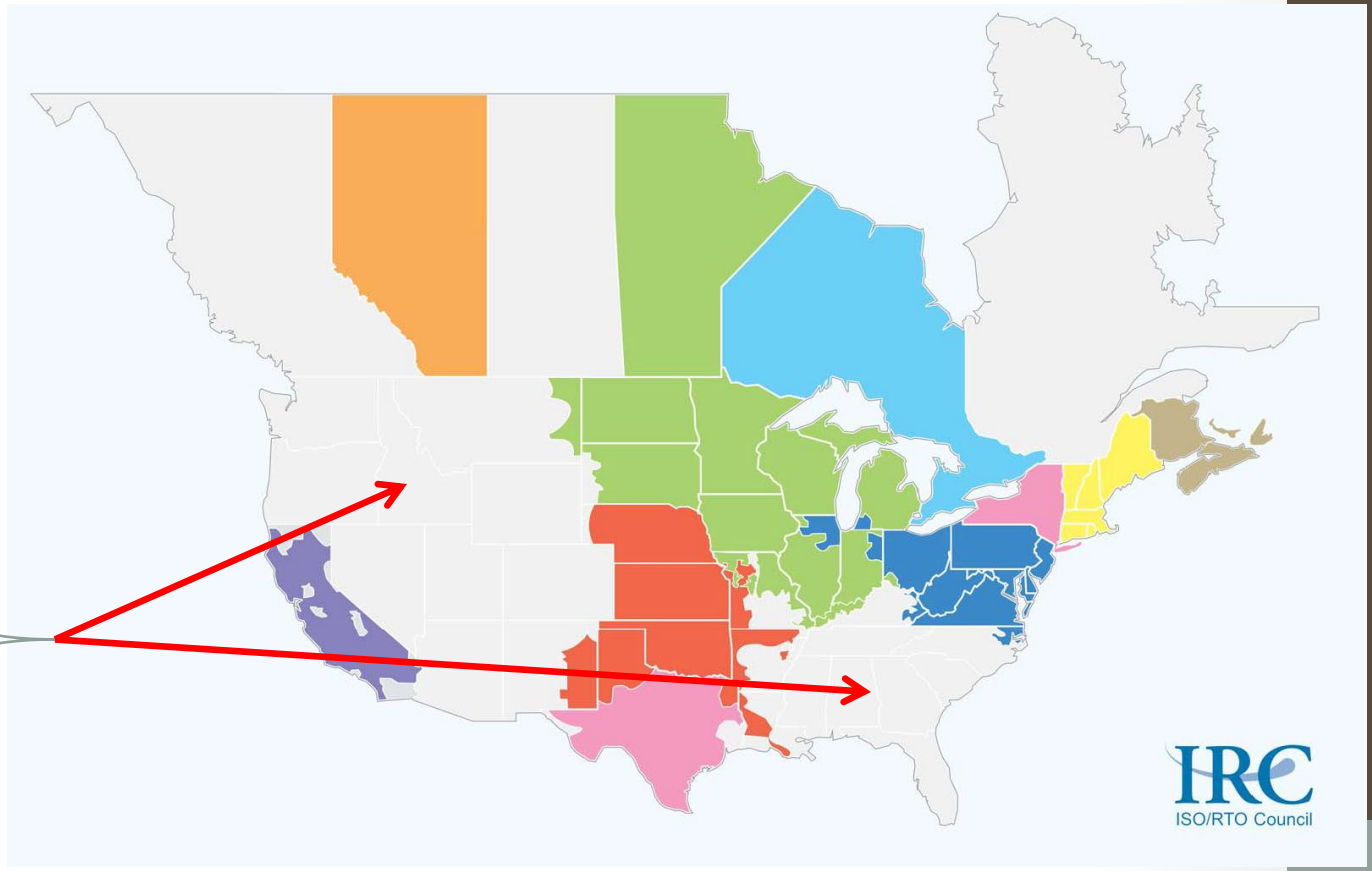
- **Improved institutional flexibility**
  - Faster energy markets and shorter intervals for transmission scheduling
  - Balancing wind and solar resources over a large geographic area to address variability (net out changes in load and generation)
  - Application of advanced solar and wind forecasting techniques
  - Make better use of existing transmission capacity
- **A more flexible generating fleet**
  - Cost-effective modifications of existing plants may be possible to improve load-following capability (ramp rate up and down, lower minimum load and faster startup capability)
  - For new generating plants, focus on flexibility
- **Demand response** – Some loads can respond rapidly (up and down) with automation
- **Energy storage** – e.g., pumped hydro, batteries, compressed air, plug-in electric vehicles

Source:
Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge, Western Governors' Association, 2012

Supplemental Slides

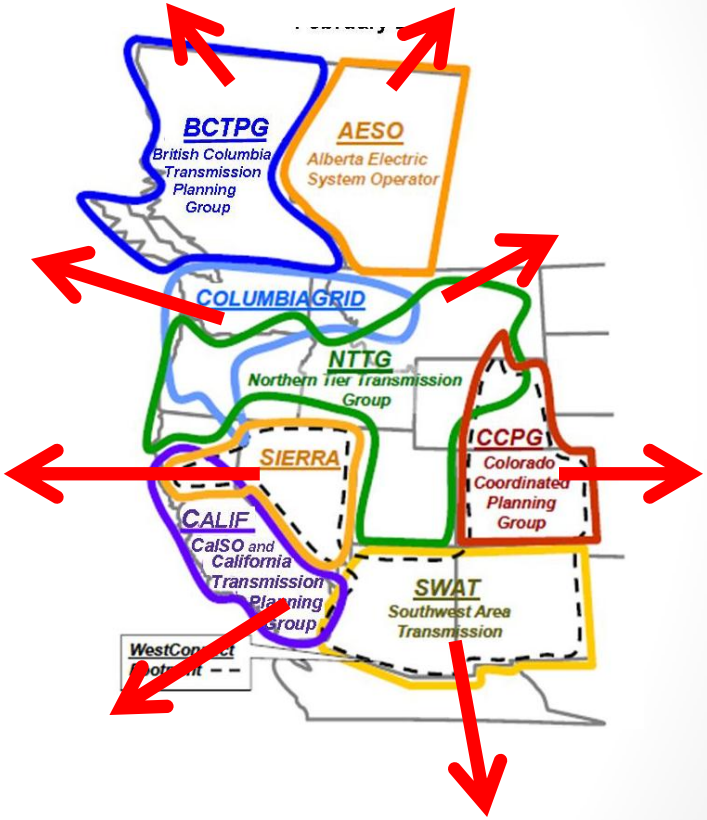
Areas where generation and demand are aggregated

Where variability is not aggregated over a broad footprint and higher cost generation may be used to balance generation and load



Grid expansion planning challenges

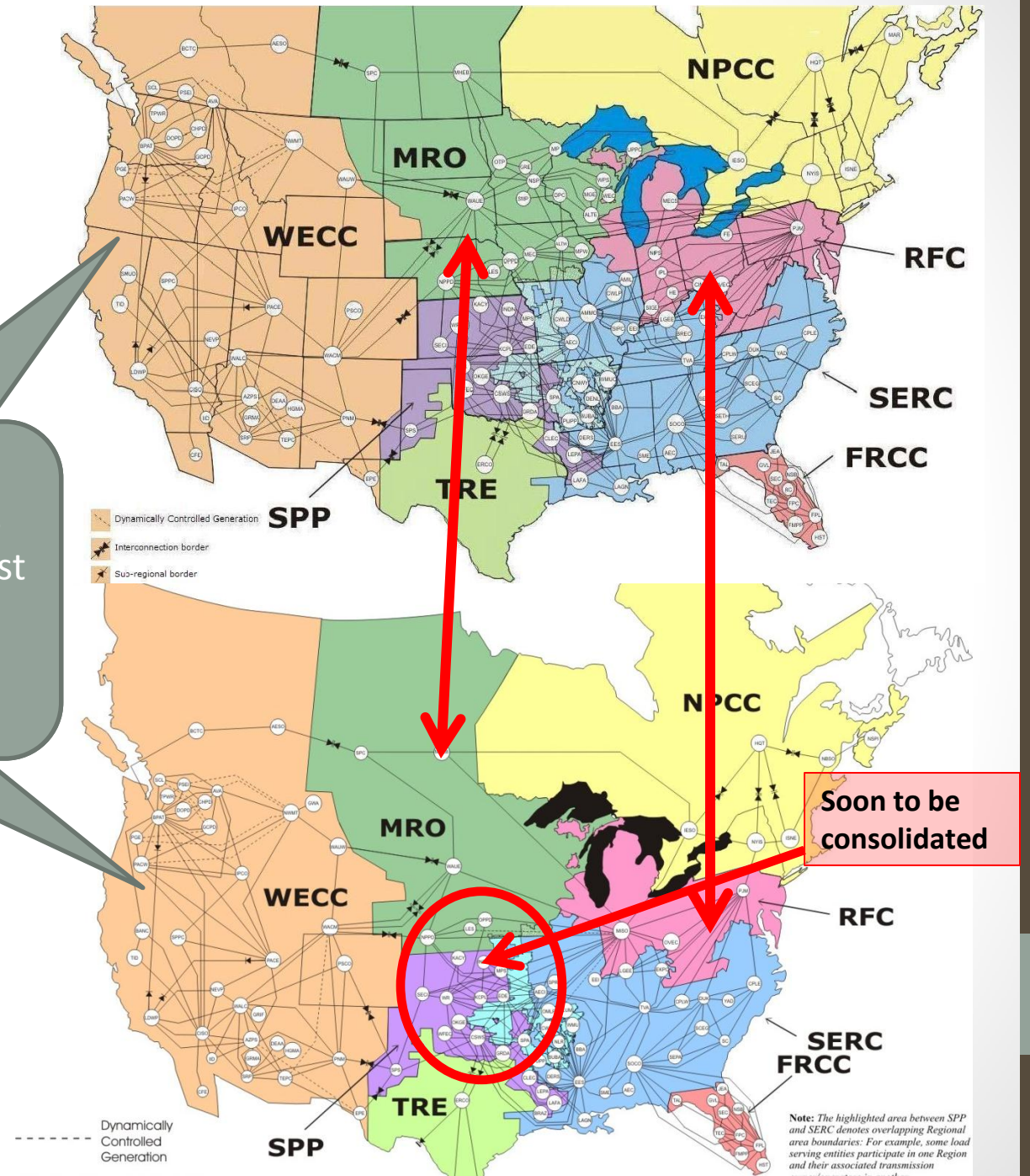
- Will funding of interconnection-wide transmission expansion planning continue?
- Will transmission planning become Balkanized under Order 1000?



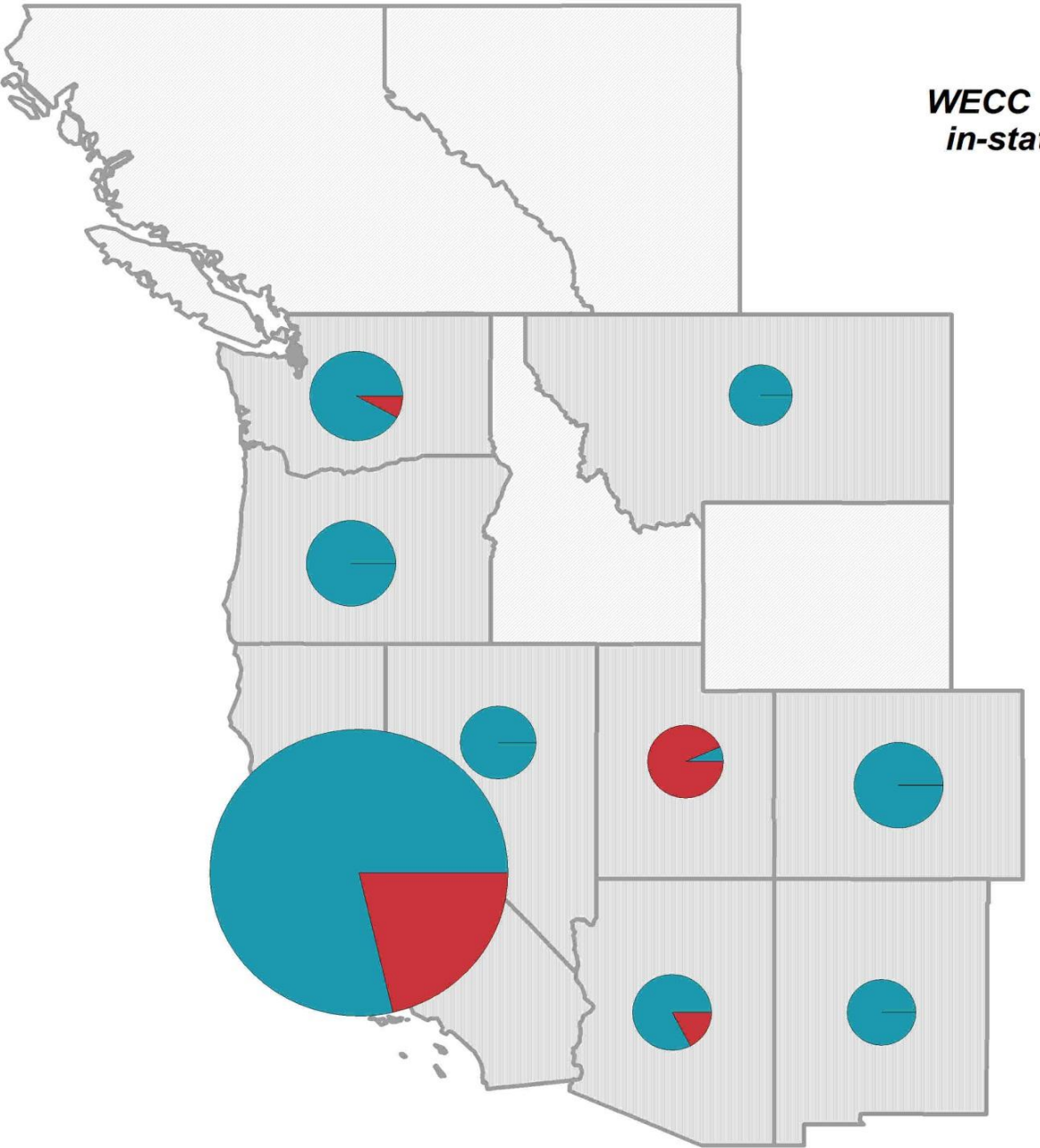
2007

Balancing Authorities proliferating in the West (but consolidating elsewhere)

2012



RPS Compliance Using In and Out of State/Province Resources (by Energy)



WECC Wide: 81% of RPS energy served by in-state resources in 2022 Common Case

State/Province with RPS Goal or Mandate

State/Province without RPS Goal or Mandate

In-State Resources

Out-of-State Resources