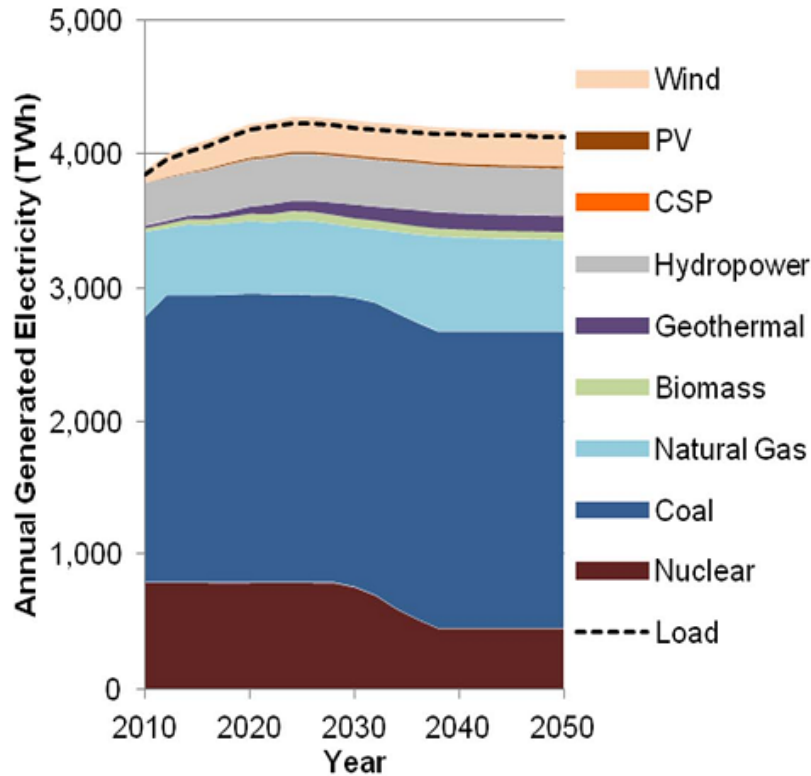
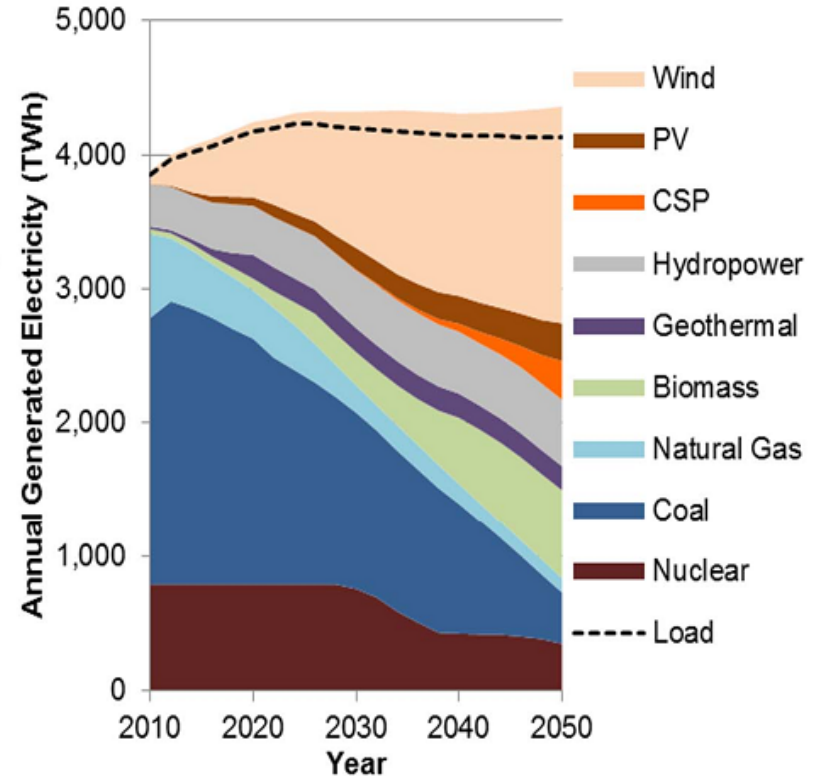


ReEDS Outputs

Baseline scenario



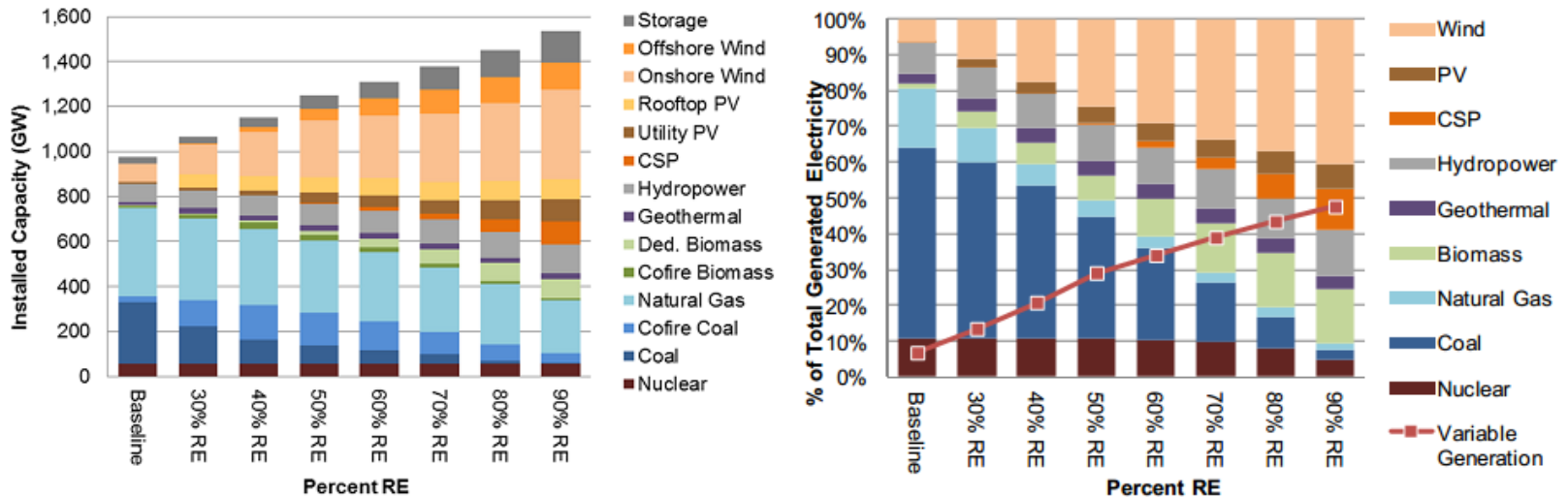
80% RE-ITI scenario



- **Renewable generation sources could supply 80% of U.S. Electricity in 2050**
- **Operational** challenges (curtailment, forecast, reserves) grow with deployment of VRE
- **Transmission** expansion can be significant with high RE targets
- **Storage** deployment grows with increasing RE targets

Renewable generation resources could adequately supply 80% of total U.S. electricity generation in 2050 while balancing supply and demand

RE-ITI scenarios

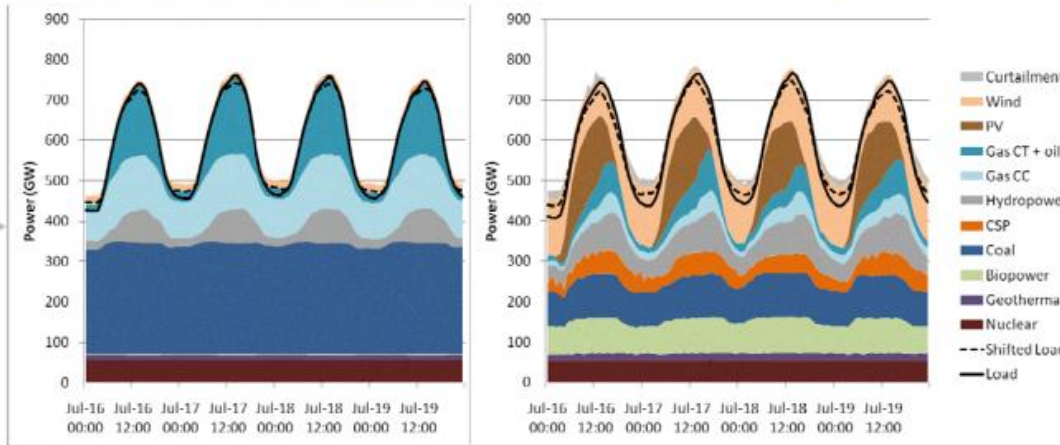


- **Deployment** significant for all major renewables
- **Operational** challenges (curtailment, forecast, reserves) grow with deployment of VRE
- **Transmission** expansion significant with high RE targets (though reduced because of the low demand assumption and reduced conventional generation)
- **Storage** deployment grows with increasing RE targets
- **Costs** rise non-linearly with RE deployment (but not exponentially)

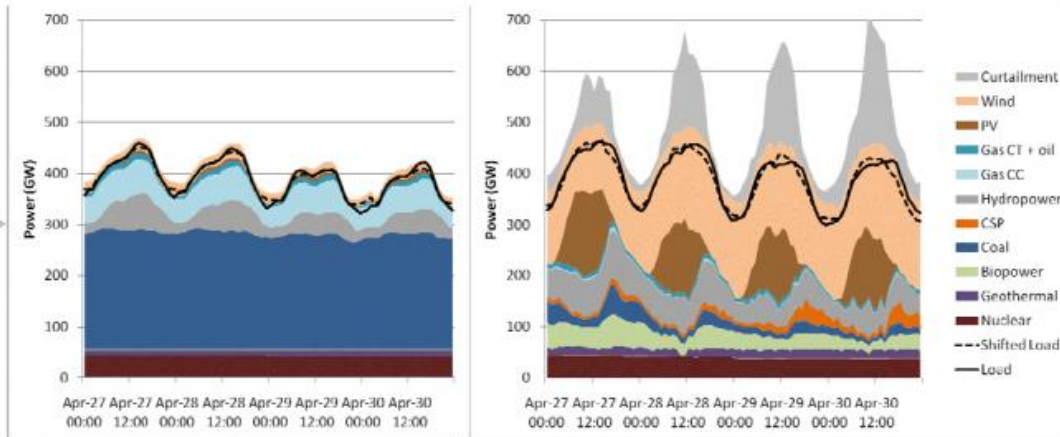
• **Constrained Scenarios:** Transmission, Resources, Flexibility

Electricity supply and demand can be balanced in every hour of the year in each region with 80% electricity from renewables*

Summer Peak



Spring Off-Peak



Baseline

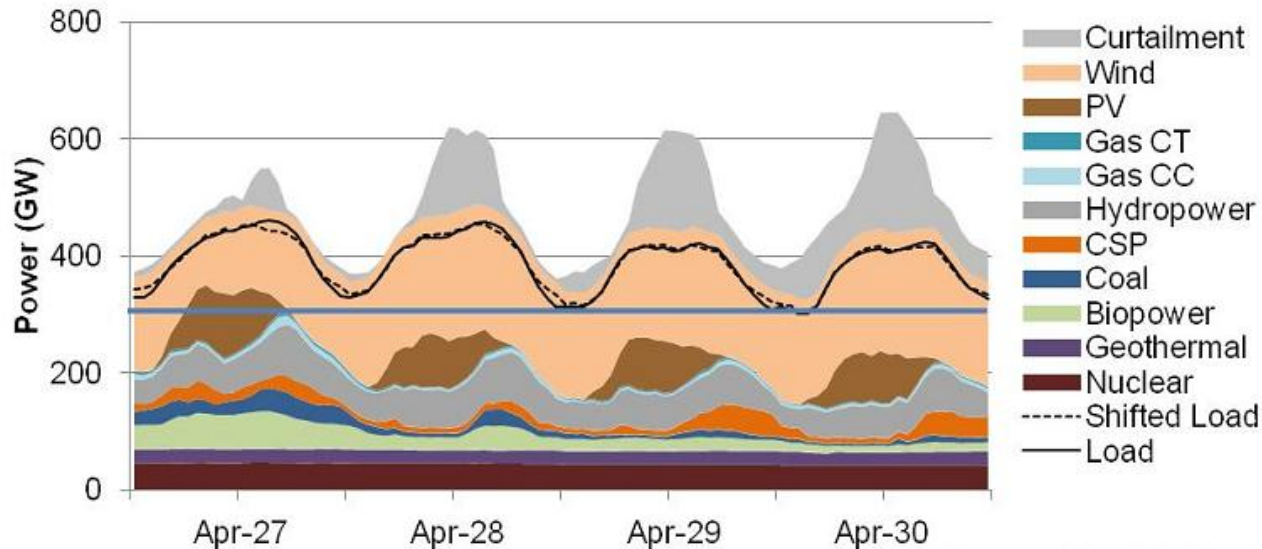
80% RE-ITI Case



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*Full reliability analysis not conducted in RE Futures

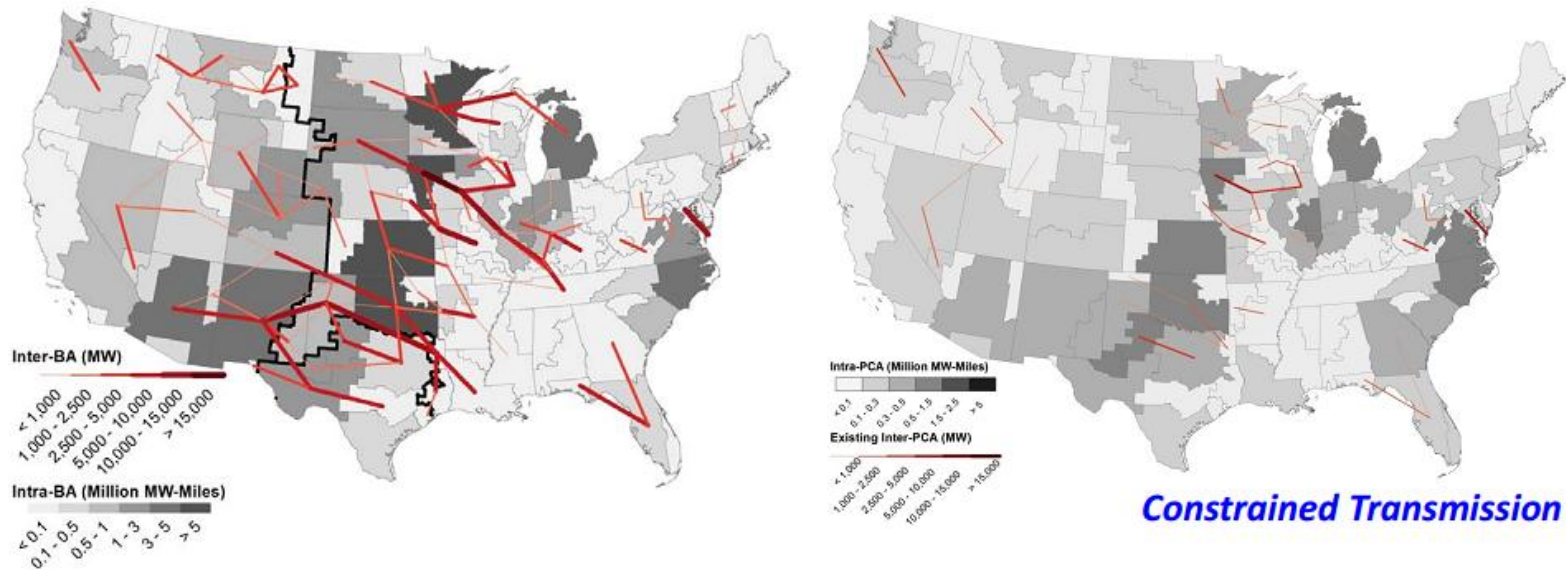
Additional planning and operational challenges include management of low-demand periods and curtailment of excess electricity



Source: Renewable Electricity Futures (2012)

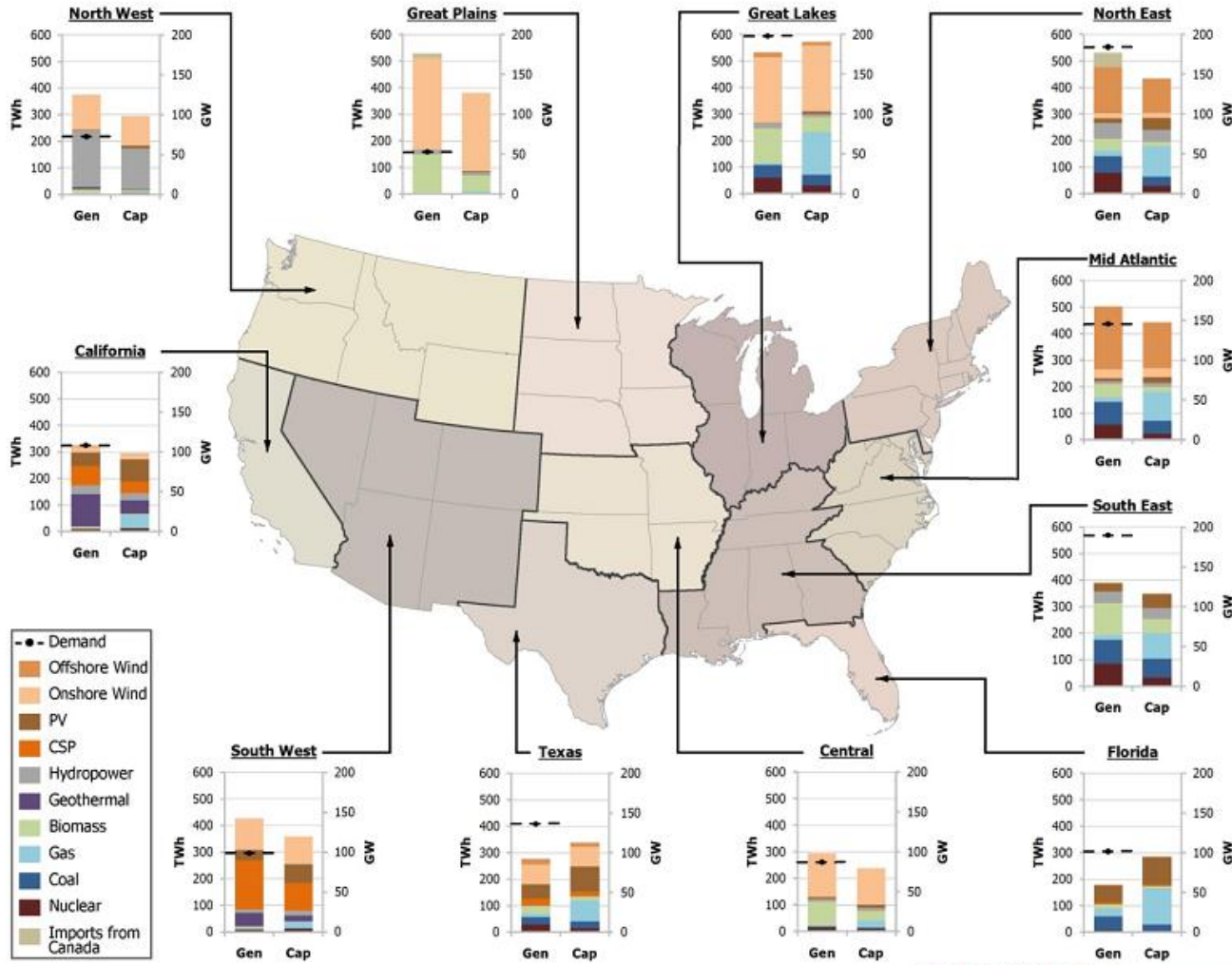
- **Operational challenges for high renewable scenarios are most acute during low-demand periods (e.g., spring).**
- **There is greater thermal power plant ramping and cycling, as well as increased curtailment of excess renewable generation (8-10% of wind, solar, and hydropower curtailed in 2050).**
- **Storage and demand-side options (e.g. PHEV charging) can help shift loads to mitigate these challenges, e.g., 100-150 GW of storage and 28-48 GW of interruptible load deployed in 2050 for the (low demand) 80%-by-2050 RE scenarios.**

As RE deployment increases, additional transmission infrastructure is required



- In most 80%-by-2050 RE scenarios, 110-190 million MW-miles of new transmission lines are added.
- AC-DC-AC interties are expanded to allow greater power transfer between asynchronous interconnects.
- **However, 80% RE is achievable even when transmission is severely constrained (30 million MW-miles)—which leads to a greater reliance on local resources (e.g. PV, offshore wind).**
- Annual transmission and interconnection investments in the 80%-by-2050 RE scenarios range from B\$5.7-8.4/year, which is within the range of recent total investor-owned utility transmission expenditures.
- High RE scenarios lead to greater transmission congestion, line usage, and transmission and distribution losses.

All regions of the country could contribute substantial renewable electricity supply in 2050



80% RE-ITI scenario

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