The Regional Energy Deployment System (ReEDS) Model

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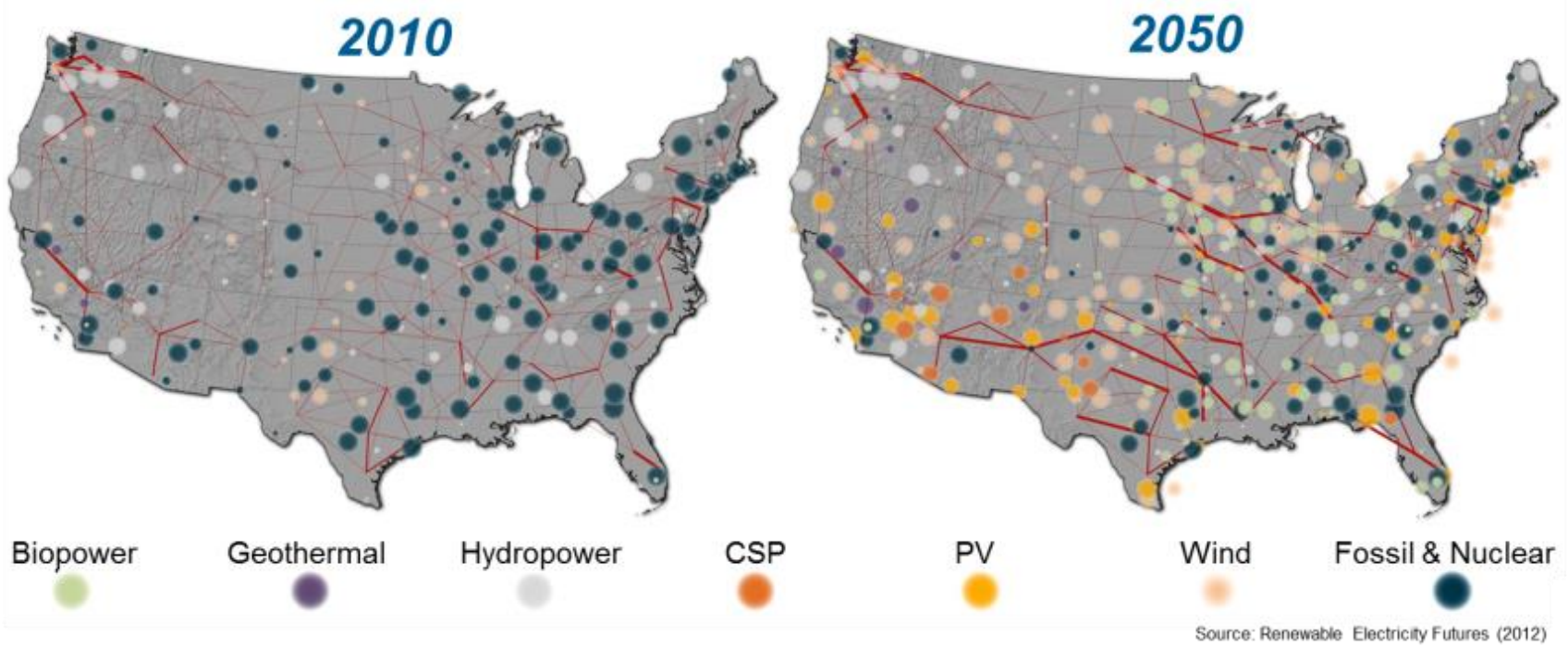
What does ReEDS do?



Given a set of input assumptions, ReEDS simulates the evolution and operation of US generation, storage, transmission, and end-use demand and associated technologies

How does the supply-side really work?

The ReEDS supply-module identifies the *least cost mix and operation* of resources (including storage) that simultaneously meets load, all other electricity service requirements (planning reserves, operating reserves), and physical and environmental constraints.

Fossil

Nuclear

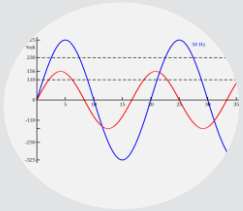
Transmission

Renewables

Regulations

Load

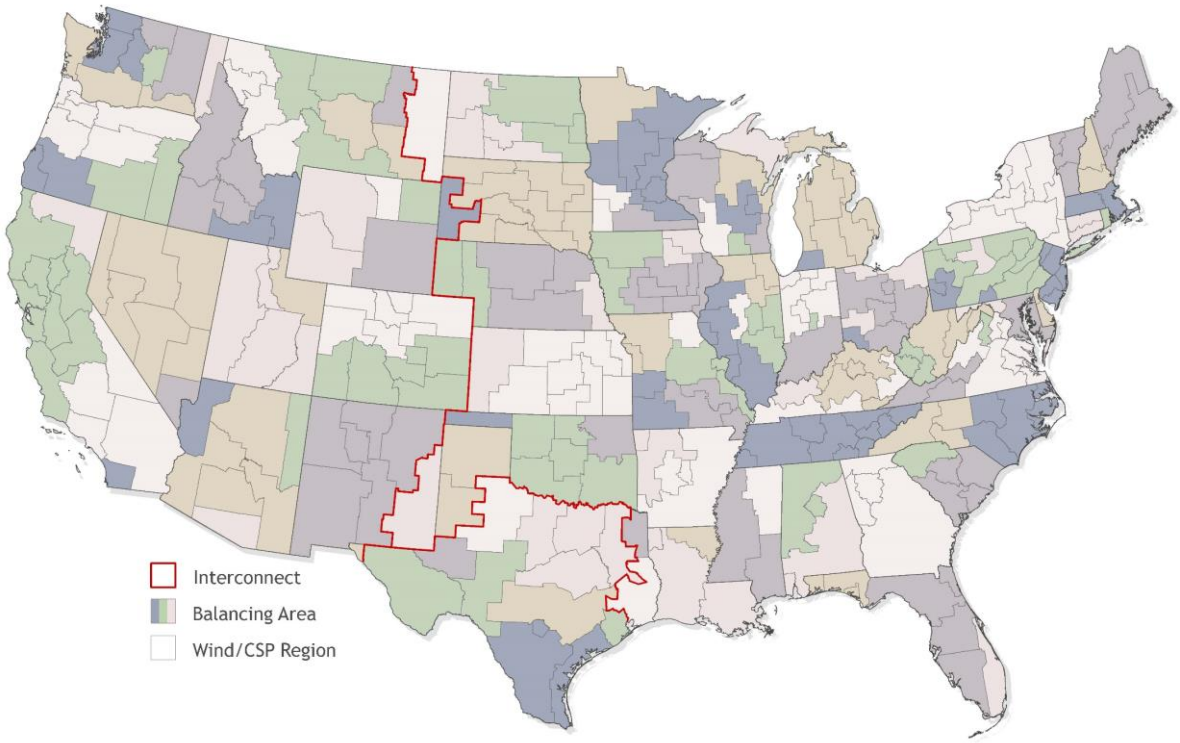
(DC) Power-flow



Ancillary Services

The Regional Energy Deployment System (ReEDS)

- 134 balancing areas; 356 RE resources regions
- Reduced-form dispatch
  - 17 time-slices used to characterize demand in a typical day in each season as well as the “super-peak”
- Hourly representation of wind, PV, CSP, and load



The Regional Energy Deployment System (ReEDS)

Spatial-attribute resolution

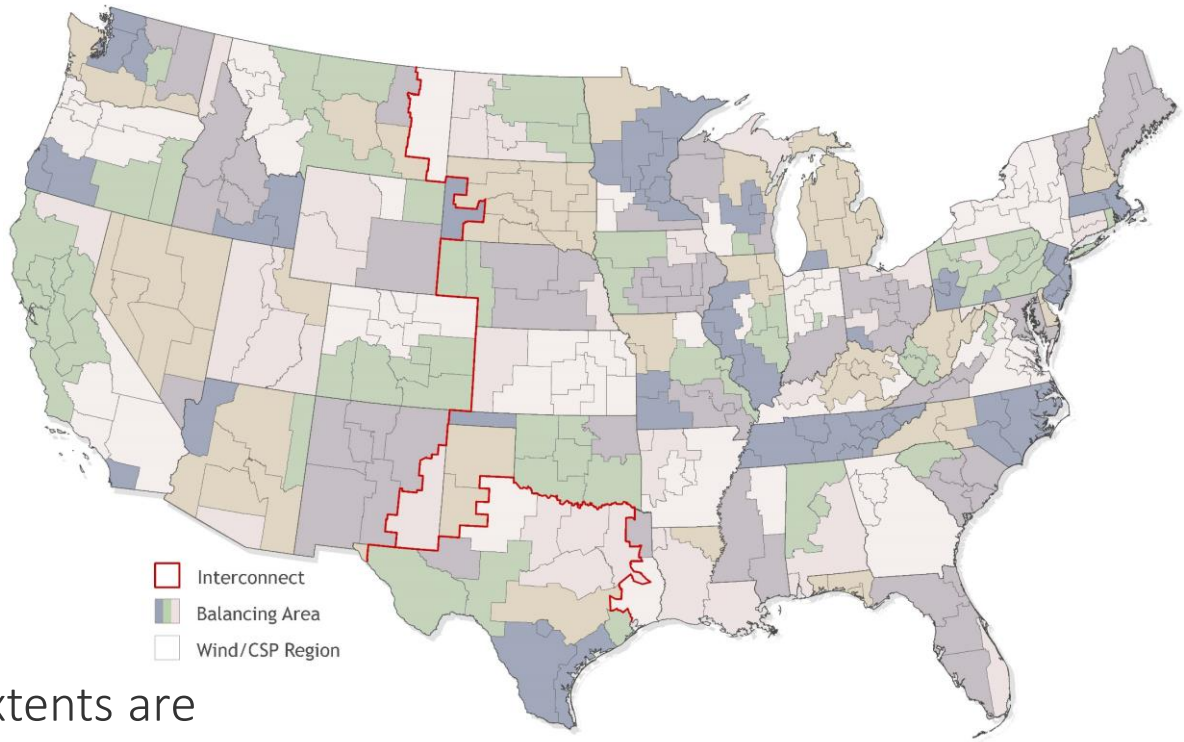
E.g., for wind:

356 resources regions

2-8 resource quality classes

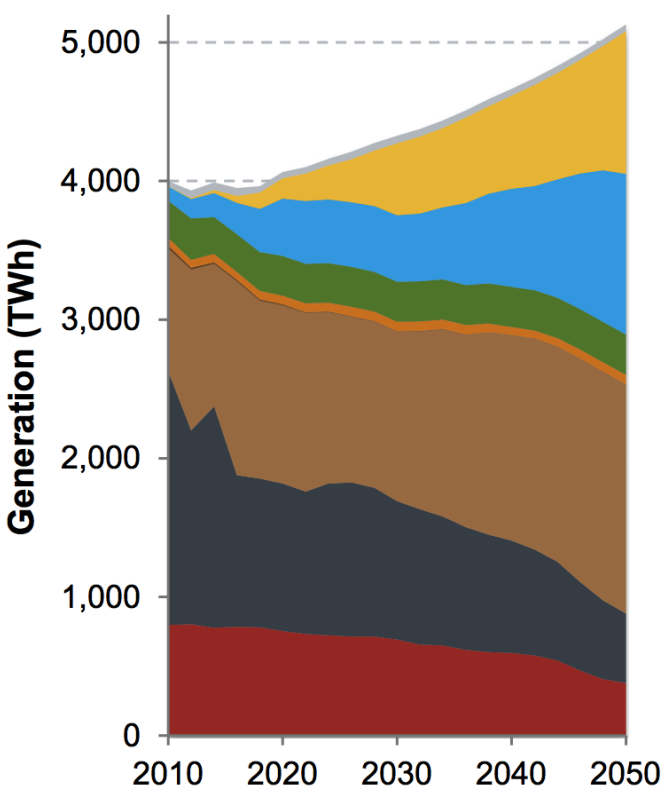
5 LCOT bins

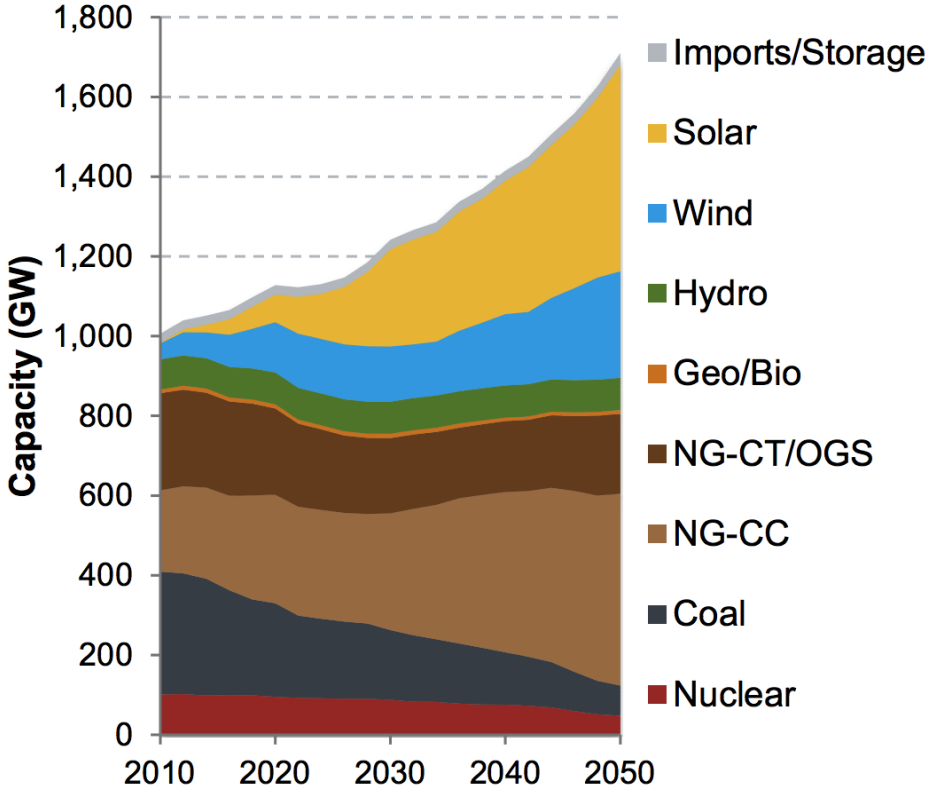
= over 9,000 'regions' representing discrete non-contiguous spatial extents



These fine resolution spatial extents are defined by the renewable energy potential (reV) model (next session)

What are the key outputs?

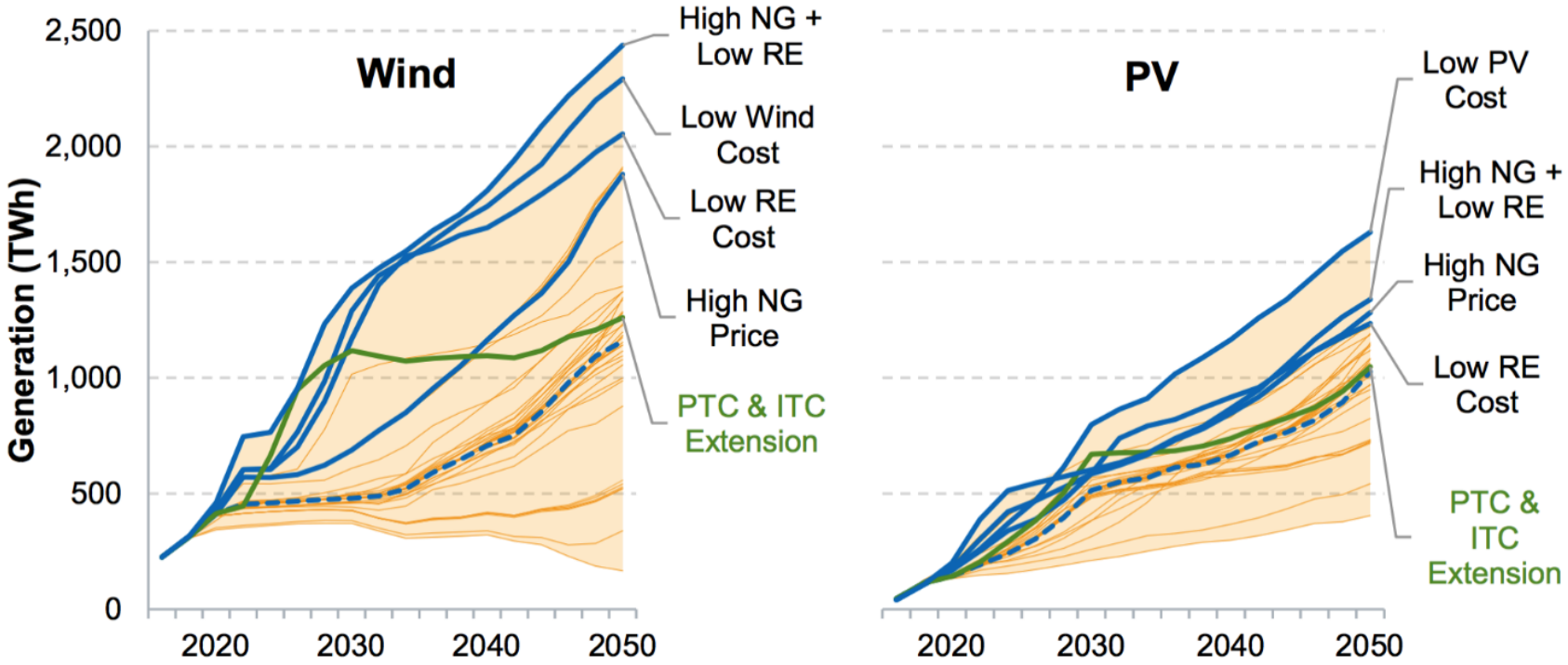




Wind Vision: A New Era for Wind Power (DOE 2015)

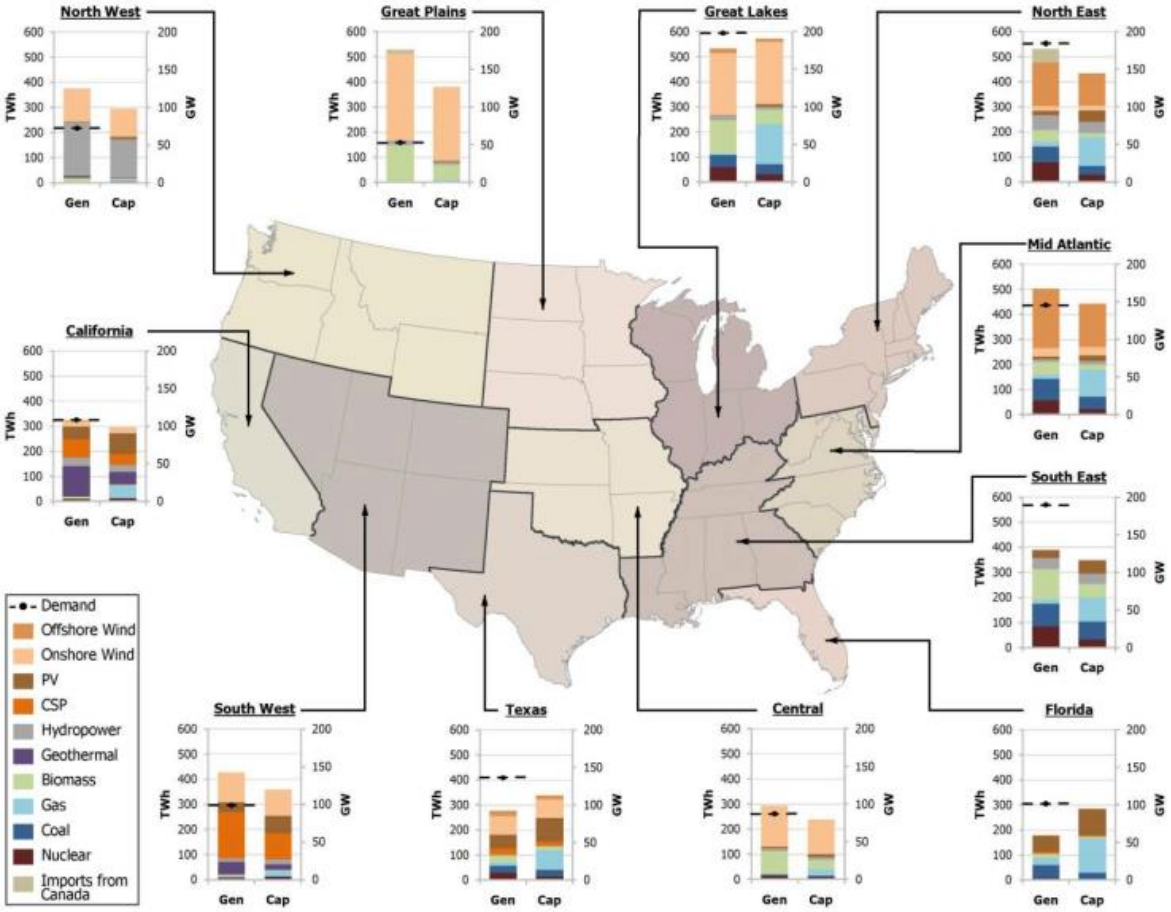
What are the key outputs?

Changes in model outcomes between scenarios



Impacts of Federal Tax Credit Extensions on Renewable Deployment and Power Sector Emissions (Mai et al. 2016)

What are the key outputs?

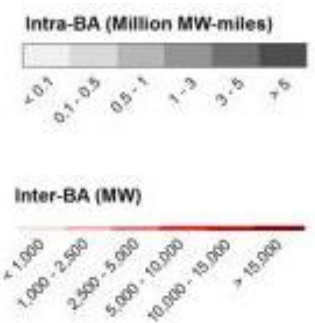


Renewable Electricity Futures Study. (NREL 2012)

What are the key outputs?

(a) Low-Demand Baseline

(b) 80% RE-ITI



Transmission Expansion

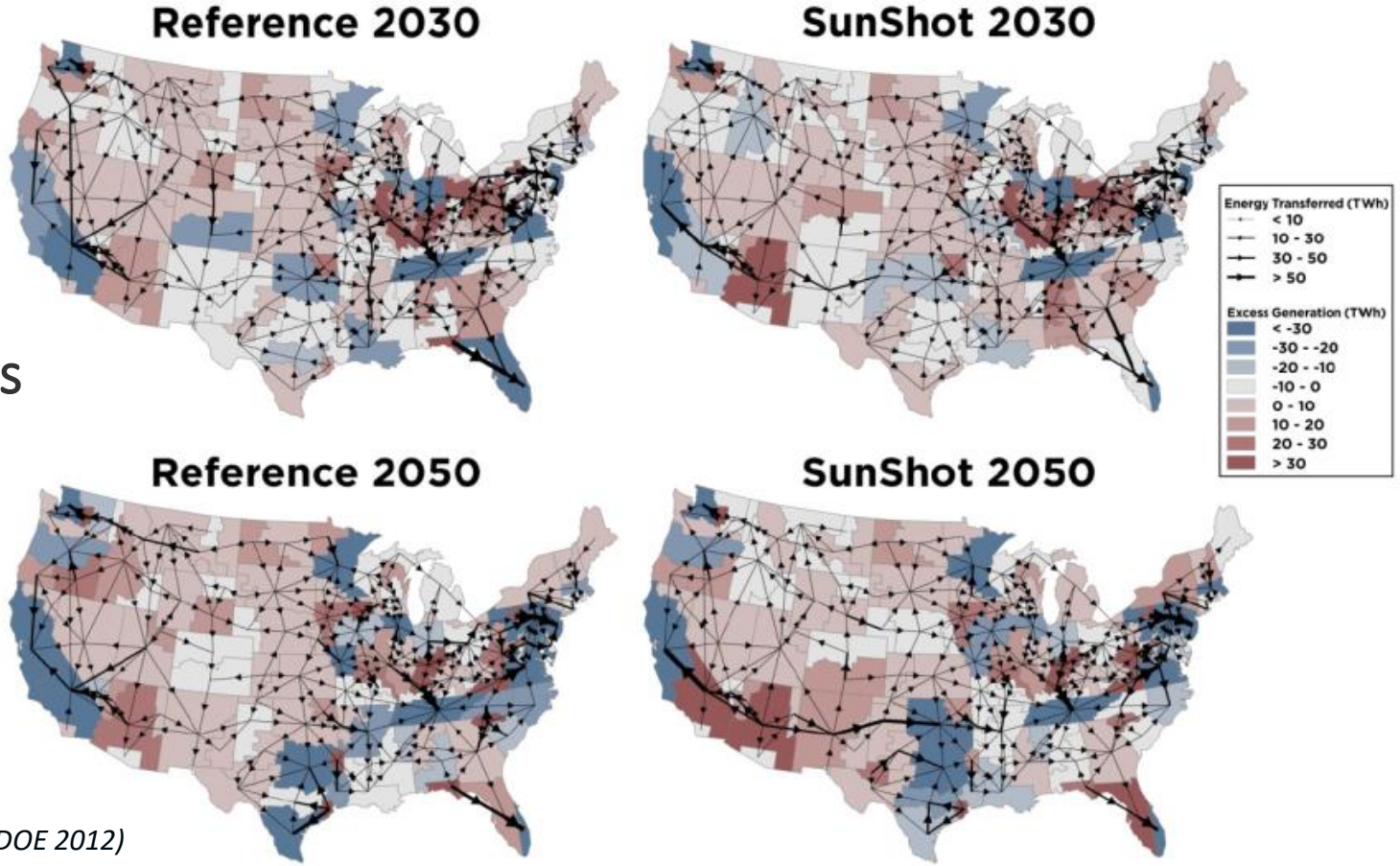
(c) 80% RE-Constrained

(d) High-Demand 80% RE

Envisioning a Renewable Electricity Future (Mai et al. 2014)

What are the key outputs?

Energy flows



SunShot Vision Study (DOE 2012)

What types of questions can be addressed with ReEDS

- **What does the model do particularly well?**
  - Examine the impacts of drivers of power sector change—policies, regulations, technology cost and performance, fuel prices—on the generation and capacity mix in the mid- to long-term
- **What doesn't the model do?**
  - Explicit unit commitment; full 8760 chronological dispatch – these are heuristically captured through analysis outside the optimization
  - AC Power flow
- **What kinds of questions can the model answer?**
  - What are the impacts of investment incentives on the evolution of generation and capacity?
  - How would reductions in the cost (or an improvement in the performance) of a technology impact the future US capacity mix?

Where ReEDS is Going

- Examples of new capabilities that are under development:
  - Multiple battery storage durations
  - Enhanced energy value of storage capability
  - Addition of RE-storage hybrid technologies
  - Improved supply curves for RE resources
  - Retail rate module
  - Re-introduction of water and climate impacts
  - Addition of more weather years
  - Flexible spatial and temporal resolutions

Staying Engaged

- ReEDS mailing list
  - E-mail us at ReEDS.Inquiries@nrel.gov to get on the list
- ReEDS user group meeting
  - Likely summer 2020 in Golden, Colorado, or Washington D.C.
- “Watch” the repo to stay up-to-date on issues, patches, and new releases

Using ReEDS Summary

- See the ReEDS User Guide: https://www.nrel.gov/analysis/reeds/user-guide.html
- Request access to the ReEDS GitHub repository
  - You need a GitHub.com account to be given access
- ReEDS requirements
  - GAMS and solver
  - Python and R
  - 2 cores and 15+ GB of memory

ReEDS.Inquiries@nrel.gov

www.nrel.gov/analysis/reeds

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