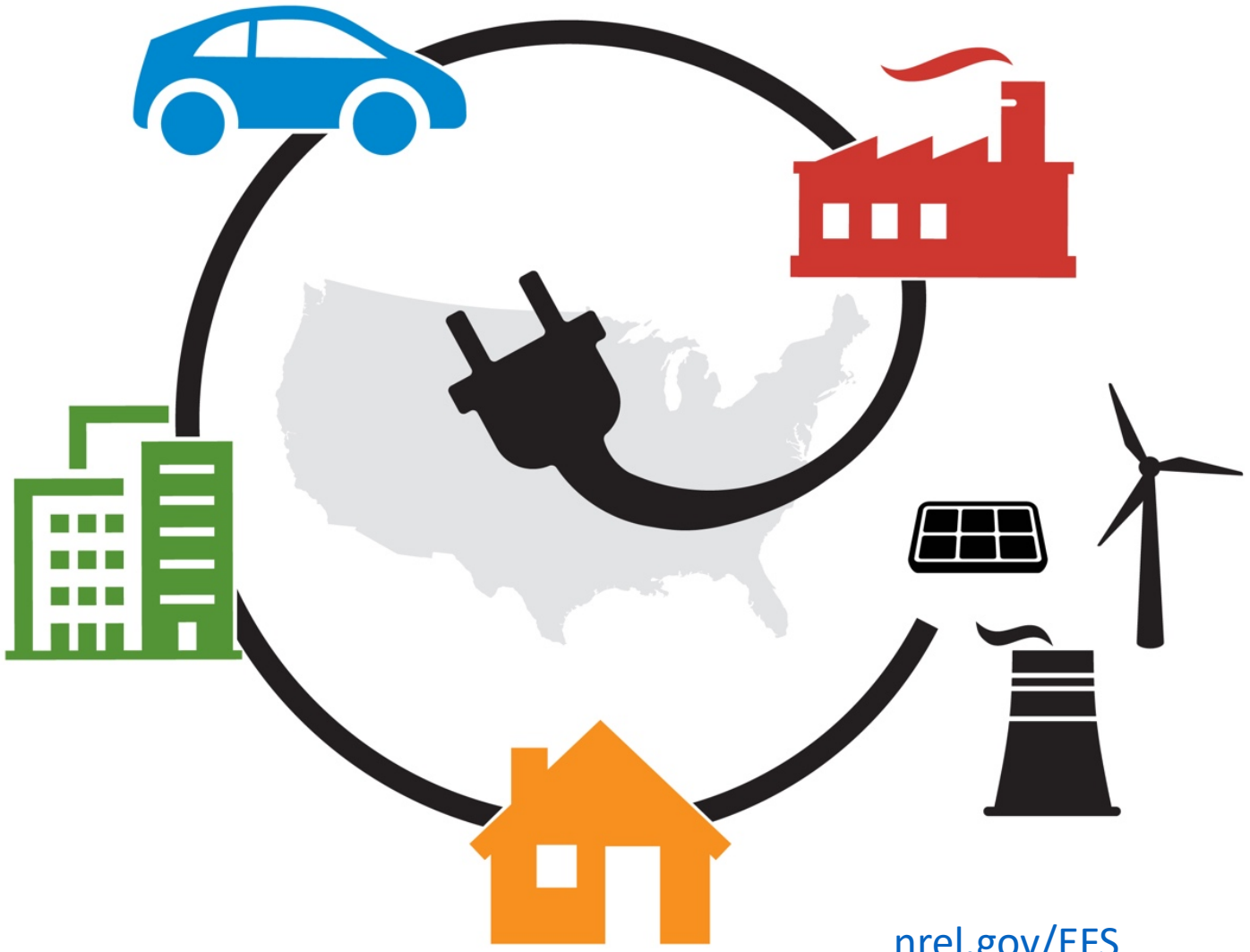
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Insights from NREL's Energy Sector-Wide Modeling Studies

Caitlin Murphy

January 12, 2021



nrel.gov/EFS

Study sponsored by U.S. DOE-EERE Office of Strategic Programs

NREL's Electrification Futures Study

End-Use Technology Adoption:
Demand-Side Scenarios

- EnergyPATHWAYS stock turnover and energy accounting model
- ADOPT vehicle choice model

2016-2050 demand

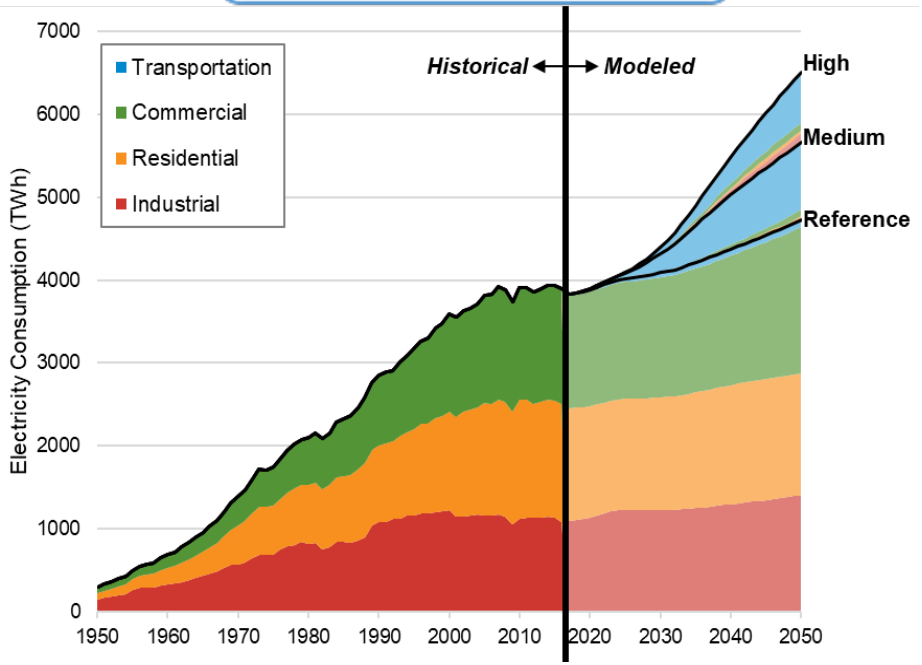
Power System Evolution:
Supply-Side Scenarios

- ReEDS capacity expansion model
- dGen rooftop photovoltaic adoption model

2050 capacity

Grid operations in 2050

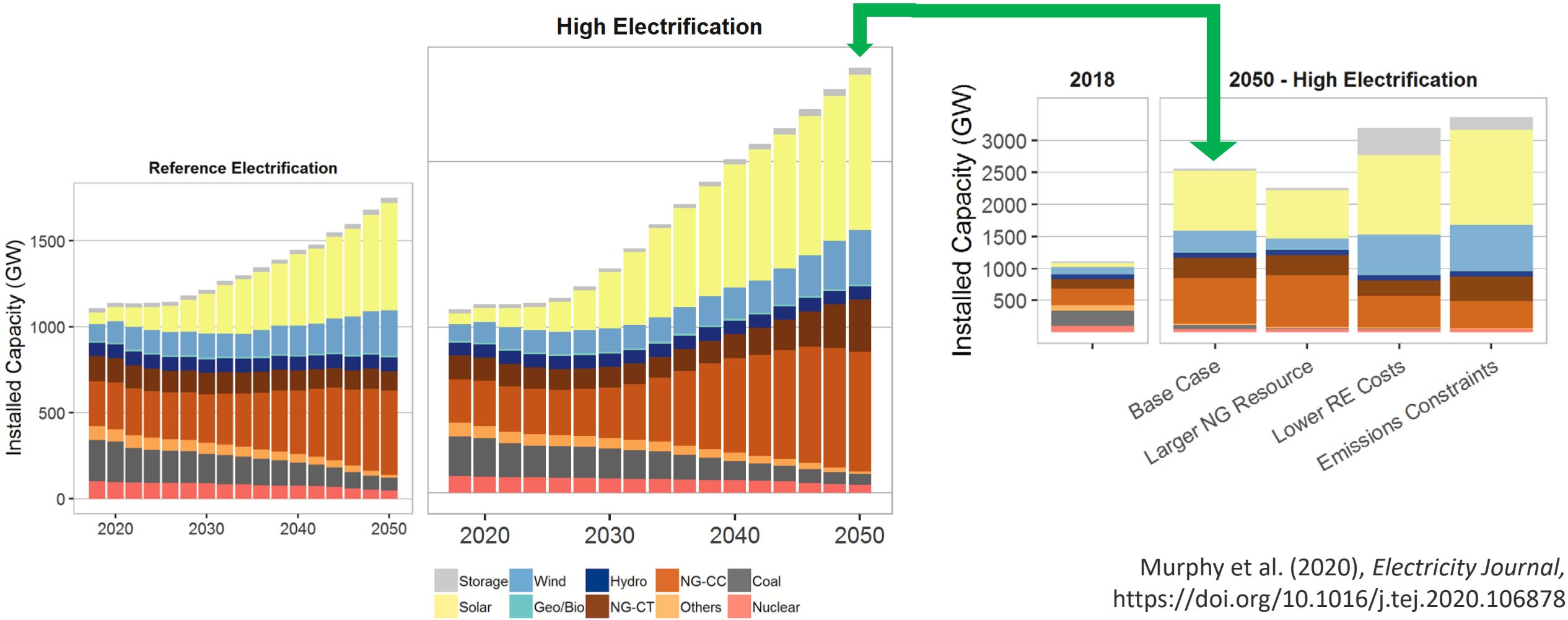
- PLEXOS production cost model



- Planning for a decarbonized electricity supply requires understanding how much supply you need
- Electrification of end-uses (and especially transportation) can dramatically influence future electricity demand

https://www.nrel.gov/docs/fy18osti/71500.pdf

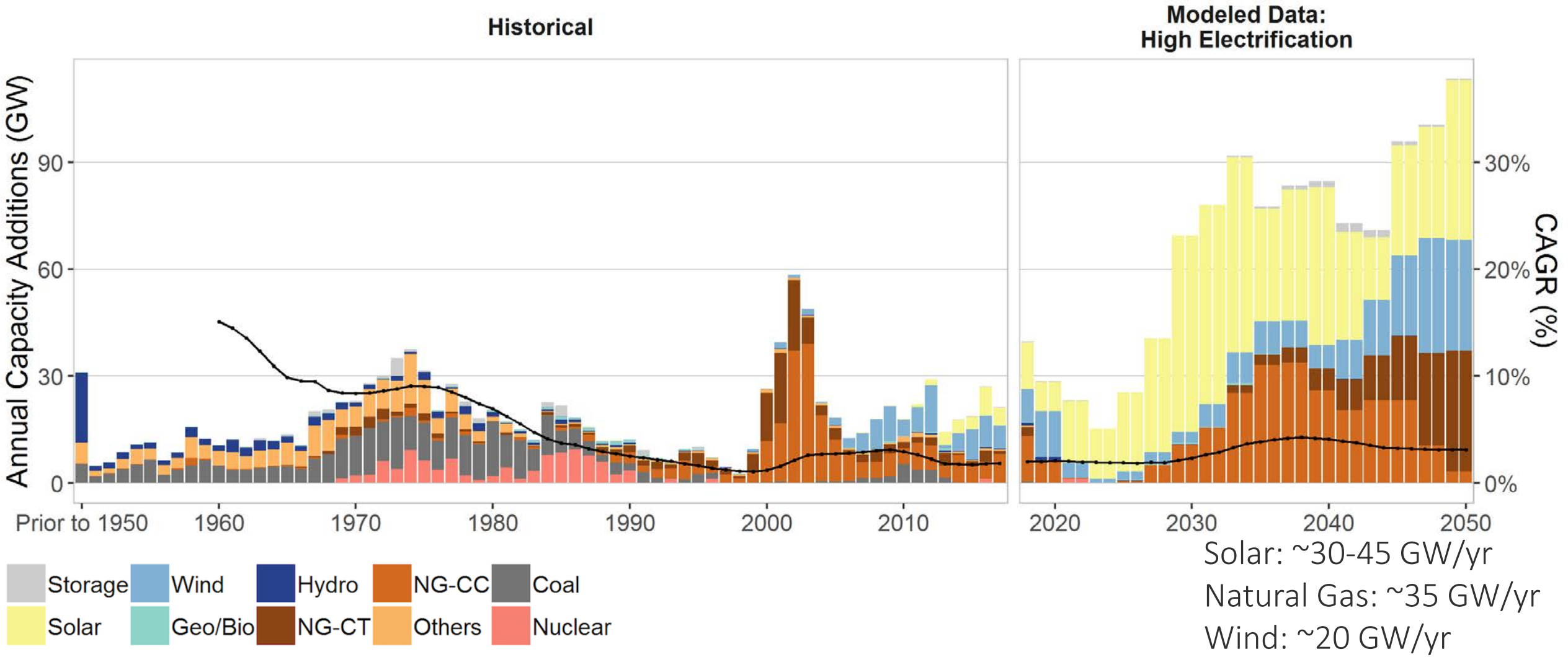
The magnitude and mix of electricity supply investments depends strongly on electrification, market, technology, and policy drivers



Murphy et al. (2020), *Electricity Journal*, https://doi.org/10.1016/j.tej.2020.106878

https://www.nrel.gov/docs/fy21osti/72330.pdf

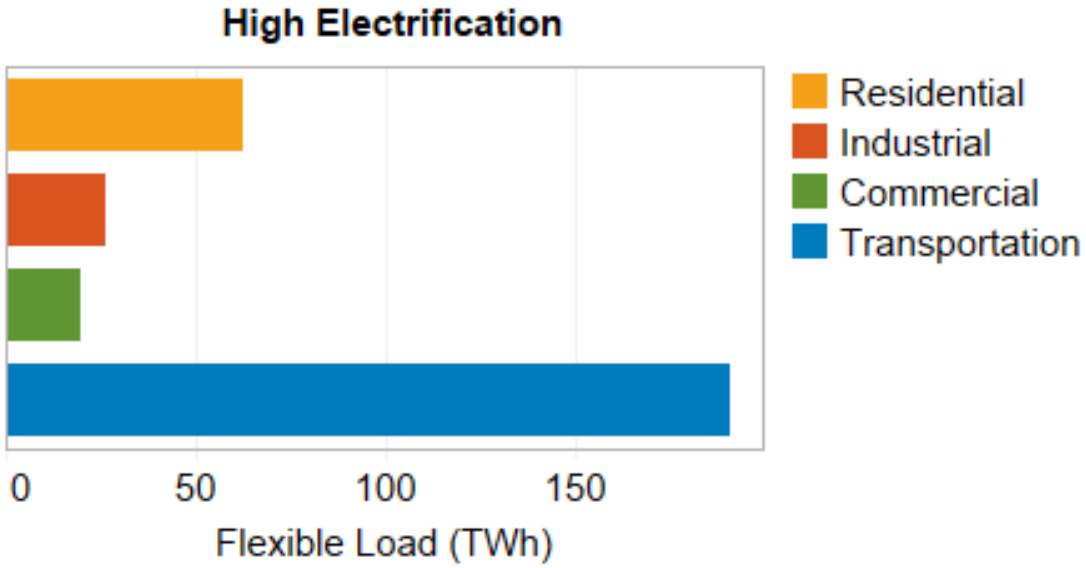
Simultaneous transitions in electricity supply and demand requires rapid and large infrastructure development



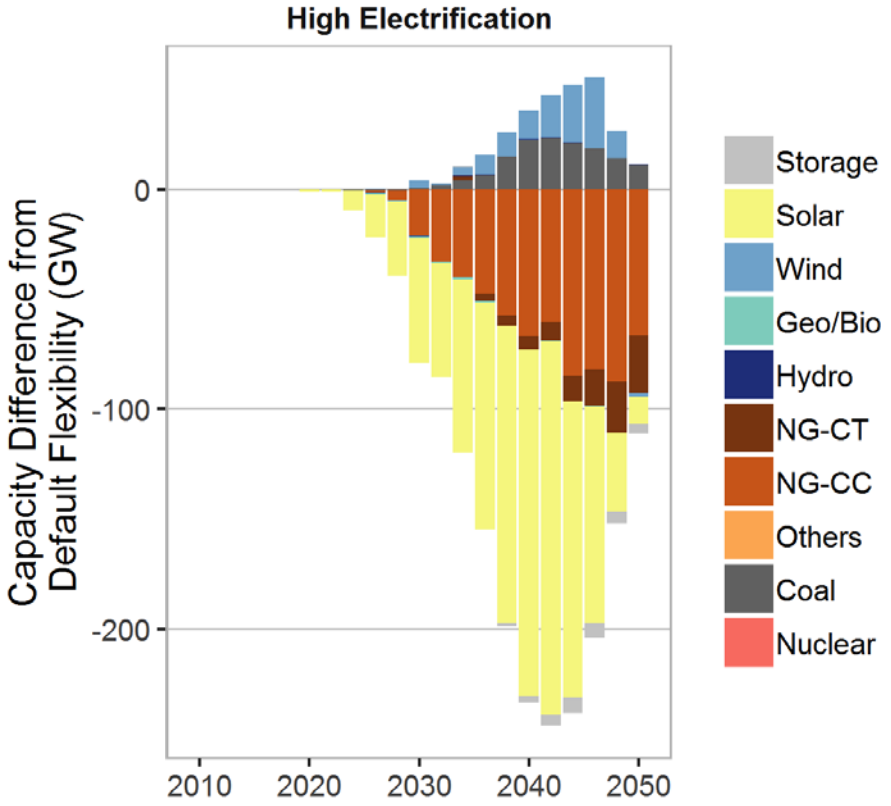
Solar: ~30-45 GW/yr
Natural Gas: ~35 GW/yr
Wind: ~20 GW/yr

https://www.nrel.gov/docs/fy21osti/72330.pdf

Flexible loads can mitigate some of the power sector infrastructure needs and associated costs from electrification

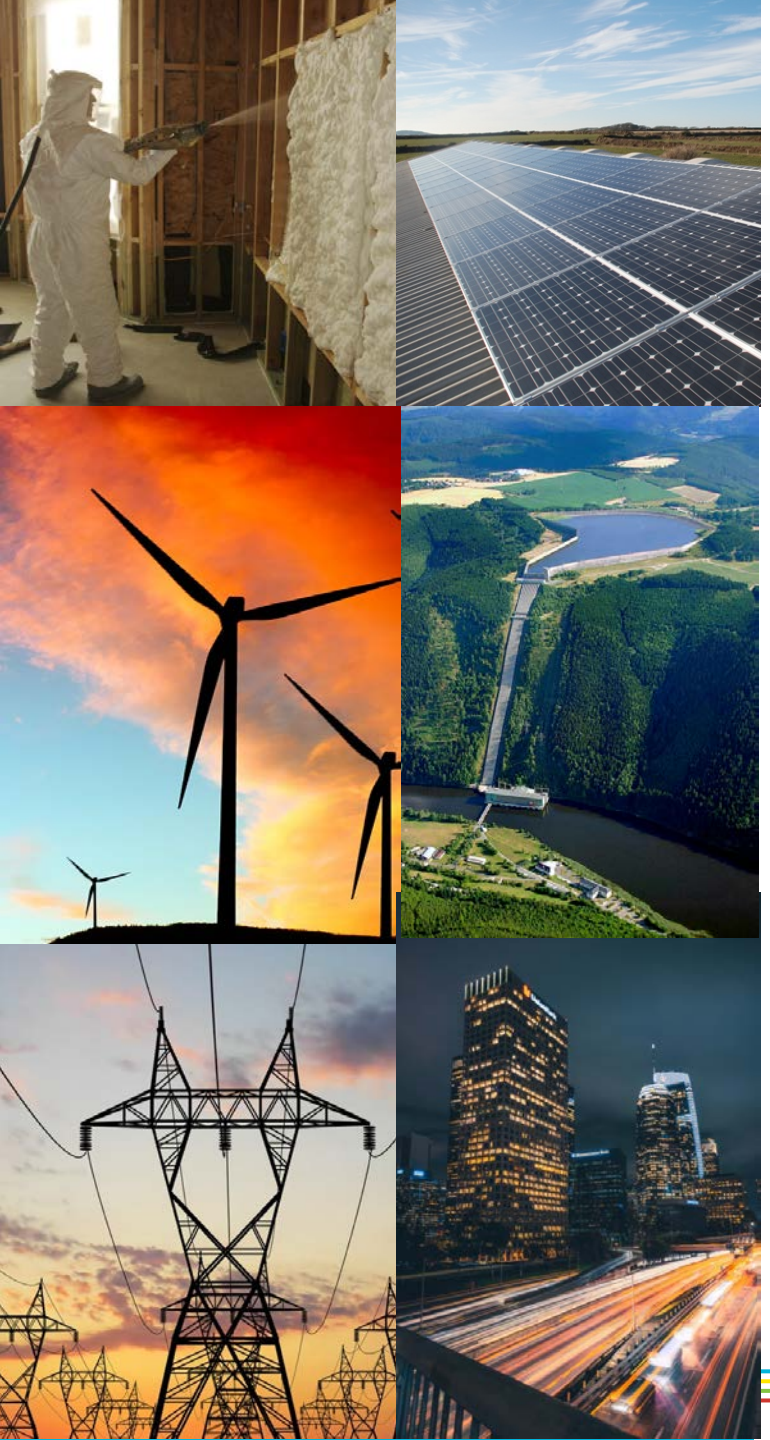


With widespread electrification would come greater potential for flexibility, primarily from optimized EV charging



Leveraging this demand-side flexibility could have a pronounced impact on the infrastructure investments needed

https://www.nrel.gov/docs/fy21osti/72330.pdf



LA100

The Los Angeles 100% Renewable Energy Study

LA100 offers detailed, ultrahigh- resolution analysis to equip LA decision-makers to understand:

- What are the **pathways and costs to achieve a 100% renewable electricity supply** while electrifying key end uses and maintaining the current high degree of reliability?
- What are the potential benefits to **the environment** and **health**?
- How might **local jobs** and the **economy** change?
- How can **environmental justice communities** benefit from and be part of the solution?

Questions? Thank you!

caitlin.murphy@nrel.gov

www.nrel.gov/efs

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

NREL
NATIONAL RENEWABLE ENERGY LABORATORY