Powering Up: Improving Energy Grid Reliability and Resilience to Lower Energy Bills

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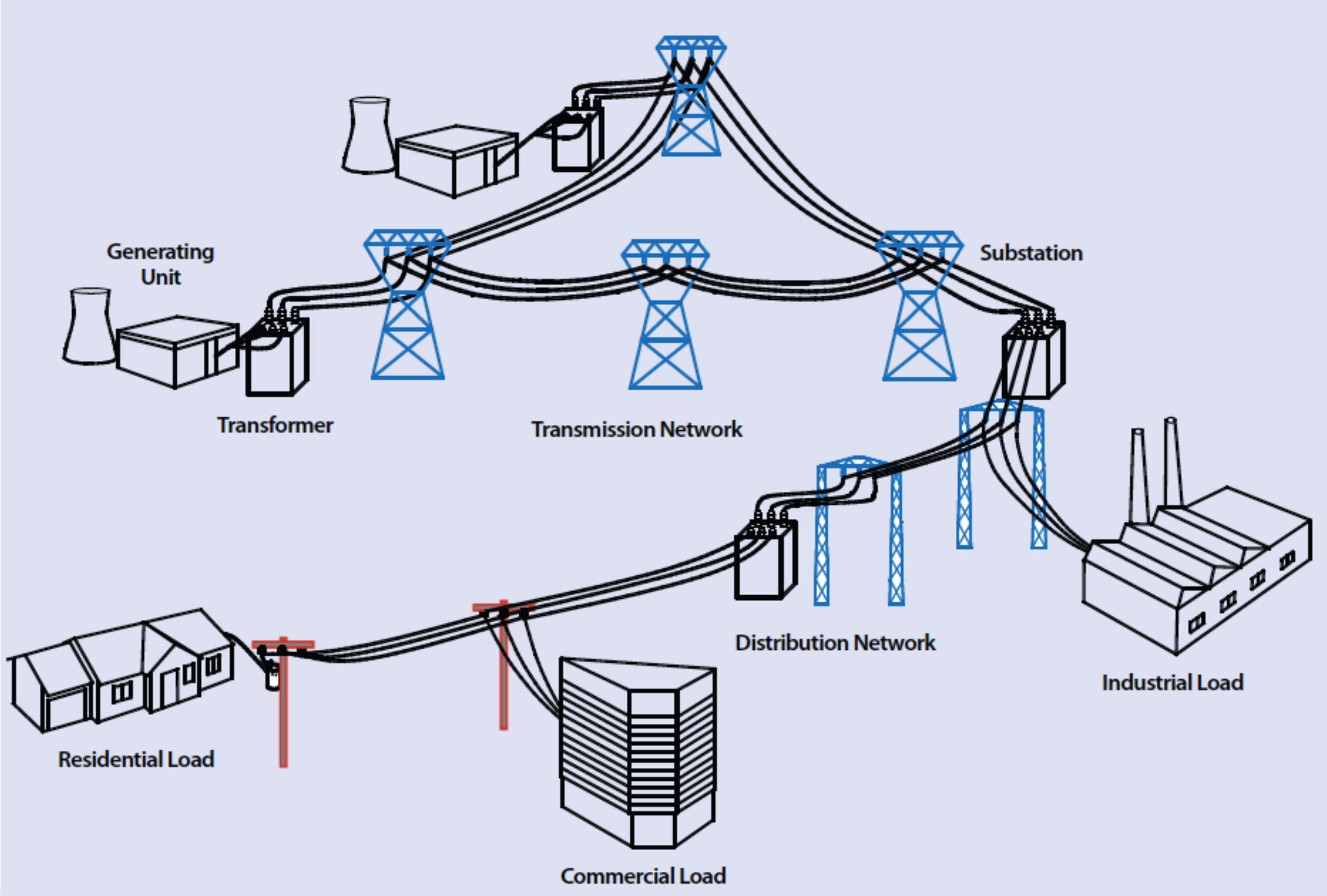
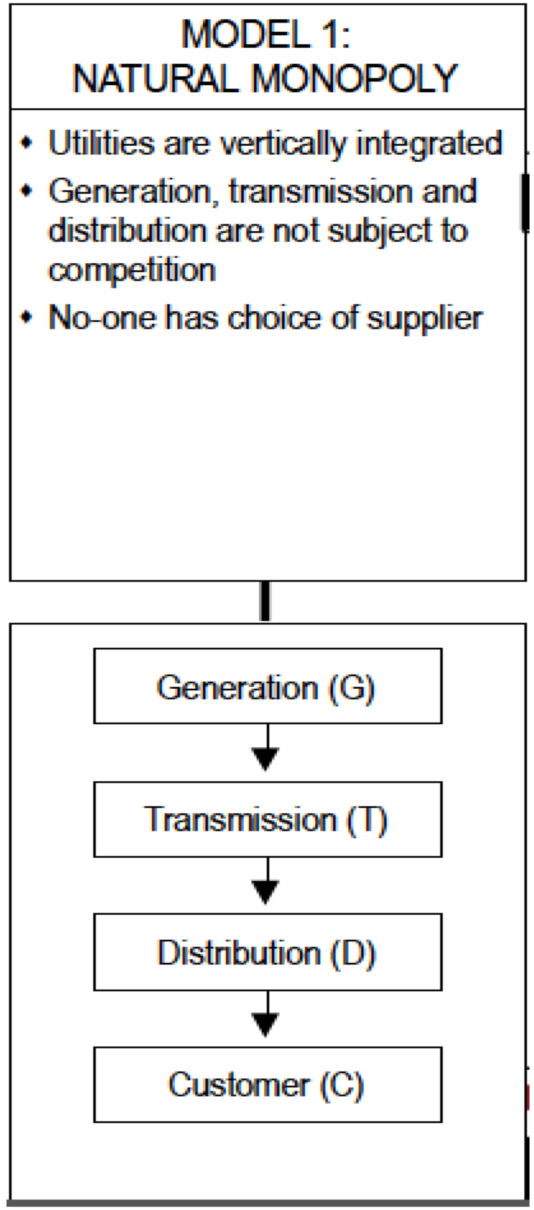


Every power system has several components

Some unique characteristics make the power system more “complicated” than other infrastructure

- Voltage fluctuates (not steady)
- Demand changes constantly (not predictable)
- Transmission has physical limits (resistance, capacity)
- Single point of failure (no redundancy)

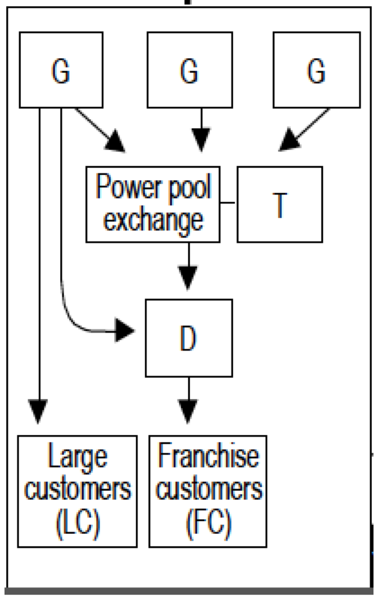
Historically, vertically integrated utilities managed the grid.



Restructuring of the electricity led to the creation of electricity markets

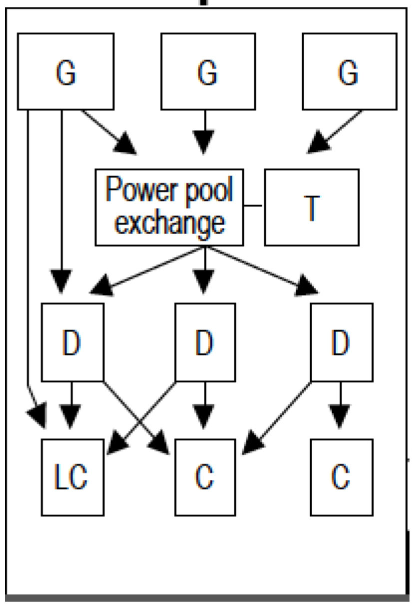
MODEL 3: WHOLESALE COMPETITION

- Distribution companies buy direct from generator (IPPs)
- Distribution companies have monopoly over final customers
- Open access to transmission wires
- Generators compete to supply power
- Power pool established to facilitate xΔ

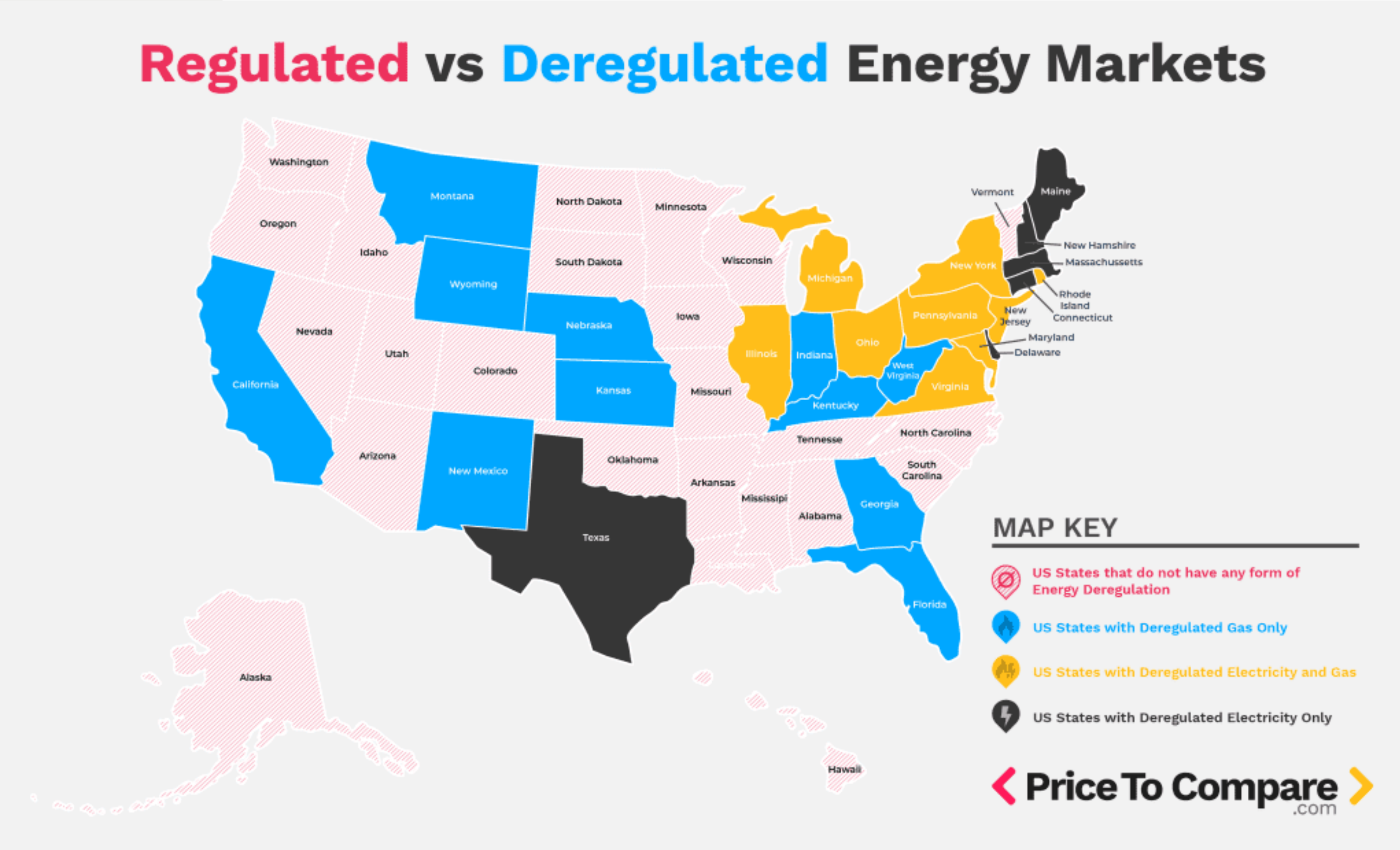


MODEL 4: RETAIL COMPETITION

- All customers have choice of supplier
- Open access to T & D wires
- Distribution is separate from retail activity
- Retail industry is competitive



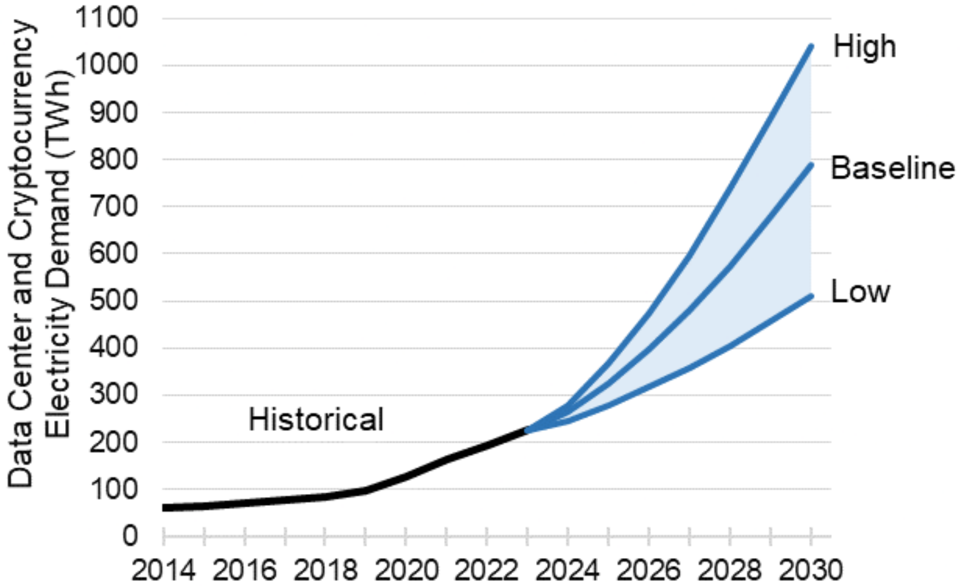
Restructuring also led to a new, complex governance structure where state PUCs, FERC, and system operators play a role

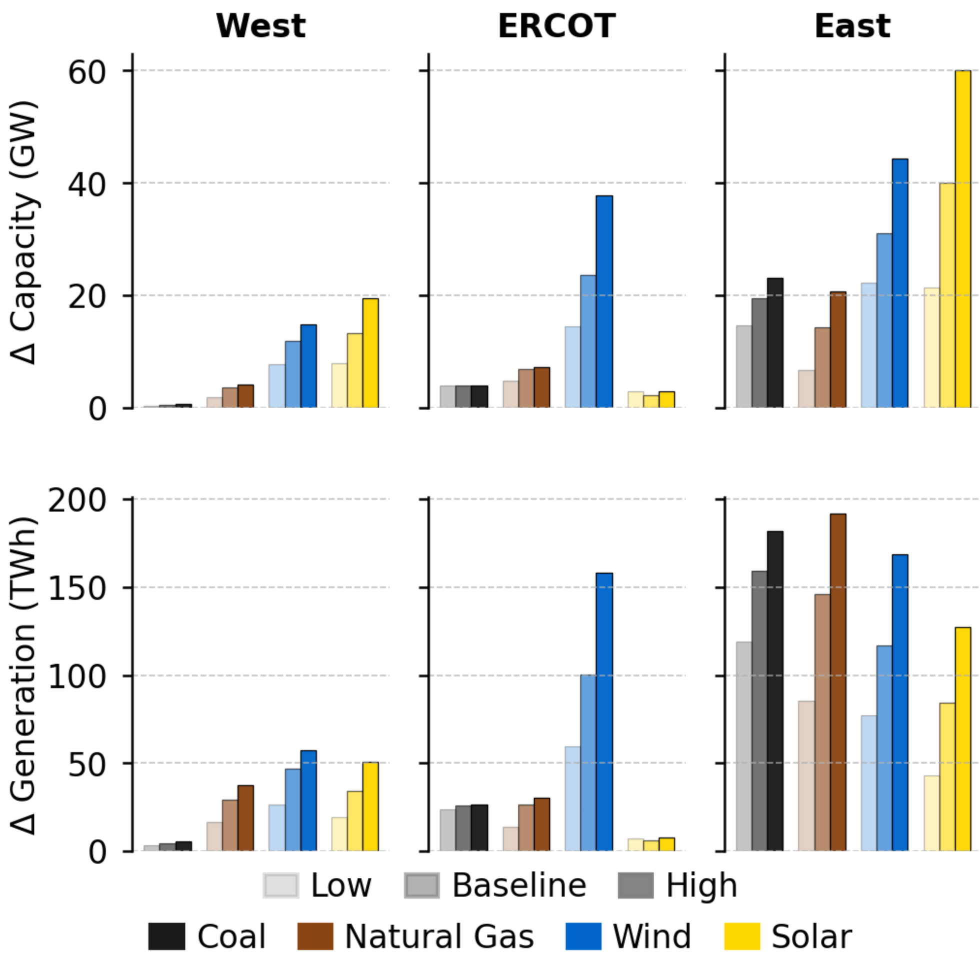


Our electricity system faces new challenges

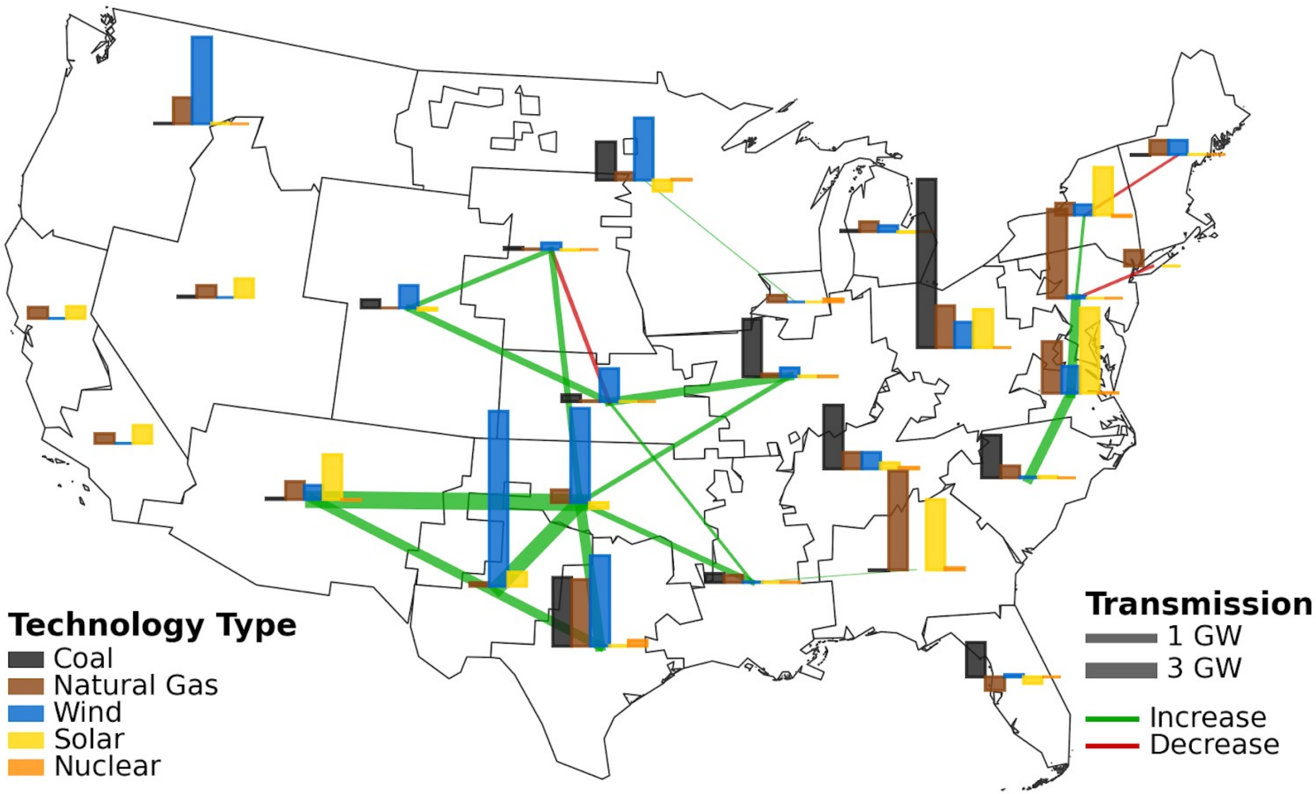
- Massive demand growth for AI
- Electrification of end uses & decarbonization
- Variable and intermittent resources
- Climate risks
- Aging infrastructure

Data center demand will require rapid growth in generating capacity by 2030





Meeting data center demand also requires transmission investments in the next five years



Decarbonizing the US energy system would also require doubling our generating capacity by 2050

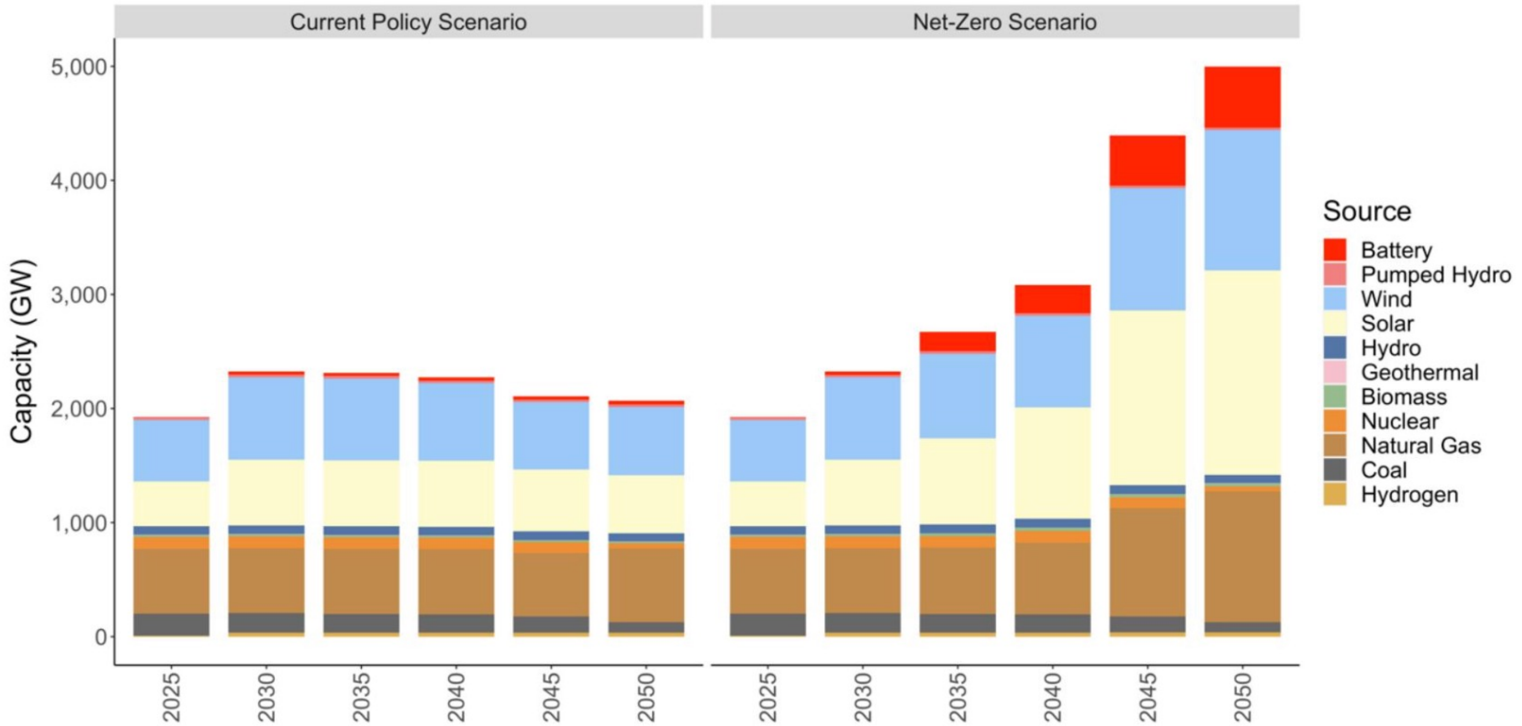


Figure 5: Electric power generation and storage capacity under each modeled scenario

There are multiple barriers to grid modernization

Inconsistent regulatory processes with multiple entities having jurisdiction	• Who is responsible for planning the grid?
Generation and transmission expansion are capital-intensive	• How are costs allocated?
Siting grid infrastructure is very challenging in the U.S.	• Permitting delays are often cited as the primary one.
Technological gaps are not the primary barrier to the grid modernization	• There are always opportunities for innovation

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