



NUENERGY
SOLUTIONS, LLC

Power Resiliency, Grid Stability & Utility Viability

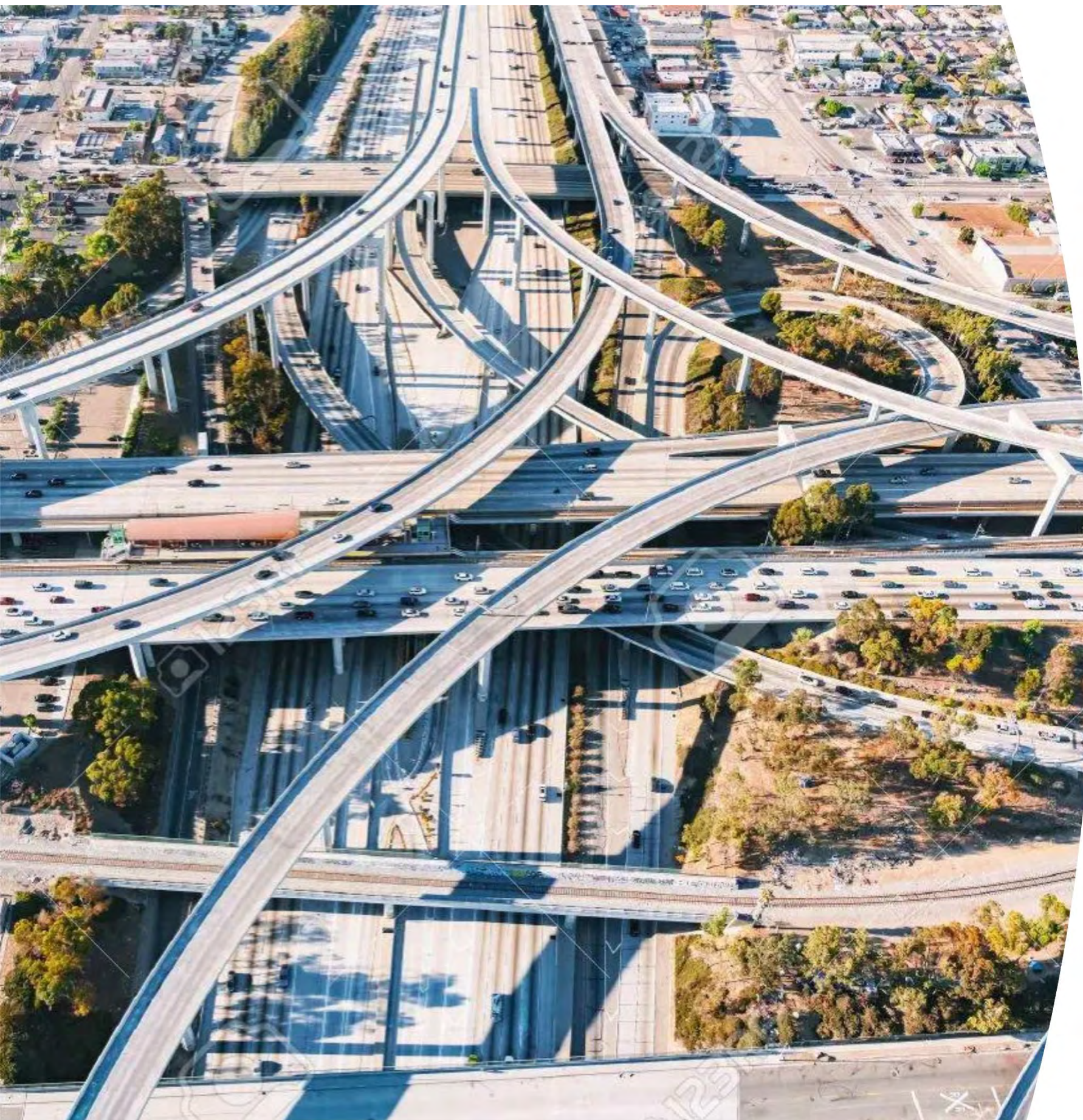
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Energy THEN

- Our energy was historically generated by centralized power plant with average 500MW each unit.
- Our energy grid was designed over 150 years ago for a one-way power delivery. (Single Lane Road)





Energy NOW

- Harnessing renewable energy resources results in 1,000's of small generating units over a decentralized geography.
- Results in unpredictable, multidirectional energy fluctuation creates instability with our energy reliability.

Integrating Alternative Energy

- Utilities in deregulated markets must stay within the power agreements.
- Increased EV charging stations create greater demand and flexibility requirements.
- Grid can't keep up with generation replacements.



Utility Challenges

- Management of power demand
- Flexibility in generation
- Replacing power generation capacity
- Aging legacy assets
- Modernizing transmission and distribution systems
- Cyber security
- Massive financial penalties for failure to meet carbon emission goals



Coal Generation

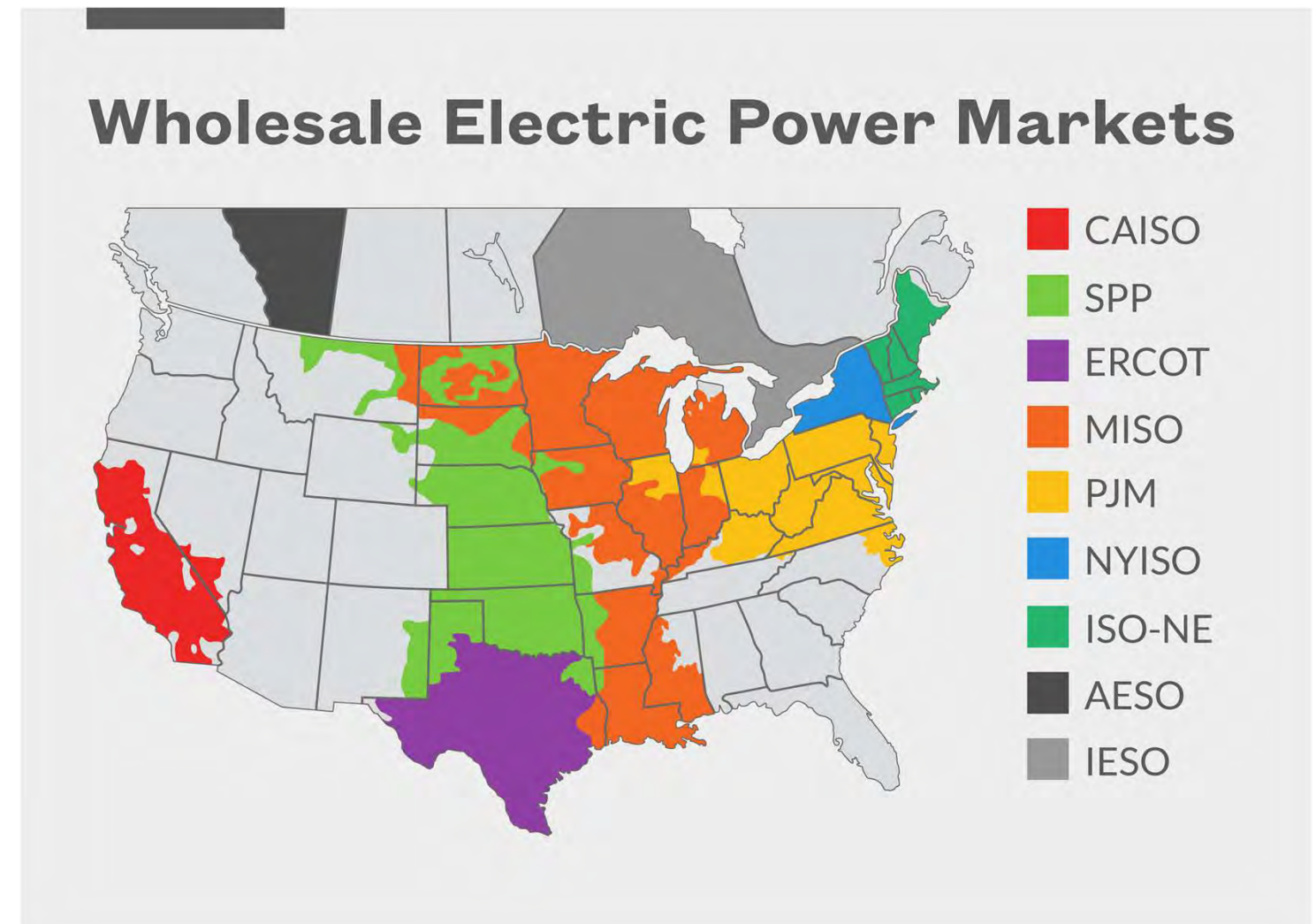
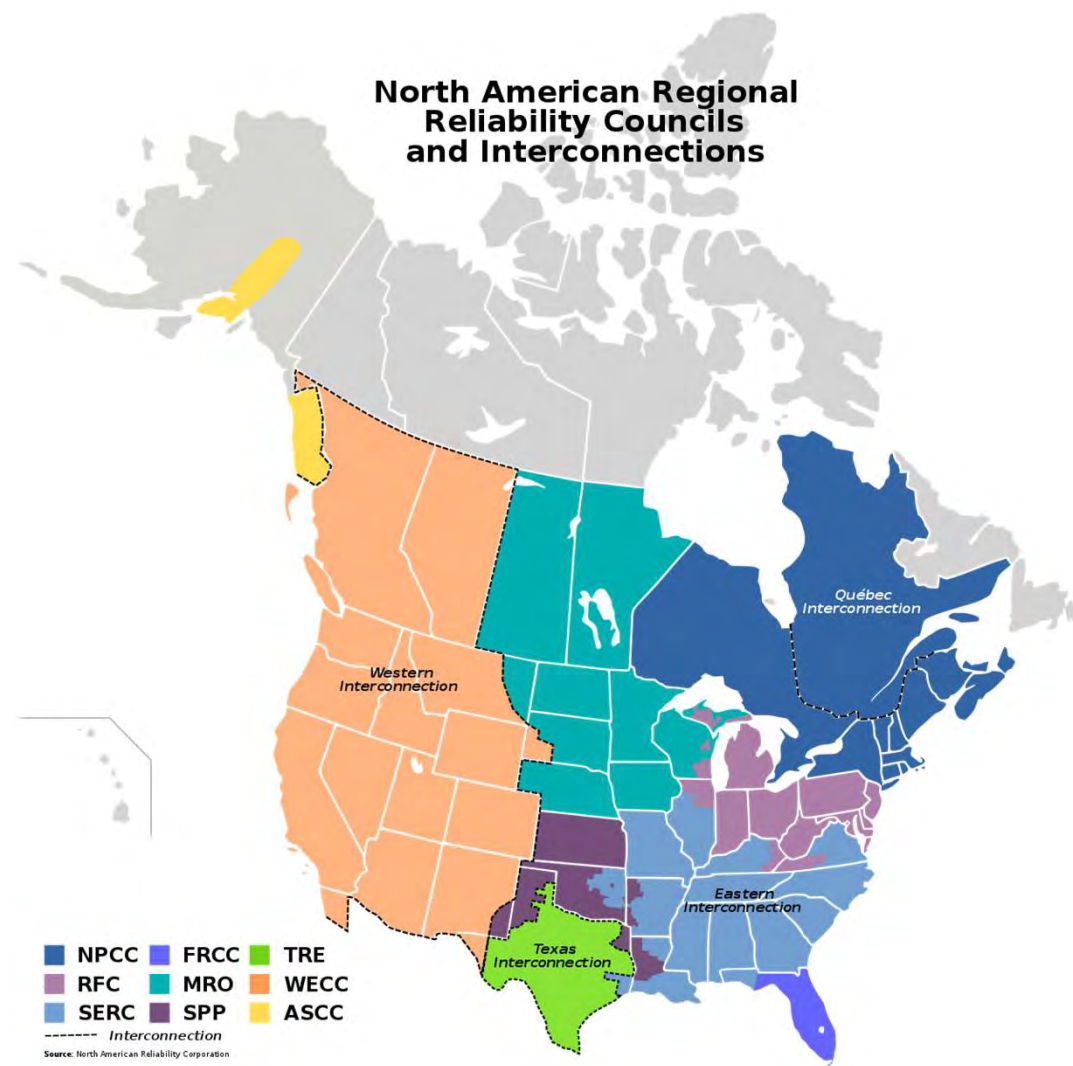
- 230 operational coal-fired power stations in the US.
- Coal generated 23% of US electricity in 2021.
- Coal was 19% of generating capacity.
- Between 2010 and May 2019, 290 coal power plants, or 40% of the US's coal generating capacity, closed.

Plans for Closing

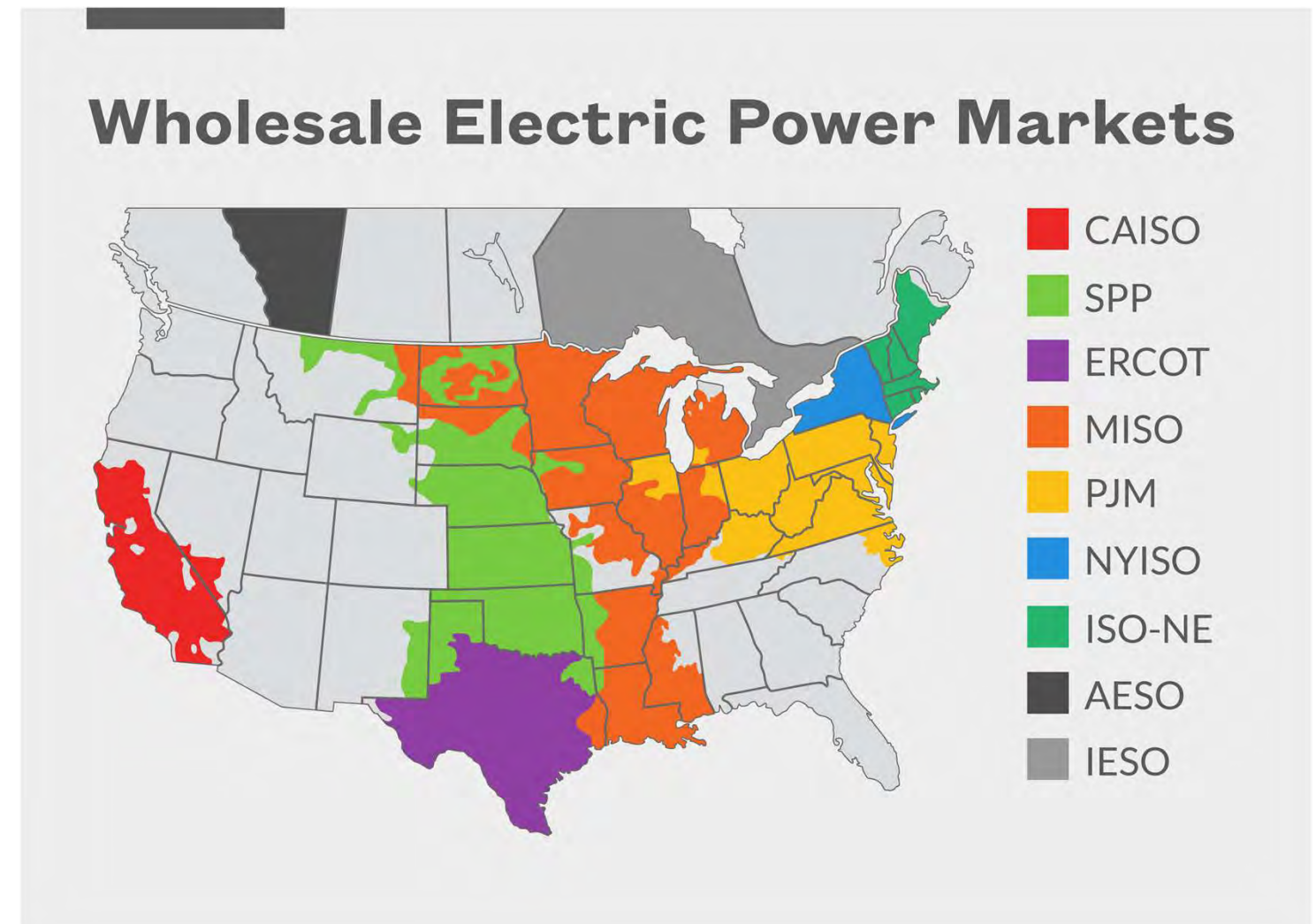
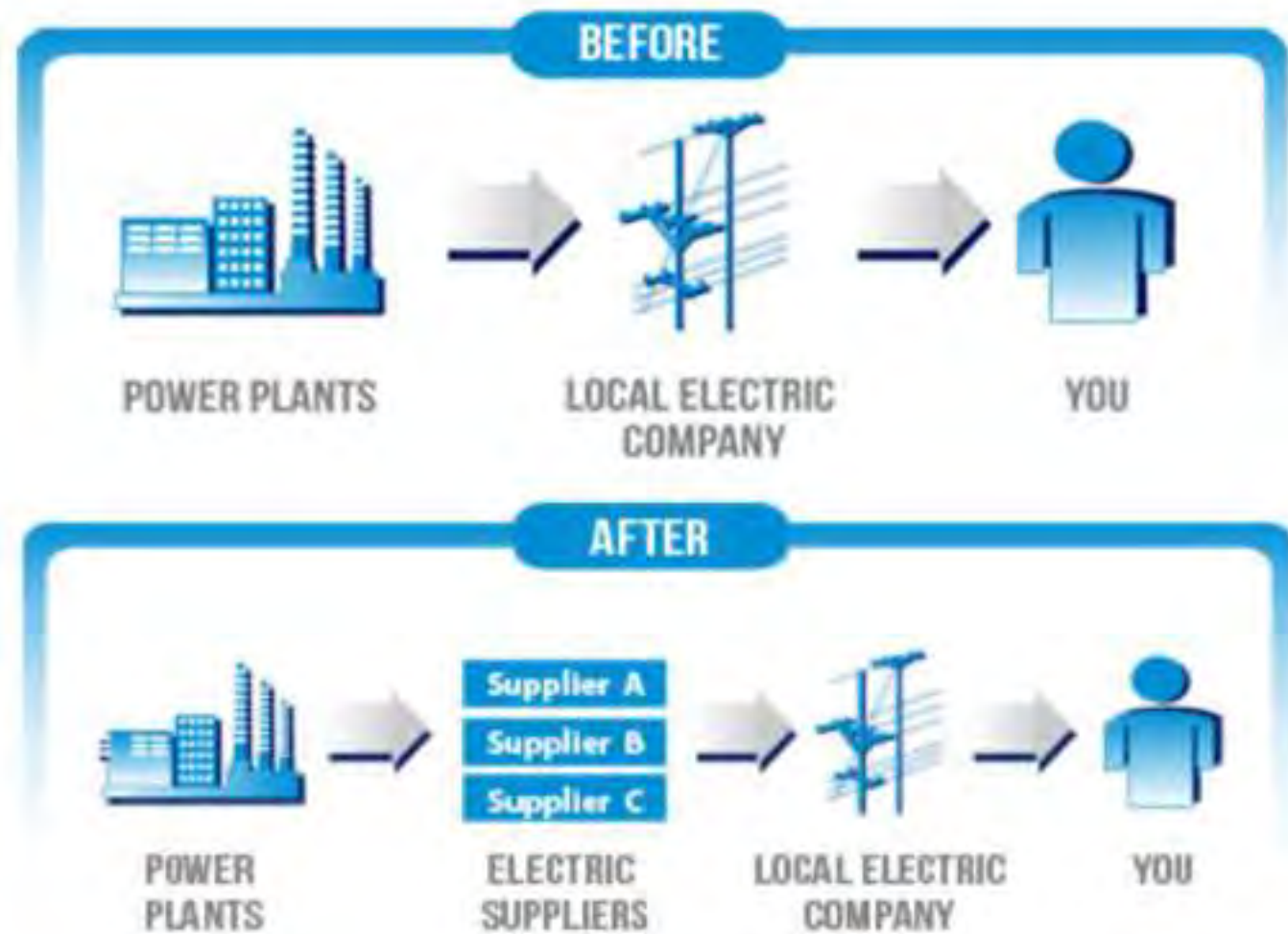
- Legacy Coal and Gas Units: Average 500MW
- Renewable Microgrid: Average 500KW.
- Equates to 1,000 Microgrids needed to replace 1 legacy generation.
- Average year built 70's.
- Average Life Span 50 years.



Integrating Renewables



Regulated vs Deregulated Markets



Wholesale Energy Market

Energy as a Commodity:

Utilities buy and sell energy into the market. Energy portfolio's include renewables, gas, oil, coal and nuclear.

Bid Requirements:

Energy markets have specific requirements to determine bid prices to sell, most cases this includes fuel cost only and doesn't allow for O&M costs.

Market Requirements:

Energy markets have specified requirements for generation availability. i.e.: required minimum daily/weekly starts, within those starts the ramp to full load also has required minimum time frames. Many cases the units don't meet the minimum requirements because of original design limitations.

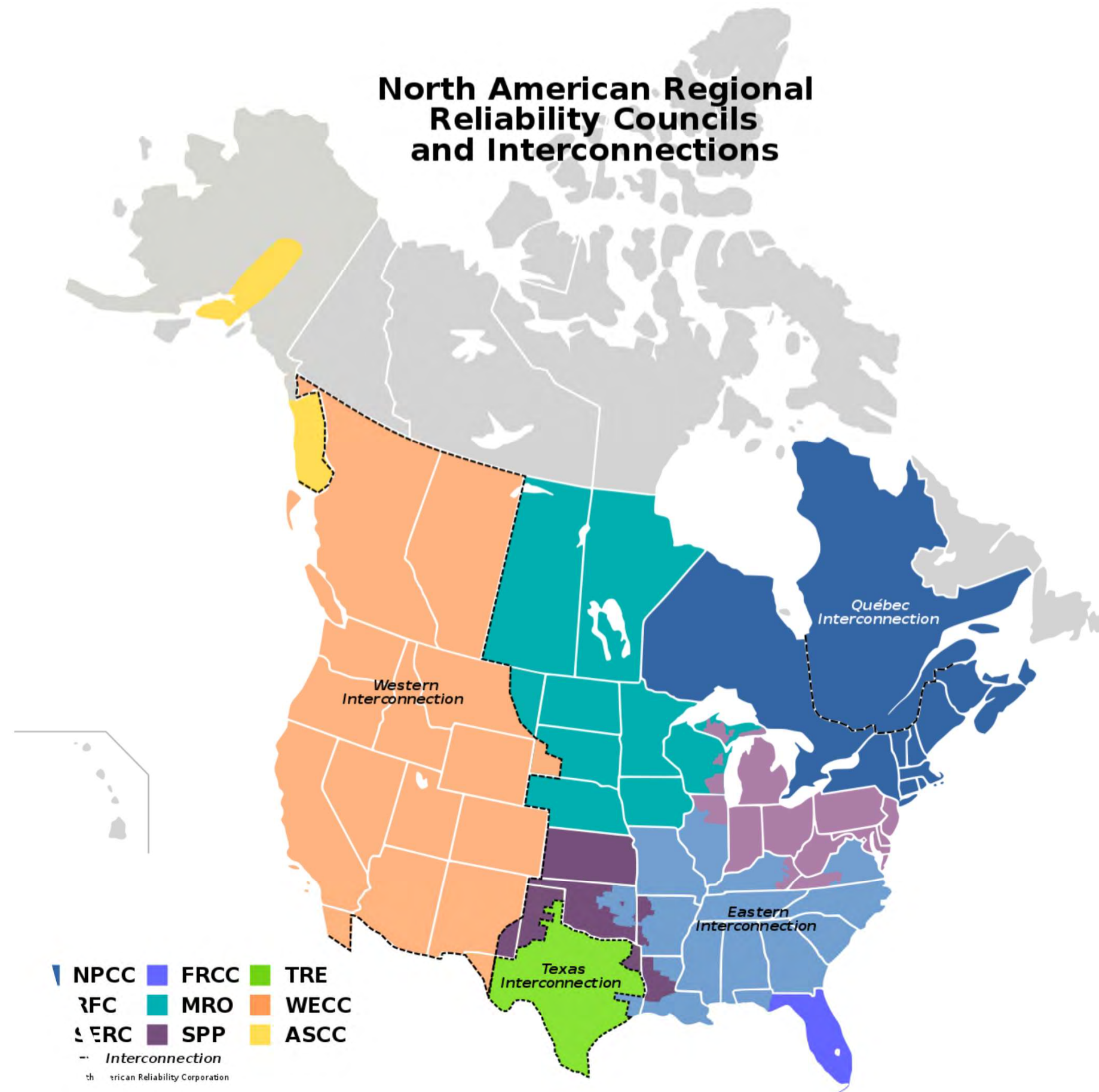
Price Volatility:

Low-cost gas and wind generation causes price volatility. Utilities pay the RTO/ISO to run in a negative market. The most economical and flexible units will be called for energy more often.

Interconnection Regions

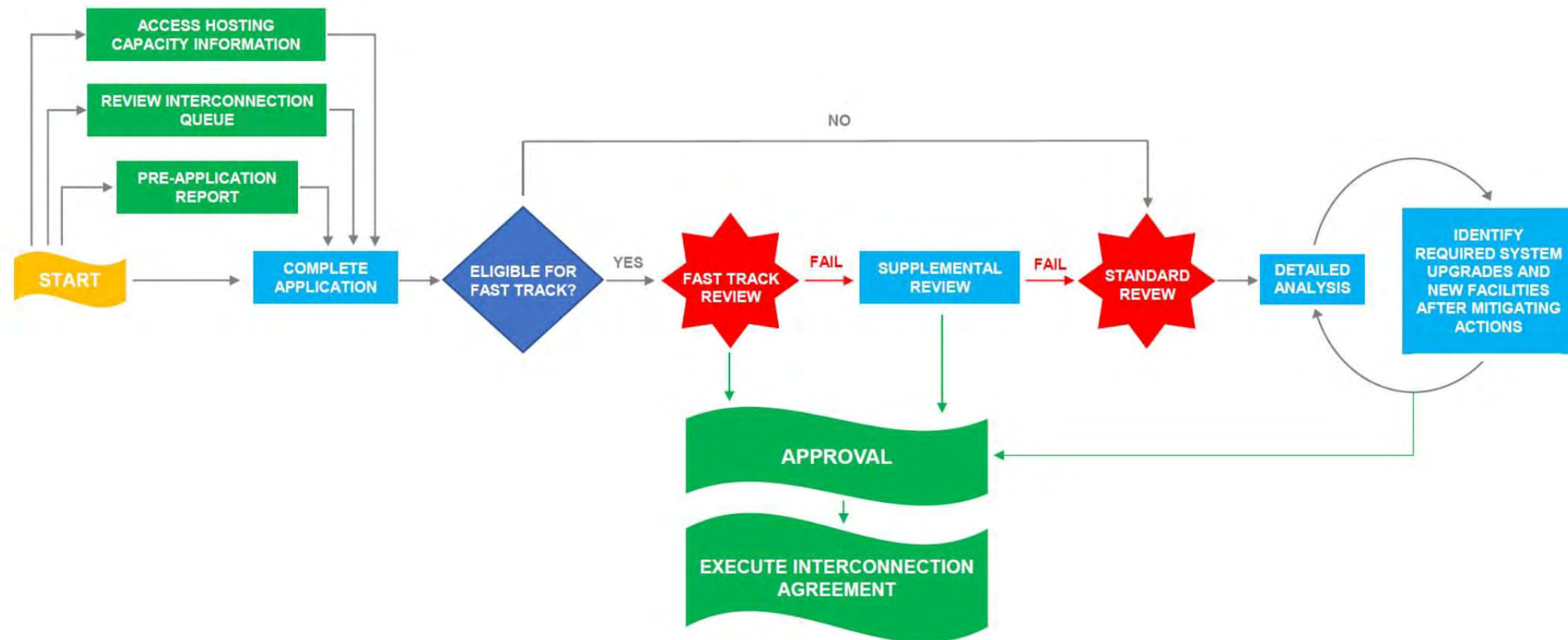
The U.S. grid is divided into three major regions:

- The Eastern Interconnection, which operates in states east of the Rocky Mountains.
- The Western Interconnection, which covers the Pacific Ocean to the Rocky Mountain states.
- The Texas Interconnected system.



Interconnection Types

Type of Interconnection	Typical Interconnection Voltage ⁴	Typical Project Generation Capacity (AC) ⁵	Primary Electricity Markets ⁶
Distribution export: Direct connection ⁷	4 kV–37 kV Some 60 kV–115 kV	50 kilowatts (kW)–5 megawatts (MW)	Wholesale markets under Federal Energy Regulatory Commission (FERC) jurisdiction and/or retail markets under state utility commission, municipal, or cooperative jurisdiction
Distribution: Net metered ⁸	4 kV–37 kV Some 60 kV–115 kV	1 kW–2 MW	Retail markets under state utility commission, municipal, or cooperative jurisdiction
Distribution: Virtual net metered and community renewables ⁹	Usually 4 kV–37 kV Some 60 kV–115 kV	20 kW–5 MW	Retail markets under state utility commission, municipal, or cooperative jurisdiction; sometimes direct connection to a utility
Transmission	Some 60 kV–115 kV 220 kV–765 kV	> 5 MW	Wholesale markets under FERC jurisdiction



Interconnection Process

Economic Importance



- A central management of power supply is vital to our continued energy stability
- Influential companies are highly invested in the energy transition
- Our worldwide economy currently fluctuates partly based on supply chain and demand for renewable energy components
- Our legacy generation facilities face challenges sourcing fuel resources and escalating costs. (coal and gas)

Questions?



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