Energy Policy Fundamentals

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What is “Energy Policy” ?

Energy policy is the manner in which a given entity (often governmental) has decided to address issues of energy development including:

- energy production,
- energy distribution,
- and energy consumption.

The attributes of energy policy may include:

- legislation,
- international treaties,
- incentives to investment,
- guidelines for energy conservation,
- taxation
- and other public policy techniques.”

https://en.wikipedia.org/wiki/Energy_policy

What is “Energy Policy” ?

Energy policy in the United States involves:

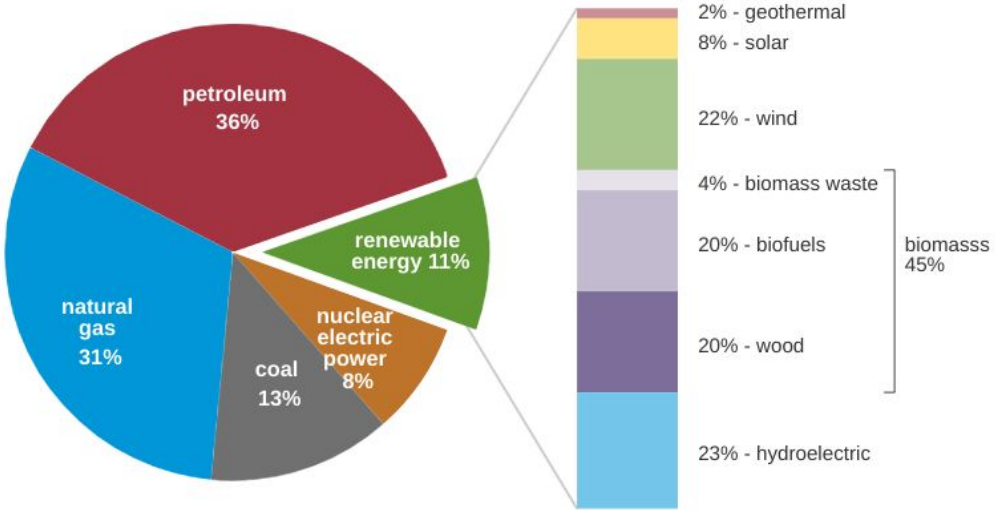
- Federal,
- State,
- and Local Governmental actions

Related to the production, distribution, and consumption of different sources of energy:

- Fossil fuels such as:
  - coal,
  - oil,
  - and natural gas
- Renewable energy sources such as:
  - solar,
  - wind,
  - nuclear,
  - and hydroelectric power

https://ballotpedia.org/Energy_policy_in_the_United_States

US Energy Sources 2018: It's not all electricity...



Note: Sum of components may not equal 100% because of independent rounding.
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2019, preliminary data

Primary energy consumption includes:

- Electricity (c. 40%)
- Heat (c. 20%)
- Transport (c. 30%)
- Industry (c. 10%)

% figures are my estimates from the links below

https://www.eia.gov/energyexplained/us-energy-facts/

https://en.wikipedia.org/wiki/Energy_in_the_United_States#/media/File:Energy_Flow_US_2017.png

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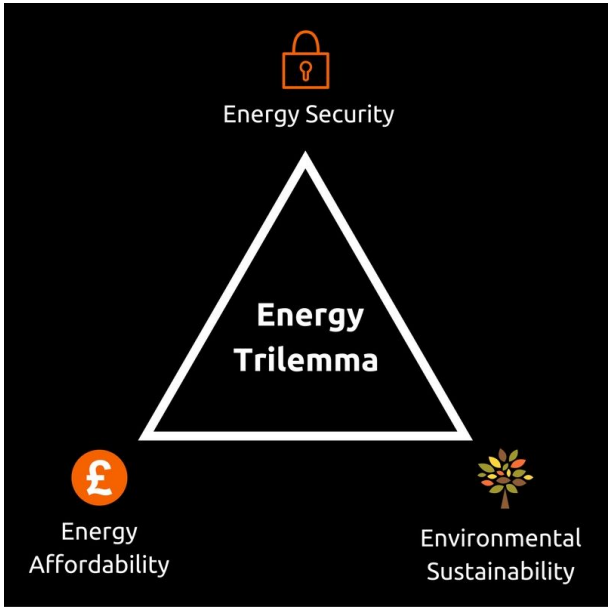
The “Energy Trilemma”



Energy Security: Reliably supplying energy (electricity/heat) to customers in the face of:

- Short-term risks (e.g. blackouts)
- Long-term risks (e.g. oil market shocks due to wars)

Affordability: Cost (both average cost and volatility).

- Note some definitions use “Energy Equity = Access + Affordability” - more appropriate in developing countries

Sustainability: CO2 (or equivalent), plus pollution of air/land/water

Optimal Energy Policy

$$\text{Policy Utility} = \sum \text{Security} + \sum \text{Affordability} + \sum \text{Sustainability}$$

Integrate over time and you have your answer….

Optimal Energy Policy

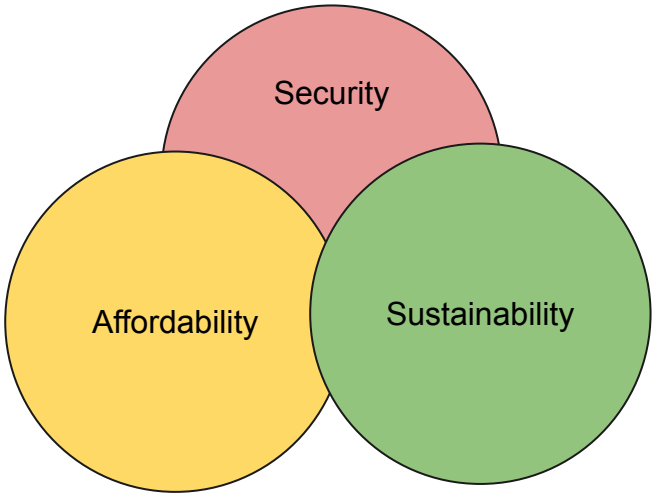
Policy Utility = $\sum$ Security + $\sum$ Affordability + $\sum$ Sustainability

Integrate over time and you have your answer….

Can anyone see any issues with this approach?

Are these the only 3 issues that policy-makers grapple with?

What's missing from the trilemma?



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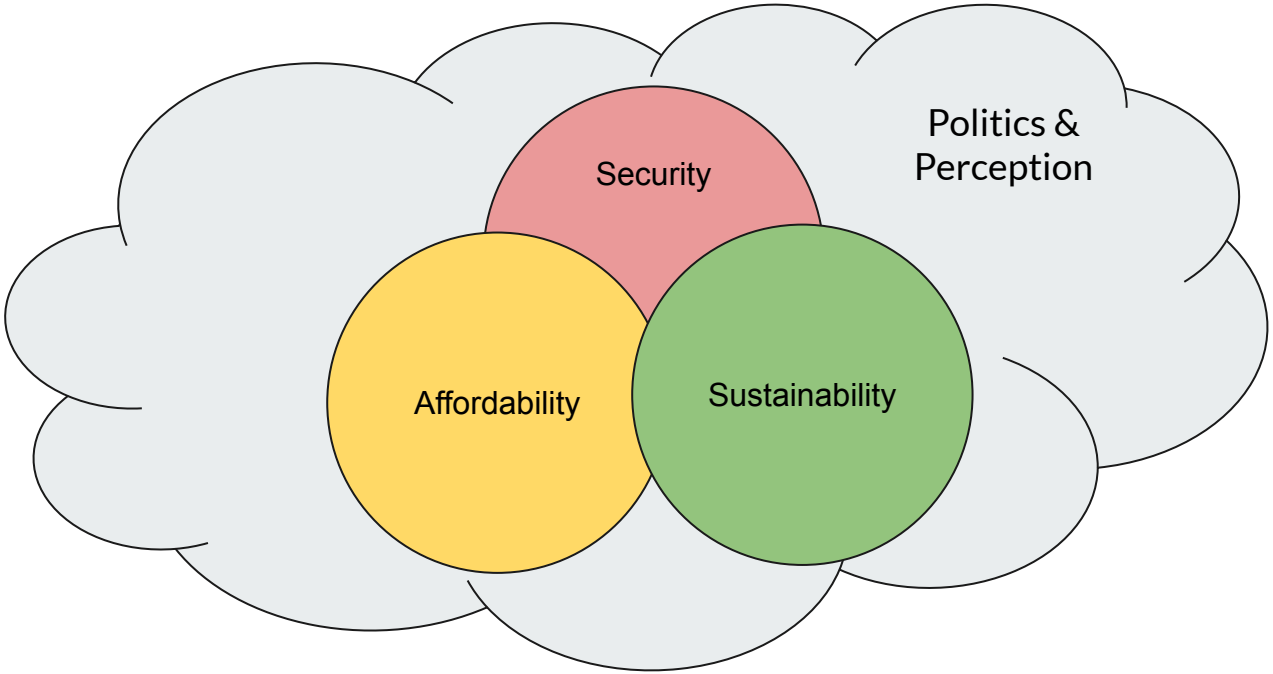

The trilemma alone can lead to "Utilitarian" solutions that are not acceptable in democracies

Would you be prepared to:

- Have wind turbines right next to your house?
- Stop eating meat?
- See coal miners lose their jobs?

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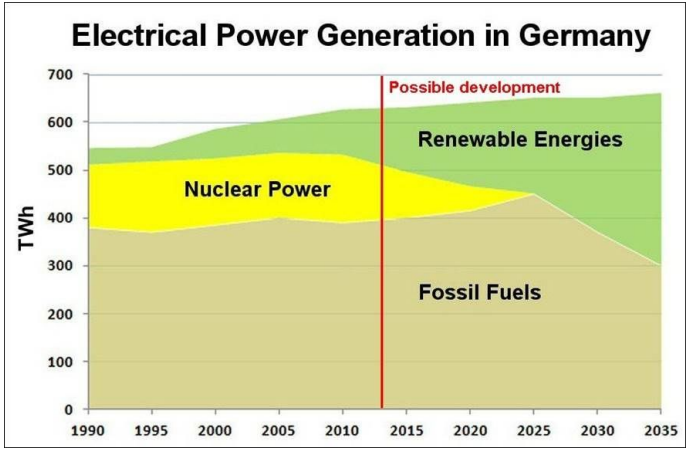
  - Renewable Energy + Nuclear in Germany
  - Carbon taxes in the UK
  - US Shale Gas
- Quickfire Policy Analysis

https://reneweconomy.com.au/can-germany-survive-energiewende-33428/

1. Renewable Energy (RES) + Nuclear in Germany

In 2011, the German government legislated to phase-out nuclear in Germany by 2022. This was in reaction to the Fukushima disaster and (somewhat ironically) the impact of the Green Party in German politics

At the same time, Germany has deployed significant RES (wind/solar), but the initial projects were very expensive



Scorecard	Security of Supply	Affordability	Sustainability	Politics	Overall
Rating					
Comments	Limited reliability on imports of gas Coal + RES are local resources	Coal is cheap, but early renewables subsidies were very expensive	Carbon emissions in the power sector have not significantly reduced	Retaining lignite jobs is good politics, the cost of early RES subsidies is not...	Combined policy has cost a lot of money without reducing CO2. However, the world now benefits from Germany funding RES R&D / commercialisation

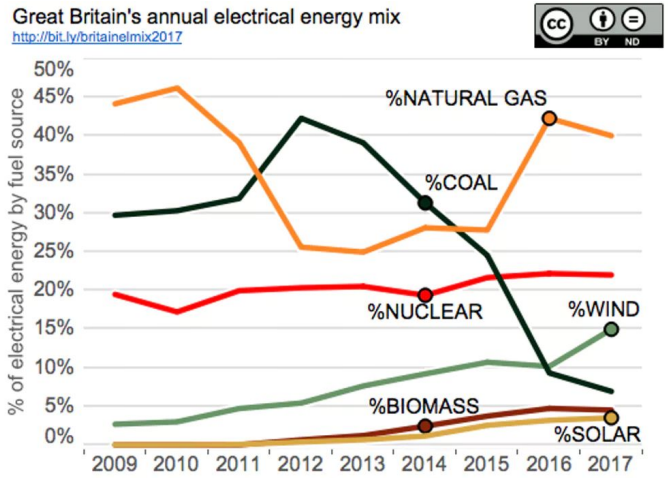
https://poweringpastcoal.org/assets/docs/members/House_of_Commons_Library_Briefing_Note_on_CPS_SN05927.pdf

https://www.carbonbrief.org/analysis-why-the-uks-co2-emissions-have-fallen-38-since-1990

2. Carbon Taxes in the UK

The UK introduced a carbon tax (£/t_CO2eq) in 2013. This was triggered by frustration with the low prices in the EU emissions trading scheme.

The tax acts to make coal more expensive than gas for generating electricity. The result has been a complete collapse in coal generation in the UK



Scorecard	Security of Supply	Affordability	Sustainability	Politics	Overall
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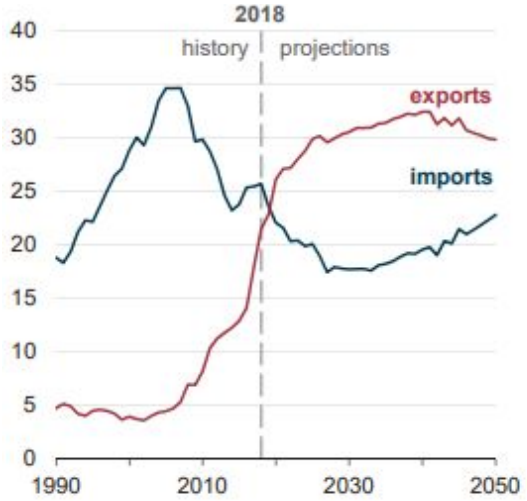
Comments	Both coal and gas are mainly imported to the UK, so no change	Some prices increases (wholesale price up 10-20%) - but this is only 4-7% of total consumer bill	UK power sector emissions have dropped by 55% since 2013	Consumers are mainly unaware of the carbon tax and there has not been much negative media coverage	Coal has been virtually phased-out of the UK electricity sector in 5 years, offering a model for other countries.

https://www.cnbc.com/2019/01/24/us-becomes-a-net-energy-exporter-in-2020-energy-dept-says.html

3. US Shale Gas boom

Since the start of the US Shale Gas (and oil) boom in 2008, the US has reduced its reliance on fuel imports and is now a net exporter.

Note: Shale Gas/Oil is also known as "tight gas/oil". Shale gas/oil are recovered via hydraulic fracturing of rock, as opposed to traditional drilling



US gross energy trade

Oil + Gas + Coal

Net exporter form 2018

Scorecard	Security of Supply	Affordability	Sustainability	Politics	Overall
Rating					
Comments	The US is now an exporter of both oil and gas - and therefore less exposed to Middle Eastern geopolitics	Benchmark natural gas price index (Henry Hub) has fallen by 65% since 2008 (9 to 3 $/MMBtu)	Shale gas is reducing coal burning in the US. However there are concerns about methane leakage	- Energy security - Low Prices - Jobs! Great politics	US shale boom has fundamentally transformed US energy policy, and to some extent US foreign policy. However, cheap gas reduces the incentive to develop RES projects.

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https://en.wikipedia.org/wiki/Three_Gorges_Dam

Three Gorges Dam, China

22,000 MW hydro dam in Hubei province, central China, operational since 2012. Biggest power station in the world (by capacity)

The reservoir displaced 1.3m people and has caused other environmental impacts, including increased landslides.

Scorecard	Security of Supply	Affordability	Sustainability	Politics	Overall
Rating	?	?	?	?	?
Comments					

https://www.iberdrola.com/about-us/lines-business/flagship-projects/vineyard-wind-offshore-wind-farm

https://insideclimatenews.org/news/19082019/vineyard-wind-offshore-renewable-energy-delay-boem-environmental-cumulative-review-nepa-massachusetts

Offshore Wind in Massachusetts

800 MW project Vineyard 1 to be installed south of Cape Cod. 84 x 9.5 MW turbines will be installed.

US Government has ordered further environmental studies, which are delaying the permitting process. Vineyard is likely to be the first large-scale offshore wind farm in the US.

Scorecard	Security of Supply	Affordability	Sustainability	Politics	Overall
Rating	?	?	?	?	?
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https://www.nrel.gov/water/mhk-research.html

Wave and Tidal Energy

Wave and Tidal Energy projects have struggled to move beyond the demonstration stage.

Technologies include: Sea Snakes, Tidal Fans, Tidal Kites, and Wave Paddles.

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Hot Topics in Energy Policy

From the excellent Columbia Energy Exchange podcasts:

- Beyond the Paris Agreement: Art & science of climate negotiation
- Outlook for US offshore wind projects
- Challenges of communicating climate change
- Nuclear's role in energy security & climate goals
- What's up with Carbon Tax legislation?
- How energy markets influence geopolitics and the global economy
- Coal communities face risk of fiscal collapse
- US natural gas in a changing climate

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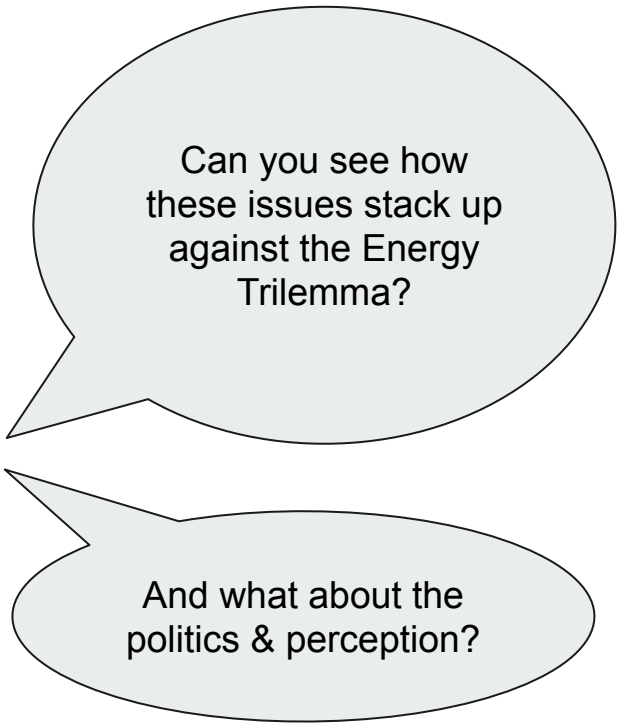

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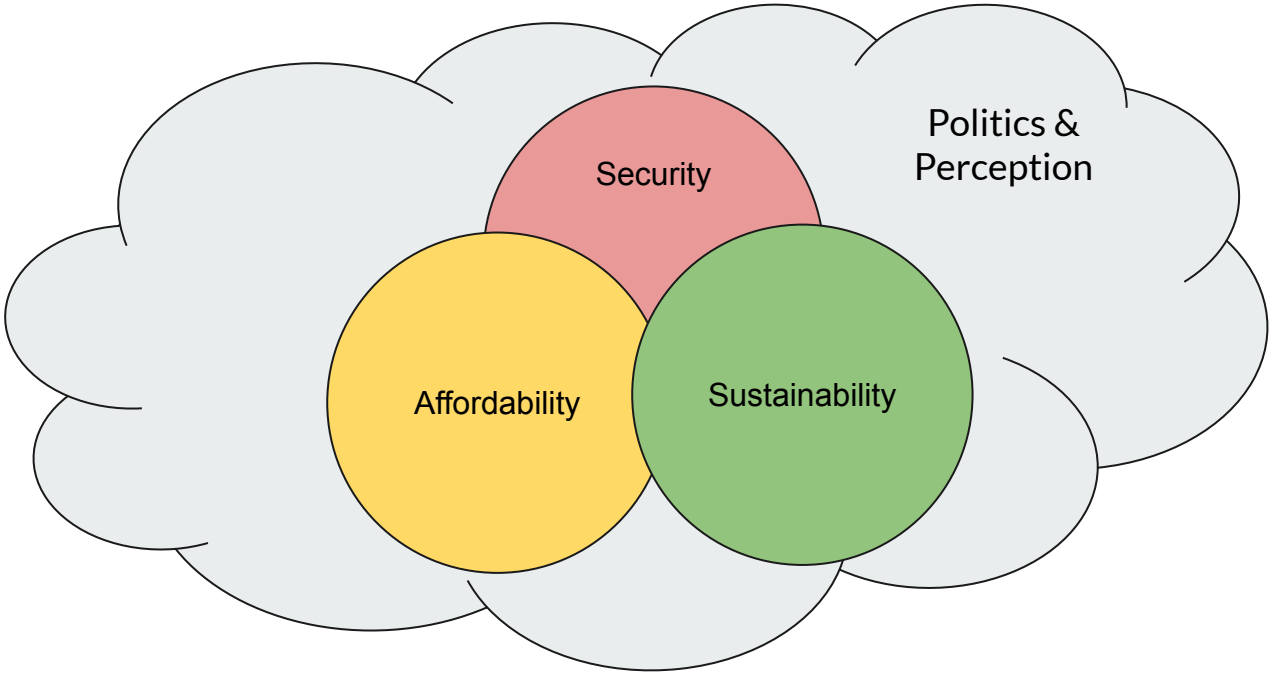

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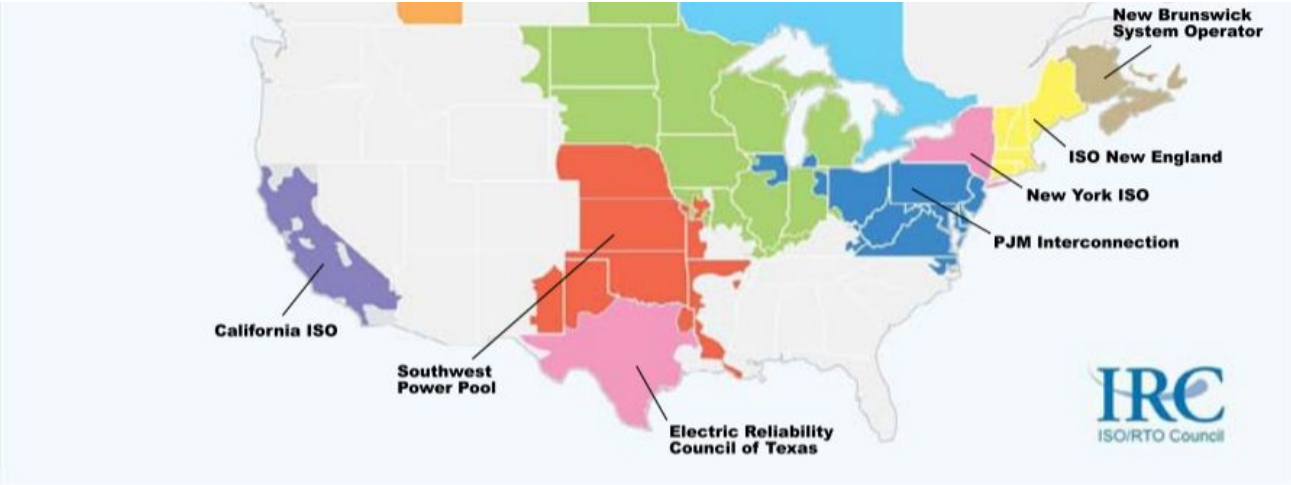
Aside: Battery Storage in the US

Figure 1.2 Regions with Organized Electricity Markets

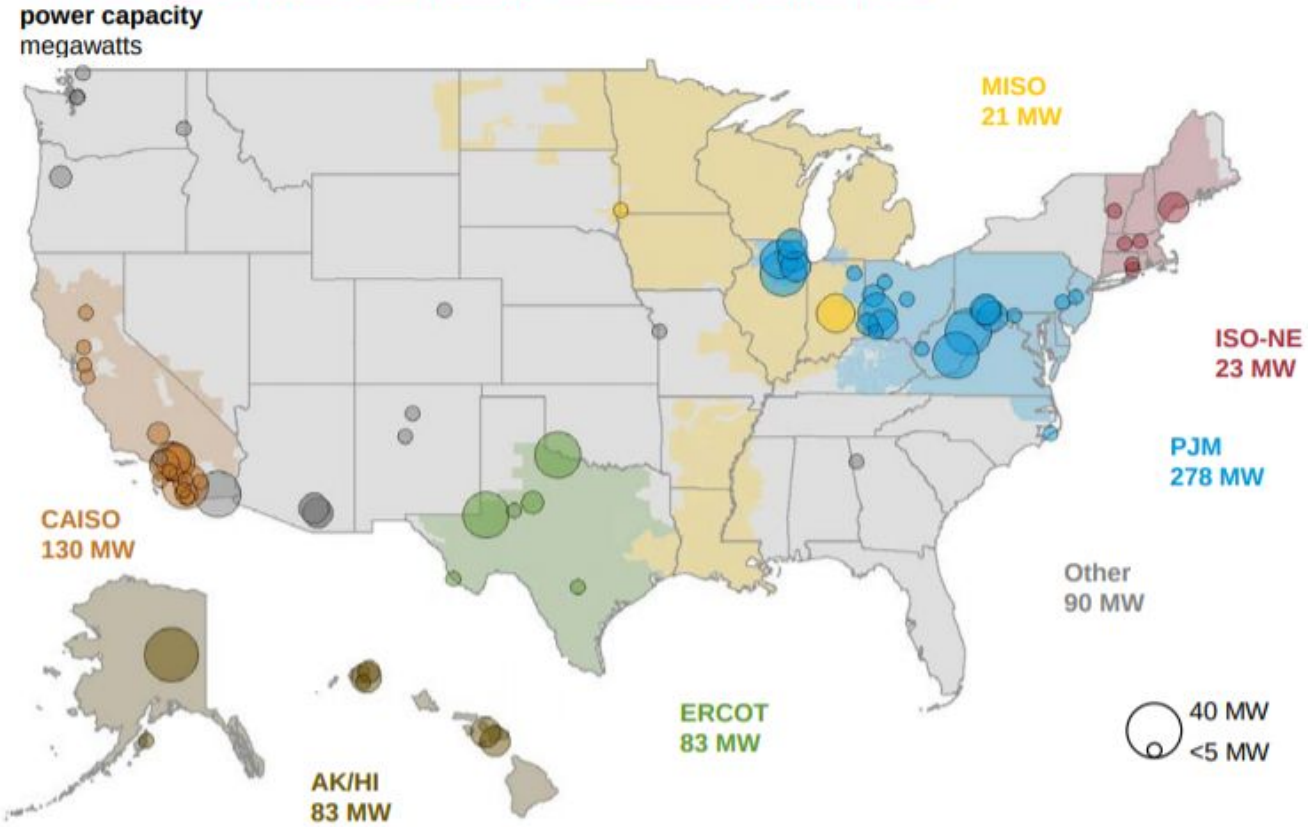


Source: ISO/RTO Council, http://www.isorto.org. Copyright © ISO/RTO Council, all rights reserved.

http://energy.mit.edu/wp-content/uploads/2011/12/MITEI-The-Future-of-the-Electric-Grid.pdf

https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf

Figure 2. U.S. Large-Scale Battery Storage Installations by Region (2017)



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