Resource Adequacy & Reliability

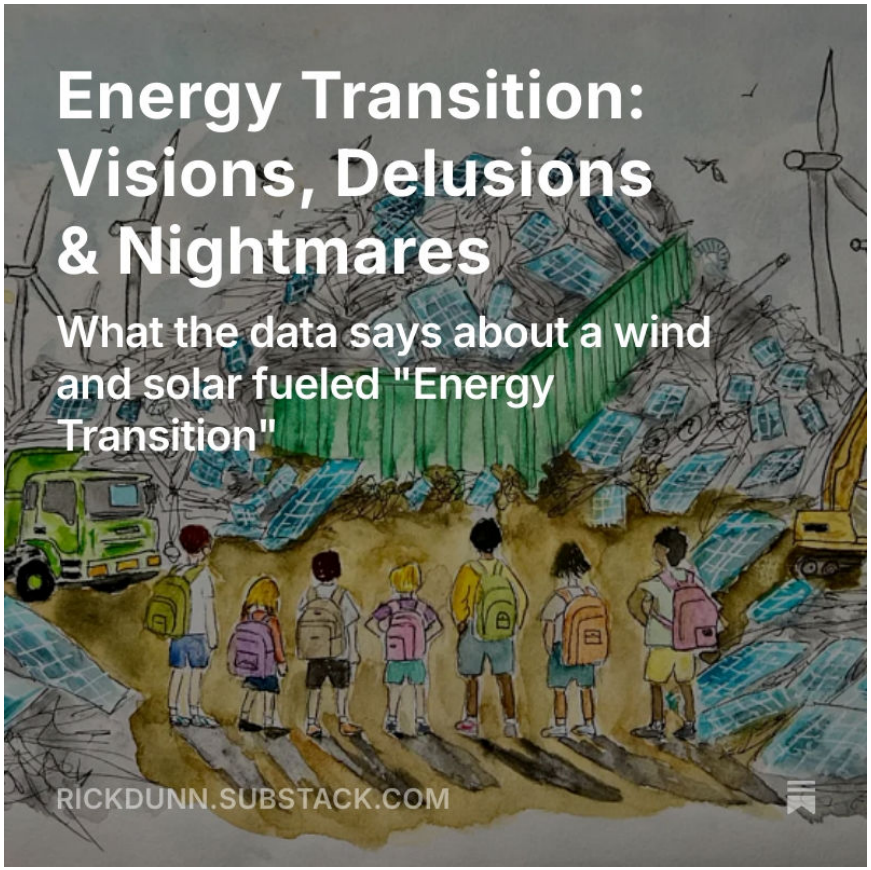
CEO & Utility Managers Roundtable 2025

Rick Dunn, General Manager

March 17, 2025

Your Trusted Energy Partner

I Just Couldn't Take it Anymore!



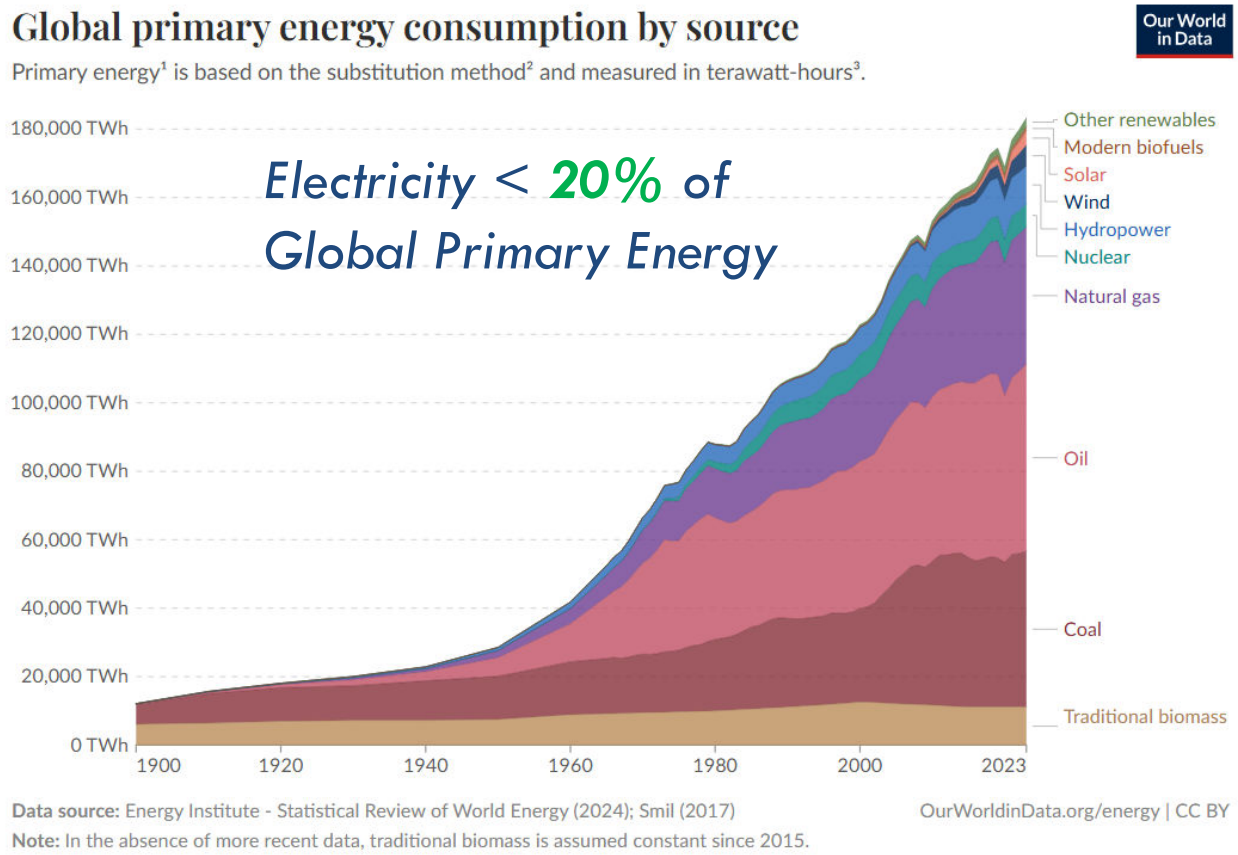
Rick Dunn, P.E. - Pro Nuclear, Experience & Common Sense
By Rick Dunn

More than 'bumper sticker' clean energy policy information. Politicians are designing the power grid and we're heading for a cliff.

https://rickdunn.substack.com/

- ✓ ***Began Publishing November 2023***
- ✓ ***Optional & Free to Subscribe***
- ✓ ***Artistic Collaboration: Marjean Allen-Dunn***

"Energy Transition" *Reality Check*



*Electricity < **20%** of Global Primary Energy*

2.4% Wind & Solar

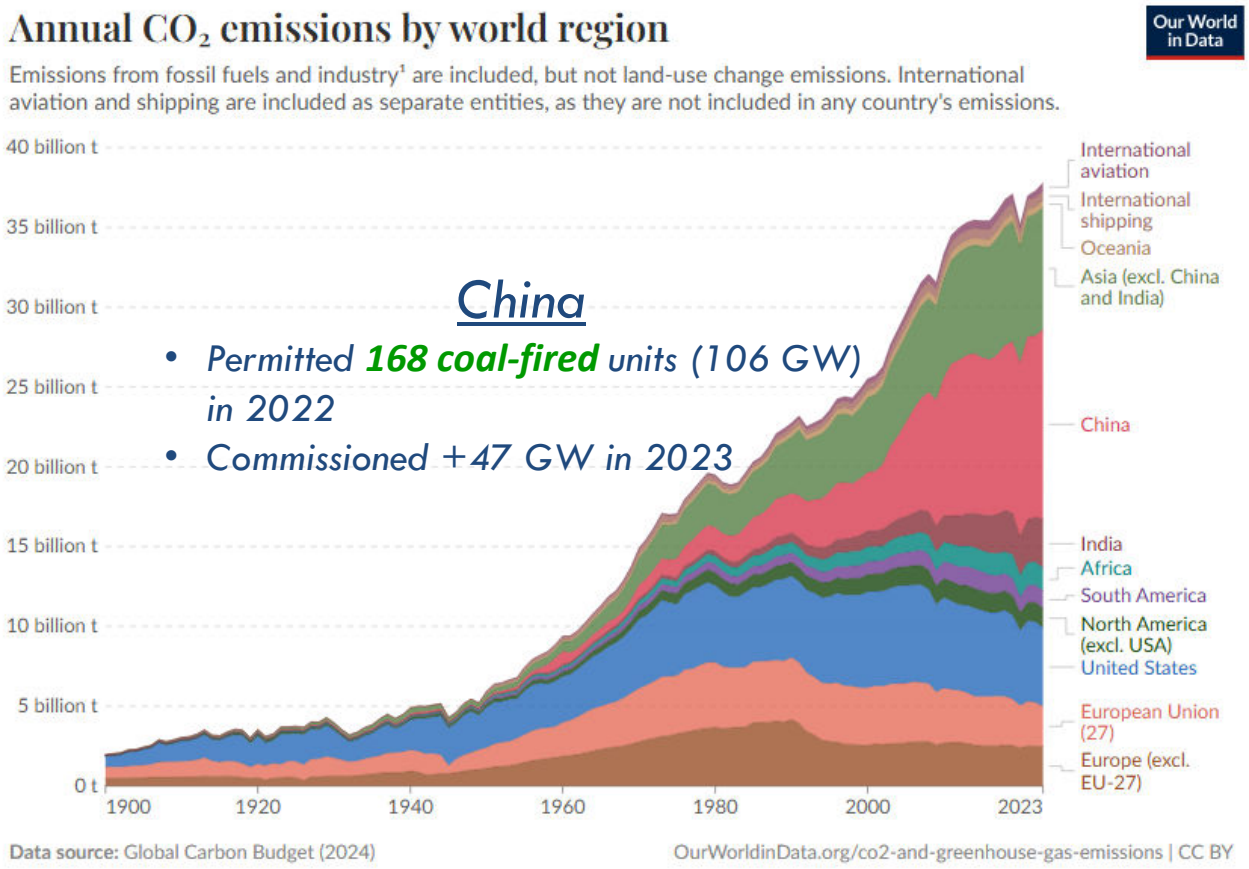
85% Fossil Fuels

92% CO_2 Emitting

Wood, Animal Dung, Charcoal, & Crop Residues

Source: https://ourworldindata.org/energy-production-consumption

U.S. Pushes Grid to Blackouts: *Global CO_2 Emissions Rise*



Source: https://ourworldindata.org/grapher/annual-co-emissions-by-region

Since 2007

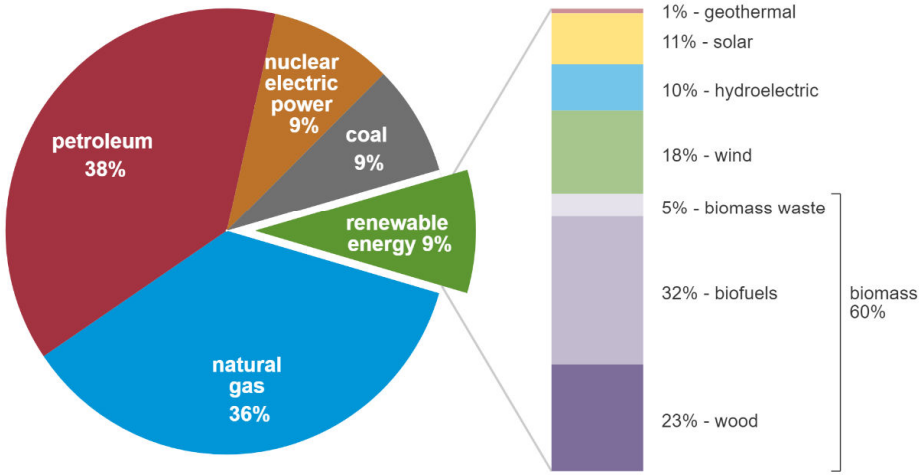
- ✓ U.S. ***decreased*** by 1.22 billion t
- ✓ China ***increased*** by 4.92 billion t
- ✓ China Increase ***> U.S. total*** of 4.91 billion t in 2023
- ✓ *Western Civilization is not going to convince **poor people to stay poor***

U.S. Energy Transition: *Progress Report*

U.S. primary energy consumption by energy source, 2023

total = 93.59 quadrillion British thermal units

total = 8.24 quadrillion British thermal units



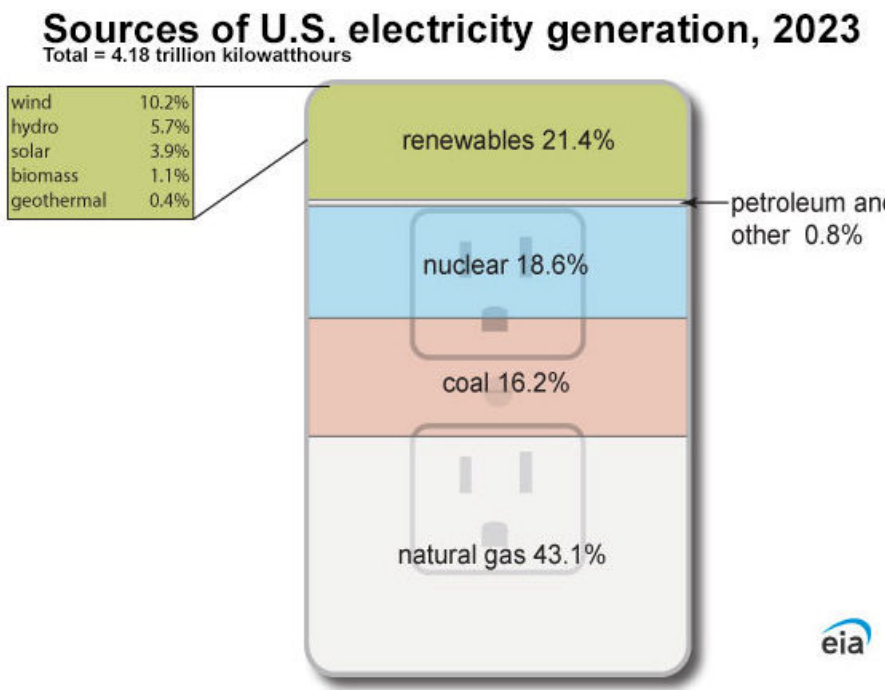
Data source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2024, preliminary data
Note: Sum of components may not equal 100% because of independent rounding.

- Fossil Fuels = 83%
- Wind & Solar = 2.6%
  - Hydro = 0.9%
  - Total Renewables = 9%
- Nuclear = 9%
- *Electricity Represents 34% of total U.S. Energy*

Wind was 18%x 9% =1.62% & Solar was 11%x9%=0.99% (Total = 2.6%)

Using non-preferred Fossil Fuel Equivalency Approach Wind & Solar Total = 5.8%

U.S. Electricity Generation



Source: https://www.eia.gov/energyexplained/electricity/

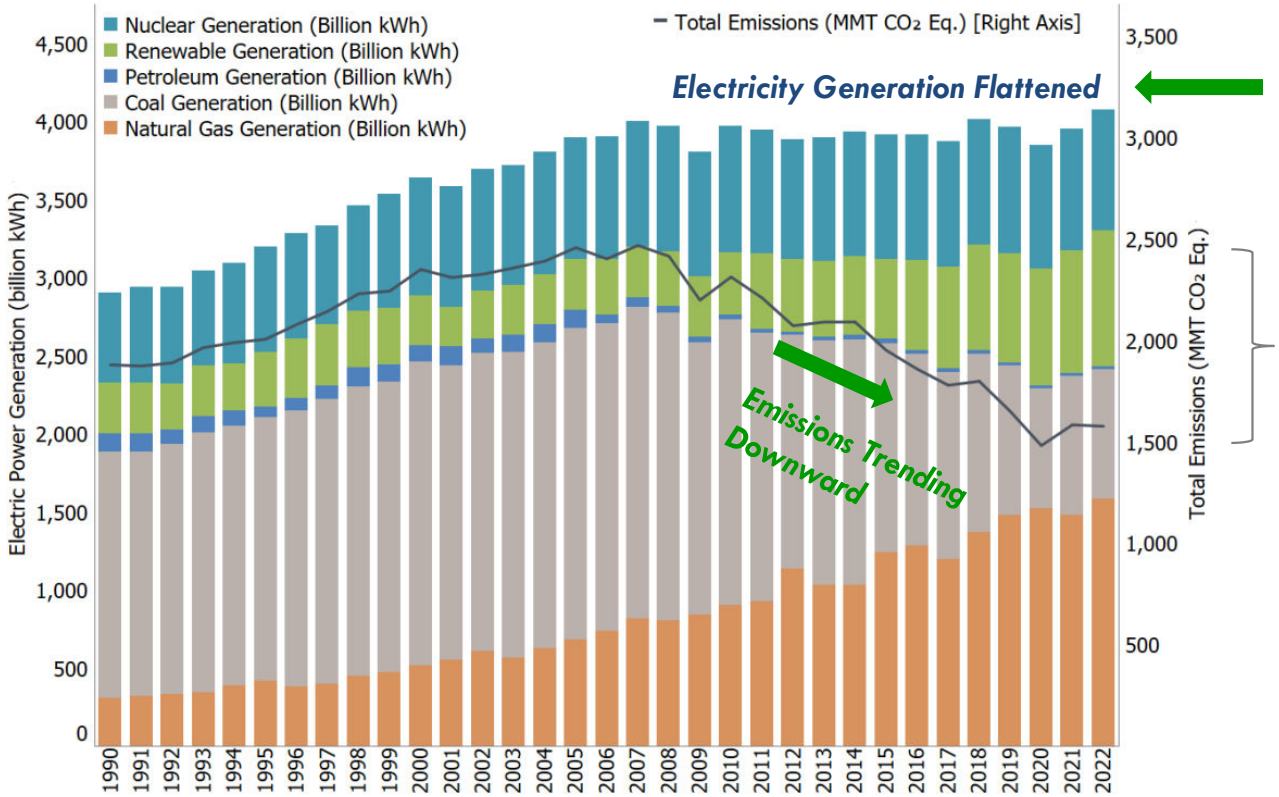
- Fossil Fuels = 60%
- Renewables = 21.4%
  - Wind & Solar = 14.1%
  - Hydro = 5.7%

84% New Generation Under Development

- Nuclear = 18.6%
- *39% Non-CO_2 Emitting*

Coal-to-Natural-Gas: *Fuel Switching*

Figure 2-8: Electric Power Generation (Billion kWh) and Emissions (MMT CO_2 Eq.)



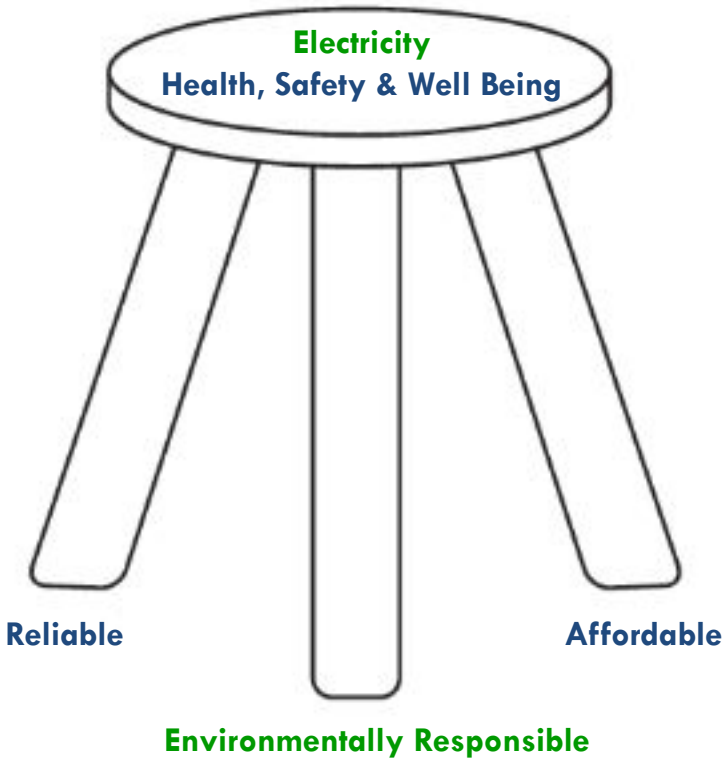
https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2022

Demand only up 2.8% in 2023 compared to 2007

36% CO_2 Reduction

- ✓ *65% due to fuel switching*
- ✓ *30% due to wind & solar*

Utility Balancing Act: *Increasingly Difficult*



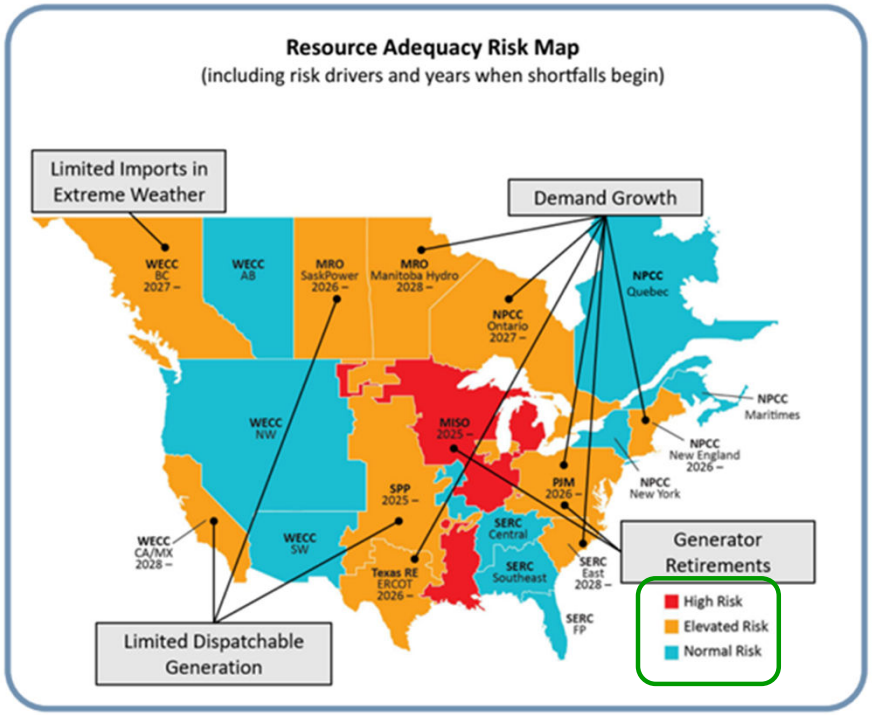
- Eliminating CO_2 Valued Above all Factors
  - ***"Dogmatic Devotion"*** *to Wind & Solar*
- Wind & Solar are Inherently *Parasitic* to the Reliable Grid
  - *Require overbuild & backup which means* ***increasing costs***
- Increasing *Development Friction*
  - *Risk of Blackouts*
  - *Costs*
  - *Land-Use Impacts*

Increasing Risk of Blackouts: *And We're Just Getting Started*

Half US at high risk of power shortfall in next decade, regulator says

By **Reuters**

December 17, 2024 2:58 PM PST · Updated 16 days ago



We're Just Getting Started

- U.S. Wind & Solar ***< 3%*** of Primary Energy
  - 14 years & ***$ hundreds of billions***
  - 2% of electricity in 2009 to 14% in 2023
- What is ***Normal Risk*** ?

TGFI . . . *A Cautionary Tale*

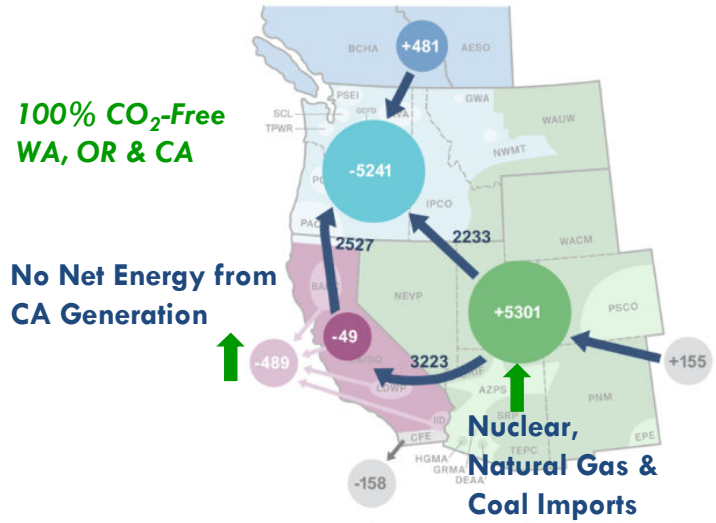
TOP STORY

Winter Storm Pushed Northwest Close to Rolling Blackouts

Steve Ernst Mar 22, 2024

CLEARING UP
An Independent News Service from NewsData

Regional Net Imports & Exports, All Hours



Source: OASIS Transaction Schedules (scheduledetail), BPA Transmission Operations Data (AC Intertie Path data), Form EIA-930 Interchange data, CAISO OASIS.

January 2024 *5-Day Cold Snap*

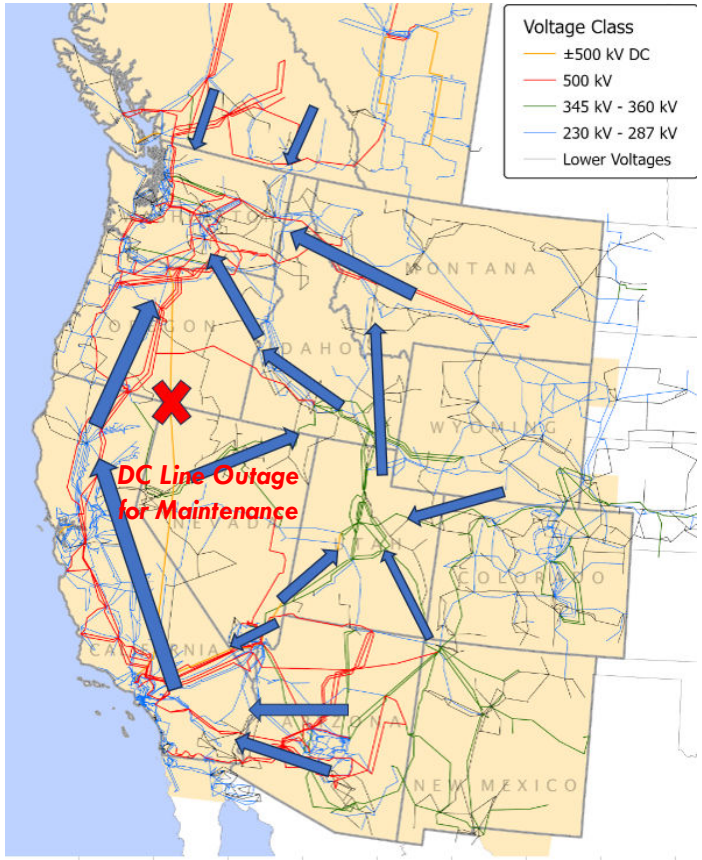
- ✓ Hydro *short on water* & wind power collapsed to zero
- ✓ +2,000 MW of coal *retirements*
- ✓ 2% to 6% *demand growth* since December 2022

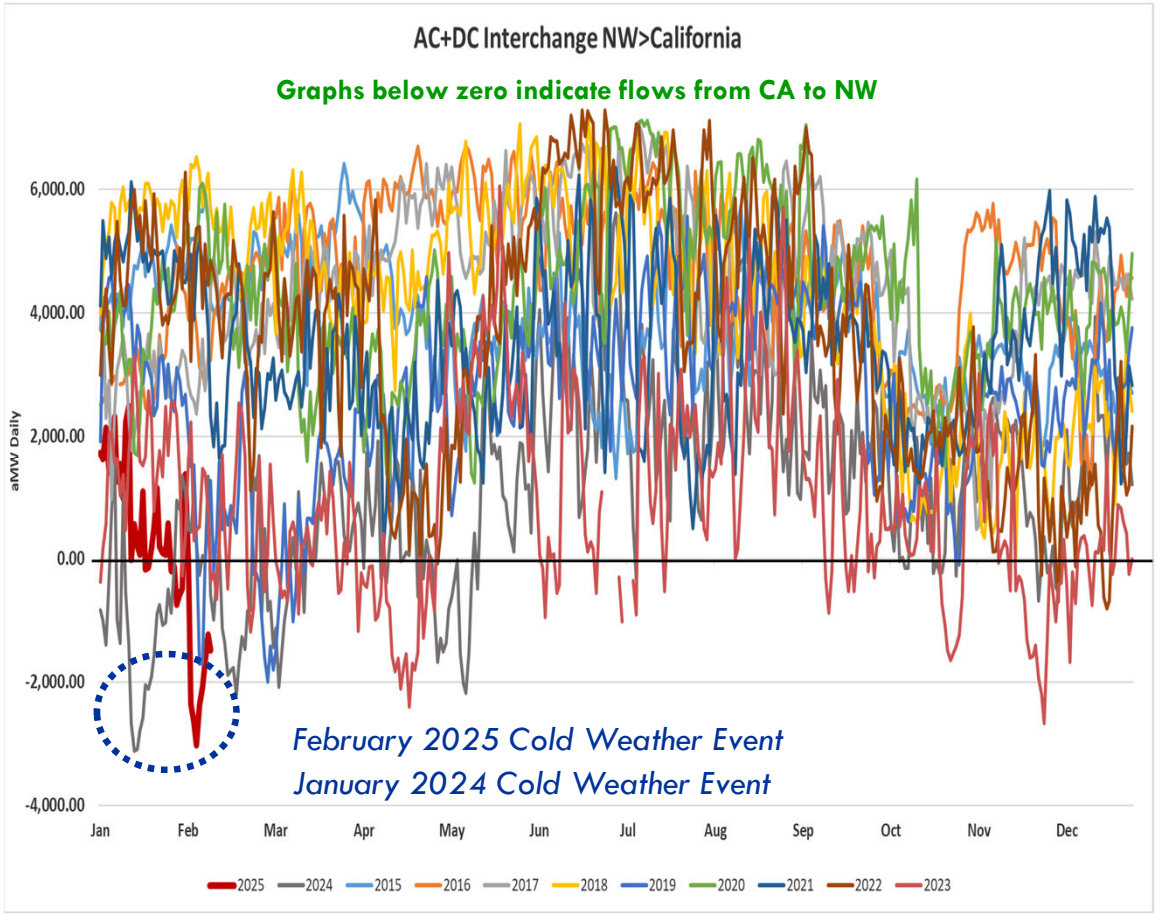
Post-mortem Analysis

- *4 BAAs along w/ AESO declared **Energy Emergencies**.*
- ***Imports** for all 120 Hours; short **energy** and capacity*
- *Northwest grid & gas pipeline systems at **immediate risk** with **no margin** for the unexpected*

From Exporter to Importer: *We've Only Just Begun in WA & OR*

January 2024 Cold Weather Event





CO_2-Free Energy Strategies: *Everywhere but Here*

Like Others - Washington Aims to Electrify Everything

Decarbonizing the Electricity Sector

97% growth in electricity end use demand by **2050**

43% of electricity imported by 2050

36% from WY & MT wind

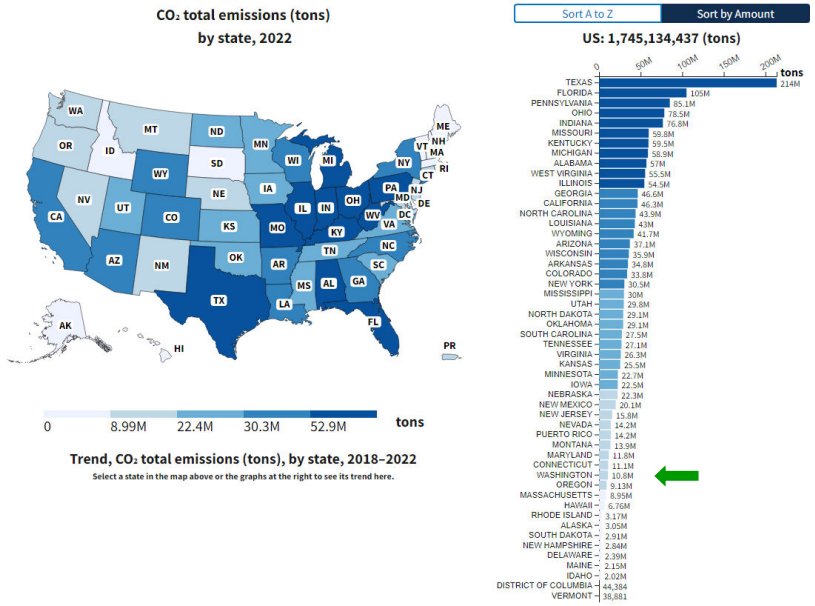
ELECTRICITY EMISSIONS INTENSITY

2020	2030	2050
85 grams/kWh	6.5 grams/kWh	0 grams/kWh

- Double end use electricity load by 2050
  - ✓ Electricity to displace fuels in transportation, industry, buildings
  - ✓ Hydrogen electrolysis and electric boilers as flexible demand resources
- Invest in new transmission capacity and renewable generation, coordinating with other states
- Develop distributed energy resources with smart grid capabilities to ensure reliability and flexibility
- Strengthen market mechanisms to ensure resource adequacy and efficient electricity markets.
  - ✓ Coordination with other states and federal government

- ✓ *Planned **Exploitation** and **Industrialization** of Rural & Natural Landscapes Elsewhere*
- ✓ *Unprecedented Development in an **Anti-Development Era***

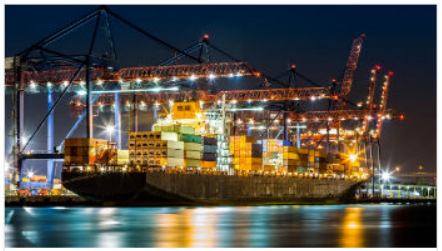
Electricity Sector CO_2 Emissions



- ✓ *WA = 10.8 MMT (**0.62%** of U.S. Total)*
- ✓ *How do the rest of you live with yourselves?*

Increasing *Development Friction* = Increasing Risk of Blackouts

Risks to Planned Resource Additions



Supply Chain Disruptions

Supply chain issues that surfaced during the pandemic in 2020 continue to affect the industry, particularly the construction of new projects and the interconnection of new generating resources. A recent survey found that supply chain issues remain a significant problem in 2024.

Interconnection Queue

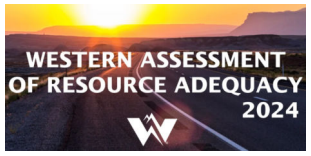
The interconnection queue nationwide grew more than 30% in 2023 and has increased eightfold in the last decade. The planned additions over the next 10 years will exacerbate this issue, although FERC Order 2023 calls for reforms to reduce the backlog and address uncertainty in the interconnection process.

Siting Delays

There has been increasing resistance to building new energy facilities, particularly wind, solar, and battery projects. These projects have encountered opposition in at least 45 states, according to a recent report that found that local opposition to new energy facilities is widespread and growing.

Increased Costs

Increased costs of materials for new wind and solar construction, transmission expansion, and replacement of plant equipment have caused project delays and maintenance deferrals. The rise in interest rates in recent years has also substantially increased the cost of capital for all energy projects.

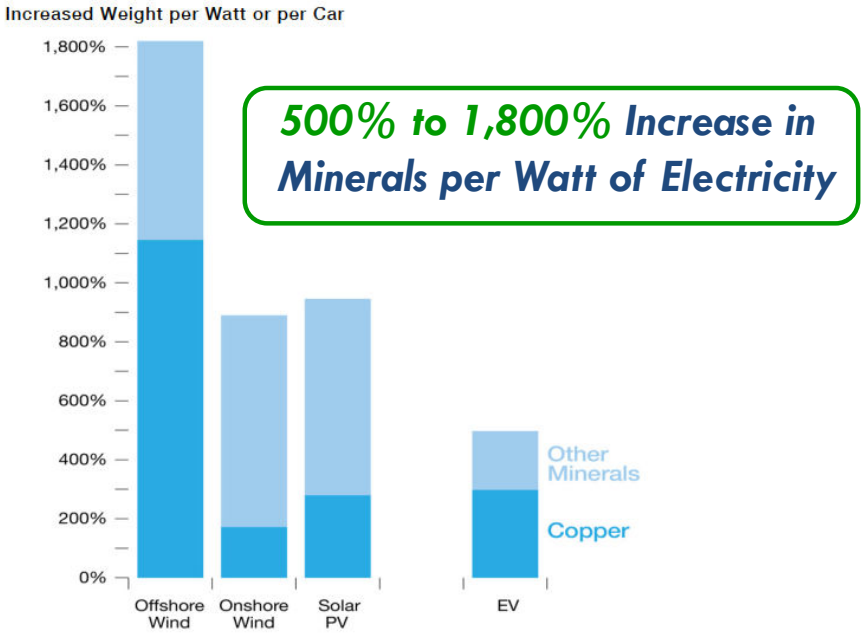


https://feature.wecc.org/wara/

Supply Chain Disruptions: *Radical Increase in Demand for Minerals*

6. ENERGY TRANSITION HARDWARE RADICALLY INCREASES THE DEMAND FOR MINERALS

Mineral Demands for Solar, Wind, and EV to Replace Hydrocarbon Machines

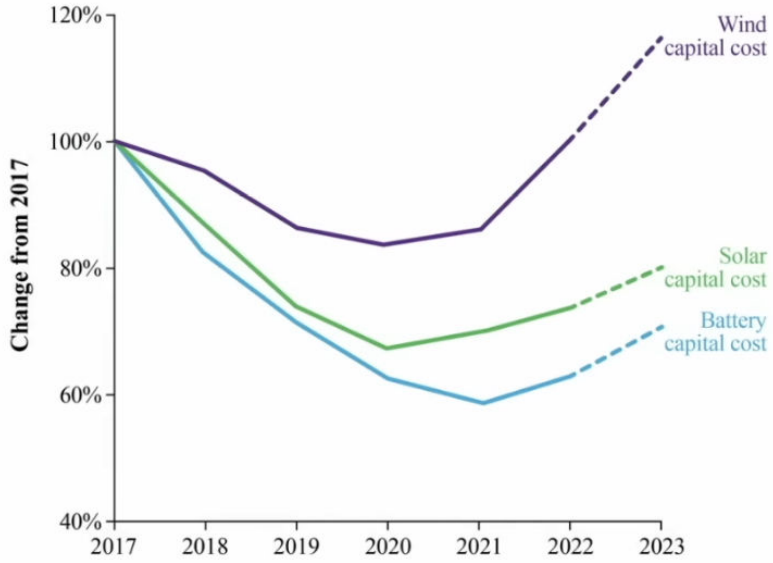


500% to 1,800% Increase in Minerals per Watt of Electricity

Source: "The Role of Critical Minerals in Clean Energy Transitions," World Energy Outlook Special Report, International Energy Agency (IEA), May 2021

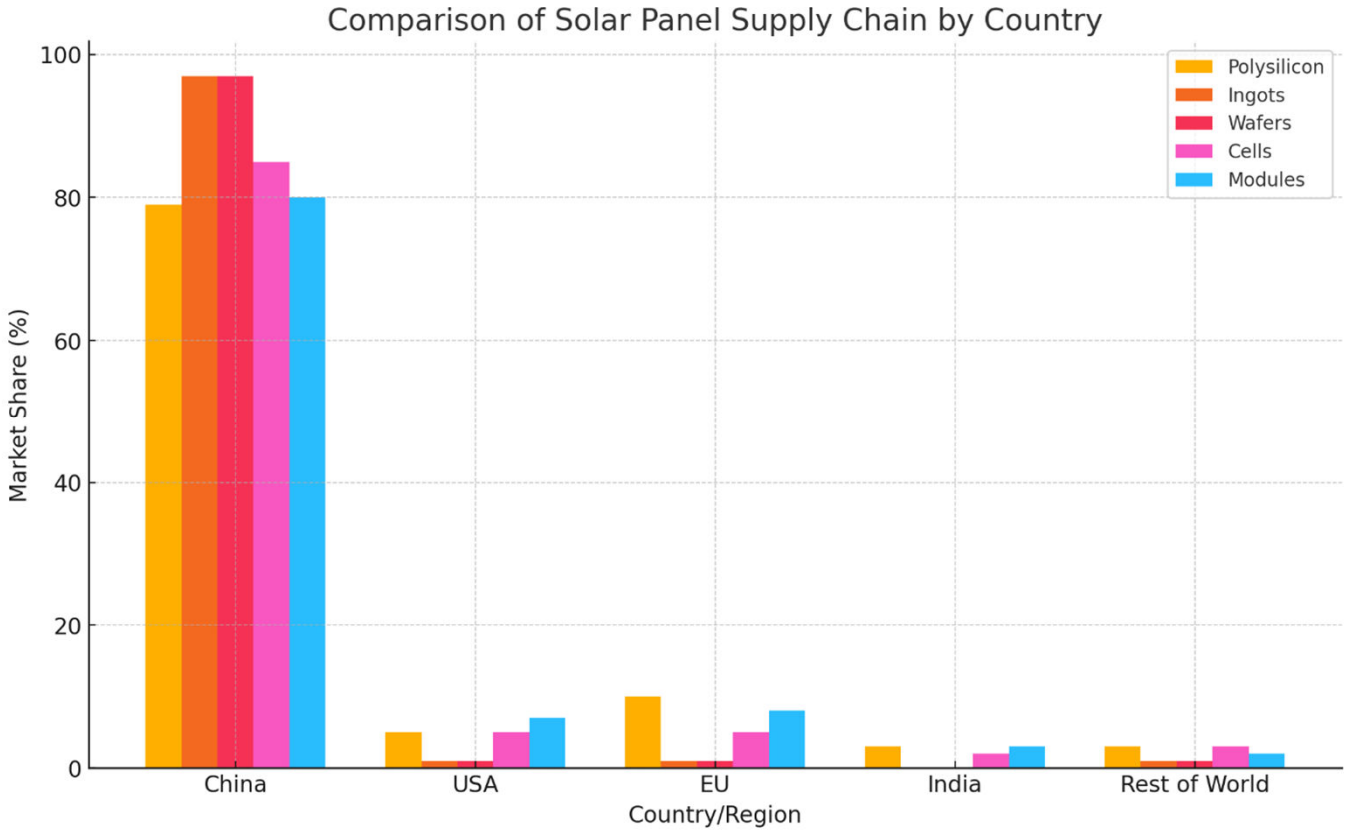
Green Machines Costs Rising

Material inputs ~70% cost solar module, battery



Mark Mills Manhattan Institute: https://www.youtube.com/watch?v=sgOEGKDVvsg

Supply Chain Disruptions: *Deep Reliance on Imports*

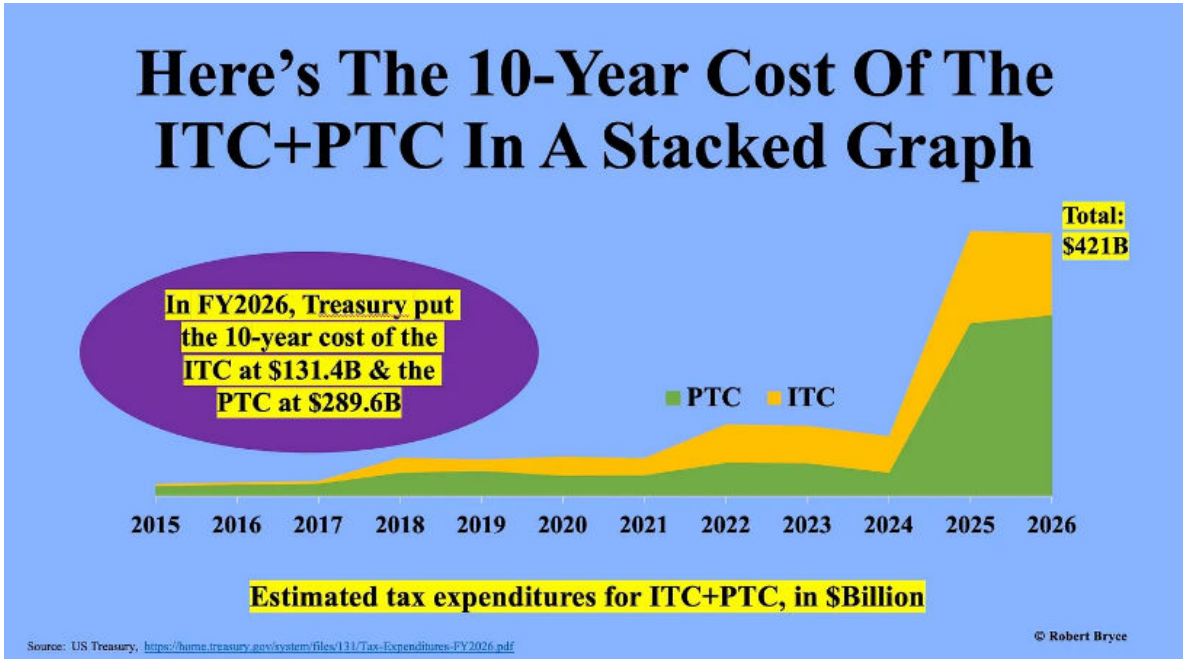


Source: ChatGPT using International Energy Agency Data

*"A **majority** of all new generation capacity under development is for **solar** energy (51%), followed by wind (33%) and natural gas (7%)."*

APPA 2024 Update
https://www.publicpower.org/periodical/article/appa-report-says-nearly-468000-mw-new-generation-capacity-under-development

Interconnection Queue: *ITC & PTC Feeding Frenzy*



Source: https://robertbryce.substack.com/p/heres-the-real-hockey-stick

Robert Bryce

Energy, power, innovation, and politics.

*"… over the coming decade, thanks to the ITC+PTC, the alt-energy sector will get nearly **18 times more** in federal tax credits than the entire hydrocarbon sector*

*"…and **nine times** more than the nuclear sector."*

Transmission Lines: *Development & Operations Friction*

- ✓ **High up front capital costs & long siting, permitting & construction lead times**
  - 15 years or more not uncommon
- ✓ **Wildfire legal and financial risks**
  - Risk mitigation includes preemptive shutoffs and blackouts

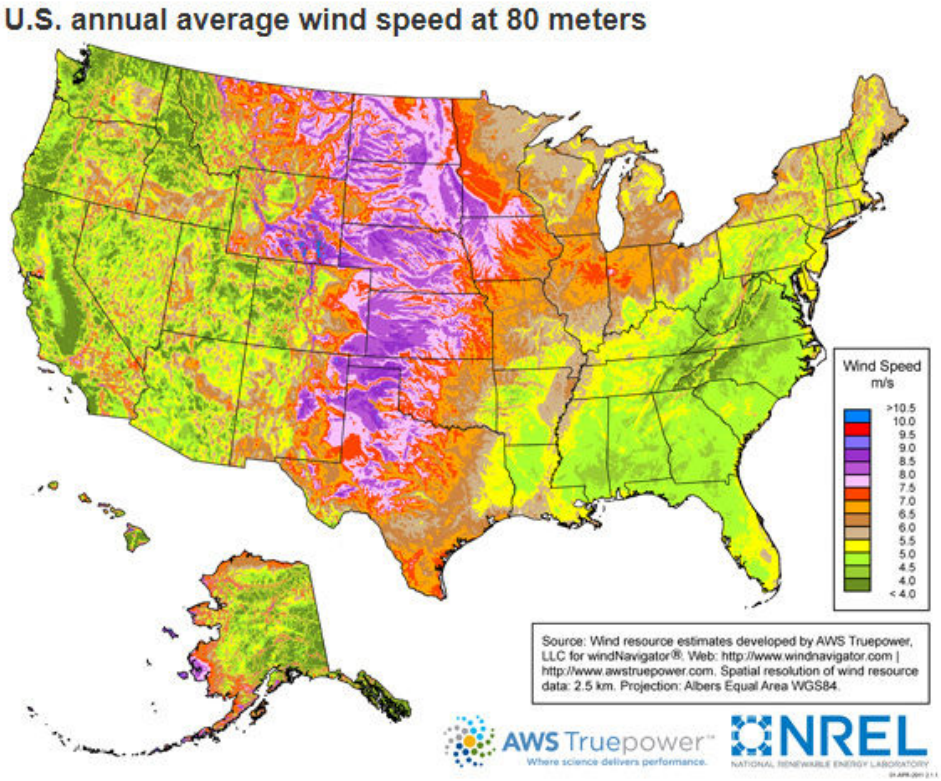
BRIEF

PG&E exits bankruptcy, but long-term wildfire risk could put it 'back in the soup'

PacifiCorp: Wildfire Insurance Costs Pose 'Material Threat' to Financial Stability

CLEARING UP • September 8, 2023

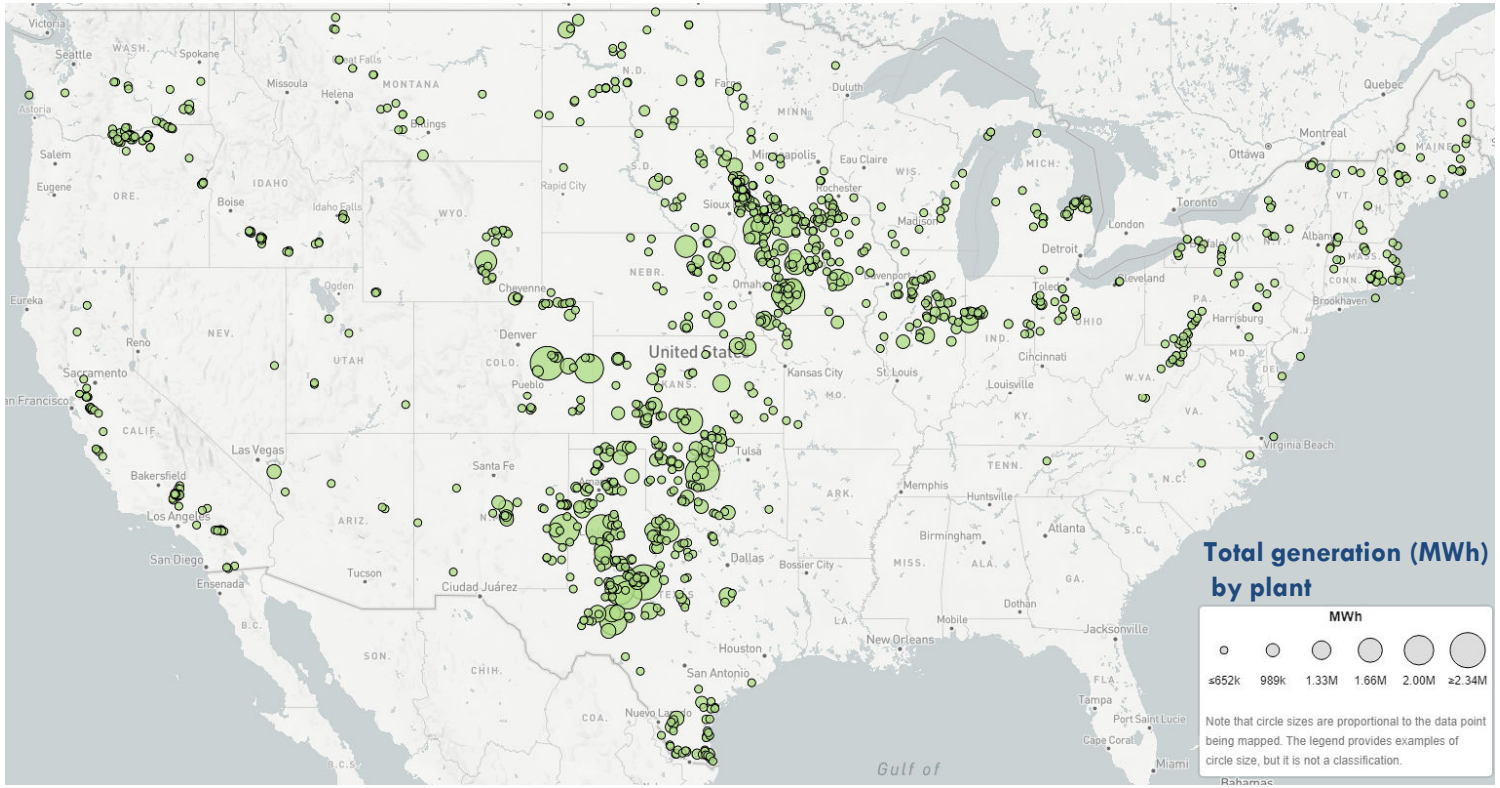
Siting Delays: *Land-Use Conflicts*



"…you have to question whether people (and animals) living in and near the areas represented by the brown to purple coloration …will have an ***unending appetite*** *for more-and-more industrial wind farms."* Me

Wind = *1.62%* of *Primary Energy*

- ✓ ***75,000 Industrial Wind Turbines Today***
- ✓ ***Exponential Ecological Impacts with more than Fractional Primary Energy Contributions***



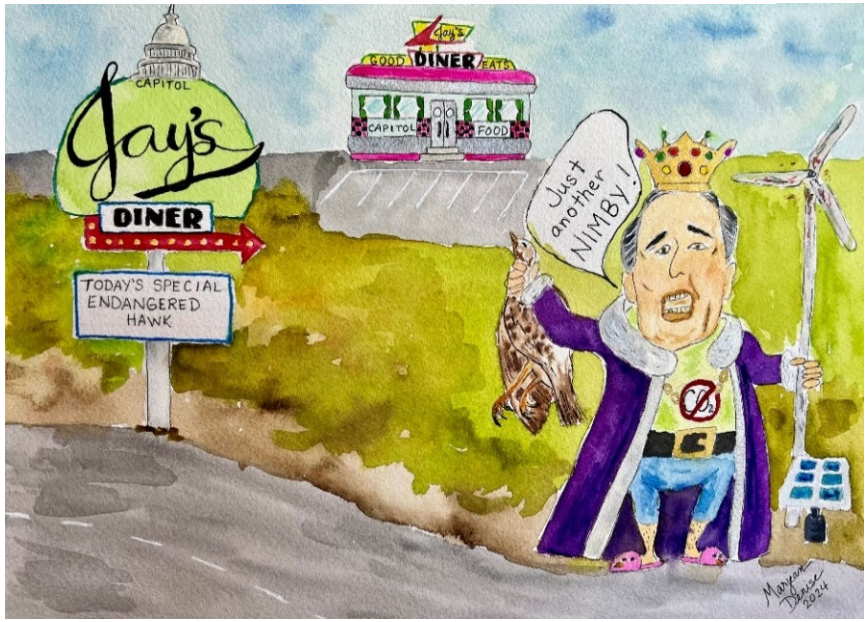
Source: epa.gov/egrid/data-explorer

Inflaming the Rural/Urban Divide: *"Green Tyranny"*

Bold Action or Green Tyranny?

How Jay Inslee's Energy Policy Delusions and Hypocrisy are Inflaming the Urban-Rural Political Divide and Ignoring the Plight of an Endangered Species

RICK DUNN, P.E.
JUN 03, 2024



"You've got to break a few eggs to make an omelet".

Step 1

Replace Environmentalism with Climatism

Wrecking the Planet to "Save It"

Step 2

Regulatory Reforms

Preemption & Eminent Domain on Steroids

Step 3

Push the Grid to a Reliability Cliff

More wind & solar over a bigger area … and fast!

Step4

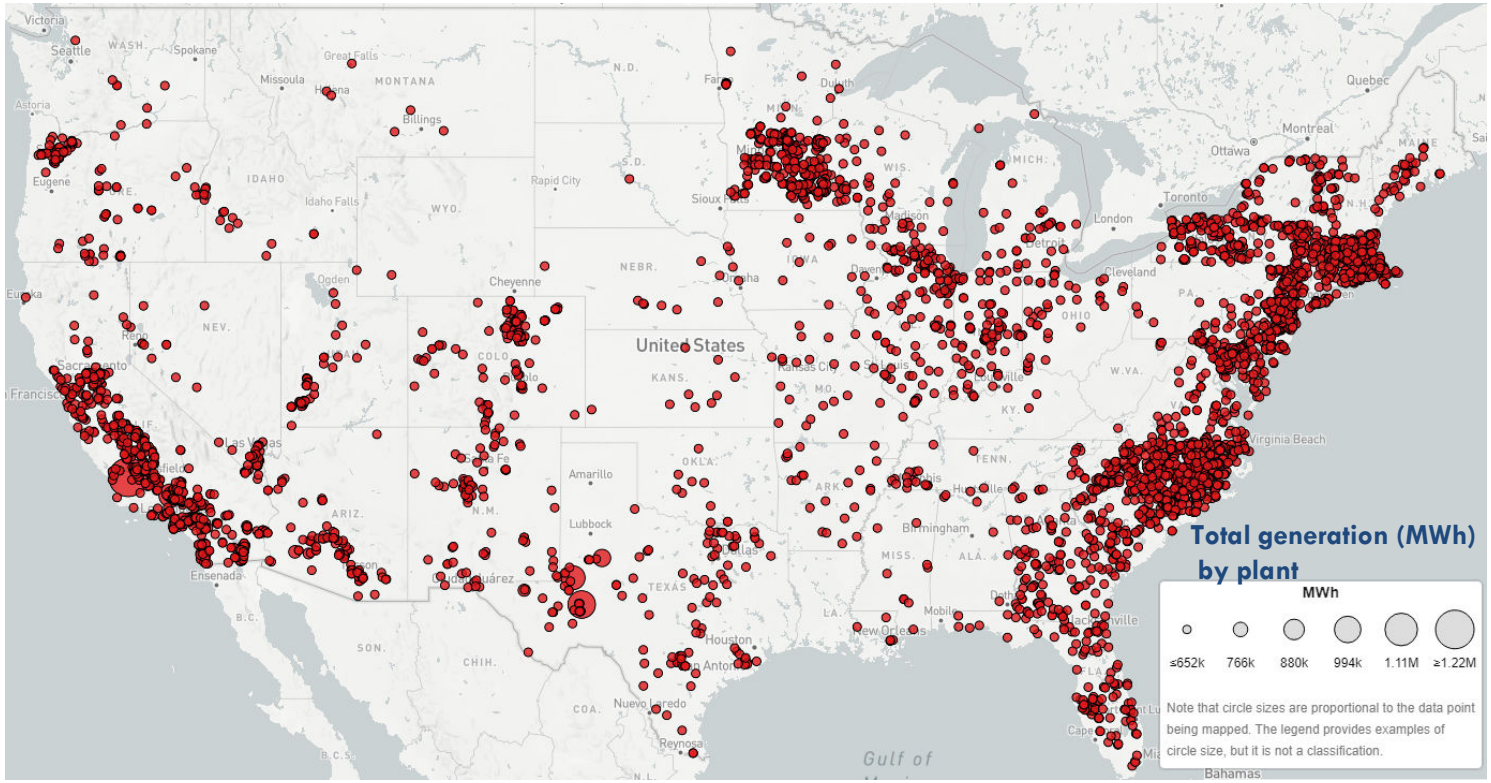
Propaganda

Our "bold actions" will change the future of the planet & there's no price too high for others to pay

https://rickdunn.substack.com/p/bold-action-or-green-tyranny

Solar = 0.99% of Primary Energy

- ✓ *500 to 600 million solar panels today*
- ✓ *1 billion solar panels in next 3 to 5 years*
- ✓ *25-Year Lifecycle*
- ✓ *No federal recycling mandate*
  - *Recycling costs*
  - *$30–$40 per panel*
  - *landfilling costs*
  - *$1–$20 per panel*



Source: epa.gov/egrid/data-explorer

Siting Delays: Land-Use Conflicts

Source: https://www.americanexperiment.org/reports/not-in-our-backyard

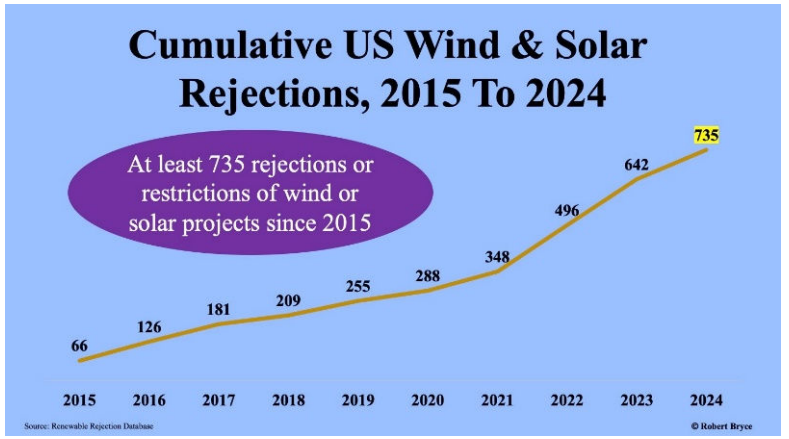
Land-use conflicts are a key issue today and those conflicts are already proving to be the limiting factor in the growth of renewables.

ROBERT BRYCE

Tally Of US Wind & Solar Rejections Hits 735

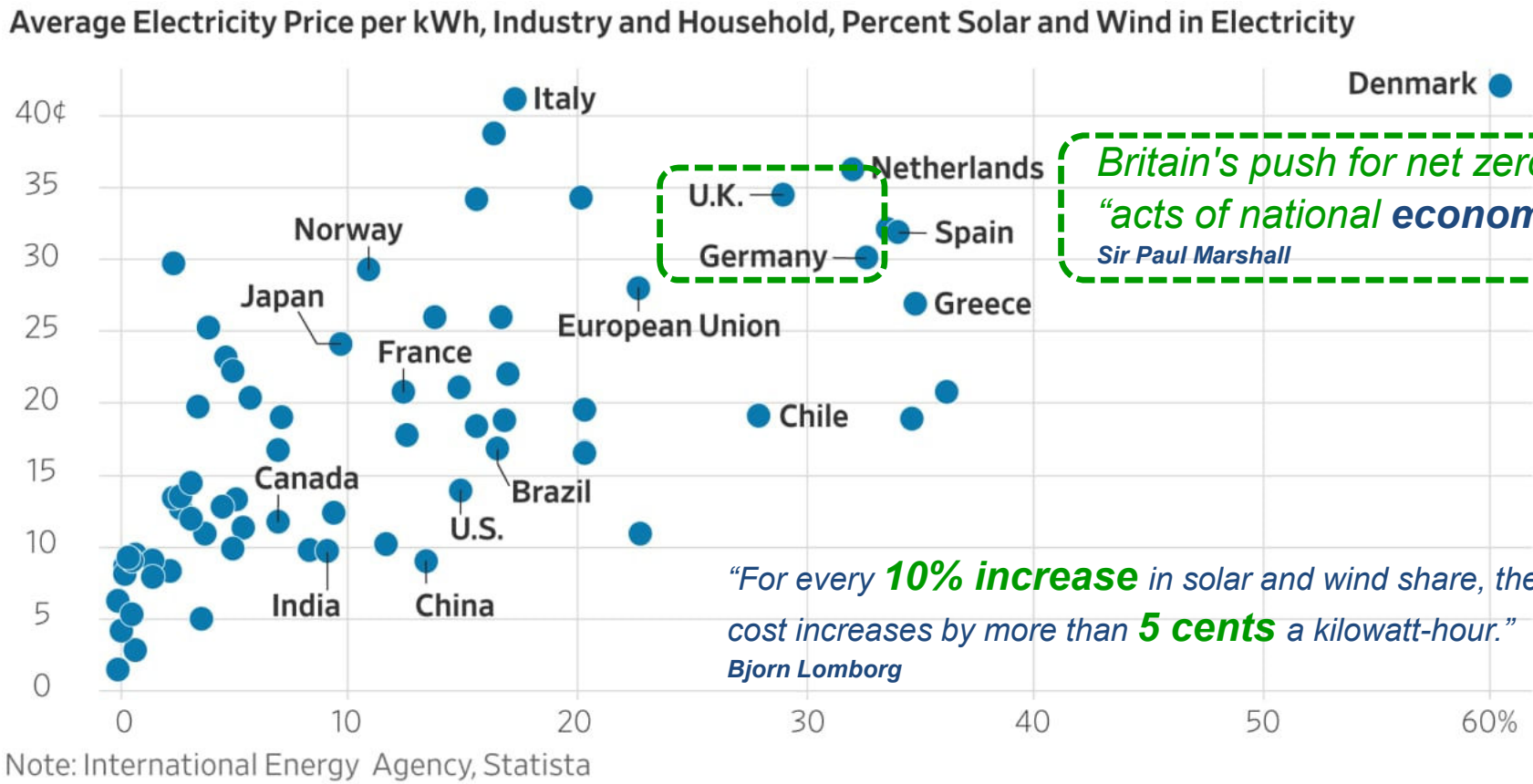
What the media, and academics, won't tell you about the raging backlash in rural America against Big Wind and Big Solar, in 10 charts

SEP 22, 2024



Tally Of US Wind & Solar Rejections Hits 735 - Robert Bryce (substack.com)

Increased Costs: "Cheap" Wind & Solar is a Lie

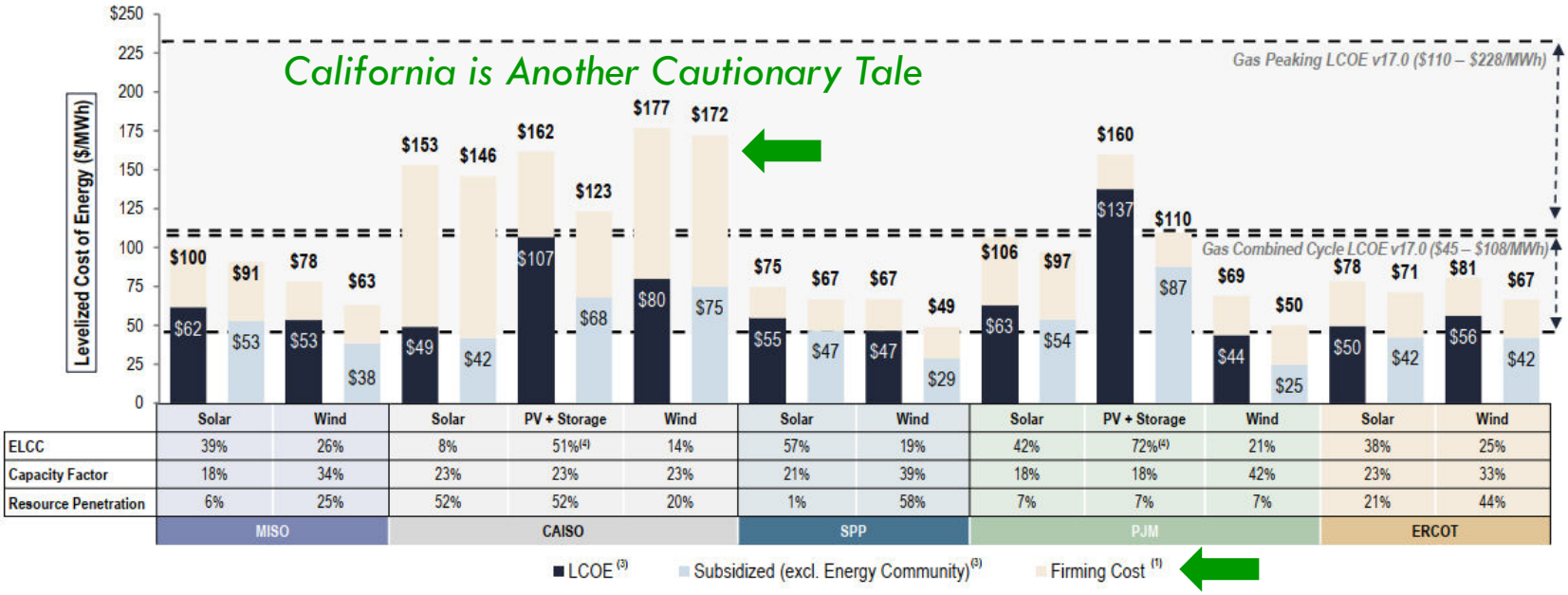


Britain's push for net zero are:
"acts of national ***economic suicide****."*
Sir Paul Marshall

"For every ***10% increase*** *in solar and wind share, the electricity cost increases by more than* ***5 cents*** *a kilowatt-hour."*
Bjorn Lomborg

Coming 'Clean': *Wind & Solar Firming Costs*

LCOE Including Levelized Firming Cost ($/MWh)[3]



	Solar	Wind	Solar	PV + Storage	Wind	Solar	Wind	Solar	PV + Storage	Wind	Solar	Wind
ELCC	39%	26%	8%	51%[4]	14%	57%	19%	42%	72%[4]	21%	38%	25%
Capacity Factor	18%	34%	23%	23%	23%	21%	39%	18%	18%	42%	23%	33%
Resource Penetration	6%	25%	52%	52%	20%	1%	58%	7%	7%	7%	21%	44%
	MISO		CAISO			SPP		PJM			ERCOT	

Source: *Lazard and Roland Berger estimates and publicly available information.*

Note: Total LCOE, including firming cost, does not represent the cost of building a 24/7 firm resource on a single project site, but, instead, the LCOE of a renewable resource and the additional costs required to achieve the resource adequacy requirement in the relevant reliability region based on the net cost of new entry ("Net CONE"). ISO ELCC data as of April 2024.

(1) Firming costs reflect the additional capacity needed to supplement the net capacity of the renewable resource (nameplate capacity * (1 – ELCC)) and the Net CONE of a new firm resource (capital and operating costs, less expected market revenues). Net CONE is assessed and published by grid operators for each regional market. Grid operators use a natural gas peaker as the assumed new resource in MISO ($8.22/kW-mo), SPP ($8.56/kW-mo) and PJM ($10.20/kW-mo). In CAISO, the assumed new resource is a 4-hour lithium-ion battery storage system ($18.92/kW-mo). For the PV + Storage cases in CAISO and PJM, assumed storage configuration is 50% of PV MW and 4-hour duration.

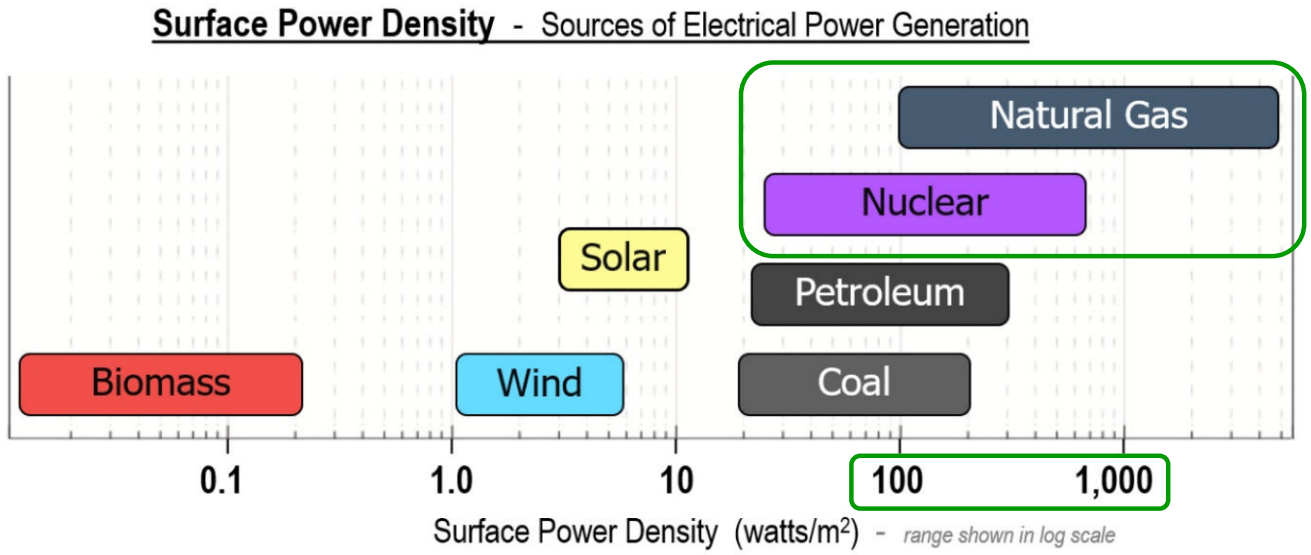
(2) ELCC is an indicator of the incremental reliability contribution of a given resource to the electricity grid based on its contribution to meeting peak electricity demand. For example, a 1 MW wind resource with a 15% ELCC provides 0.15 MW of capacity contribution and would need to be supplemented by 0.85 MW of additional firm capacity in order to represent the addition of 1 MW of firm system capacity.

(3) Reflects the average of the high and low of Lazard's LCOE v17.0 for each technology using the regional capacity factor, as indicated, to demonstrate the regional differences in project costs.

(4) For PV + Storage cases, the effective ELCC value is represented. CAISO and PJM assess ELCC values separately for the PV and storage components of a system. Storage ELCC value is provided only for the capacity that can be charged directly by the accompanying resource up to the energy required for a 4-hour discharge during peak load. Any capacity available in excess of the 4-hour maximum discharge is attributed to the system at the solar ELCC. ELCC values for storage range from 90% to 95% for CAISO and PJM.

LAZARD

Rebalancing The 3-Legged Stool: *Finding Common Ground*



(image source: Ecotech Advisors, Inc. Only renewable energy sources that are site agnostic are considered. Data source: "The spatial extent of renewable and non-renewable power generation: A review and meta-analysis of power densities and their application in the U.S." (John van Zalk & Paul Behrens, 2018))

What if we built:

- ✓ **As Little Transmission as Absolutely Necessary**
- ✓ **Reliable Generation Plants**
  - ***Energy-Dense with small-footprints***
  - ***Low or no-CO_2***
  - **Closer to where people live**

Best of the Above!

Big Tech Knows: *Reliable = Nat Gas + Nuclear*

Big Tech's "Dirty Little Secret"

Natural Gas Power + Renewable Energy Certificates

"Greenwashing"

https://rickdunn.substack.com/p/wind-and-solar-green-industry-fantasyland

Wind & Solar 'Green Industry' Fantasyland #1

How 'Big Tech's' 100% renewable deception, detached from reality politicians, and the legacy of Northwest hydropower are fueling false hopes of industrial development in Washington and Oregon.

RICK DUNN, P.E.
FEB 25, 2024

CNBC MARKETS BUSINESS INVESTING TECH POLITICS VIDEO INVESTING CLUB PRO LIVESTREAM

ENERGY

AI could drive a natural gas boom as power companies face surging electricity demand

PUBLISHED SUN, MAY 5 2024•6:53 AM EDT | UPDATED SUN, MAY 5 2024•12:00 PM EDT

Spencer Kimball
@SPENCEKIMBALL

SHARE

Driving Nuclear Renaissance

AWS acquires Talen's nuclear data center campus in Pennsylvania

Cloud company pays $650 million – plans 960MW campus

March 04, 2024 By: Dan Swinhoe Have your say

CNBC MARKETS BUSINESS INVESTING TECH POLITICS VIDEO INVESTING CLUB PRO LIVESTREAM

Constellation Energy to restart Three Mile Island nuclear plant, sell the power to Microsoft for AI

PUBLISHED FRI, SEP 20 2024•7:22 AM EDT | UPDATED 2 HOURS AGO

Spencer Kimball
@SPENCEKIMBALL

SHARE

Amazon Steps Up for *Site-1 SMR*

On-Line Goal = Early 2030s

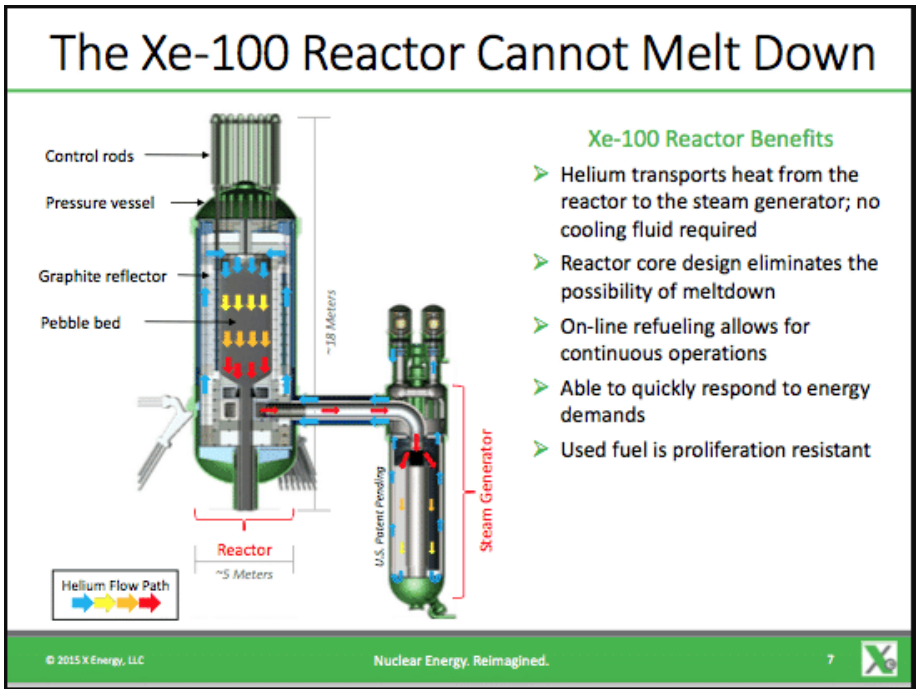
energy amazon

ENERGY NORTHWEST

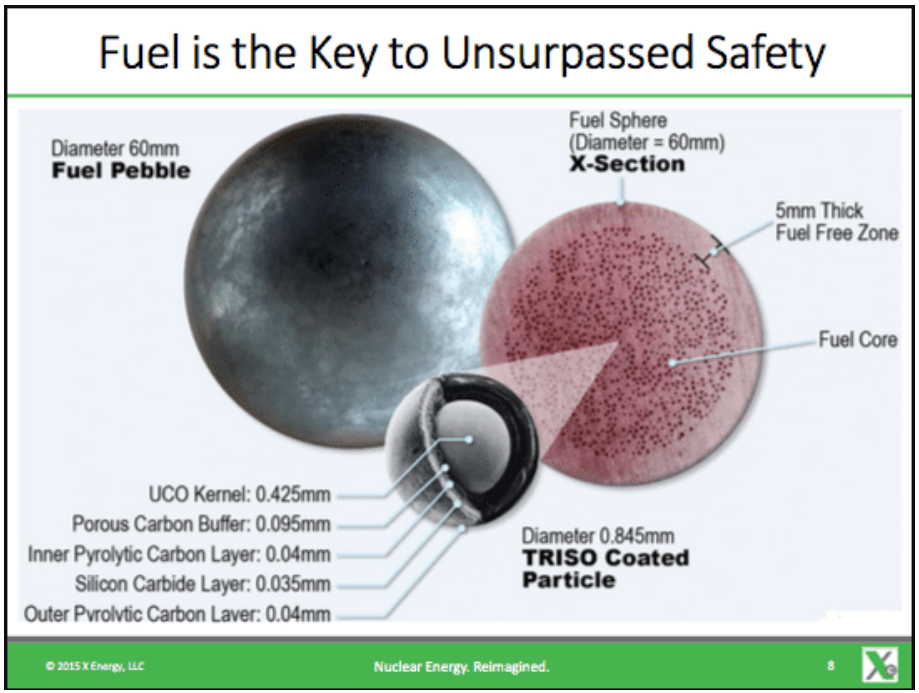
- ✓ Original ***ARDP*** Grant #1, now ***DOE Loan*** Program Office
- ✓ Amazon to purchase first ***4 modules***
- ✓ Energy Northwest has option to build additional ***8 modules***
- ✓ Additional power available to ***Amazon and northwest utilities***

Scalable, CO_2-Free, *Safe & Reliable*

Meltdown-Proof



Walk-Away-Safe



Closing Thoughts: *High Stakes Probability Game*

Possible Unserved Load

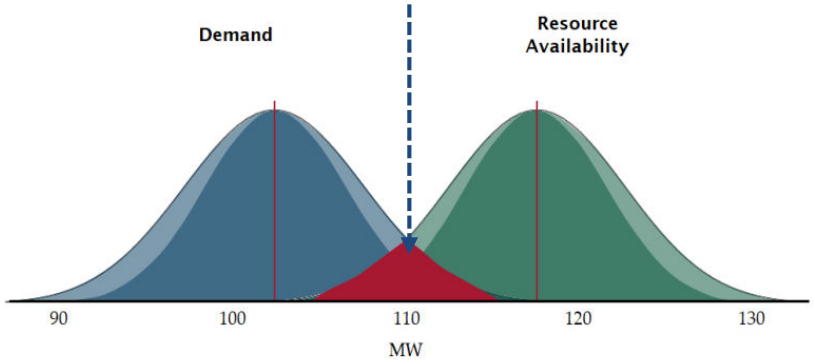


Figure 8: Demand and Resource Availability Curves Expanded Due to Variability

WECC Western Resource Adequacy Assessment 2021

- ✓ Most strained times on the system ***may not align*** with peak demand

- ✓ Planning entities should calculate Planning Reserve Margins based on ***energy*** instead of ***capacity***

Probability Wind & Solar Will:

- ✓ *Show Up During Capacity Critical Hours*
  - *Effective Load Carrying Capability (ELCC)*
    - *Wind is blowing & sun is shining **somewhere***

- ✓ *Be Built On Time & In the "**Right Location**"*
  - *Saturation & diminishing reliability contributions*

- ✓ *Show Up Over Consecutive Days (**Energy Challenge**)*

Other Thoughts from a Heretic:

- ✓ *Forces deepening dependence on exploitation of neighboring states and regions **disguised as cooperation and opportunity***

- ✓ *Requires states to surrender much **self determination***

Closing Thoughts: *Shifting Priorities*

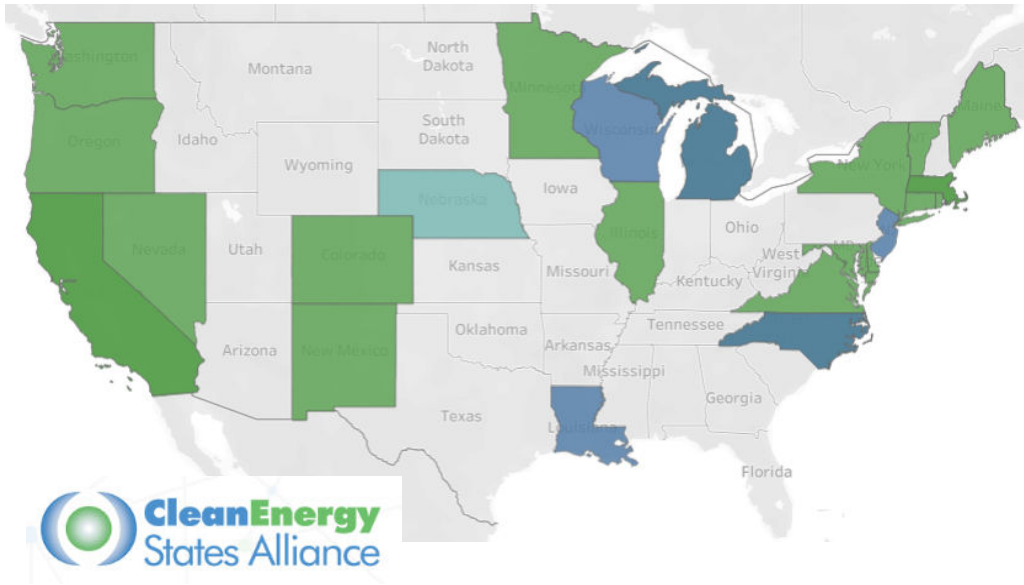
Charting a New Direction in U.S. Energy Policy or Irreconcilable Differences?

Secretary Wright Acts to "Unleash Golden Era of American Energy Dominance"

U.S. Secretary of Energy Chris Wright signed his first Secretarial Order today directing the Department of Energy to take immediate action to unleash American Energy in accordance with President Trump's executive orders.

- "Net-zero policies ***raise energy costs*** for American families and businesses, ***threaten the reliability*** of our energy system, and undermine our energy and national security."
- "They have also ***achieved precious little in reducing global greenhouse gas*** emissions."

100% Renewable/Carbon-Free



Closing Remarks: *Questions & Predictions*

1) Will "*dogmatic devotion*" to wind and solar give way to "climate & energy realism" before we go over a ***reliability cliff*** ?

2) What will become of PTC & ITC and "Permit Reform" ?

   - Opportunity to *question assumed* ***inevitability*** of wind & solar as foundational technologies
   - States looking to exploit their ***neighbors' landscapes*** may need to seriously recalibrate

3) Electricity Intensive ***Economic Development*** Opportunities

   - Onshoring ***manufacturing*** plus data centers & AI
   - Those with ***natural gas*** will be the "Haves"; others should prepare to be disappointed
   - Will some states and jurisdictions ***go the way of the UK*** and Germany?

Natural-Gas-to-Nuclear: *N2N*

Source: ChatGPT DALL•E

*"How about an energy future of **abundance and human flourishing**, not one based on unprecedented land grabs, intermittency, variability, and scarcity."* Me

- ✓ ***Reliable*** *& Resilient*
- ✓ *Energy-Dense &* ***Small Footprint***
- ✓ *Built Close to Where* ***People Live***
- ✓ *Forward Looking &* ***Globally Impacting***