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# Navigating the Energy Landscape in 2024



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# Today's Topics



Emerging  
Energy  
Trends

Constraints  
to Meeting  
Demand

Impacts to  
Site  
Selection

Future  
Outlook

# Energy Issues and Trends



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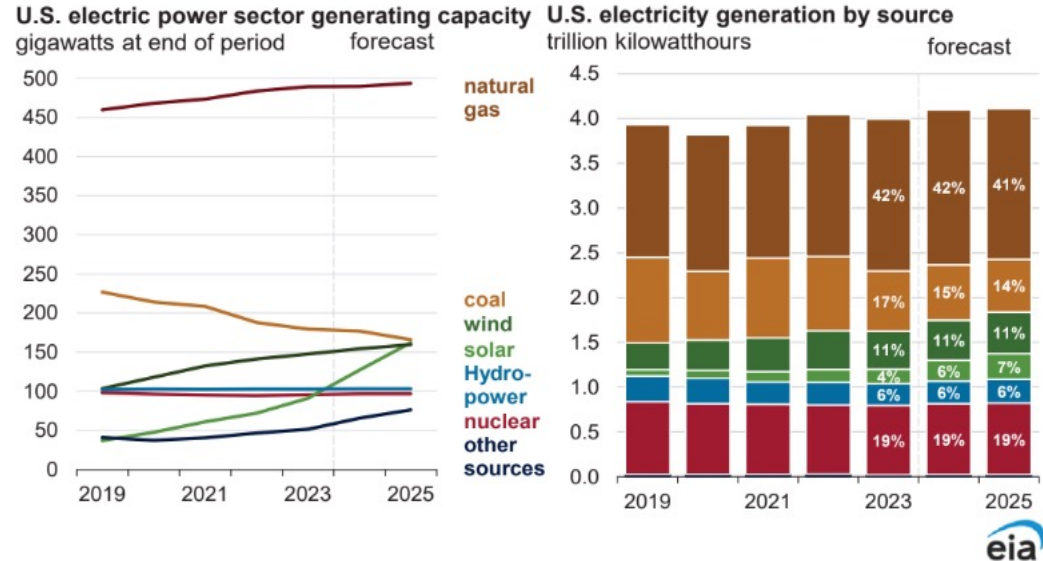


# Natural gas continues to be the leading source of US electric power generation, though new generation from gas is projected to be flat in the short-term while solar generation rises rapidly

The share of US generation fueled by natural gas will fall from 42% in 2023 to 41% in 2025

US coal generation is projected to falls from 17% last year to 14% by 2025

Solar will provide 6% of total US electricity generation in 2024 and 7% in 2025, up from 4% in 2023





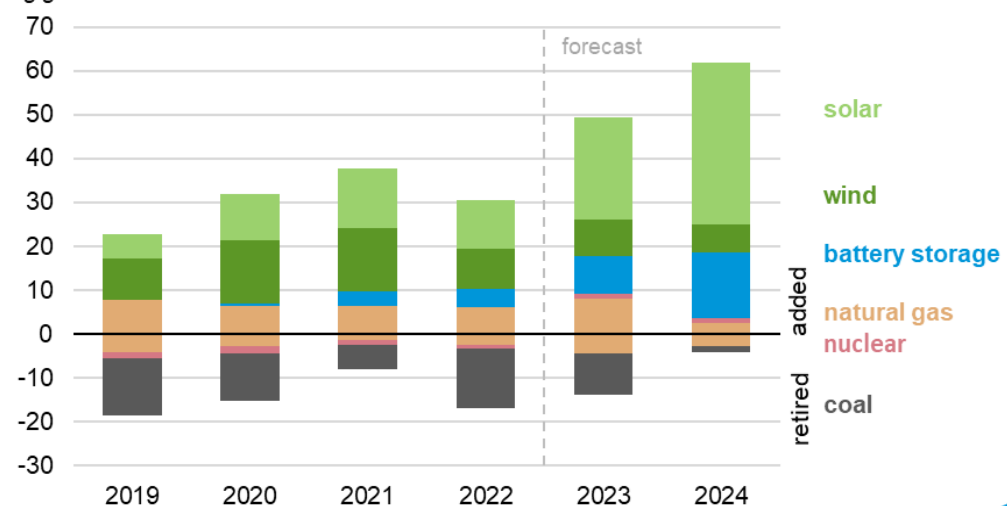
# Solar power and battery storage are forecasted to lead new electric power generation sources

The electric power sector added 19 gigawatts GW of solar capacity in 2023, a 27% increase

- 36 GW are projected to be added in 2024 and 35 GW in 2025
- Cumulative US grid-scale battery storage capacity roughly doubled in 2023, to ~18 GW and could reach 32 GW in 2024
- Renewables are set to provide more than one-third of total electricity generation globally by early 2025, overtaking coal

Production from wind and solar power worldwide was ~55% higher in 2023 than in 2020

Annual change in U.S. electric power sector generating capacity by source  
gigawatts



Data source: U.S. Energy Information Administration, *Short-Term Energy Outlook*, December 2023



# The short-term electricity price forecast for US industrial power was flat but prices rose in much of the country

Henry Hub natural gas spot price likely to remain below \$2.00 per MMBtu in 2Q24 as winter ends with natural gas inventories 37% above the five-year average

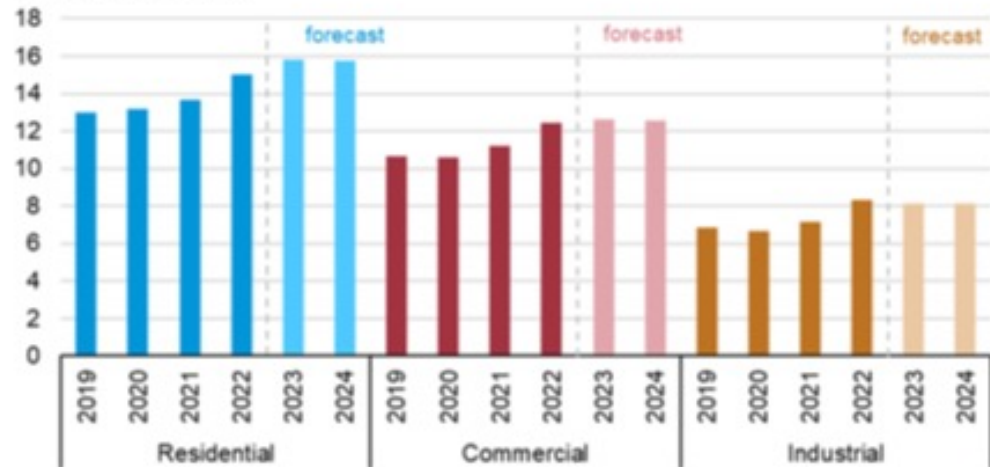
- Though futures pricing is increasing

While gas and fuel prices eased, power costs still rose in 2023:

- High interest rates
- Supply chain shortages
- Unprecedented damage from extreme weather, climate change, wildfires, natural disasters
- Cyber and physical security investment

Electricity prices for energy-intensive industries in the European Union in 2023 were almost double those in the US and China

U.S. average annual electricity price to ultimate customers, by sector  
cents per kilowatthour



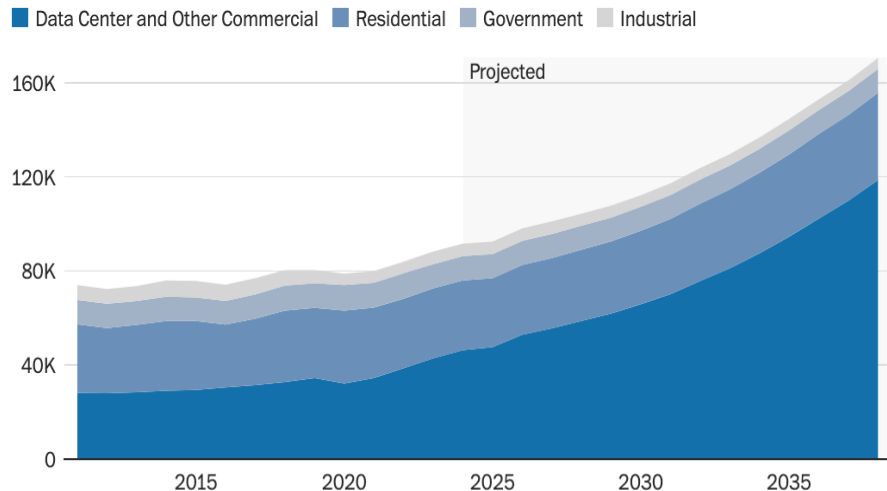
Data source: U.S. Energy Information Administration, Short-Term Energy Outlook, December 2023 eia



# Utilities are projecting a massive increase in electric power demand

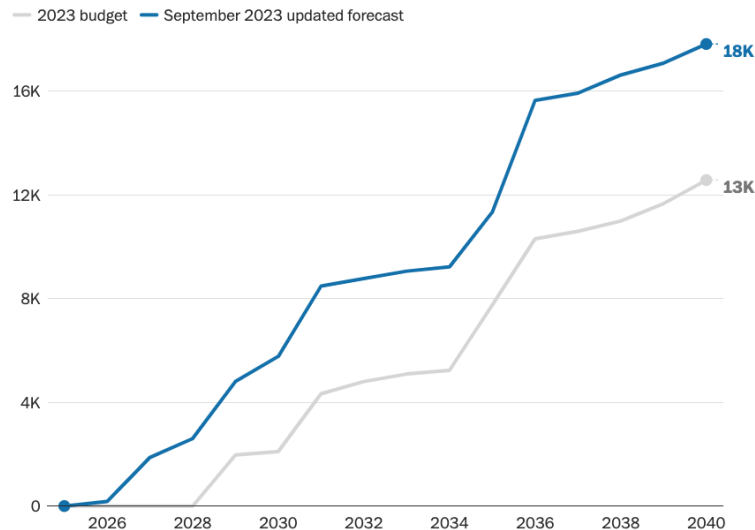


Dominion Energy customer demand in Virginia, in gigawatt hours



Source: Dominion Energy's Virginia Electric and Power Company Integrated Resource Plan

The amount of new electricity Georgia Power needs to bring online to meet projected winter demand, in megawatts.



Source: Georgia Power Integrated Resource Plan Update, September, 2023.



# Rapid demand increase combined with an aging, insufficient grid and generation system may be creating a perfect storm

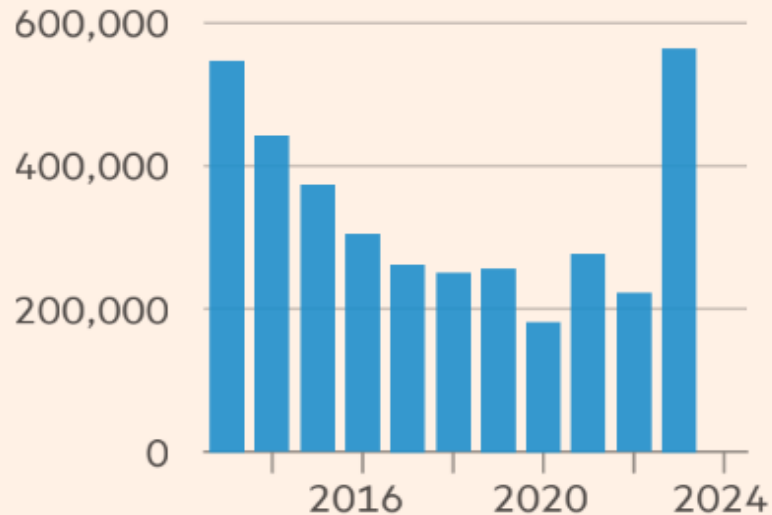
Demand for electric power is soaring in the US and across most of the industrialized world

- NERC has sharply increased projections for peak power demand for the next decade
- US peak summer demand is projected to grow by 38,000 MW in the next 5 years – like adding another California to the grid
- PJM Interconnection (the nation's largest regional grid) is expecting an additional 10,000 megawatts of demand by 2030 that wasn't forecast last year - akin to adding another New York City to the system

The largest driver of increased electricity demand was \$481B in industrial projects that have been announced since 2021, including the manufacturing of chips and batteries

- The second largest driver was the anticipated construction of \$150B in new data centers by 2028
- Clean technologies such as electric heat pumps, water heaters and cars a third driver

Energy load growth (GWh)



# Explosive growth in Data Center/AI could increase overall US power demand by 50% or more within 5 years



Data centers used 4% of US electricity in 2022 – that is projected to increase to 6% by 2026, and and continue to grow

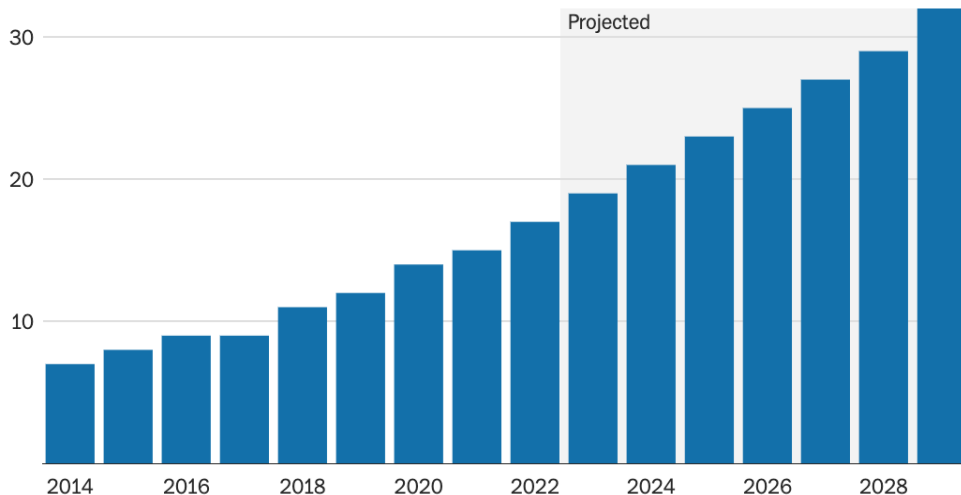
Electricity consumption from data centers, artificial intelligence and the cryptocurrency sector could double by 2026

Generative AI could increase data center demand for clean electricity up to 7X

Utility shortages caused by data center demands are happening in almost every US market

Northern Virginia reportedly needs the equivalent of several large nuclear power plants to serve the new data centers planned and under construction

Data center energy demand, in gigawatts. Each gigawatt is roughly the amount of power generated by a large nuclear plant.



Source: McKinsey and Company, January, 2023.

# Constraints to Meeting Demand



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# Demand to be Met – Global Issue



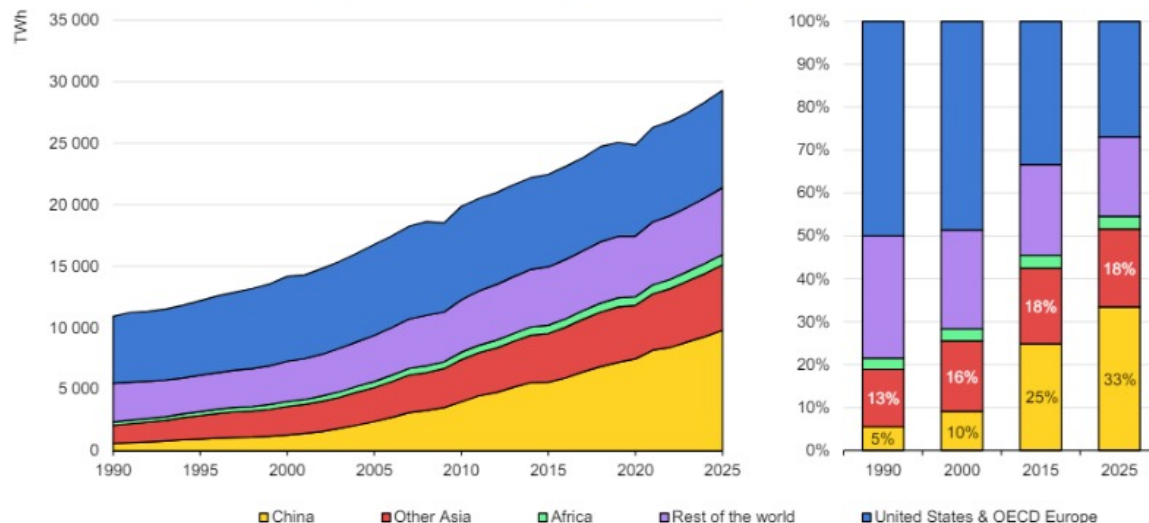
The U.S. is not the only location where demand for electricity is growing

Electricity Market Report 2023

Global overview

**By 2025, Asia will account for half of the world's electricity consumption and one-third of global electricity will be consumed in China**

Evolution of global electricity demand by region (left) and regional shares (right), 1990-2025



Source: International Energy Agency, Electricity Market Report 2023

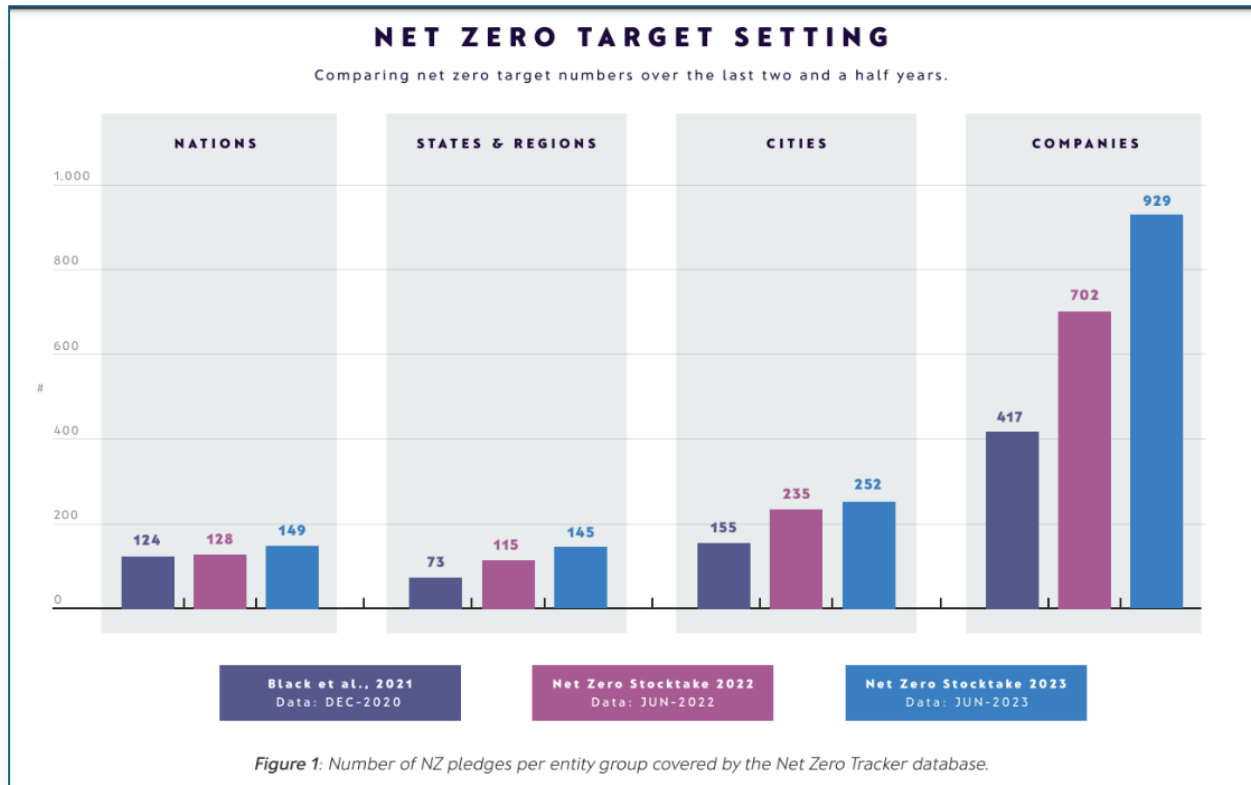
IEA, CC BY 4.0.

# Demand to be Met – Transition to Renewable



Setting aside net new aggregate demand, demand for **renewable** energy to replace traditional energy is growing, causing a strain on the (re)development of generation and transmission.

- More than 140 countries, including the biggest polluters – China, the US, India and the EU – have set a net-zero target, covering about 88% of global emissions.
- More than 9,000 companies, over 1000 cities, more than 1000 educational institutions, and over 600 financial institutions have joined the Race to Zero, pledging to take rigorous, immediate action to halve global emissions by 2030.
- 40%+ of Fortune Global 500 companies have either announced their intention to reach net-zero emissions by 2030 or have already achieved it.



# Constraints – Oh So Many



The aging US electric power grid is not ready for rapidly growing demand for power, and it certainly is not ready for the rapidly growing demand for distributed power

- Permitting delays for new generation and transmission projects are compounding the issue
- At the end of 2022 there was a queue of more than 2,000 GW awaiting interconnection, and average wait times were about five years, according to Federal Energy Regulatory Commission (FERC).
- Distribution can be an even bigger hurdle than transmission, with density, easements and congestion being challenges in urban areas and pure distance being an issue in rural areas.

Shortages of steel, aluminum, transformers, and other components are still delaying and disrupting power projects

Building the required transmission lines and transfer stations involves huge land acquisitions, exhaustive environmental reviews and negotiations to determine who should pay costs

Wind investment dropped 35% over the past year

- Higher costs and permitting challenges
- Projects are facing long delays, stretching out to 16 months, though 2024 is expected to see a turn around
- Push back on offshore wind

Massive transition to different forms of generation is not realistic over the short-term

- Utility executives are lobbying to delay the retirement of fossil fuel plants and bring more online.
- Soaring consumption is delaying coal plant closures in Kansas, Nebraska, Wisconsin and South Carolina.

# Limitations of Renewables

- High cost of installation
- High grid infrastructure costs
- Low generation per acre
- Supply chain challenges
- Intermittency
- Fuzzy math
- Subject to extreme weather





# Addressing Constraints



Billions awarded and more is likely coming under the Infrastructure Investment and Jobs Act for:

- grid reliability and resiliency
- battery supply chain development
- electric vehicle (EV) programs
- energy efficiency

IRA investment and production tax credits have made utility-scale solar and onshore wind, including projects paired with storage, competitive with marginal costs of existing conventional generation

- IIJA and IRA have had a big impacts on solar and storage - utility-scale solar captured announced investment of US\$92 billion across 38 states
- Could boost annual wind and solar new utility-scale solar, wind, and storage cumulative deployment to 850 GW by 2030

In 2024, developments in the seven selected hydrogen hubs move into design and planning, and the launch of the country's first end-to-end green hydrogen system

***This activity drives up the pipeline of projects awaiting interconnection approvals and demand for materials and equipment***

# Addressing Constraints



## Transmission and distribution remain a primary constraint for renewable energy deployment

- Interregional and regional transmission would need to more than double and quintuple, respectively, to meet high clean energy growth projections by 2035.
- DOE has announced plans to make its largest-ever investment in that part of the US energy network to
  - accelerate high-voltage transmission line permitting
  - funnel \$3.46 billion toward upgrading the country's aging electric grid
- FERC is working with Regional Transmission Organizations (RTOs) to improve the queuing process to prioritize “real” projects.

# Impacts of Energy Issues on Site Selection



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# Opportunities and Challenges



**From:** William Hearn <[william.hearn@origisenergy.com](mailto:william.hearn@origisenergy.com)>

**Sent:** Monday, November 14, 2022 1:41 PM

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**Subject:** RE: First Look: The State of Site Selection - REPLY

I was noticing that this MAY be the first year that renewable energy has made it into the survey AND that in fact it may be more of a highly ranking site selection issue.

This reflects the conversations I have had with Guild members – we also did a renewable break out session at the annual conference this year.

I can tell you there is a lot of confusion among the EDOs about this topic – from “its all good until the client realizes the cost,” - to “we really just hand this off to the utility.”

This topic is ripe for follow-up from the SSG and gets to our core mission. What do you guys think about follow-up (surveys or such) on this topic? There is so much going of from green hydrogen, solar and storage – changes in grid policy.

Dennis Donovan “This is the first time I have seen in my career a jump of a site selection criteria into the top tier of criteria” .... *paraphrasing*

# Expectations



## What is it that our customers need... what are they asking for?

- A site that will deliver the required power on time and at a budgeted cost
- No delays in the infrastructure development at the site as needed
- Strong partnerships at the utility
- If possible, low carbon power (renewable preferred)
- High levels of reliability

## New demands on site selection:

- Better information on site selection requirements on energy
- Better preparation on energy responses in general and site specific
- Solutions oriented approaches on energy issues

## General environment will remain for some time:

- challenges in securing energy across manufacturing / industrial / data center markets
- energy alone will also create opportunities

# Opportunities



## Market for Green Steel – sustainability advances in the supply chain

- SSAB – Perry County MS - Green Steel
- 700 permanent jobs / 7,000 construction jobs
- Federal Grant with HyStor Energy to produce fossil free iron
- Zero carbon off-grid green hydrogen with underground storage 24/7 dispatchable energy



## Energy to Meet Growing Demand across Technologies

- Kindle Energy – Combined cycle natural gas plant
- 750 million / 700 MW plant
- Merchant plant supplying energy to rural cooperatives
- 94 new jobs



# Evolving Requirements



## Continued interest in renewables to deliver on sustainability objectives?

- Will availability of renewables drive competitive advantage?
- Will such an advantage be decisive?
- What are the key site selection criteria that firms would consider?

## New demands on site selection/economic development:

- Understand energy profile of sites, particularly larger industrial sites.
- Understand and leverage key infrastructure (access to grid / substations / sub-surface storage / pipelines)
- Prepare in advance for large loads, with an eye on pre-approval, cost and timing.
- Uncertainty may prevail as firms assess alternatives - these decision models are relatively new.
- Become familiar with the energy development firms in your market... especially if options are signed for energy projects (e.g., solar).
- Don't shy away from solar as a non-job creating industry - it supports community image for some firms.
- To the extent possible, obtain information from clients on energy needs and work with utilities to develop scenarios.
- Align with existing industry on energy needs for future planning - if you are not solving for existing industry, someone else will.
- Work closely with utility economic development partners to understand upgrades and generation plans that impact your market – look to develop specialized collateral.

# Future Outlook



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# What Our Clients Want

- Hundreds of Megawatts
- Now
- Carbon Free
- New to the World
- Reliable
- Less than 5 cents per kWh



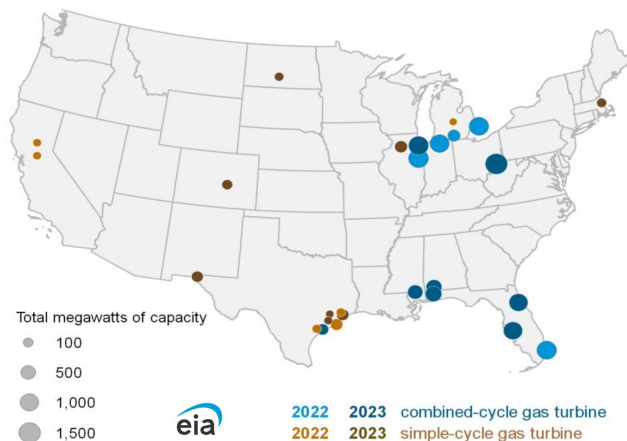
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# Natural Gas is Cheapest, Cleanest Fuel that is On-Demand

[New natural gas-fired capacity additions expected to total 8.6 gigawatts in 2023](#)

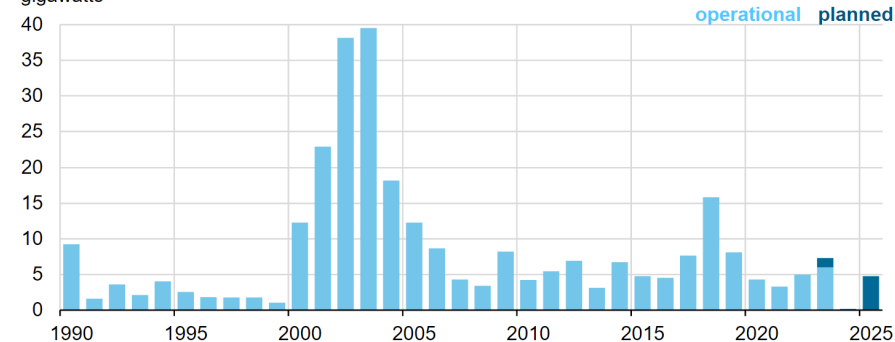
U.S. natural gas-fired electric generation capacity additions, simple-cycle and combined-cycle gas turbines (2022–2023)



Data source: U.S. Energy Information Administration, *Monthly Electric Generator Inventory*

Note: Data for 2023 include the Big Bend power plant, which, after a two-phased modernization project, began partial operations in 2021 and full operations in January 2023.

Annual U.S. combined-cycle gas turbine electric generation capacity additions (1990–2025)  
gigawatts



Data source: U.S. Energy Information Administration, *Monthly Electric Generator Inventory*

[Source: New natural gas-fired capacity additions expected to total 8.6 gigawatts in 2023 - U.S. Energy Information Administration \(EIA\)](#)

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# Amazon just bought a 100% nuclear-powered data center

Michelle Lewis | Mar 5 2024

- 1200 acres next to 2 GW nuclear plant operated by Talen Energy
- \$620 million
- Amazon will develop 960 MW data center complex
- Fixed price, long-term, high reliability, low-carbon
- Talen Energy formed Cumulus Data Assets in 2020 for precisely this reason – to converge “digital infrastructure and clean power.”

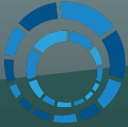


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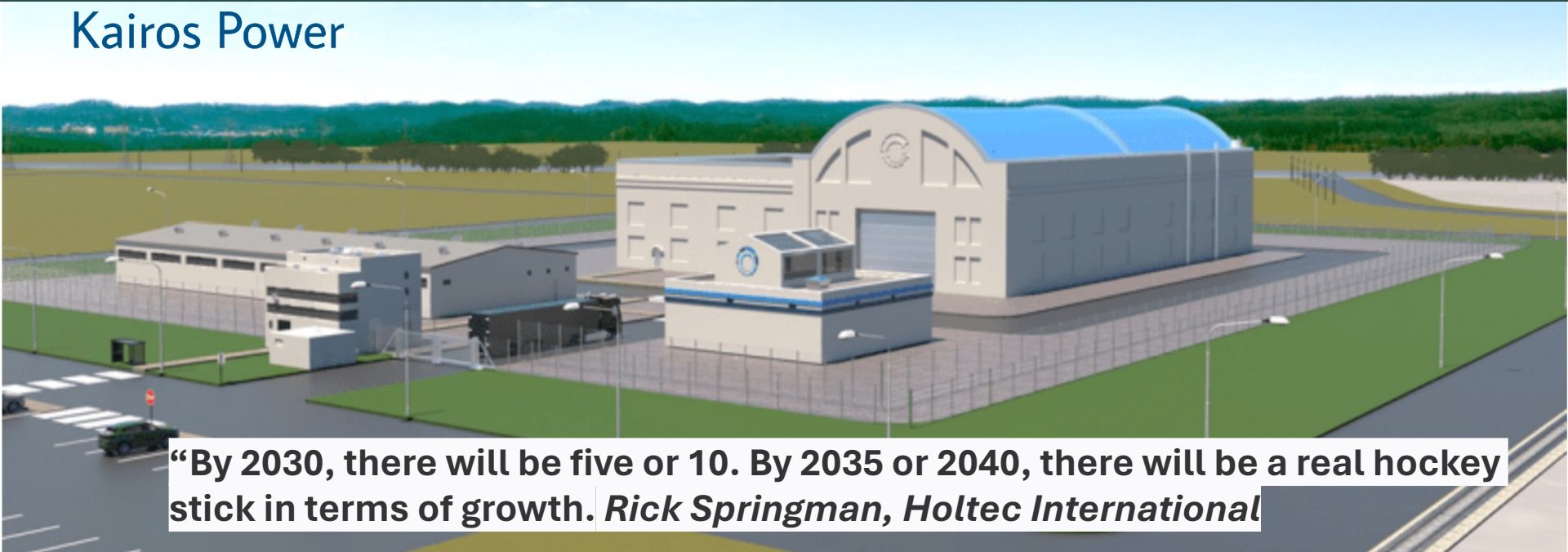
# NRC Approves Construction for Hermes Reactor



DECEMBER 12, 2023

*Oak Ridge, Tennessee*

Kairos Power



**“By 2030, there will be five or 10. By 2035 or 2040, there will be a real hockey stick in terms of growth. *Rick Springman, Holtec International*”**

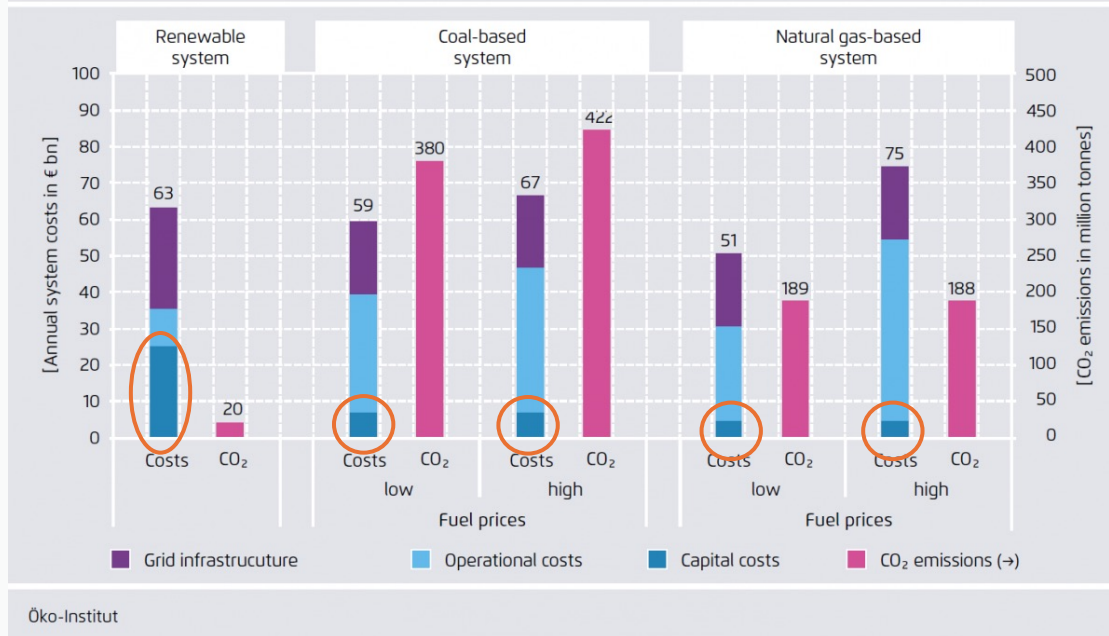
# Price Pressure on Utilities' Existing Customers



- Renewables have high capital costs, and the fuel is free
- Coal and gas have lower capital costs, most of cost are in the fuel
- Utilities are making costly investments for future generation based on today's rate payers
- In an environment where interest rates are higher

Comparison of total system costs of predominantly renewable, coal and natural gas-based power systems with CO<sub>2</sub> prices of €50, 2050

Figure S-1







## **Much of North America faces ‘elevated risk’ of blackouts in extreme winter conditions: NERC**

Climate change, rising energy demand and natural gas dependence mean “a massive grid disruption is inevitable,” said Mark Spurr, legislative director at the International District Energy Association.

Published Nov. 9, 2023



# The Reality



## Not enough supply to meet demand

Demand is growing quickly, supply will take a while to catch up generally

Not enough sites with the ability to meet demand within the time frame of the project



## Low Carbon is Desired

..but not required in the near term.

Energy is air

Low carbon is food



## Investment in Reliability is Critical

Reliance on renewables has destabilize the grid due intermittency issues

Gas is more reliable, but still subject to supply interruptions

Nuclear is low carbon and reliable

Coal, Diesel, Oil are examples of firm, dispatchable power not subject to supply issues



## We Need New Strategies

All-of-the-above generation mix

New financing and delivery models

# PRICE

# Resources



- *Power Hungry Podcast*, Robert Bryce
- *Shorting the Grid*, Meredith Angwin
- International Energy Agency [www.iea.org](http://www.iea.org)
- Edison Electric Institute [www.eei.org](http://www.eei.org)





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