

Christopher T. Halvorson

Christopher T. Halvorson is a founding member and the President of Magellan Scientific, LLC. Magellan is an off-grid, decentralized digital asset technology company working within blockchain ecosystems supporting the expanding digital infrastructure and advanced computing systems within North America.

Mr. Halvorson is also co-founder and the Chief Executive Officer (CEO) of Pin Oak Energy Partners, LLC, an Appalachian Basin Focused natural gas exploration, production and midstream company. Pin Oak Energy maintains over 3,000 natural gas & oil wells, operates 1,200 miles of midstream pipeline assets and controls nearly 210,000 net deep acres prospective to both Marcellus and Utica shale formations across Ohio, Pennsylvania and West Virginia.

Mr. Halvorson has more than 25 years of proven financial and corporate leadership experience. He has held board and leadership positions with a variety of public and private energy and technology companies. Prior to his co-founding of Pin Oak Energy, Mr. Halvorson was a managing member and Chief Financial Officer of Appalachian Basin Resources LLC (AB Resources). AB Resources was a private equity backed exploration and production company focused on unconventional hydrocarbon reservoirs in the Appalachian Basin (Pennsylvania, Northern West Virginia and Ohio). In addition, he served on the Board of Directors of C12 Energy, LLC from 2013 through 2015. C12 was a private equity backed, Denver Colorado based exploration and production company involved in enhanced and improved oil recovery projects across North America. Before his recent experience, Mr. Halvorson held management position with Exco Resources, Inc. (a Dallas Texas based oil & natural gas company) and North Coast Energy, Inc. (a Cleveland Ohio based oil & natural gas company). He began his professional career as a CPA with the accounting firm of Hauser+Taylor, LLP in Cleveland Ohio. He is a graduate from Indiana University at South Bend with degrees in both Accounting and Finance.

Mr. Halvorson is active within national, regional and statewide organizations that support and promote both the natural gas and oil industry along with Bitcoin and Blockchain technologies. His work includes, but is not limited to, the following organizations:

The Ohio Oil & Gas Association (OOGA)

Mr. Halvorson is member of the Board of Trustees for the Ohio Oil & Gas Association. In his role, Mr. Halvorson interacts with National, State and Local stakeholders and legislators to promote Ohio's natural gas and crude oil industry. The Ohio Oil and Gas Association's mission is to protect, promote, foster and advance the common interest of those engaged in all aspects of the Ohio crude oil and natural gas producing industry. OOGA represents the people and companies directly responsible for the production of crude oil, natural gas, and associated products in Ohio.

Marcellus Shale Coalition (MSC)

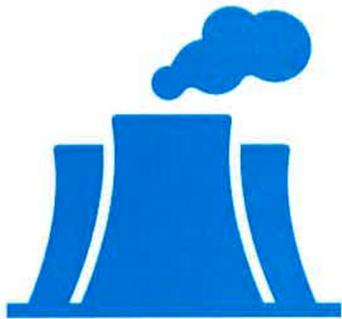
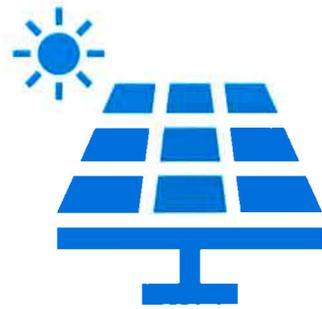
Mr. Halvorson is Board Member of the Marcellus Shale Coalition. The Marcellus Shale Coalition works with exploration and production, midstream and supply chain partners in the Appalachian Basin and across the country to address issues regarding the production of clean, job-creating, American natural gas from the Marcellus and Utica Shale plays. The MSC provides in-depth information to policymakers, regulators, media and other public stakeholders on the positive effects responsible natural gas production is having on families, businesses, and communities across the region.

Ohio Blockchain Council (OBC)

Mr. Halvorson is an executive committee member and Treasurer of the Ohio Blockchain Council. The Ohio Blockchain Council is advancing Bitcoin and Blockchain technology in Ohio. The OBC committed to providing a unified industry voice in Ohio around it's four key initiatives: Education, Advocacy, Shareholder Engagement and Conduit to the Chamber of Digital Commerce.

Ohio Bitcoin Foundation (OBF)

Mr. Halvorson is a founding supporter of the Ohio Bitcoin Foundation. The Ohio Bitcoin Foundation is an education based 501(c)(3) focused on education legislators, regulator, stakeholders and the public in Ohio on the benefits of Bitcoin and Bitcoin network.



8/23/2022

# Bitcoin is Energy

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Chris Halvorson  
President, Magellan Scientific, LLC



When we had clunky, power hungry, suitcase-sized bag phones in the 1980's we couldn't have imagined our modern energy efficient smart phones.

Where would we be if we condemned computing because of extremely high energy use, inefficient mainframes computers from the 1950's?



# Bitcoin is Energy

The Proof of Work (POW) protocol is the backbone of the Bitcoin global blockchain network that provides security, stability, immutability and sovereignty.

We shouldn't shy away from the relationship between Bitcoin and energy, but instead, lean into Bitcoin's energy use as a tool to help grow more efficient, sustainable electrical systems

What will Bitcoin, Decentralized Finance (DeFi) and Cryptocurrencies look like in 5-, 10- or 20-years?

What did this industry look like 5-years ago? How much has it changed?

No industry is perfect in its initial phase

Industries mature and become more efficient over time with investment

# Bitcoin helps solve many of the challenges we have with our existing electrical system

Bitcoin can help “balance” the grid by consuming excess power during off-peak periods

Bitcoin makes uneconomic power generation projects (i.e., renewables) economic by support baseload energy consumption and shutting down when power needs to be dispatched to the grid

Bitcoin allows energy to be produced at the source (geothermal in remote NV, wind in southern Argentina and Chile, solar in the Middle East)

Bitcoin is an economic battery. Excess energy can be used to generate Bitcoin. That Bitcoin can then be sold to buy energy during peak consumption

How is TX taking advantage of Bitcoin mining to strengthen the ERCOT grid?

# Bitcoin miners say they're helping to fix the broken Texas electric grid

*(CNBC.com, December 2021)*

- Through “demand response” programs, ERCOT will pay major industrial users [like large Bitcoin mining facilities] to cut power when power is needed for the grid
- This is where bitcoin mining comes into play. Miners function as “interruptible load,” meaning they are able to turn off their machines with a few seconds’ notice when the grid needs extra power
- This arrangement makes good economic sense for Bitcoin miners. Bitcoin miners commit to buying a certain amount of power, and either use it for mining if the grid doesn’t need it, or sell it back at a profit if the grid demands it
- Texas Bitcoin miners are building facilities where wind and solar are abundant and the transmission system is constrained, meaning that power wants to flow down the line, but the lines are full. These mines will absorb abundant renewable energy at times when supply outpaces demand

How is TX taking advantage of Bitcoin mining to strengthen the ERCOT grid (part 2)?

# Renewable Energy Now Powers 60% of Texas' BTC Mining Operations

*(Techstory, July 2022)*

- Solar and wind power are intermittent, meaning they can't be counted on to produce electricity around the clock
- Bitcoin miners are decentralized, they can choose to locate themselves wherever there is cheap electricity
- That means they can take advantage of periods of overproduction from renewable sources and help to even out the fluctuations in the grid
- In other words, bitcoin miners are helping to make renewable energy more reliable and predictable while making renewable development more economic

# In the Bitcoin Mining World, Low-Cost Energy Wins

Energy is always cheapest when generated and consumed nearest to its fuel source

Enter...Pennsylvania!!



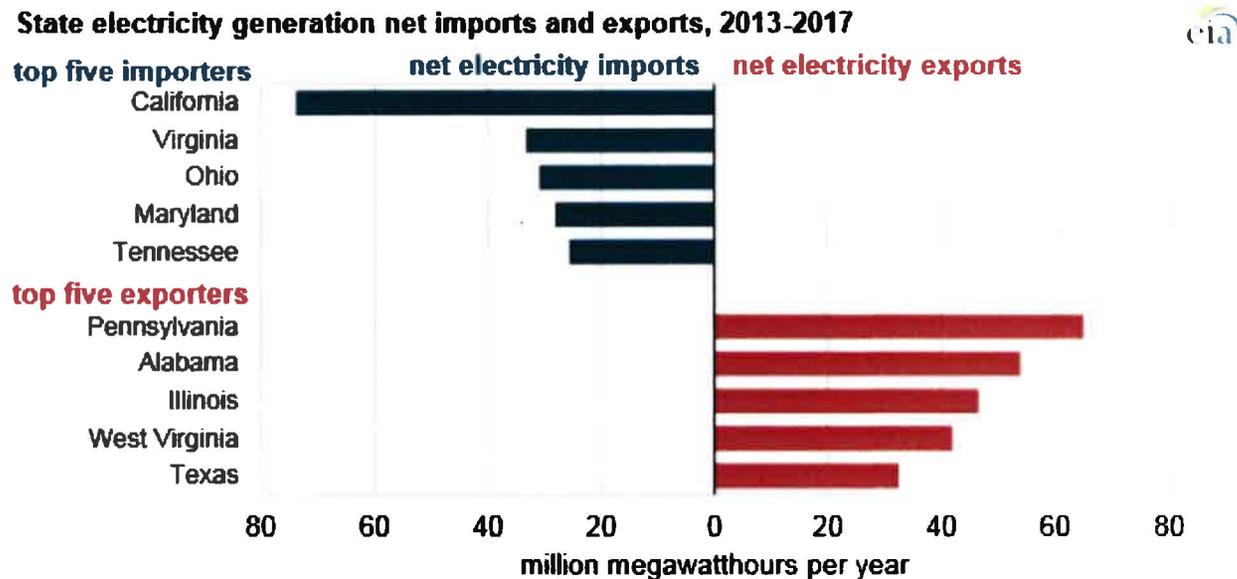
# Report: Pennsylvania largest net exporter of electricity in U.S. (4/19/21)

Pennsylvania was the largest net exporter of electricity in the United States from 2013-2017, according to the U.S. Energy Information Administration (EIA).

The EIA said Pennsylvania sent an annual average of 59 million megawatt hours of electricity to other states.

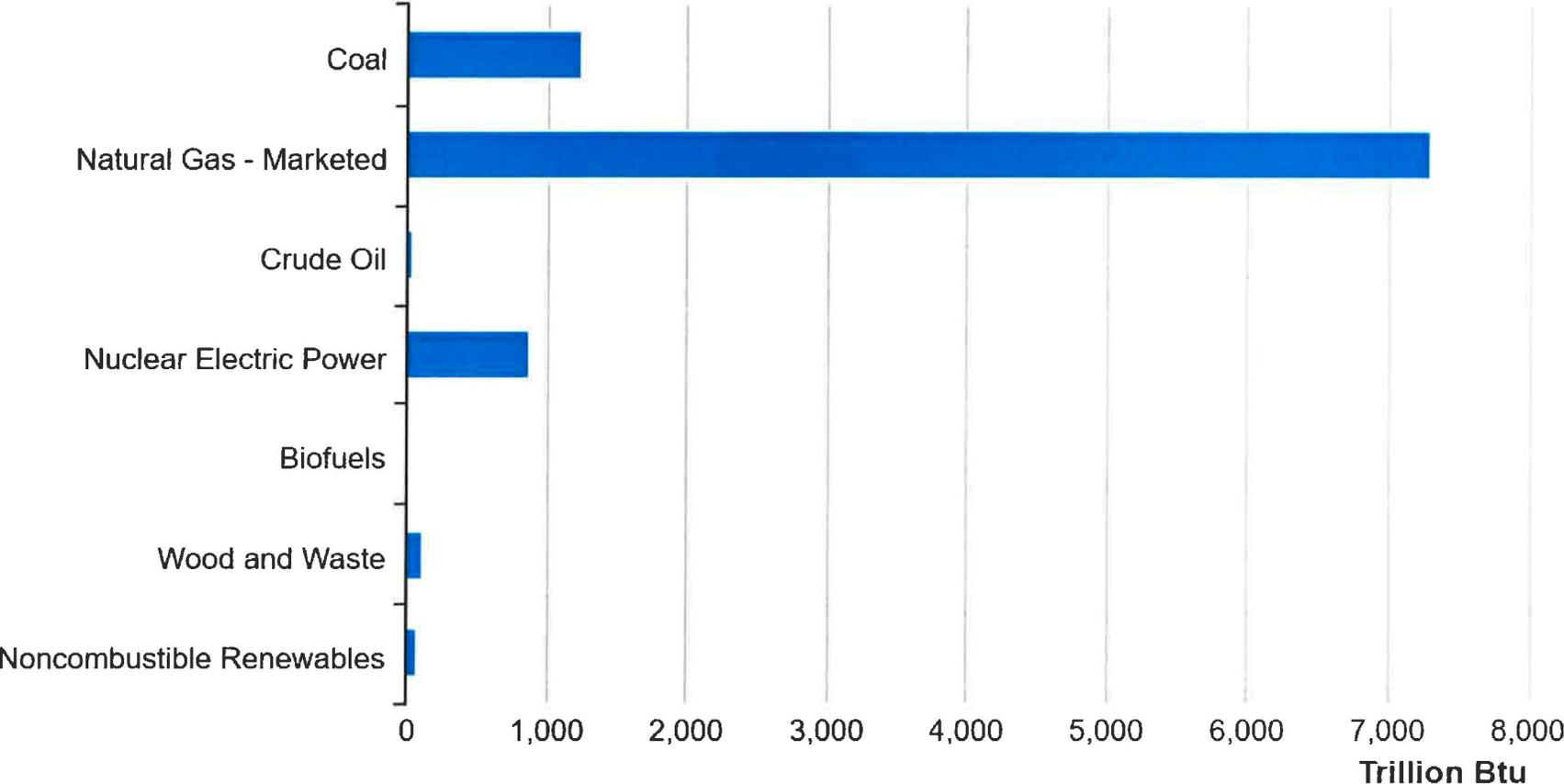
Pennsylvania's wealth of energy fuel resources helps explain its status as the top electricity exporter in the Lower 48, according to the EIA .

The Appalachian region — Pennsylvania, Ohio and West Virginia (Marcellus and Utica shales) — remained the largest natural gas-producing region in the United States in 2018.



# Pennsylvania Energy Production Estimates, 2019

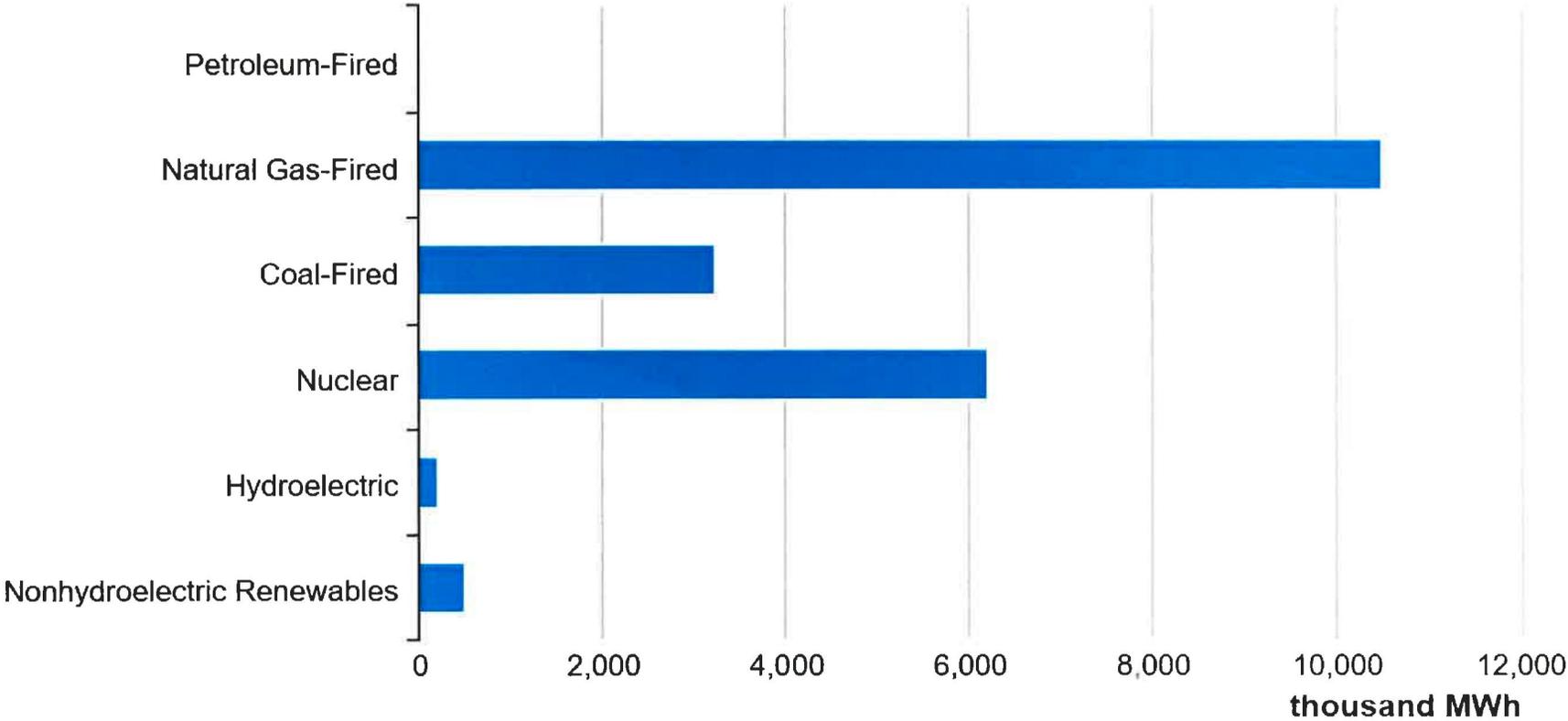
 [DOWNLOAD](#)



Source: Energy Information Administration, State Energy Data System

# Pennsylvania Net Electricity Generation by Source, Feb. 2022

 [DOWNLOAD](#)



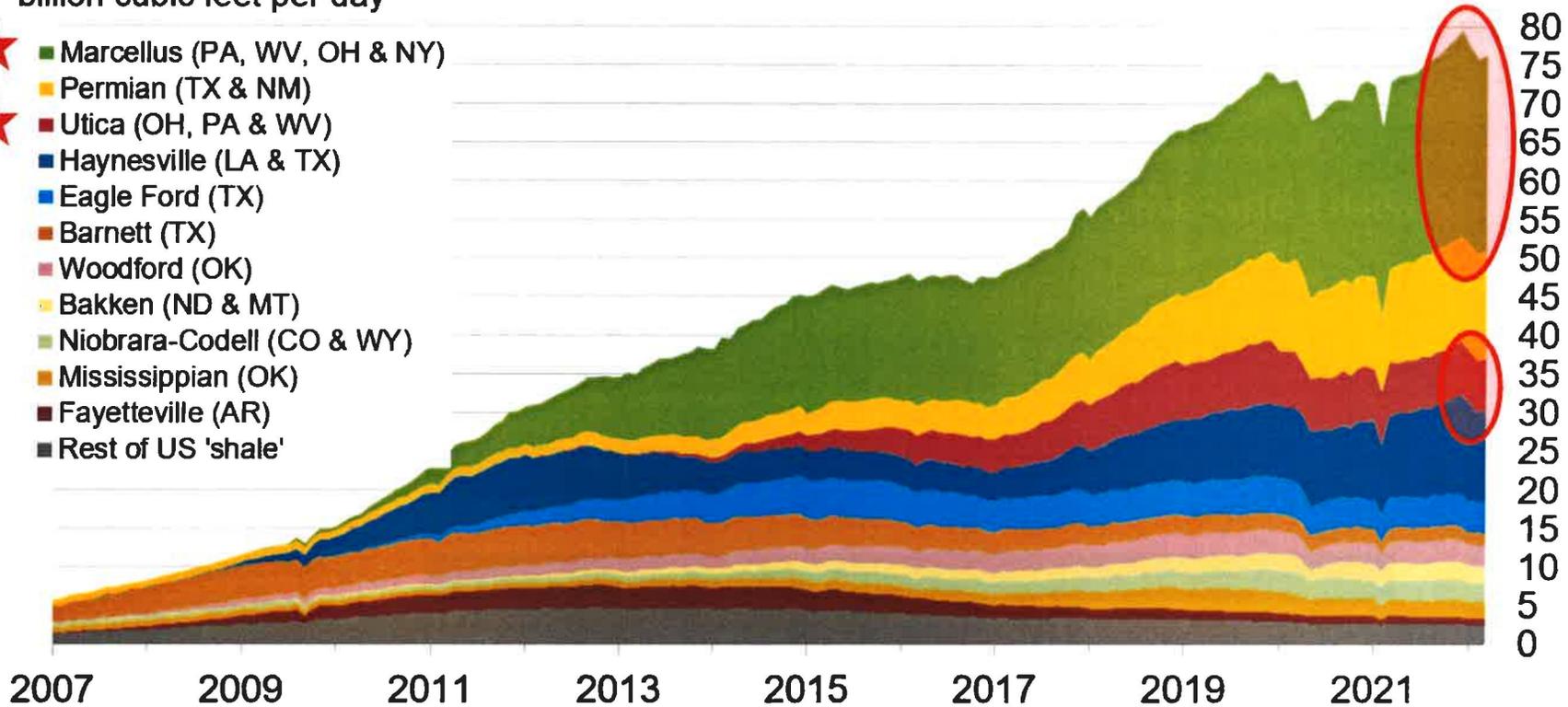
 Source: Energy Information Administration, Electric Power Monthly

# Monthly dry shale gas production

billion cubic feet per day



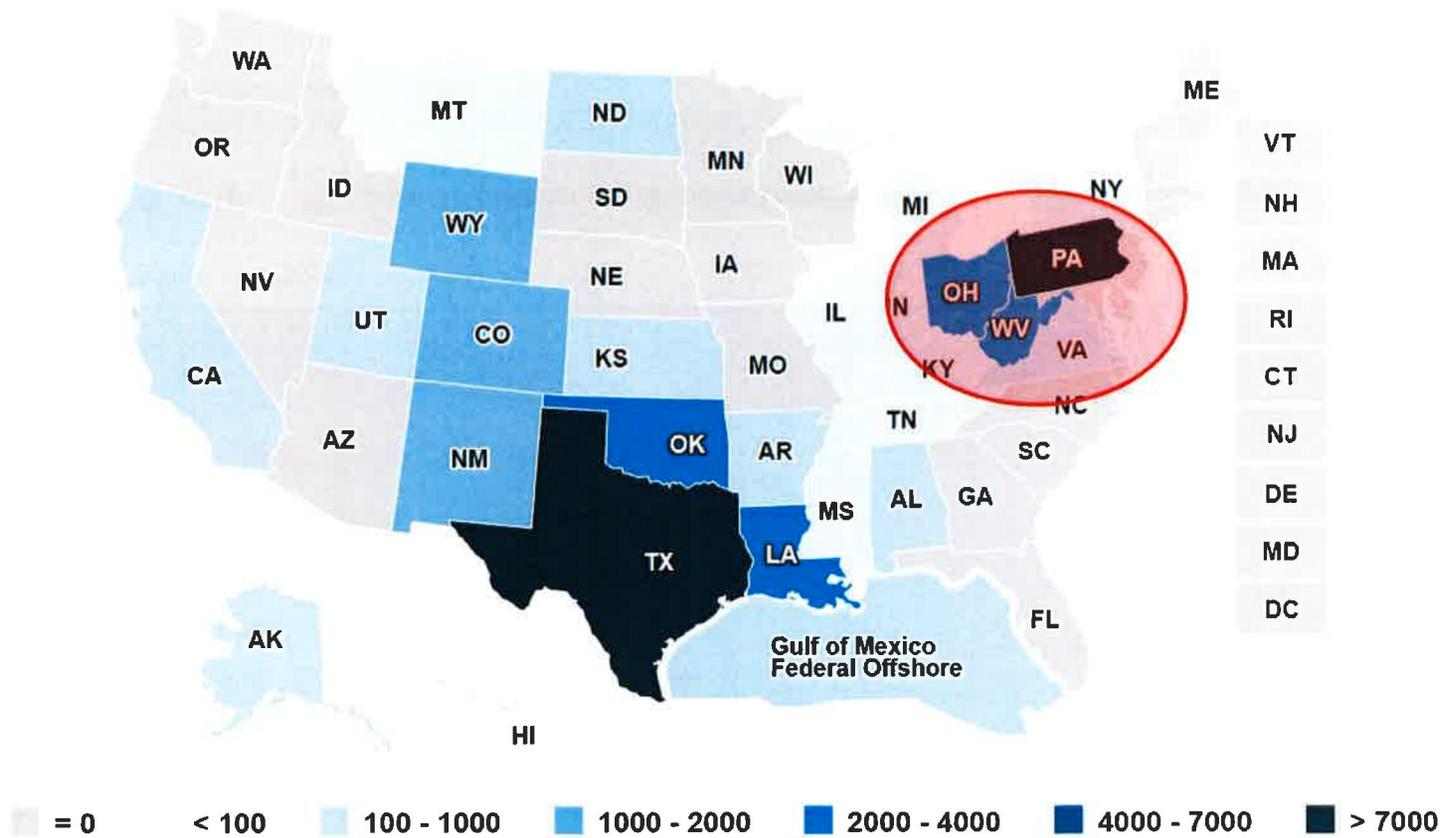
- ★ Marcellus (PA, WV, OH & NY)
- ★ Permian (TX & NM)
- Utica (OH, PA & WV)
- Haynesville (LA & TX)
- Eagle Ford (TX)
- Barnett (TX)
- Woodford (OK)
- Bakken (ND & MT)
- Niobrara-Codell (CO & WY)
- Mississippian (OK)
- Fayetteville (AR)
- Rest of US 'shale'



**43%+ Natural Gas production comes from the Marcellus and Utica Shales**

# U.S. dry natural gas production by state in 2020

billion cubic feet

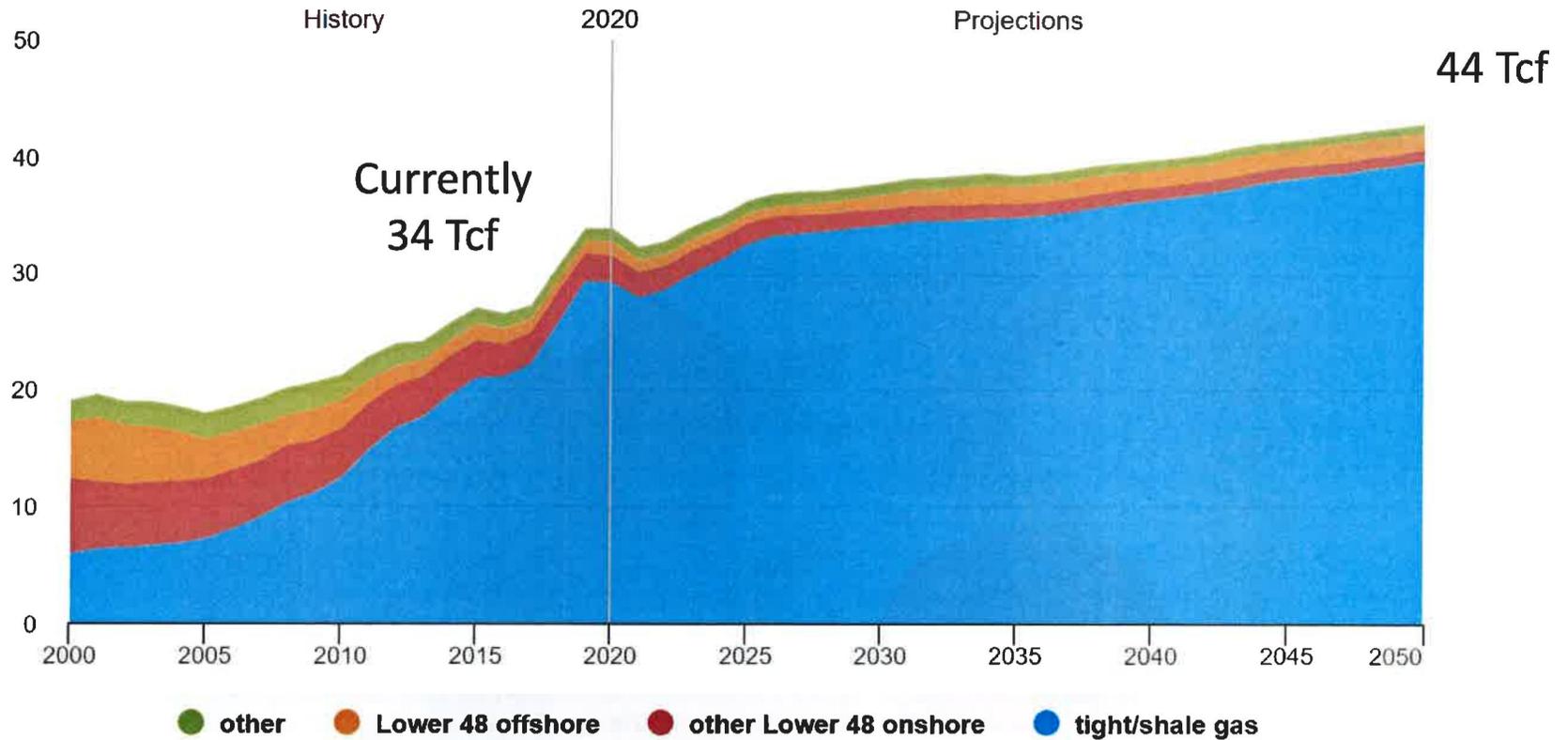


Source: U.S. Energy Information Administration, *Natural Gas Annual*, September 2021

**Ohio, Pennsylvania, Virginia & West Virginia create a global hub of natural gas and energy production which is an invaluable regional strategic advantage**

## U.S. dry natural gas production by type, 2000-2050

trillion cubic feet



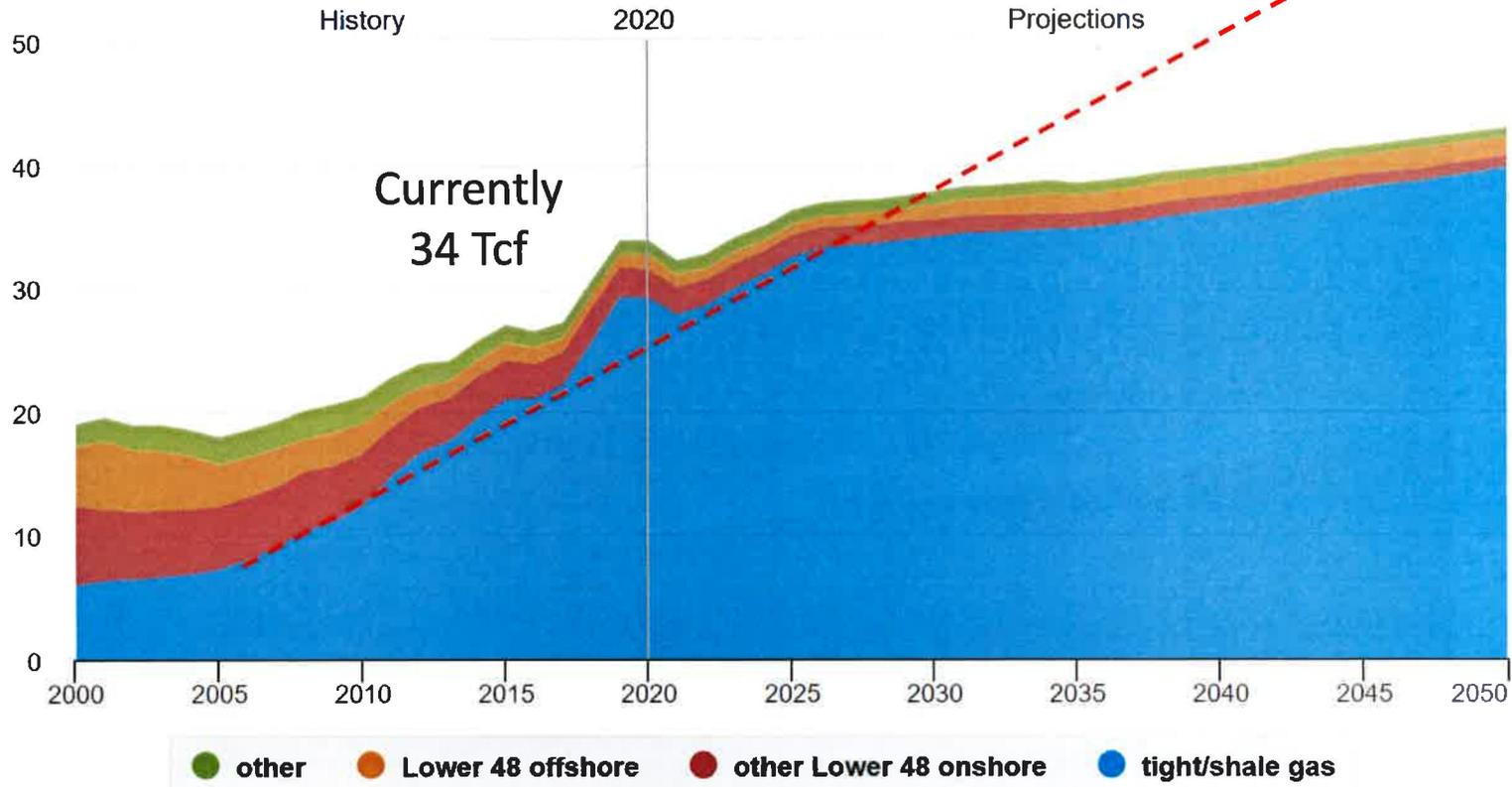
Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021 Reference case*, February 2021

Note: *Other* includes Alaska and coalbed methane.

EIA expects at 30% increase in natural gas production between now and 2050

## U.S. dry natural gas production by type, 2000-2050

trillion cubic feet



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2021 Reference case*, February 2021  
Note: *Other* includes Alaska and coalbed methane.

There is a strong case that the EIA's expectation is materially short of the actual growth in natural gas production

# EXAMPLE 1

## On-Pad Natural Gas Electricity Generation



# EXAMPLE 1

## On-Pad Natural Gas Electricity Generation

Efficient use of natural gas as an electricity generating fuel

Low carbon per kWh (< 0.9 Lbs/kWh) with zero electrical line-loss in transmission

Digital Pipeline. No need for rights-of-way through sensitive state forests and lands

No electrical transmission lines needed (reduced impact on land)

# EXAMPLE 2

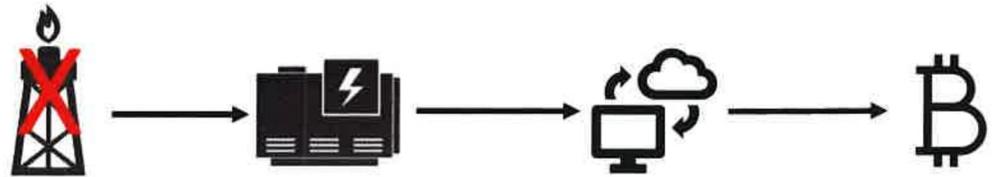
## Flare Mitigation

Before...



Step-out Marcellus / Utica development flares natural gas when there is no pipeline connection.

After...



Natural gas is diverted through lean-burning gas turbines or generators and converts to electricity used to mine Bitcoin.

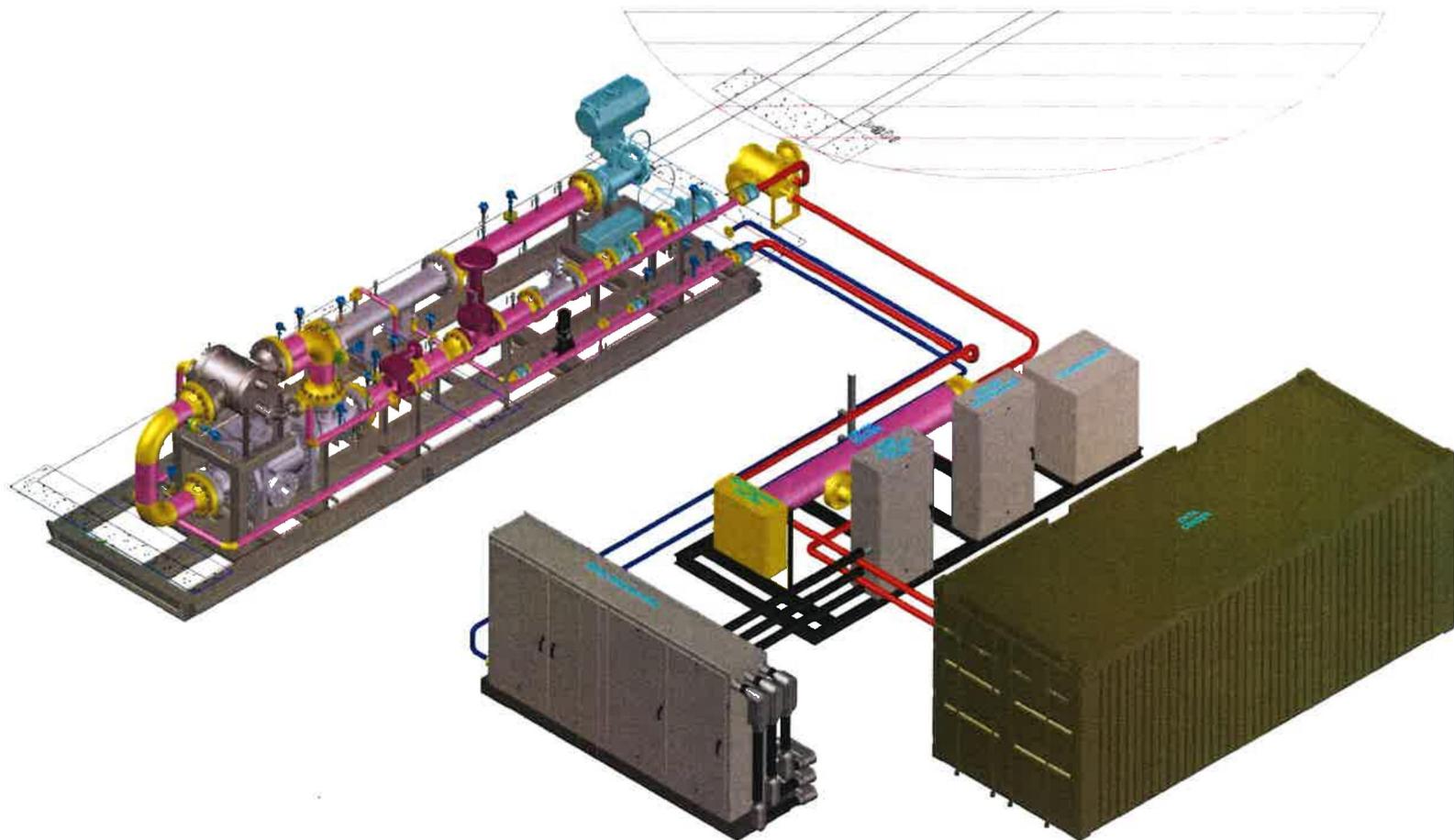
# EXAMPLE 3

## Flare Mitigation

CO<sub>2</sub>e is reduced by 63% when flare gas is capture and converted to electricity using clean-burning natural gas powered turbines (According to Crusoe Energy's Digital Flare Mitigation system)

# EXAMPLE 3

## Natural Gas Regulating Station Modernization & Decarbonization



# EXAMPLE 3

## Natural Gas Regulating Station Modernization & Decarbonization

Gas Letdown Generator/turboexpander converts high pressure flows of natural gas into electricity through the pressure reduction (e.g., Letdown) process

Elimination of scope 1 and scope 2 emissions from natural gas regulating stations

Converts previously wasted energy into zero-emission electricity to be used in on-site data centers to generate digital assets

This process also generates Renewable Energy Credits (RECs) and Investment Tax Credits (ITCs)

# EXAMPLE 4

## Coal Refuse Converted into Electricity



# EXAMPLE 4

## Coal Refuse Converted into Electricity

Electricity generated from the site is delivered to the grid when needed and used to mine Bitcoin when not needed.

The consumption of the coal waste coal/coal refuse from bituminous mining helps clean up the types of locations

The ash that is produced by the plant can be used as fertilizer or ingredients in cement, according to Pennsylvania environmental regulations; the plant itself has a Tier II exemption as an alternative energy source

This process also generates Renewable Energy Credits (RECs) and Investment Tax Credits (ITCs)

# EXAMPLE 5

## Zero-Carbon Nuclear Energy



# EXAMPLE 5

## Zero-Carbon Nuclear Energy

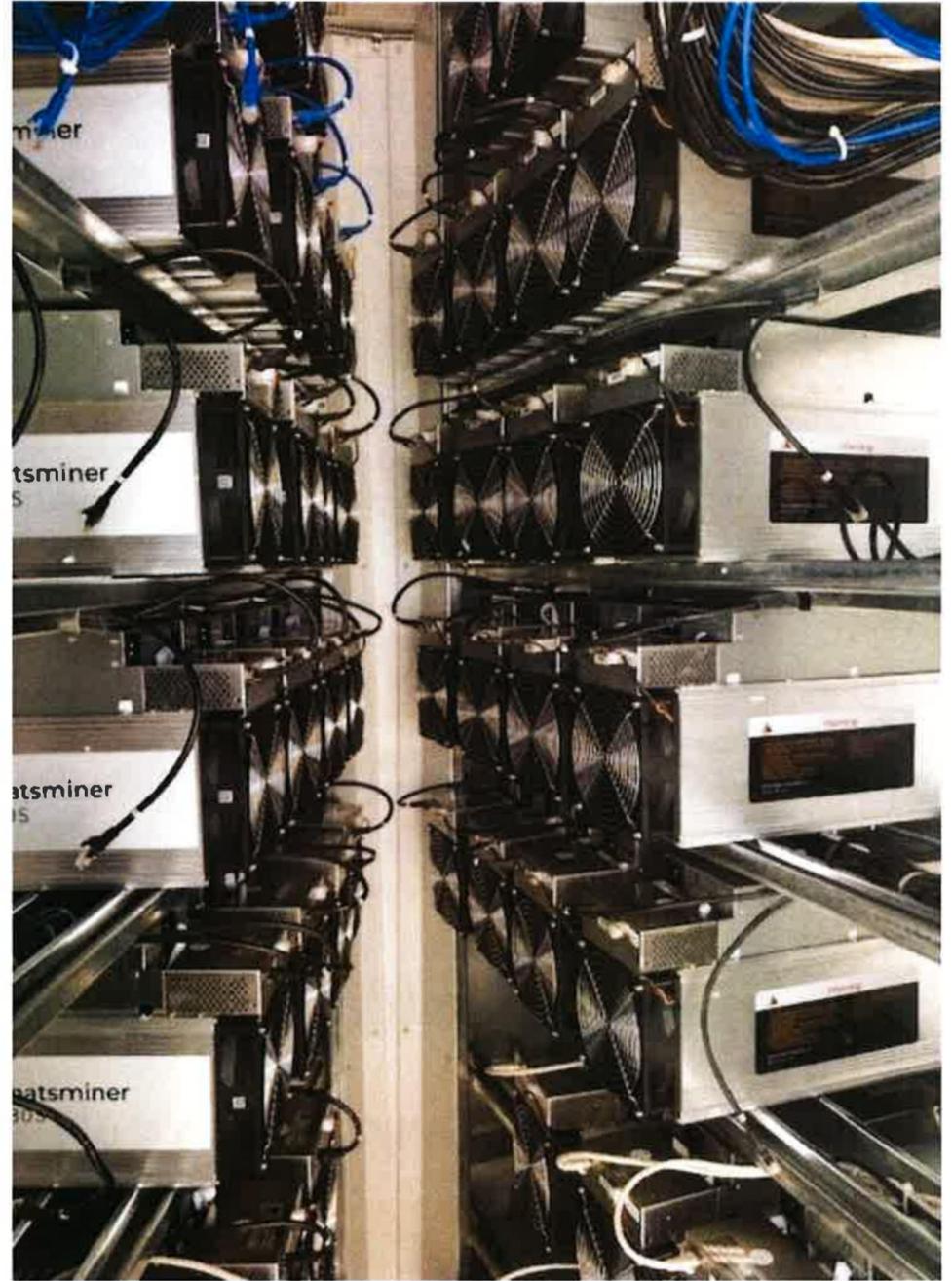
Power purchase agreements support operation of nuclear facility allowing on-site energy generation to be diverted to crypto mining when electricity is not need by the grid



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One final thought...

Why not in PA? Why is TX so far ahead? 750 MW = 125 MMcf/d natural gas



Riot Blockchain's Whinstone facility located in Rockdale, TX, has a total power capacity of 750 MW, with 400 MW currently developed. Whinstone's facility is believed to be the largest single facility, as measured by developed capacity, in North America for Bitcoin mining.

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