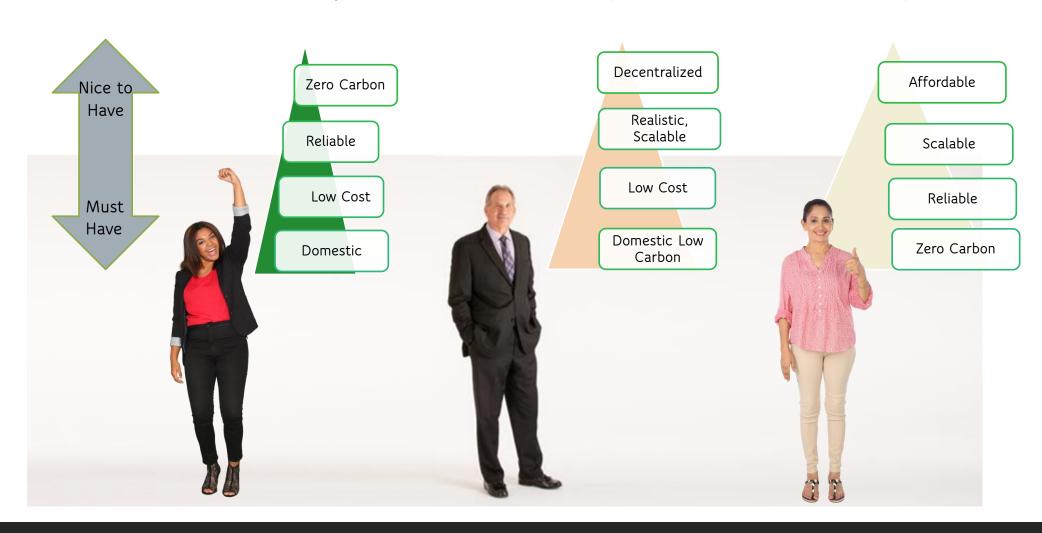


# American Oil & Gas 2023 - A Forward View

- Domestic Energy Overview / Update the role of hydrocarbons in the total energy supply, current trends in oil & gas prices & implications.
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- Shenandoah & The Wilcox a glimpse at the future of Offshore Oil & Gas

# Energy Is Embedded in Everything, So Decisions Involve Deep Values

Crises reveal "preferences." Everyone has a hierarchy.



# Annual Energy Outlook 2023

with projections to 2050



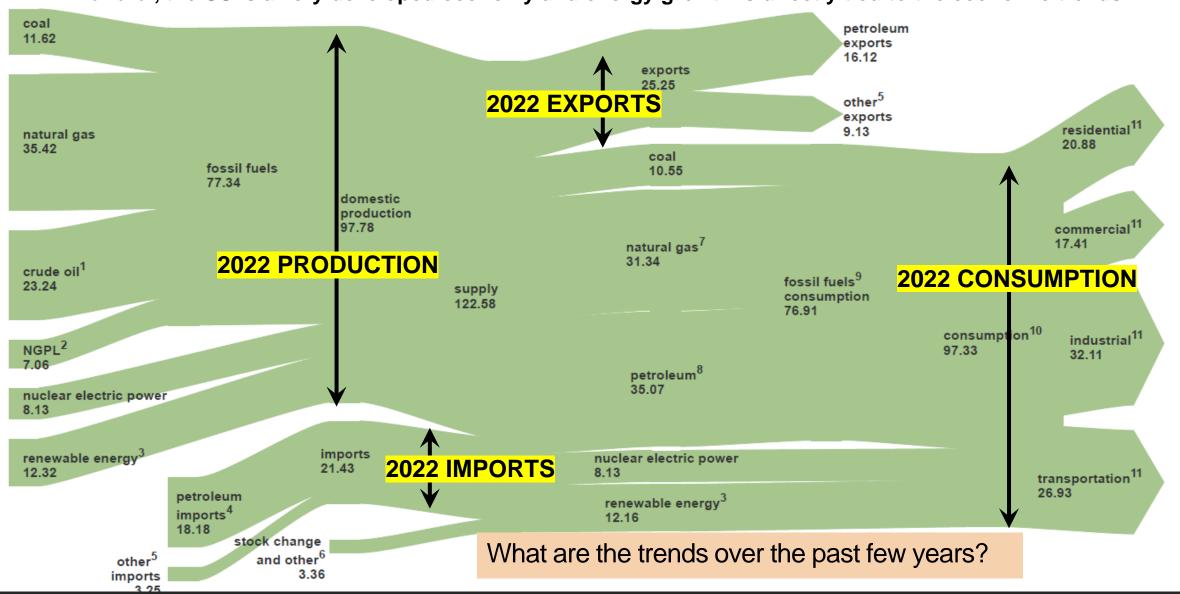
Annual Energy Outlook 2023 Release at Resources for the Future

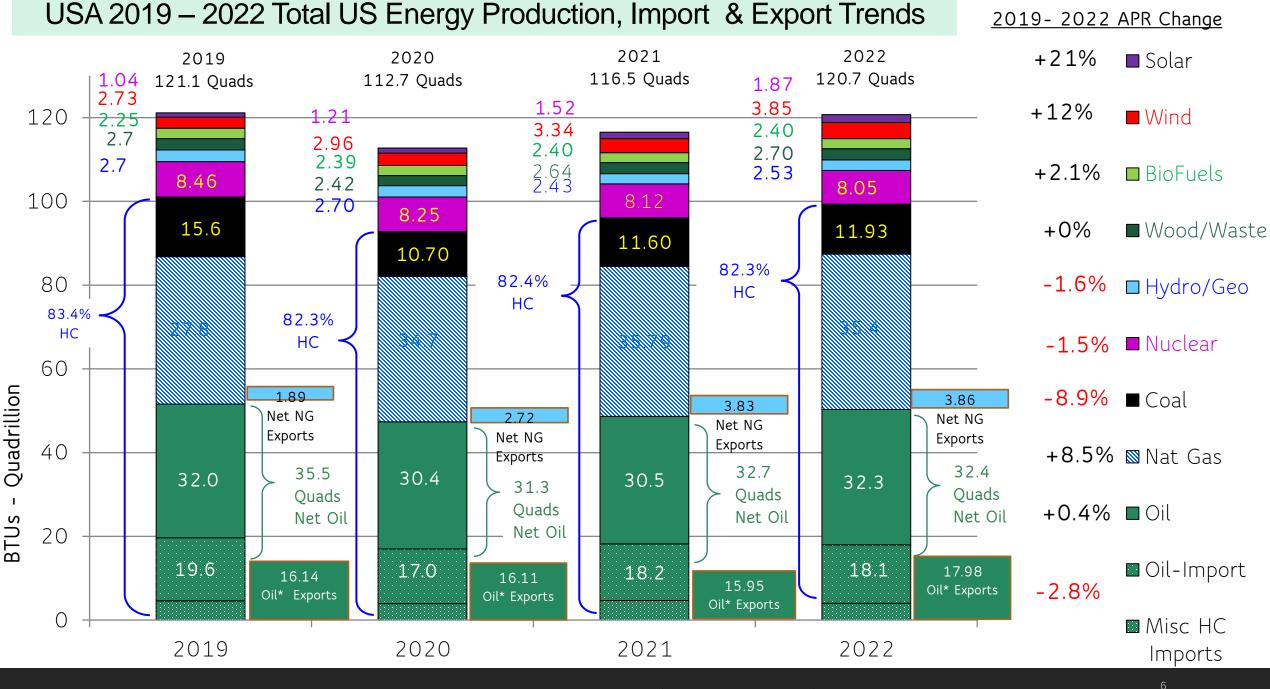
Joseph DeCarolis, EIA Administrator Angelina LaRose, Assistant Administrator for Energy Analysis



#### US Energy Flow 2022, Quadrillion BTU

- > The global economy continues to recover from COVID.....amid the chaos of Europe, Putin, & China.
- > Energy demand and consumption continues to grow as more societies leave the third world behind......
- > However, the US is a very developed economy and energy growth is directly tied to the economic trends.

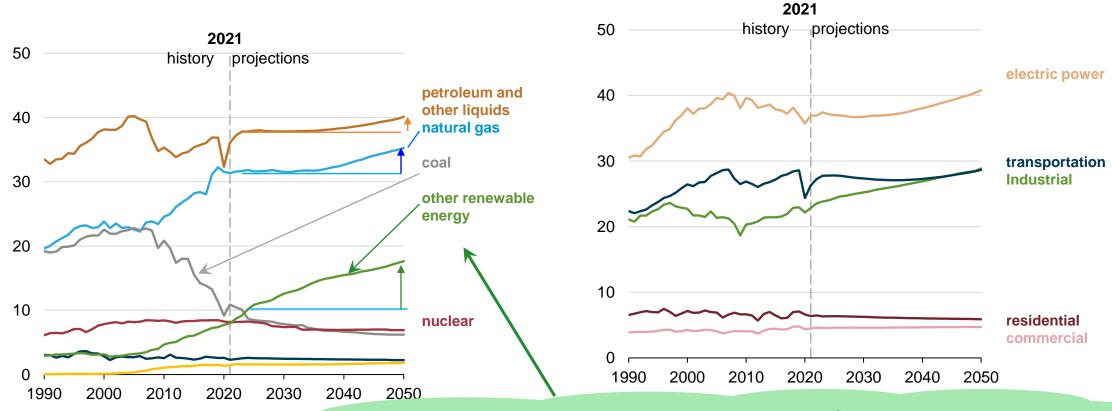


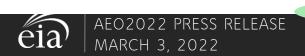


# **2022** – US Renewables consumption grows fastest but remains far below petroleum and other liquids consumption in 2050

Energy consumption by fuel AEO2022 Reference case quadrillion British thermal units

Energy consumption by sector AEO2022 Reference case quadrillion British thermal units





#### 2023 US-EIA - Energy Growth Projections - Oil & Gas Vs Renewables

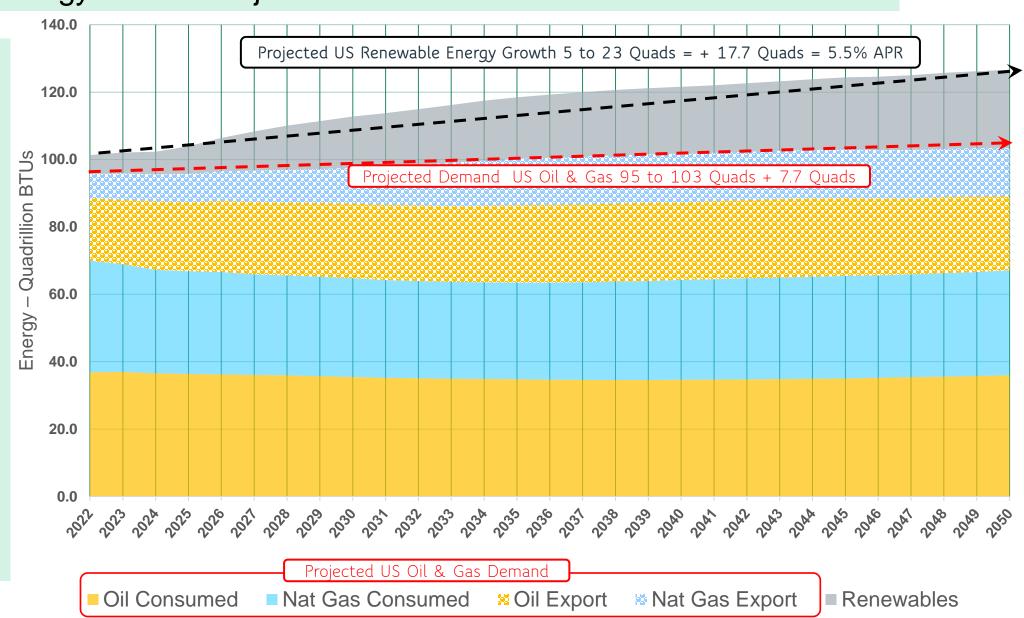
As per the US EIA, in 2050..

Renewable energy growth will increase from 2.7% to 5.5% per year due to IRA investment.

The US will produce more oil and Gas in 2050 than 2023.

Oil and Gas Exports will drive the growth in production.

Assumptions?







#### 2023 EIA - US Energy Growth Projections - Oil & Gas Vs Renewables 2022-2050

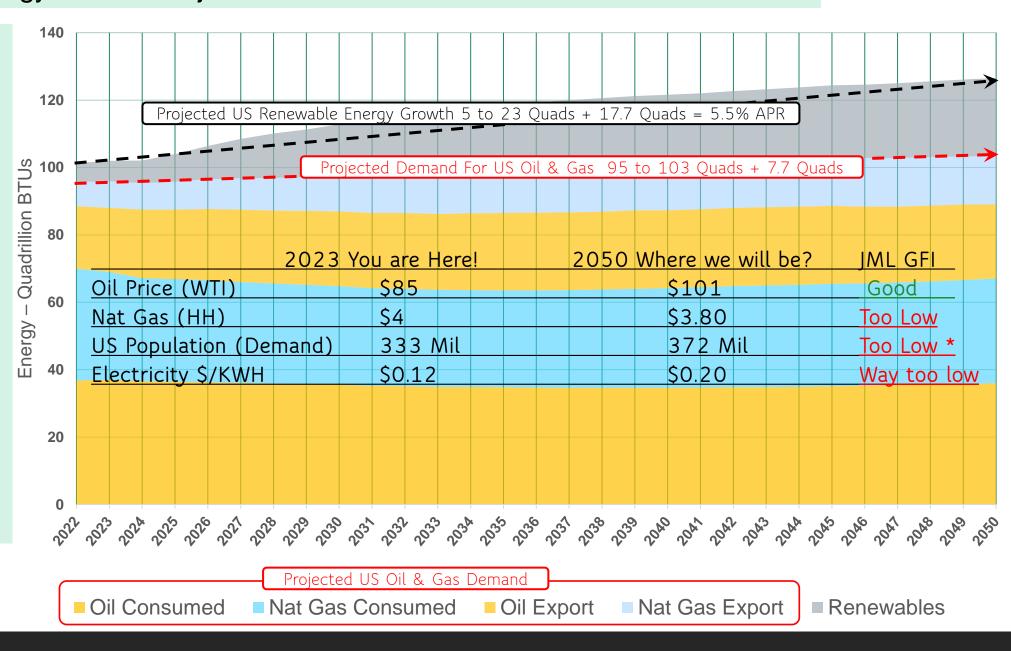
Are the EIA 2050 projections realistic?

Prices? - Oil – Yes, Nat Gas – No.

Population Growth (Demand) @ 1.4 Mil/Yr?

Nope: Assumes immigration limited to legal limits, unrealistic.

Electricity prices do not significantly increase? Nope, unrealistic.



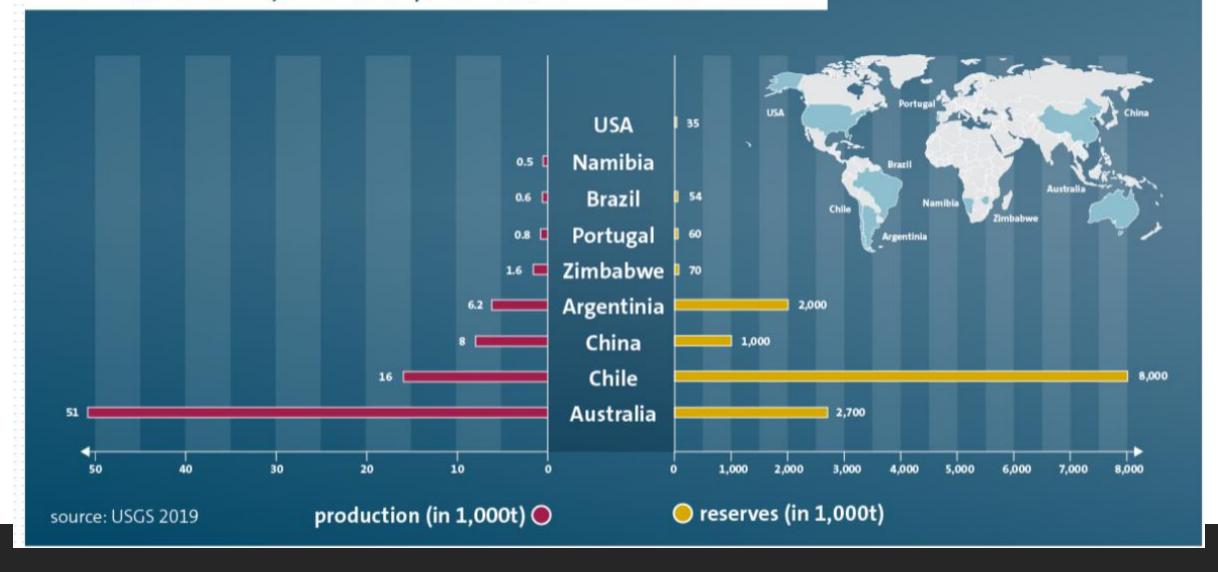
# CM-Critical Minerals, the Lifeblood of Renewables

Critical Minerals – Key to vital industries, US is import reliant (>50%) on 31/35 Critical Minerals with the US 100% dependent on 14 Critical Minerals.

| _ | (110 | the CC 10076 dependent on 11 Childan Ministrale. |    |                |    |             |  |                      |  |  |  |
|---|------|--|----|----------------|----|-------------|--|----------------------|--|--|--|
|   | 1    | Aluminum   | 11 | Gallium        | 21 | Platinum <  | 31   | Titanium             |  |  |  |
|   | 2    | Antimony   | 12 | Germanium      | 22 | Potash      | 32   | Tungsten             |  |  |  |
|   | 3    | Arsenic  | 13 | Graphite (Nat) | 23 | Rare Earths | 33   | <b>Uranium</b>       |  |  |  |
|   | 4    | Barite   | 14 | Hafnium        | 24 | Rhenium     | 34   | Vandium              |  |  |  |
|   | 5    | Beryllium  | 15 | Helium         | 25 | Rubidium    | 35   | Zirconium            |  |  |  |
|   | 6    | Bismuth  | 16 | Induim         | 26 | Scandium    | I A D D D D D D D D D D D D D D D D D D                              |                      |  |  |  |
|   | 7    | Cesium   | 17 | Lithium        | 27 | Strontium   | Key R  | y Renewable Minerals |  |  |  |
|   | 8    | Chromium   | 18 | Magnesium      | 28 | Tantalum    | Barite – Drilling Mud<br>Titanium Stress Jts/Risers<br>Chrome Tubing |                      |  |  |  |
|   | 9    | Cobalt   | 19 | Manganese      | 29 | Tellurium   |  |                      |  |  |  |
|   | 10   | Fluorspar  | 20 | Niobium        | 30 | Tin         |  |                      |  |  |  |

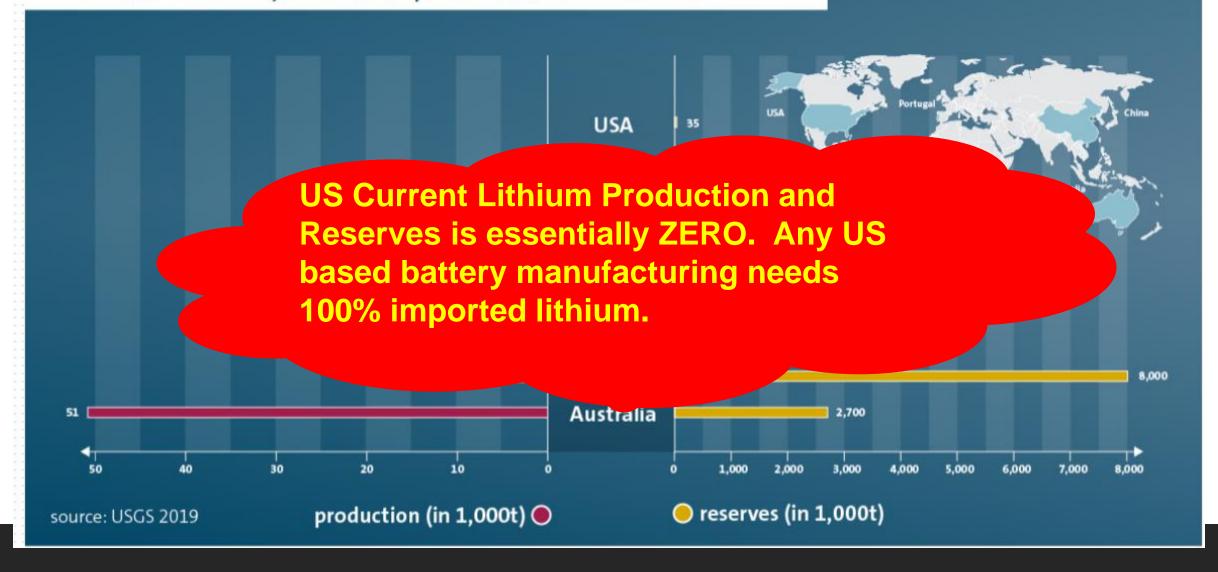
#### **AUSTRALIA AND CHILE IN THE FRONT ROW**

Countries with major Lithium production and reserves



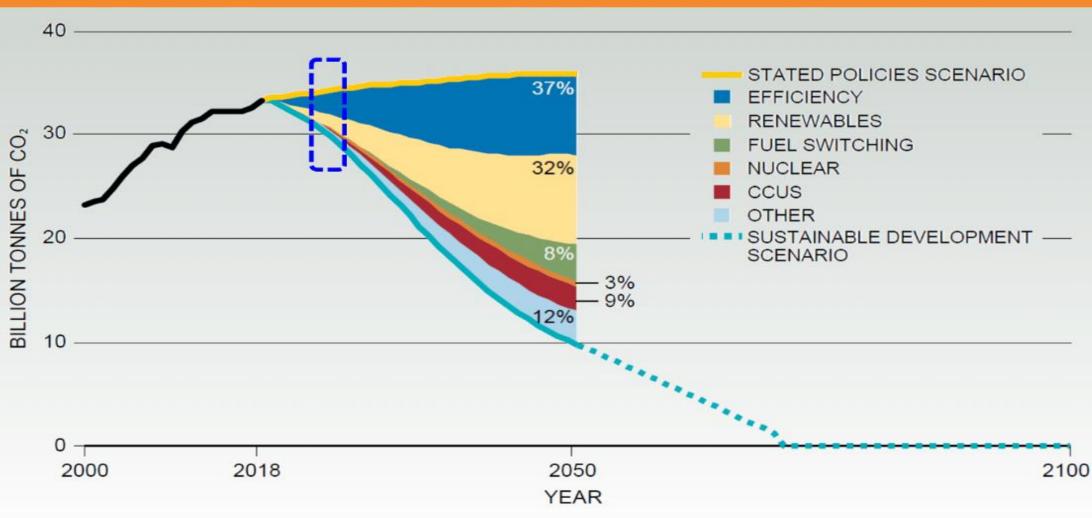
#### **AUSTRALIA AND CHILE IN THE FRONT ROW**

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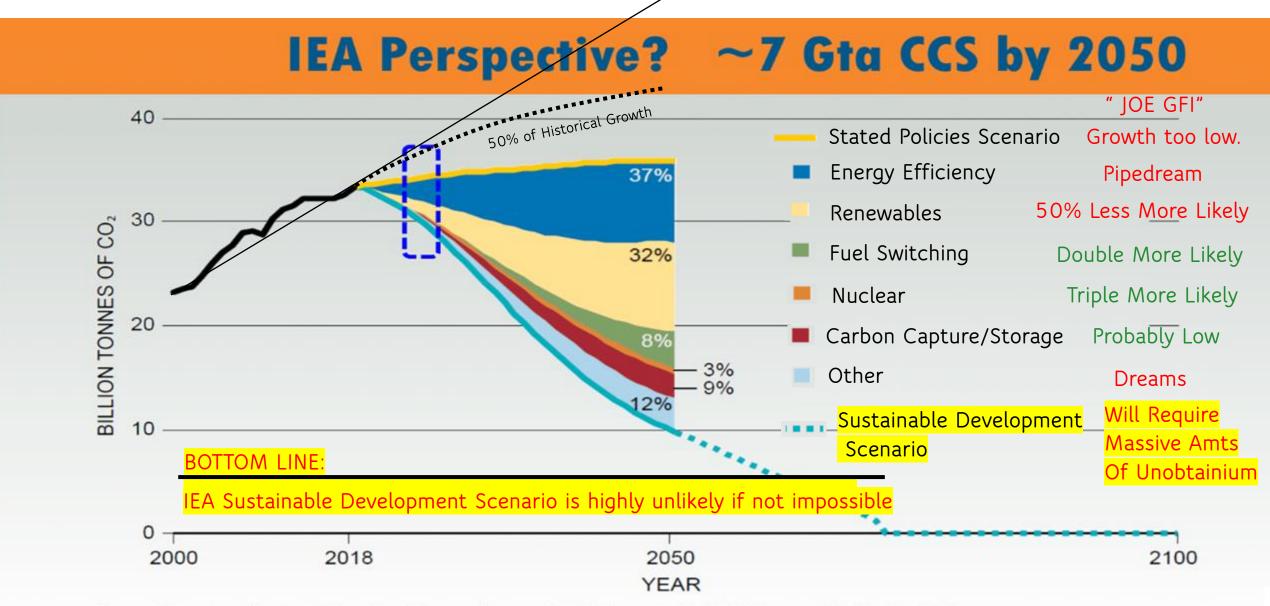
# What does the International Energy Agency Protect for 2050?

# IEA Perspective? ~7 Gta CCS by 2050



Source: Based on data from International Energy Agency, World Energy Outlook 2019, as modified by the NPC.

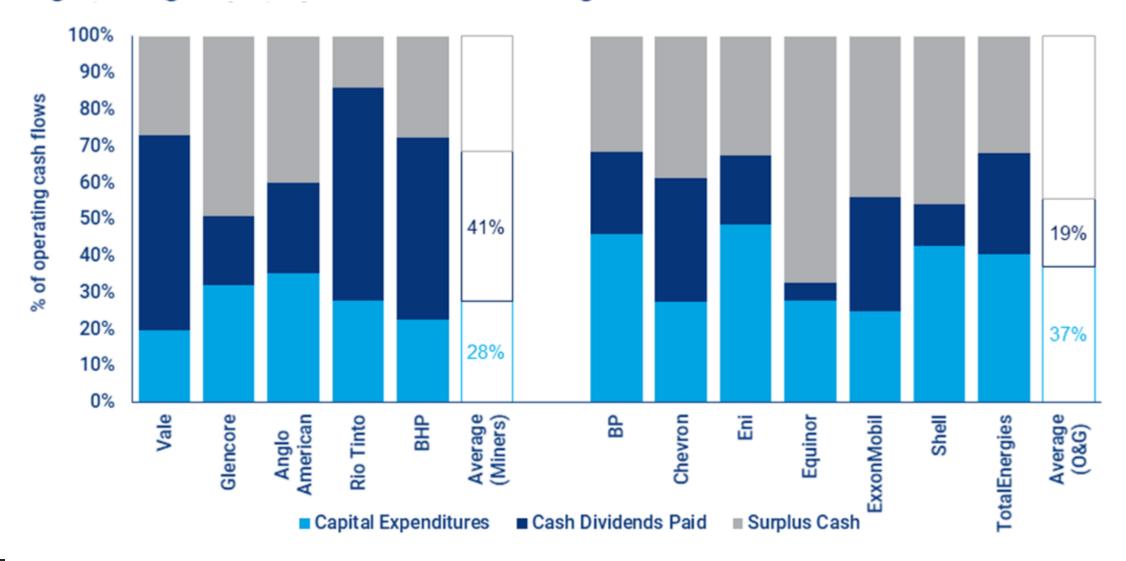
# What does the International Energy Agency Project for 2050?



Source: Based on data from International Energy Agency, World Energy Outlook 2019, as modified by the NPC.

# "Big Renewables" = "Big Raw Materials" = "Big Mining"

#### Big Mining invests even less than Big Oil



Source: https://www.woodmac.com/news/the-edge/why-miners-wont-invest-in-the-metals-supercycle/

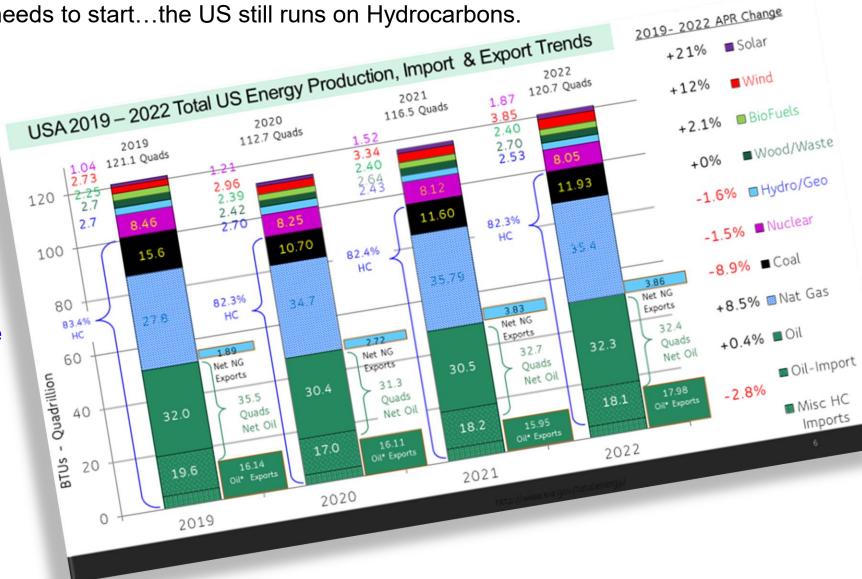
#### US Energy Production 2022 Status Summary

1. The transition to renewables still needs to start...the US still runs on Hydrocarbons.

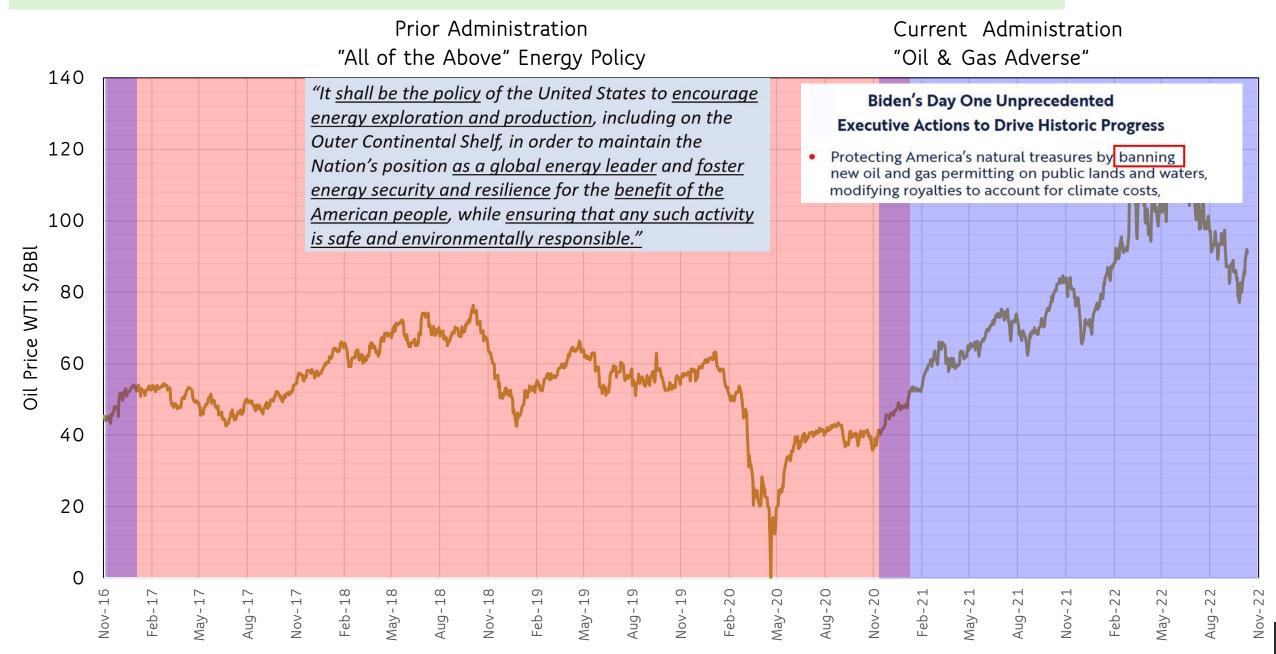
.....even COAL!

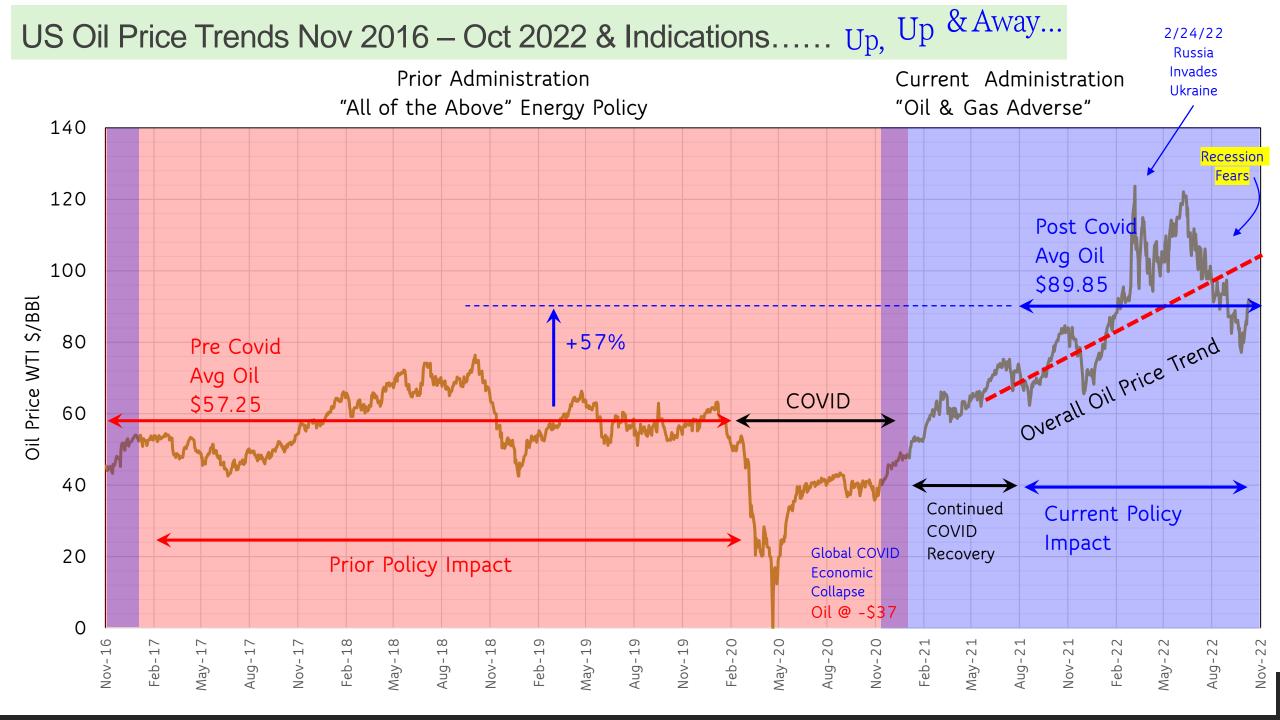
- 2. We were and are energy independent in Natural Gas... but domestic supply is actually decreasing due to exports driven by high global prices.
- 2. Domestic Oil Supply is increasing, but we are not, nor have we been in 40 yrs energy independent in Oil (imports remain > exports).

So....what about prices? (and Policies)

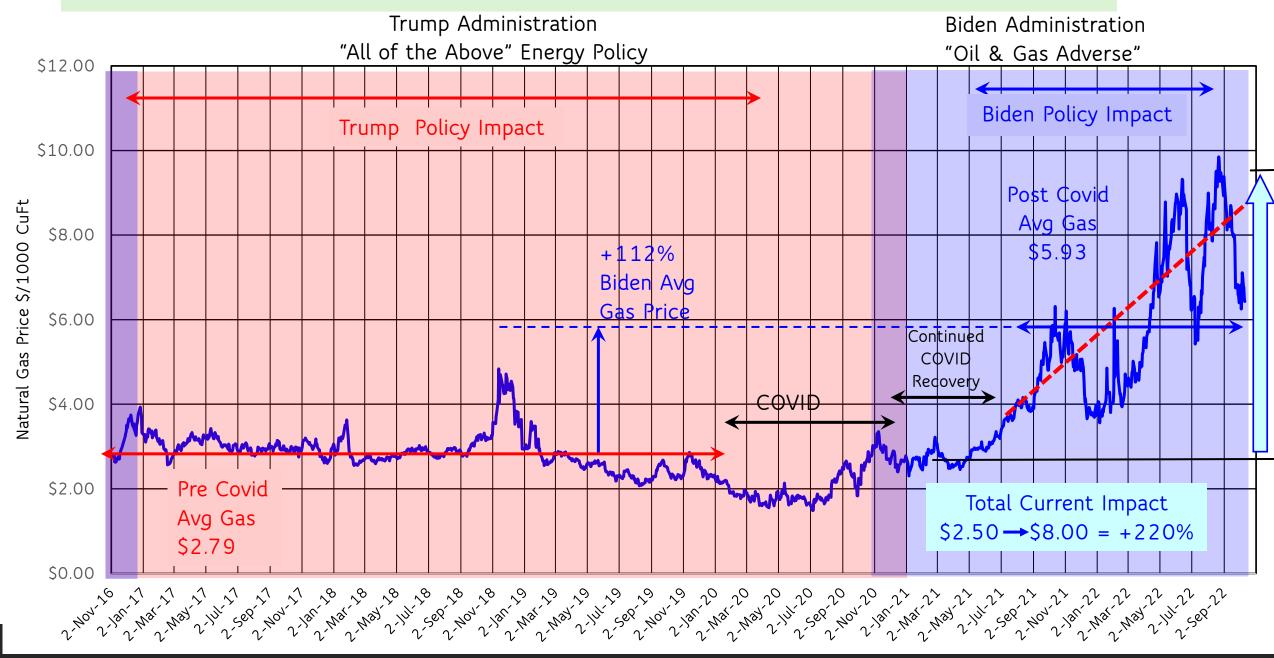


#### US Oil Price Trends Nov 2016 – Oct 2022 & Indications.....





#### US Natural Gas Price Trends Nov 2016 – Oct 2022 & Indications









# World's Largest LNG Buyer Concerned About Another Price Spike

#### Electricity Cost – US Government Inflation Data

40-45% of US Electricity is from Natural Gas...so electric bills are skyrocketing....right?

#### Electricity priced at \$222.38 in 2019 → \$254.14 in 2022

# Electricity Inflation Calculator

# Cost \$ 222.38 Start year 2019 End year 2022 Calculate Inflation

#### Prices for Electricity, 2019-2022 (\$222.38)

According to the U.S. Bureau of Labor Statistics, prices for electricity are 14.28% higher in 2022 versus 2019 (a \$31.76 difference in value).

The current national average price is \$0.16 for "Electricity per KWH". This data is collected by a national survey and can vary from region to region.

**Between 2019 and 2022:** Electricity experienced an average inflation rate of 4.55% per year. This rate of change indicates significant inflation. In other words, electricity costing \$222.38 in the year 2019 would cost \$254.14 in 2022 for an equivalent purchase. Compared to the overall inflation rate of 4.09% during this same period, inflation for electricity was higher.

**In the year 2019:** Pricing changed by 0.20%, which is significantly below the average yearly change for electricity during the 2019-2022 time period. Compared to inflation for all items in 2019 (1.81%), inflation for electricity was lower.

#### Electricity Cost – US Government Inflation Data

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#### **Electricity Inflation** Calculator

Cost

\$ 222.38

Start year

2019

**End** year

2022

Calculate Inflation

US Govt "Official Electricity Inflation" rate is 14% for the last 3 yr period 2019 – 2022.

4.55% per yr for 3 yrs = 14%

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of change indicates significant inflation bills "say" something else!

would cost \$254.14; electric bills "say" something else!

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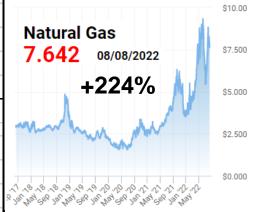
inflation for electricity was lower.

#### Joe's Electricity Cost Example – 73% Natural Gas & 27% Coal (Wyoming)

| CLECO - Louisiana Electr       | icit | y Price   | Tr   | ends 2 | 201       | L9 - 20 | 22 |                |      |        |           |        |    |        |          |        |
|--------------------------------|------|-----------|------|--------|-----------|---------|----|----------------|------|--------|-----------|--------|----|--------|----------|--------|
| Billing Period                 |      | July 2019 |      |        | July 2020 |         |    | July 2021      |      |        | July 2022 |        |    |        |          |        |
| Power Used KWH                 | 2583 |           | 2043 |        |           | 2442    |    |                | 2330 |        |           |        |    |        |          |        |
| Residence Charge               |      |           | \$   | 9.00   |           |         | \$ | 9.00           |      |        | \$        | 9.00   |    |        | \$       | 9.00   |
| Storm Restoration (Fixed)      |      |           | \$   | 2.00   |           |         |    |                |      |        |           |        |    |        |          |        |
| Energy Charge 0-750 KWH        | \$   | 0.0713    | \$   | 53.44  | \$        | 0.0713  | \$ | 53.44          | \$   | 0.0698 | \$        | 52.33  | \$ | 0.0698 | \$       | 52.33  |
| Energy Charge 750-1000 KWH     | \$   | 0.0500    | \$   | 12.50  | \$        | 0.0713  | \$ | 17.81          | \$   | 0.0698 | \$        | 17.44  | \$ | 0.0698 | \$       | 17.44  |
| Energy Charge 1000-1500 KWH    | \$   | 0.0500    | \$   | 25.00  | \$        | 0.0713  | \$ | 35.63          | \$   | 0.0837 | \$        | 41.86  | \$ | 0.0837 | \$       | 41.86  |
| Energy Charge >1500 KWH        | \$   | 0.0500    | \$   | 54.16  | \$        | 0.0713  | \$ | 38.69          | \$   | 0.0902 | \$        | 84.96  | \$ | 0.1005 | \$       | 83.39  |
|                                | \$   | 0.0562    | \$   | 145.10 | \$        | 0.0713  | \$ | 145.56         | \$   | 0.0805 | \$        | 196.59 | \$ | 0.0837 | \$       | 195.02 |
| Fuel Charge                    | \$   | 0.0185    | )\$  | 47.80  | \$        | 0.0319  | \$ | 65.11          | \$   | 0.0351 | \$        | 85.59  | \$ | 0.0712 | )\$      | 165.87 |
| Enviromental Charge            | \$   | 0.0019    | \$   | 4.83   | \$        | 0.0015  |    | 284%           | - 3  | 0.0009 | \$        | 2.30   | \$ | 0.0025 | \$       | 5.83   |
| Storm Restoration Charge/KWH   | \$   | 0.0013    | \$   | 3.31   | \$        | 0.0013  | رٰ | 2.02           | \$   | 0.0025 | \$        | 6.11   | \$ | 0.0025 | \$       | 5.79   |
| Infrastructure Recovery Charge | \$   | 0.0040    | \$   | 10.34  | \$        | 0.0060  | \$ | 12.30          | \$   | 0.0039 | \$        | 9.59   | \$ | 0.0080 | \$       | 18.75  |
|                                | \$   | 0.0257    | \$   | 66.28  | \$        | 0.0406  | \$ | 82.99          | \$   | 0.0424 | \$        | 103.58 | \$ | 0.0842 | \$       | 196.24 |
| Total KWH Based Charges        | \$   | 0.0818    | \$   | 211.38 | \$        | 0.1119  | \$ | 228.55         | \$   | 0.1229 | \$        | 300.17 | \$ | 0.1679 | )\$      | 391.26 |
|                                |      |           |      | 37%    |           | K       | _  | - 10% —        | 7    | K      |           | 37% —  | 7  |        |          |        |
| Total Bill                     | \$   | 0.0861    | \$   | 222.38 | \$        | 0.1163  | \$ | 237.55         | \$   | 0.1266 | \$        | 309.17 | \$ | 0.1718 | <b>\</b> | 400.26 |
|                                |      | _ +       |      |        |           |         |    | <u> 100% —</u> |      |        |           |        |    |        |          |        |

#### Coal Prices.

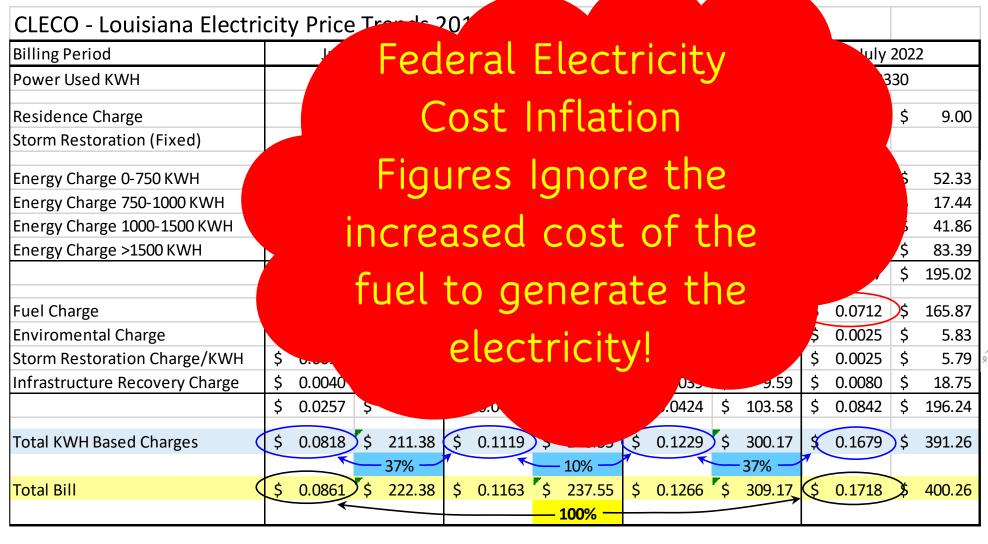
From 2019 to 2022 (as per EIA) increased 10% for US electricity generation.



Actual Fuel Costs Increased 166% 2019 to 2022, "Fuel Charge" Up 284%

(0.0185 to 0.0712 /KWH)

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#### Coal Prices.

From 2019 to 2022 (as per EIA) increased 10% for US electricity generation.



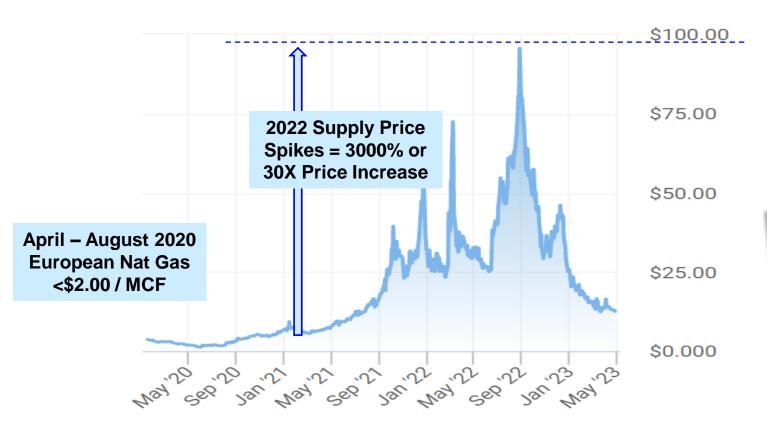
Actual Fuel Costs Increased 166% 2019 to 2022, "Fuel Charge" Up 284%

(0.0185 to 0.0712 / KWH)

It could be worse.....is Europe a sign of things to come?

08:41 am CDT 27/04/2023

# Dutch TTF Natural Gas 12.54 -2.89%



Nat Gas to Oil Equivalent Price

\$72.14 \$ X 5.6 MCF BBL = 403 BBL

Germany's Economy Faces A €260 Billion Blow As Energy Crunch Persists

> Germany's Power Prices Hit Record-High As Utilities Limit Output

By Tsvetana Paraskova - Aug 05, 2022, 11:30 AM CDT

# UK Plans On Power Outages This Winter



The UK is planning on running short on natural gas this coming winter, resulting in blackouts, according to Bloomberg sources familiar with the government's plans—even with emergency coal-fired power plants in operation.

#### Electricity Theft moves from the third world into (what was) the first world.



Common 3<sup>rd</sup> World Practice - Wrap a transfer wire to capture far field electricity from high voltage lines.

# UK Electricity Theft Breaks Records As Energy Bills Soar

By ZeroHedge - Aug 08, 2022, 3:00 PM CDT

- ▶ The average annual UK gas and electricity bill rose from £1,400 in October 2021 to £2,000.
- Analysts are predicting that average energy bills could climb even higher, with the lowest forecast sitting at a whopping £3,358.



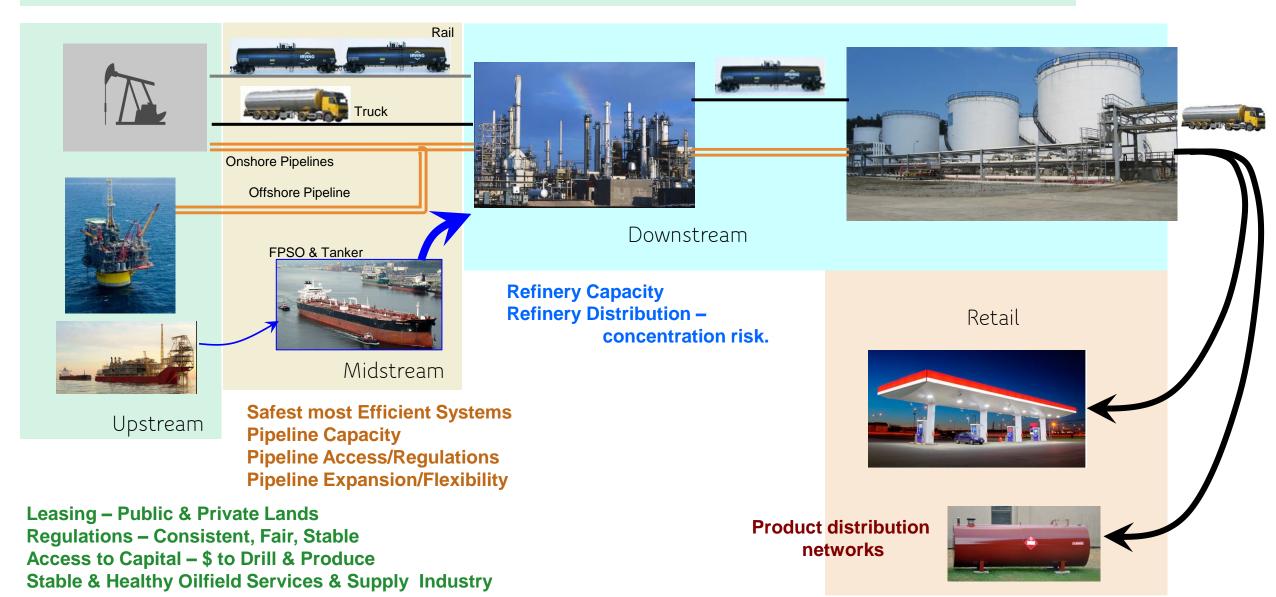
A record number of people stole <u>electricity</u> in England and Wales last year, according to new figures released by the Home Office.

Police forces received 3,600 reports of "dishonest use of electricity" in the 12 months to March 2022, an increase of 13 percent on the previous year and the highest level since records began in 2013.

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- Shenandoah a glimpse at the future of Offshore Oil & Gas

#### US Oil & Gas Industry Sector Overview – From the Ground to Your Tank



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#### Upstream – First Steps Acquire the Lease and The Permits

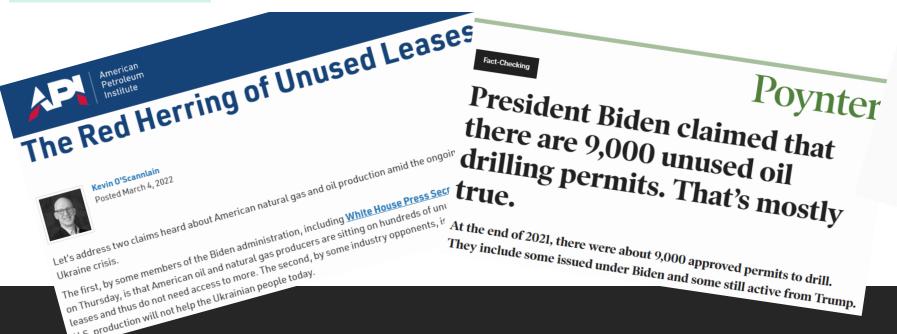




| Leasing Measure                 | Private+State Lands & Waters | Federal Lands & Waters        |  |  |  |  |  |  |
|---------------------------------|------------------------------|-------------------------------|--|--|--|--|--|--|
| Mineral Acreage                 | 42% 1.76 Billion             | 58% 2.46 Billion (1.76, 0.70) |  |  |  |  |  |  |
| % Oil Production                | 74.5%                        | 25.5% (16.2%, 9.3%)           |  |  |  |  |  |  |
| % Natural Gas Production        | 89.0 %                       | 11.0 % (2.0%, 9.0%)           |  |  |  |  |  |  |
| Days to Process Drilling Permit | 2 Days (Texas)               | 142 Days                      |  |  |  |  |  |  |

5/3/22 The Leasing Controversy: Shifting blame to the industry —"there are 9,000 approved oil leases that the oil companies are not tapping into currently." White House Press Secretary Jen Psaki

5/4/22 - Correction 9000 unused Drilling Permits not Leases White House Press Secretary Jen Psaki







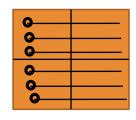
#### Upstream – Leasing 101

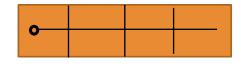


Onshore Federal Land Leased by BLM Maximum size is 2560 acres = 4 Sq Miles

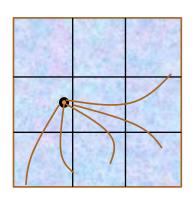


Offshore Federal Leases by BOEM Maximum size block is 3x3 miles = 9 Square miles.





Each Lease, when developed likely contains multiple wells.



#### So why isn't every lease drilled or every drilling permit used?

Regulatory Uncertainty – *In the 2020 election President Biden promised to end oil drilling on Federal lands and waters* – Industry submitted drilling permit applications for years in advance, attempting to secure the right to drill existing leases should the President follow through on a promised moratorium.

Onshore, many leases are held up in litigation by environmental groups. As of March 2022, Western Energy Alliance is in court defending over 2,200 Federal leases, most of which cannot be developed while cases wind their way through the courts, with multiple wells per lease the total "wells' being contested is significant.

You need both a lease & a permit. Drilling permit approval is often required before signing a rig contract, with onshore "burn rates" at ~\$125,000 per day and offshore burn rates exceeding \$1,000,000 per day, rigs and crews can not sit idle, once on contract the approved permits must be in place.

Geology – Subsurface oil and gas reservoirs rarely fall within a single lease. Often multiple leases must be put together to form a viable unit that is attractive to drill. And one dry hole can invalidate many leases

#### Prior Administration US Outer Continental Shelf Oil & Gas Leasing

2017 - Alaska OCS, Atlantic & Pacific OCS Presidential Moratoriums removed by Trump.

2017 - Secretary Zinke announces all US OCS is under consideration for Offshore Development, 100% of Eastern & Western GOM Leased Biannual ... However, .....

Lease sales in new areas were not scheduled. Focus placed on permits to acquire updated seismic data in Atlantic & Pacific OCS

Alaska OCS

Pacific OCS



2019 –

- US OCS achieves record offshore oil production close to 2 Million Bbls/day.....&.....
- Active Leasing programs in the offshore Artic, Cook Inlet and the Western & Central Gulf of Mexico.



#### Current Administration US Outer Continental Shelf Oil & Gas Leasing -1

<u>Jan 2020</u> - Biden orders the Interior Department to halt scheduling new oil and natural gas leases on public lands and waters & review existing permits for fossil fuel development.

<u>June 2021</u> – 5<sup>th</sup> Circuit Judge rules Biden Administration must hold lease sales as per plan.

Nov 2021 – Western & Central GOM Sale 257 held..but leases were not awarded

Jan 2022 - DC Federal District Judge rules in favor of "Earth Justice", Sale 257 is vacated.

Alaska OCS **Pacific** OCS Atlantic No New Leases OCS Presidential Moratorium Open - Lease Sales Scheduled & Held Western Central Eastern Open - No sales Scheduled or Held Gulf of Mexico

May 2022 - Biden cancels future lease sales for Cook Inlet Alaska & Gulf of Mexico

July 2022 - Biden Proposes New 5
Yr Leasing Plan with Potential
Central & Western Gulf of Mexico &
Cook Inlet Lease Sales, pending
review & comment & will be at the
discretion of the Sec of Interior.

# Current Administration US Outer Continental Shelf Oil & Gas Leasing -2

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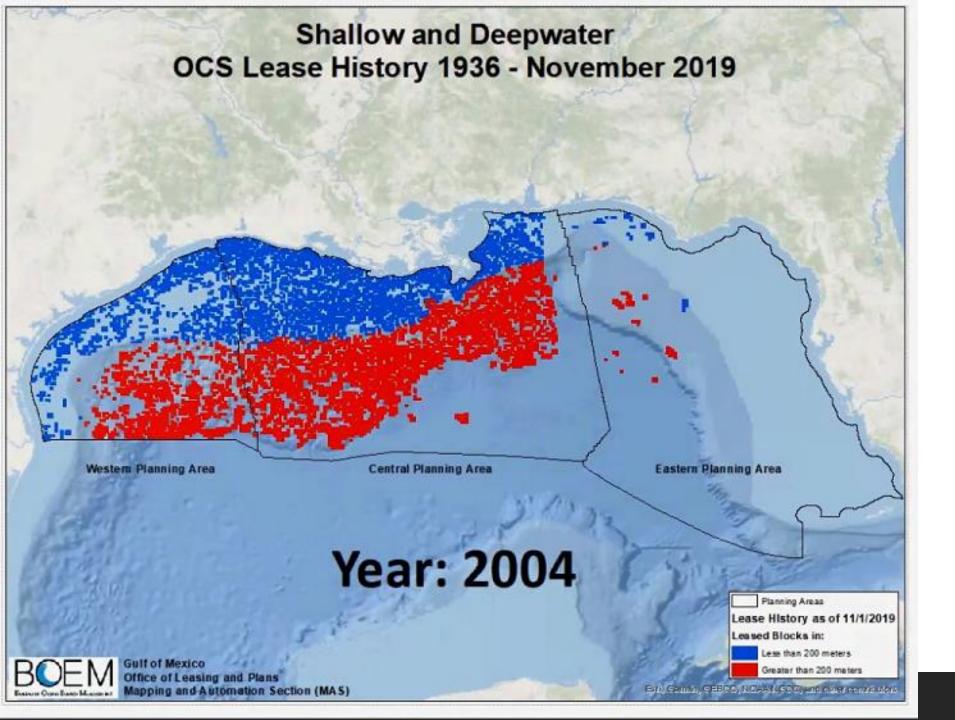
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Alaska OCS of Federal Offshore Acreage is Off Limits to Development **Pacific** OCS No New Leases OCS Presidential Moratorium Open - Lease Sales Scheduled & Held Western Central Eastern Open - No sales Scheduled or Held Gulf of Mexico

May 2022 - Biden cancels future lease sales for Cook Inlet Alaska & Gulf of Mexico

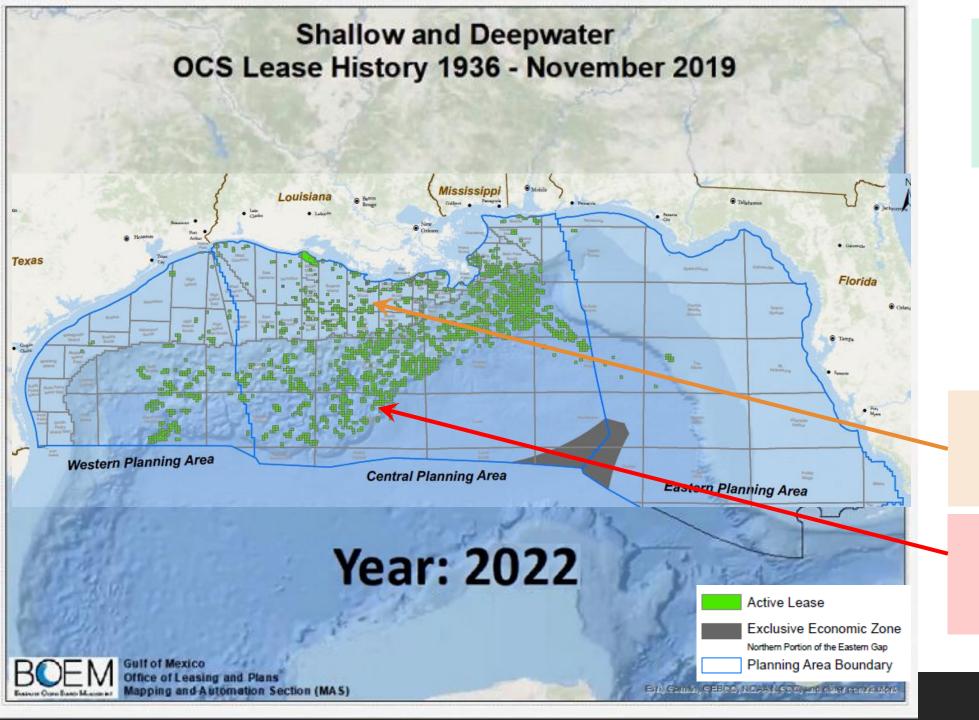
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Atlantic August 2022 – Manchin adds
OCS legislative terms via "Inflation
Reduction Act" tying OCS Wind
Energy leasing to Central & Western
Gulf of Mexico Oil & Gas Leasing.



US Gulf of Mexico Oil & Gas Active Lease Trend

2004
Highpoint in
Offshore
Leased Acreage



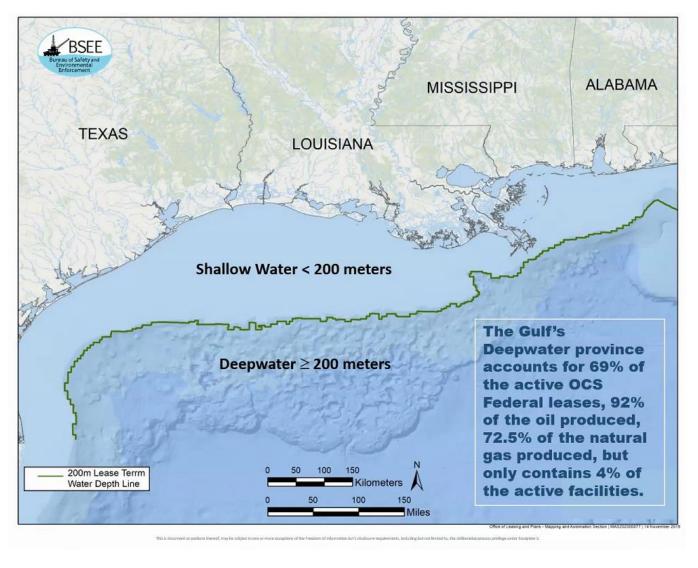
US Gulf of Mexico Oil & Gas Active Lease Trend

2004
Highpoint in
Offshore
Leased Acreage

2022
Majority of Shelf
Unleased,

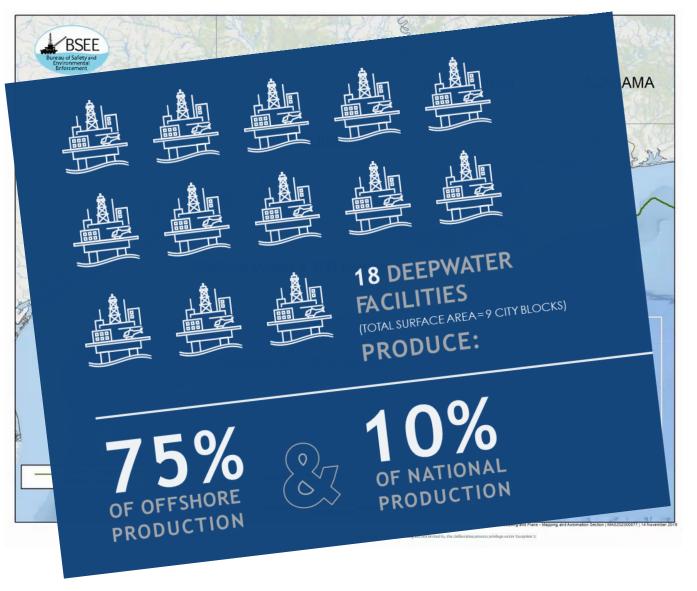
Majority of Deepwater is unleased.

#### Importance of Continued US Leasing – Onshore & Offshore



- ➢ OIL & Gas Exploration is a Dynamic Process
- Acreage that is Leased, but unproductive with low prospective development, can change over night due to:
  - Technology,
  - · Seismic Data, advances, and
  - Equipment & Processes continuous improvement.
- Continued access to acreage is essential to enable utilization of new technology & data....the chicken/egg example applies.
  - The ability to work in deeper waters, frac longer intervals, & drill to higher pressures and temperatures....can't be proven with out new leases.
- New Leases and New Ideas allows existing production facilities to remain utilized (pipelines, platforms, etc).
  - Approximately 4 out of 5 Deepwater Facilities (53 of 68) Produce less than 50% of their Daily
     Nameplate Capacity. Thus......
  - Majority of new Deepwater Developments tie into existing infrastructure

#### Importance of Continued US Leasing – Onshore & Offshore



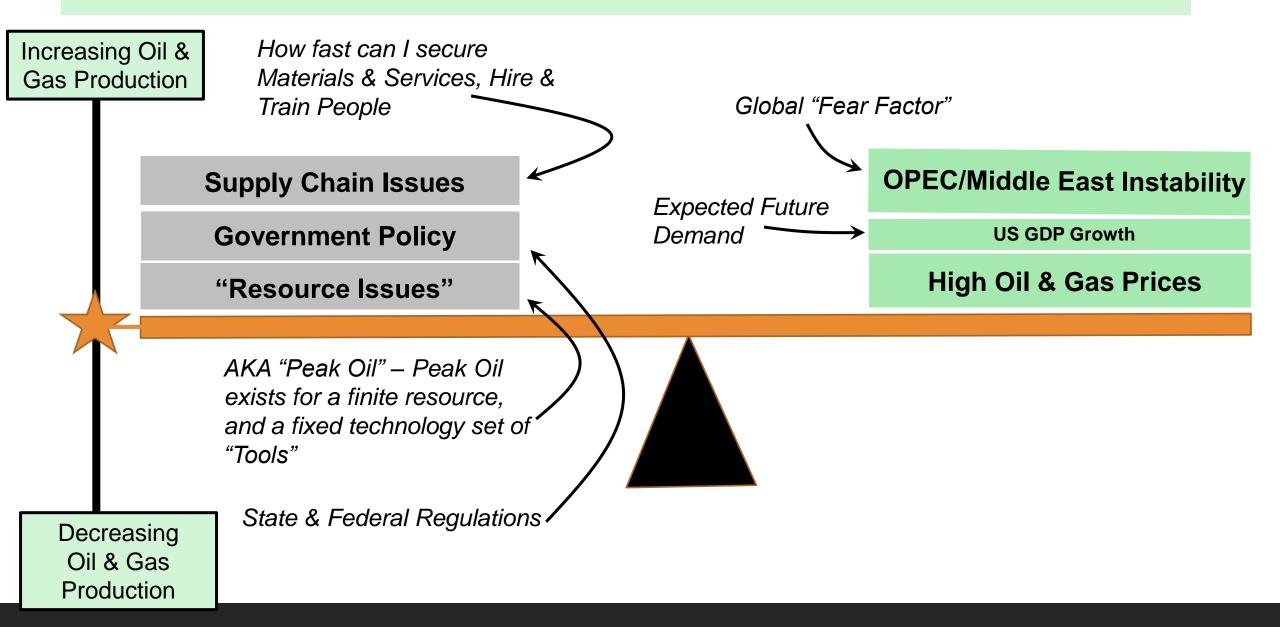
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  - Technology,
  - Seismic Data, advances, and
  - Equipment & Processes continuous improvement.
- Continued access to acreage is essential to enable utilization of new technology & data....the chicken/egg example applies.
  - The ability to work in deeper waters, frac longer intervals, & drill to higher pressures and temperatures....can't be proven with out new leases.
- New Leases and New Ideas allows existing production facilities to remain utilized (pipelines, platforms, etc).
  - Approximately 4 out of 5 Deepwater Facilities (53 of 68) Produce less than 50% of their Daily
     Nameplate Capacity. Thus......
  - Majority of new Deepwater Developments tie into existing infrastructure

## American Oil & Gas 2022 - A Forward View

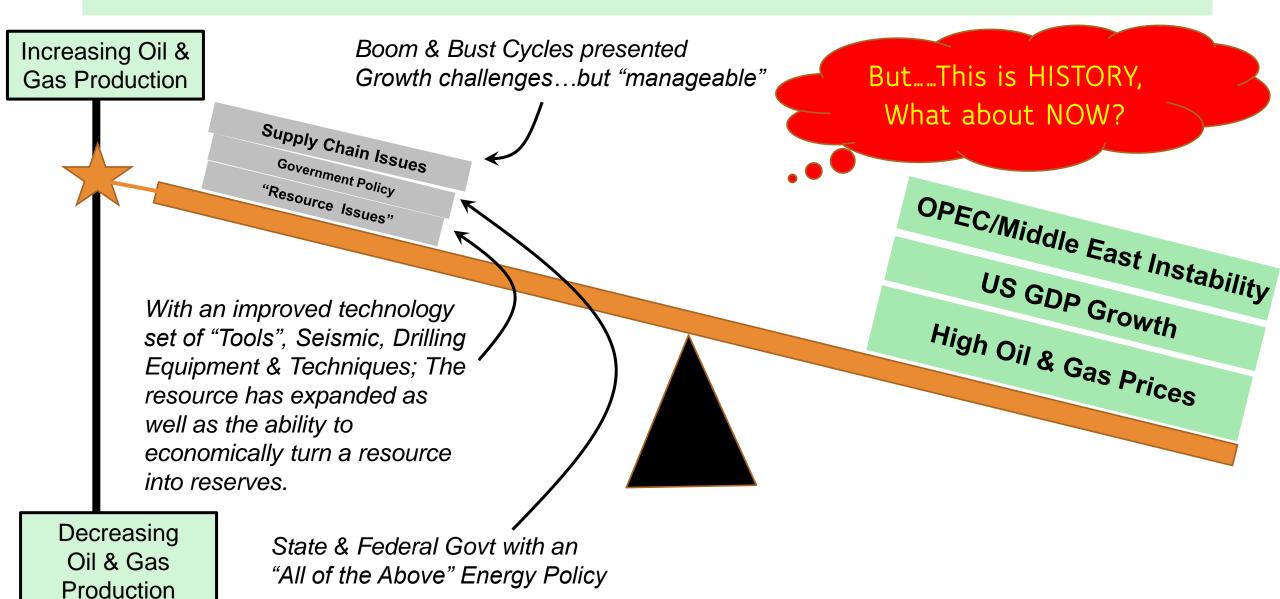
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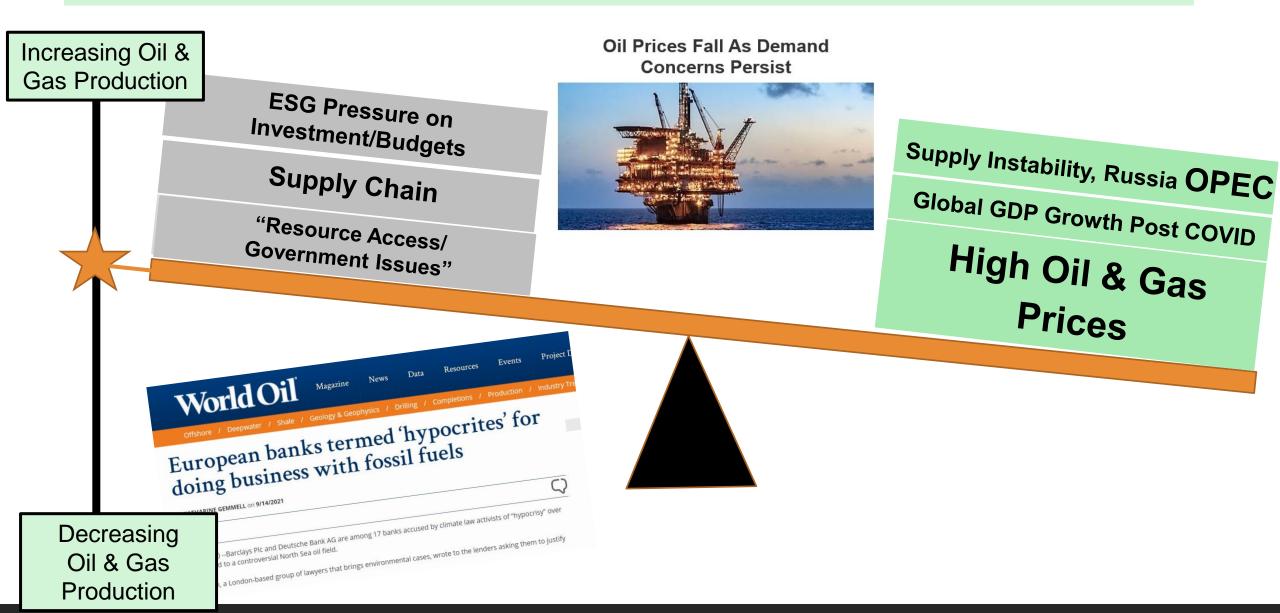
## US Oil & Gas Industry Production Growth a Historical Balancing Act



## The US Oil & Gas Industry Production Growth a Historical Balancing Act



## The US Oil & Gas Industry Production Growth - Current Balancing Act



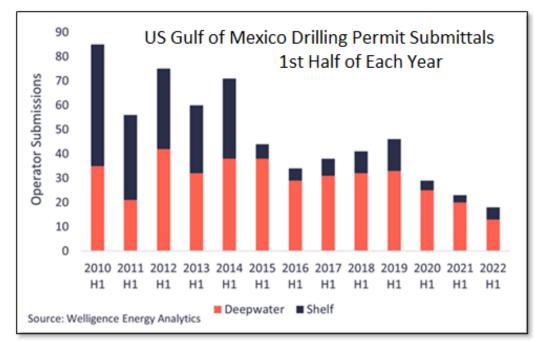
#### US Oil Production Indicators – Why the "Muted" Industry Response to High Prices

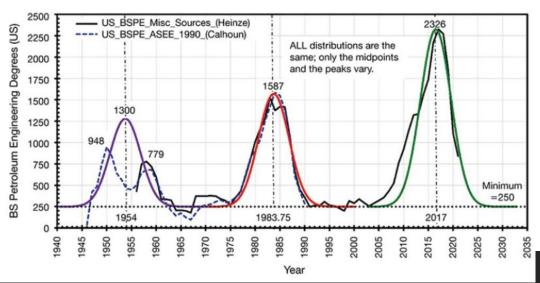
- **ESG Pressure** − Negative Investor Sentiment
- ➤ Government Administration Limited to no support for oil and gas development
- ➤ Supply Chain Issues Especially tubulars (steel pipe)
  - Only 4 Steel mills in the US manufacture oilfield tubulars,
  - ■Main mill in Lorain OH is currently closed post COVID, current mills can not make pipe >10" OD. US import quotas and tariffs do not account for this situation.
  - ■Four Permian Basin rigs released in July 2022 for lack of pipe.
  - German Steel Mills closed due to age & energy costs.
  - Quotas on Steel form Brazil
  - Basic Materials, even staff are in short supply.

#### **≻**Staffing –

Younger workforce has been "turned against" oilfield careers.

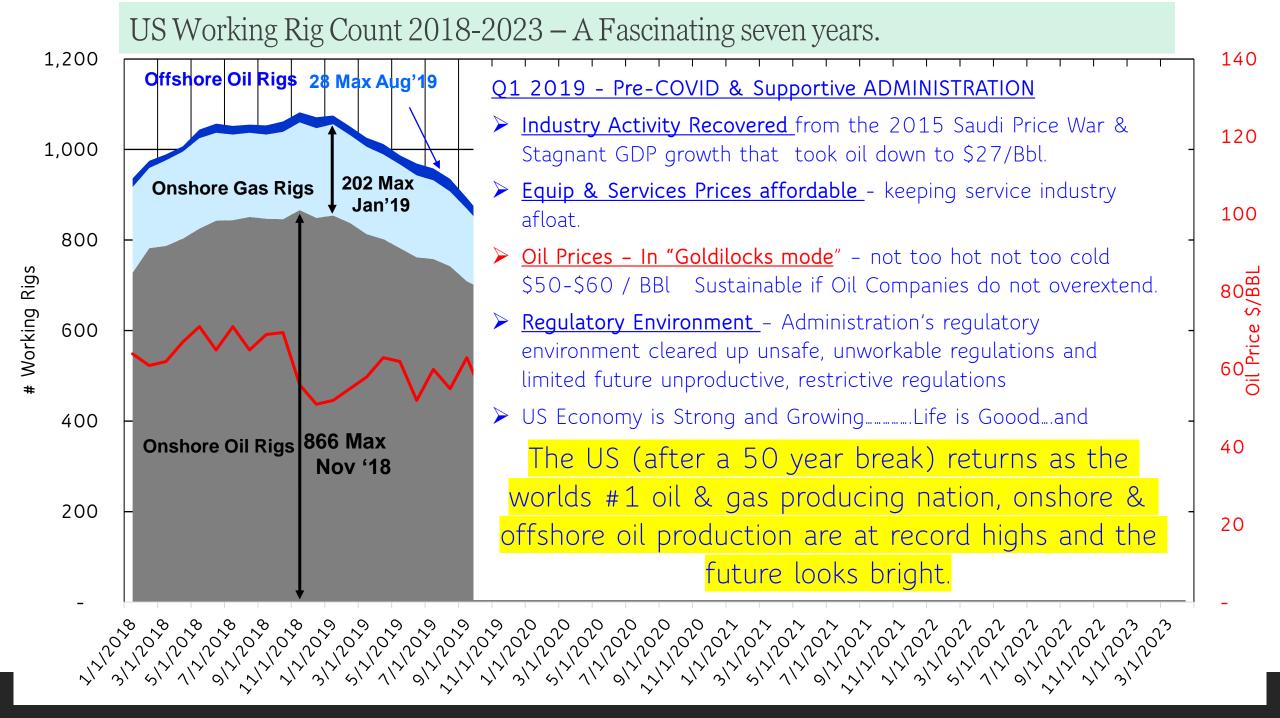
Prior staff, intolerant to a boom/bust cycle "career" – are reluctant to return to work only to be laid off in 12-28 months

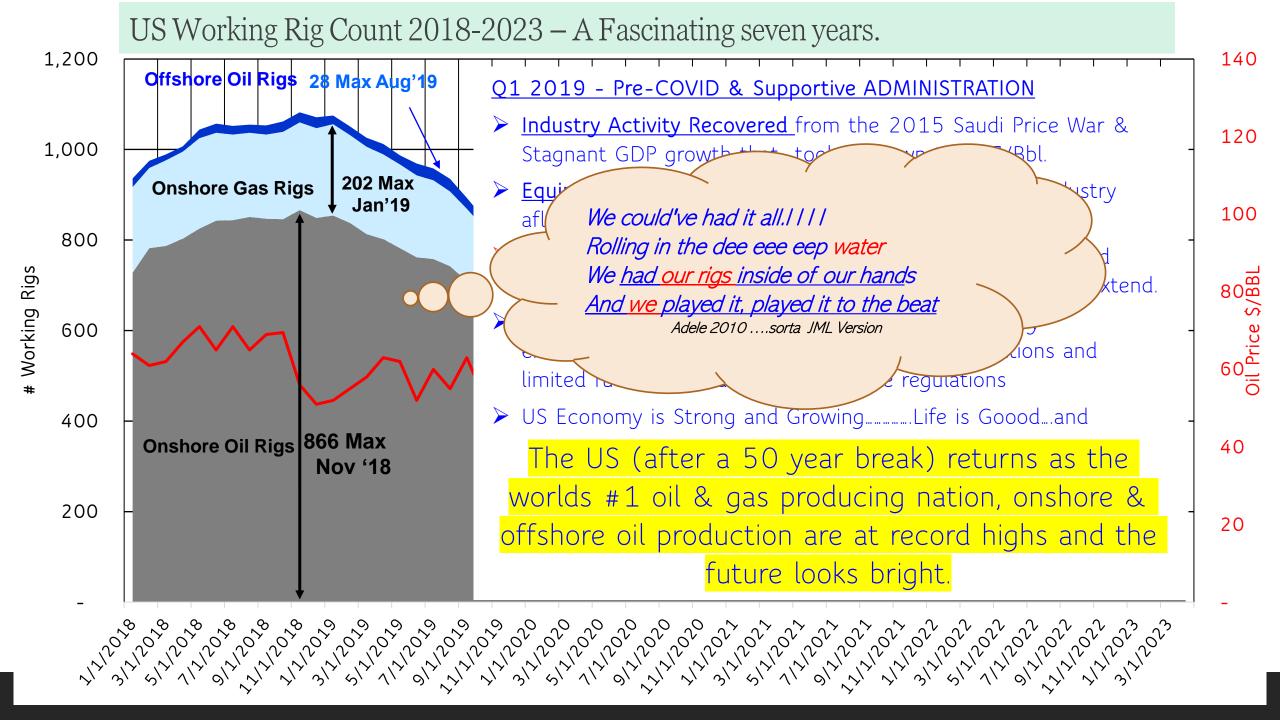


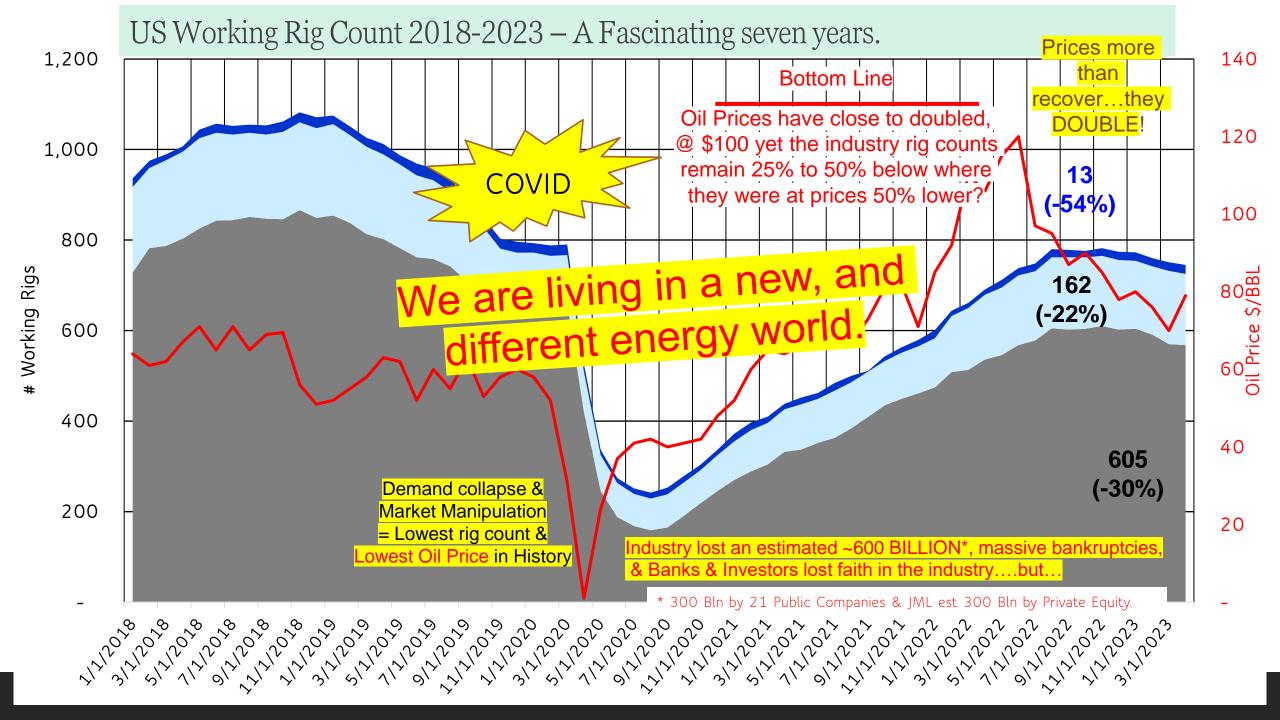


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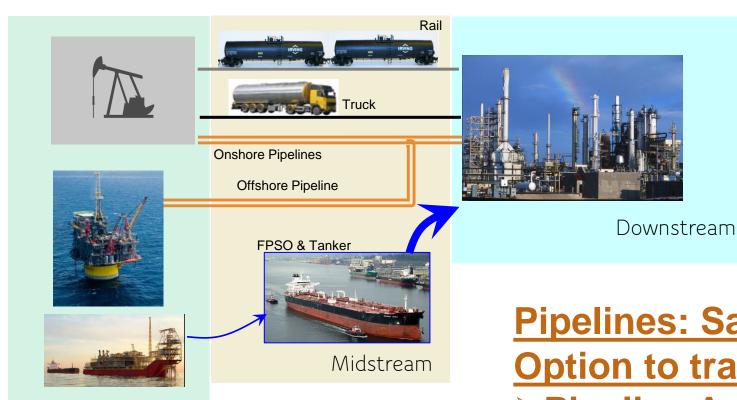




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## US Oil & Gas Industry Sector Overview – From the Ground to Your Tank - Midstream



Leasing – Public & Private Lands
Regulations – Consistent, Fair, Stable
Access to Capital – \$ to Drill & Produce
Stable & Healthy Oilfield Services & Supply Industry

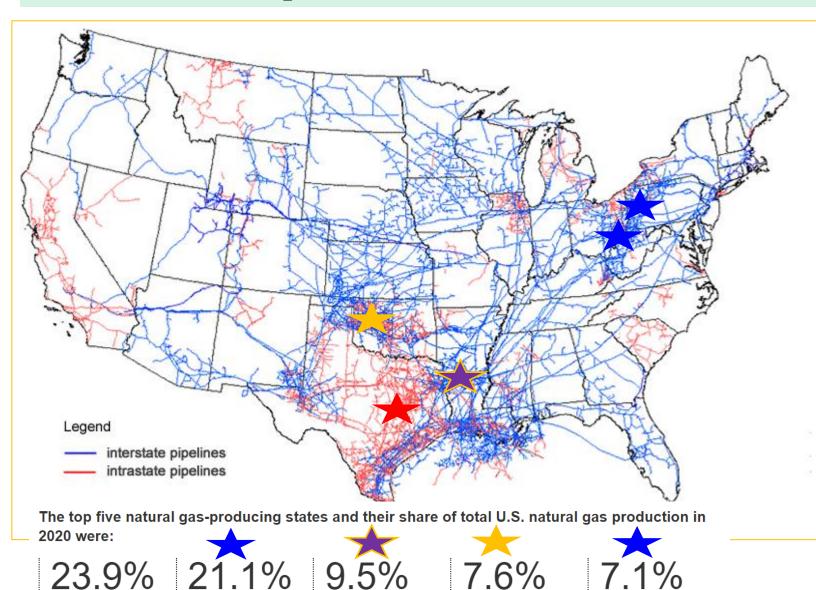
Upstream

Pipelines: Safest most Efficient Option to transport oil and gas.

- **➢ Pipeline Access/Regulations**
- **➢ Pipeline Capacity / Coverage**
- **➢ Pipeline Expansion/Flexibility**

## US Natural Gas Pipelines

Pennsylvania



West Virginia

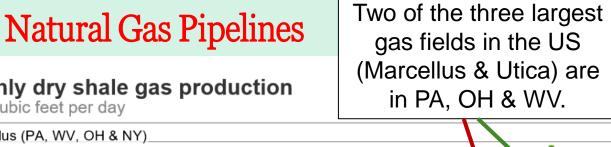
Oklahoma

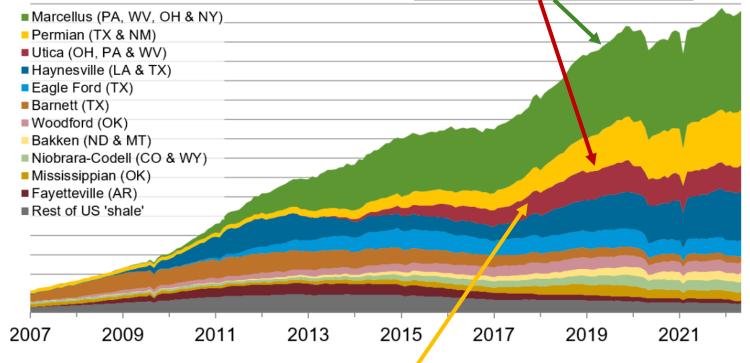
- ✓ Extensive National Pipeline Network
  Transporting Gas from the Gas Fields
  of the 70's 80"s and 90s across
  America.
- ✓ Concern is network has not been updated for the gas fields of the 2010s and 2020s.

## US Natural Gas Pipelines

#### Monthly dry shale gas production

billion cubic feet per day





The Permian, US Gas Field #2 also has Pipeline Issues.

The top five natural gas-producing states and their share of total U.S. natural gas production in 2020 were:

Pennsylvania Louisiana

Oklahoma

West Virginia

80

75

70

65

60

55

50

45

40

35

30

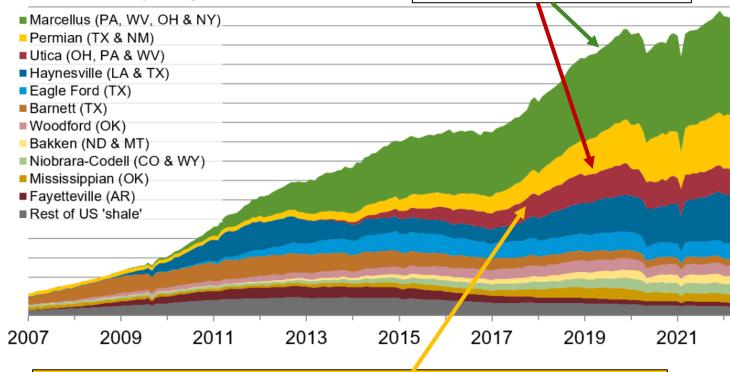
- ✓ Due to "Green" objections to increased or updated oil and gas projects, new pipelines to move Marcellus & Utica gas out of the region are tied up in court and permitting challenges.
- New England competes with the European LNG market....with the largest US gas field next door.
- Resulting in gas getting to the east coast markets, via less safe, and more inefficient methods with an ironic higher carbon footprint.

## US Natural Gas Pipelines

#### Monthly dry shale gas production

billion cubic feet per day

Two of the three largest gas fields in the US (Marcellus & Utica) are in PA, OH & WV.



The Permian, US Gas Field #2 also has Pipeline Issues.

The top five natural gas-producing states and their share of total U.S. natural gas production in 2020 were:

23.9%

es Pennsylvania

1% 9.59

7.6%

7.1%
West Virginia

- ✓ Due to "Green" objections to increased or updated oil and gas projects, new pipelines to move Marcellus & Utica gas out of the region are tied up in court and permitting challenges.
- ✓ New England competes with the European LNG market....with the largest US gas field next door.
- ✓ Resulting in gas getting to the east coast markets. via less safe. and more

## Stranded PA Marcellus Gas Converted to LNG, Trucked to New England

June 18, 2019 | CNG/LNG, Industrywide Issues, Pennsylvania, Statewide PA



80

75

60

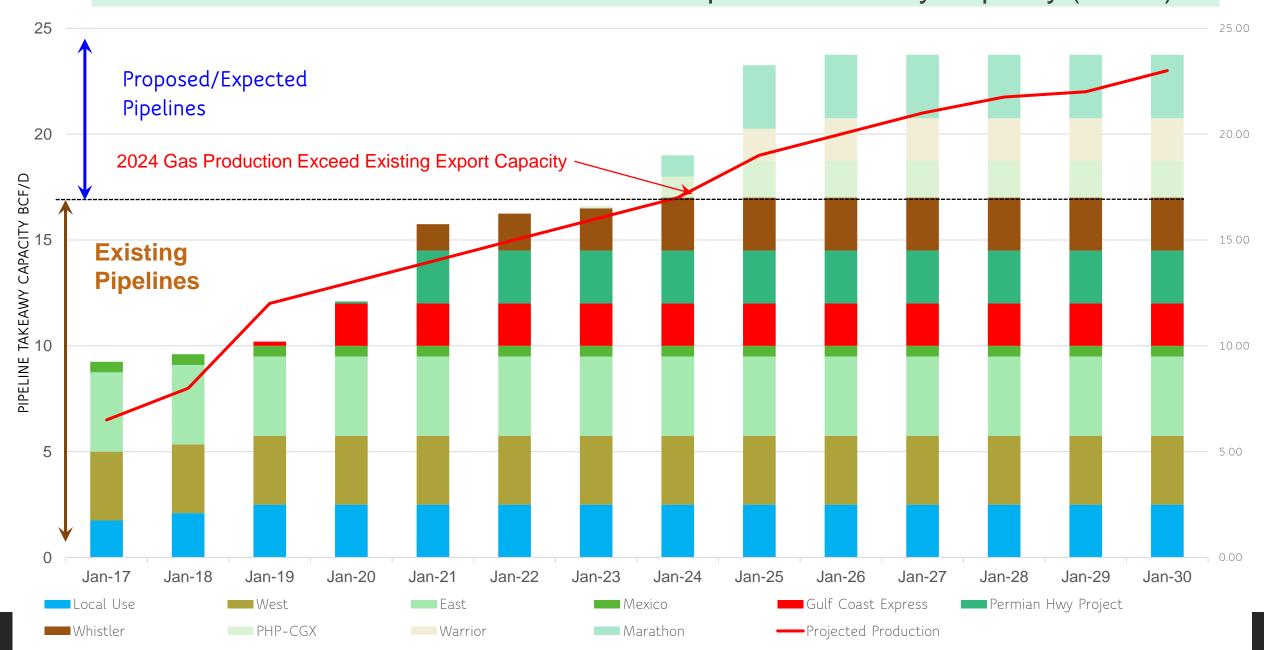
50

EDGE well pad LNG unit (click or larger version)

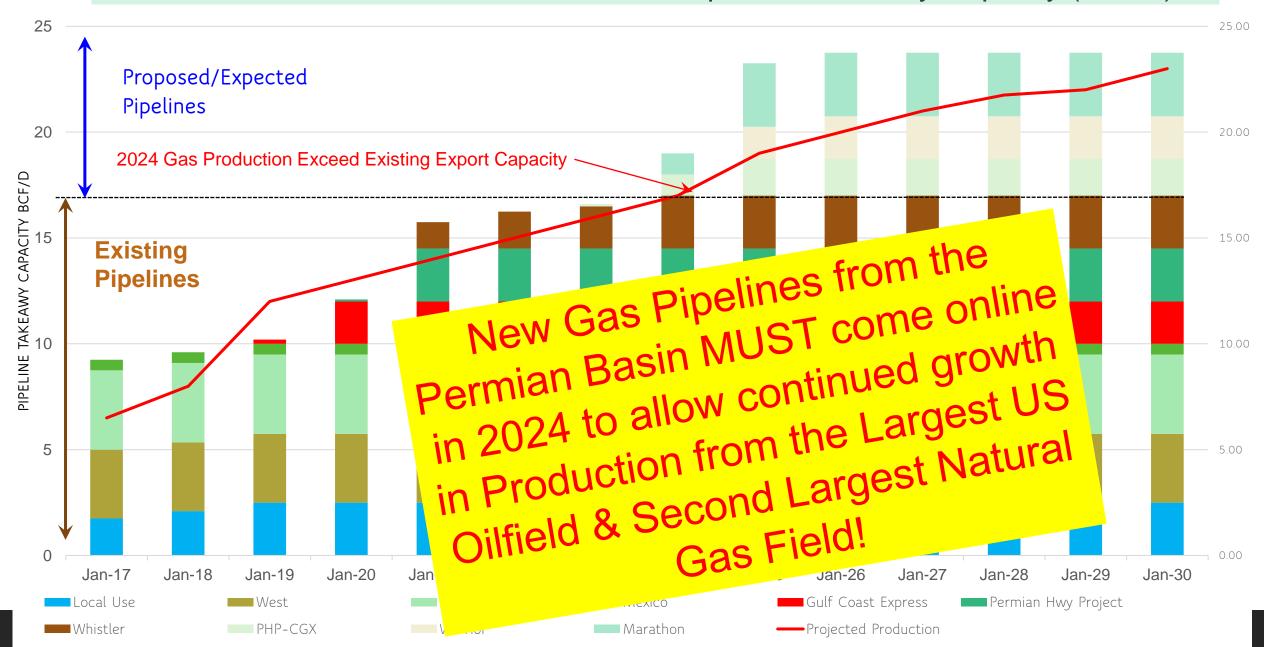
Got a well drilled and ready to produce with no prospects of connecting it to a pipeline system any time soon? No problem! We have exciting, breaking news to share. Edge Gathering Virtual Pipelines 2 LLC (EDGE) earlier today announced in May they deployed a special LNG unit to a remote Marcellus well in PA, converting gas from the well into LNG. The LNG was then loaded

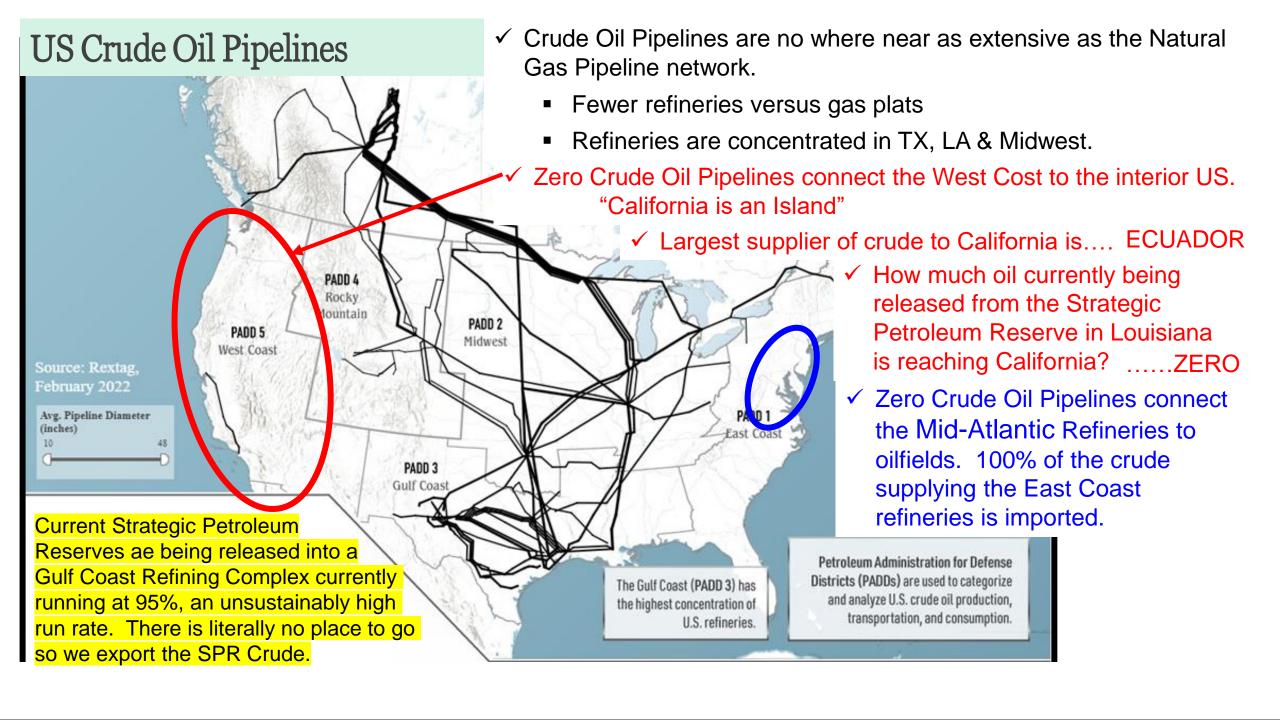
into a special unit and trucked to a gas utility some 300 miles away in New England. A new "virtual pipeline" is born!

#### Permian Associated Gas Production Vs Pipeline Takeaway Capacity (BCFD)

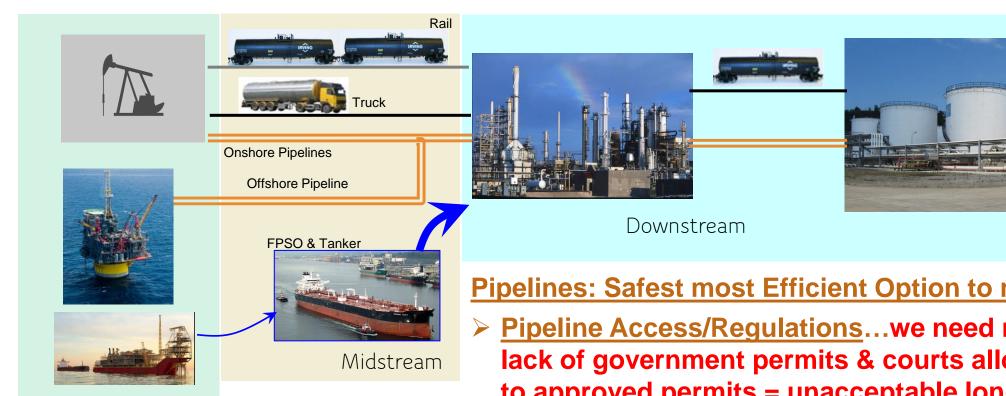


#### Permian Associated Gas Production Vs Pipeline Takeaway Capacity (BCFD)





## US Oil & Gas Industry Sector Overview – From the Ground to Your Tank



**Leasing – Public & Private Lands** Regulations - Consistent, Fair, Stable Access to Capital - \$ to Drill & Produce Stable & Healthy Oilfield Services & Supply Industry

Upstream

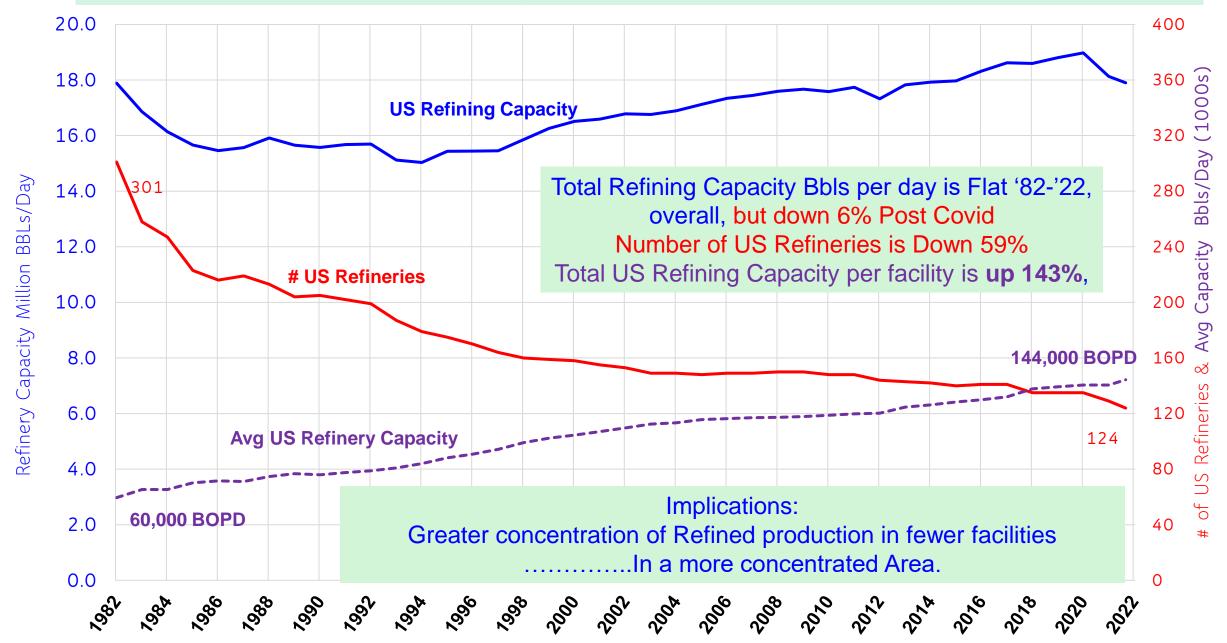
#### Pipelines: Safest most Efficient Option to move Crude Oil

- > <u>Pipeline Access/Regulations...we</u> need more pipelines, but lack of government permits & courts allowing challenges to approved permits = unacceptable long project delays.
- > Pipeline Capacity / Coverage Inadequate key markets are not served domestically (New England)
- Pipeline Expansion/Flexibility is a Short term solution, a band aid on the Capacity and Coverage Issues

## American Oil & Gas 2022 - A Forward View

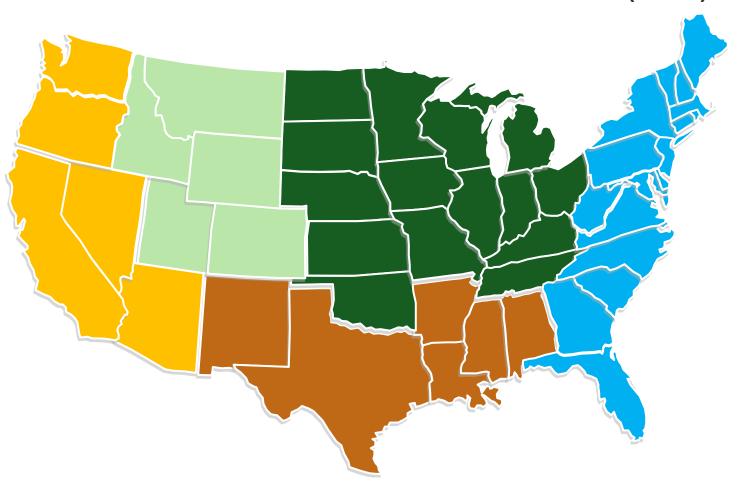
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#### 30 Years – US Refining, Capacity, Facilities & Capacity Trends

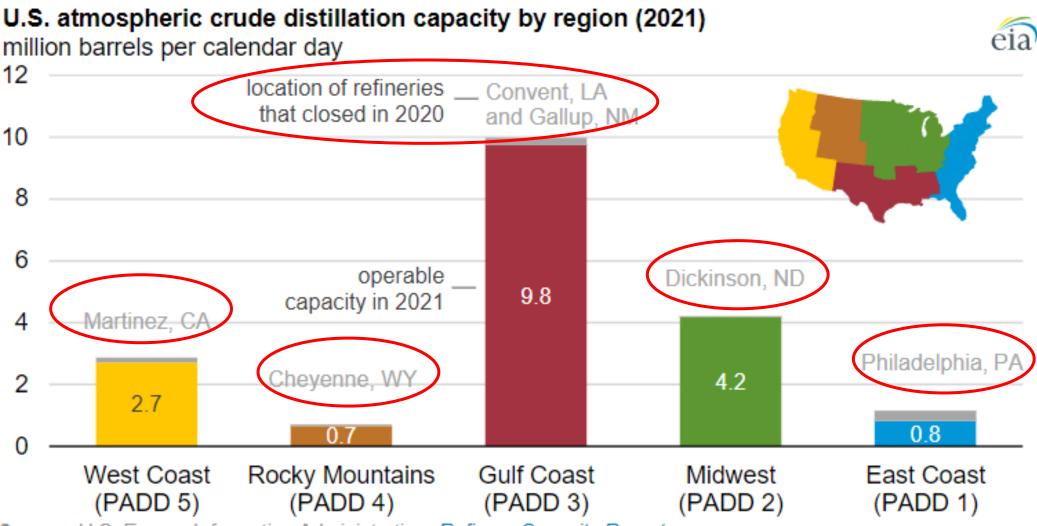


#### Refined US Oil Products – Who Makes & Who Takes

#### **Five Petroleum Administration for Defense District (PADD)**

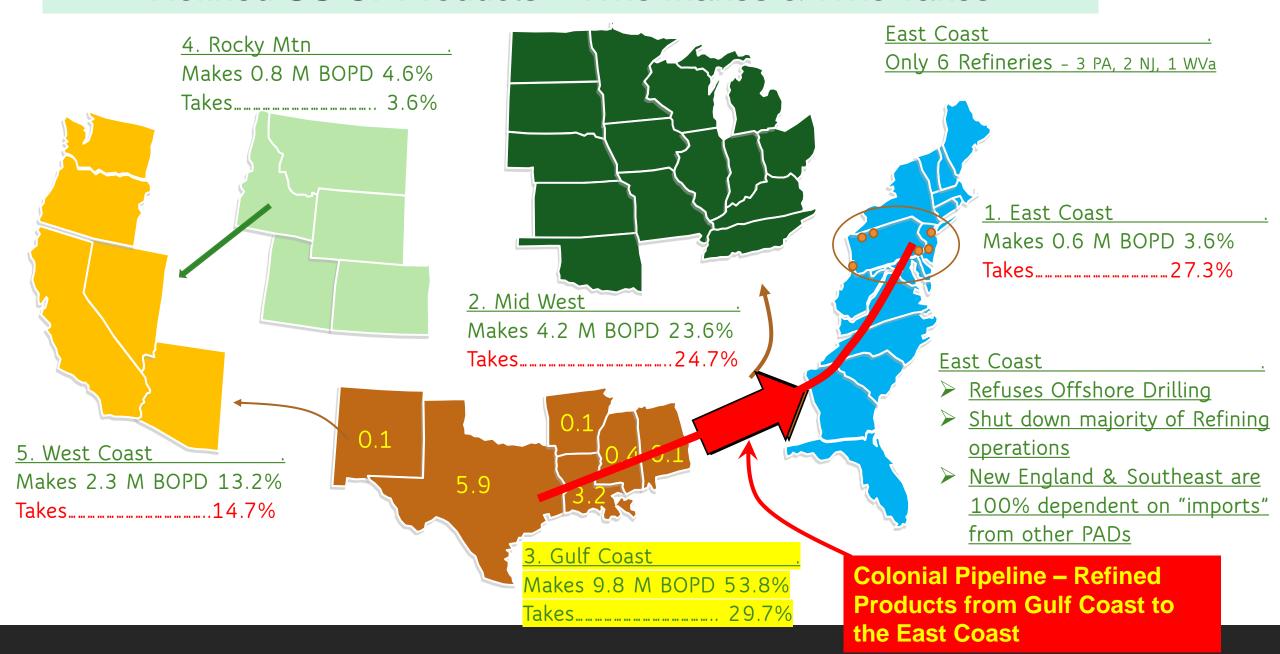


#### PADD – Petroleum Administration for Defense Districts



**Source:** U.S. Energy Information Administration, *Refinery Capacity Report* **Note:** Closures reflect refinery capacity that was present in the 2020 *Refinery Capacity Report* but which we removed in the 2021 *Refinery Capacity Report*.

#### Refined US Oil Products – Who Makes & Who Takes



### Refined US Oil Products – Risks & Exposures

- Reduced small and mid sized refineries put more of the nation exposed to the aging interior fuel distribution networks
- Concentration of the nations refining operations on the Gulf Coast
- Isolation of the East and West Coast from Crude Oil and for the East Coast Refined products.
  - Cyber security Risks have already become apparent.
  - Potential supply disruptions are real (Ex Colonial Pipeline "Ransome/Hack")

## ReCap - American Oil & Gas 2022 - A Forward View

#### Domestic Energy Overview / Update

- Oil and Gas will dominate our energy economy for the next 30 years.
- Ramp up of renewables has not started & is likely to only slightly exceed the increased need for MORE oil and gas by 2050.
- Domestic US Oil & Gas-
  - Upstream (Exploration & Development) Overview
    - Leasing Is industry holding back on providing more oil and gas? No economic government and supply chain constraints (including people) is muting the response.
  - Exploration & Development, Rig Count Insights & Production E&D activity drilling & production needs to increase significantly to even match current production.
  - Midstream Pipelines & Transport We will need more pipelines and an improved midstream infrastructure to even sustain oil and gas production and refining.
  - Downstream Refining Current choke point for many areas of the country we will see increasing gas and natural gas pricing differentials Higher on the East & West coasts.
- ➤ Is it all Doom and Gloom? Have we gone B.A.N.A.N.A.S? No
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Build

Absolutely

Nothing

Anywhere

Near

Anyone

Soon

and gas by 2050.

ment and supply

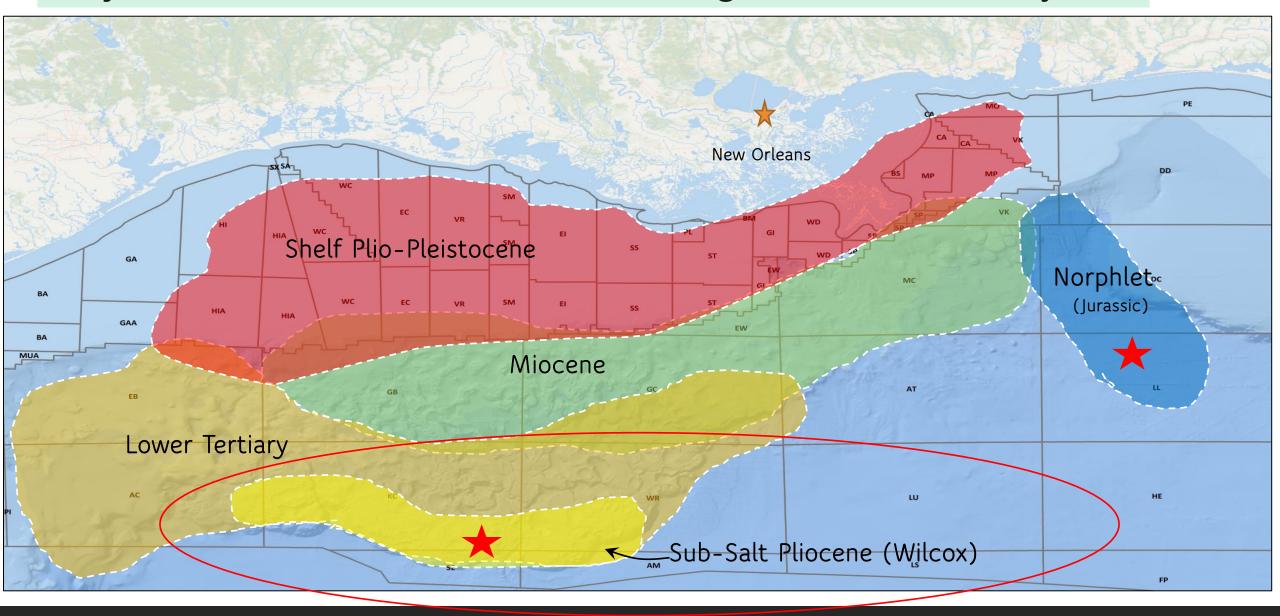
production needs

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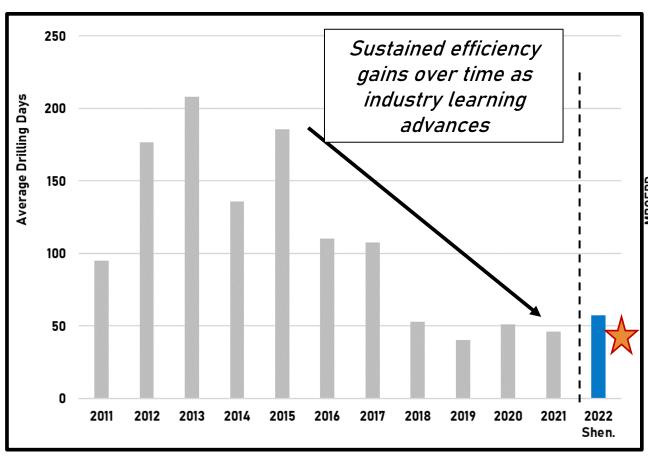
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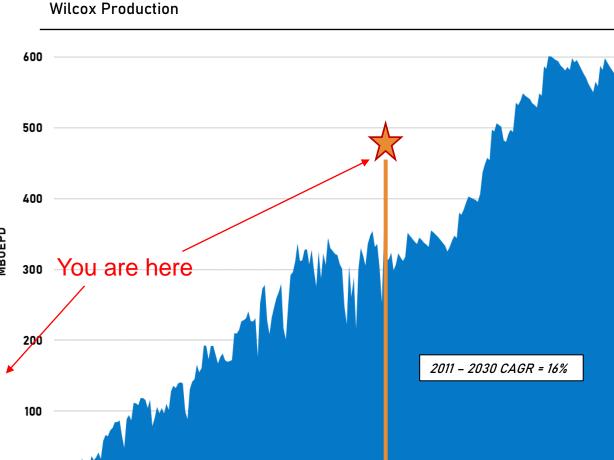
## Major Offshore Gulf of Mexico Geologic Oil & Gas "Plays"



## Wilcox Well-Cost & Production Trends Actual & Projected

**Drilling Days Over Time** 





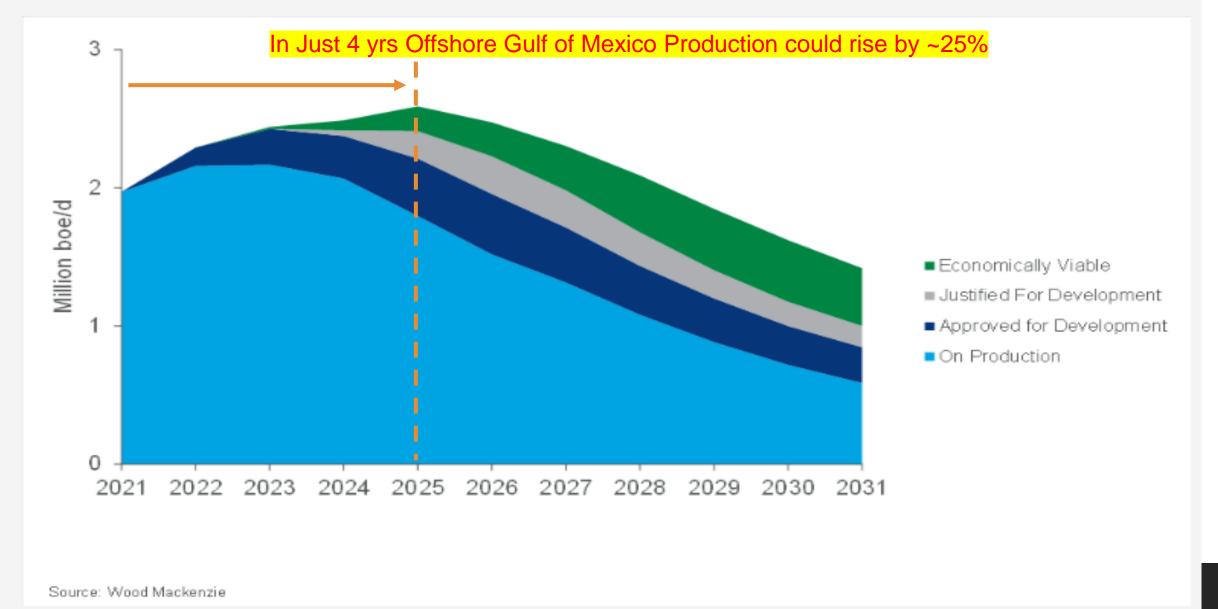
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Lower Costs Via New Technology

Increased Production Via Better Rocks & Geological Understanding

## Wilcox & Deepwater Projected Production Increases

#### GoM production by project status



# Are all the onshore elephants gone?

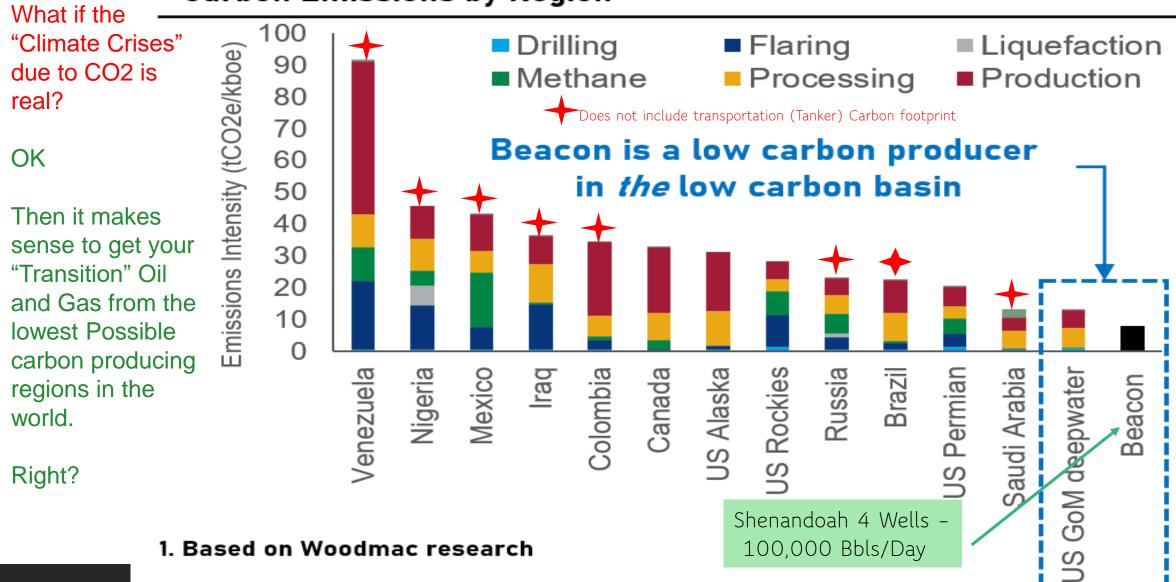


# Billion Barrel Oil Reserve Discovery Confirmed In Central Wyoming

Published on August 8, 2022 — in Energy/News

## Expanded US Production & Carbon Emissions





## With all these Challenges, Risks and Exposures to our Energy Security – What should we do?



America Faced similar challenges prior to WWII.

American Oil and Gas Powered the world to defeat the Nazi and Axis threats.

American Oil and Gas can provide the stability to global oil and gas supply but only if.....

A similar national effort can be made to address the inherent weaknesses in our current system of limitations and restrictions...

A revised joint industry and government working relationship is needed to ensure we successfully navigate energy into the middle of the century

#### Won't OPEC just turn on the Taps and crash prices to restrict the US?



REGIONS ENERGY GEOSCIENCE ENGINEERING TECHNOLOGY VESSELS SUBSEA

#### OPEC+ Approves Tiny Oil Output Rise in Rebuff to Biden

By Maha El Dahan and Ahmad Ghaddar • August 3, 2022

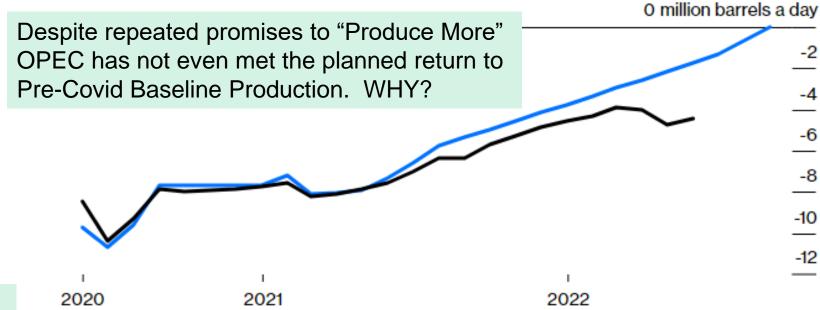


During COVID OPEC Agreed to lower baseline production to support prices with planned increases to get back to the baseline

#### Theory and Practice

OPEC+ crude production is lagging well behind planned levels

Planned cut from original baselines
Actual cut



Source: OPEC

Note: Cuts are from original baselines and include Saudi Arabia's additional unilateral cuts



US Energy Strategy Feels like.....

Trying to cram in too much.... too late?

- "Prediction is very difficult, especially if it's about the future." -Niels Bohr (physicist)
- > Oil & Gas will continue to matter for a long time (i.e. your full career!)
- Natural gas has a brighter future than crude oil & the US will continue to be a material global player in natural gas
- > Regardless of technology transitions, efficiencies, etc. ...you must drill wells!
- ➤ The organizations that efficiently drill, complete and produce the best wells should "win"......
- More oil and gas activity (and careers) rather than less is the most likely scenario
- ➤ Global energy demand & thus prices should maintain at \$70-\$100 levels (with substantial upside) to sustain a profitable industry…despite "political head winds".
- Don't give up the ship as she is about to sail!!
- Dr Rasouli & the Petroleum Engineering faculty would love to talk with you!

