Discovering and commercializing unconventional reservoir plays larger and more prolific than the Permian Basin and Marcellus Shale: The promise of international unconventional reservoirs

Greg Leveille and Doug Valleau

June 22, 2026

ExxonMobil Permian Basin drilling operations

Marcellus Shale hydraulic fracturing operations

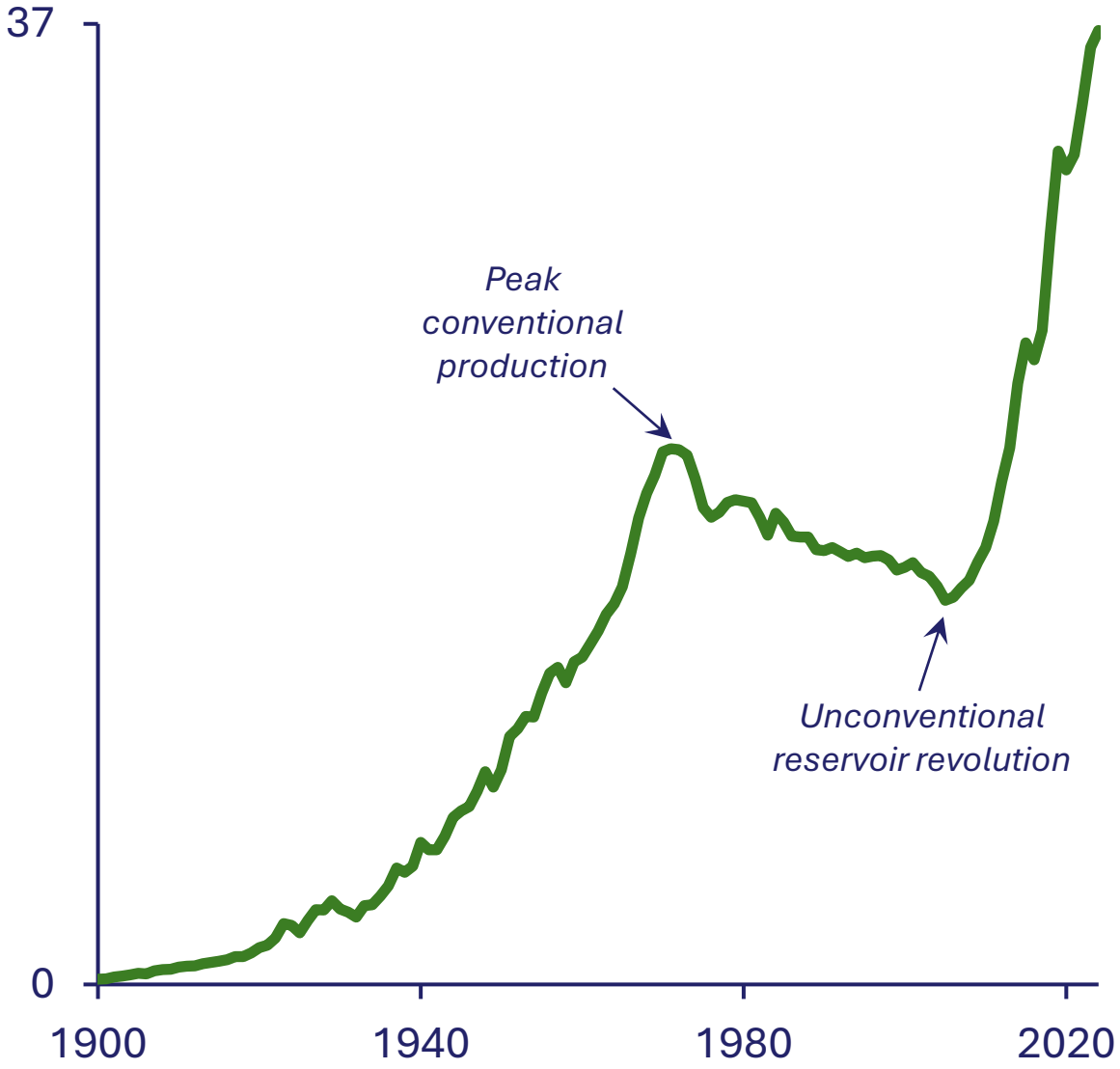
Presentation outline – Leveille

- American exceptionalism
- History shows again and again…
- Why now is the time to move overseas
- The importance of arriving ahead of the herd
- Don’t just look in the obvious places

America is by far the world's largest producer of unconventional hydrocarbons

U.S. oil and gas production

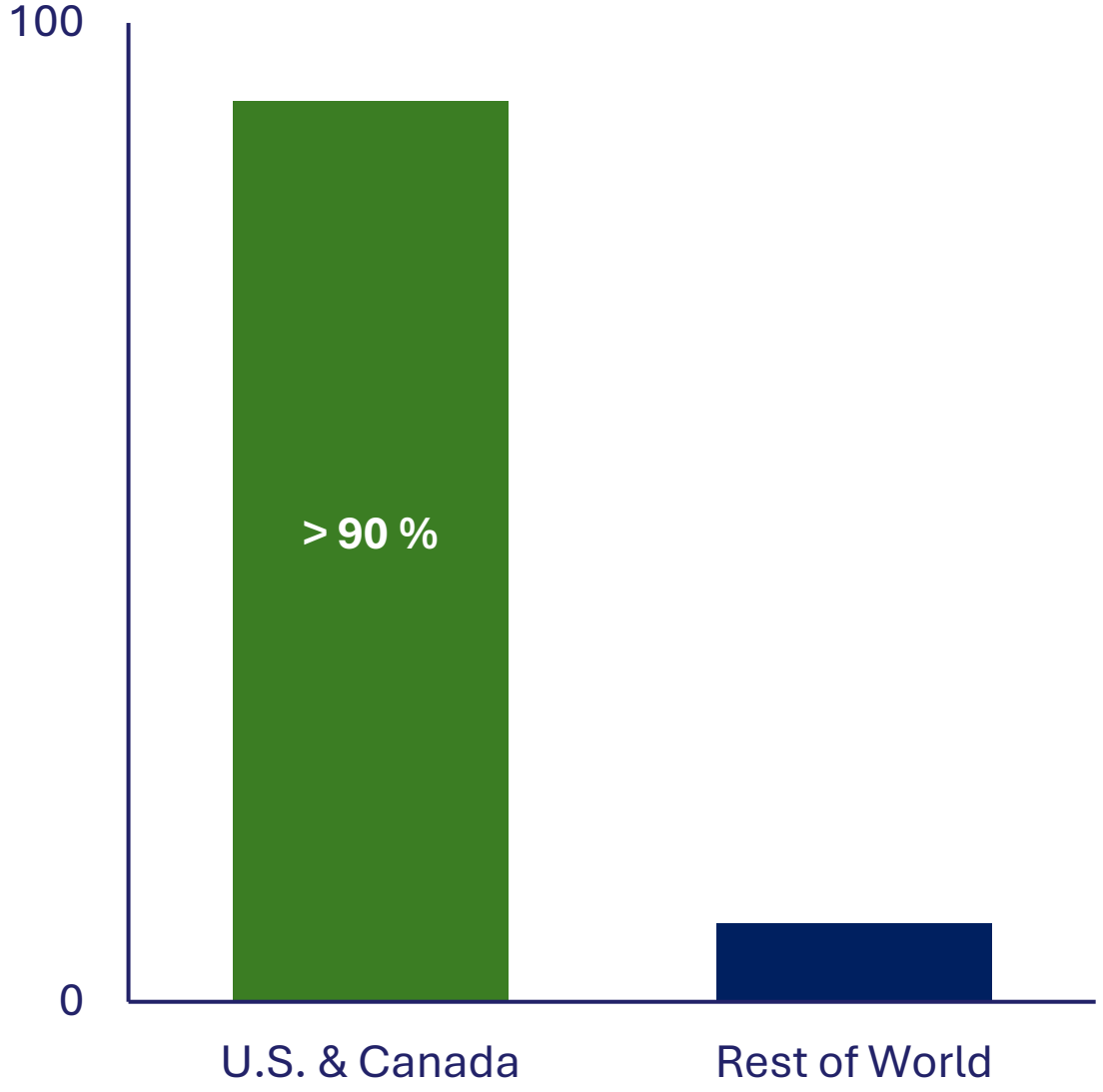
(Million barrels of oil equivalent per day)



Sources: U.S. EIA and Energy Institute websites

Unconventional oil and gas production

(Percent of total global production)

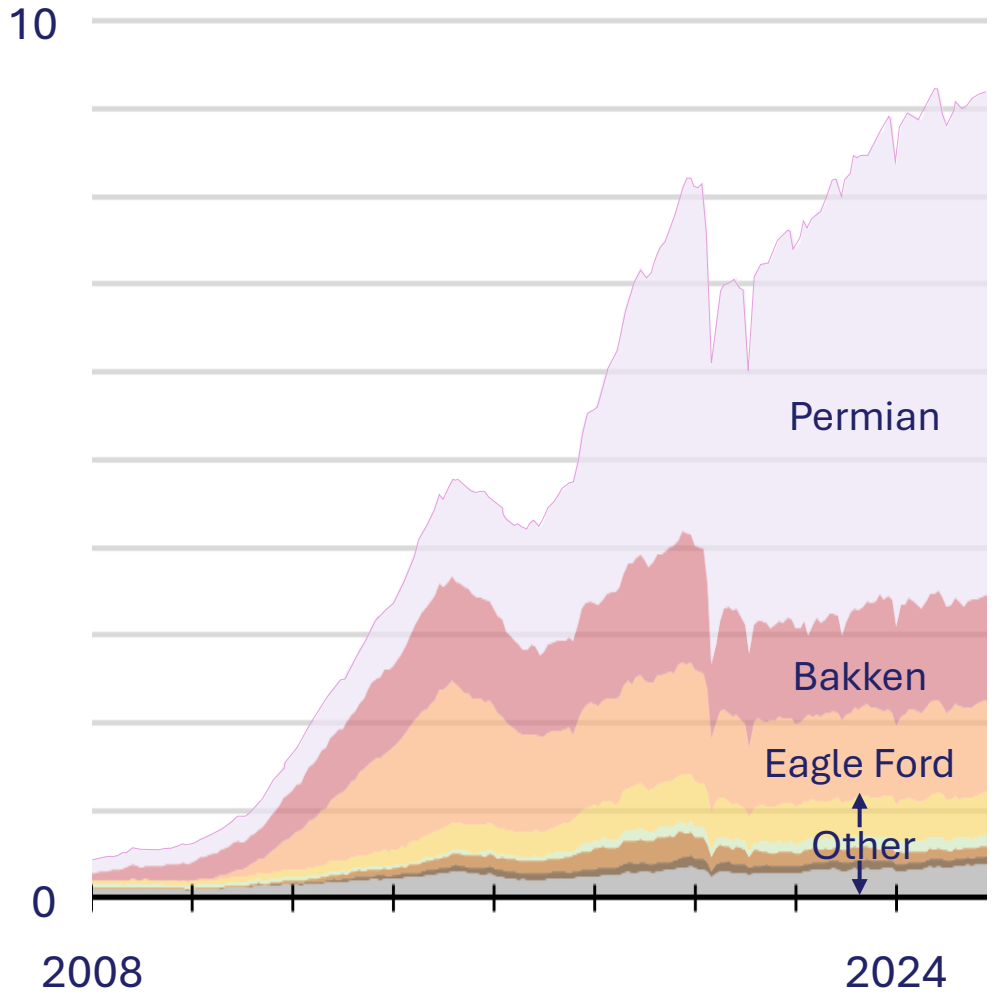


Sources: U.S. EIA, Energy Institute, and other sources

Most U.S. unconventional production comes from six plays, with the Permian Basin and the Marcellus Shale being the two largest plays by both flow rate and EUR

Oil production

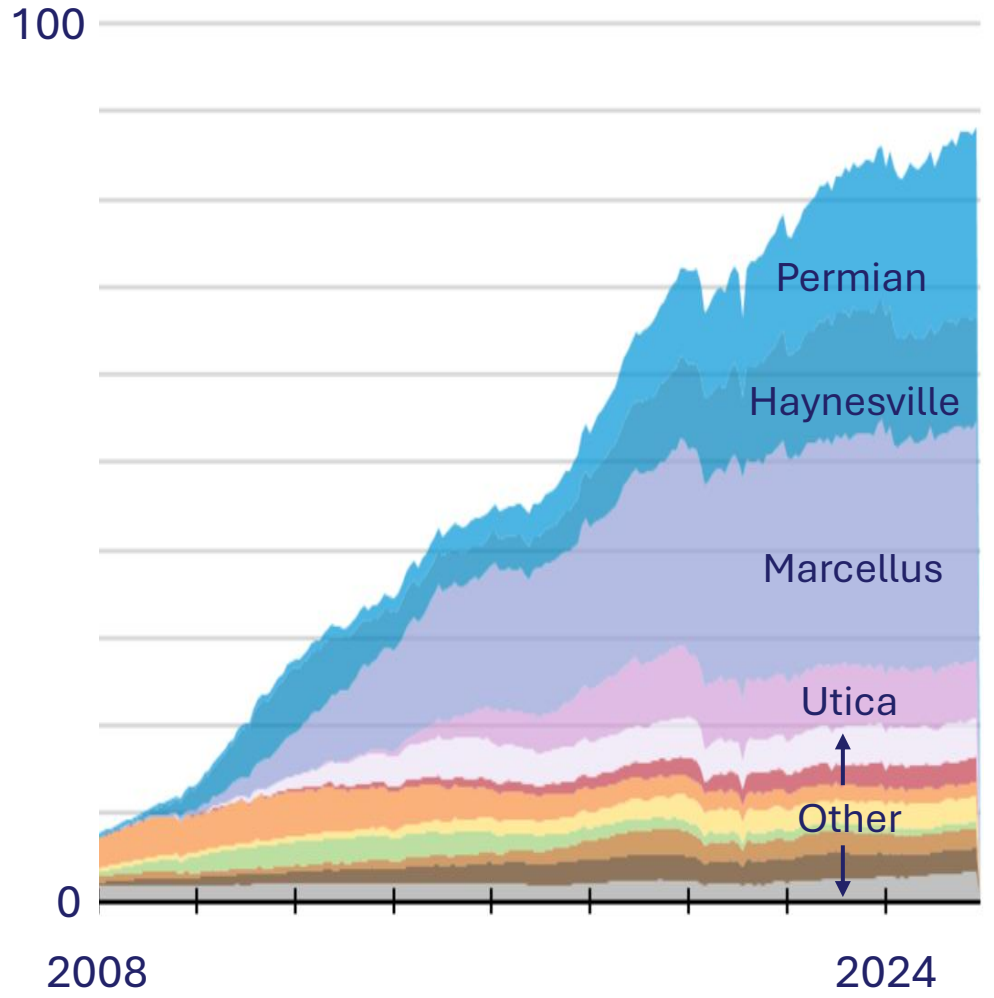
(Million barrels per day)



Source: U.S. EIA

Dry shale gas production

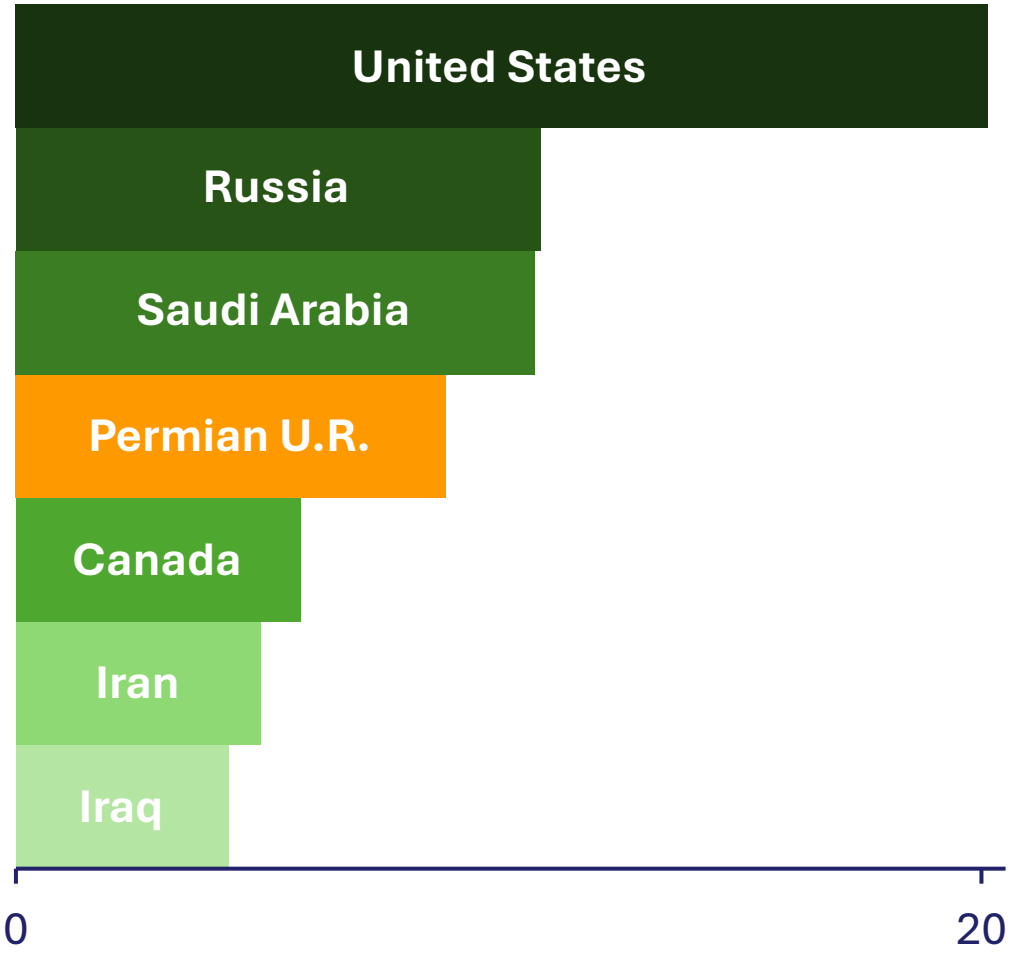
(Billion cubic feet per day)



Source: U.S. EIA

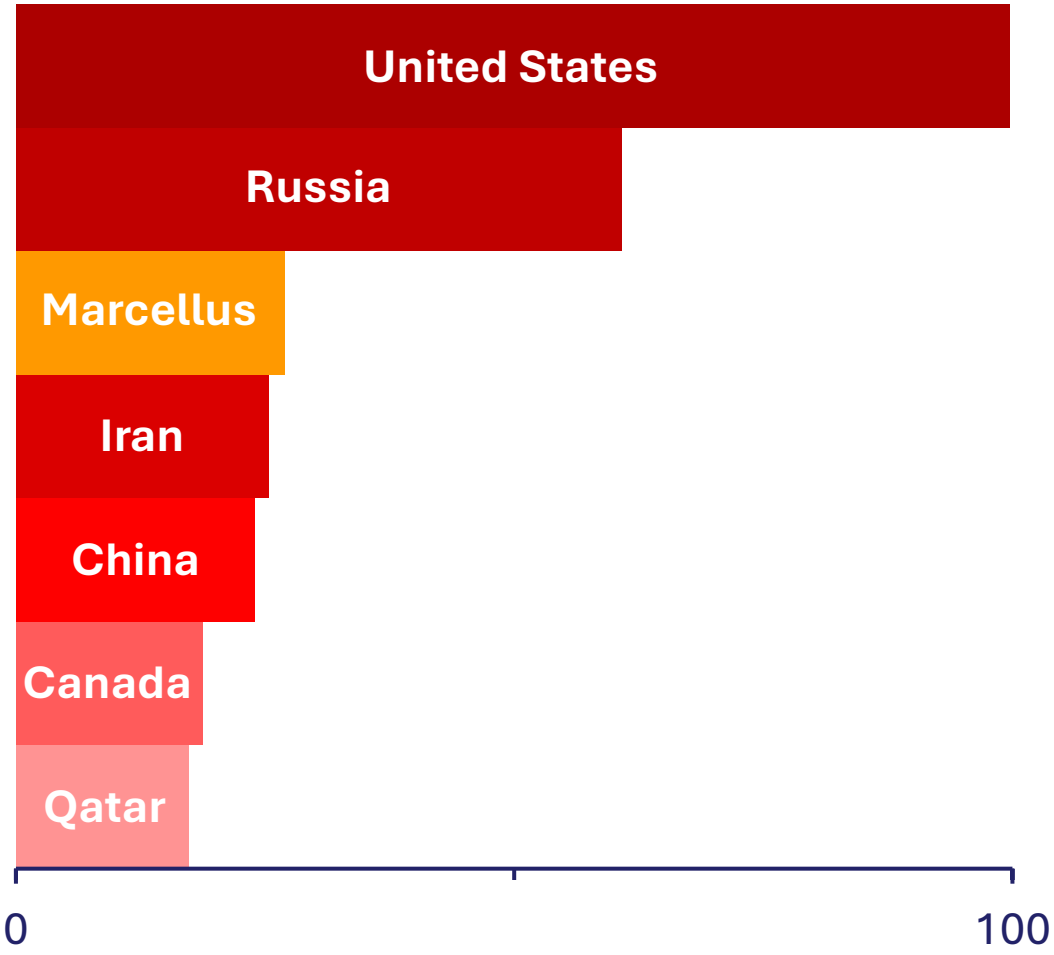
Permian Basin unconventional reservoirs and the Marcellus Shale are producing more oil & gas, respectively, than most countries on our planet

Oil production[1]
(Million barrels per day)



Sources: U.S. EIA and Energy Institute websites; [1] Oil production is as defined by the Energy Institute; includes oil, condensate, and NGLs

Gas production[2]
(Billion cubic feet per day)



Sources: U.S. EIA and Energy Institute websites; [2] Gas production is as defined by the Energy Institute; includes only dry gas, no NGLs

Onshore conventional production: Born in the USA, decades of dominance, eventually eclipsed by production from larger fields overseas

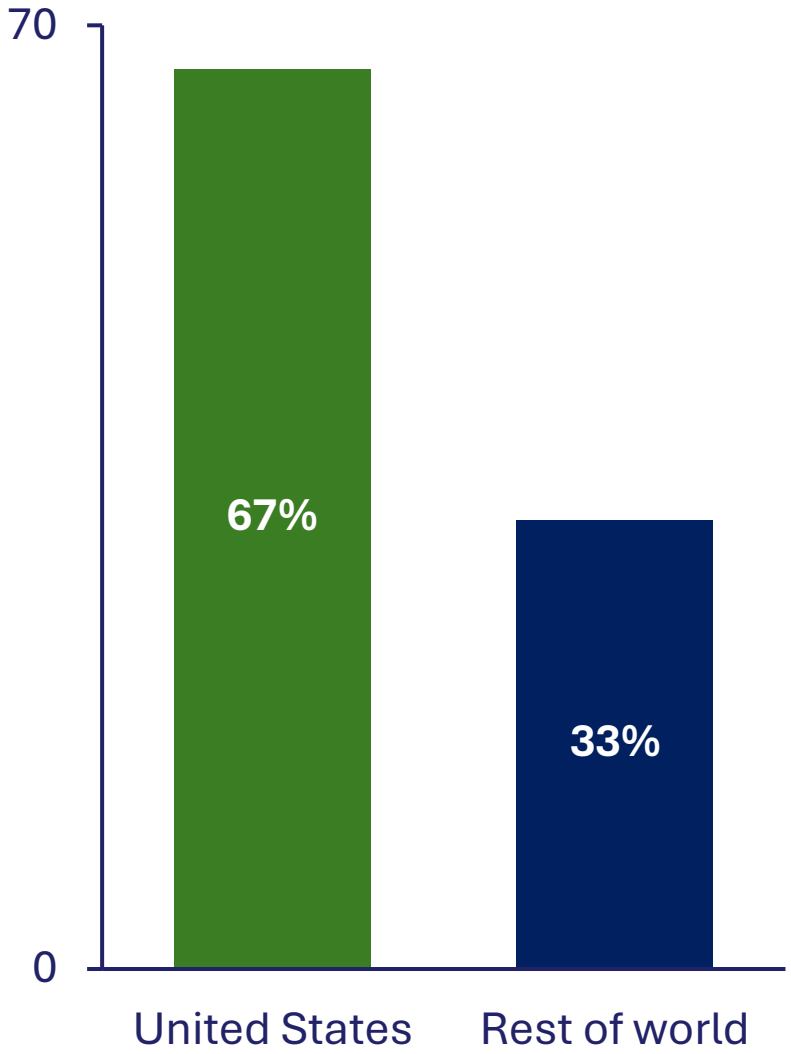
Birth of the oil industry in 1859

(Drake well, Pennsylvania, USA)

Source: Britannica website

Conventional oil output 1859-1950

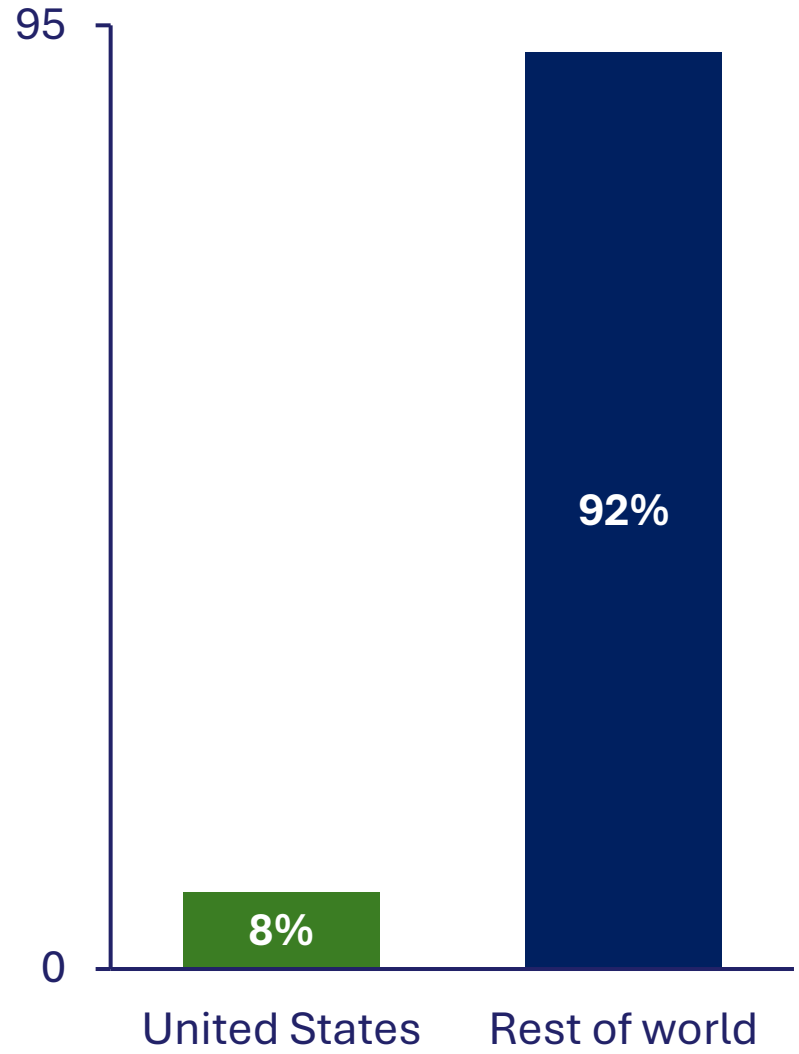
(Cumulative percentage of total global output)



Source: Wallace Pratt, 1952, Toward a philosophy of finding oil, AAPG Bulletin V 36, Number 12

Conventional oil production in 2025

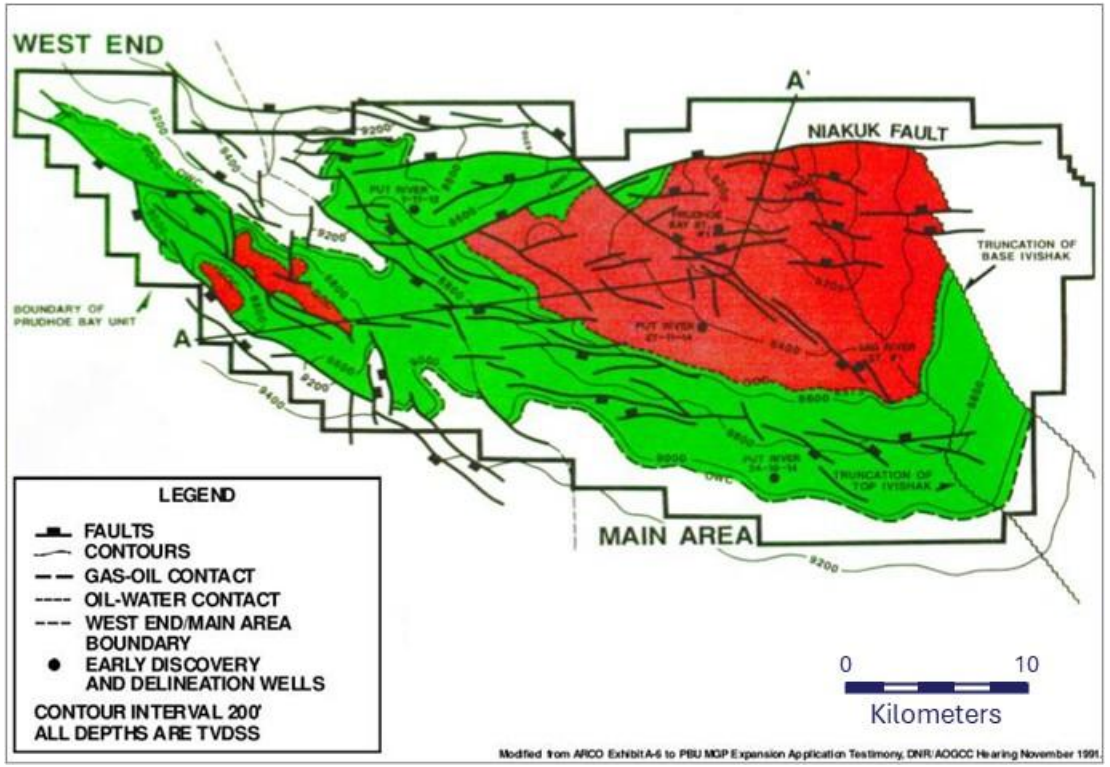
(Percentage of total global output)



Source: Energy Institute, U.S. EIA, and other sources

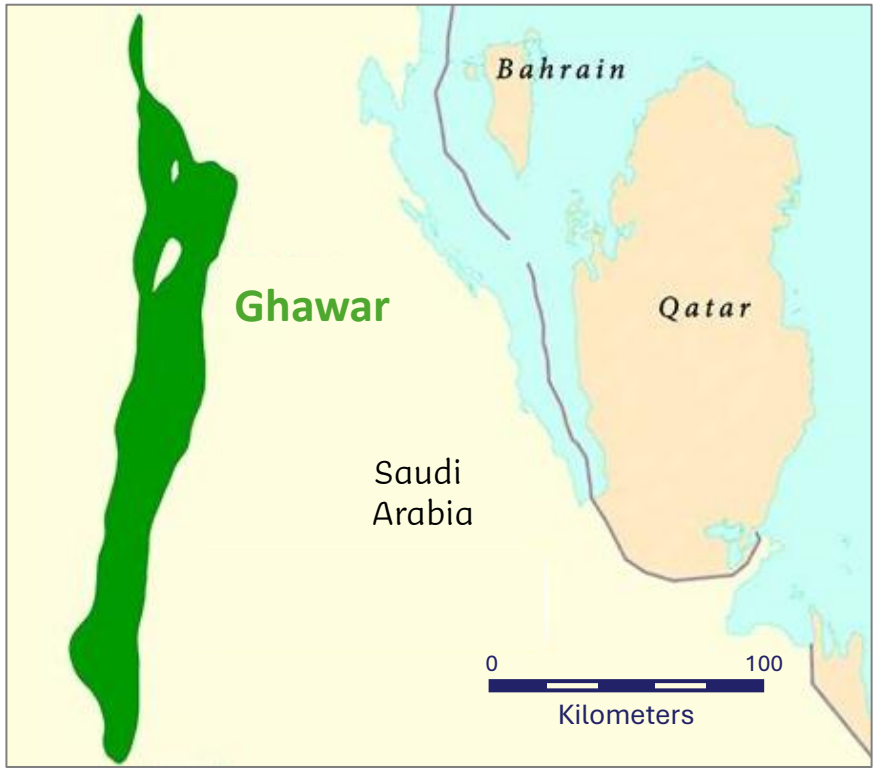
America’s onshore conventional fields are unexceptional by global standards

America’s largest onshore conventional oil field



Prudhoe Bay: ≈ 16 billion barrels of oil EUR

Our planet’s largest onshore conventional field



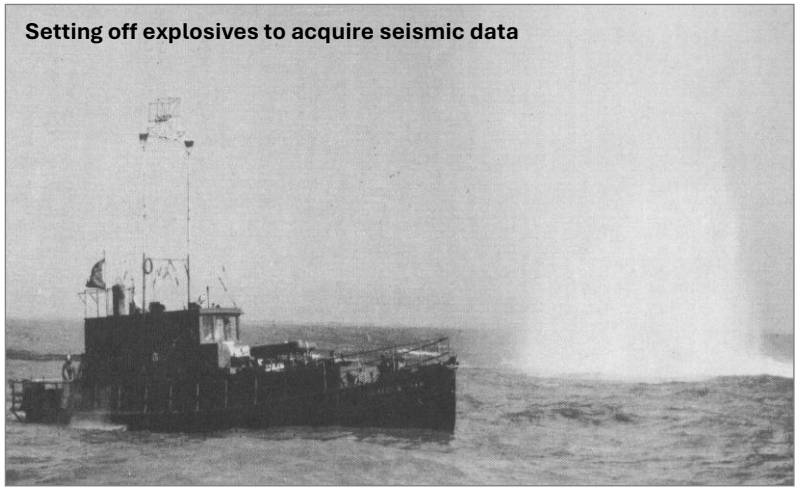
Ghawar: ≈ 125 billion barrels of oil EUR

EUR = Estimated ultimate recovery

Offshore production at scale first occurred in the shallow waters of the Gulf of Mexico shortly after the end of the second world war

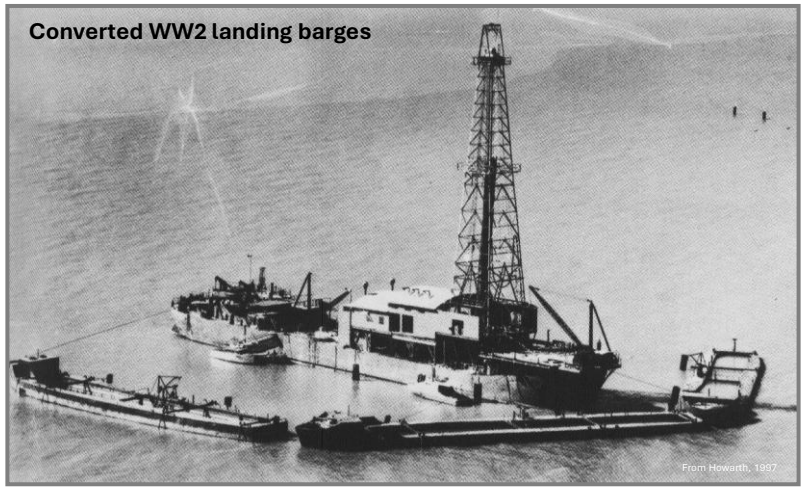
Seismic acquisition techniques

Setting off explosives to acquire seismic data



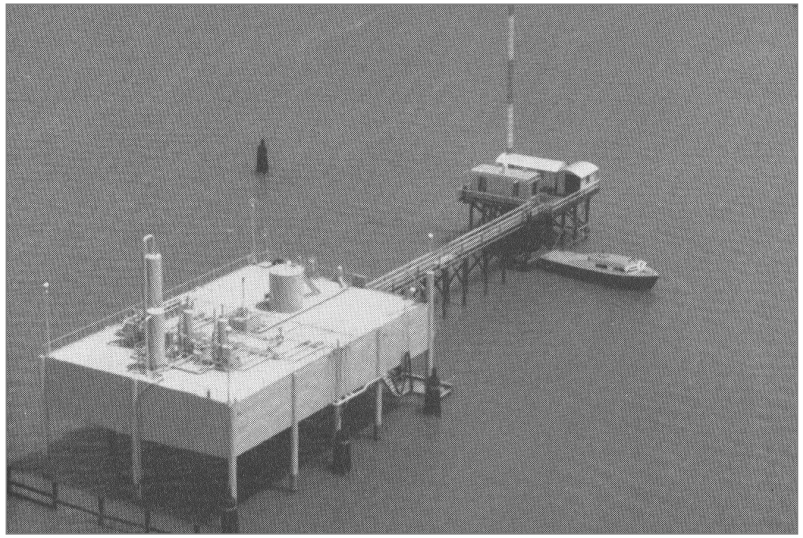
Offshore drilling rigs circa 1950

Converted WW2 landing barges

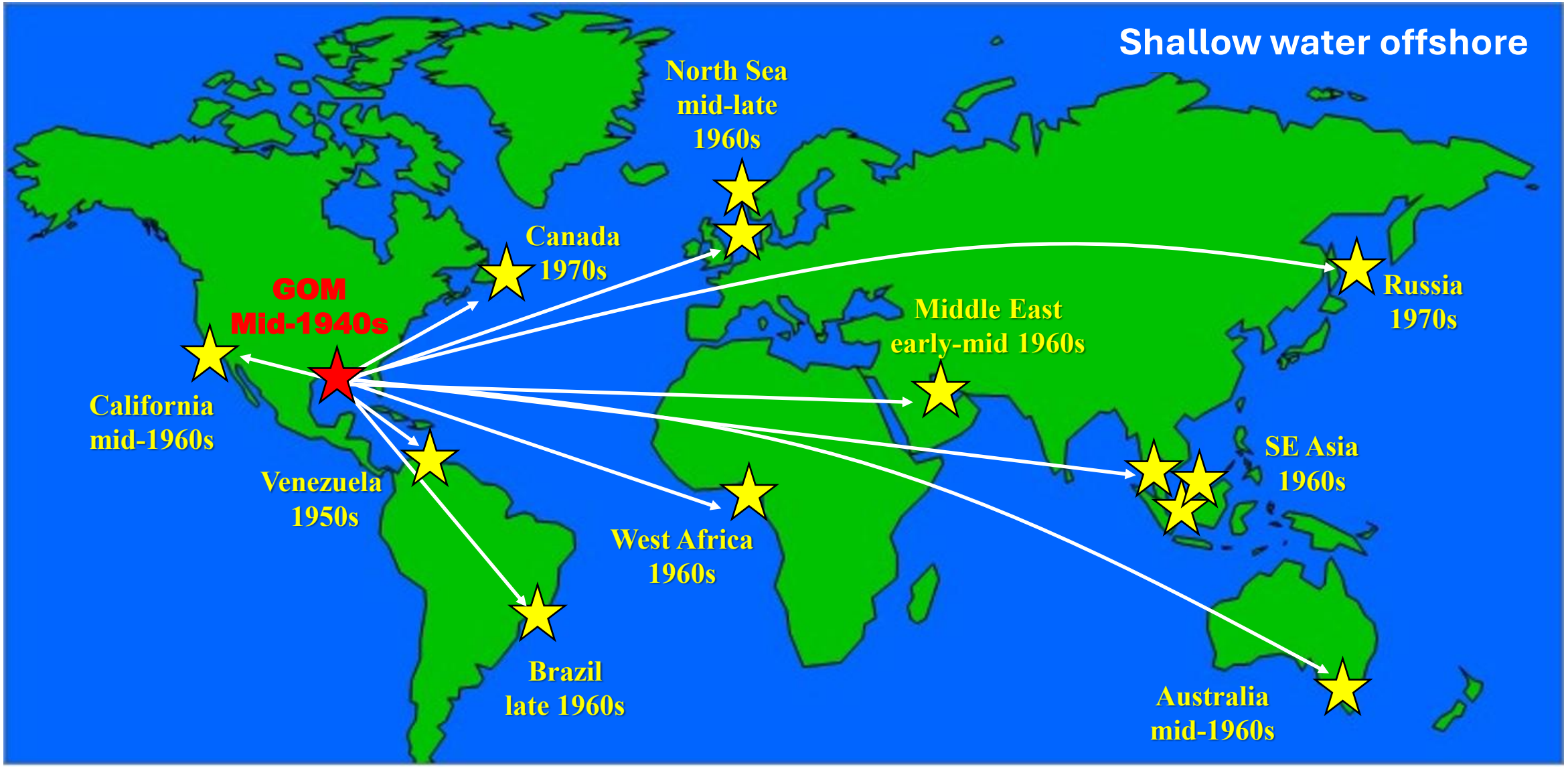


Offshore production platforms

Early offshore production platforms



The U.S. dominated shallow offshore oil & gas output for nearly two decades, but the U.S. was eventually surpassed by the ROW once technologies matured sufficiently



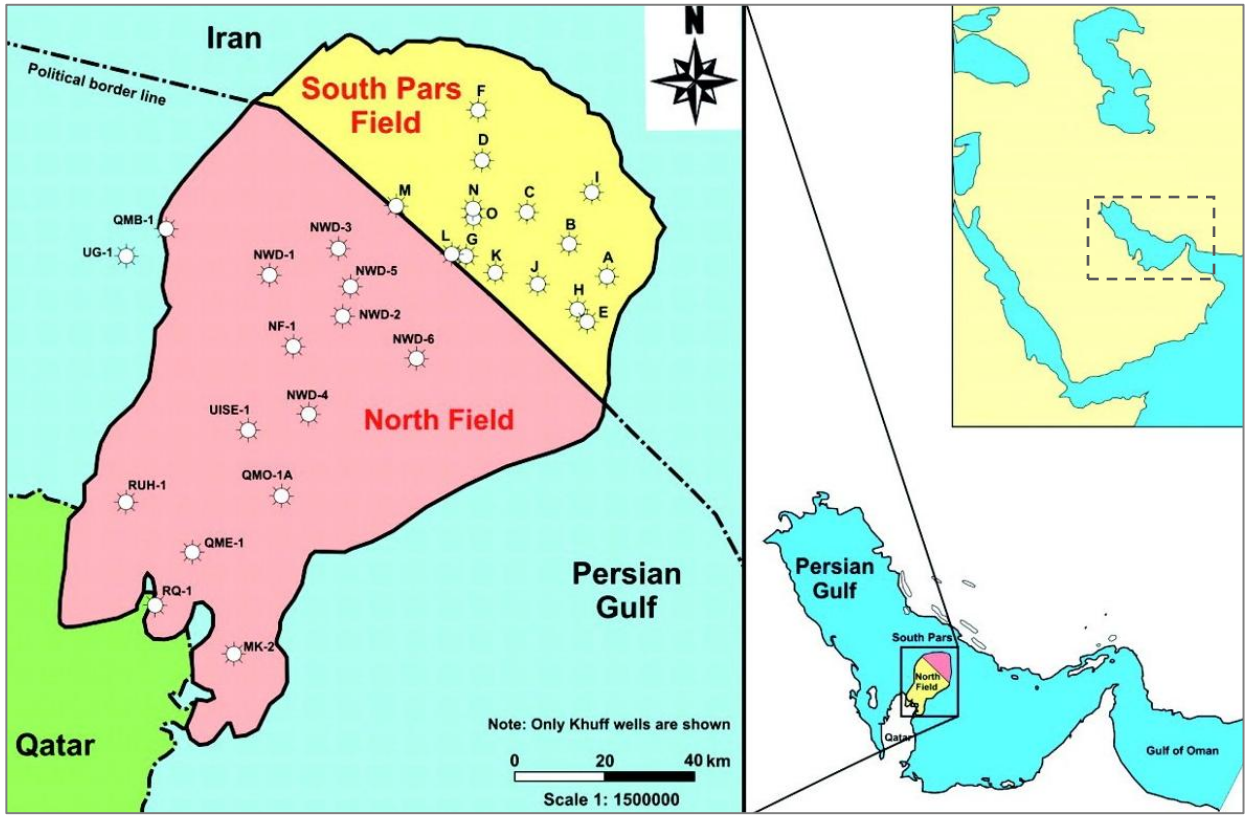
ROW = Rest of world; GOM = Gulf of Mexico

The largest international shallow water fields are far larger than those in the USA

America's largest shallow water fields

Several fields in the Gulf of Mexico: 0.5 to 1 billion BOE EUR

The largest shallow water field on our planet

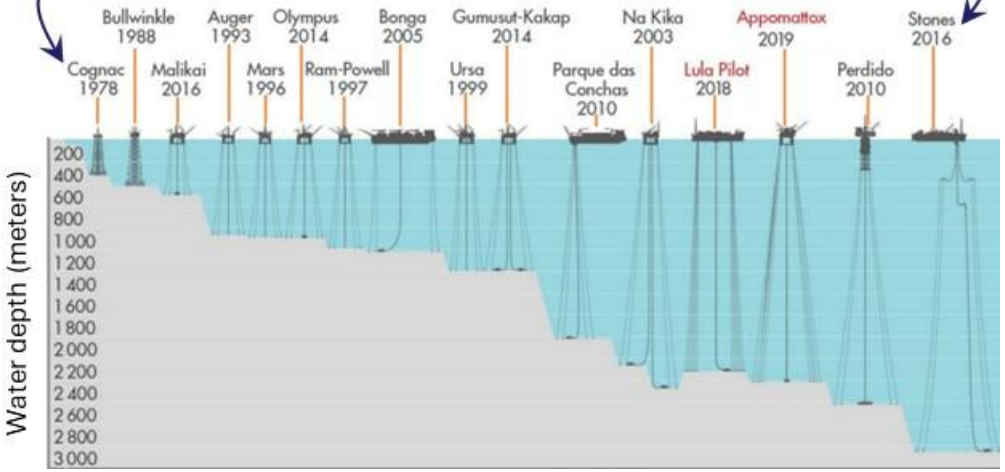


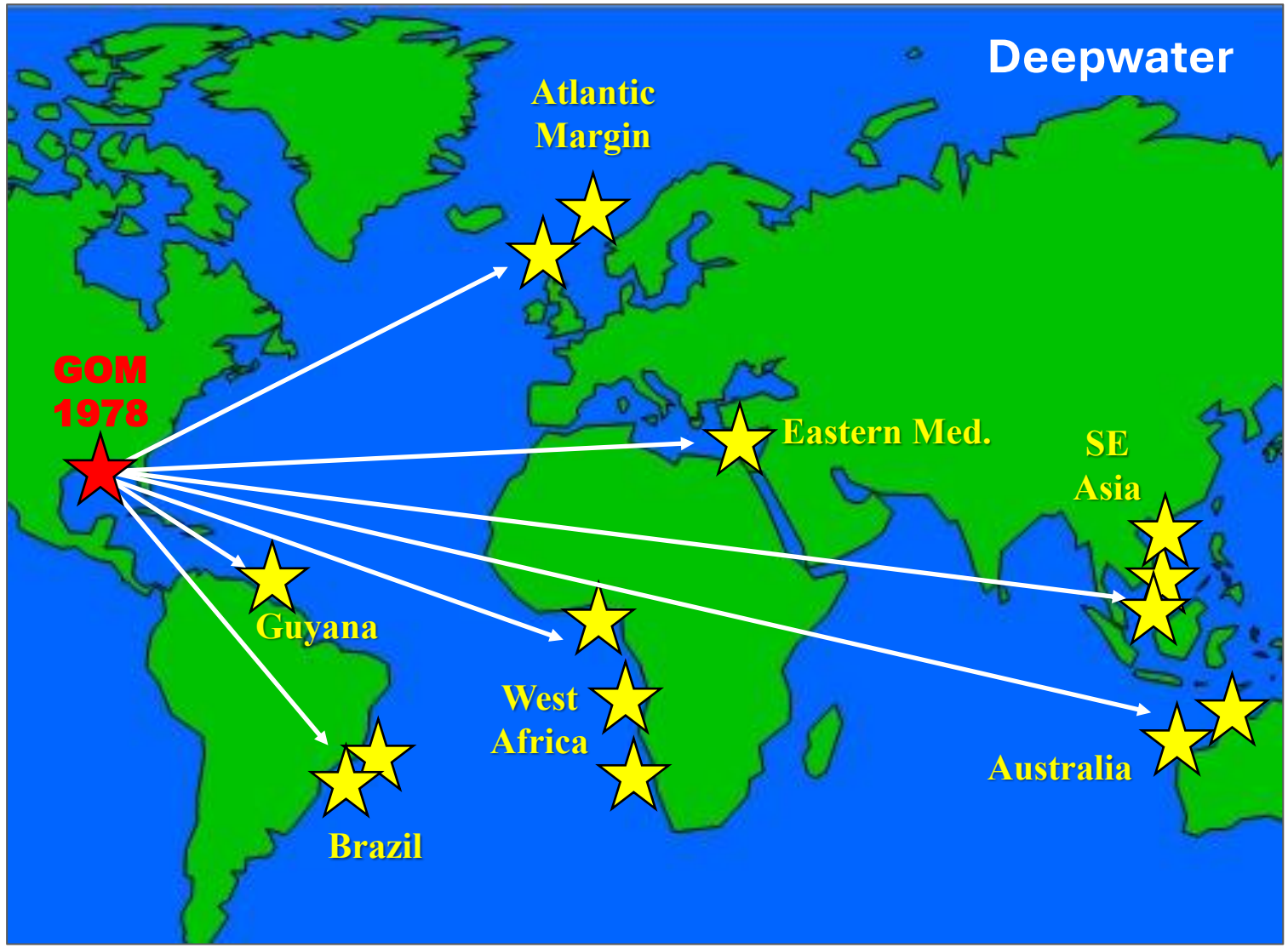
North Field / South Pars Field: > 200 billion BOE EUR

Evolved technologies + better petroleum systems = Robust economic outcomes

EUR = Estimated ultimate recovery; BOE = Barrels of oil equivalent

Deepwater: Born and nurtured in the USA, but bigger fields eventually found elsewhere



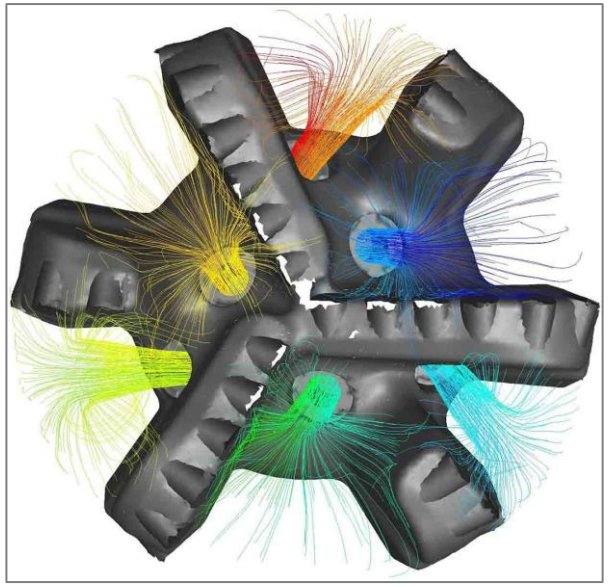


Evolved technologies + better petroleum systems = Robust economic outcomes

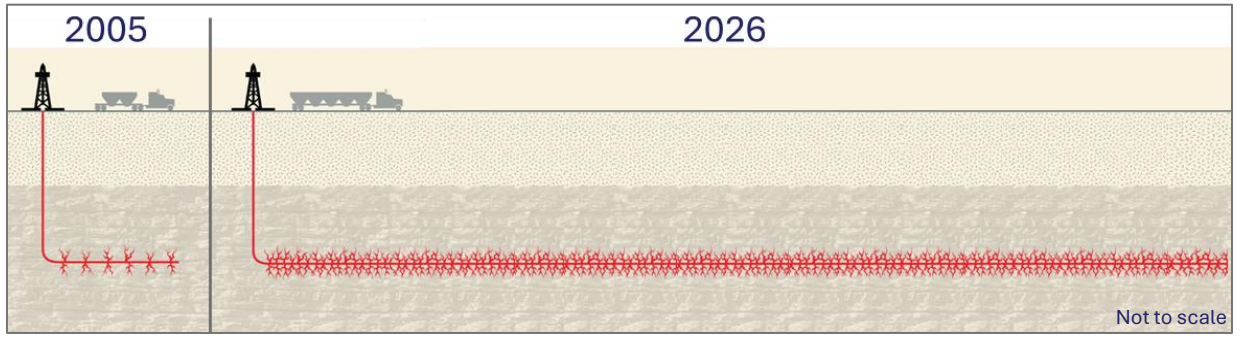
Now is the time to pursue international unconventional E&P because one can apply 2026 U.R. technologies to targets better than the best U.S. Tier 1 acreage

Drilling further, faster

Better rigs



Better bits

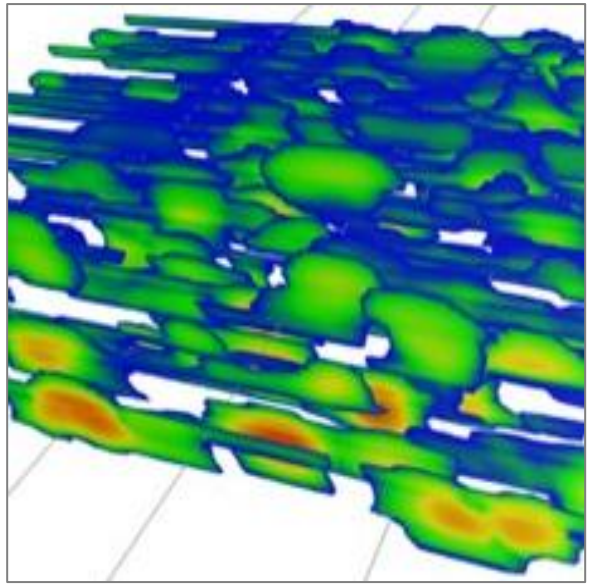


Ability to drill much longer horizontal sections

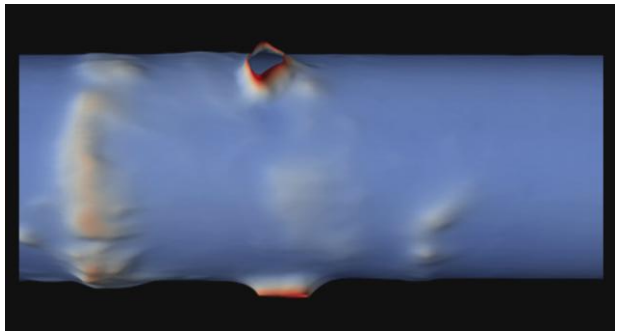
Sources: Rig picture from Drilling Contractors website; Bit picture from SLB website. U.R. = Unconventional reservoirs

Optimized hydraulic fracturing capabilities

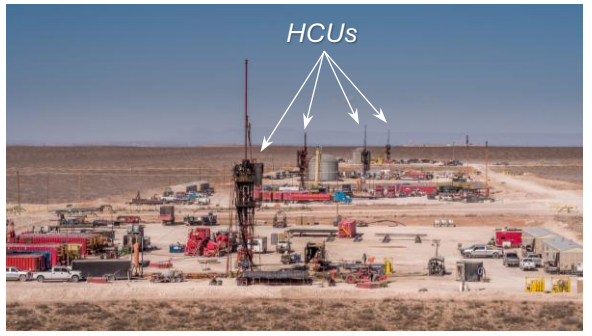
Better equipment



Better modeling



Better frac initiation



Better wellbore clean out

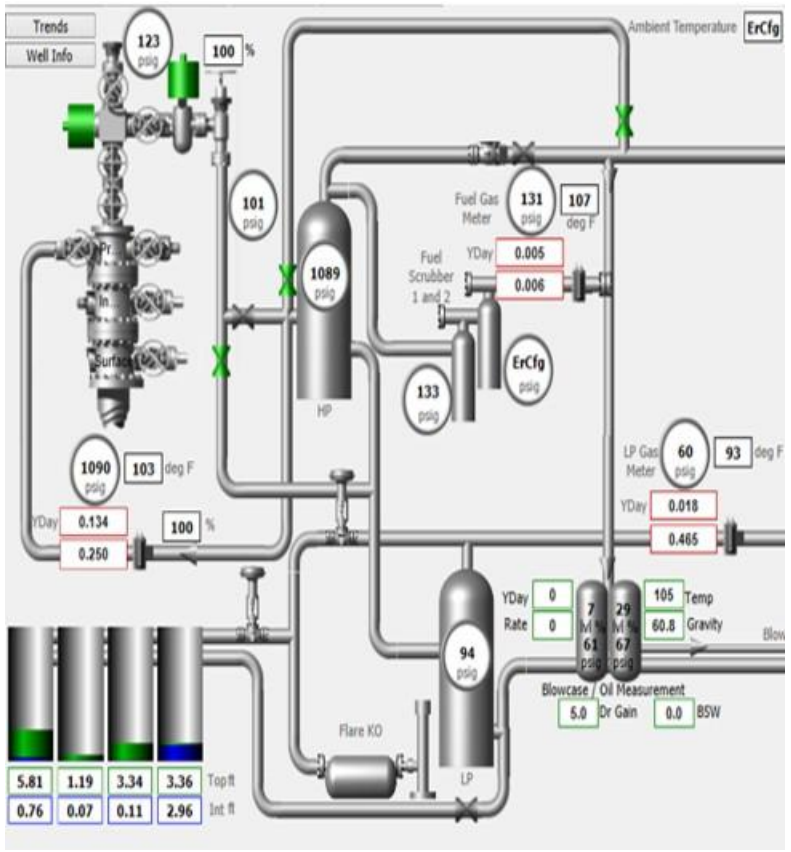
Sources (clockwise): Liberty Energy, ResFrac, Dark Vision, Deep Well Services websites; HCUs = hydraulic completion units

By centralizing infrastructure and using advanced digital technologies it is possible to dramatically reduce operating costs

Infrastructure centralization

Real time monitoring

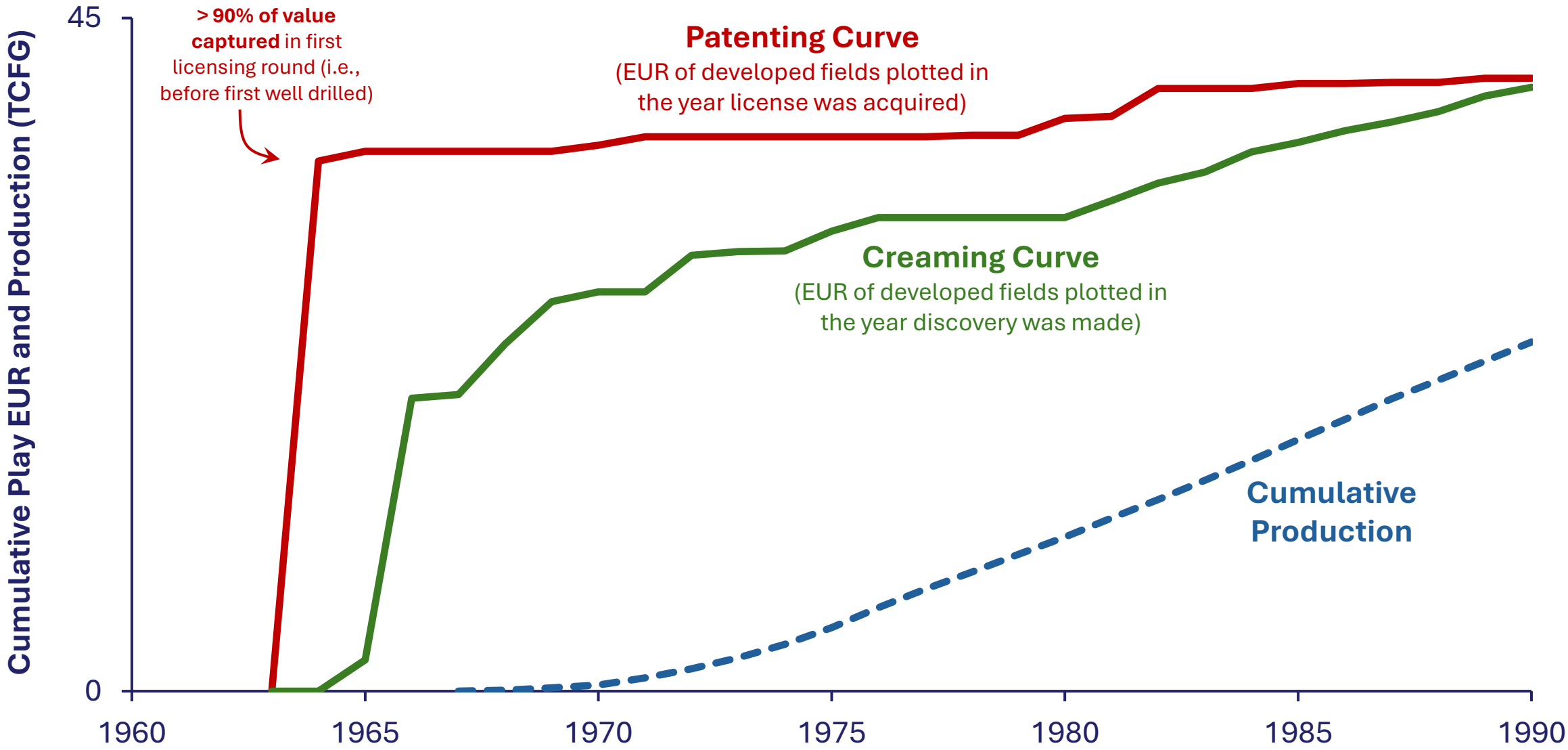
Automated process optimization



Source: ConocoPhillips' November 2019 Analyst & Investors Meeting slide deck

Don’t wait: The biggest and best fields/plays are normally captured by early movers

Example from the Rotliegendes play, U.K. Southern North Sea

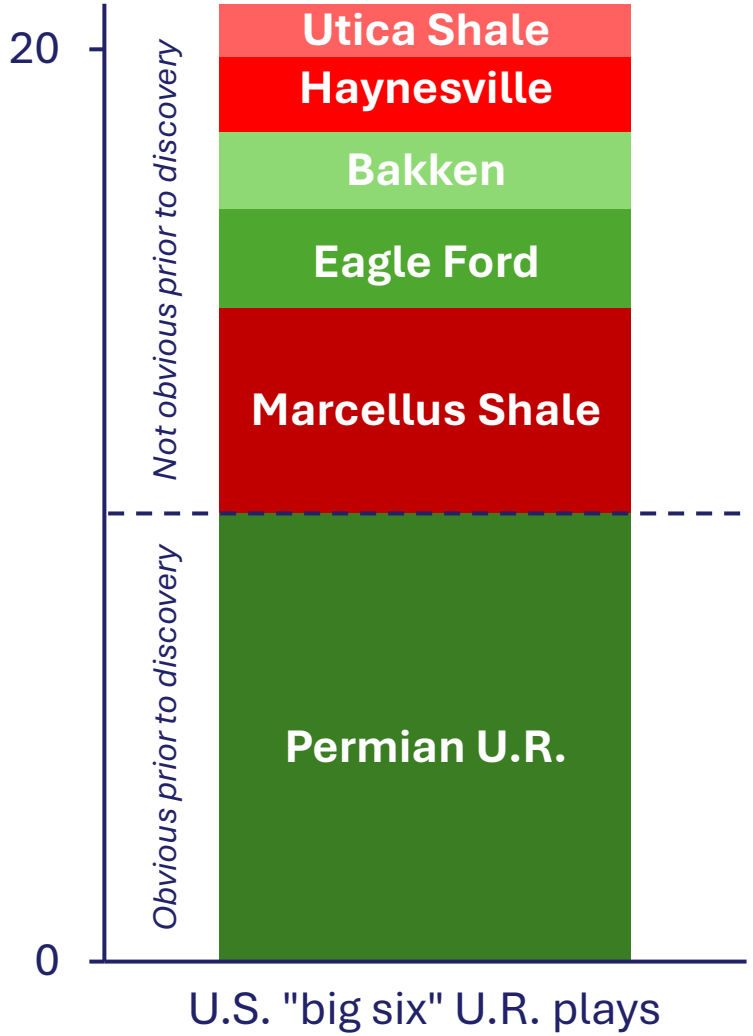


Data from various sources including publications, presentations, and UK government databases; Cum. Prod. Estimated from multiple sources; SNS = southern North Sea; EUR = estimated ultimate recovery (from producing fields within play); TCFG = trillion cubic feet of gas

Five of the "big six" unconventional reservoir plays in the U.S. are <u>not</u> located in "obvious places" to find super-giant oil and gas fields

Oil & gas production

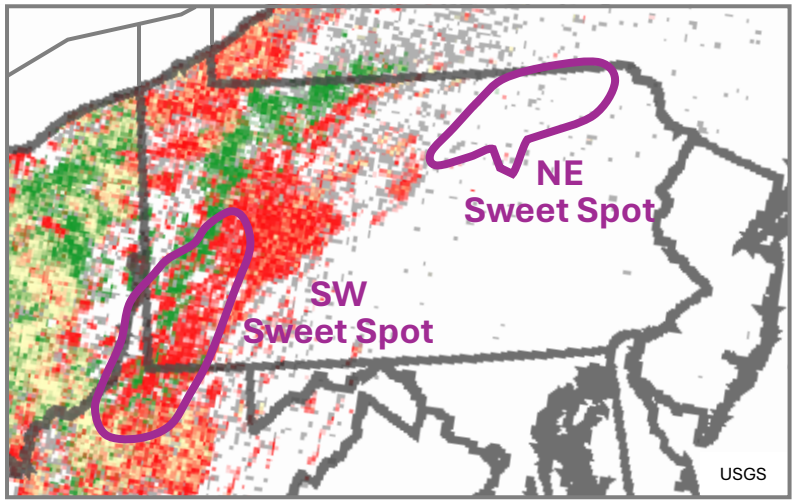
(Million BOEs per day)



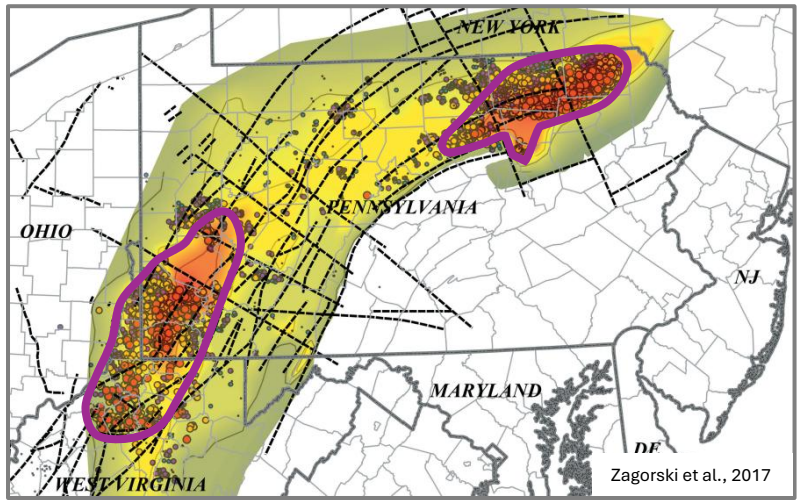
Sources: 3/26 EIA tight oil and dry gas; BOE = barrels of oil equivalent; U.R. = unconventional reservoirs

Marcellus Shale pre-discovery

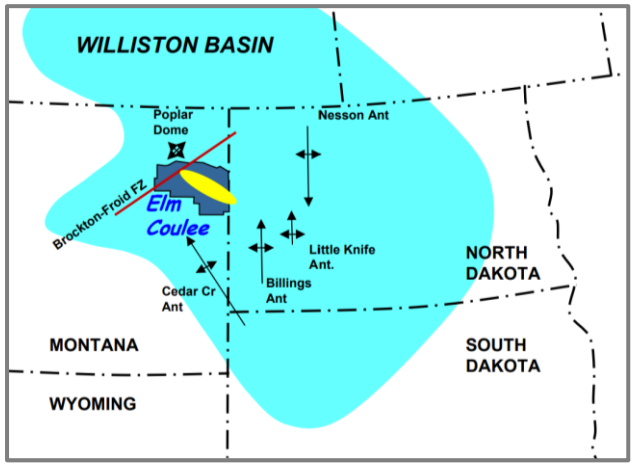
Wells drilled prior to start of 21st century



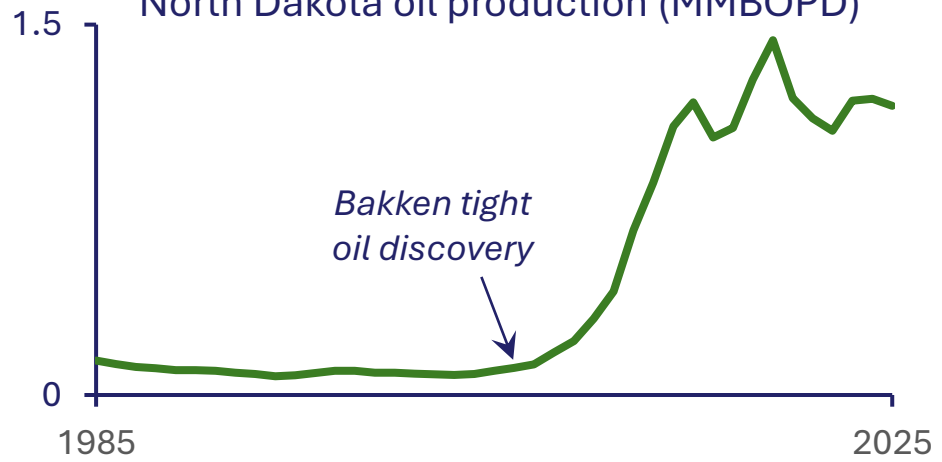
Marcellus Shale net pay map



Bakken Formation (North Dakota)



North Dakota oil production (MMBOPD)



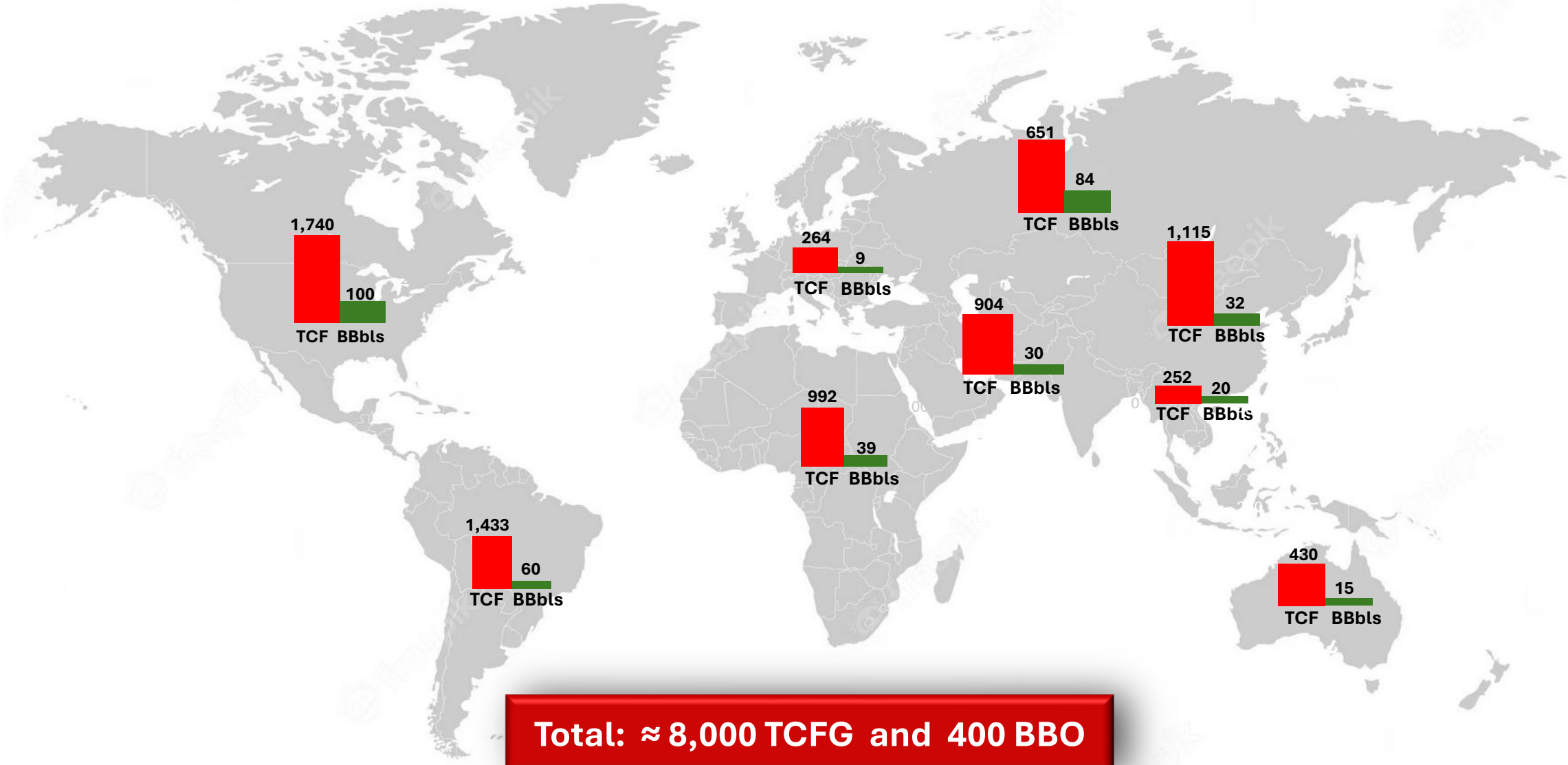
Sources: Map from Walker, 2006; Production data from North Dakota Oil and Gas Division website (LINK)

Presentation outline – Valleau

- The “Size of the Prize” – The global endowment
- Benchmark U.S. plays
- Example international plays
- The global hunt for Big Shale

Global Unconventional Resource Endowment

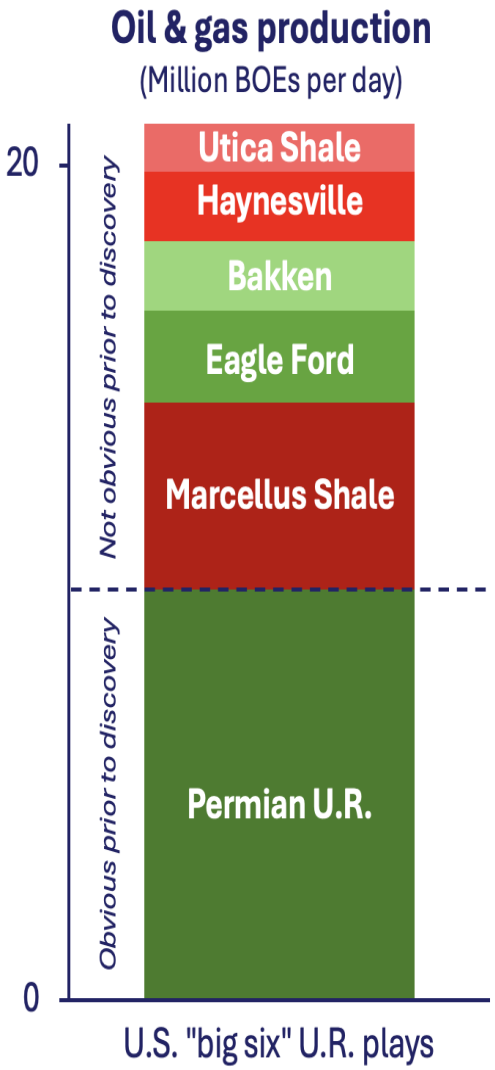
Estimated Technically Recoverable Resources

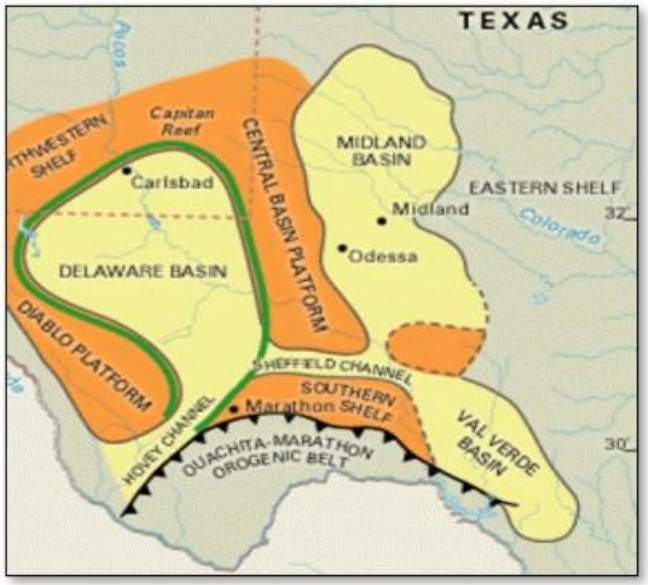


Total: ≈ 8,000 TCFG and 400 BBO

Sources: World Energy Review (2020), BP Statistical Review (2020), EIA (2019), World Energy Council (2016), USGS World Shale Assessment (2013); TCFG = Trillion cubic feet of gas; BBO & BBbls = Billion barrels of oil

Benchmark U.S. Plays





PERMIAN BASIN

Area: ~ 86,000 mi²
Thickness: 100’ to > 800’

Production (2026):
6.7 MMBO per day
22.7 BCFG per day

EUR: 66 BBbls & 300 TCF

MARCELLUS

Area: ~ 95,000 mi²
Thickness: 50’ to > 200’

Production (2026):
36 BCFG per day
0.24 MMBO per day

EUR: 2 BBbls & 215 TCF

EAGLE FORD

Area: ~ 30,000 mi²
Thickness: 30’ to > 200’

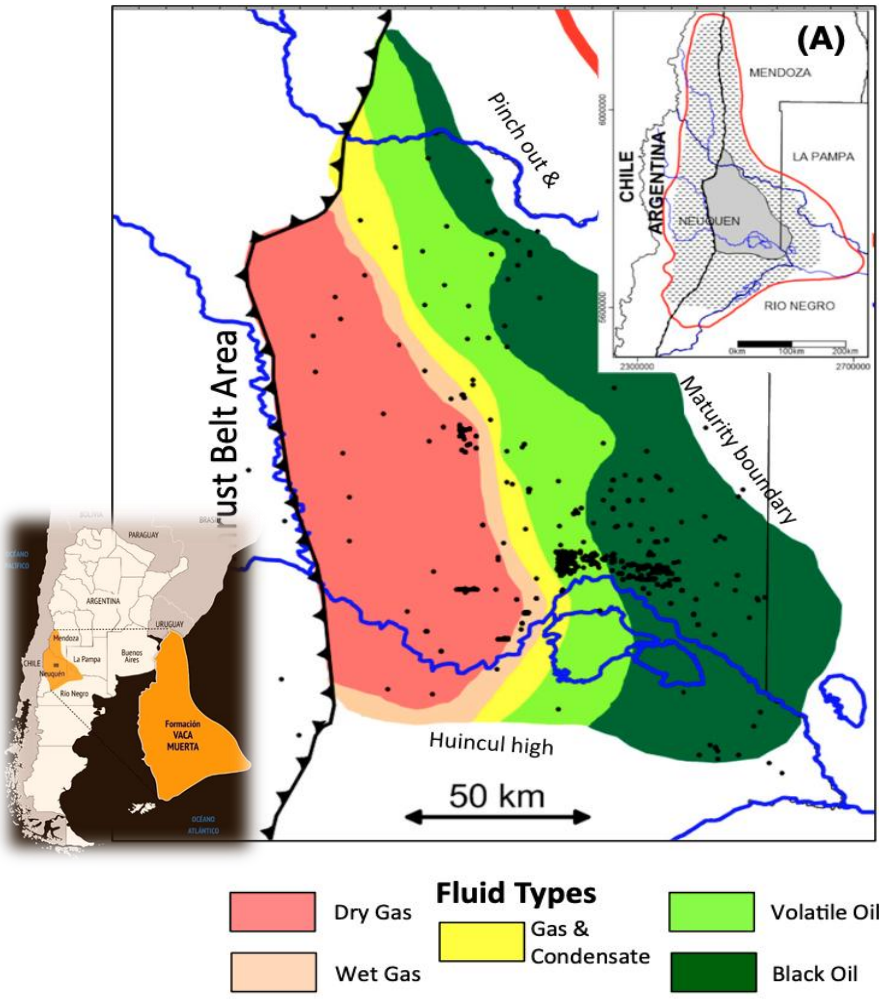
Production (2026):
1 MMBO per day
4.1 BCFG per day

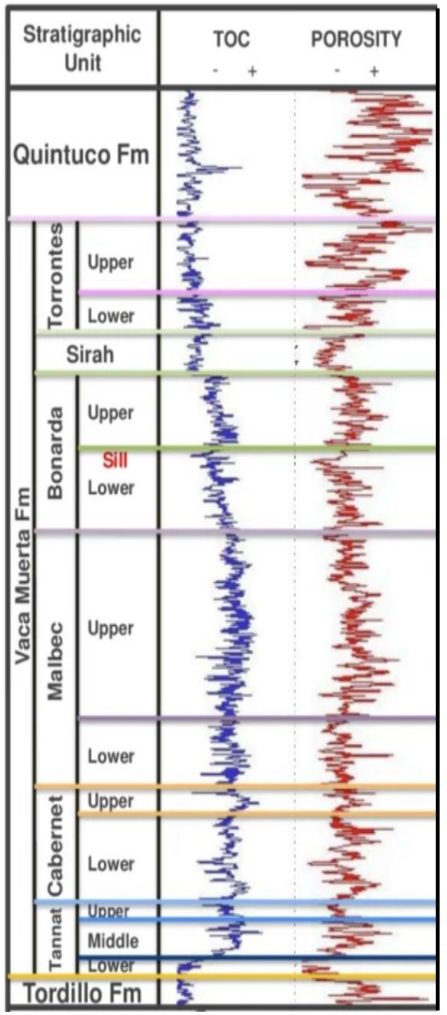
EUR: 8.5 BBbls & 66 TCF

Sources: EIA, USGS, Rystad, Enverus, WoodMac; TCF = Trillion cubic feet of gas; BBbls = Billion barrels of oil

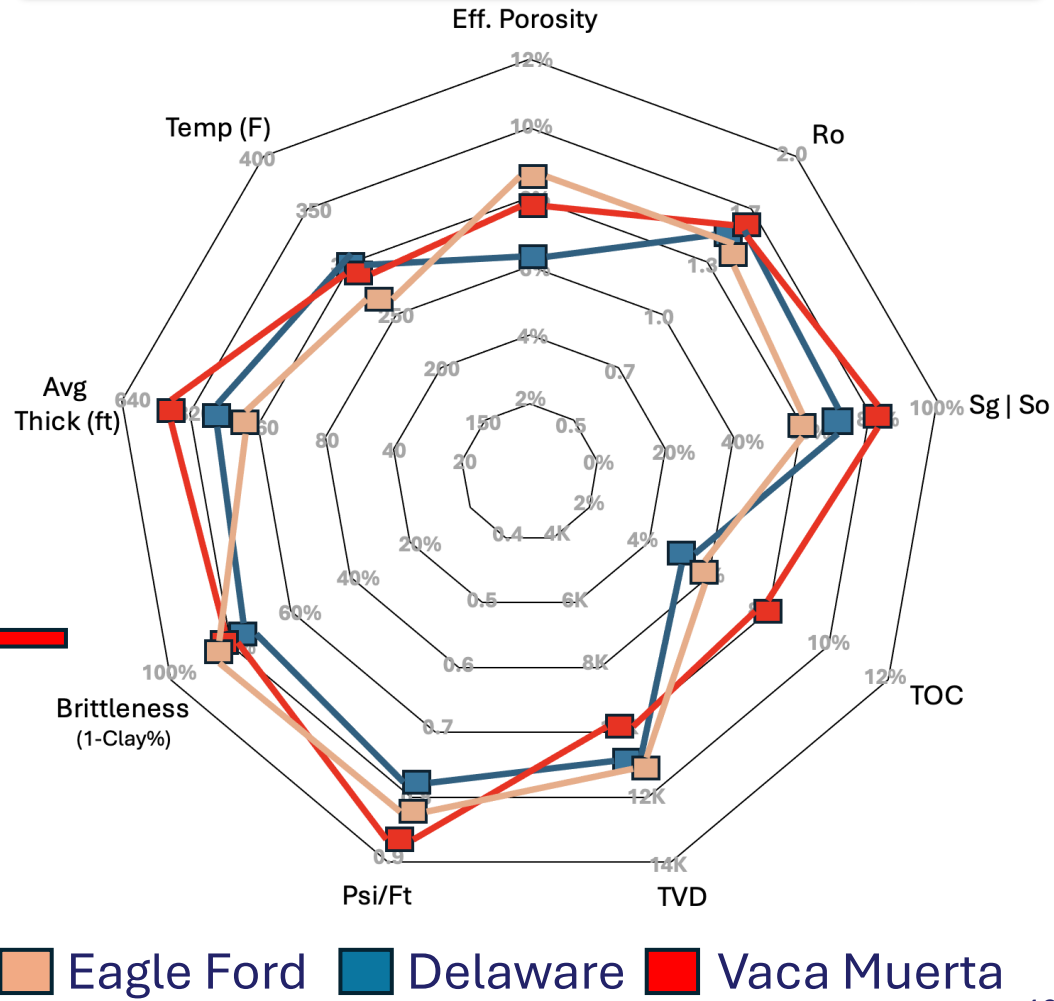
Argentina - Vaca Muerta

EUR: 308 TCF & 16 BBbls





Play benchmarks with Delaware Basin & Eagle Ford

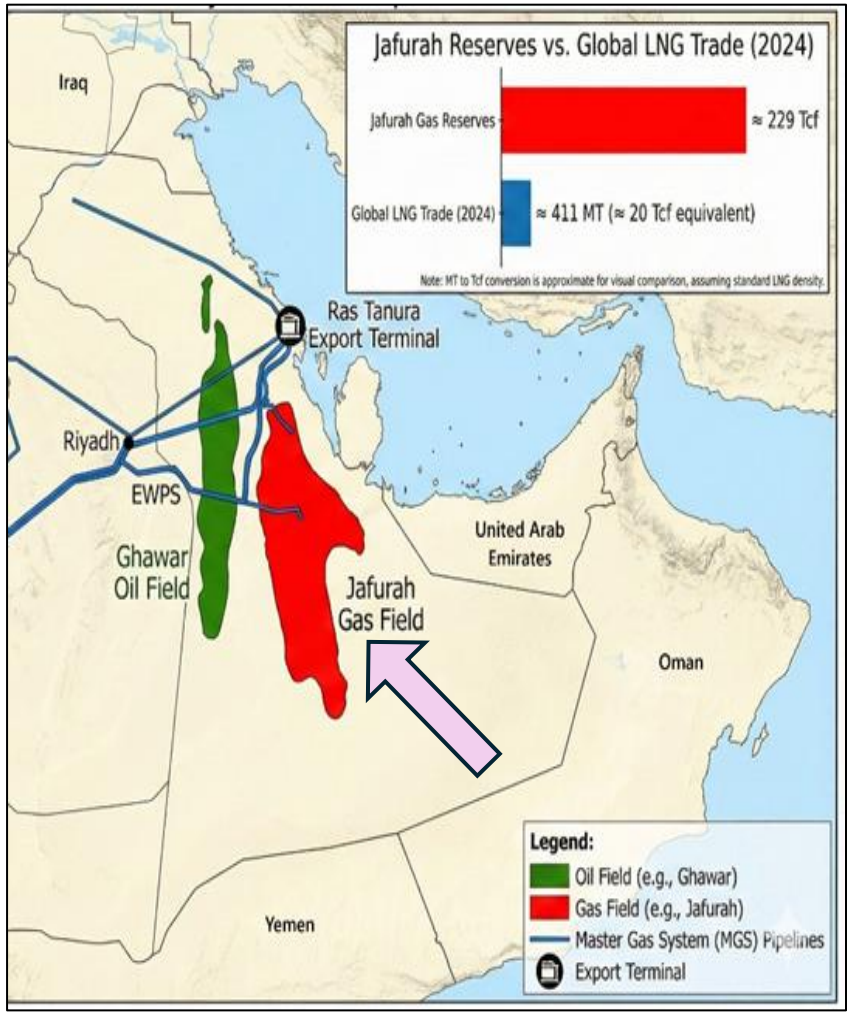


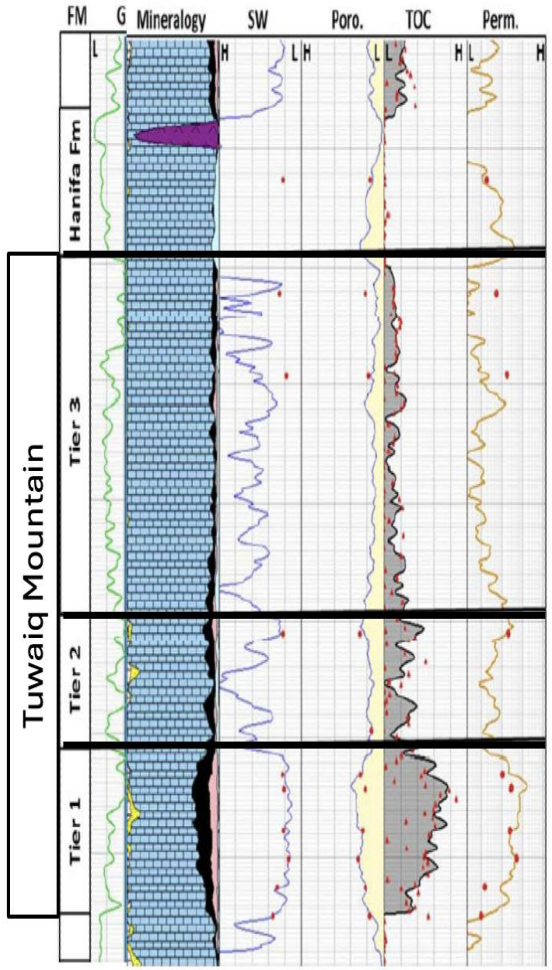
Source: Neuquen Super Basin: AAPG Bulletin, v. 104, no. 12 (December 2020), pp. 2521–2555

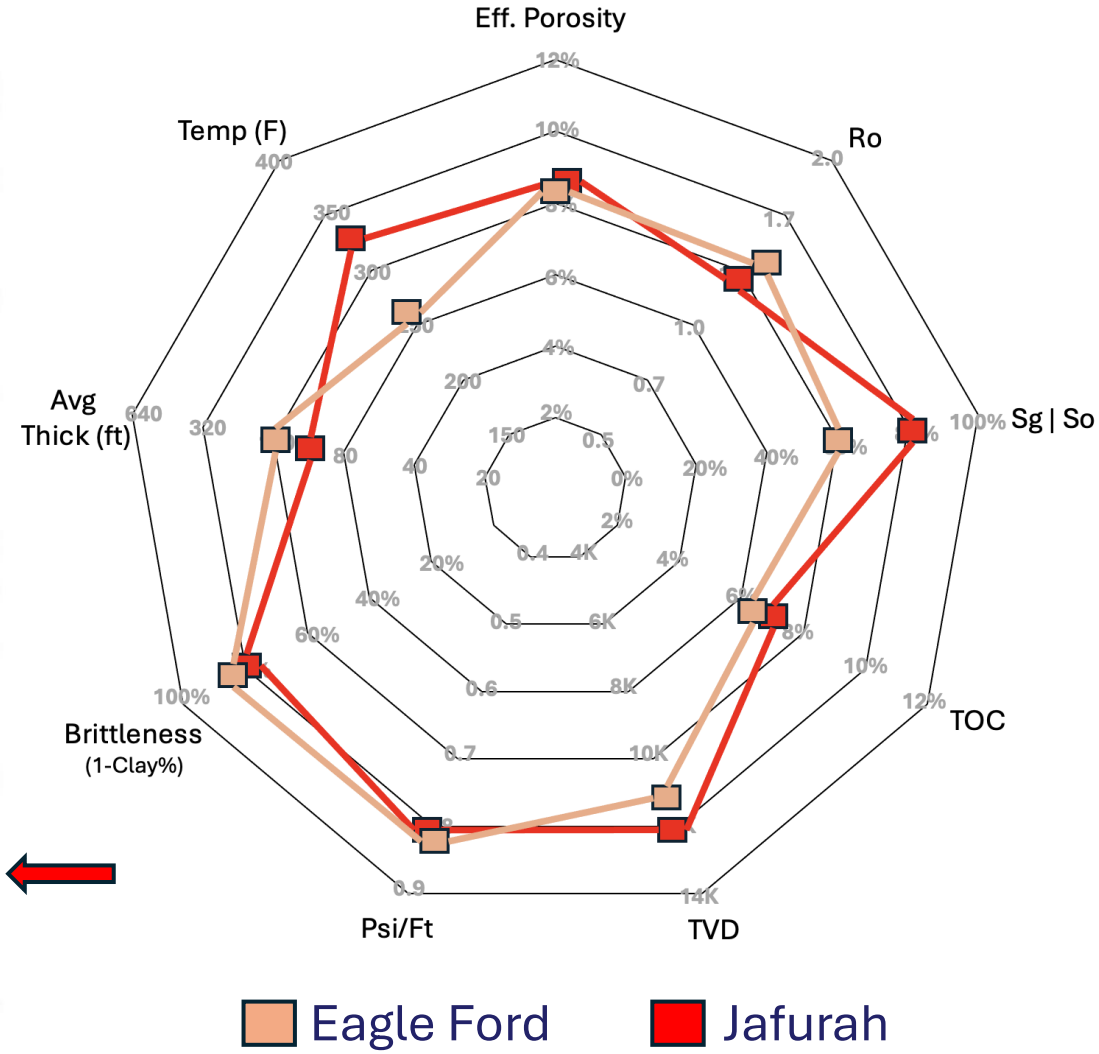
Saudi Arabia – Jafurah Shale Gas Field

EUR: 229 TCF & 75 BBbls[1]

Play benchmarks with the Eagle Ford





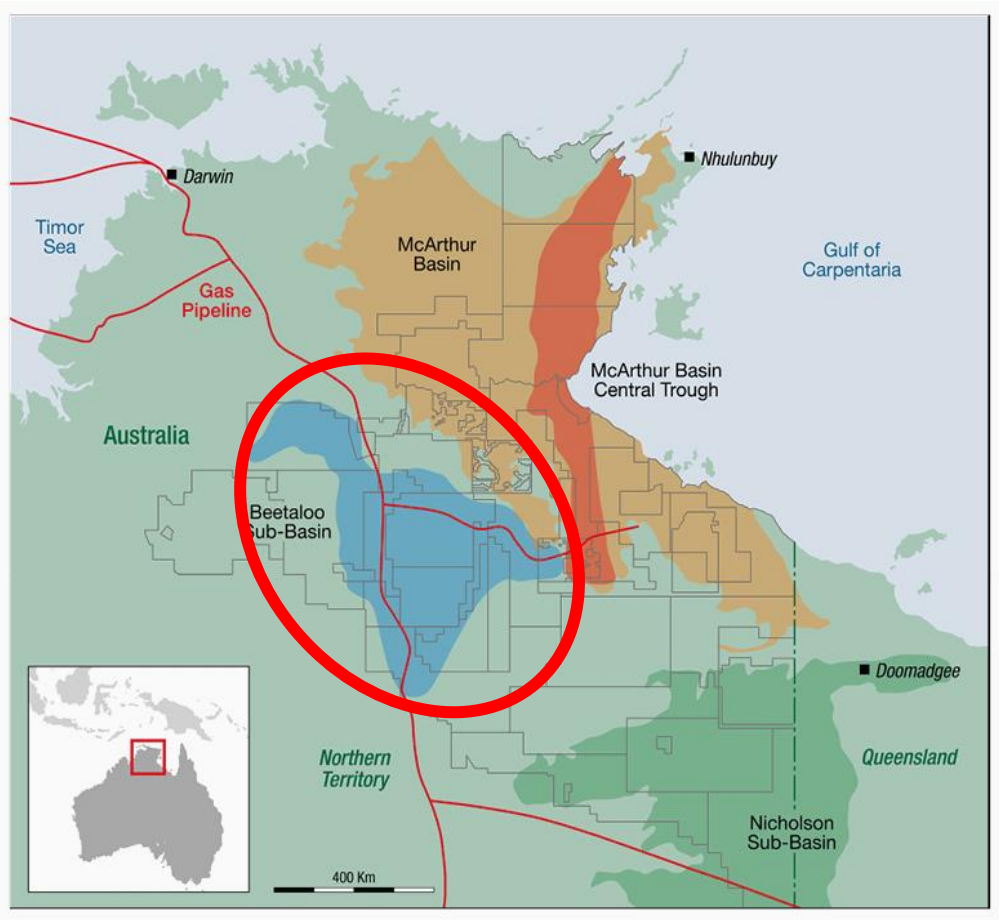


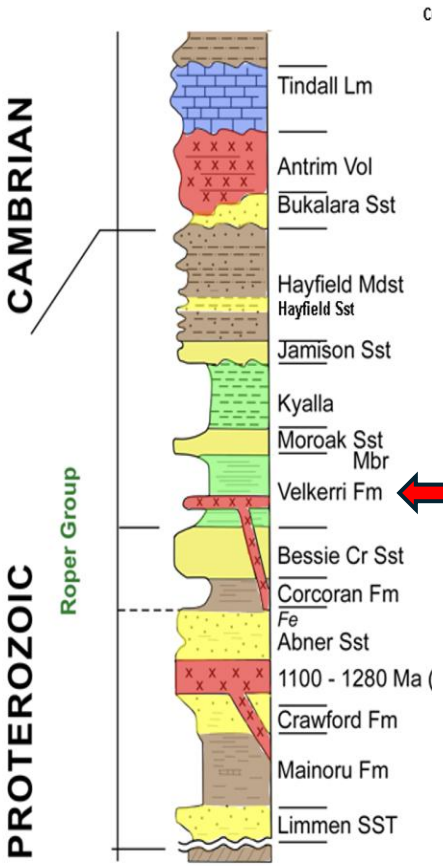
1 DeGolyer & MacNaughton for Aramco, 2024

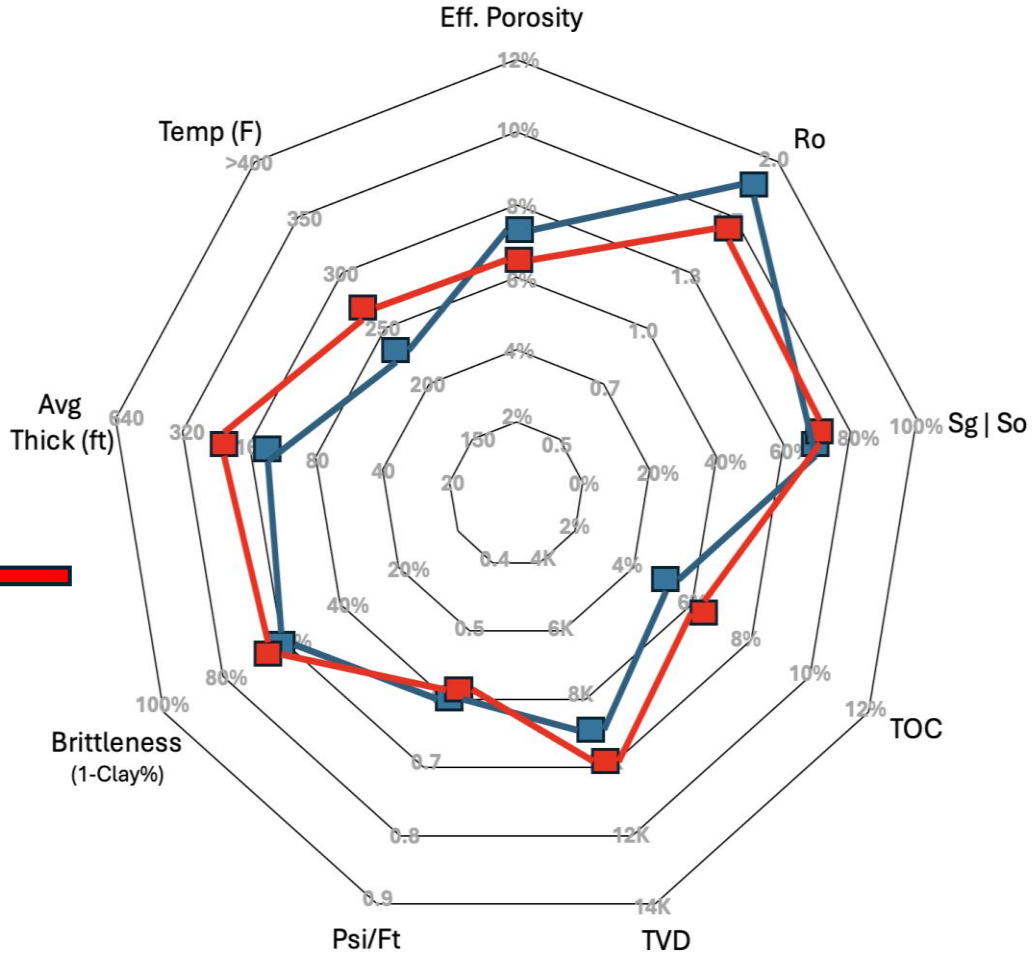
Australia – Beetaloo Basin

EUR: ~ 38 TCF & 8 BBbls

Play benchmarks with the Marcellus



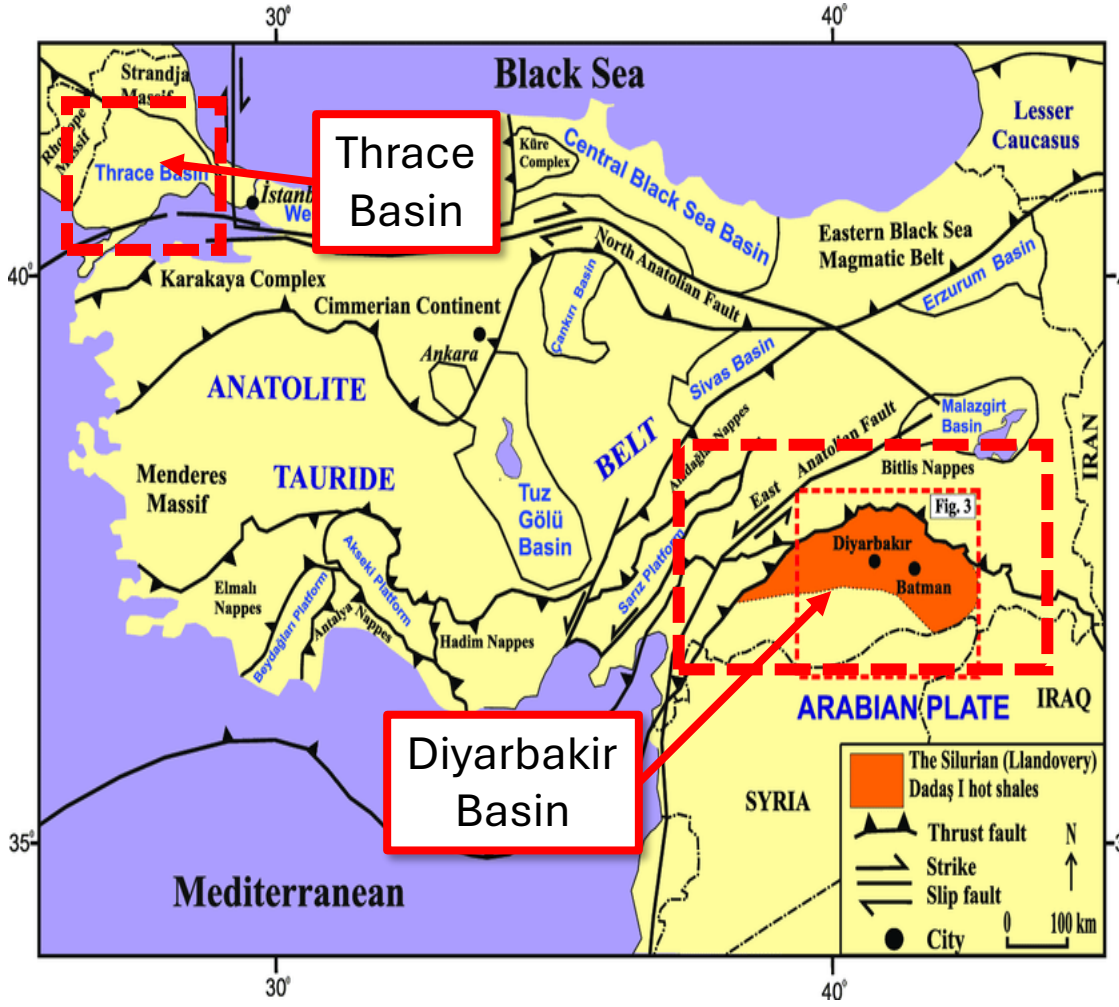


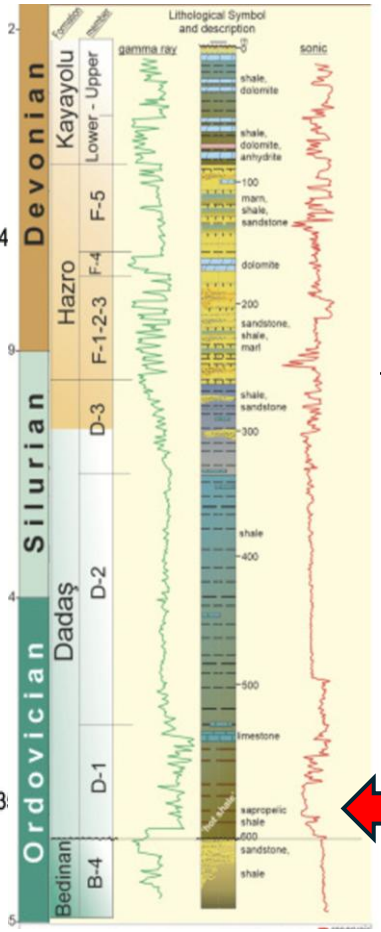


Sources: Tamboran, GeoExPro, ARI & USGS

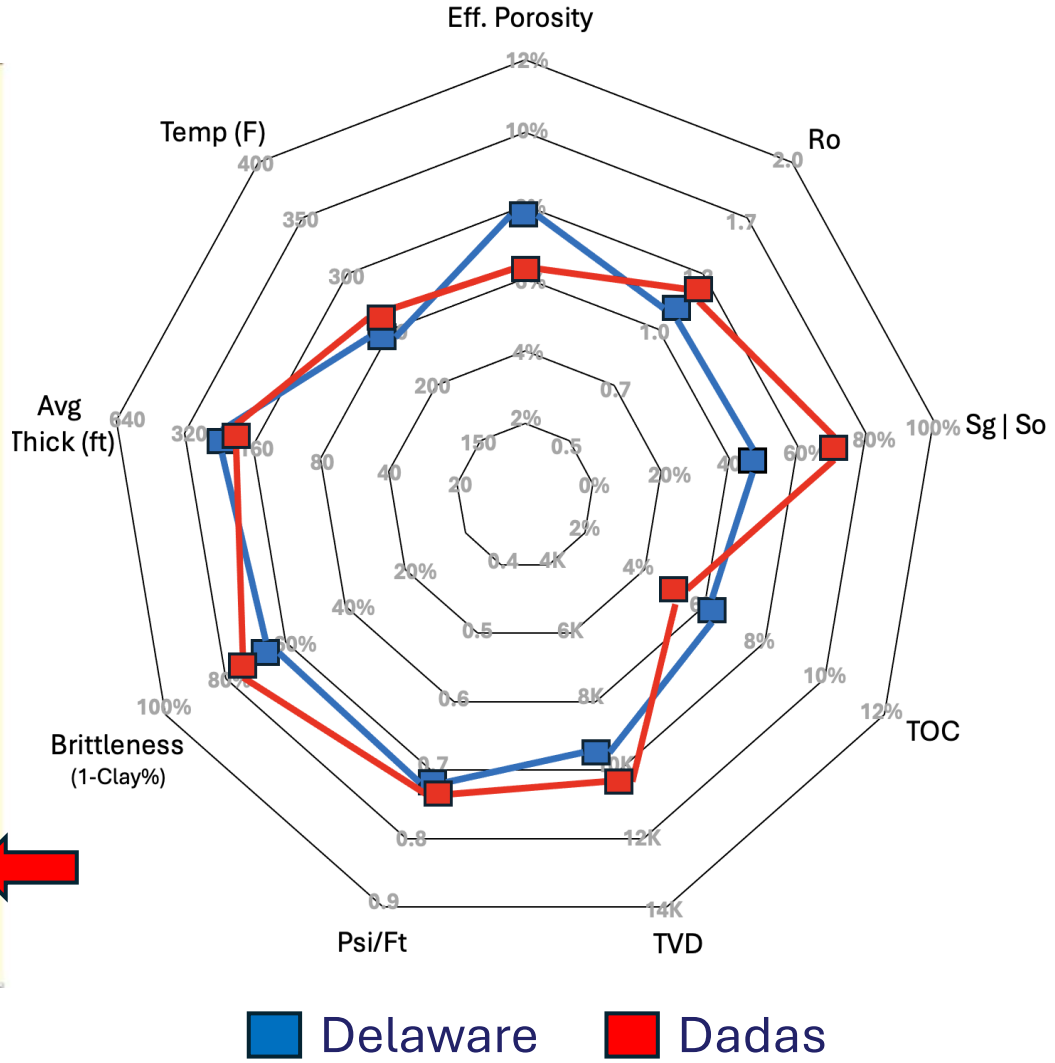
Türkiye – Silurian Dadas Hot Shale

EUR: ~ 20 TCF & 6 BBbls



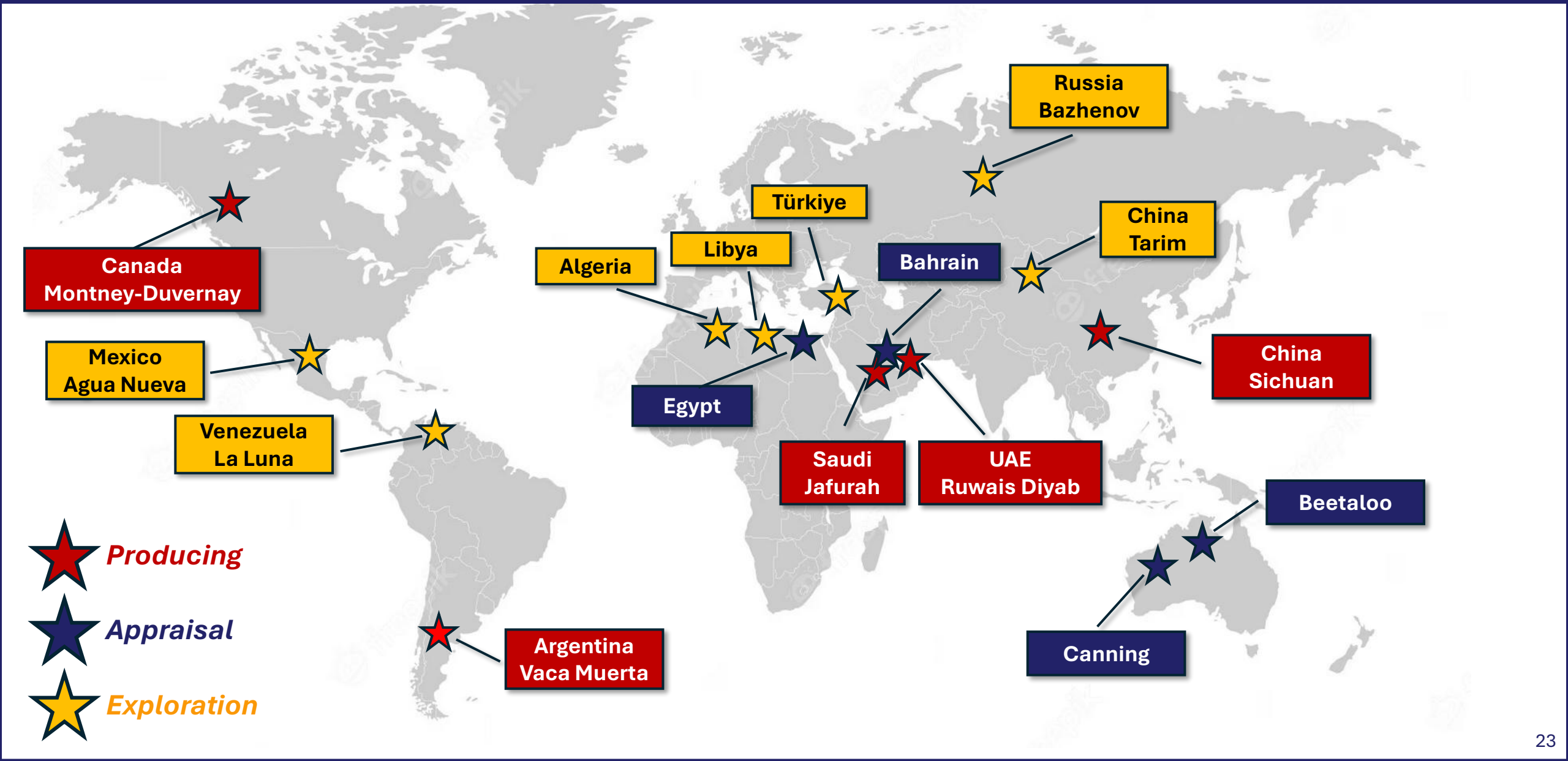


Play benchmarks with the Delaware



Sources: TransAtlantic & WoodMac 2026

Hunting for "Big Shale"
As good or better than the U.S.

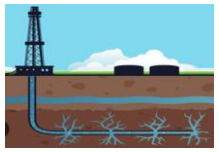


U.S. companies are already going global with shale

Why should we care about International “Shale”

Tap into emerging growth markets

Spread risk and reduce dependance on domestic markets

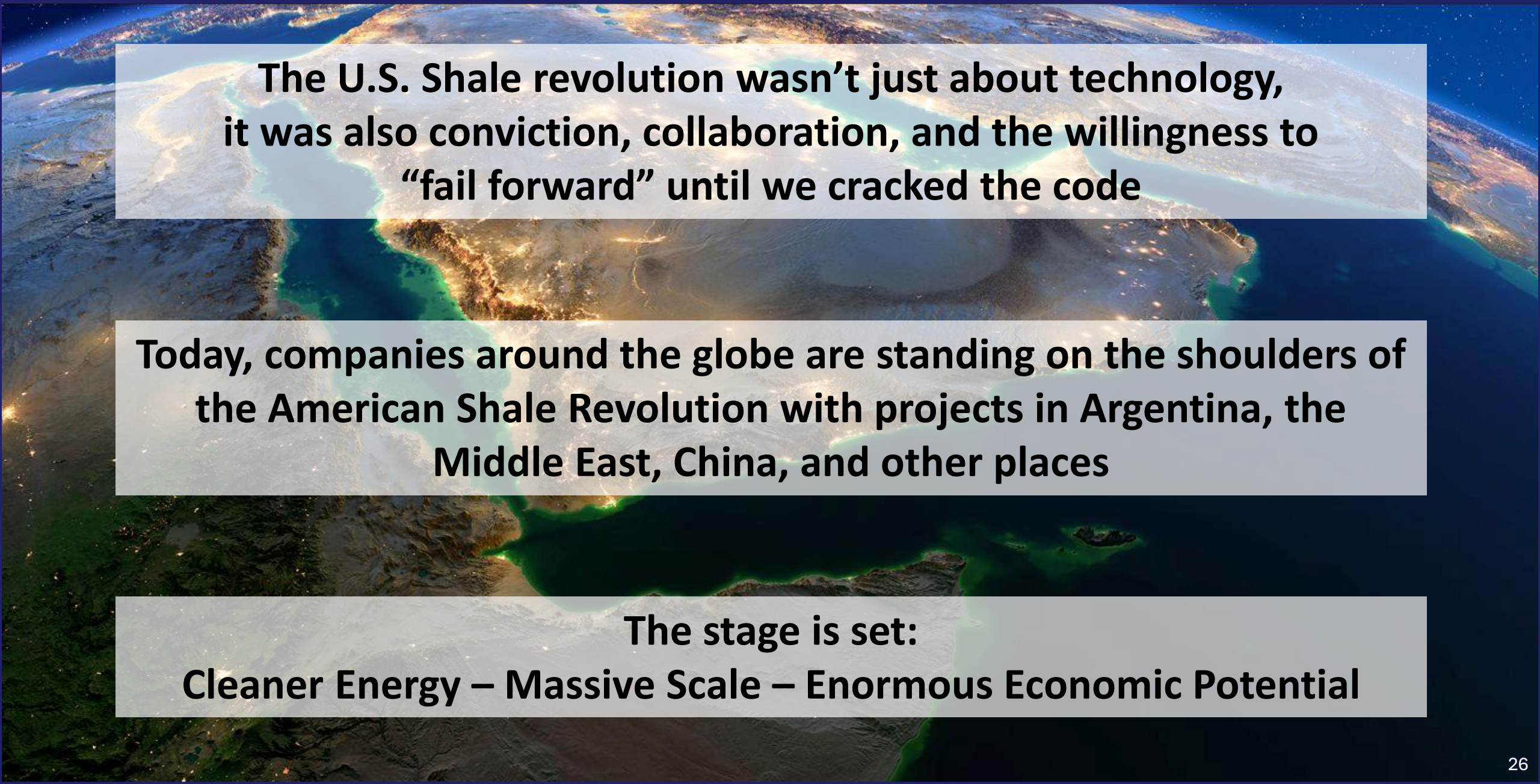


Leverage U.S. technology and operational expertise

Develop joint-ventures and partnerships to share risks and investment costs

Pursue shale gas as a cleaner alternative to coal aligns with global sustainability goals and fights energy poverty

The spark is lit – The global community is catching fire



The U.S. Shale revolution wasn't just about technology, it was also conviction, collaboration, and the willingness to "fail forward" until we cracked the code

Today, companies around the globe are standing on the shoulders of the American Shale Revolution with projects in Argentina, the Middle East, China, and other places

The stage is set:
Cleaner Energy – Massive Scale – Enormous Economic Potential

Discovering and commercializing unconventional reservoir plays larger and more prolific than the Permian Basin and Marcellus Shale: The promise of international unconventional reservoirs

Greg Leveille and Doug Valleau

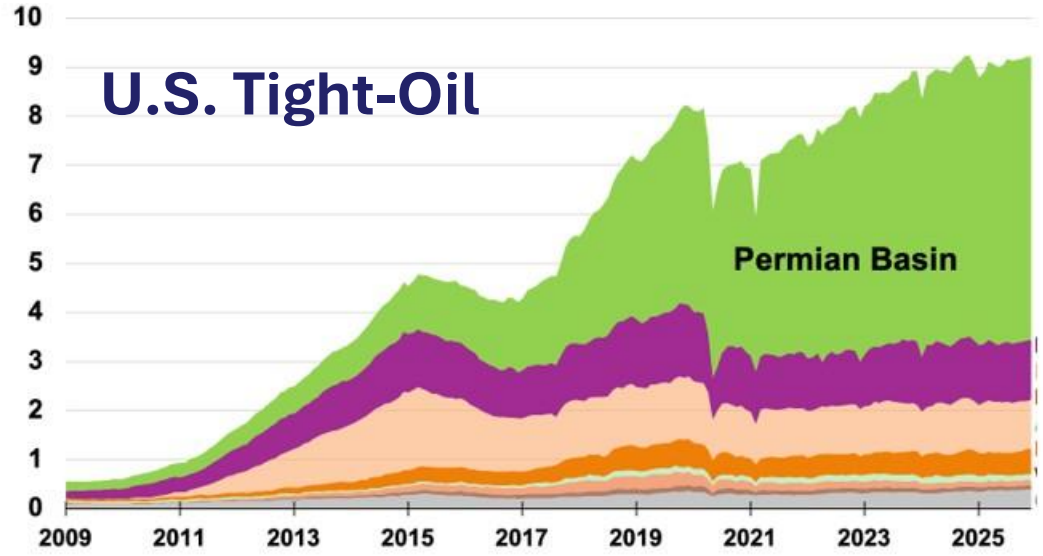
June 22, 2026

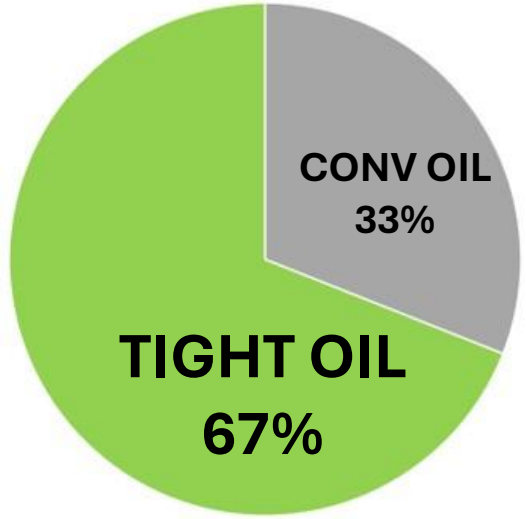
ExxonMobil Permian Basin drilling operations

Marcellus Shale hydraulic fracturing operations

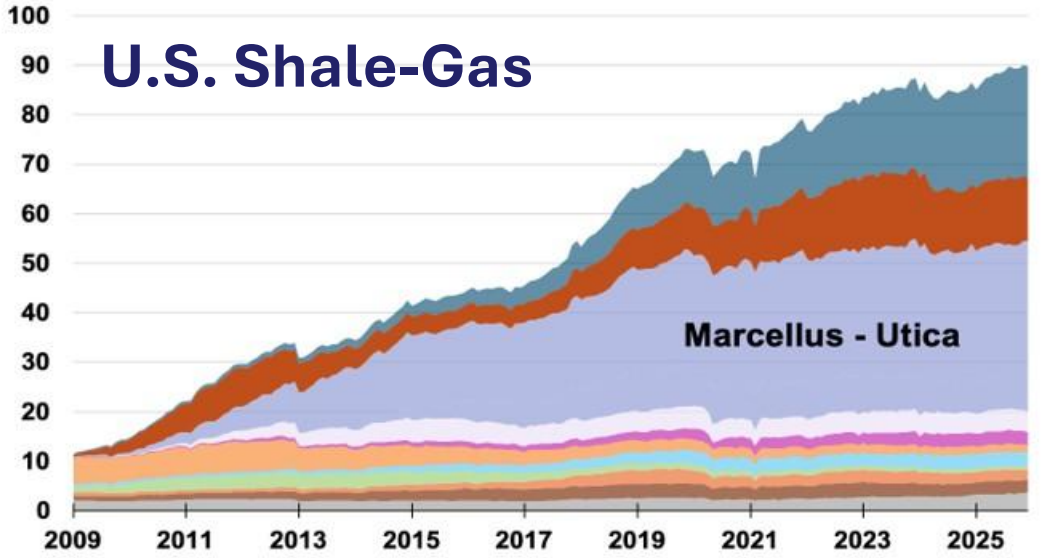
Additional materials

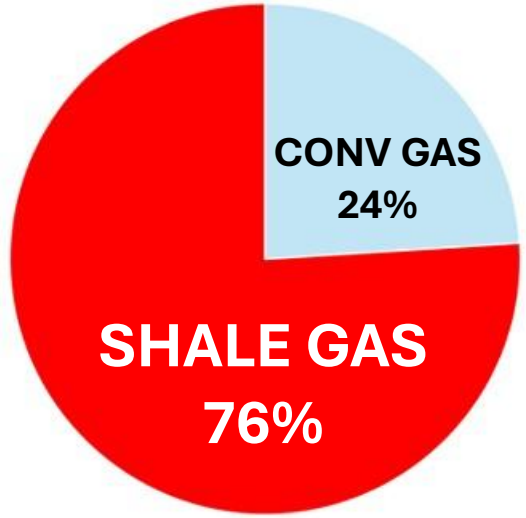
“Shale” dominates U.S. oil & gas production





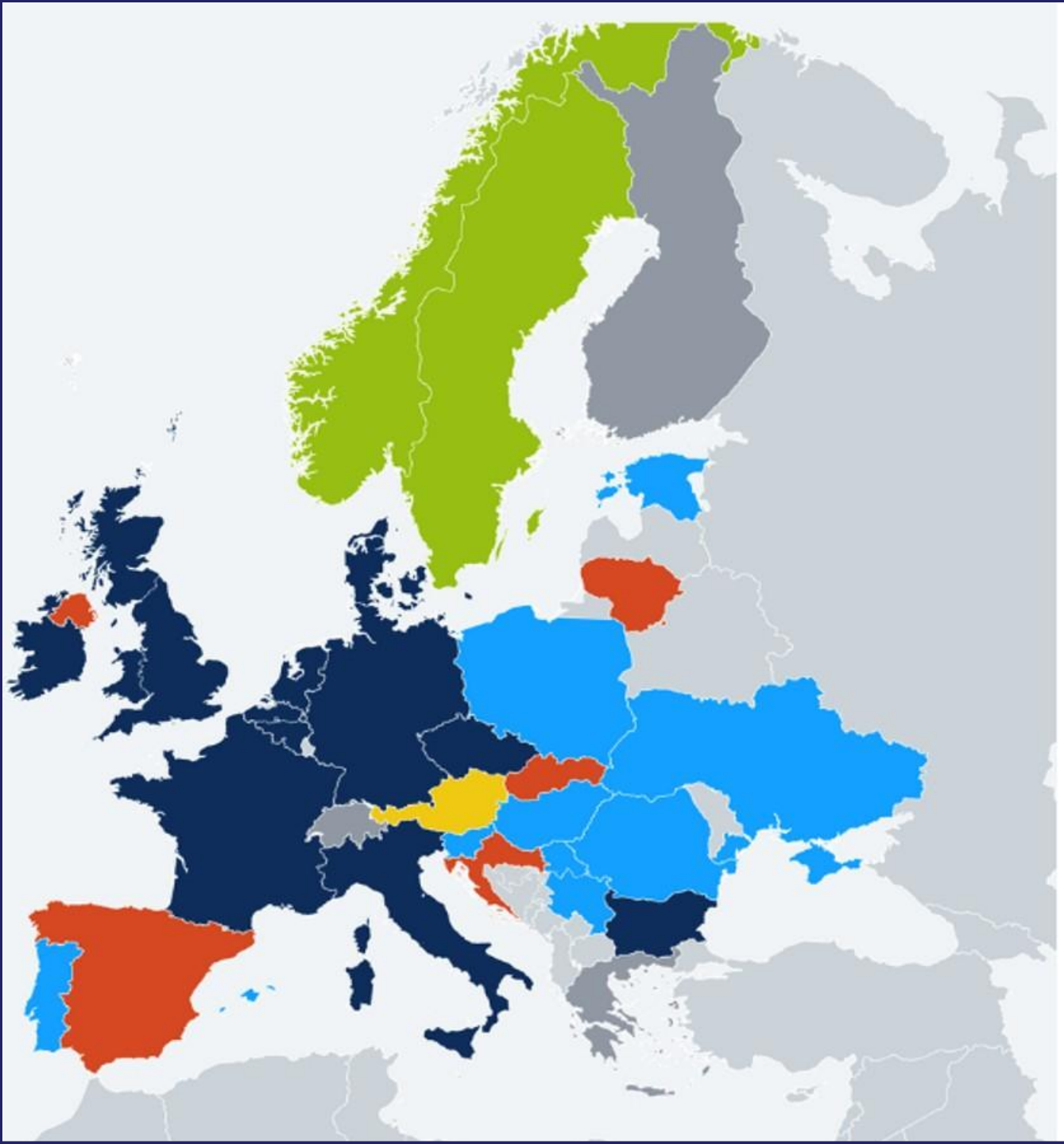
Total U.S. Oil:
13.6 MMBO per day





Total U.S. Gas:
118.5 BCF per Day

FRACCING IN EUROPE

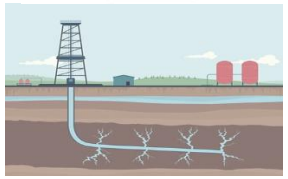


- Allowed/exploratory drillings
- Ban/moratorium
- Heavy restrictions
- Declared not economically viable
- Abandoned
- No decision/no gas desposits
- No data/not specified

Source: https://www.dw.com/en/will-fracking-make-a-comeback-in-germany-in-face-of-gas-crunch/a-62814035

What makes the Vaca Muerta successful?

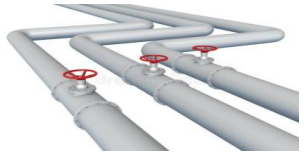
Great geology – thick stacked pays like the Permian Basin



Embraced U.S. Technology & redefine “Shale” as an industrial manufacturing process; Invited U.S. companies to participate

A favorable political environment (at least for now)

Reduced regulatory burdens; well-established social license to operate; can fast-track environmental and exploration permits

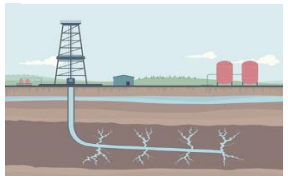


Building out extensive infrastructure with planned LNG exports

Allows repatriation of profits, tax incentives, reduced royalty rates, and grants customs and import exemptions

What makes Jafurah successful?

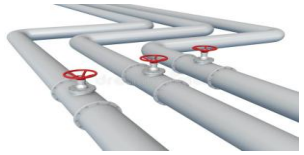
Eagle Ford like play; largest liquid-rich shale gas in the Middle East



Embraced U.S. Technology & redefine “Shale” as an industrial manufacturing process
Opened Research Centers in the U.S. and formed SAEV (Saudi Arabia Energy Ventures)

Shale gas is a security project, not a commercial upstream play
Frees up crude oil for export

Shale gas is separated by law from conventional, allowing manufacturing appRoash to environmental controls and phased development

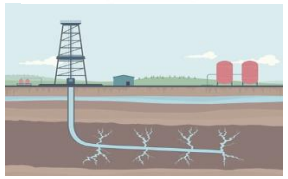


Dedicated midstream network, gas processing & NGL fractionation plant to supply domestic power, and petrochemical feedstock

Focus on community and local economic commitments including job creation, training, and commitment to environmental best practice

What makes the Beetaloo successful?

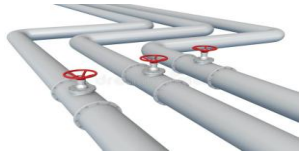
Unique geologic setting (~1.4 Billion yrs); benchmarks with Marcellus



Tamboran has secured both U.S. drilling rigs (H&P) and a completions fleet (Liberty Energy); both service companies have taken equity or commercial positions in the play

Government removed frac-ban and facilitated Indigenous Land Use Agreements

Government fast-tracked pipeline permits and invested $48MM into pipelines to connect with existing infrastructure allowing “appraisal gas” to be sold rather than flared

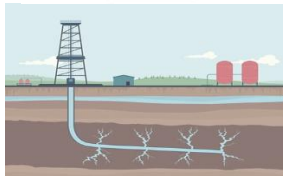


Government provided $55MM in loan guarantees for compressor/processing facilities

Project is a strategic national energy asset, the low CO_2 content makes it environmentally advantageous, has the potential to create 13,000 jobs, and unlock $17 billion in economic growth over 20 years.

What could make Dadas play successful?

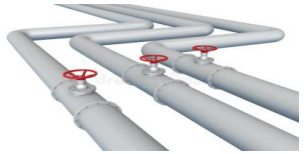
This Exploration play looks a bit like the Permian Basin
Silurian shales are the major source for major Arabian Fields (Ghawar, Pars/North Field)



Partnership with Continental Resources will bring a strong technical and operational experience in shales to evaluate the Unconventional potential in Diyarbakir and Thrace Basins

TransAtlantic (operator) JV with TPAO (Turkish Petroleum) and Continental to develop Unconventionals. Exploration License (5 yr term) convertible to Production License (20 yr term)
JV Agreement contains U.S. style JOA provisions

18-year partnership between TransAtlantic and TPAO has established a strong local License to Operate. TransAtlantic also owns & operates Frac Equip/Crews, Workover Rigs and Dirt Crews With local employment and provides these services to TPAO

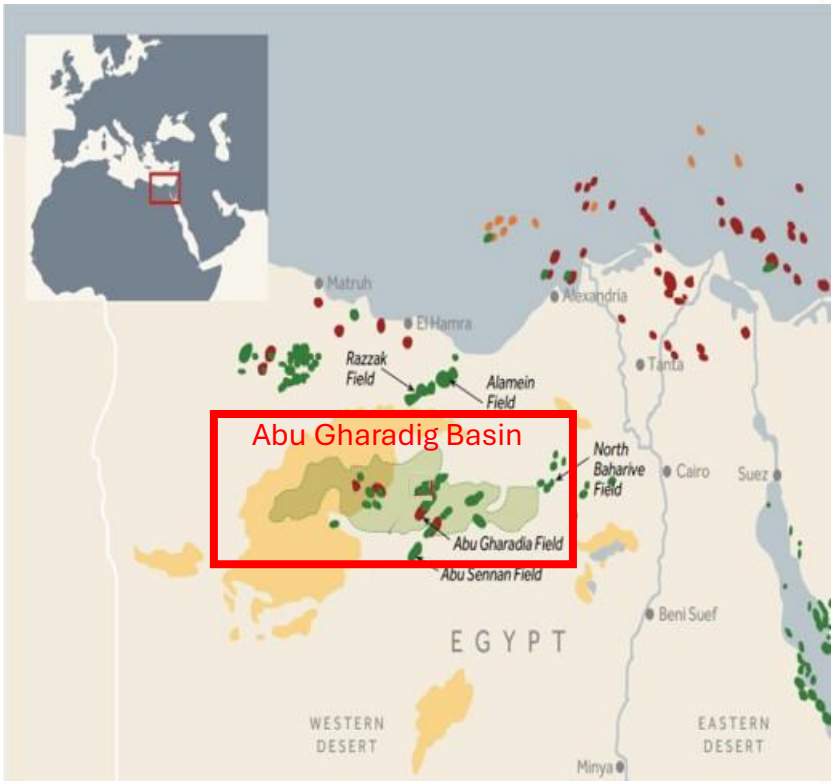


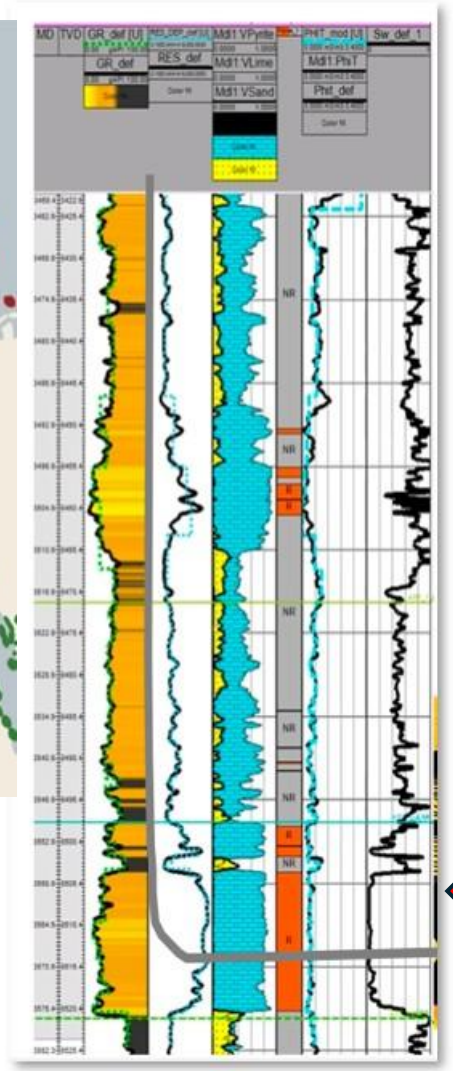
Crude Oil produced is sold to local Refineries; Natural Gas sold into the National grid

Royalties to the Government = 12.50% on all Licenses. No production tax.
Income tax +/- 22-25% with deductions similar to U.S.

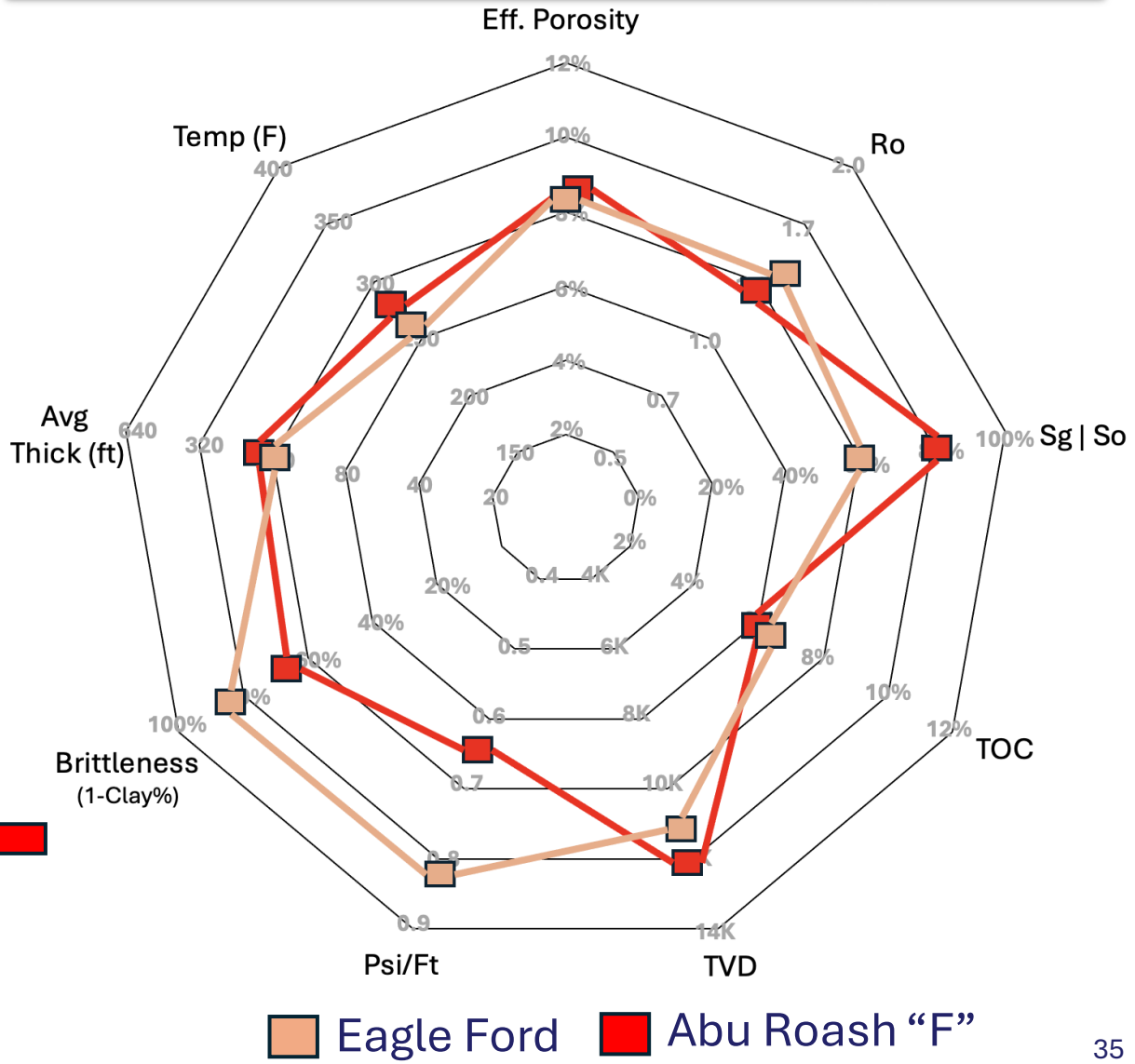
Egypt – Western Desert (Abu Roash “F”)

EUR: ~ 40 TCFe





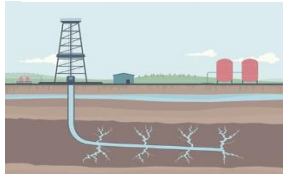
Play benchmarks with the Eagle Ford



Source: TAG Oil and EIA

What makes the Abu Roash “F” successful?

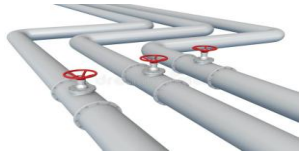
Historic penetrations of the source rock yielded strong oil shows; Geology benchmarks well with the Eagle Ford



NOC created a PSA with a North American operator to import modern knowledge to pilot and develop the Abu Roash “F”

Company provides technical services, capital and operatorship for pilot and early development; the NOC provides access to data, existing wellbores and oversight/approval

EGPC/Badr/ENPEDCO provide regulatory approvals, supervise operations and interface with international contractors



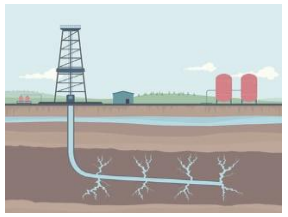
Will connect to existing production facilities; under the PSA company funds development while sales/royalties/taxes are handled per the concession/ENPEDCO arrangements

Company is paid a sliding-scale service fee based on production and must post performance guarantees to make the PSA effective

Roadmap to Success

Geology & Resource

- Good rock
- Resource size
- Deliverability
- Access to Water & Frac Sand



Evolved Technology

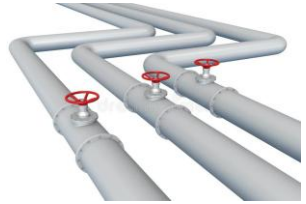
- Drilling rigs
- Frac equipment
- Technical services
- Skilled labor

Host/Gov't relations

- NOC is partner, not an overseer
- Work Programs support fast cycle development
- Political Stability & Accountability

Regulatory Environment

- Environmental policy
- Permitting
- Import of equipment
- Social License



Business Factors

- Law & Order
- Sanctity of contracts
- Infrastructure development
- Market Access

Economics / Fiscal Terms

- Repatriation of profits
- Government take
- Exchange rate

Great Geology + Technology + Enlightened Government & Regulatory Environment

Modified from: "Risk assessment of oil and gas investment environment in countries along the Belt and Road Initiative", Center for Energy and Environmental Policy Research, 2024