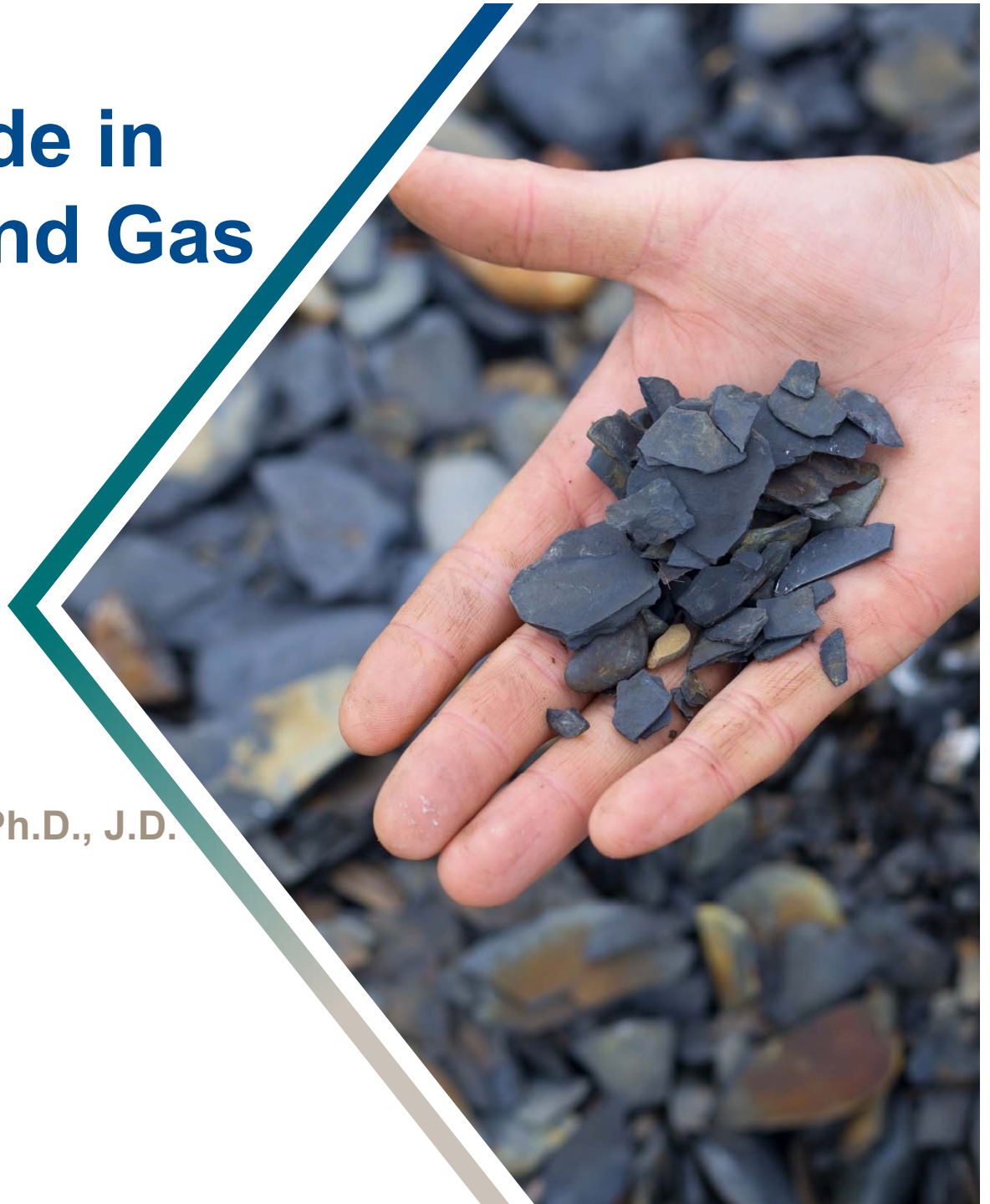


The Past Decade in the Shale Oil and Gas Industry

Kesavalu M. Bagawandoss, Ph.D., J.D.

August 10, 2020

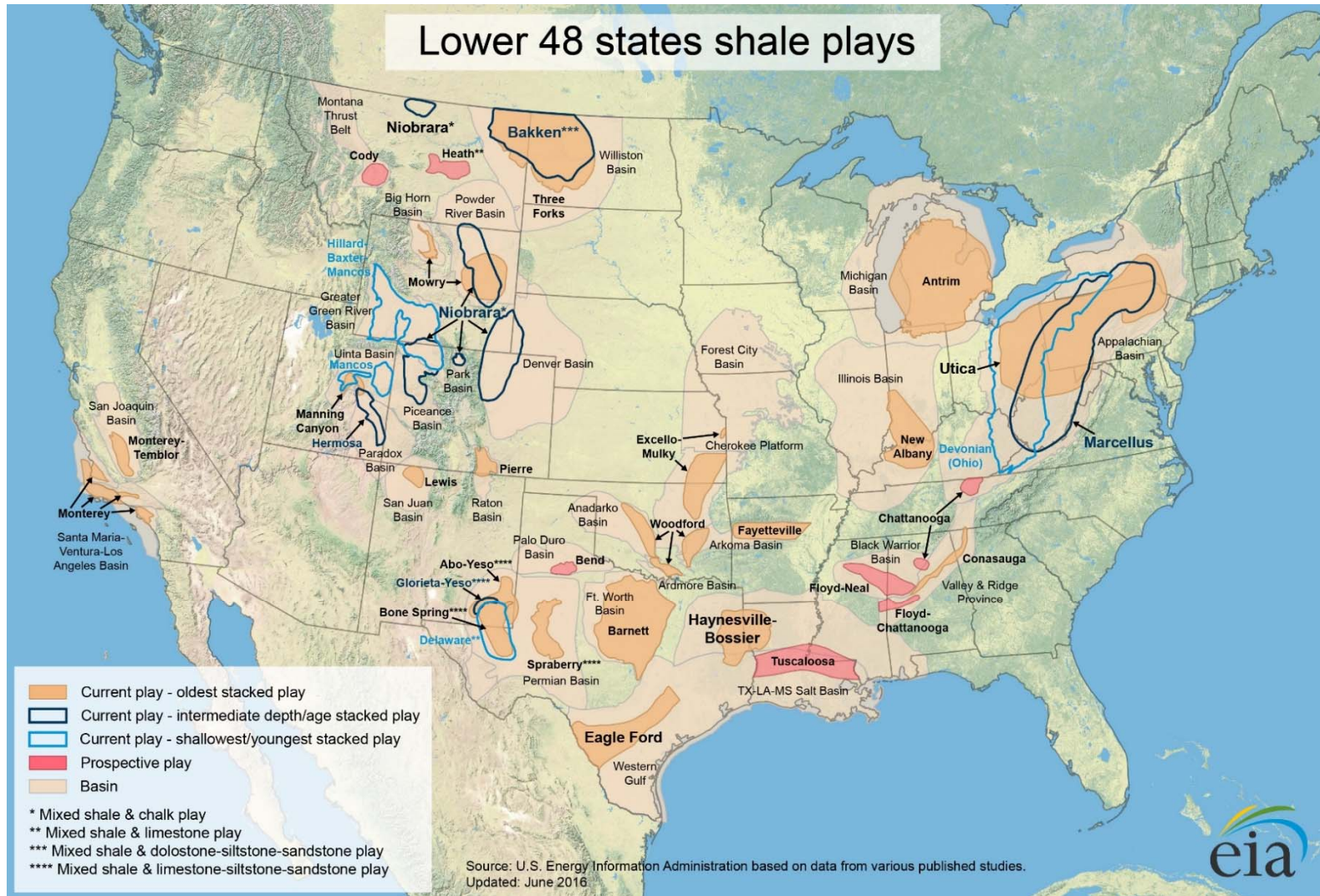


Agenda

- Shale Plays
- Introduction
- Technology Advancements
- Production of Crude Oil
- Production of Natural Gas
- Distribution Infrastructure
- Imports and Exports
- Market Condition Variations
- Environmental Conditions/Controls
- Issues
- Summary

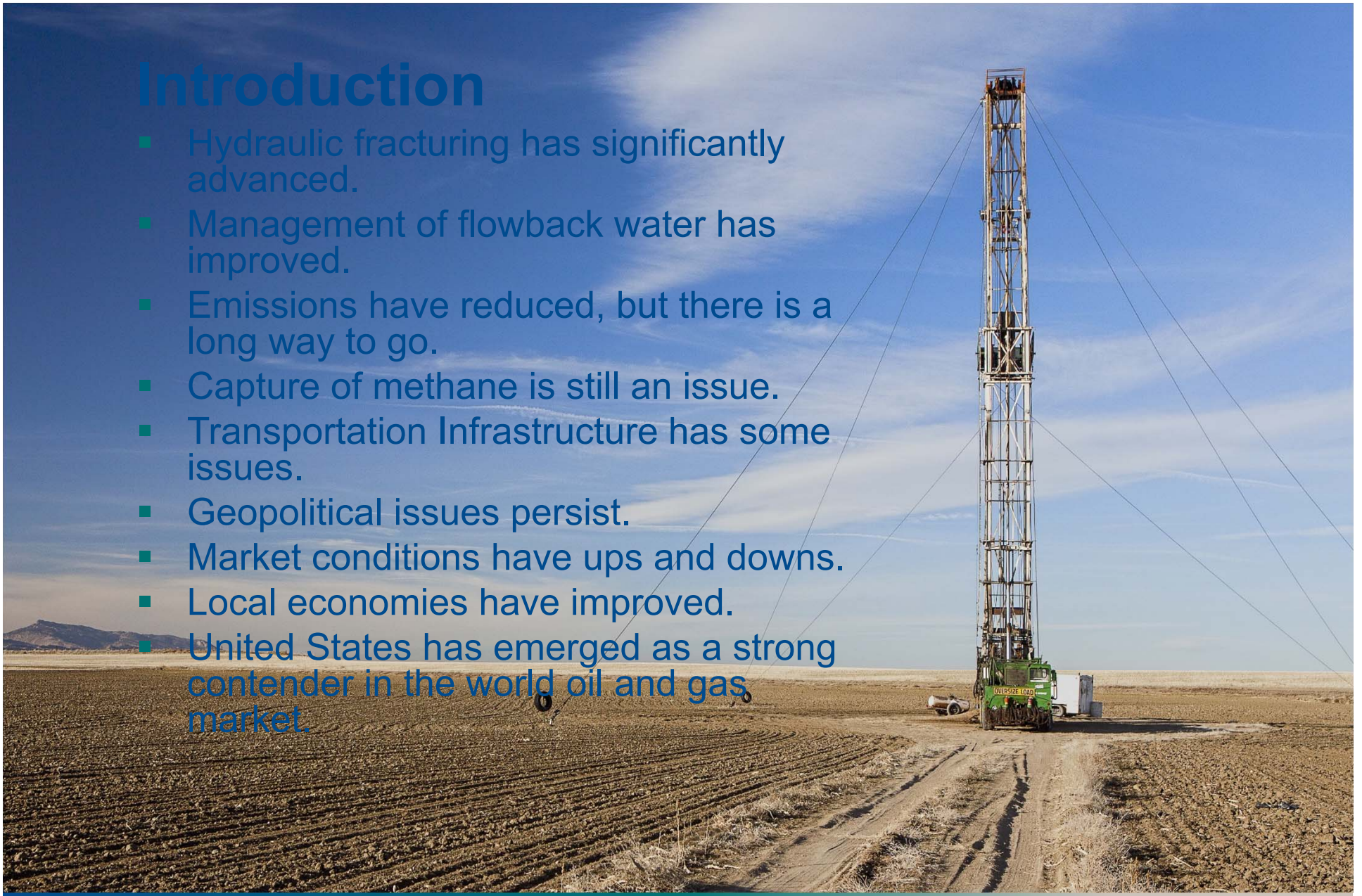
▪ *Maps and figures from EIA*

Shale Plays



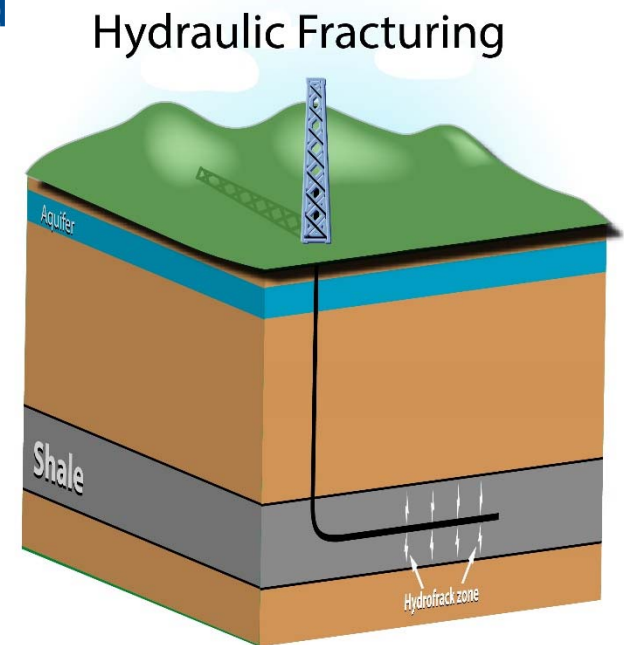
Introduction

- Hydraulic fracturing has significantly advanced.
- Management of flowback water has improved.
- Emissions have reduced, but there is a long way to go.
- Capture of methane is still an issue.
- Transportation Infrastructure has some issues.
- Geopolitical issues persist.
- Market conditions have ups and downs.
- Local economies have improved.
- United States has emerged as a strong contender in the world oil and gas market.



Technology Advancements

- One lateral at dawn
- Multilateral wells from a single well pad
- Stacked wells from a single well pad (30 to 40 wells to different depths before turning them horizontally through six different strata, each with its own characteristics)
- Lateral length increases
- Subsurface conditions monitoring technology advancement
- Sand strength and makeup differences
- Mapping tool advancements
- Water reuse for fracturing (for non-freshwater use)

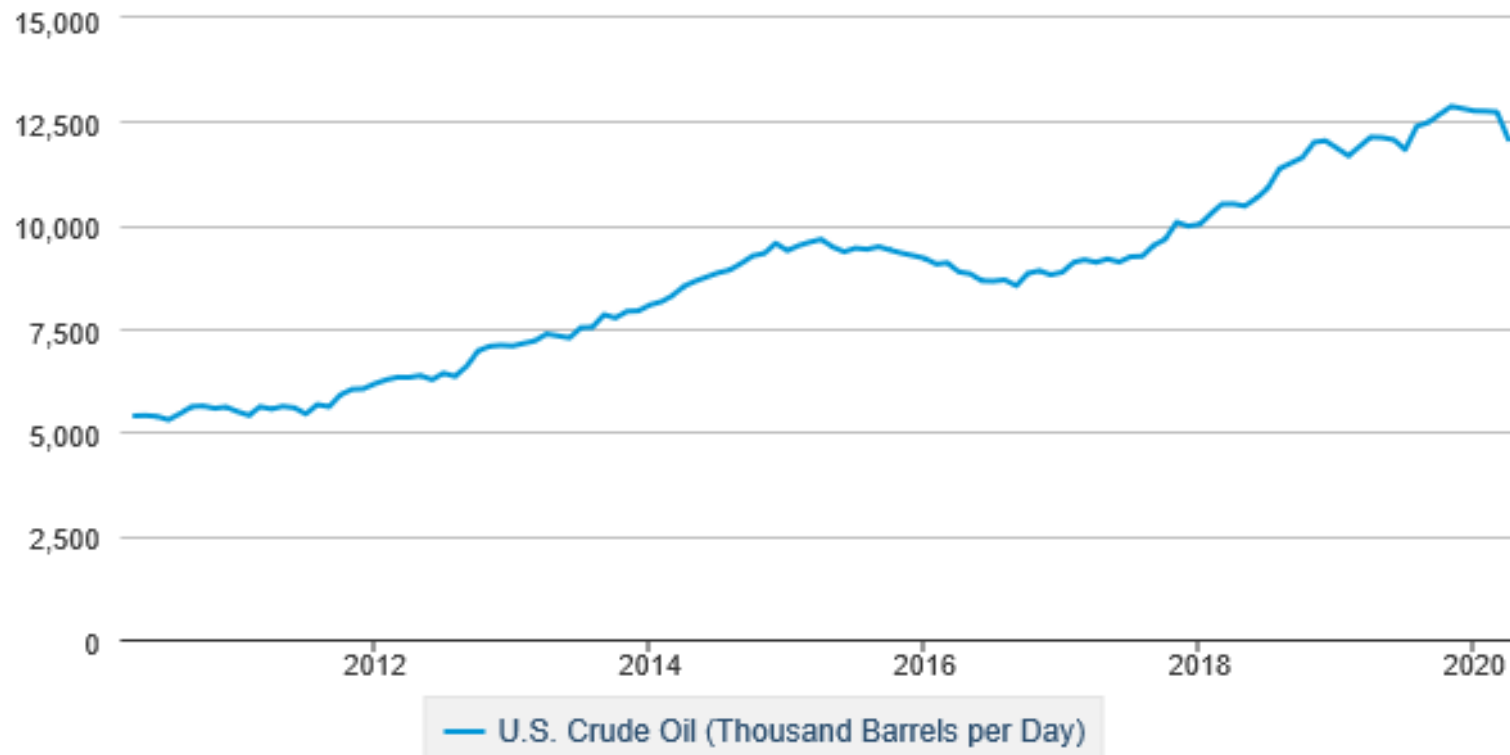


Crude Oil Production

U.S. crude oil production



thousand barrels per day



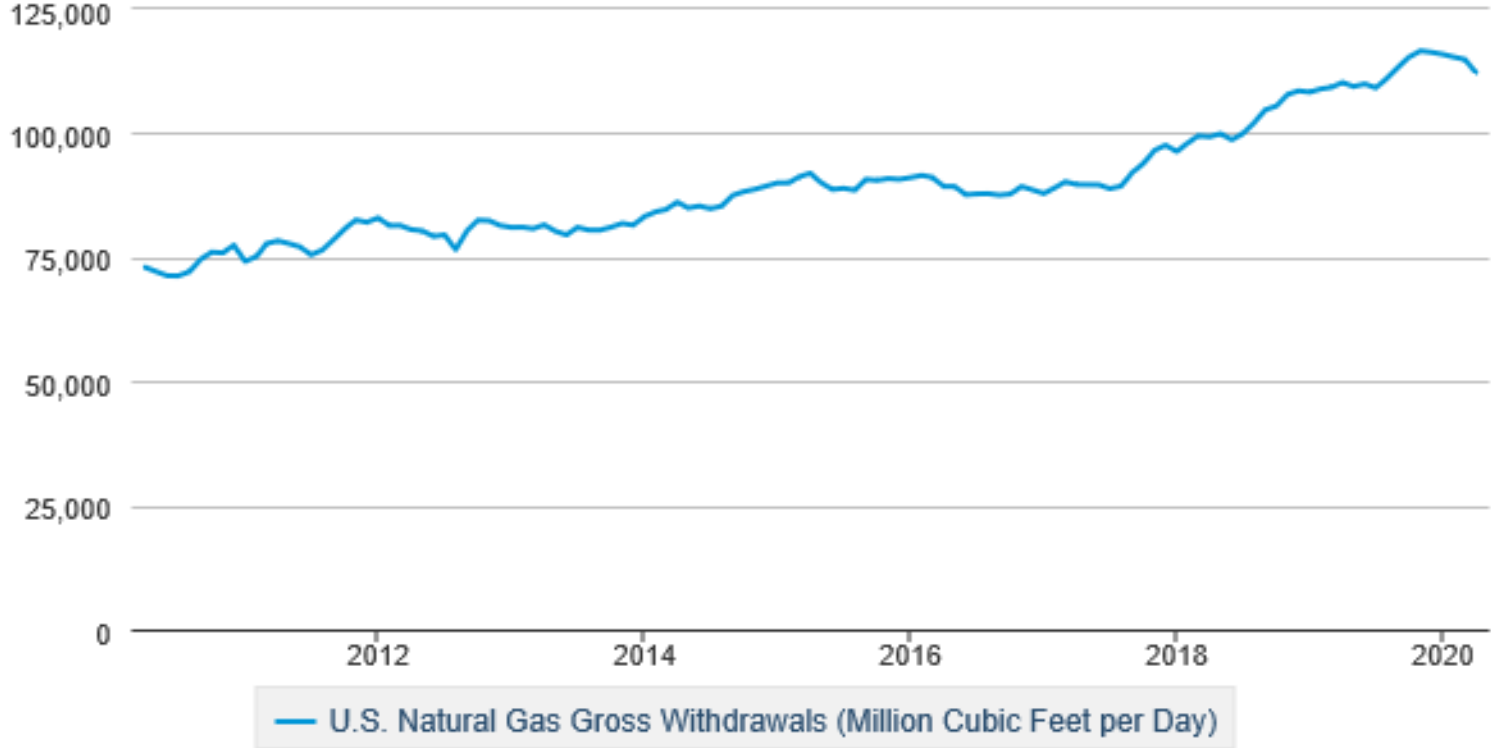
Source: U.S. Energy Information Administration

Natural Gas Production

U.S. natural gas production (gross withdrawals)



million cubic feet per day



Source: U.S. Energy Information Administration



Distribution Infrastructure


- Pipeline capacity is lacking for both natural gas and crude oil transportation.
- Crude by rail is ongoing
- Capture of methane is lacking - not just in North Dakota, but in all other areas as well, due to large volumes of production of both natural gas and crude oil
- Crude at well head contains oil, natural gas, liquids and water
- Conditioning infrastructure at the Bakken has significantly advanced due to regulations
- Liquefied natural gas (LNG) terminals and crude oil export terminals are used



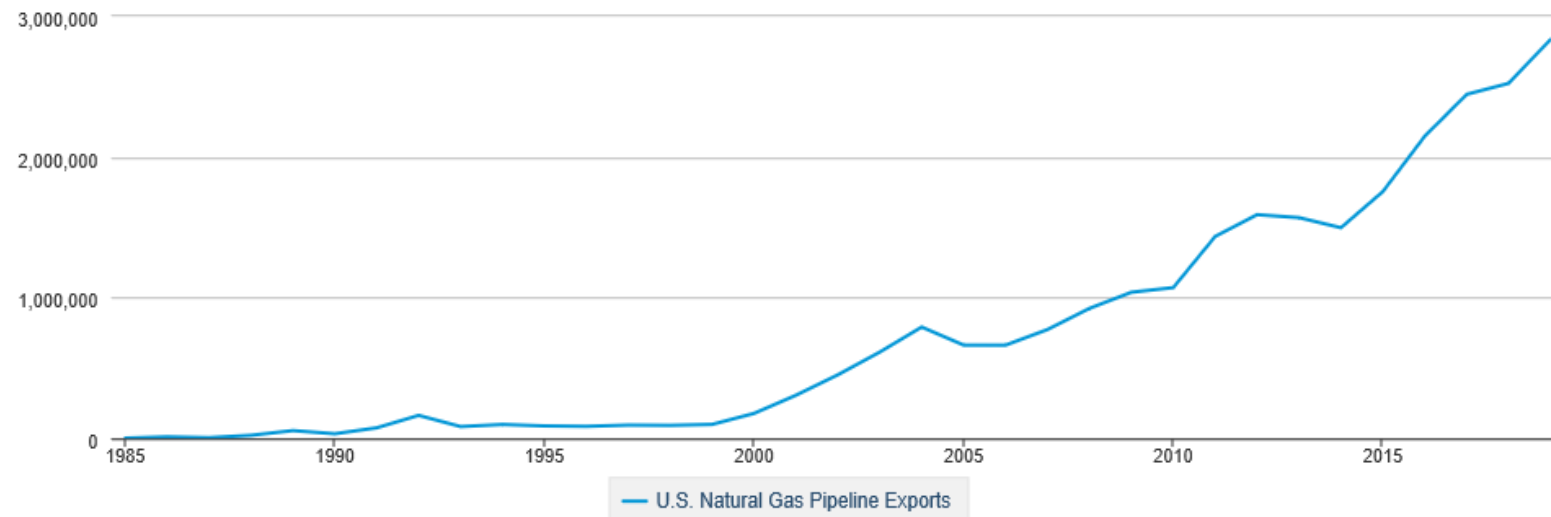
Imports and Exports

- Natural Gas Exports

U.S. Natural Gas Pipeline Exports

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Million Cubic Feet




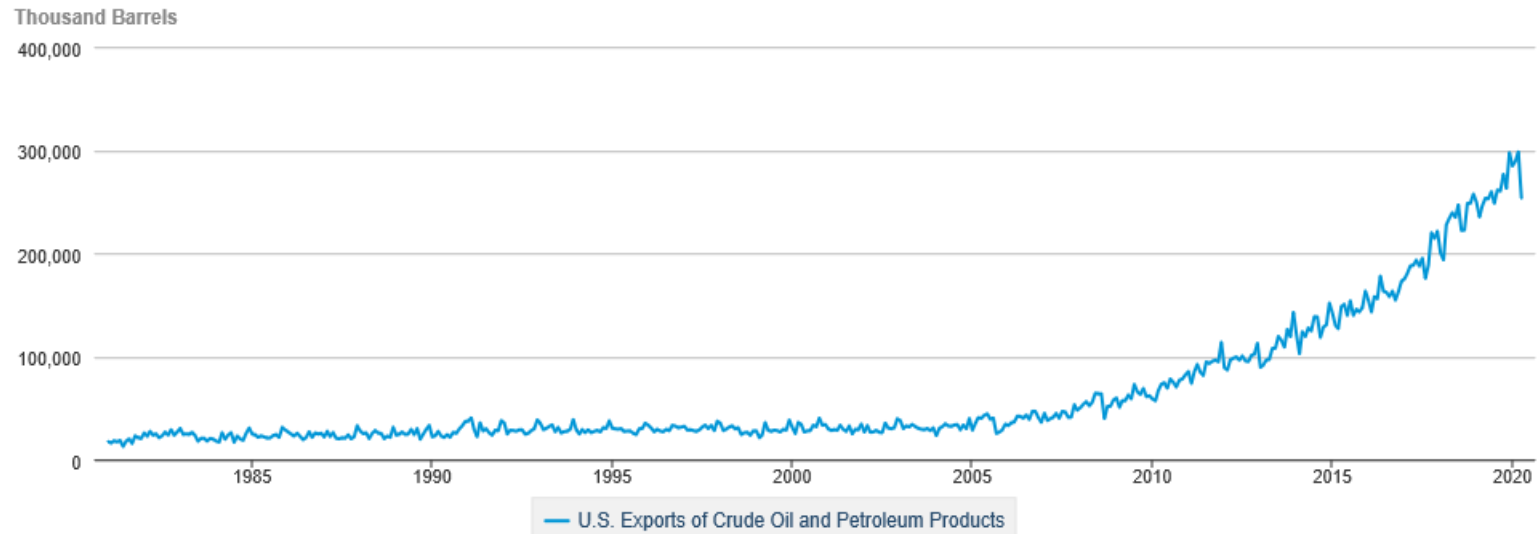
 Source: U.S. Energy Information Administration


Imports and Exports

- Crude Oil Exports

U.S. Exports of Crude Oil and Petroleum Products

 [DOWNLOAD](#)



 Source: U.S. Energy Information Administration

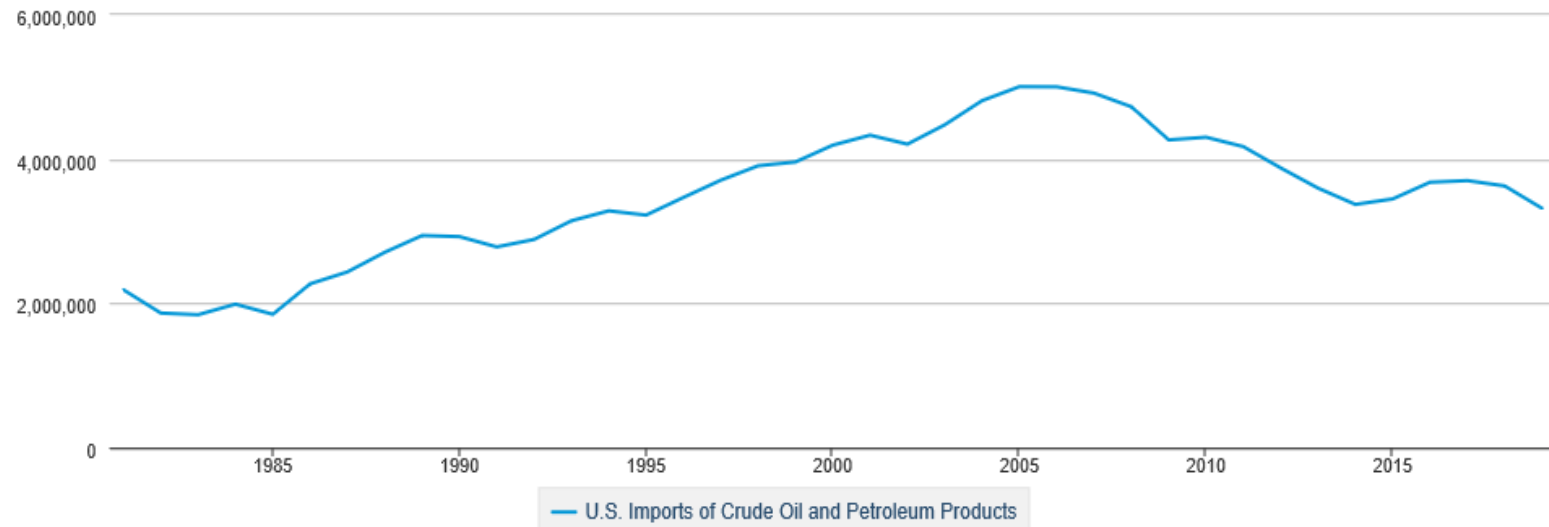
Imports and Exports

- Crude Oil Imports

U.S. Imports of Crude Oil and Petroleum Products

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Thousand Barrels



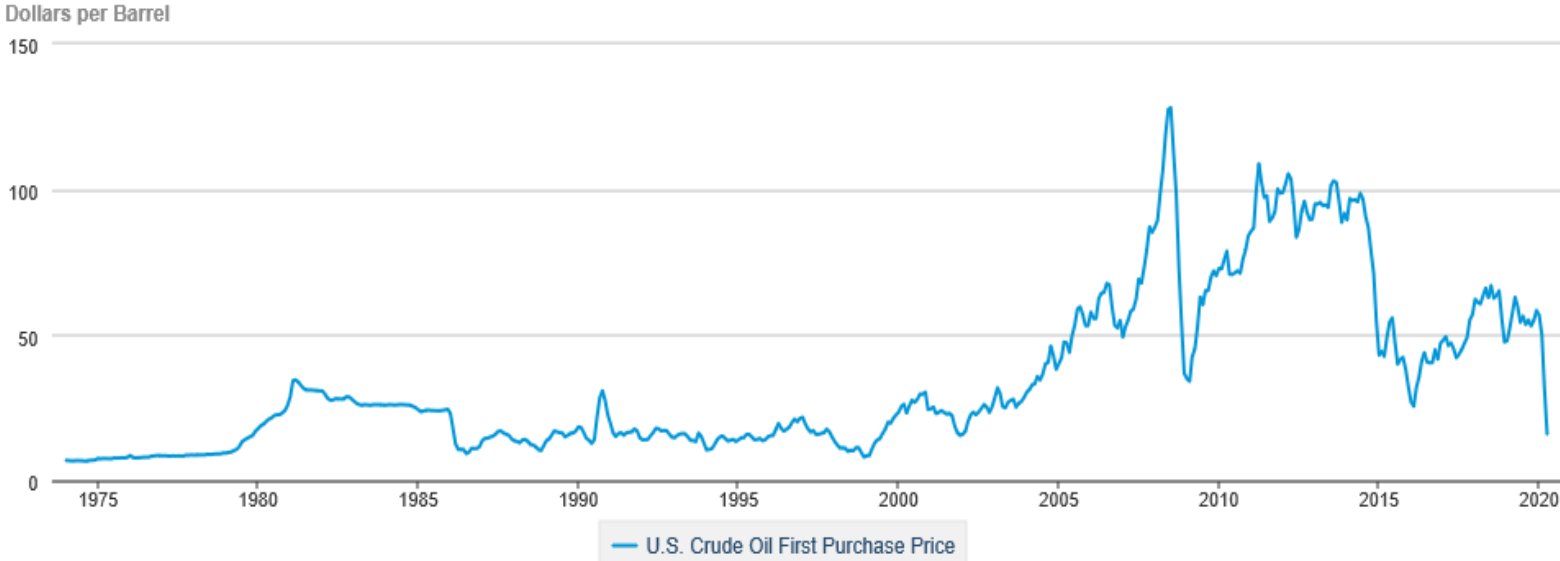
 Source: U.S. Energy Information Administration

Market Condition Variations

- Crude Oil Prices

U.S. Crude Oil First Purchase Price

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 Source: U.S. Energy Information Administration

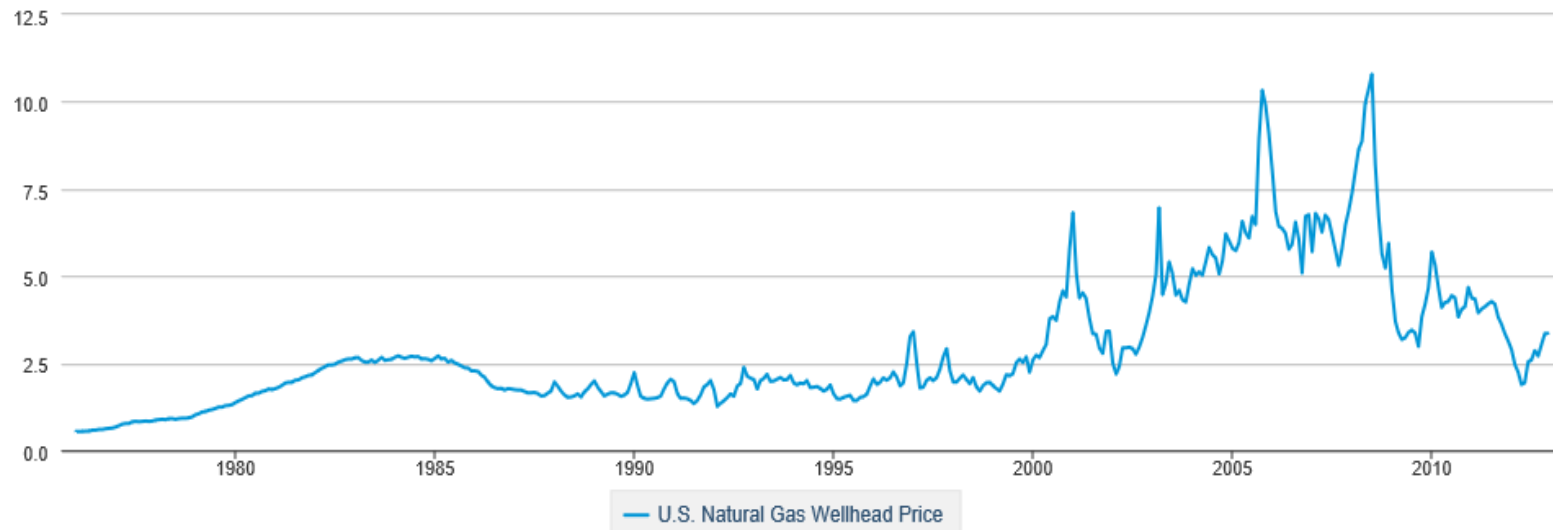
Market Condition Variations

- Natural Gas Prices

U.S. Natural Gas Wellhead Price

[↓ DOWNLOAD](#)

Dollars per Thousand Cubic Feet



 Source: U.S. Energy Information Administration

Environmental Conditions/Controls

- Better treatment technologies than 2010.
- Better emissions control due to regulations.
- Flaring at well head and Lease Acquisition and Custody Transfer (LACT) units ongoing.
- Regulatory guidelines exist with deadlines.
- Capture of methane not contained due to lack of pipeline infrastructure.
- Per- and polyfluoroalkyl substances (PFAS) concerns exist due to aqueous film-forming foam (AFFF) usage at well sites and elsewhere.

Issues

- Lack of pipeline infrastructure
- Methane emissions
- Naturally occurring radioactive material (NORM)
- Price at markets
- Geopolitical issues



Summary

- Energy health is strong in the U.S.
- Better environmental controls in the past decade on emissions and waste treatment.
- Global demand for our energy exports – LNG and crude oil.
- Import lower quantity of crude oil from foreign sources.
- Oil prices increasing



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Thank You

QUESTIONS?



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