



THE OXFORD
INSTITUTE
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STUDIES

A RECOGNIZED INDEPENDENT CENTRE OF THE UNIVERSITY OF OXFORD



A Shale Gas Field

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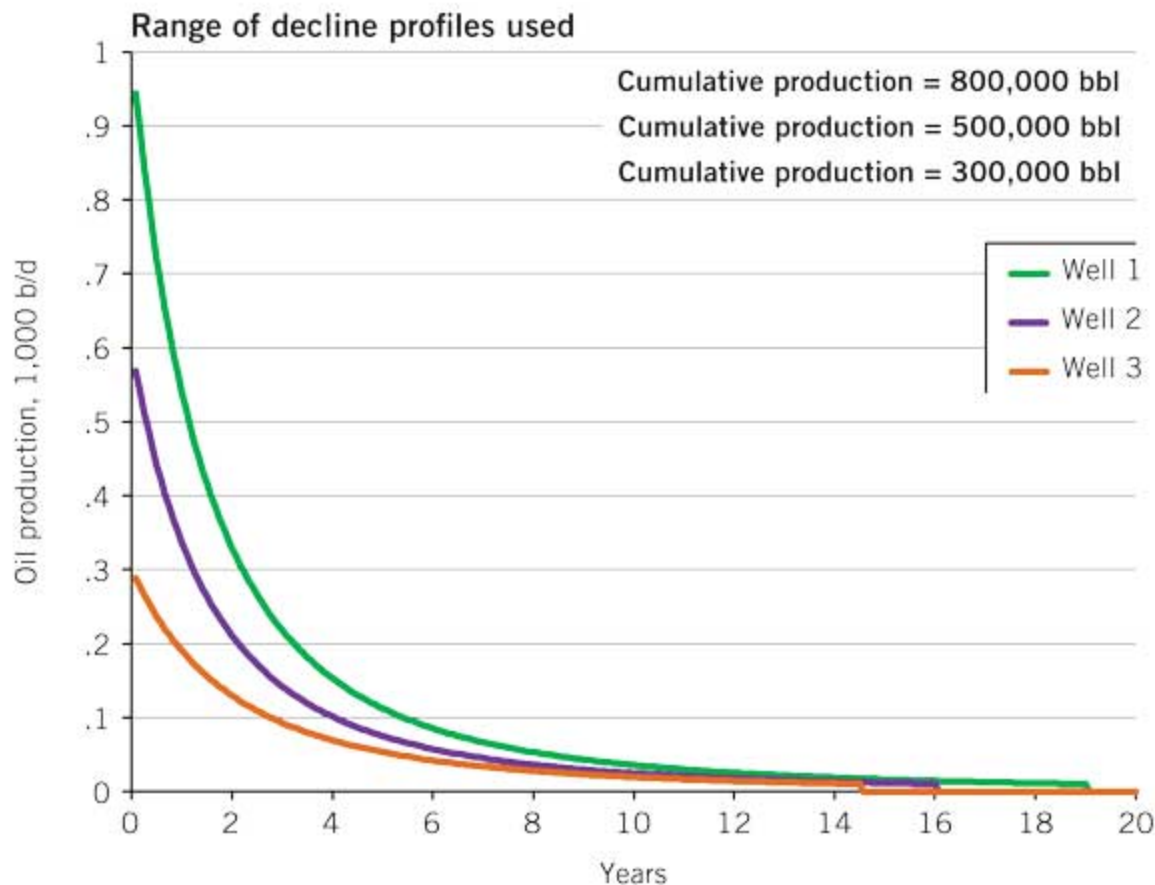
The Economics of Energy Corporations (2)



Shale Oil Production Profile

TYPE PRODUCTION PROFILES AND PRODUCTION USED IN MODELING

FIG. 1



1. Immediate surge to peak production
2. Rapid decline over the first few years
3. Long plateau at low production rates

Let's model a shale gas field

- Resources and reserves – 1000bcf with 10% recovery rate
- Start date – year after first investment
- Peak production – 25% of reserves
- Time to peak – 1st year
- Length of peak – 1 year
- Decline rates – 50% in year 2, 35% yr 3, 25% yr 4, 10% from then



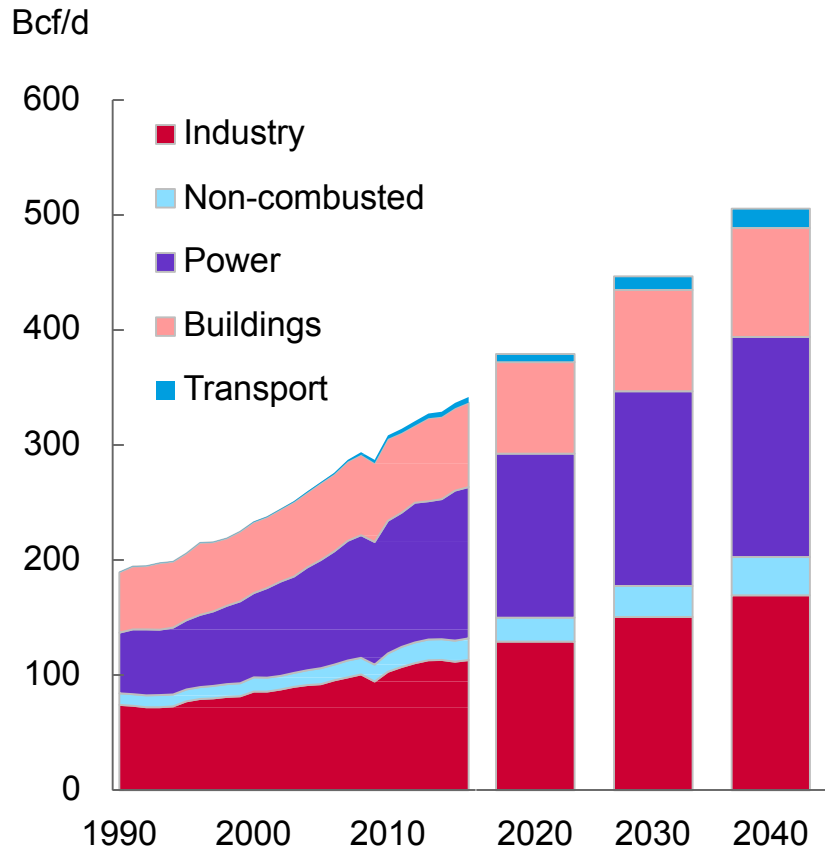
Gas Price

- Gas price has tended to be at a discount to oil on a heat equivalent basis
- 1 barrel of oil equals 6 million cubic feet (mcf) of gas
 - 1 million barrels = 1 billion cubic feet (Bcf)
- Oil price to gas price calculation:
 - » (Oil price / 6) x gas discount
 - » $60 / 6 \times 90\% = \$9/\text{mcf}$
- Gas industry analysts also talk about the relationship between gas and oil prices as a slope
- The slope is just the gas price divided by the oil price in percent
 - $9 / 60 = 15\%$ slope
 - Slope on a heat equivalent basis is 16.67%
 - Normal slope is between 11% to 15% to allow for gas price discount

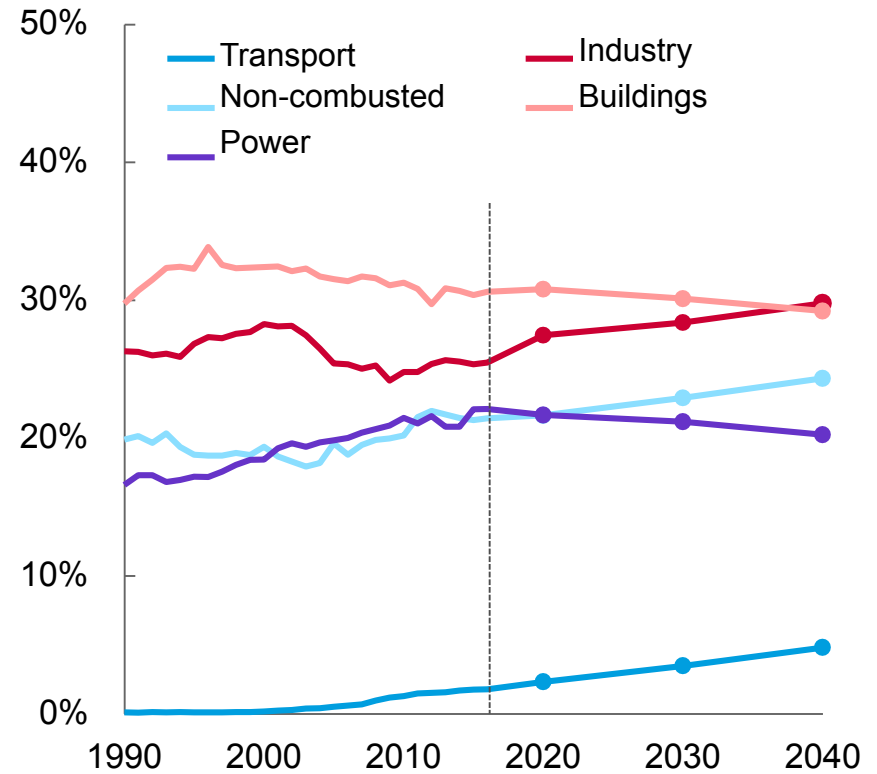


Growth in natural gas demand...

Gas consumption by sector



Gas share by sector

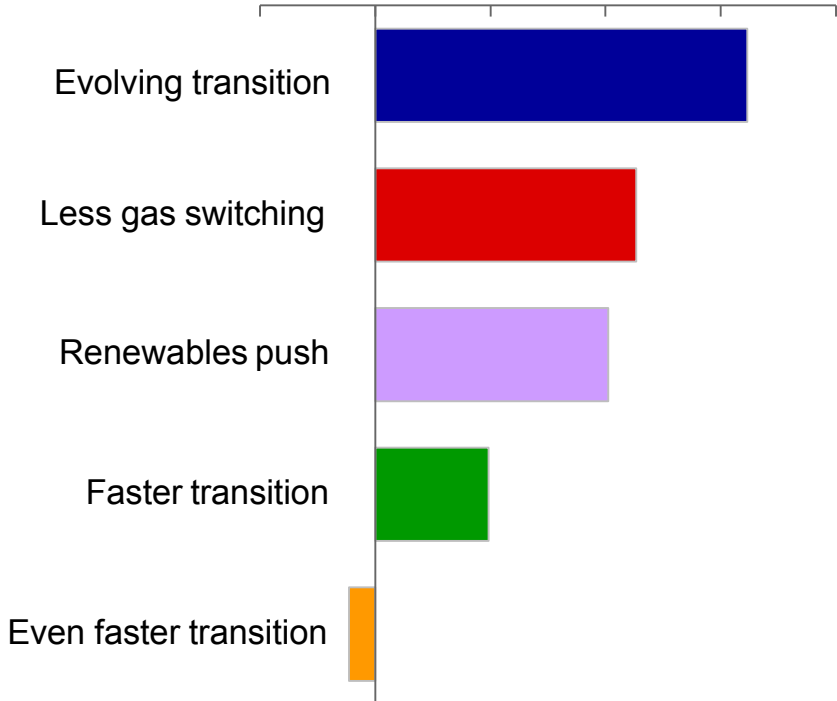


Prospects for gas demand could be dampened

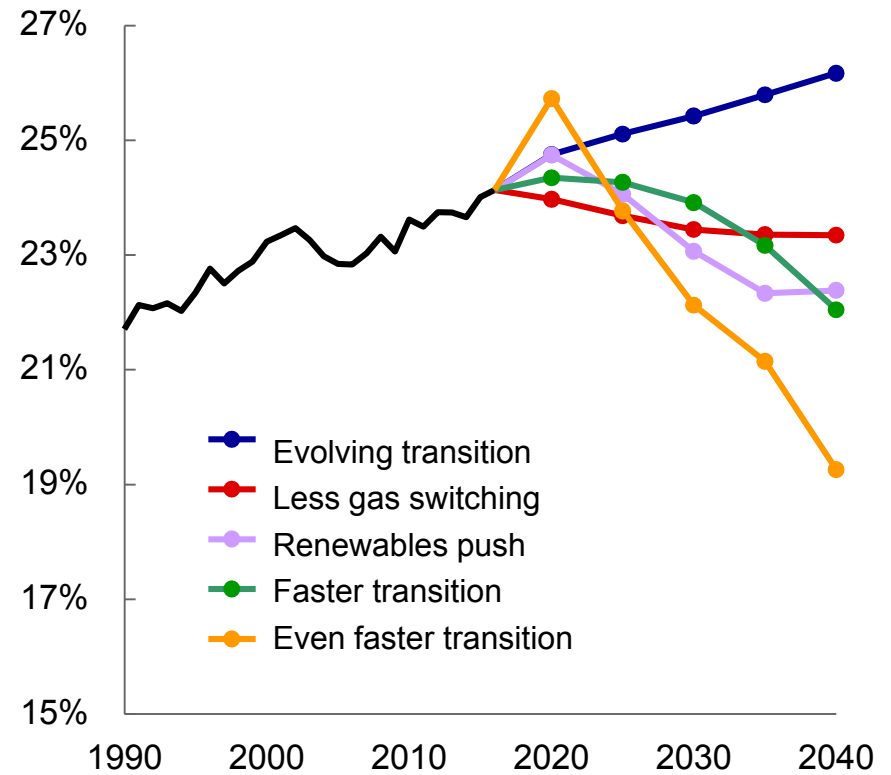
Gas demand growth 2016-2040

% per annum

-0.5% 0.0% 0.5% 1.0% 1.5% 2.0%

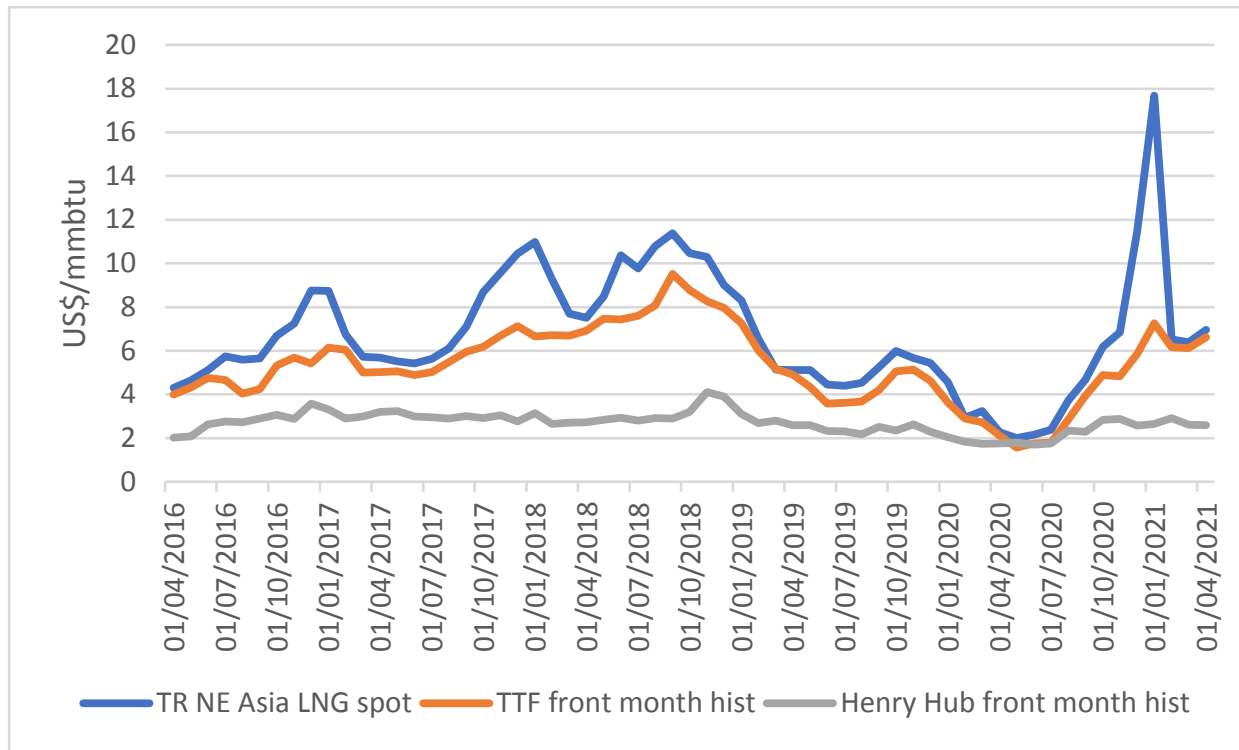


Gas share of primary energy 1990-2040



Gas prices have been falling and converging

Global gas prices

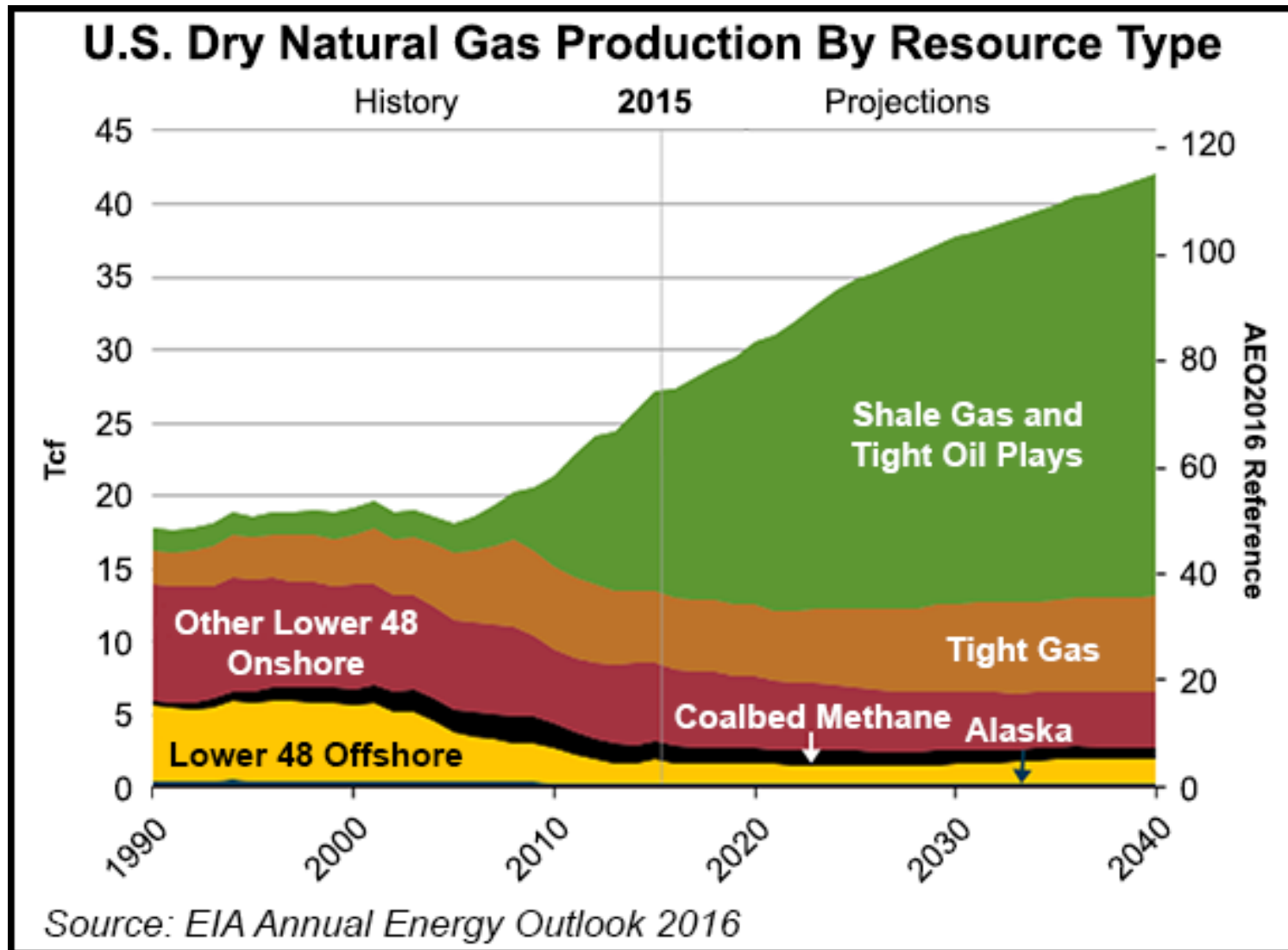


Gas increasingly priced relative to competing gas supply

Rising supply and a recent fall in demand saw price 2018-2020

Winter 2020/21 underlined risks of short-term market dislocation, in this instance due to cold weather

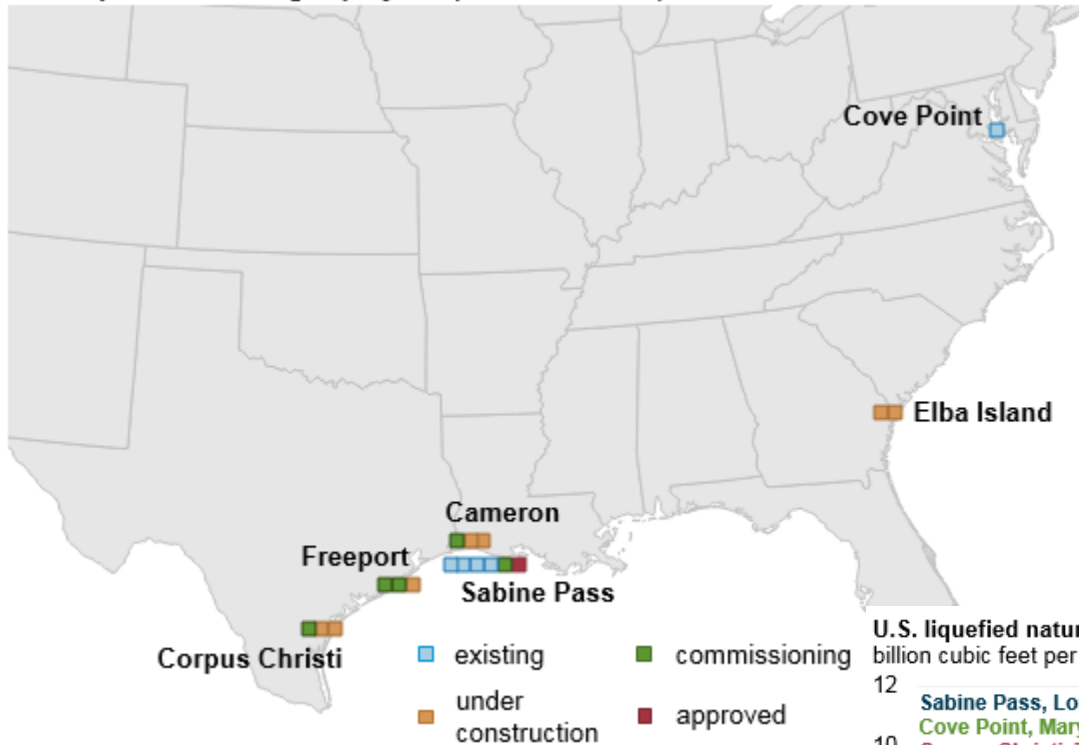
US shale gas production has risen sharply and looks set to continue



US gas is now being exported

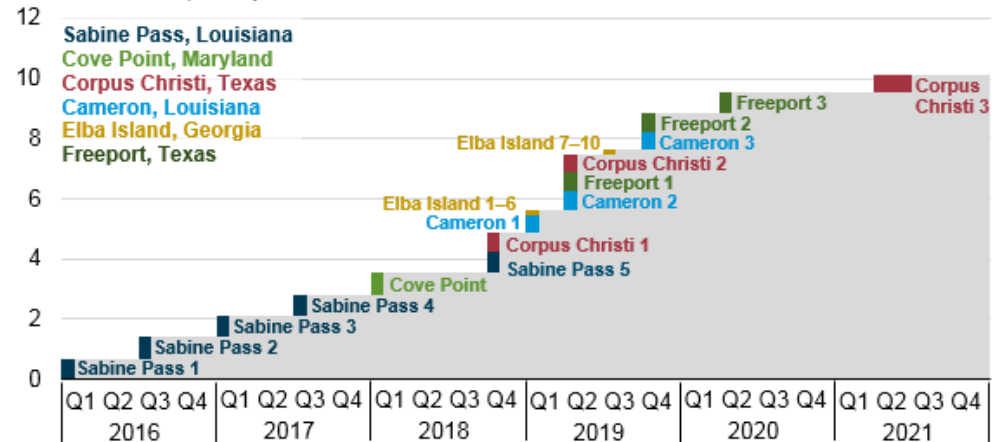
US LNG projects set to expand

U.S. liquefied natural gas projects (November 2018)



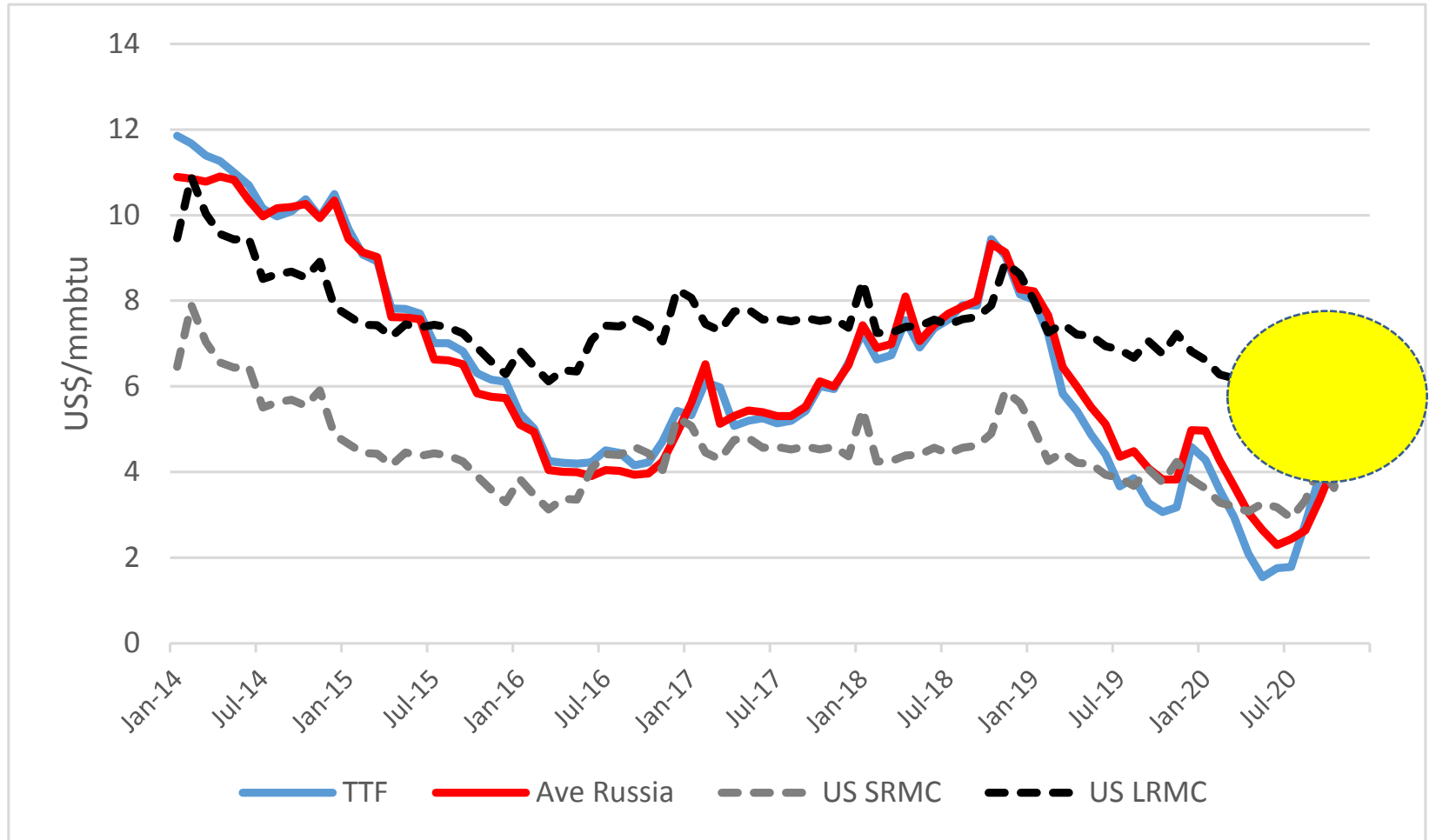
U.S. liquefied natural gas export capacity, 2016–2021

billion cubic feet per day



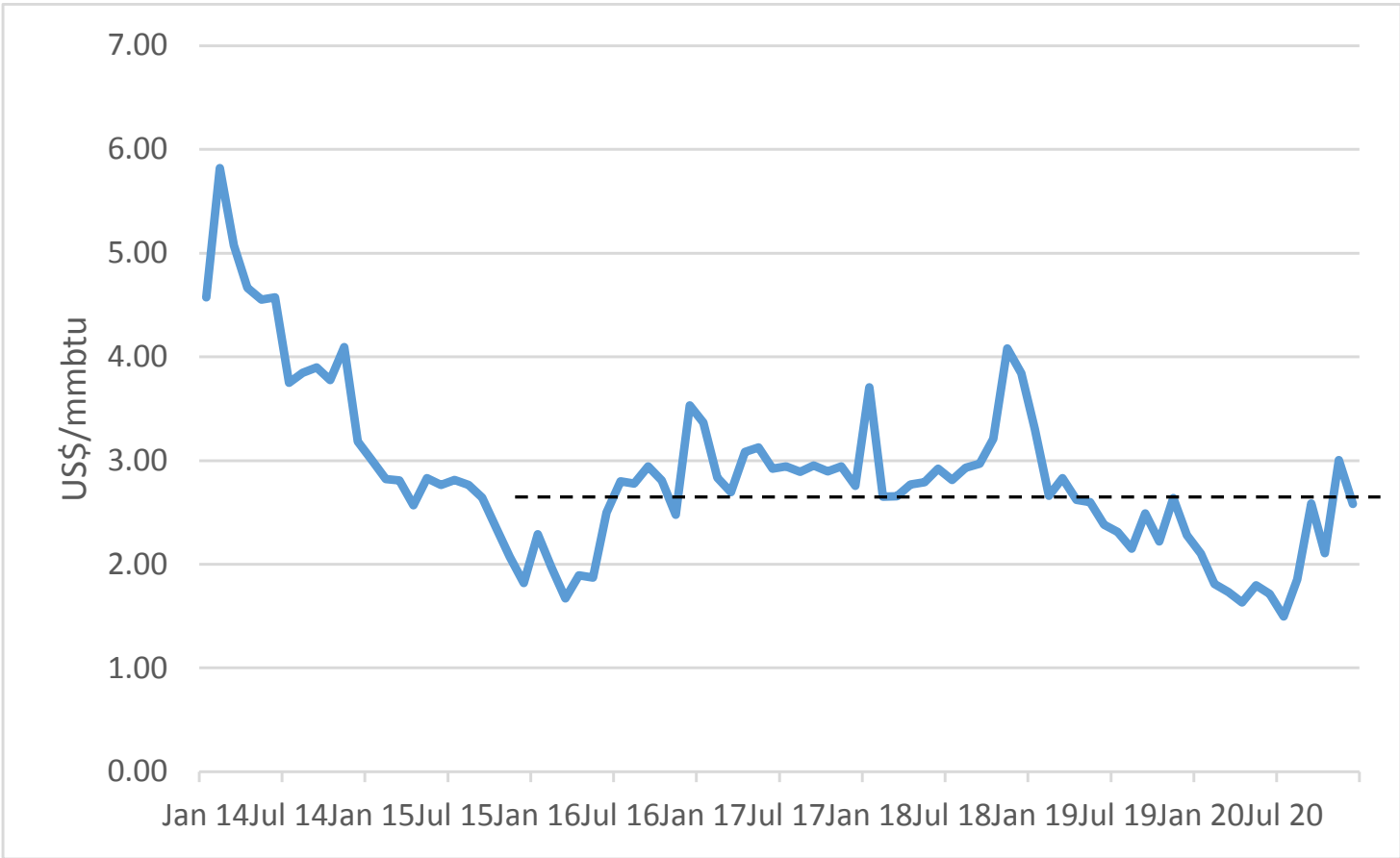
Is it worth exporting US gas?

European gas price versus US LNG at cost



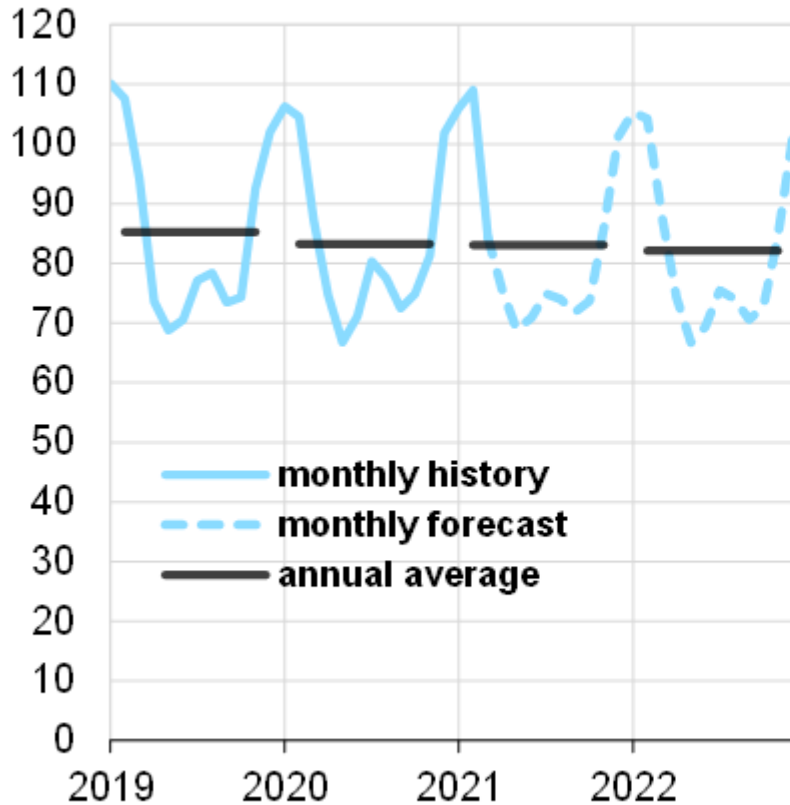
Decline in natural gas prices exaggerated by Covid-19

US (Henry Hub) Gas Price

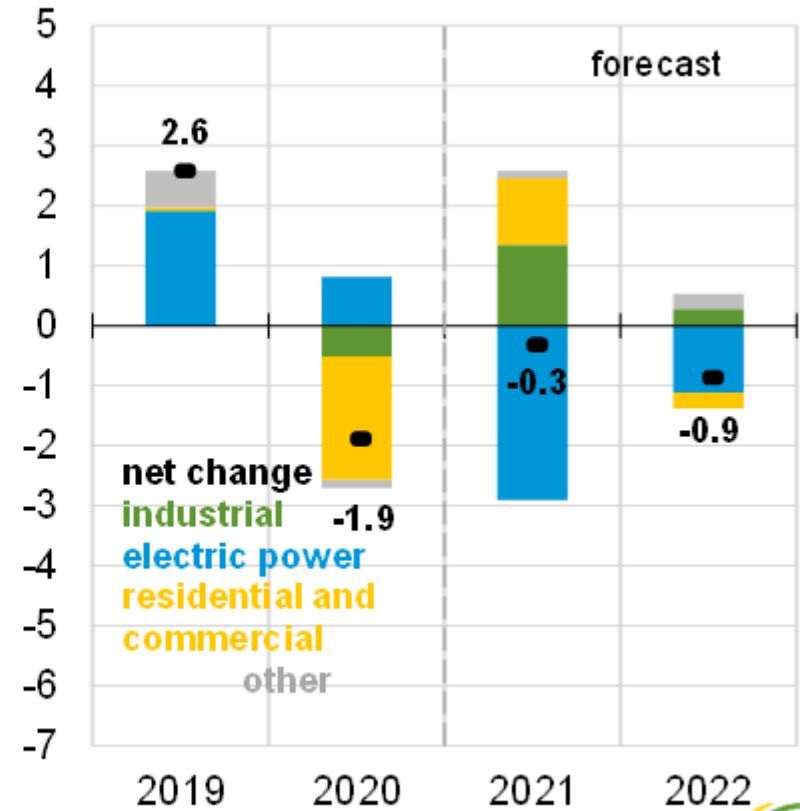


US Gas Market – demand remaining weak due to higher prices

U.S. natural gas consumption
billion cubic feet per day



Components of annual change
billion cubic feet per day



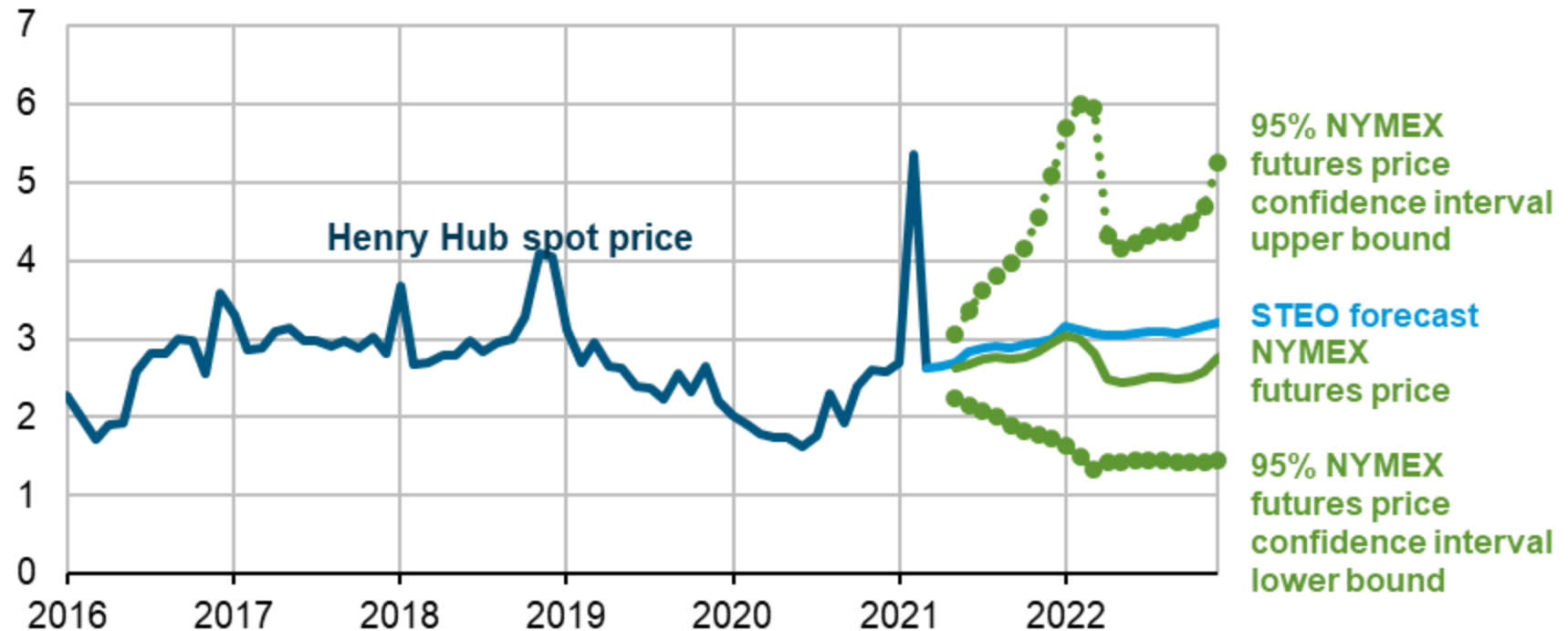
Source: U.S. Energy Information Administration, Short-Term Energy Outlook, April 2021



US Gas Market – price outlook

Henry Hub natural gas price and NYMEX confidence intervals

dollars per million Btu



Note: Confidence interval derived from options market information for the five trading days ending Apr 1, 2021. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Sources: U.S. Energy Information Administration, Short-Term Energy Outlook, April 2021, and CME Group



WACC Calculation

A Small Shale Producer

- Risk free rate – 1.75%
- Corporate Interest Rate – 3.5%
- Equity Market return – 10.53%
- Company Beta – 2
- Corporate Tax Rate – 20%
- Debt/Equity – 60:40

- What is the WACC (discount rate)?

- What is the breakeven gas price?

