

U.S. DEPARTMENT OF ENERGY'S ROLE IN NATURAL GAS REGULATION, AND CONSIDERATIONS FOR HYDROGEN

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NO FEDERAL REGULATORY FRAMEWORK FOR HYDROGEN EXPORTS AT THIS TIME, BUT FEDERAL NATURAL GAS REGULATORY AUTHORITY IS DISTRIBUTED AMONG SEVERAL AGENCIES



Department of Energy

- Authority over the trade of natural gas as a commodity
- Cooperating agency on environmental reviews of facilities



Federal Energy Regulatory Commission

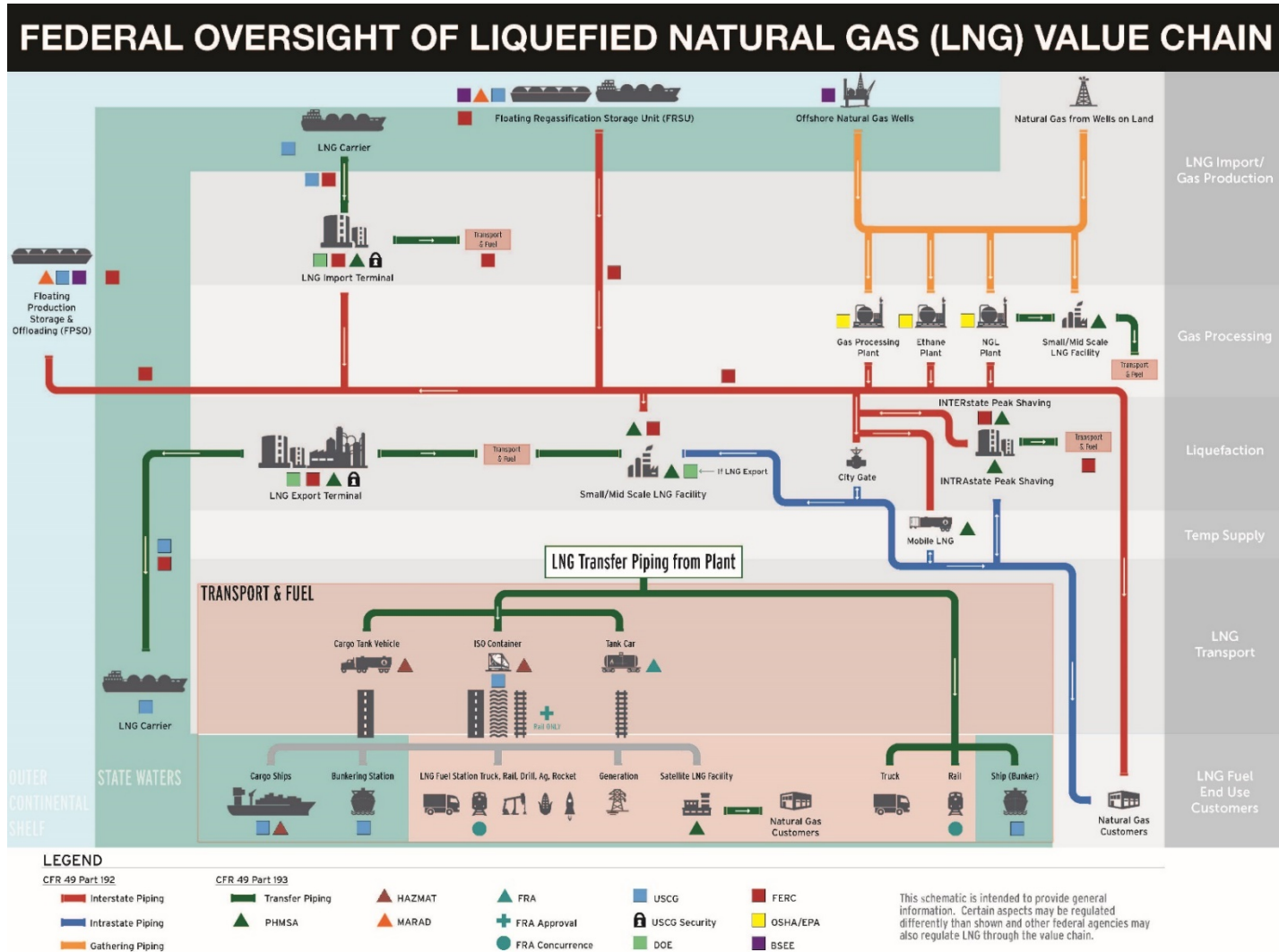
- Authority over the siting, construction, and operation of onshore LNG terminals
- Lead agency on environmental reviews of onshore facilities



Maritime Administration

- Authority over the siting, construction, and operation of deepwater offshore LNG terminals
- Co-lead agency on environmental reviews of offshore facilities with U.S. Coast Guard

MANY FEDERAL, STATE, AND LOCAL AGENCIES HAVE ROLE IN PERMITTING PRODUCTION, DISTRIBUTION, AND EXPORT OF NATURAL GAS AND LNG



PUBLIC INTEREST DETERMINATION EVALUATION CRITERIA FOR EXPORTS TO NON-FREE TRADE AGREEMENT COUNTRIES

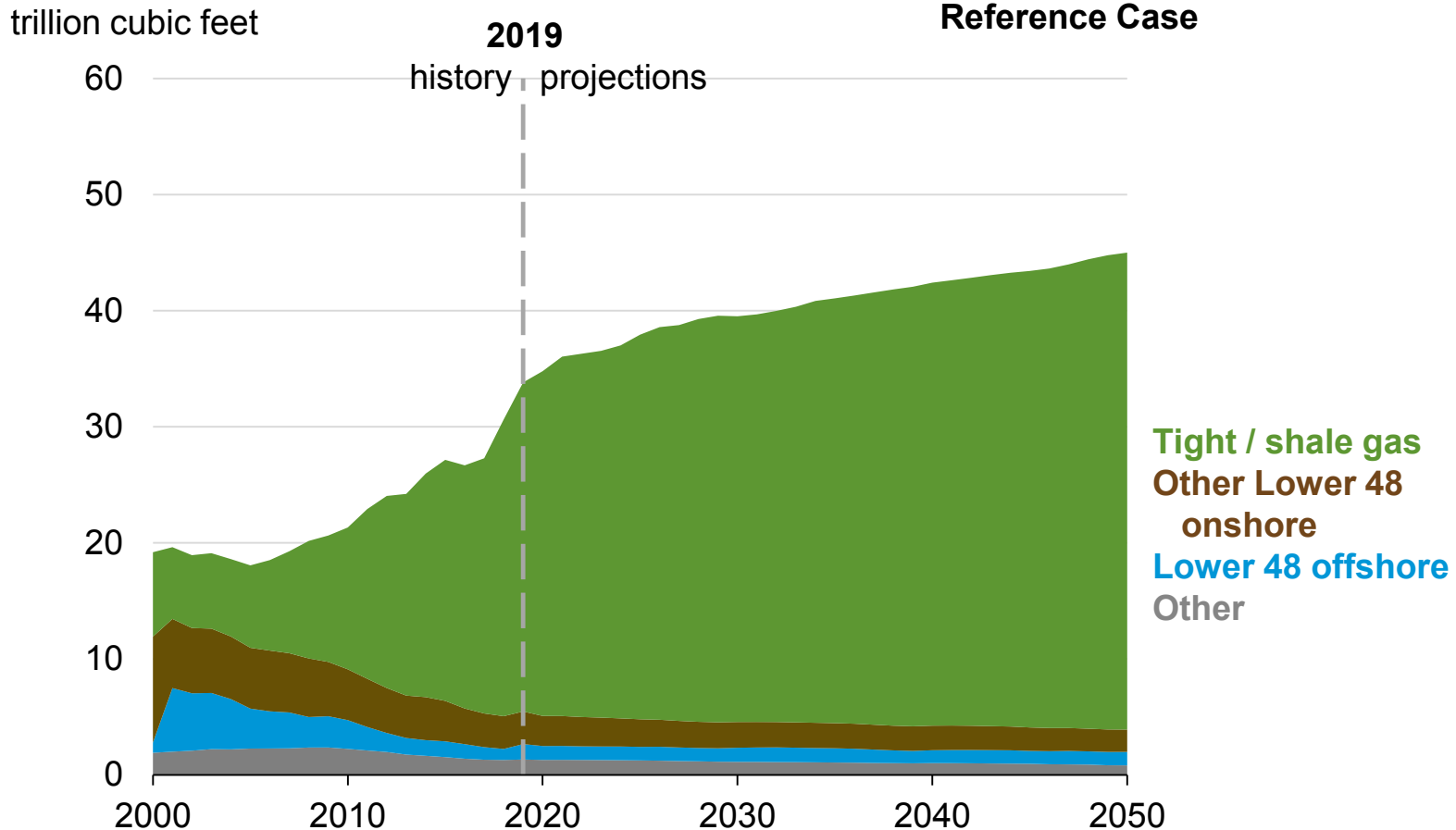
Criteria for Evaluating the Public Interest

- Domestic need for the natural gas proposed for export
- Adequacy of domestic natural gas supply
- U.S. energy security
- Impact on U.S. economy
- Other Considerations:
 - International considerations
 - Environmental considerations
 - Other issues raised by commenters and intervenors deemed relevant

U.S. NATURAL GAS PRODUCTION HAS RISEN OVER 50% SINCE 2000 AND WILL HAVE MORE THAN DOUBLED BY 2050

Energy Information Administration Annual Energy Outlook 2020

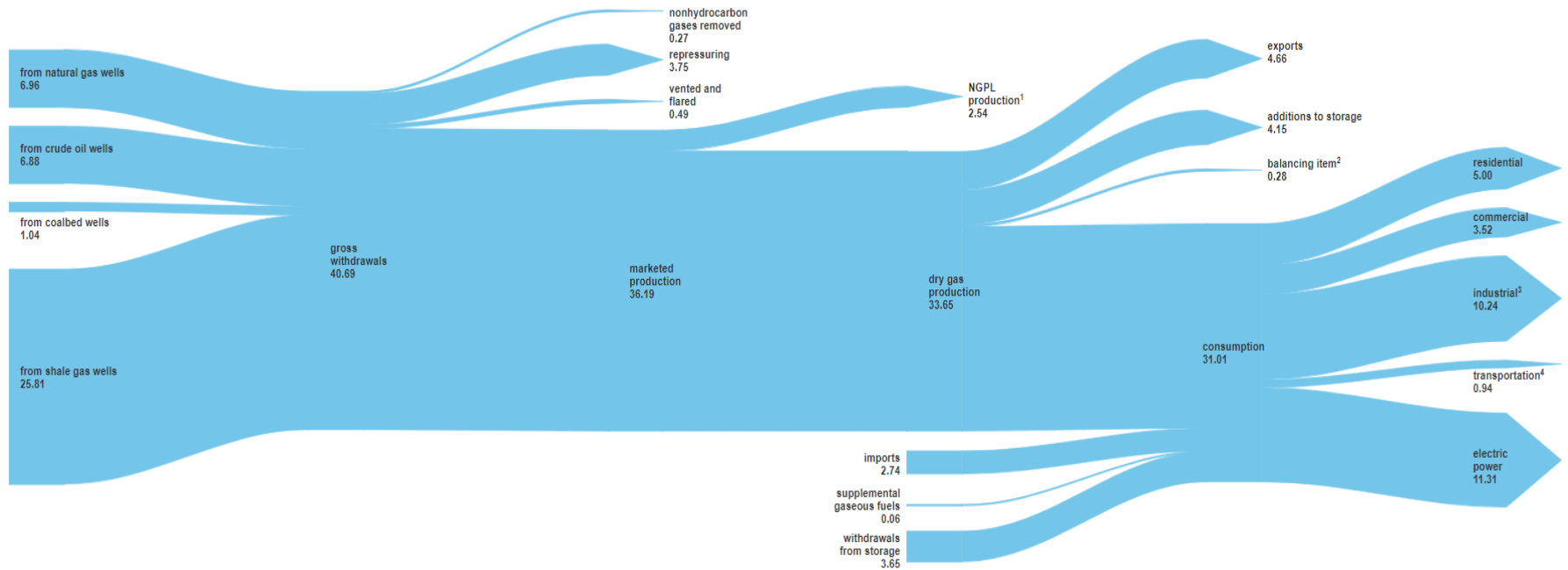
Dry natural gas production by type



MAINTAIN UNDERSTANDING OF HOW AND WHERE OUR DOMESTIC MARKET IS OPERATING

U.S. natural gas flow, 2019

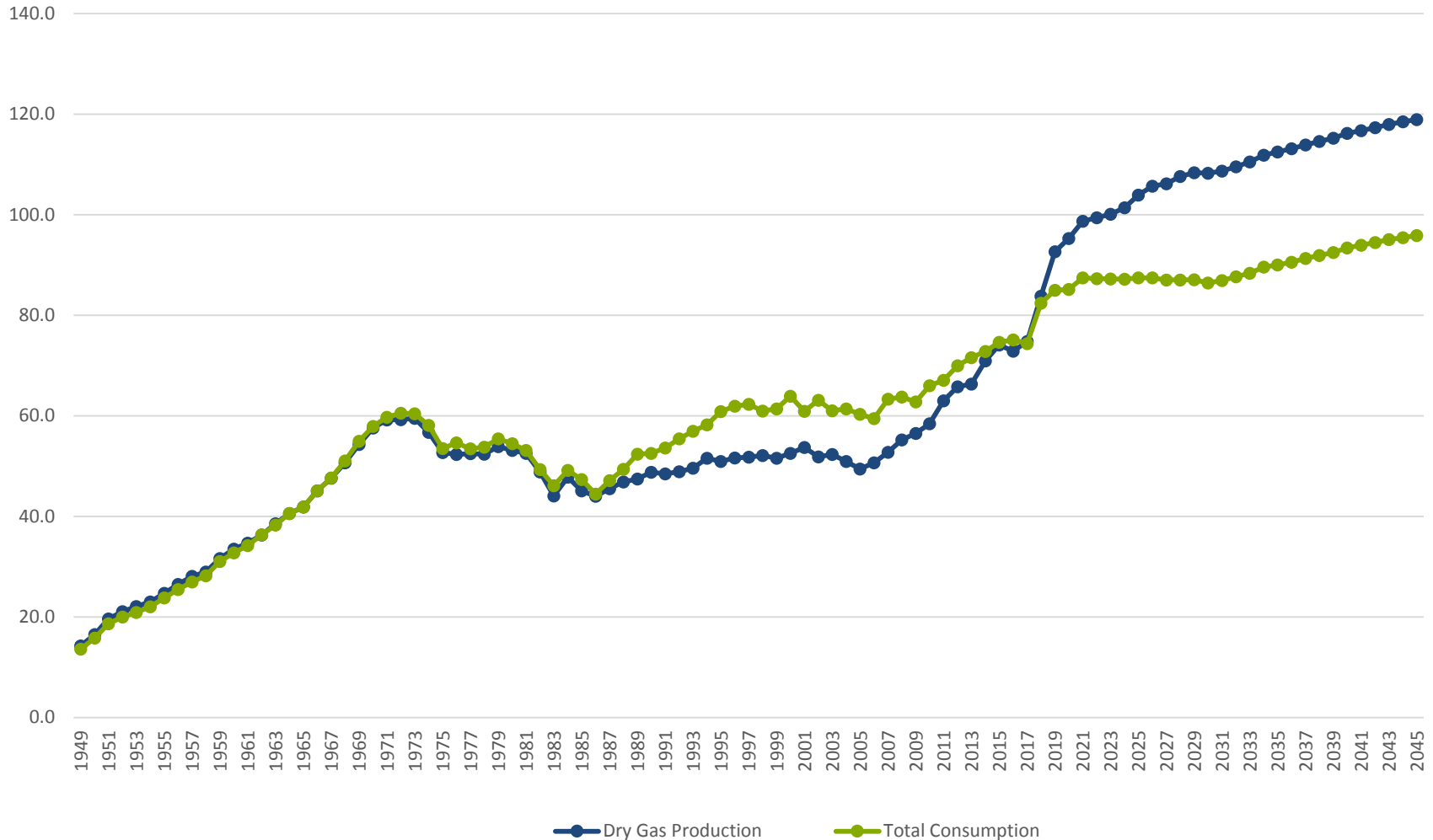
trillion cubic feet



¹ Natural gas plant liquids production (NGPL), gaseous equivalent. | ² Quantities lost and imbalances in data due to differences among data sources. Excludes transit shipments that cross the U.S.-Canada border (i.e., natural gas delivered to its destination via the other country). | ³ Lease and plant fuel, and other industrial. | ⁴ Natural gas consumed in the operation of pipelines (primarily in compressors) and as fuel in the delivery of natural gas to consumers, plus a small quantity used as vehicle fuel. | Notes: • Data are preliminary. • Values are derived from source data prior to rounding for publication. • Totals may not equal sum of components due to independent rounding.

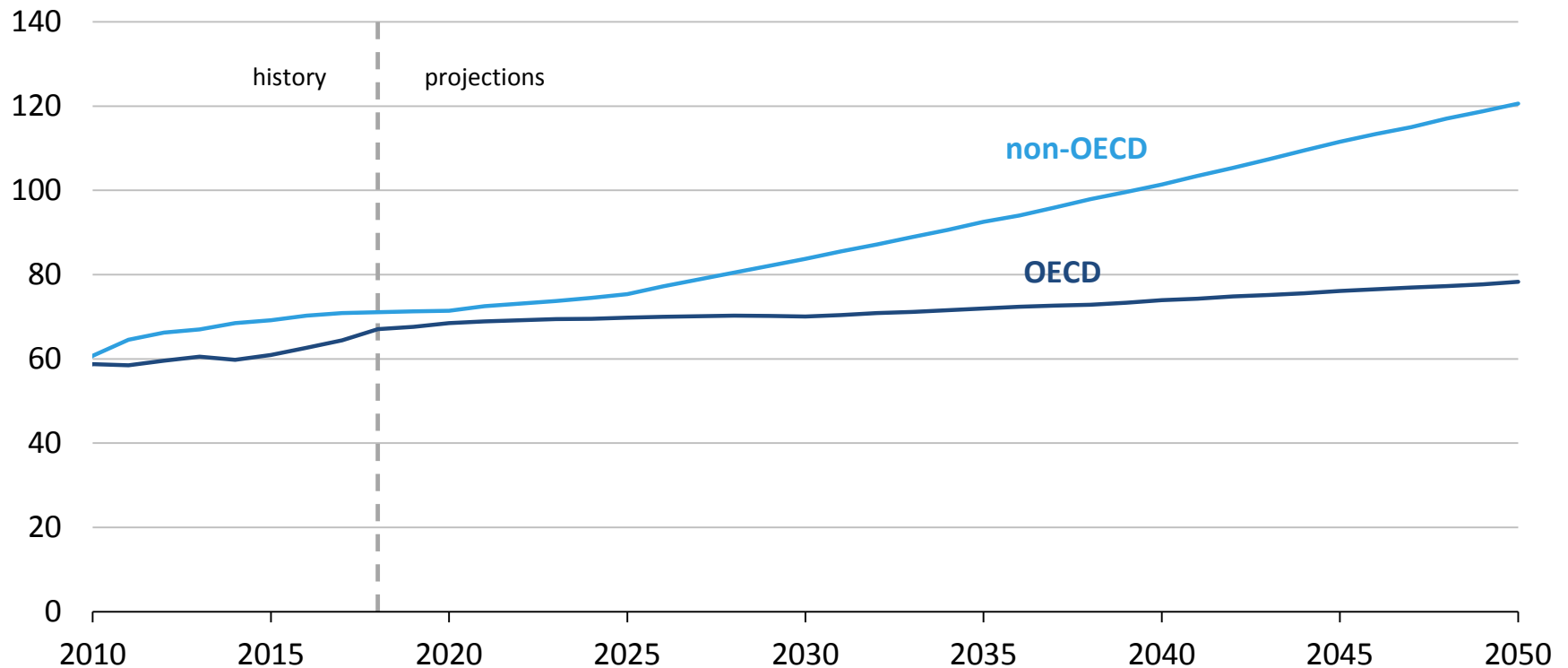
U.S. NATURAL GAS PRODUCTION CONTINUES TO EXCEED CONSUMPTION

Billion cubic feet per day (Bcf/d)



GROWING GLOBAL DEMAND FOR NATURAL GAS WILL CONTINUE TO INCREASE NATURAL GAS AND LNG TRADE

World natural gas consumption
quadrillion British thermal units



Source: Energy Information Administration International Energy Outlook 2019

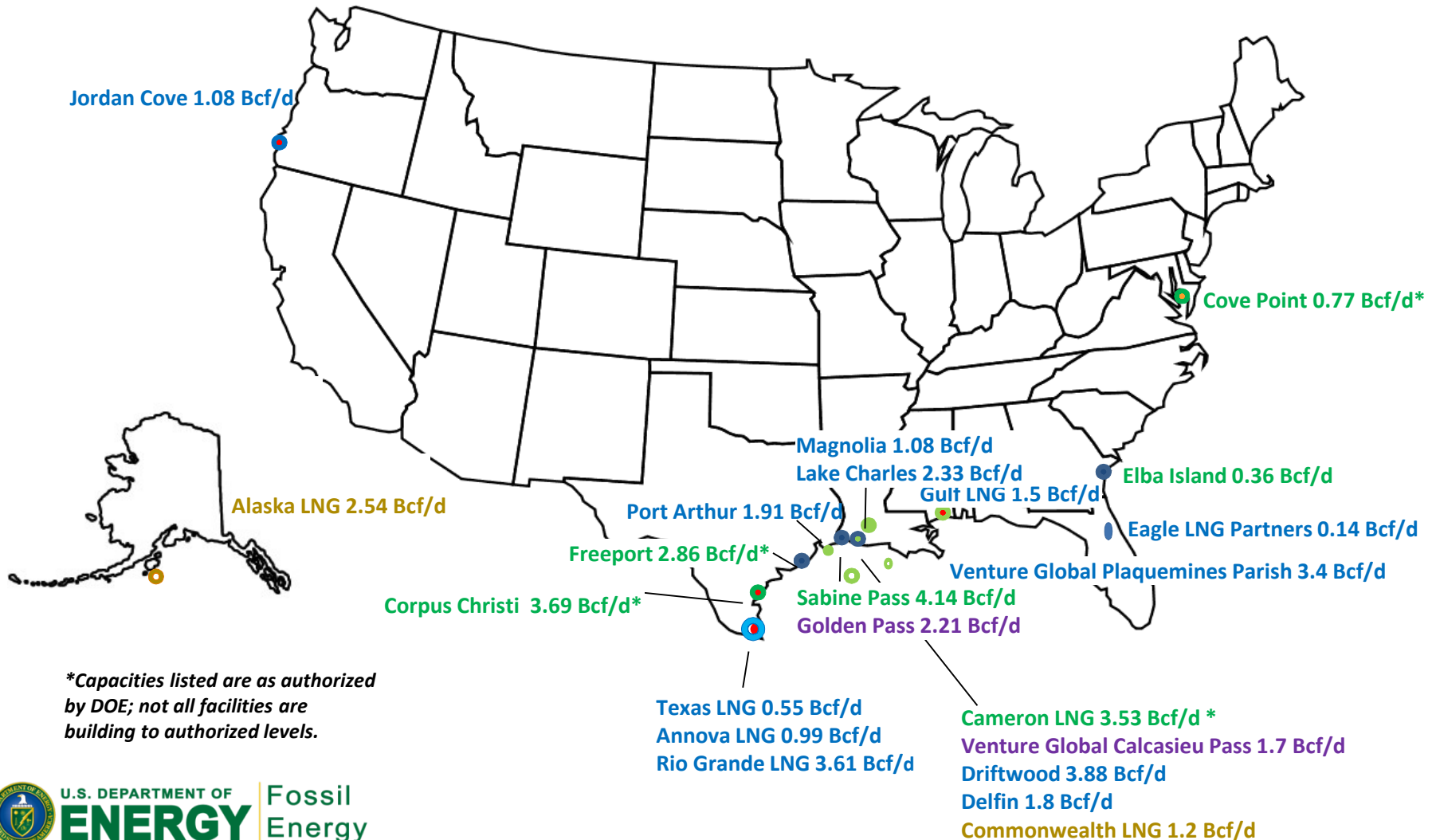
U.S. LNG EXPORT FACILITIES – JULY 2020

Operating

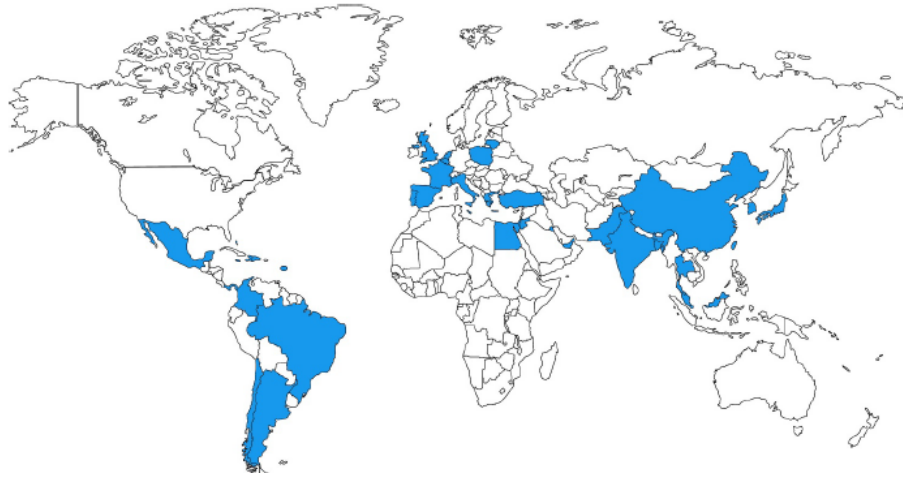
Permitted - Under Construction

Permitted -Not Under Construction

Pending Permitting



U.S. LNG EXPORTS 2/2016 THROUGH 5/2020

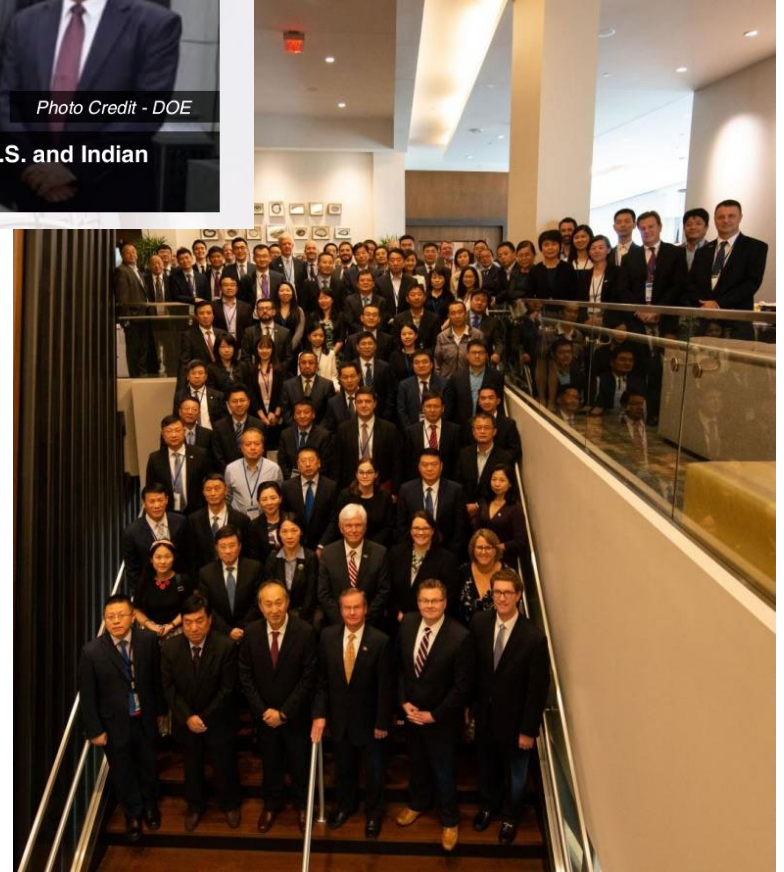


Region	Number of Countries Receiving Per Region	Volume Exported (Bcf)	Percentage Receipts of Total Volume Exported (%)	Number of Cargos*
East Asia and Pacific	7	1,725.1	35.2%	501
Europe and Central Asia	12	1,542.6	31.5%	478
Latin America and the Caribbean**	11	1,097.4	22.4%	367
Middle East and North Africa	5	239.4	4.9%	70
South Asia	3	298.3	6.1%	87
Sub-Saharan Africa	0	0.0	0.0%	0
Total LNG Exports	38	4,902.7	100.0%	1,503

EXPORT PROMOTION AND INTERNATIONAL ENGAGEMENT



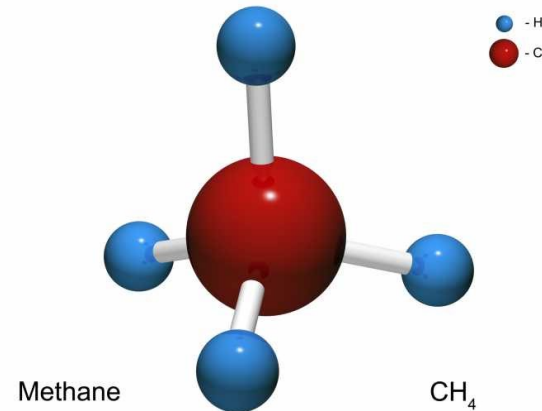
Fmr. Secretary Perry at Dominion Cove Point



18th U.S. - China Oil & Gas Industry Forum

HYDROGEN AND NATURAL GAS – KEY COMPARISONS

HYDROGEN H_2



	Hydrogen	Natural Gas
Energy Type	Secondary	Primary
Transport	Pipeline/Tanker	Pipeline/Tanker
End-Use	(Potential)Residential/ Commercial/Refining/ Manufacturing/Power Production/ Transportation (Fuel Cells)	Residential/Commercial/ Manufacturing/Power Production/ Transportation
Safety	Hazmat	Hazmat

HYDROGEN EXPORT POTENTIAL FROM LNG TERMINALS

- According to an analysis conducted for the Australia Renewable Energy Agency, global demand for hydrogen is projected to increase during the next 20 years, as shown below (x000 Tonnes)*

Country	2025			2030			2040		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Japan	88	516	1,338	875	1,761	3,858	1,896	4,131	9,573
Republic of Korea	74	223	493	373	728	1,562	1,001	2,175	5,304
Singapore	3	15	31	27	51	103	96	168	481
China	48	226	698	1,028	3,318	7,009	7,853	17,430	40,989
Rest of the World	98	448	1,170	1,053	2,678	5,729	4,958	10,927	25,758
Total	311	1,429	3,731	3,357	8,536	18,260	15,804	34,831	82,105

SOURCE: ACIL ALLEN ANALYSIS

- Australia has a plan to build a hydrogen export industry to supply a \$7 billion market in China, Japan, South Korea and Singapore by 2030.
- While the United States does not currently export hydrogen in significant amounts, global initiatives to reduce CO₂ emissions could expand global trade of hydrogen.
- United States can also take advantage of abundant, low-cost natural gas supplies, distribution network, and LNG infrastructure to become a major hydrogen exporter.
- Similar to LNG, hydrogen could be liquefied at LNG terminals before being loaded onto highly-insulated tanker ships.
 - Japan's Kawasaki Heavy Industries (KHI) has begun building facilities in Australia to liquefy and ship hydrogen and start exporting hydrogen in a trial, by end of 2020 and through 2021.
 - KHI is building world's first ocean-going liquid hydrogen vessel that will be commercialized around 2030 with larger vessels.

HYDROGEN EXPORT POTENTIAL FROM LNG TERMINALS – CO-LOCATING HYDROGEN WITH LNG

- Locating hydrogen production in proximity to or at existing LNG terminal will save costs by utilizing already existing infrastructure and resources – transmission and distribution lines, storage, transport routes, and established industry knowledge and expertise.
- The primary infrastructure required to support hydrogen export relates to LNG terminal infrastructure through modification of an existing liquids berth, or through development of a hydrogen specific berth.
- Hydrogen loading berth needs to include one or more liquid hydrogen storage tanks, a hydrogen liquefaction plant, a dedicated hydrogen delivery pipeline or road/rail tanker delivery receival gantry for the feedstock, and the associated cryogenic transfer equipment from pipeline/tanker to production facilities through to storage and storage to ship.
- Specific berth requirements are uncertain while liquid hydrogen vessels are under design and development. It is anticipated that ports with berth depths that can handle vessels designed as bulk petroleum-product, or liquid carriers, are likely to receive new cryogenic liquid-hydrogen bulk-transport ships when they begin to manufacture and are commonly in service.



Cheniere's Sabine Pass

HYDROGEN EXPORT POTENTIAL FROM LNG TERMINALS – NEXT STEPS

- Successful pilot projects will require hydrogen vessels similar to LNG transport ships currently servicing the natural gas industry. Existing berths, which can support LNG import/export or bulk petroleum-products import/export, are likely to define the minimum long-term sea transport industry requirements.
- Other issues include whether there will be a transitional period where terminals will be able to receive both LNG and other products like hydrogen, and the costs for retrofitting LNG terminals to liquefy and transport hydrogen.
- International competition between Australian hubs and hydrogen export terminals in other countries will require competitive or lowest cost production and shipping routes to markets in Asia and other long distance locations.

