NORTH AMERICAN PETROLEUM RENAISSANCE
(Reshaping World LNG Markets)

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About EPRINC

- Founded 1944
- Not-for-profit organization
- Studies intersection of petroleum economics and public policy
- Provides independent and technical analyses for distribution to the public
- Supports USG projects, e.g. Quadrennial Energy Review, DoD strategic outlook
- EPRINC Embassy Series
- IEEJ-EPRINC Project on “Future of ASIAN LNG
- www.eprinc.org
Before we get started

A few words on public finance theory (cost/benefit analysis), net economic value, and the law of diminishing returns
ANWR-Alaska National Wildlife Refuge

Project has high net benefits as it is close to existing transportation infrastructure and onshore.
Steve McQueen, a San Francisco detective in the iconic thriller, *Bullitt*, chases the bad guys in his 1968 Ford Mustang GT fastback with a 325 horse power V8.

How do the cars of today compare with McQueen’s Mustang?

**Answer:**
1968 Mustang, 1 ton of criteria pollutants per 100,000 miles
2016 Mustang, 10 pounds of criteria pollutants per 100,000 miles
A Comment on Environmental Regulation
How Much Should We Pay for the Last 10 Yards?

Source: Pugliaresi, L. and Max Pyziur, CAFE, Gasoline Prices and the Law of Diminishing Returns, March 2016, EPRINC
Dueling Chemistries: Batteries & Barrels

Range Per Pound Of Fuel

Source: Courtesy of Mark Mills, Manhattan Institute
Dueling Hardware & Technology Asymptotes

Energy Output Per $1 Million CapEx

Solar & Wind: Cost per kW

Source: Courtesy of Mark Mills, Manhattan Institute
WESTERN INTERIOR SEAWAY

Main U.S. Shale Basins and Plays
Power of Source Rock + Private Property

Source: EIA
US Natural Gas Production

Source: EPRINC from EIA data
Total Dry Gas Production Y/Y Growth

Associated gas production (e.g. Bakken, Eagle Ford, Niobrara, and Permian) and major dry gas plays (Marcellus, Haynesville) is driving a significant portion of the Y/Y growth in total dry gas.

Source: Raymond James, EIA
U.S. Oil Production (millions of barrels/day)

Source: EIA
New-well oil production per rig

Source: EIA
Permian Basin Horizontal Decline Curves (Texas and New Mexico) (b/d)

Source: PetroNerds, DrillingInfo.
Source: Completion Design Changes on Well Productivity, Curtis & Montalbano, EPRINC paper, (November 2017). Note: Well productivity indexed to a base curve, which equals 1.
North American Petroleum Renaissance Needs Pipelines
(Incremental Production Must Be Moved to Coastal Processing Centers)

Source: CAPP
Note: Of Net Imports of 5.3 mbd, 2.4 mbd from Canada

Source: EIA
NAFTA Single Market Lens
(Net Imports of Crude & Petroleum Products)

NAFTA PETROLEUM CONSUMPTION: 22 MMB/D

Source: EIA
Can LNG Markets Look Like Oil Markets?

...........or at least more like the US Natural Gas Market
U.S. Natural Gas Market is both Prolific and Efficient because........

1. Resource is vast, distributed among many players, subject to constant cost reductions and technology improvements, rapid infrastructure build-out (except in NY), government oversight is largely (but not always) efficient.

2. The separation of pipeline transportation services from gas sales

3. Third-party access to pipelines, storage, and LNG terminals

4. Transparency in the reporting of gas pipeline capacity utilization, tariffs, and prices at market hubs

5. Broad liquidity in the physical and financial markets

Nat Gas consumption increased from 50 bcf/d in 2005 to 73 bcf/d 2017 and LNG exports are rising
US NATURAL GAS EXPORT COULD GROW QUICKLY

trillions cubic feet/year

Note: ≈ 4 tcf/yr (11 bcf/d) or 82 MMt on the water
By 2030 (maybe)

Source: EIA, Reference Case
US LNG Exports Are Growing & Face Challenges

billions of cubic feet/day

9 bcf/d = 67.4 MMt LNG in 2020?

Source: EIA, projects approved and under construction
ASIA now (Jan 2018) at $10 MMBTU
LNG Short vs. Long Term

Range of Uncertainty remains large, almost 100 million tons in 2030

Source: IFC (World Bank)
Base Case vs. Low Case (China/India) vs. High Case (Niche Markets)

- Supply Opportunity for New Projects
- Supply Under Construction
- Existing supply
- Global Demand
- Global LNG Demand with China & India Low Case
- Global LNG Demand with Niche Market High Case

Source: Poten & Partners
LNG Demand Growth Requires Growth Outside JKT

Key uncertainties in niche markets
- Credit ratings
- Seasonality requirements
- Infrastructure requirement and development
- Logistics of small scale, and timing

Source: Poten & Partners
Note: By 2020, an estimated (cumulative) 3.0 Bcf/d of contracts will expire, and by 2025 10.4 Bcf/d will expire. Most of these expiring contracts are in Asia Pacific markets.

Sources: FTI & ICF, EIA
The Future of Asian LNG

Challenges and Opportunities for Policy Makers

• Joint Effort IEEJ and EPRINC

• Supported by Governments of Japan and U.S.

• Policy Proposals Presented in Tokyo (Oct 2017) -- Accepted by both Governments

• Discussions on Follow Up Study for 7th Annual LNG Producer Consumer Meeting in Nagoya (October 2018) – Now Underway
Study overview

- The Institute of Energy Economics Japan (IEEJ) and the Energy Policy Research Foundation, Inc. (EPRINC) undertook an assessment of future LNG demand growth in Asia and strategies to improve the competitiveness of U.S. LNG exports in the region.

- The two organizations have reached out to nearly 100 experts, government officials and market participants through a series of workshops in Washington D.C., Tokyo, and Bangkok since July 2017.

- We also engaged our own research teams and the project received support from Economic Research Institute for ASEAN and East Asia, as well as the U.S. and Japanese governments.
Asia’s LNG market

- Asian LNG market will reach 350 million metric tons in 2030, growing twice from 2015.
  - Historic Asian LNG demand centers, Japan, Taiwan, and Korea are likely to experience modest or declining demand growth.
  - Emerging Asian LNG importers such as China and India will see rising demand for LNG, growing by more than four times from 2015 to 2030.
  - Power sector and industrial sector will be major drivers of the future LNG demand growth in emerging Asian countries.
Policy recommendations

- Developing more transparent and flexible LNG market
  - Remove destination restrictions to stimulate spot markets and price discovery
  - JFTC study’s finding of incompatibility of destination restriction to Japanese Anti-Monopoly Act is important.
  - Creation of Asian hubs is essential to activate spot trading and price discovery.

- Sustaining competitive US LNG export platform:
  - Streamline the regulatory process
  - Provide clarification of U.S. revocation risk on LNG exports.

- Providing financial supports
  - Engage their export credit agencies (ECAs) and multilateral development banks (MDBs), to increase supports for LNG projects.

- Capacity building
  - Provide capacity building program for emerging LNG importing countries in the areas of policy, regulations, technologies, technical standards, operational safety guidelines, environmental regulation, and so on.

- Assisting policy and regulatory developments in Asia
  - Help structure energy mix targets and policy planning so that Asian countries could take full advantage of natural gas.