LNG Market Outlook for the Indo-Pacific

U.S.-Asia Gas Partnership Webinar Series

November 19, 2020

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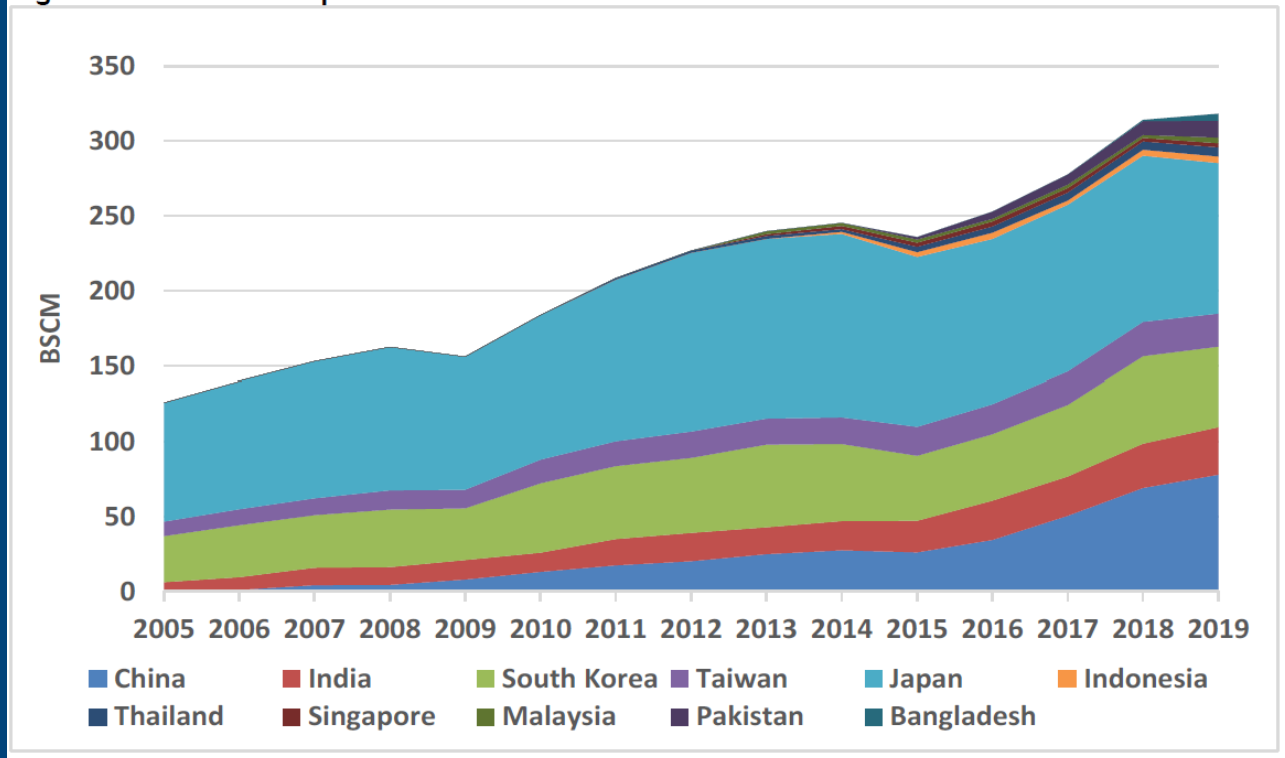
Asian LNG Imports

Long dominated by a handful of countries …

Figure 1: Asian LNG Imports



Source: IEA, Platts LNG Service

- Before 2000s, essentially only LNG importers in Asia were Japan, South Korea, Taiwan
- Within last 20 years, China and India began importing LNG
- "Big 5" LNG importers still accounted for 90% of total Asian imports in 2019
- However, 7 Indo-Pacific countries started importing LNG since 2011
- At least 2 others plan to build LNG import facilities

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Asian LNG Imports

… but new importers have emerged in last 10 years.

Map Ta Phut LNG Terminal
Rayong, Thailand

Singapore LNG Terminal

PGN FSRU Lampung,
Indonesia

Summit LNG Terminal
Moheshkhali Island, Bangladesh

- 2011: Thailand
- 2013: Singapore & Malaysia
- 2014: Pakistan & Indonesia
- 2018: Bangladesh
- 2020: Myanmar
- Vietnam & Philippines planning to build LNG import terminals by early-/mid-2020s

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LNG Demand Outlook

Demand growth slows in traditional importers, accelerates in new importers

- Import growth in traditional importers (Japan, South Korea, Taiwan) stalls

- Demand expected to accelerate in China & India post-2020
  - China main driver of global demand growth, add 130 Bcm/y additional demand 2019-2025
    - Industrial sector main contributor (additional 60 bcm/y)
    - Res/com sectors add 30 bcm/y due to urbanization, coal-to-gas conversions
  - Indian demand growth fueled by supportive government policies, improved infrastructure
    - Also driven by industrial sector (36% of demand growth)

- Demand expected to increase in Emerging Asia with new import infrastructure
  - Emerging Asia 2nd biggest source of demand growth after China
    - Projected to add 35 bcm/y 2019-2025
  - Driven by power sector
    - +60% of demand growth 2019-2025
    - 15 GW of new gas-fired generation capacity across region

Case Study: India

- Increasing natural gas consumption has broad policy support in India
  - PM Modi pledged to increase natural gas from 6% to 15% total primary energy consumption by 2030
  - Natural gas consumption could increase by 28 Bcm/y by 2025 (over 50% increase from 2019)
- Demand growth in industrial, energy, transport, and residential sectors
  - Industrial sector is primary driver (36%), followed transport (34%) and residential (19%)
  - Transport supported by roll-out of +7,000 CNG filling stations by 2029
  - Residential by roll-out of city gas distribution networks (+35M household connections)
- Outlook for LNG imports
  - India was 4th-largest LNG importer in the world (2019)
  - To meet energy demands, GOI forecasts LNG import capacity to increase more than 30% over next several years

Case Study: Thailand

- Natural gas already plays important roles in Thailand's power and industrial sectors
  - Gas made up ~70% power generation (2017); power generation was ~75% total gas demand (30 Bcm)
  - Around 10 Bcm used in industrial sector and as feedstock
- New Power Development Plan lays out larger role for natural gas than previous plans
  - Share of natural gas in power sector expected to be ~60% through early 2030s (~44 Bcm gas demand)
  - Share expected to decrease to ~50% by late 2030s (~46 Bcm gas demand) due to renewables adoption
- LNG imports increased as domestic production, pipeline imports have plateaued
  - First import terminal (Map Ta Phut) started operations in 2011; expanded to 10 mtpa in 2017
  - Further expansion of Map Ta Phut planned along with several other import projects
  - LNG imports expected to rise from 11 Bcm (2019) to 28 Bcm (2030) and 35 Bcm (2040)

Case Study: Vietnam

- LNG demand in power sector projected to increase dramatically over next 25 years.
  - Vietnam Energy Institute expects increase over 450% from 2025 (1.5 mtpa) to 2030 (8.5 mtpa)
  - Double from 2030 to 2035 (17.2 mtpa); eventually reach nearly 30 mtpa by 2045
- Government looking to construct as many as 7 LNG import terminals
  - Three projects with combined capacity of 13 mtpa approved by government
  - Construction of first terminal (Hai Linh) completed earlier this year; expected start of operations 2021
- New Master Power Development Plan being drafted
  - Has selected 22 LNG-to-power projects with combined potential capacity of 108.5 GW
  - Would be almost double current total generation capacity (56 GW)

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Global Standards to Support LNG Development

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API's Global Industry Services Division

Mission: Provide world-class services that enable the oil and natural gas industry to operate efficiently, safely, reliably, profitably, and sustainably

- 100+ Employees
- 145 Auditors
- 200 Training Programs
- 700+ Publications
- 200+ Events
- 56,000 Personnel Certifications in 128 Countries
- 5,000 Company Certifications in 80+ Countries
- 50,000+ Licensed Products

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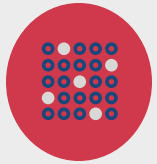
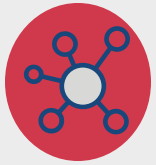
API Standards Development Process

Transparent, impartial, and **consensus-based** process



Driven by research, data and **science-based** decisions

Committees made up of **thousands of volunteers** from industry, academia, government, and NGO's



Collaborate with other standards bodies to avoid duplication; connect globally

Incorporate new **proven engineering practices**, updated periodically

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700 Standards

API standards and recommended practices are incorporated by reference into both federal and state oil and gas regulations and they are the most widely-cited petroleum industry standards by international regulators.

3,800 Citations

in state regulations

650 Citations

by U.S. federal government organizations: U.S. Coast Guard, U.S. EPA, FTC, BSEE, OSHA, and PHMSA

780+ International References

by Brazil, China, Saudi Arabia, Singapore, Indonesia, Vietnam, and others.

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Benefits of Global Standards in the Gas Sector

Use of global standards helps **facilitate natural gas trade** across economies

Reliance on standards developed by the private sector help **minimize unnecessary regulatory burdens**, economic inefficiencies, technical barriers to trade

Use of international standards in policies can help **spur economic growth** while advancing environmental, health, safety, and sustainability performance

Facilitate use of products and materials that are interoperable, **improving industry infrastructure** and efficiency

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API Standard 620

Design and Construction of Large, Welded, Low-Pressure Storage Tanks

- Outlines the design and construction of large field-assembled, welded, low pressure carbon steel above ground storage tanks (including flat-bottom tanks) that have a single vertical axis of revolution, that contain petroleum intermediates (gases or vapors) and finished products, as well as other liquid products commonly handled and stored by the various branches of the petroleum and natural gas industry

- Standard is applicable to tanks that (a) hold or store liquids with gases or vapors above their surface or (b) hold or store gases or vapors alone

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API Standard 625

Tank Systems for Refrigerated Liquified Gas Storage

Covers low pressure, aboveground, vertical, and cylindrical tank systems storing liquefied gases requiring refrigeration

- Provides general requirements on responsibilities, selection of storage concept, performance criteria, quality assurance, insulation, and commissioning of tank systems.
    - storage capacity of >800 cubic meters

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API Standard 521

Pressure-Relieving and Depressuring Systems

- Used primarily in oil refineries
- Also applicable to petrochemical facilities, gas plants, LNG facilities, and oil and gas production facilities
- Standard is designed to aid in the selection of the system that is most appropriate for the risks and circumstances involved in installations. This standard specifies requirements and gives guidelines for the following:
    - examining the principal causes of overpressure;
    - determining individual relieving rates;
    - selecting and designing disposal systems, including such component parts as piping, vessels, flares, and vent stacks.

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API MPMS Chapter 8.6

Refrigerated Light Hydrocarbon Fluids – Sampling of LNG – Continuous and Intermittent Methods

Specifies methods for the continuous and the intermittent sampling of LNG while it is being transferred through an LNG transfer line

Modified U.S. national adoption of ISO 8943. Modifications include:

- clarification on sampling, specifically for extracting a representative sample, location of sample probe
- sample conditioning prior to analysis

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API MPMS Chapter 17.10.1

Measurement of Cargoes on Board Marine Gas Carriers, planned for 2021

Establishes how to measure the quantities of cargoes on LNG carriers

Standard includes the measurement of liquid volume, vapor volume, temperature and pressure, accounting for the total quantity of the cargo on board

Planned as a modified U.S. National Adoption of ISO 10976

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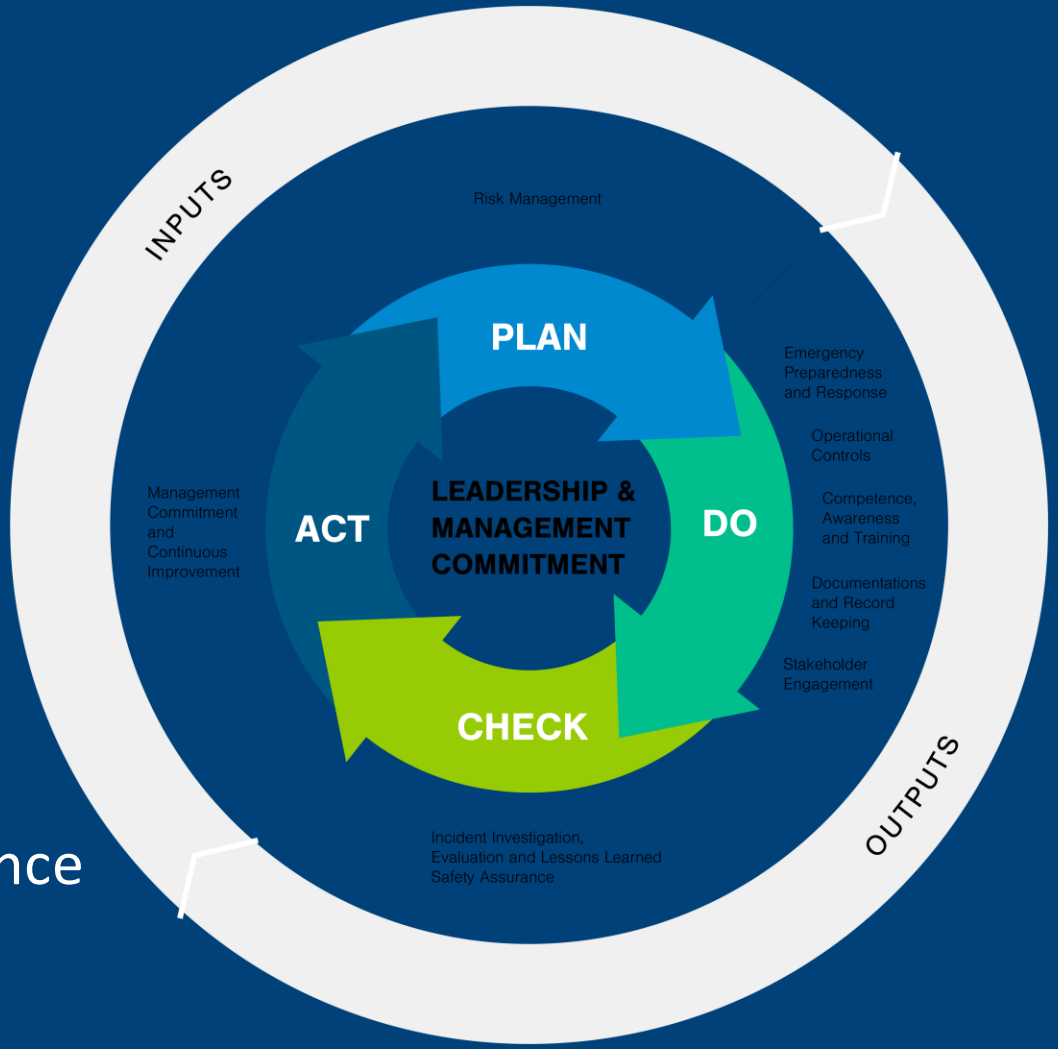
API RP 1173

Pipeline Safety Management Systems (SMS)

- Effectively manage risks faced by the organization
- Communicate with stakeholders
- Ensure the effective operation of key processes
- Drive continual improvement of performance



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Pipeline Safety Management System Elements

Leadership and Management Commitment

Management Review and Continuous Improvement

Emergency Preparedness and Response

Competence, Awareness, and Training

Incident Investigation, Evaluation, and Lessons Learned

A read-only version of API RP 1173 is available on www.PipelineSMS.org

Safety Assurance

Stakeholder Engagement

Risk Management

Documentation and Record Keeping

Operational Controls

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