Examining Cracks in Emerging Asia's LNG-to-Power Value Chain

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Institute for Energy Economics and Financial Analysis
IEEFA.org

About the Report

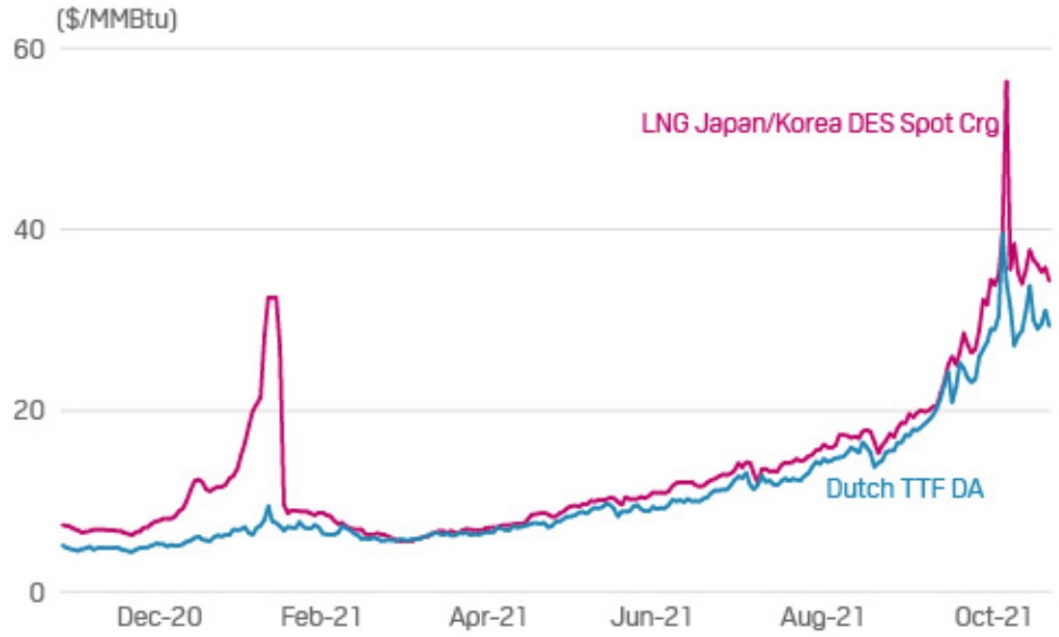
IEEFA's primary goal from the analysis was to answer this question:

"Will current gas crises and the growing gas supply-demand gap in emerging Asia materialize into actual investments into LNG-to-power infrastructure?"

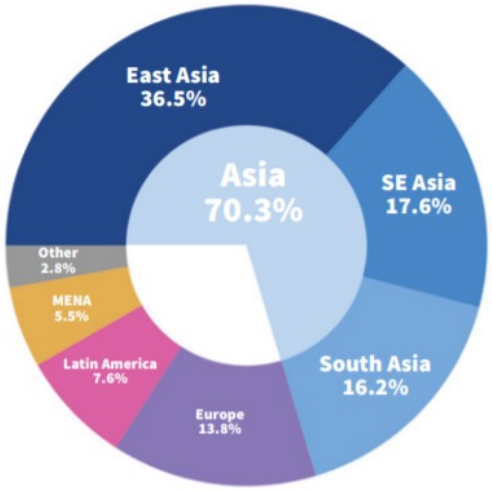
- **Objective 1**: Identify the macroeconomic and financial risks/benefits associated with increasing reliance on imported LNG for power generation.
- **Objective 2**: Assess fundamental project, country, and financial constraints associated with LNG-to-power projects in the region.
- **Objective 3**: Evaluate the merits of each proposed LNG and power project in the region to determine a more refined view of feasible LNG developments.
- **Countries Covered**: Philippines, Vietnam, Thailand, Myanmar, Cambodia, Pakistan, and Bangladesh.

Global LNG Markets: The Current Context

- Price-sensitive buyers in Asia are being priced out of the volatile market, leading to energy shortages and power crises.
- LNG industry: Gas is the solution, not the problem. LNG is a “bridge fuel.”
- In Emerging Asia, declining domestic gas production + GDP growth = growing supply-demand gap. This has led to a huge proposed pipeline of LNG projects.



LNG Import Capacity Under Development

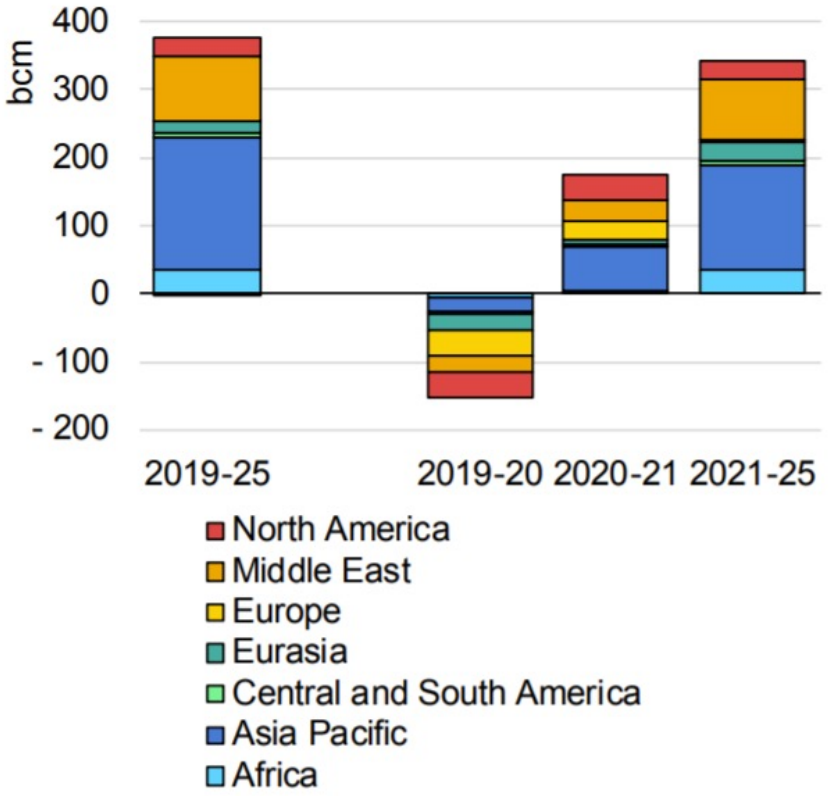


Source: S&P Platts, Global Energy Monitor

Asia-Pacific is Driving Global Gas Demand Growth

- **China**: Addition of 130 bcm/y to 2025.
  - Drivers: Industry, residential, transport.
- **Emerging Asia**: Addition of 35 bcm/y.
  - Drivers: Power sector (60%).
  - Industrial demand growth is prominent only in Pakistan, Bangladesh, and Indonesia.
- **India**: Addition of 28 bcm/y.
  - Main drivers: Industrial sector (36%), transport (34%), residential (19%).
- **Japan-Korea**: Demand to shrink.

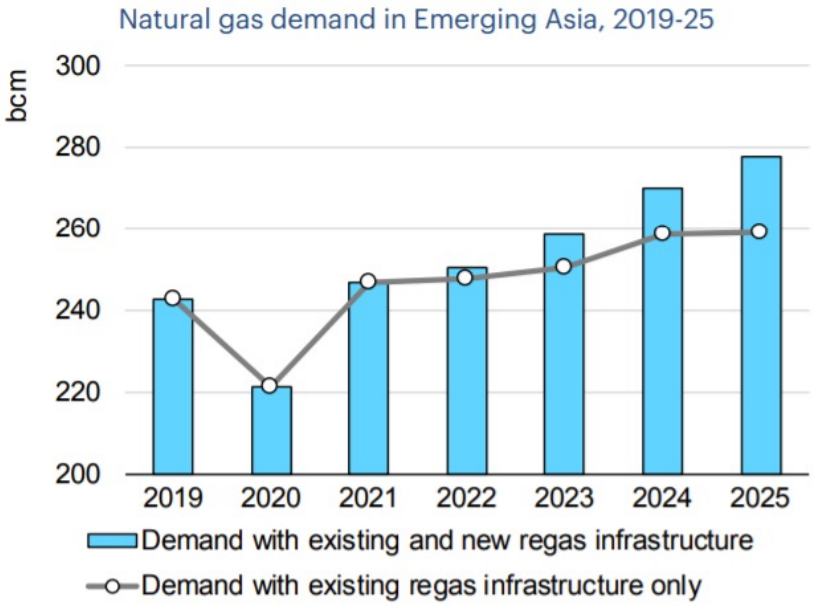
Regional breakdown of demand growth over the forecast period, 2019-25



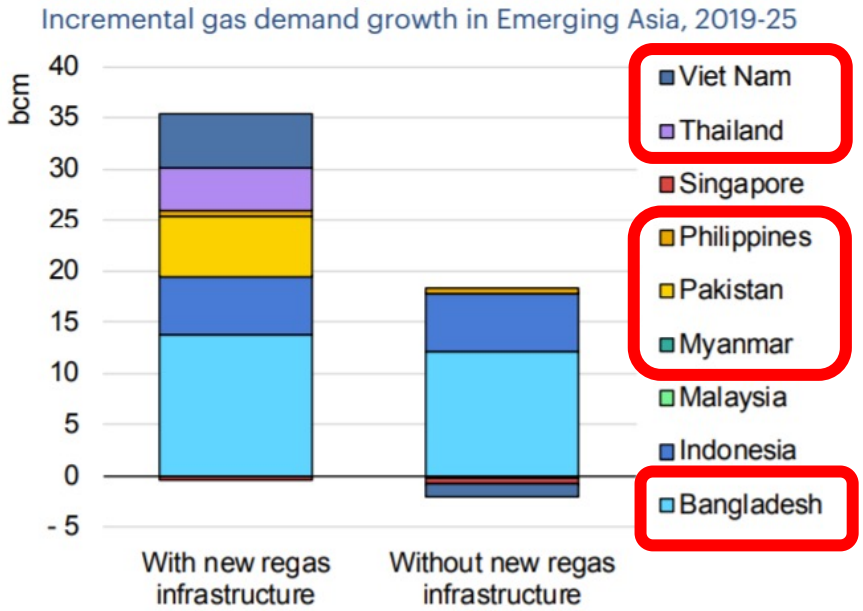
Source: IEA

Emerging Asia: A Closer Look

- IEEFA has tracked **139 mtpa** of terminal capacity and **99 GW** of power capacity in Pakistan, Bangladesh, Vietnam, Thailand, Philippines, Myanmar, Cambodia.
- IEA: "Infrastructure constraints, shifting policy priorities and the dependence on external financing could impose limits on gas consumption growth..."
- Gas demand growth could be cut 50% without new regas infrastructure.



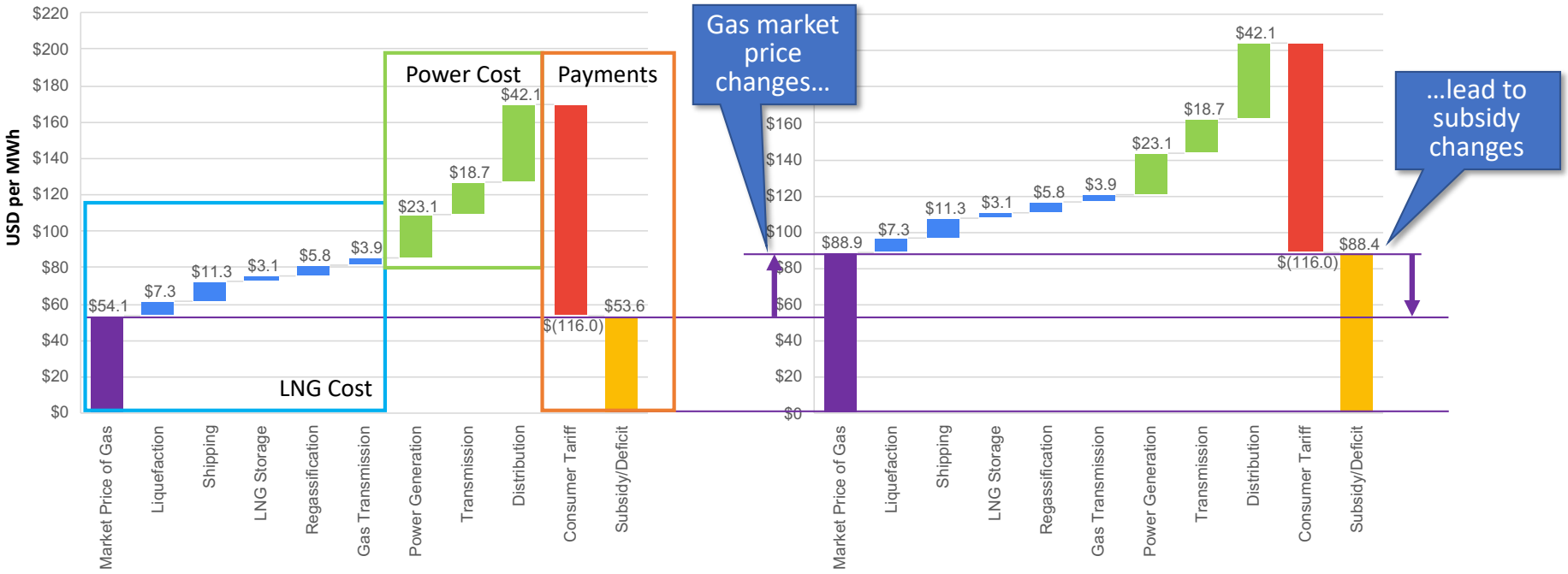
Source: IEA



Source: IEA

Key Economic and Financial Risks of LNG Imports

1. **Commodity price volatility:** LNG price volatility can raise the cost of power delivered to nearly US$300 per megawatt-hour (MWh).
2. **FX volatility:** A +/-20% change in LNG prices, combined with a +/-10% change in FX rates, can increase/decrease the final power price by US$18-30/MWh.
3. **Higher power tariffs** OR **higher subsidy burdens**. Either way, the people pay.



Key Economic and Financial Risks of LNG Imports (cont.)

4. **Fuel supply insecurity** caused by disruptions in global trade or unaffordable spot prices. Even countries with long-term contracts face fuel shortages if exporters divert cargoes to spot markets.
5. **Stranded asset risks**: Volatile fuel prices and declining RE costs can limit utilization of LNG-to-power assets. Resurgence of domestic production in emerging Asia?
6. **Limited and decreasing project finance capital availability.** Cross-border financiers are under increasing pressure to support global decarbonization goals while limiting exposure to higher risk credits in sub-investment grade markets.

LNG market eyes price hikes, delays on Suez disruption

Published date: 26 March 2021 An extended blockage of the Suez Canal would be likely to delay LNG

Eni defaults on term cargo delivery to Pakistan

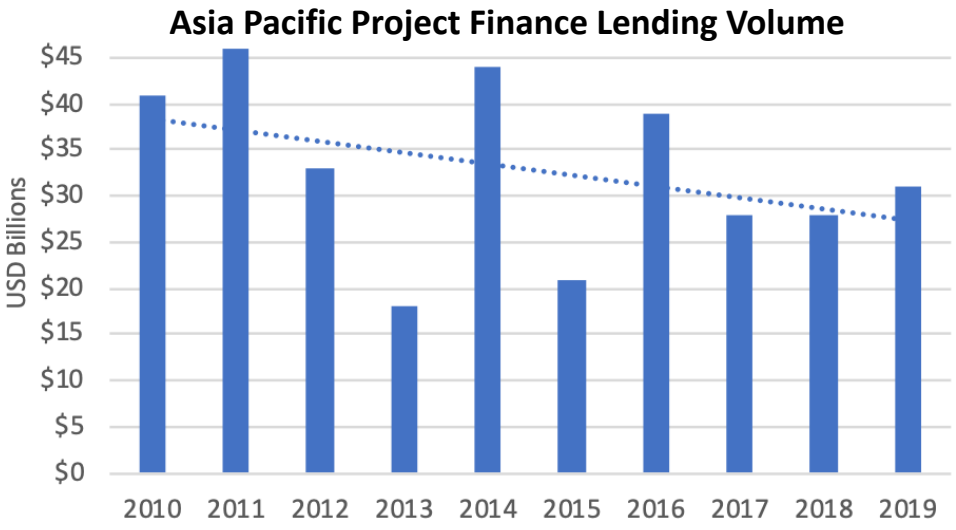
03 Sep 2021 - LNG | Market Alert

Contracted foreign suppliers slash LNG sale to Bangladesh

M AZIZUR RAHMAN | Published: October 26, 2021 08:58:22 | Updated: October 26, 2021 14:49:33

ELECTRIC POWER | NATURAL GAS — 05 May 2021 | 03:22 UTC — Singapore

LNG market upheavals push Asian buyers to seek more legal protection in contracts

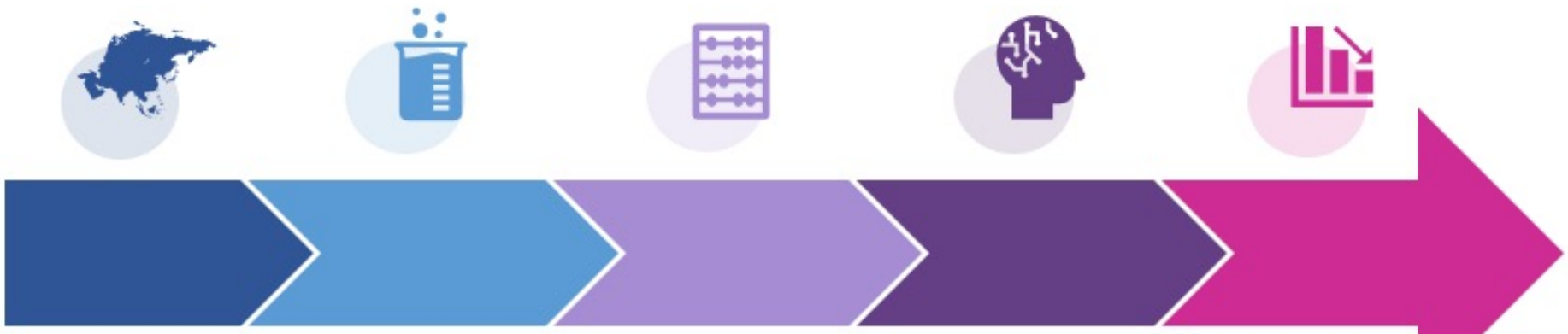


Sources: IJ Global, S&P Global.

Key Economic and Financial Risks of LNG Imports

	Risk	Description	Country Examples
1)	Commodity Price Volatility	The inherent volatility of global gas markets significantly impacts delivered gas and power prices.	Thailand, Bangladesh, Pakistan*
2)	Foreign Exchange Volatility	US dollar-denominated LNG charges expose consumer prices to macroeconomic impacts, mostly felt through inflation.	Thailand, Bangladesh, Pakistan*
3)	Higher Power Tariffs for End-Users	In markets that pass through fuel price fluctuations to end-users, imported LNG can raise final gas and power tariffs.	Thailand, Philippines, Cambodia
4)	Higher Government Subsidy Burdens	In subsidized markets, government entities must pay for fuel price fluctuations via additional national budget allocations.	Vietnam, Bangladesh, Pakistan, Myanmar
5)	Declining Economic Competitiveness of Domestic Industries	Higher fuel costs can raise industrial operating costs, hurting regional competitiveness. Country commitments to LNG may force multinationals with corporate sustainability targets to relocate.	Thailand, Bangladesh, Vietnam
6)	Fuel Supply Insecurity	Disruptions in global LNG trade can cause gas shortages. High prices can force buyer countries out of spot markets, causing fuel shortages. Even countries with long-term supply contracts face fuel shortages if exporters opt to divert cargoes into higher-priced spot markets.	Bangladesh, Pakistan, Thailand*
7)	Limited Project Financing Available for Fossil Gas Assets	The supply of money for a given market is not endless. Commercial banks have prudential lending limits, which can limit their exposure to just one or two infrastructure projects.	Bangladesh, Cambodia, Myanmar, Pakistan, Vietnam
8)	Imported Fossil Fuel Lock-in Limits Renewables Penetration	Fixed LNG offtake volumes and power plant capacity payments can cause long-term dependence on imported fossil fuels, limiting each country's ability to benefit from declining renewables energy costs.	Emerging Asia
9)	Stranded Asset Risk for LNG-to-Power Investments	Volatile global fuel prices and pentration of low-cost renewables can limit utilization of LNG-to-power assets. Renewed growth in domestic gas production can reduce the need for LNG import assets.	Emerging Asia
10)	Growth of Sustainable Investing Makes Long-term LNG Financing Unreliable	Cross-border financiers--including MDBs and bilateral development institutions--are under increasing pressure to support global decarbonization and sustainable development.	Emerging Asia

Report Methodology



1 Raw Data

Started with GEM and Refinitiv raw data sets

2 Verification

Verified and cleaned the data used public information

3 Evaluation

Evaluated project fundamentals, country risks, and financial market constraints

4 Assess Feasibility

Used findings to define valuation factors and assess feasibility

5 Pipeline Valuation

Developed a framework for the risk-adjusted pipeline valuation

Key Variables in the Pipeline Analysis

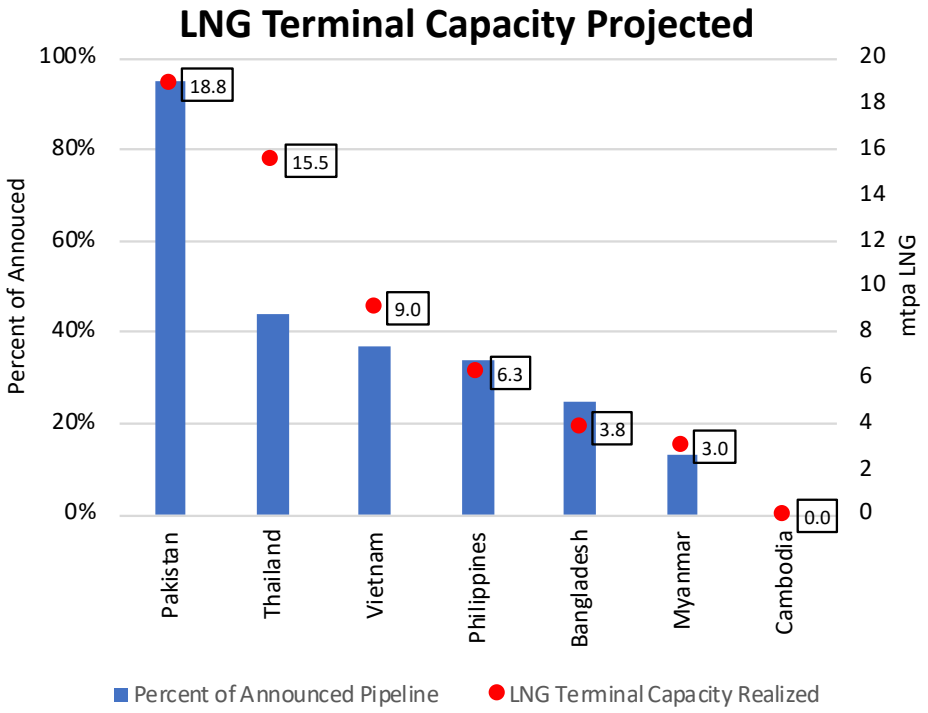
- **Location Matters.** Some of the high-profile projects in the data set are effectively in competition with each other because the the locations cannot support multiple, large-scale projects. If one goes ahead, the others may not.
- **Credibility of Sponsors.** Access to capital rests on credible offtaker demand and a bankable consortium of sponsors. For new LNG-to-power markets, large-scale "integrated" projects backed by inexperienced new sponsors are not best placed to access the level of financing required.
- **Not All Offtakers are the Same.** The nature of the offtakers is critical to bankability. New gas-to-power offtakers are generally perceived as being higher risk vs. more diversified users of gas in an existing gas market.
- **Terminals Do Not Stand on Their Own.** The financial viability of terminals rests on the credibility of power demand forecasts and assessments about the ability of the grid operator to integrate potentially high-cost power.
- **Greenfield Projects Need Higher Certainty.** There is an important cost and risk differential between greenfield and brownfield projects. Projects that can be delivered in phases may also be easier to finance.

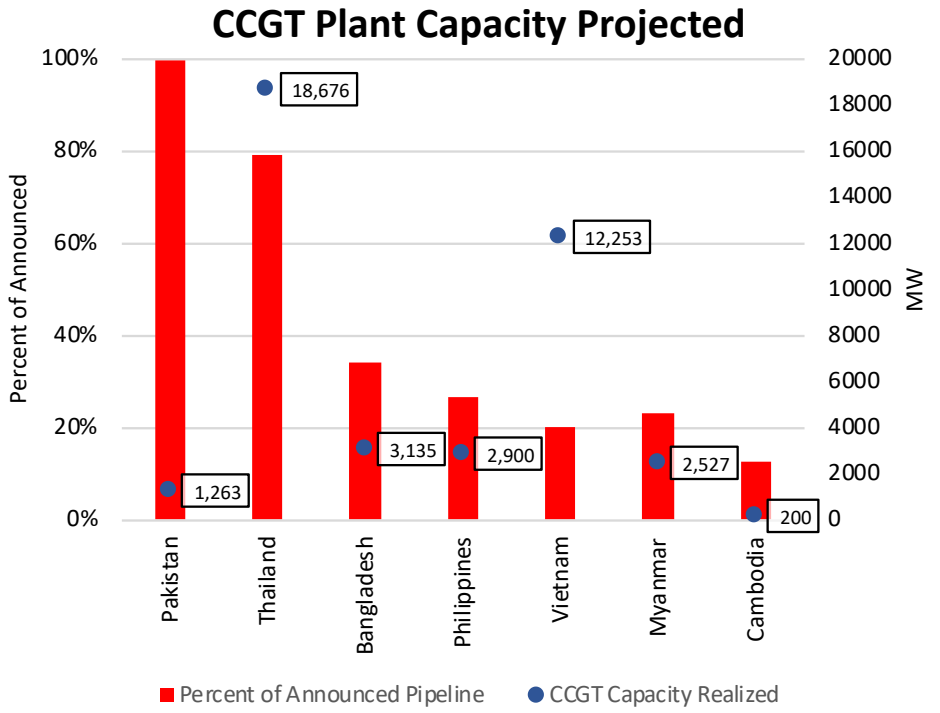
Applying the Screen

Definition of "feasible": The initial screen is intended to weed out the least likely projects. The projects that remain are considered "feasible," but they will still have to compete for capital and navigate market risks.

Applying the Screen: Results

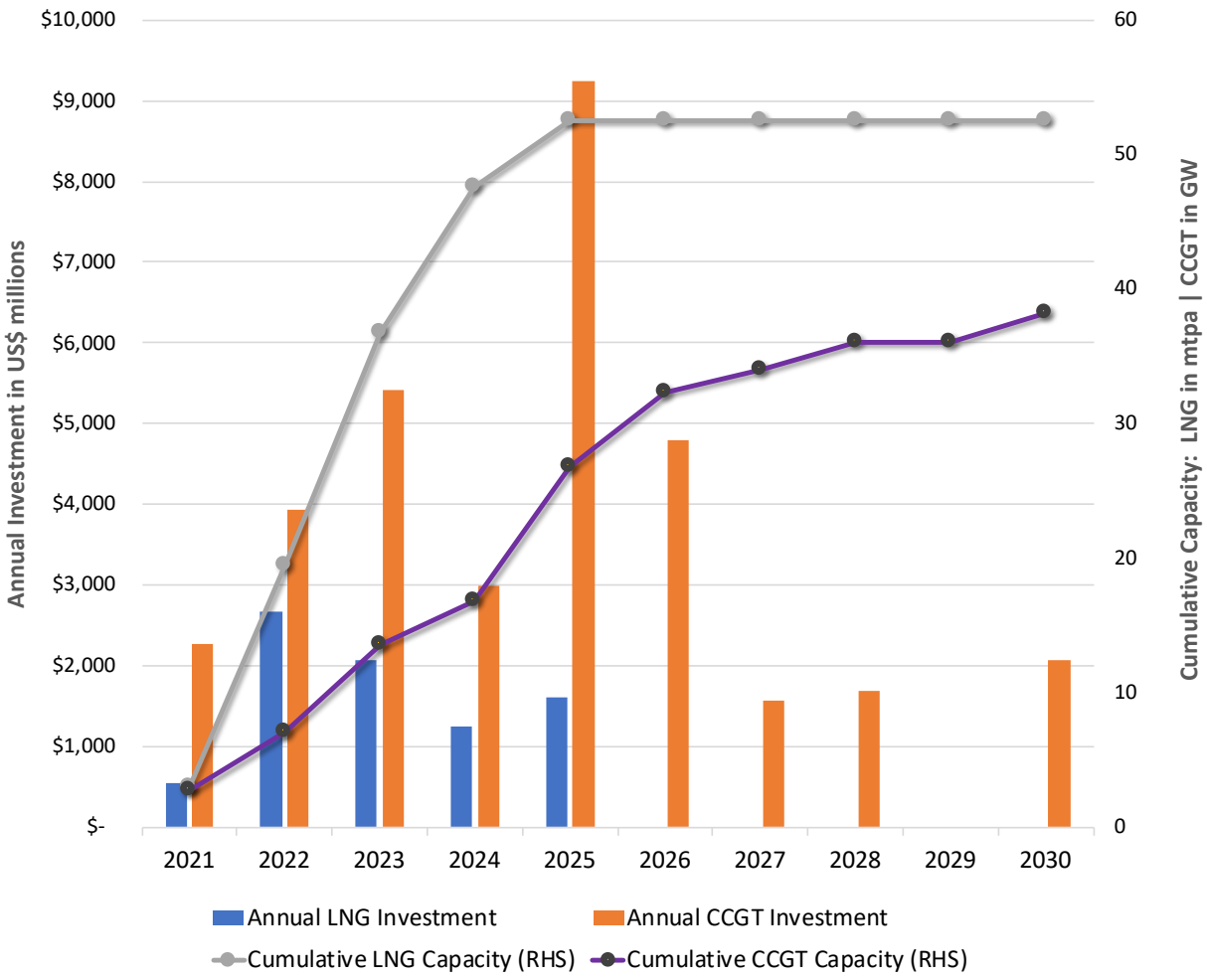
		Gross Announced Projects	After Fundamental Screening		After Financing Constraints	
			Net Result	% of Gross	Net Result	% of Gross
Total Proposed Investment	US$mn	$109,390	$42,375	**39%**	$37,690	**34%**
LNG Receiving Terminals	mtpa	139.1	52.6	38%	52.6	38%
	US$mn	$21,660	$8,400	39%	$8,400	39%
Power Plants	GW	98.7	38.3	39%	33.2	34%
	US$mn	$87,730	$33,975	39%	$29,290	33%





Annual and cumulative regional projections

- LNG import terminals may experience a near-term burst of financing.
- Later projects are likely to run into difficulty as the true costs of the LNG value chain become apparent to countries.
- CCGTs will be added more incrementally to make use of existing gas capacity or replace other retiring plant.
- Appears to be high potential for inflationary pressure arising from US dollar-denominated LNG.

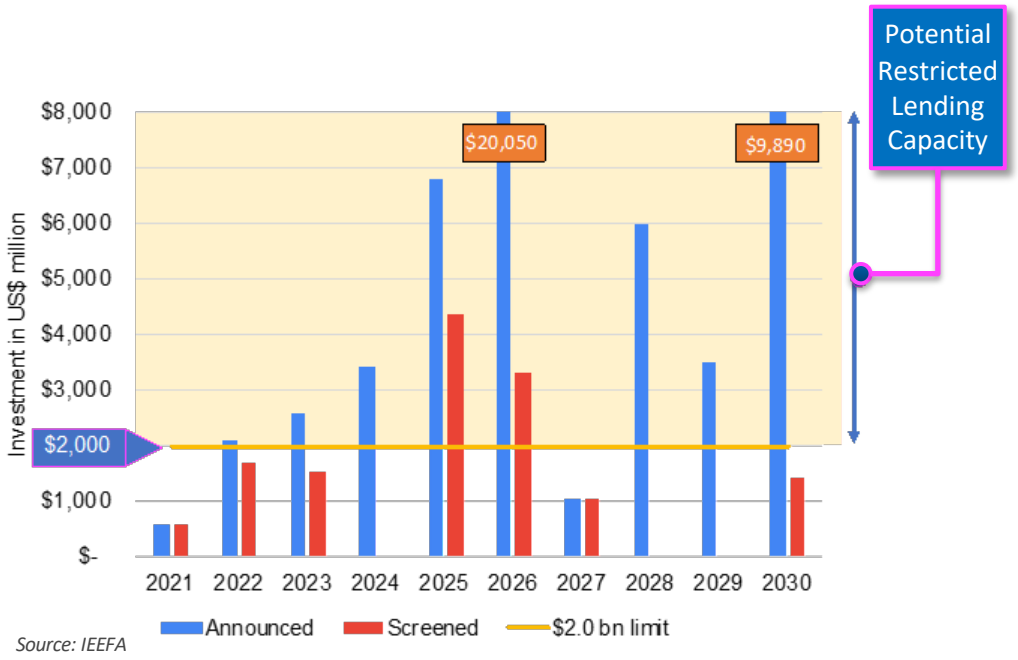


Country Assessments

Each country covered in the report faces unique challenges and risks to developing LNG-to-power infrastructure.

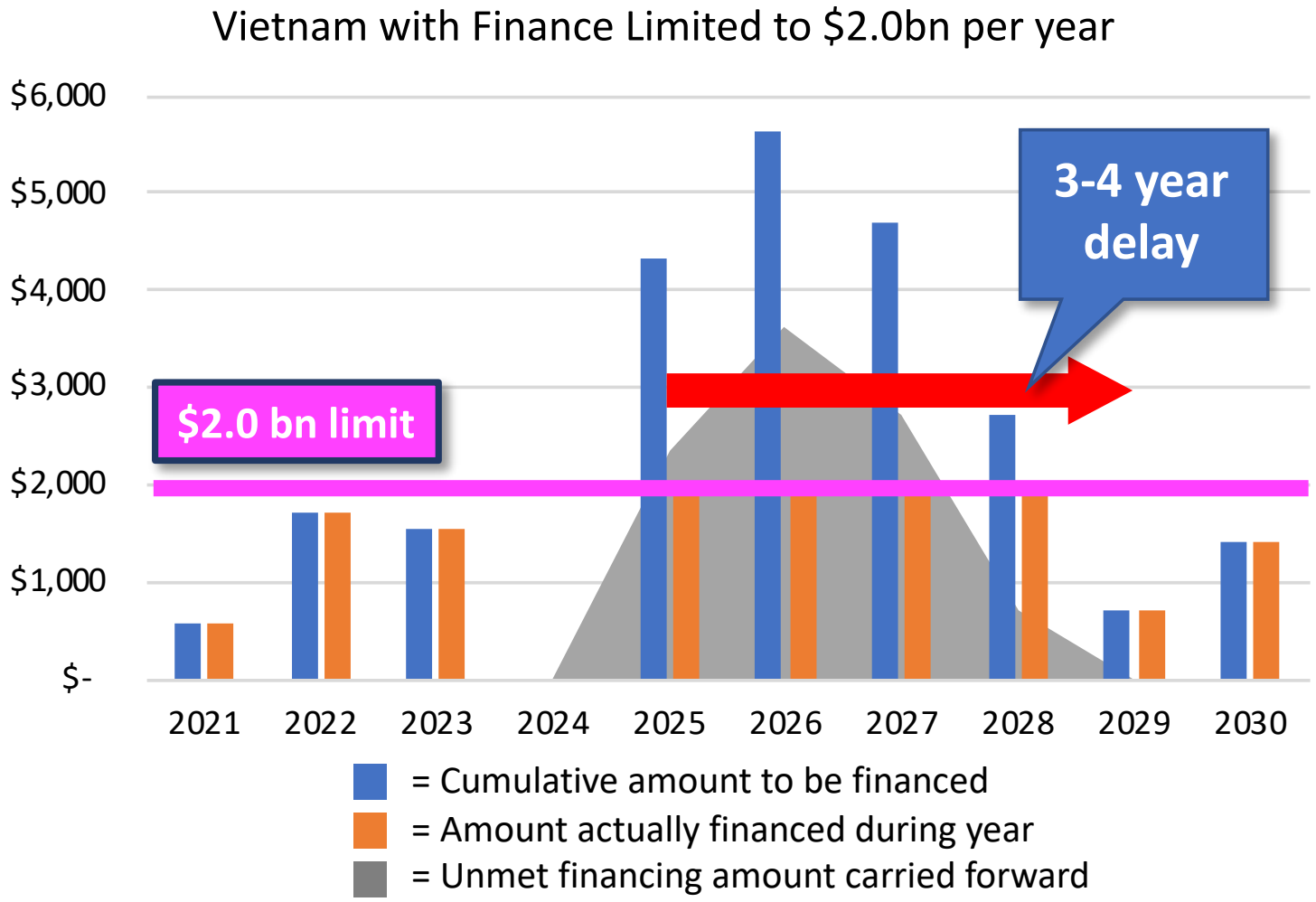
Vietnam

	Investment (US$mn)	Capacity
LNG Terminals		
Announced	$4,395	24.5 mtpa
IEEFA net projected	$1,702	9 mtpa
Projected / Announced	39%	37%
Power Generation		
Announced	$59,673	65,411 MW
IEEFA net projected	$12,253	13,260 MW
Projected / Announced	21%	20%
Total Investment		
Announced	$64,069	
IEEFA net projected	$13,955	
Projected / Announced	22%	



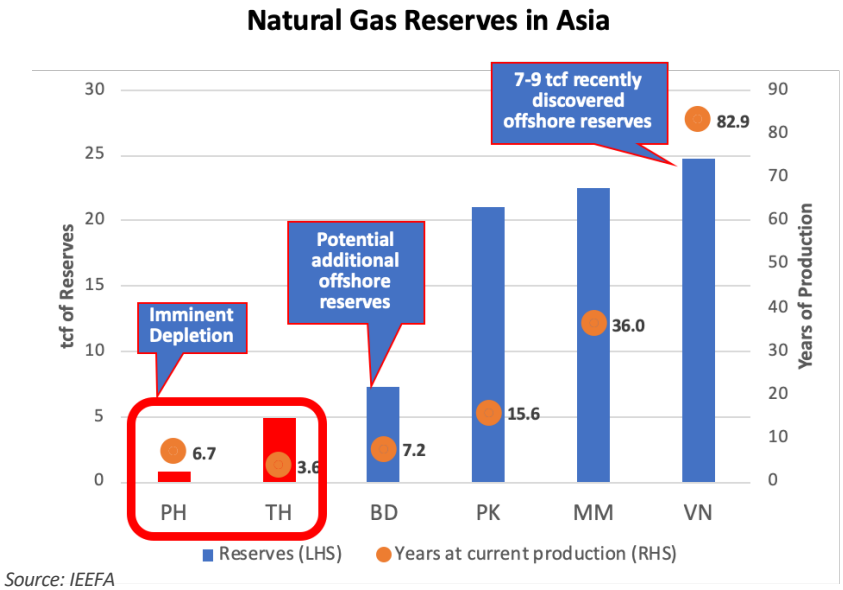
Source: IEEFA

- Largest prospective market for LNG, but project finance will continue to be highly constrained. Vietnamese projects are the most exposed to country, sector and single project lending limits.
- Limited guarantee support from the Vietnamese government.
- Even after reducing the LNG-to-power pipeline by 78% based on project and country factors, remaining projects will still likely consume all available lending headroom. **From 2025-27, an average of $3bn/yr of projects will need to be deferred or cancelled** due to capital constraints.
- This also assumes that the commercial project finance lending market remains open to lending to unabated natural gas projects. **This is unlikely to remain the case.**

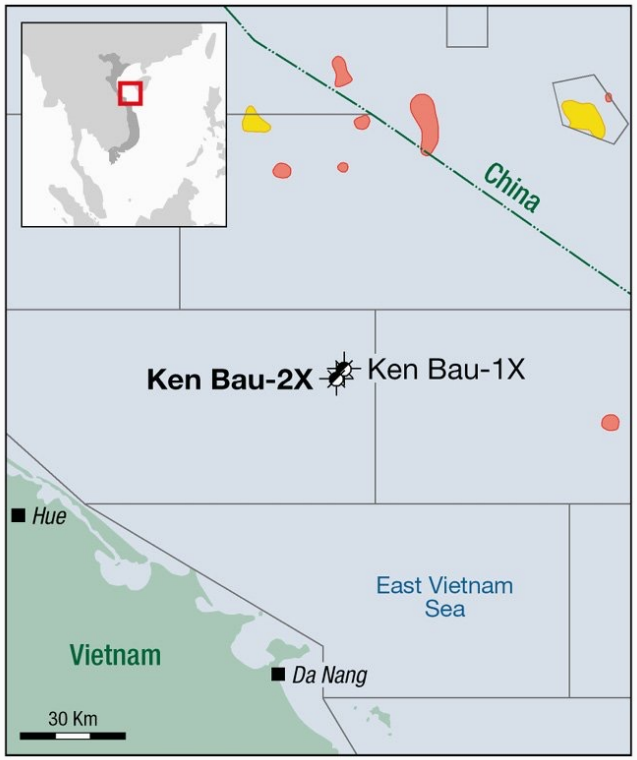


Source: IEEFA analysis.

Vietnam (cont.)



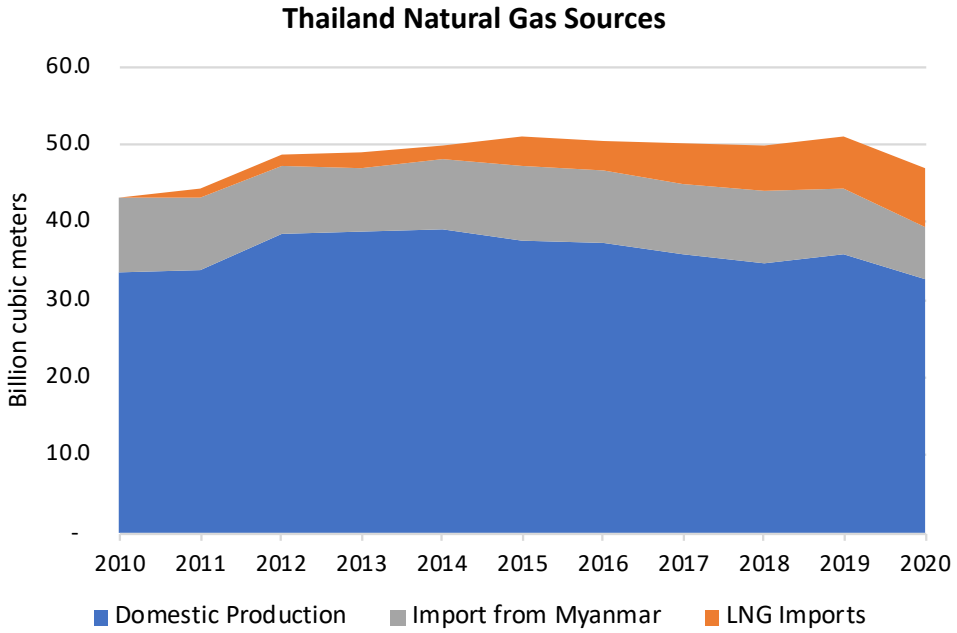
Source: IEEFA

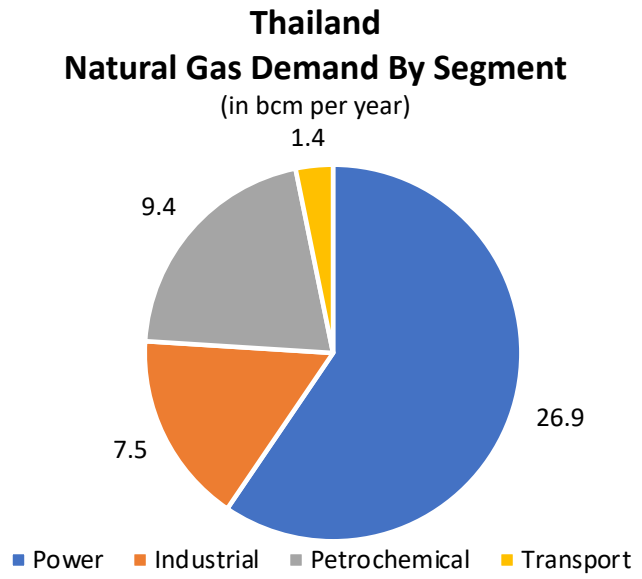


- Recent gas finds with significant recoverable reserves threaten the need for LNG assets. However, **domestic production depends on negotiations between the government and upstream companies.**
- Low negotiated prices limit profitability of new domestic production, inflating LNG requirements.
- Ken Bau = largest gas discovery in SEA in the last 20 years. Blue Whale = so large that ExxonMobil initially proposed an LNG export facility.
- *Revived domestic production is a major stranded asset risk for import infrastructure.*

Thailand

- Thailand is the 2nd largest gas consumer in emerging Asia and 5th largest in Asia, behind Korea.
- While 60% of gas goes to power generation, 38% of gas is consumed in the industrial and petrochemical sectors. This is an unusually diversified demand base for Southeast Asian countries.
- A large share of Thailand's gas is imported from Myanmar, but both countries face declining domestic gas production. Myanmar's E&P program is on hold due to the junta, while Thailand's Gulf fields are depleting within the next 5-7 years. Thus, the country is looking to import more LNG.



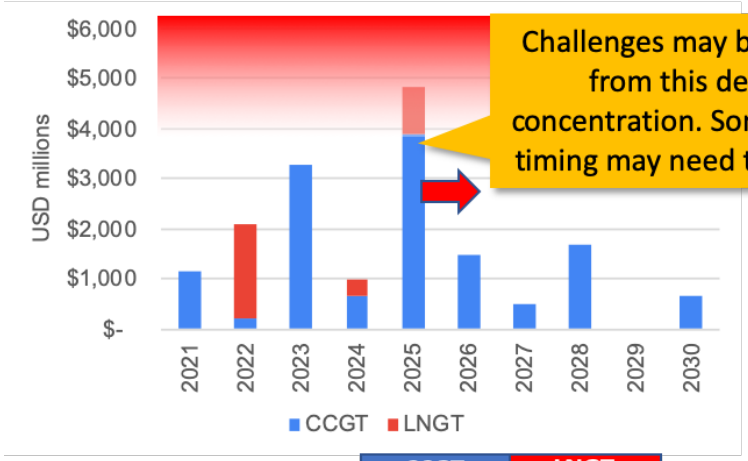


Source: BP Statistical Review of World Energy 2021

Thailand

- Both public and private sector players have aggressively announced projects. Up to 35mpta of LNG import capacity and 24GW of generation capacity have been announced.
- Financing has advanced rapidly over the last 3 years. On the LNG side, state-owned PTT has gone ahead with a 7.5mtpa import facility, and >6GW of CCGTs have been funded.
- IEEFA analysis sees about 50% of the terminal investment being in excess of market capacity. However, 67% of power projects appears to be advancing, driven in part by a systematic program for replacing aging gas-fired plants.

Projected Feasible Investment in LNG and CCGT



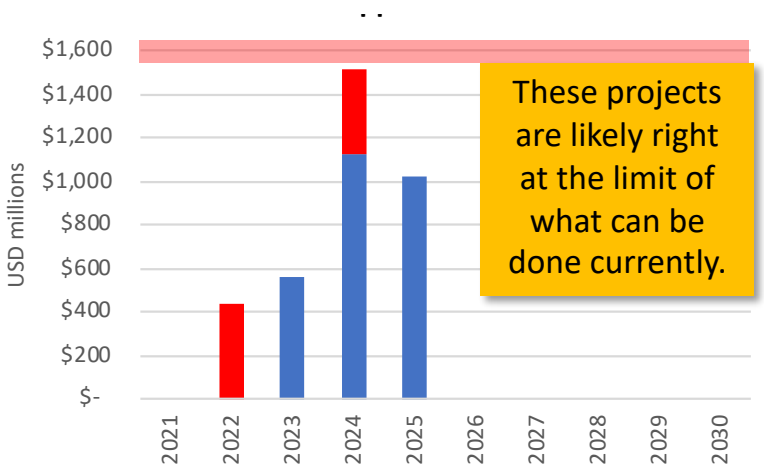
	CCGT	LNGT
Investment	$13,557	$3,129
Capacity	15890 MW	15.5 mmt

Source: IEEFA analysis

	Investment (US$mn)	Capacity
LNG Terminals		
Announced	$6,257	35.3 mtpa
IEEFA net projected	$3,129	15.5 mtpa
Projected / Announced	50%	44%
Power Generation		
Announced	$19,889	23,576 MW
IEEFA net projected	$13,557	15,890 MW
Projected / Announced	68%	67%
Total Investment		
Announced	$26,146	
IEEFA net projected	$16,686	
Projected / Announced	64%	

The Philippines

- Domestic production from the Malampaya field goes to 5 power plants, with a combined capacity of 3,460MW. But Malampaya is in terminal decline.
- Plants may require up to 5mtpa to continue operating, well below the 18.5mtpa of proposed terminal capacity. New demand will have to come from somewhere.
- Domestic conglomerates attempting to create new demand with CCGT projects. IEEFA assumes one additional CCGT and two LNG terminals are feasible given limited demand.



	CCGT	LNGT
Investment	$2,709	$838
Capacity	2900 MW	6.3 mmt

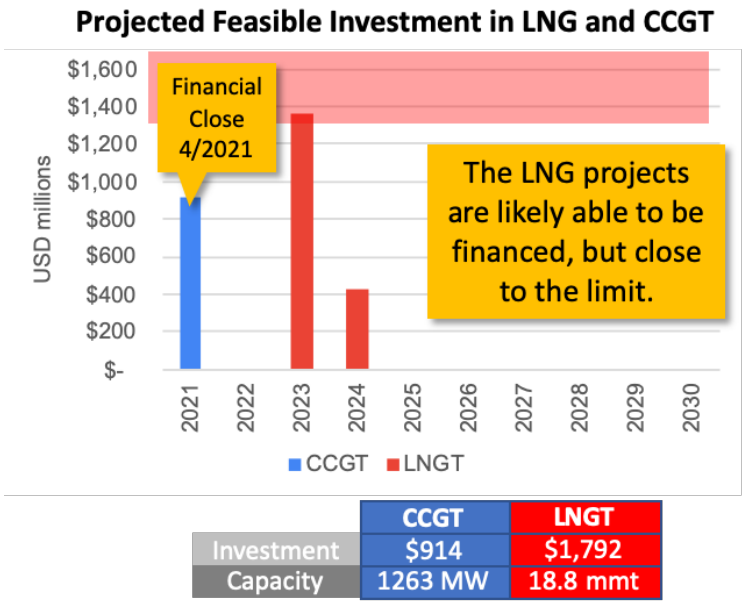
Source: IEEFA analysis

	Investment (US$mn)	Capacity
LNG Terminals		
Announced	$2,879	18.5 mtpa
IEEFA net projected	$838	6.3 mtpa
Projected / Announced	29%	34%
Power Generation		
Announced	$9,557	10,900 MW
IEEFA net projected	$2,709	2,900 MW
Projected / Announced	28%	27%
Total Investment		
Announced	$12,437	
IEEFA net projected	$3,547	
Projected / Announced	29%	

Pakistan

- Pakistan has committed to expanding its LNG import capacity to meet growing demand for gas, despite demand being artificially inflated by gas subsidies.
- IEEFA expects the currently announced LNG import terminals in Port Qasim to be feasible, and they may partly fuel an additional CCGT plant that reached financial close in 2021.
- Future projects beyond those currently in advanced development stages may not be viable.
- Fiscal stress and inflationary pressure from LNG projects, combined with an already uneconomic consumption structure will not provide sufficient comfort for future financiers.

	Investment (US$mn)	Capacity
LNG Terminals		
Announced	$1,893	19.8 mtpa
IEEFA net projected	$1,792	18.8 mtpa
Projected / Announced	95%	95%
Power Generation		
Announced	$859	1,263 MW
IEEFA net projected	$914	1,263 MW
Projected / Announced	106%	100%
Total Investment		
Announced	$2,752	
IEEFA net projected	$2,705	
Projected / Announced	98%	

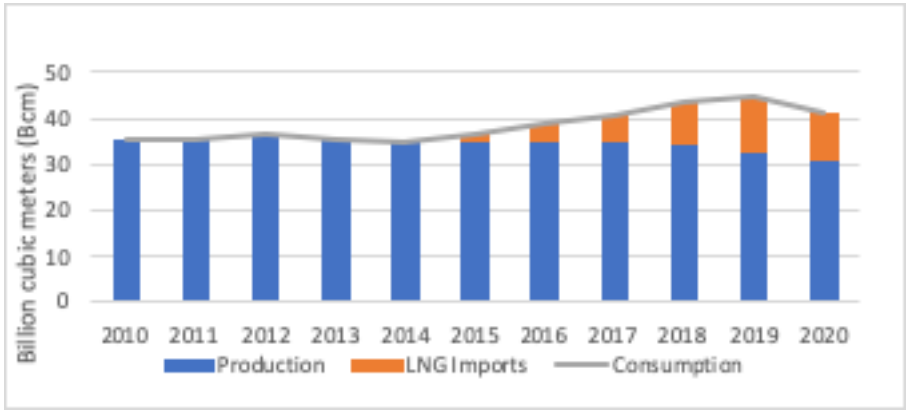


Source: IEEFA analysis

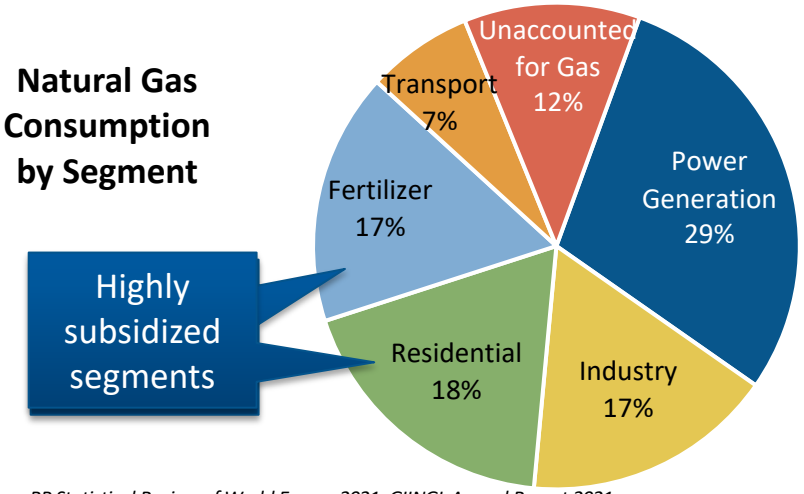
Pakistan: LNG Conundrum

- Domestic production of natural gas is in decline, while demand for gas continues to rise.
- Demand is artificially inflated due to highly subsidized residential and fertilizer consumer segments, which is kept <$2.00/MMBtu.
- Unaccounted for gas losses range between 11%-14%.
- LNG was introduced to close the supply gap; LNG now accounts for 25% of Pakistan's gas supply.
- LNG purchasing strategy has left 40% of supply subject to spot prices.
- With LNG supply prices hovering above $10/MMBtu, Pakistan faces huge additions to its energy sector circular debt conundrum.

Pakistan Natural Gas Supply and Consumption



Natural Gas Consumption by Segment

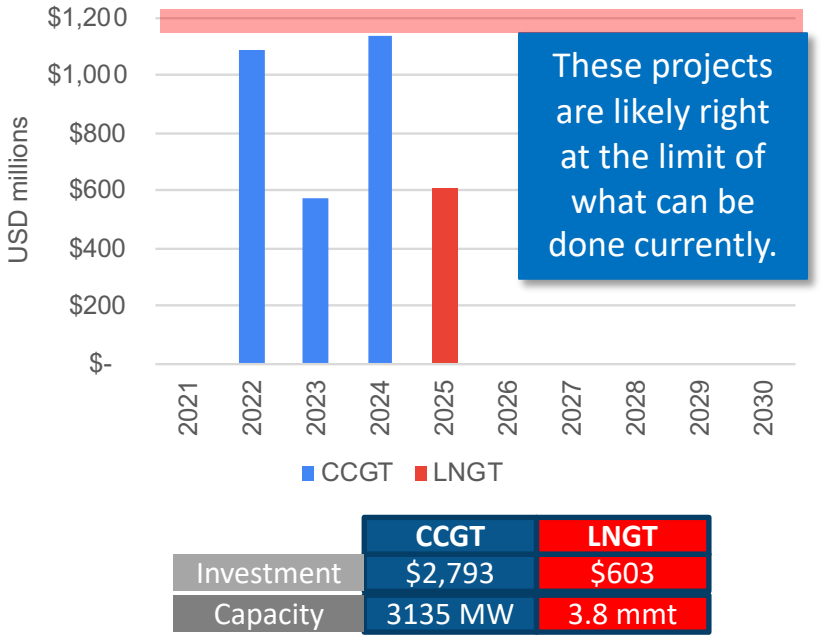


Sources: BP Statistical Review of World Energy 2021, GIINGL Annual Report 2021

Bangladesh

- IEEFA projects that less than 33% of the announced pipeline of investments are feasible, but with little guarantee that those feasible projects will go forward.
- CCGTs will comprise the bulk of investment, with an estimated 3.1GW of viable power capacity.
- LNG terminals are in question due to the economics of high-cost LNG cargoes.
- Bangladesh needs a new strategy for procuring LNG to avoid spot market risk.

	Investment (US$mn)	Capacity
LNG Terminals		
Announced	$2,234	15 mtpa
IEEFA net projected	$603	3.8 mtpa
Projected / Announced	27%	25%
Power Generation		
Announced	$8,802	9,135 MW
IEEFA net projected	$2,793	3,135 MW
Projected / Announced	34%	34%
Total Investment		
Announced	$10,436	
IEEFA net projected	$3,396	
Projected / Announced	33%	

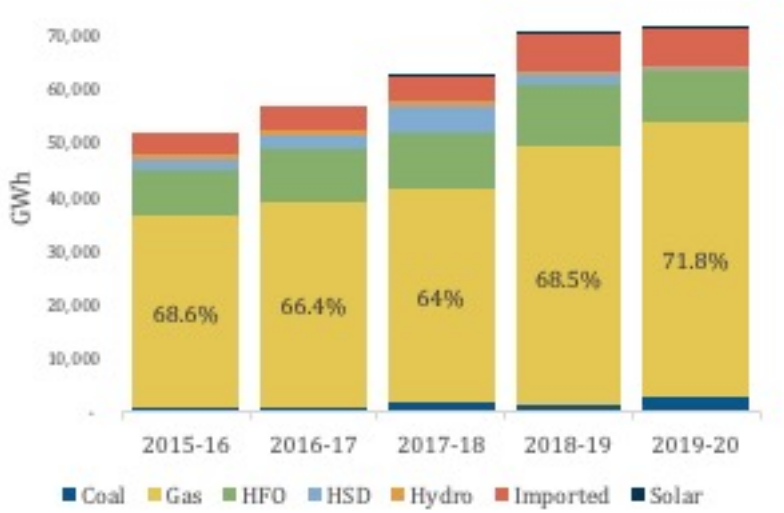


Source: IEEFA analysis

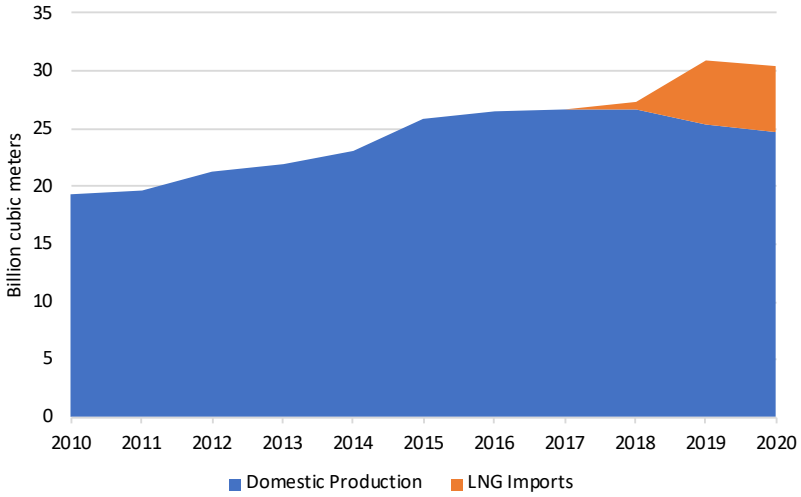
Bangladesh: Oversupply and Uncertainty

- Bangladesh has seen a boom in power generation plant capacity additions over the past 5 years, with more coming.
- Power generation capacity under construction could bring supply reserve margins above 40%.
- Domestic natural gas has been the centerpiece of BD's energy supply. Production is declining, yet highly promising offshore fields are left unexploited due to pricing issues with exploration companies.
- ***LNG imports to the rescue?*** The government turned to LNG as a quick solution to the supply/pricing challenge.
  - Unfortunately, the government canceled many of its long-term supply contracts trying to take advantage of low spot-market prices; this plan backfired, creating untenable economics.

Bangladesh Generation Mix and Percent of Gas (2015-20)



Bangladesh Natural Gas Production and Imports

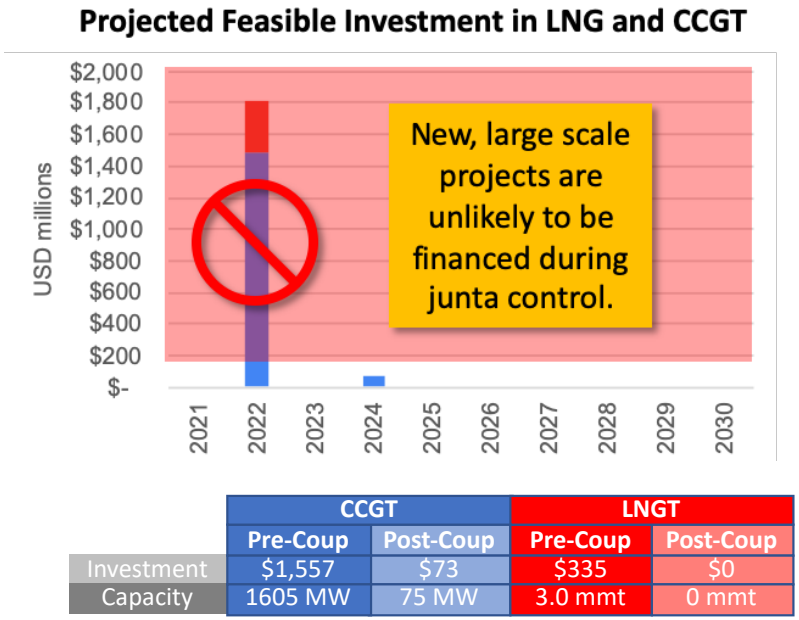


Sources: BP Statistical Review of World Energy 2021., Bangladesh Power Development Board Annual Reports

Myanmar

- Prior to Feb 2021 coup, LNG imports and downstream consumption investments appeared to have strong growth potential.
- In late 2020, the first LNG imports commenced at Thilawa industrial park from an FSRU anchored at the Yangon River, supplying captive power plants.
- While an additional terminal and 1,250MW power plant appeared potentially feasible, IEEFA does not see any new projects of scale being financing during the continuance of junta rule. Any plans to enhance Myanmar's offshore gas production are also on hold.

	Pre-Coup		Post-Coup	
	Investment (US$mn)	Capacity	Investment (US$mn)	Capacity
LNG Terminals				
Announced	$3,527	23 mtpa	$3,527	23 mtpa
IEEFA net projected	$335	3 mtpa	$0	0 mtpa
Projected / Announced	10%	13%	0%	0%
Power Generation				
Announced	$9,940	10,915 MW	$9,940	10,915 MW
IEEFA net projected	$1,557	1,605 MW	$73	75 MW
Projected / Announced	16%	15%	1%	1%
Total Investment				
Announced	$13,467		$13,467	
IEEFA net projected	$1,892		$73	
Projected / Announced	14%		1%	



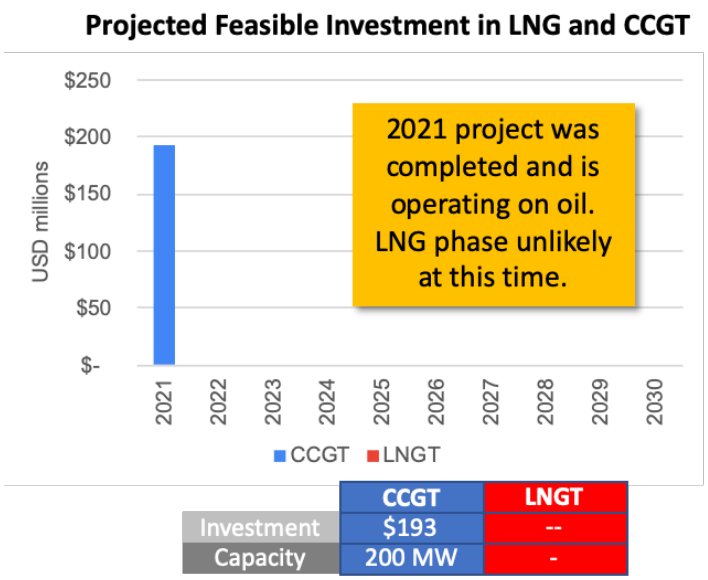
	CCGT		LNGT	
	Pre-Coup	Post-Coup	Pre-Coup	Post-Coup
Investment	$1,557	$73	$335	$0
Capacity	1605 MW	75 MW	3.0 mmt	0 mmt

Sources: IEEFA Analysis

Cambodia

- In 2021, the Cambodian government agreed to a 700MW coal-fired power plant funded through Chinese bilateral support. A 200MW HFO-fueled power plant was also commissioned near Phnom Penh, with plans to expand and run on LNG.
- These projects and other, smaller plant additions should sufficiently address medium-term power demand.
- A single 3mtpa LNG import facility and 1,600MW power project have been proposed, but IEEFA considers the projects unlikely to be realized, particularly due to uncertain fiscal stability to back those projects.

	Investment (US$mn)	Capacity
LNG Terminals		
Announced	$334	3 mtpa
IEEFA net projected	$0	--
Projected / Announced	0%	0%
Power Generation		
Announced	$1,431	1,600 MW
IEEFA net projected	$193	200 MW
Projected / Announced	14%	13%
Total Investment		
Announced	$1,756	
IEEFA net projected	$193	
Projected / Announced	11%	



Sources: IEEFA Analysis

Thank you!

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