



## Following or Leading the Natural Gas Revolution?

Mike Thomas ([mthomas@lantaugroup.com](mailto:mthomas@lantaugroup.com))

Liutong Zhang ([lzhang@lantaugroup.com](mailto:lzhang@lantaugroup.com))

# Agenda / Content

---

## **Shale Gas “Boom”**

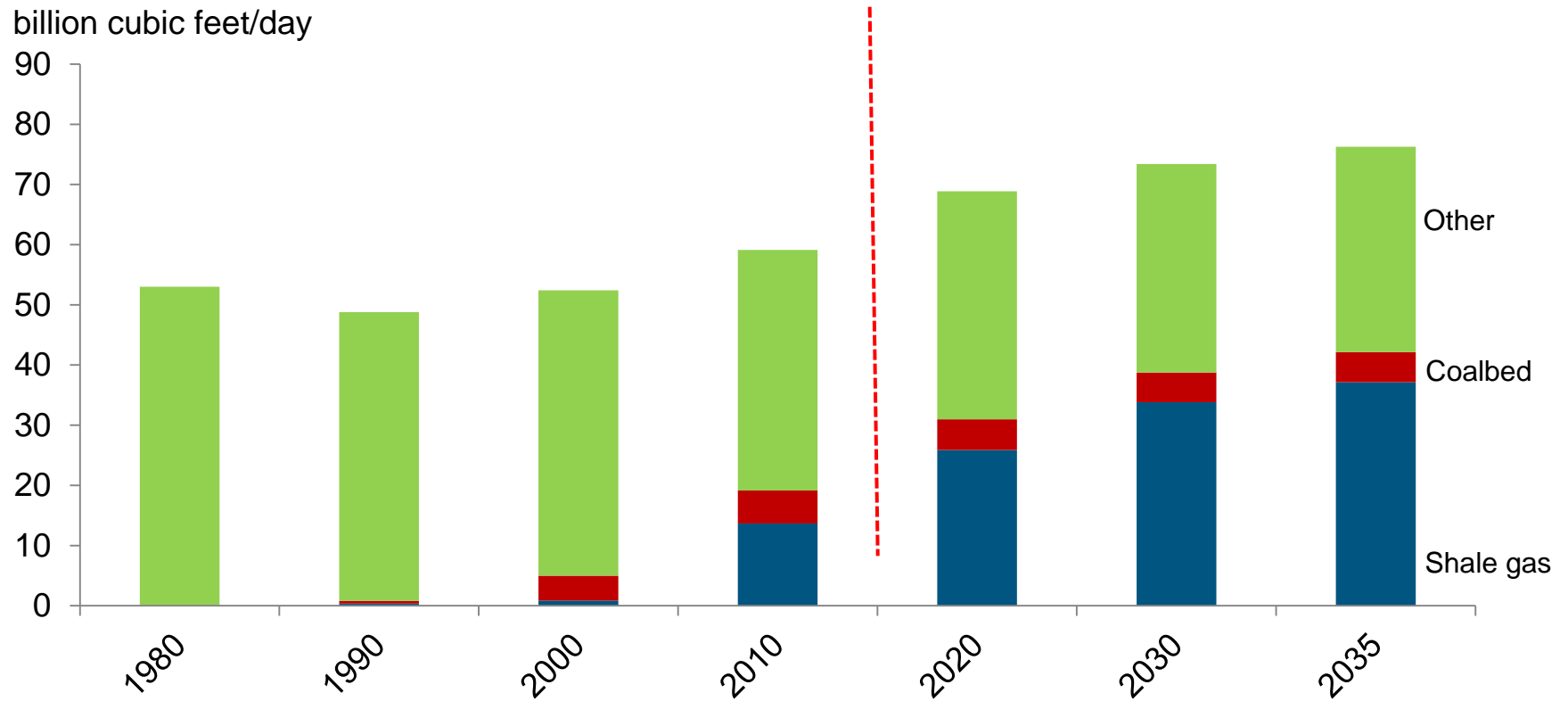
Disrupting the Global LNG market

What Next?

# Shale gas has completely transformed the US gas supply outlook

Conventional gas sources are depleting, but shale gas production will grow to drive future supply

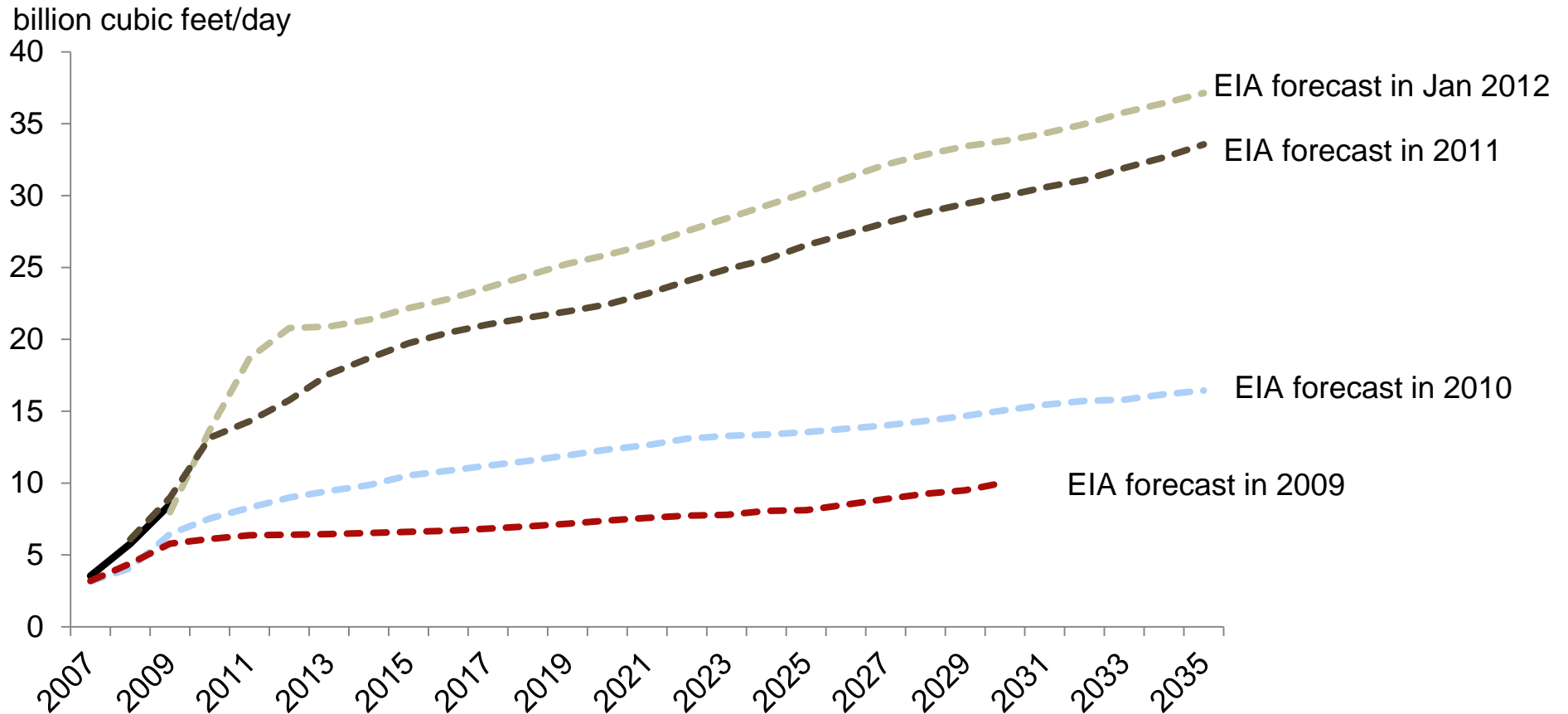
### US gas supply, 1980-2035



Source: US Energy Information Administration (EIA)

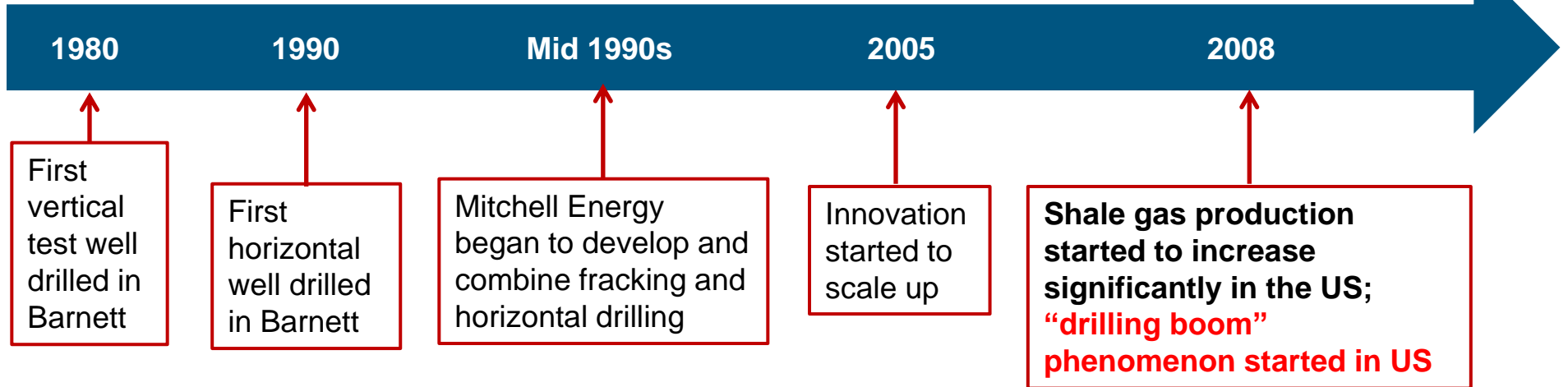
# Shale gas production has been significantly under-forecasted by the US Government

## Evolution of US Shale Gas Production Forecast by EIA



# US shale gas “revolution” story

The US shale gas revolution story – many steps taken long before recent scale up

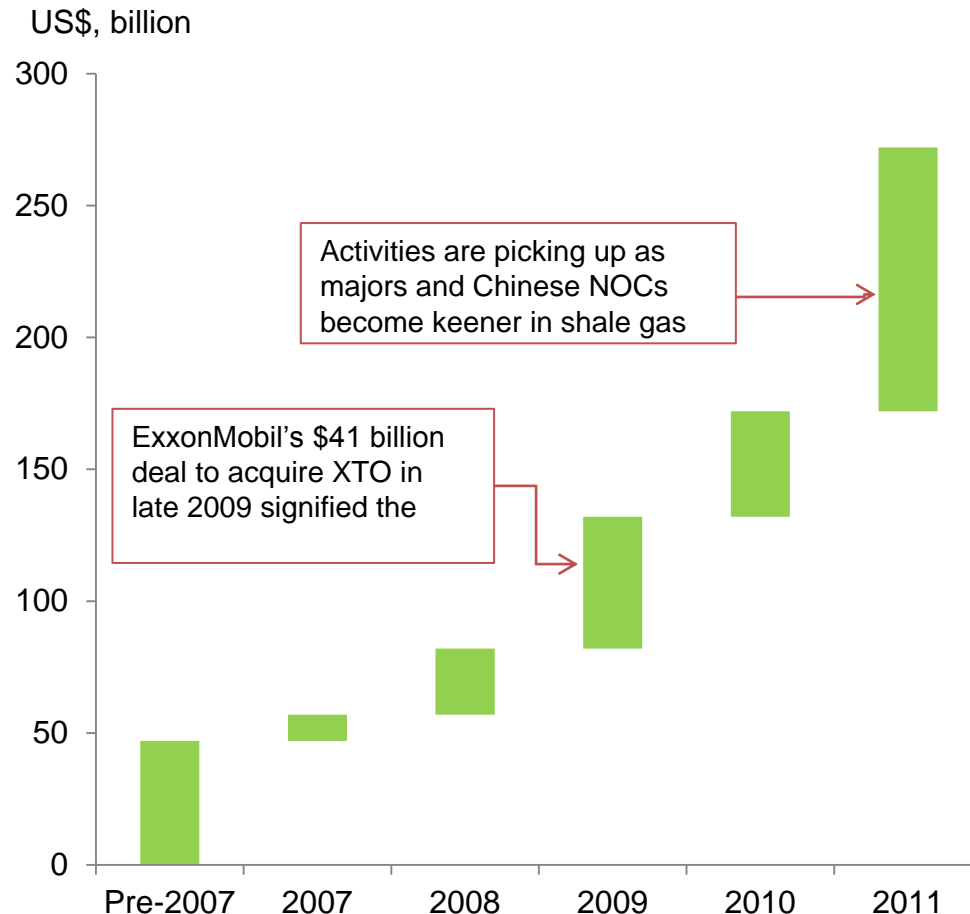


## What makes the US Shale Gas Story a Success



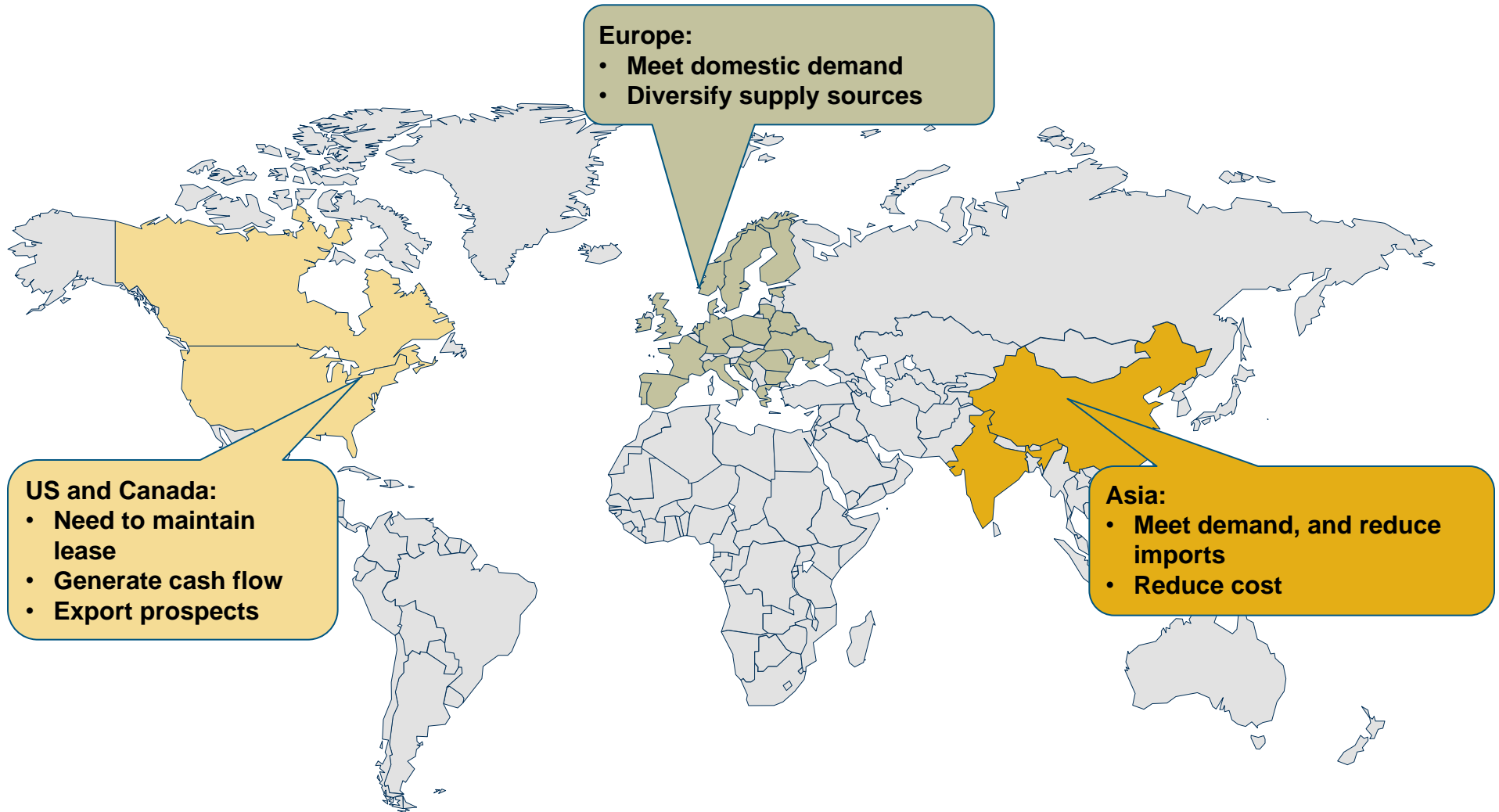
# Shale gas related transactions have amounted to be >200 billion and investment activities are picking up globally

## Shale gas related M&A transaction value



- Over \$200 billion worth of transactions from 2007 through 2011, with the US accounting about 80% so far
- In **China**,
  - Shell is co-operating with CNPC in the Chuan-yu basin and BP is co-operating with Sinopec for shale gas development in the Guizhou and Jiangsu provinces
- In **Europe**,
  - **Poland**: ConocoPhillips, ExxonMobil, Talisman, Chevron
  - **Hungary**: OMW, ExxonMobil
  - **Ukraine**: Shell
  - **Romania**: Shell
  - **Germany**: ExxonMobil

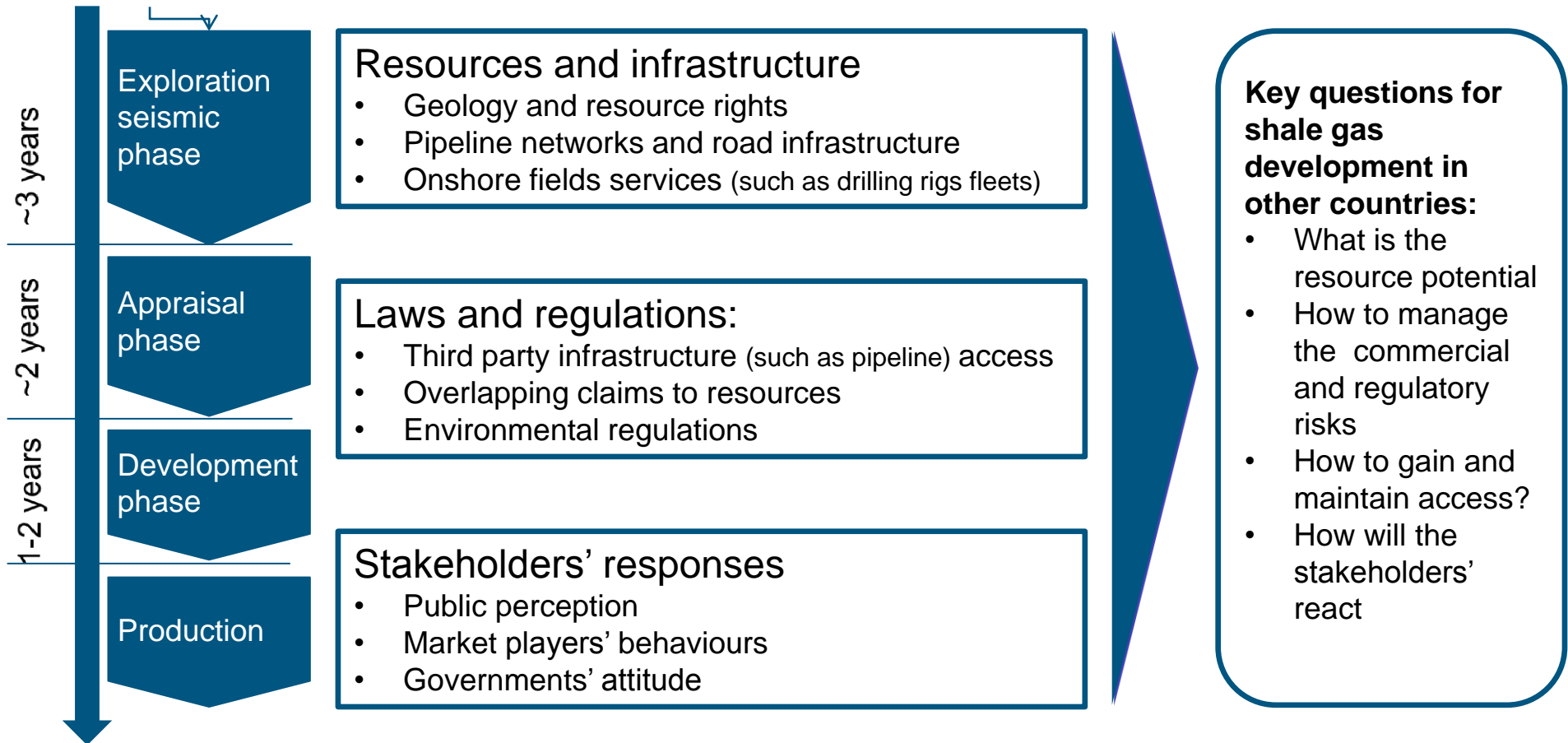
# Emerging global activities in shale gas E&P are supported by many different drivers



# Nobody wants to miss the wave, but the US story may not be easily replicated

Most countries are still in early stage of exploration

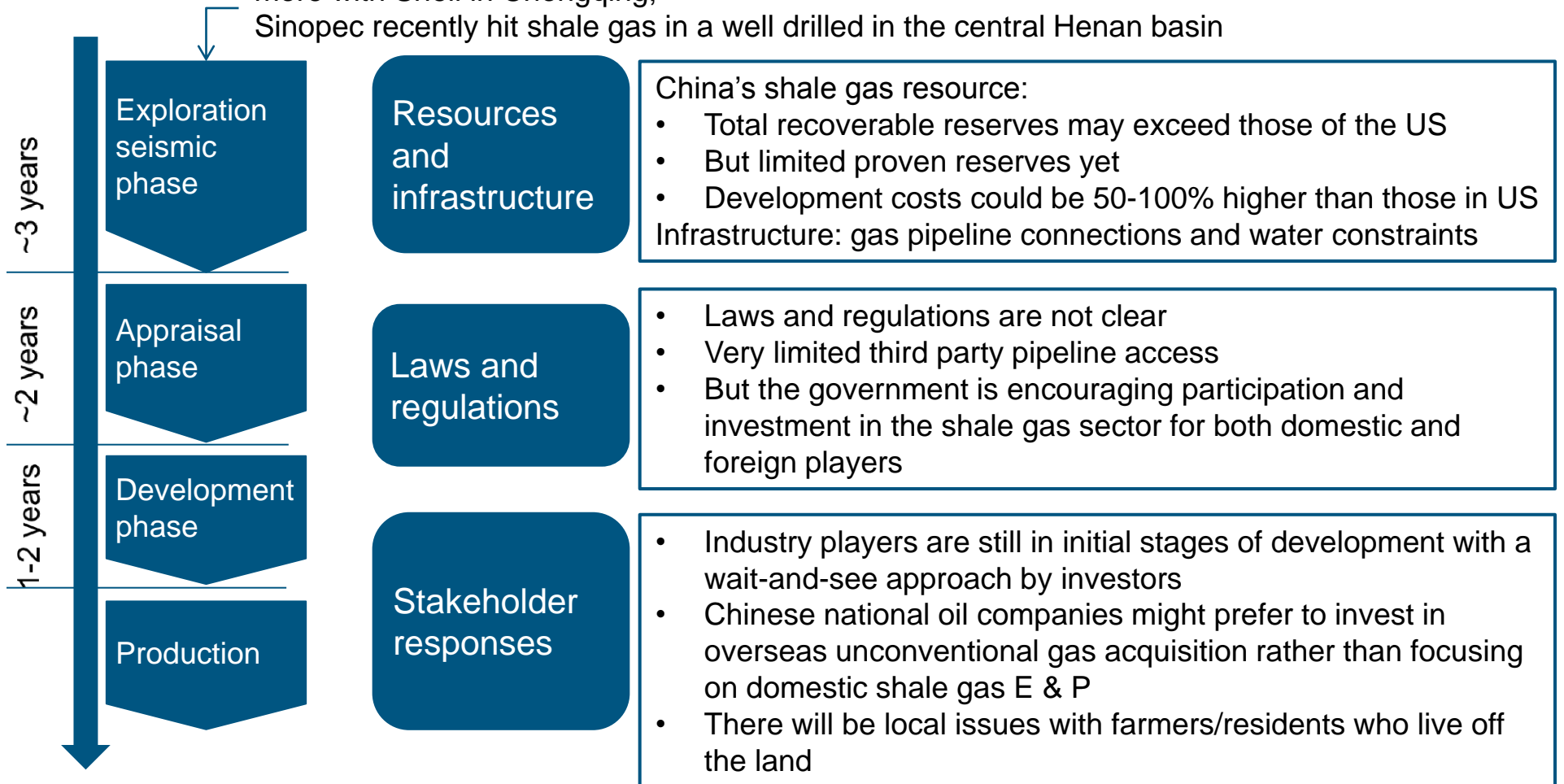
## Key Success Factors for Shale Gas Development





# All eyes are on China shale gas, but it will take time for China to develop those resources on a large scale

PetroChina drilled 1st shale gas well in end 2009 in Weiyuan and drilled two more with Shell in Chongqing;  
Sinopec recently hit shale gas in a well drilled in the central Henan basin



# Europe has significant estimated shale reserves, but the key success factors behind the US shale gas story are not found in Europe

## Technically Recoverable Shale Gas Resources (TCF)

Poland	187
France	180
Norway	83
Ukraine	42
Sweden	41
U.K.	20
others	63

Source: EIA Shale Gas Assessment Report, 2011

Shale gas E & P in Europe is still in early stage and the country with the most promising potential shale gas production is Poland.

### Resources and infrastructure

- European resource base is similar to that in the US
- No established fleet of onshore drilling rigs in Europe
- New market development is much less driven by entrepreneurial mid-tier sector than in the USA

### Laws and regulations

- Much more complicated permitting process than in US
- Unlike US, mineral resources in Europe are not privately owned and conveyed with surface right, but are government owned; Negotiations with governments are likely to be more time consuming with politicised conflicts between surface owners and resource developers

### Stakeholders' response

- Potential resistance from the public
- Some governments may restrict shale gas development for environmental reasons (e.g. France has banned shale gas exploration)

# Agenda / Content

---

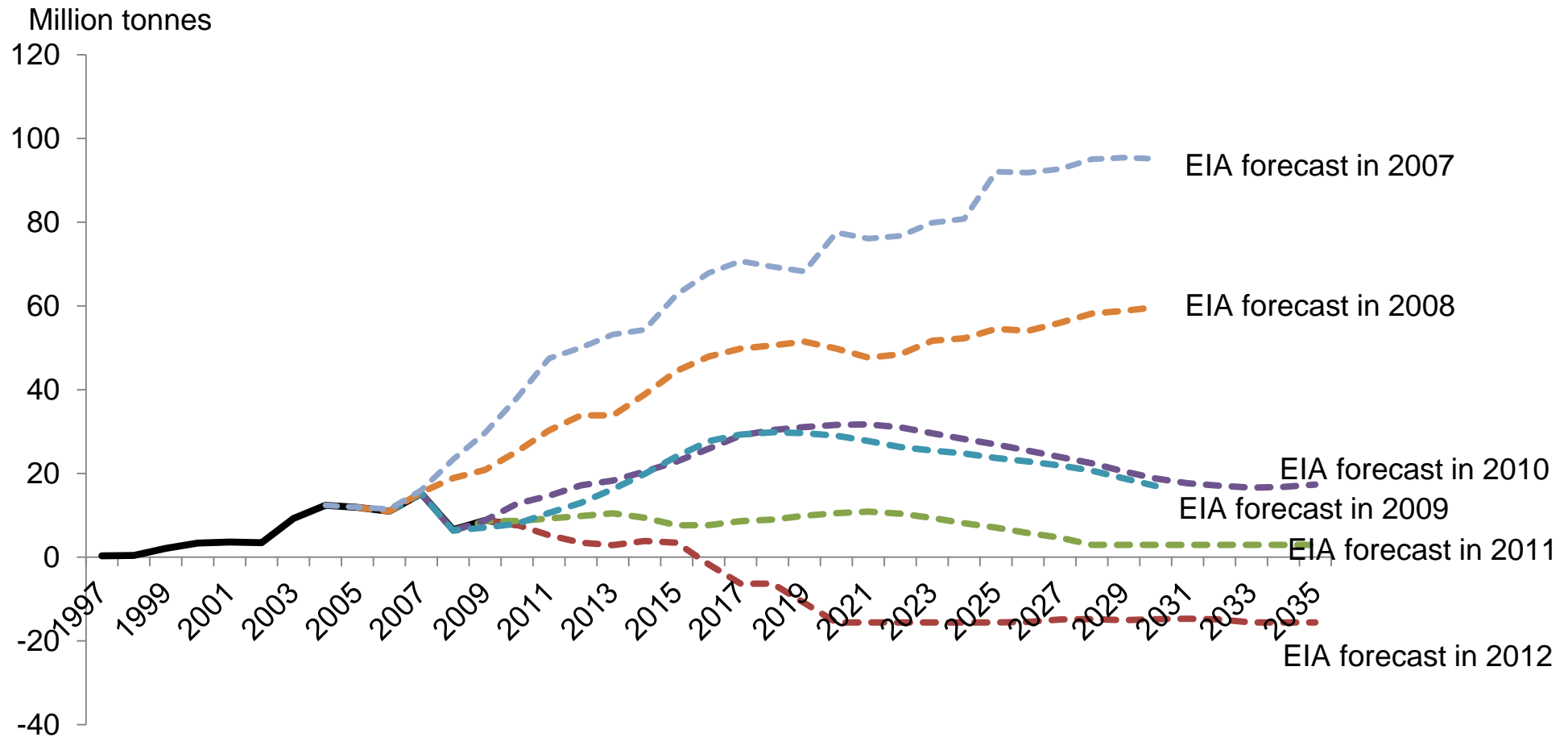
Shale Gas “Boom”

**Disrupting the Global LNG market**

What Next?

The USA, a previously anticipated major growth market for LNG imports, is expected to become a net LNG exporter as early as 2016

### Evolution of US Net LNG Imports Forecast by EIA

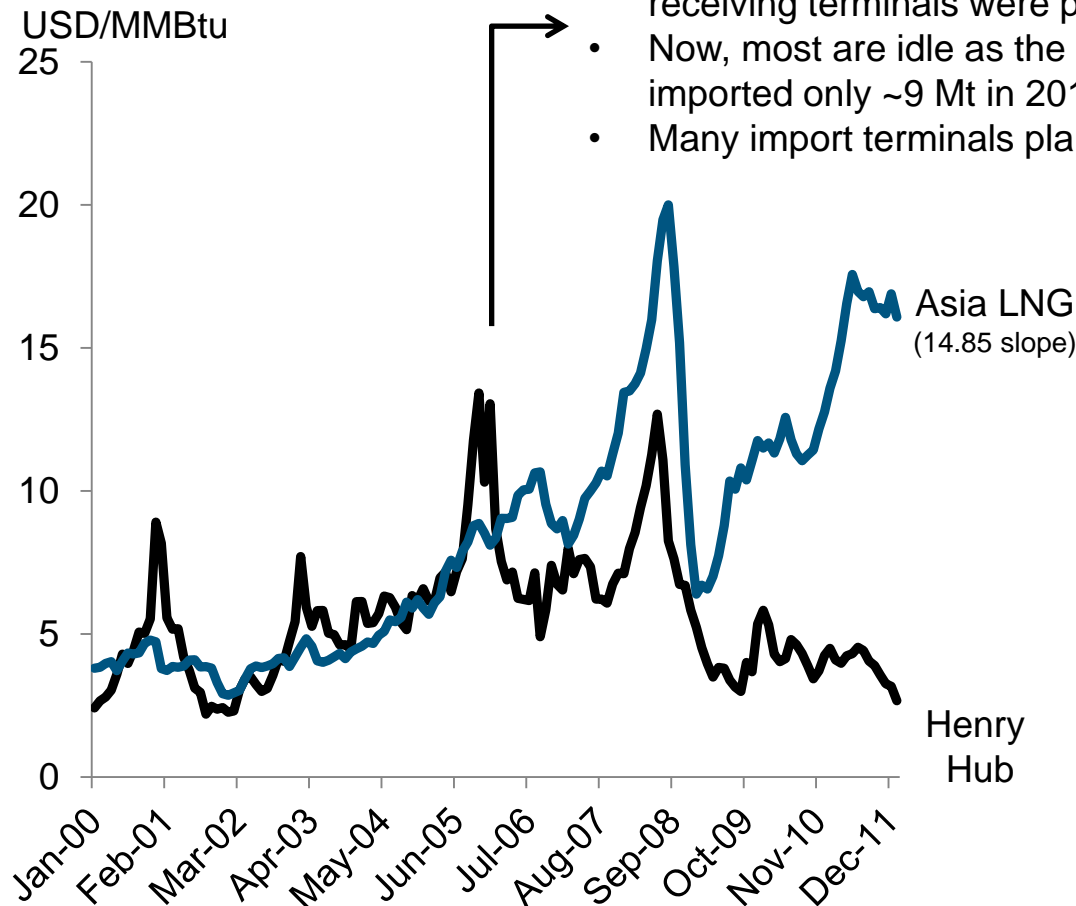


Source: US Energy Information Administration (EIA), AEO 2007-2012

# The US shale gas revolution has “disrupted” pricing and investments

## HH and Asian LNG prices

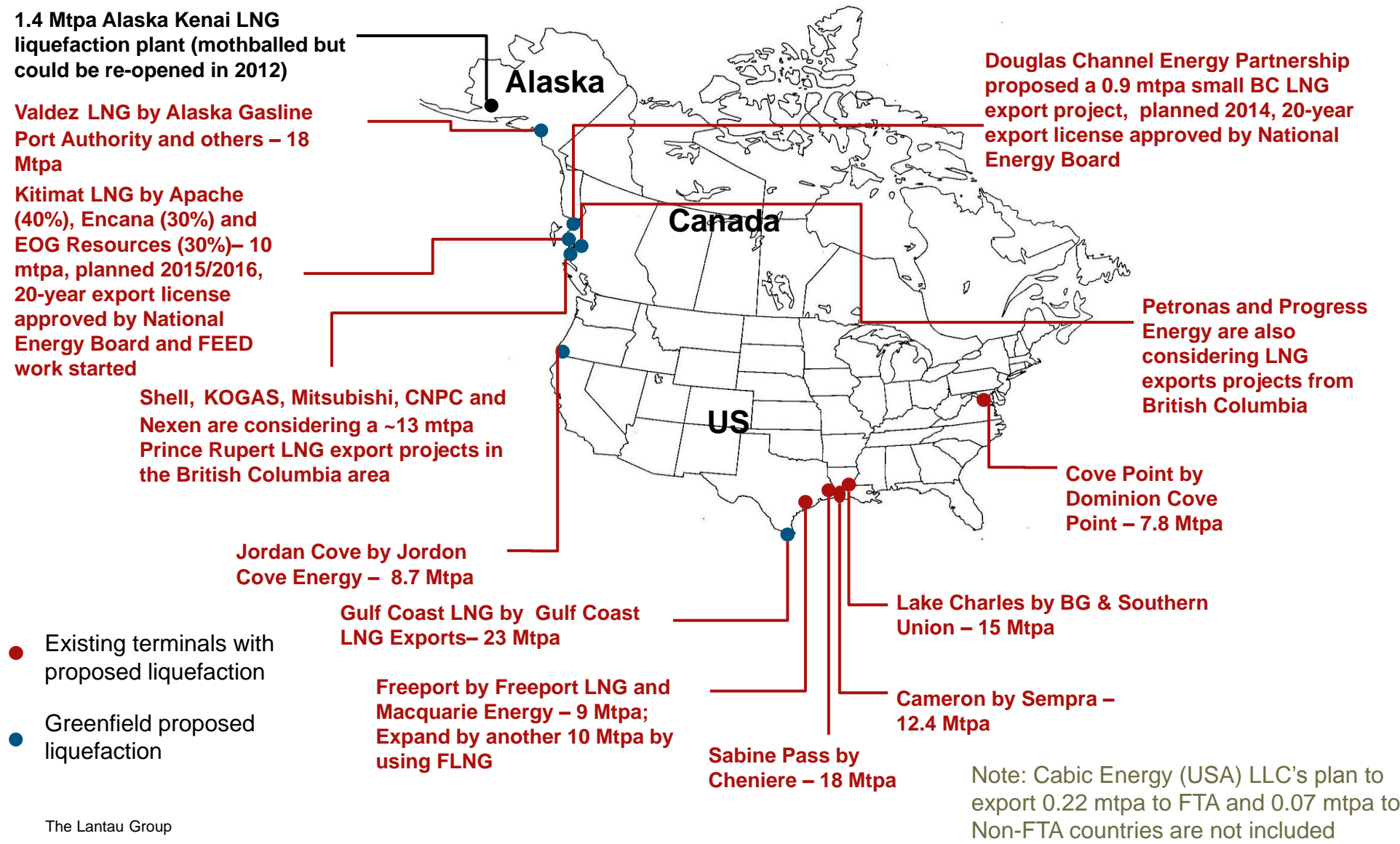
- In 2005, HH price increased to ~\$15/MMBtu because of strong demand and supply disruption (Hurricanes Katrina). In response, many LNG receiving terminals were planned and some quickly built in US
- Now, most are idle as the US has 134 Mtpa of LNG import capacity but imported only ~9 Mt in 2011
- Many import terminals plan to convert into export terminals



Regional pricing gap has widened to unprecedented wide level – more LNG is likely to be diverted to higher pricing region (i.e. Asia)

- Qatar’s original LNG export strategy: 1/3 for US, 1/3 for Europe and 1/3 for Asia; But this strategy is unlikely to be sustainable and Qatar is diverting more LNG cargos to Asia and Europe
- Trinidad & Tobago used to have 86% of its export to US, but it has to seek new customers now, likely in Asia

# >100 Mtpa LNG export projects are under plan in US and >20 Mtpa under plan in Canada



# Competition between US and Canadian export projects has increased

US DOE will grant approval for exporting LNG to non-FTA countries based on “accumulative effect” of LNG exports on US energy security

First mover advantage: many players have been quick to file applications for LNG exports and push for approvals

Competition also exist between the exports from US and those from Canada  
LNG exports: US vs British Columbia (BC) in Canada

Liquefaction cost

**US Gulf Coast:** CAPEX for converting regasification terminal US\$350-500/tonne  
**Canada British Columbia:** CAPEX for greenfield development is US\$900-1,200/tonne

Shipping cost

**US Gulf Coast:** US\$2.8/MMBtu to Asia, and will be lower after the expansion of Panama Canal in 2014  
**Canada British Columbia:** cheaper than US Gulf because of shorter route; Kitimat LNG estimated only about 11 shipping days to Asia

Other costs

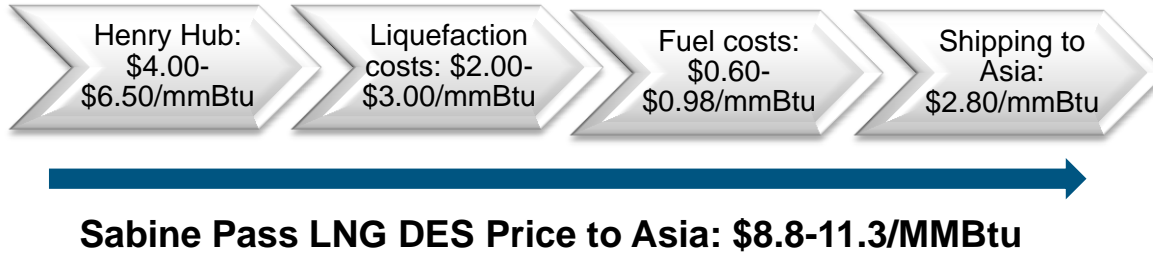
**Canada British Columbia:** BC government intends to levy carbon tax

# Cheniere Sabine Pass is the most advanced project for LNG re-export in the US

	Sabine Pass	Lake Charles	Freeport	Freeport Expansion	Cove Point	Cameron	Jordan Cove Energy	Gulf Coast LNG
Owner	Cheniere	BG, Southern Union	Freeport LNG and Macquarie	Freeport LNG	Dominion Cove Point	Sempra	Jordan Cove LNG	Gulf Coast LNG Export
Planned Export Amount (mtpa)	18	15	9	10	7.8	12.4	8.7	23
Anticipated Construction Date	April 2012 (T1&2), 2013 (T3&4)	TBD	Early 2013	TBD	2014	TBD	TBD	TBD
Anticipated Project In-service Date	2015/2016 (T1&2); 2017/2018 (T3/4)	2015	2016	TBD	Late 2016	TBD	TBD	TBD
Authorized to Export LNG to FTA Countries?	√	√	√	Under Review	√	√	√	Under Review
DOE's Issuance of Authorized to Export LNG to Non-FTA Countries	√	Under Review	Under Review	Under Review	Under Review	Under Review	Under Review	Under Review
FERC Approval for Construction	Expected before April 2012	X	X	X	X	X	X	X
LNG Marketing Sales	SPAs with BG (5.5 Mtpa), Gas Natural Fenosa (3.5 Mtpa), GAIL (3.5 Mtpa), KOGAS (3.5 Mtpa)	Sold to BG	X	X	X	X	X	X



# US LNG exports – cheaper with more flexibility, but not without risk



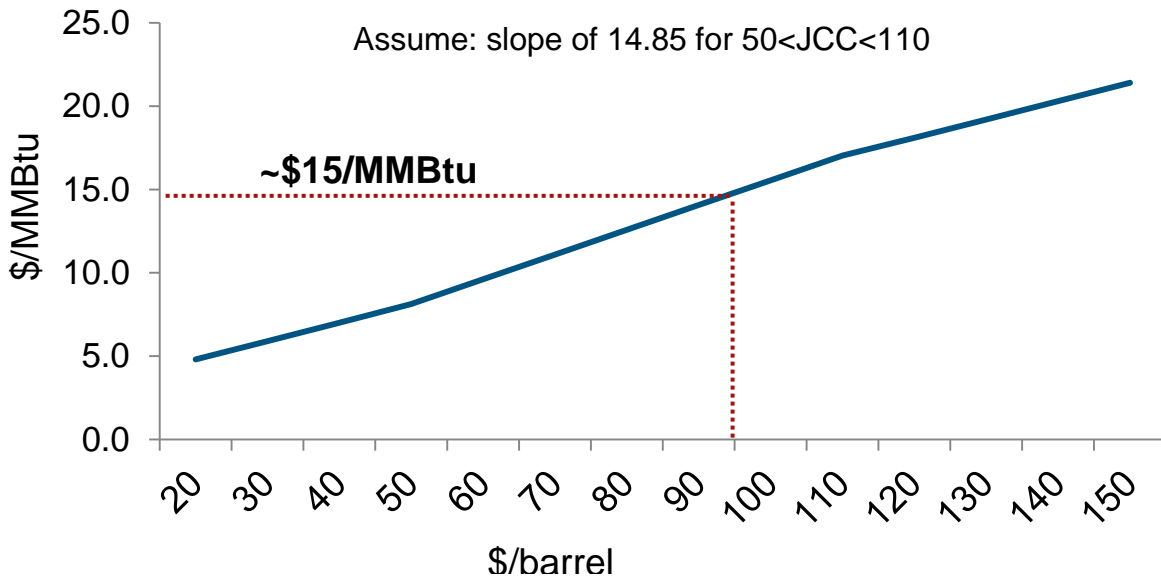
Source: Cheniere Energy, Annual Report

**\$8-11 versus \$15**

US LNG export price 20-40% less than other Asian LNG

**But with new risks:**

## Approximate Cost of New Asian LNG Contracts

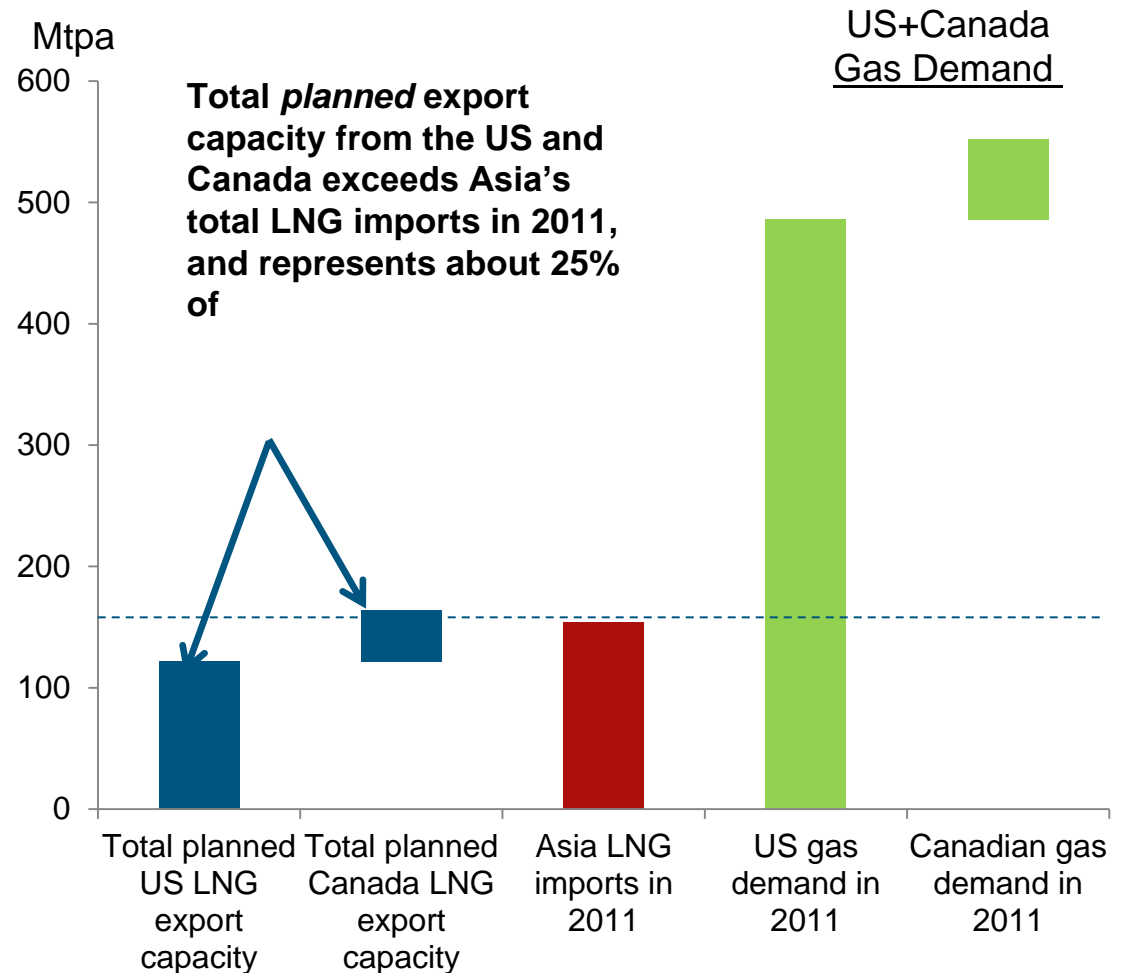


- Timing / regulatory Risk:**
- Prospects of LNG export authorization delay or withdrawal by DOE?
- Commercial risks:**
- Will supply-side competition allow LNG importers to capture the savings?
  - Henry Hub price volatility
  - Shale industry dynamics

# Impacts of large US LNG exports on the global LNG market will be significant

Although no liquefaction plants in the US and Canada have reached FID or have all necessary government approvals, the high potential commercial returns and competitive forces are motivating fast action

- Cheniere has signed 16 Mtpa Sale and Purchase Agreement with **prices linking to HH**;
  - 5.5 million tons per annum (Mtpa) with BG (3 Mtpa signed in October 2011 with pricing formula 115% HH + 2.25; 2.5 Mtpa signed in January 2012 with formular 115% HH + 3
  - 3.5 Mtpa with Gas Natural Fenosa in Nov '11, 115% HH + 2.49
  - 3.5 Mtpa with GAIL in Dec '11, 115% HH + 3
  - 3.5 Mtpa with KOGAS in Jan '12, 115% HH + 3
- Others are in advanced discussions using similar approaches



## US plans involve shale gas, but conventional exports are also increasing...

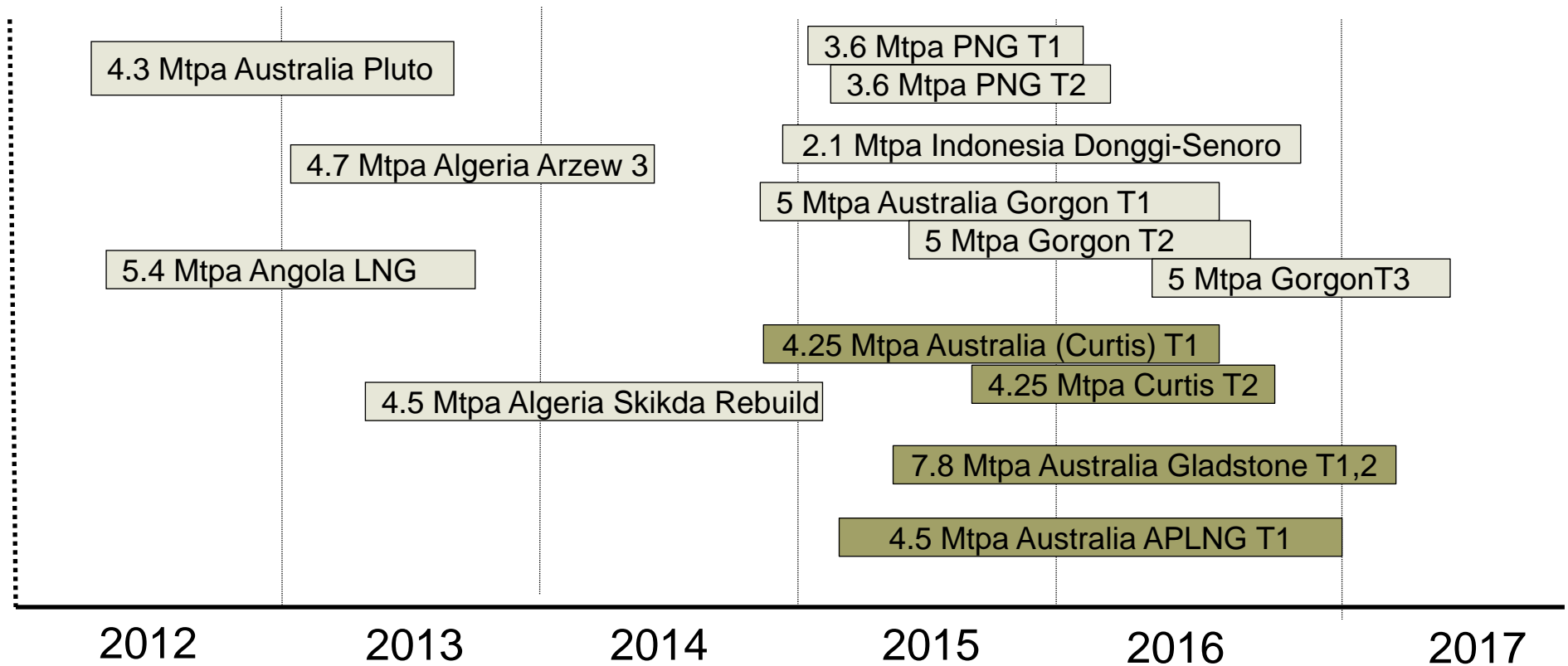
### LNG Liquefaction Capacity, million tons per anum

	In Operation/Under Commissioning	Under Construction	Announced	Total (Potential)
Qatar	80			80
Nigeria	20		8.5 - 46	30 – 68
Australia	20	53	29 – 102+	103 – 176+
Russia	10		80	90
US and Canada	3.4		120+	120+
Others	117	14.4 <sup>1</sup>	80+	80+

Note: 1. It includes 5.2 Mtpa Angola LNG (up in 2012), 4.7 Mtpa Algerian Arzew GLZ 3 (up in 2013), 4.5 Mtpa Algerian Skikda LNG (up in 2013) and 2.1 Mtpa Donggi LNG (up in 2014)

- Billions of investments are already committed to develop the Australian LNG projects
- Australia is set to become the largest LNG export country post 2020

# Australia has 53 Mtpa liquefaction capacity under construction and 45 Mtpa of capacity is expected to come on-stream between 2014-2016



Note: The left-hand end of the bar denotes expected start-date

 coal seam gas projects

## But Australian projects have many challenges

### High costs

- High labour cost with skills shortage
  - Tight immigration
  - Small population
- High construction materials' costs
- Technically difficult upstream projects
- Remote locations with little existing infrastructures

### Environmental

- Tight regulation (BTEX fracking chemicals banned and drilling buffers around towns)
- Strategic cropping land
- Water resource issues

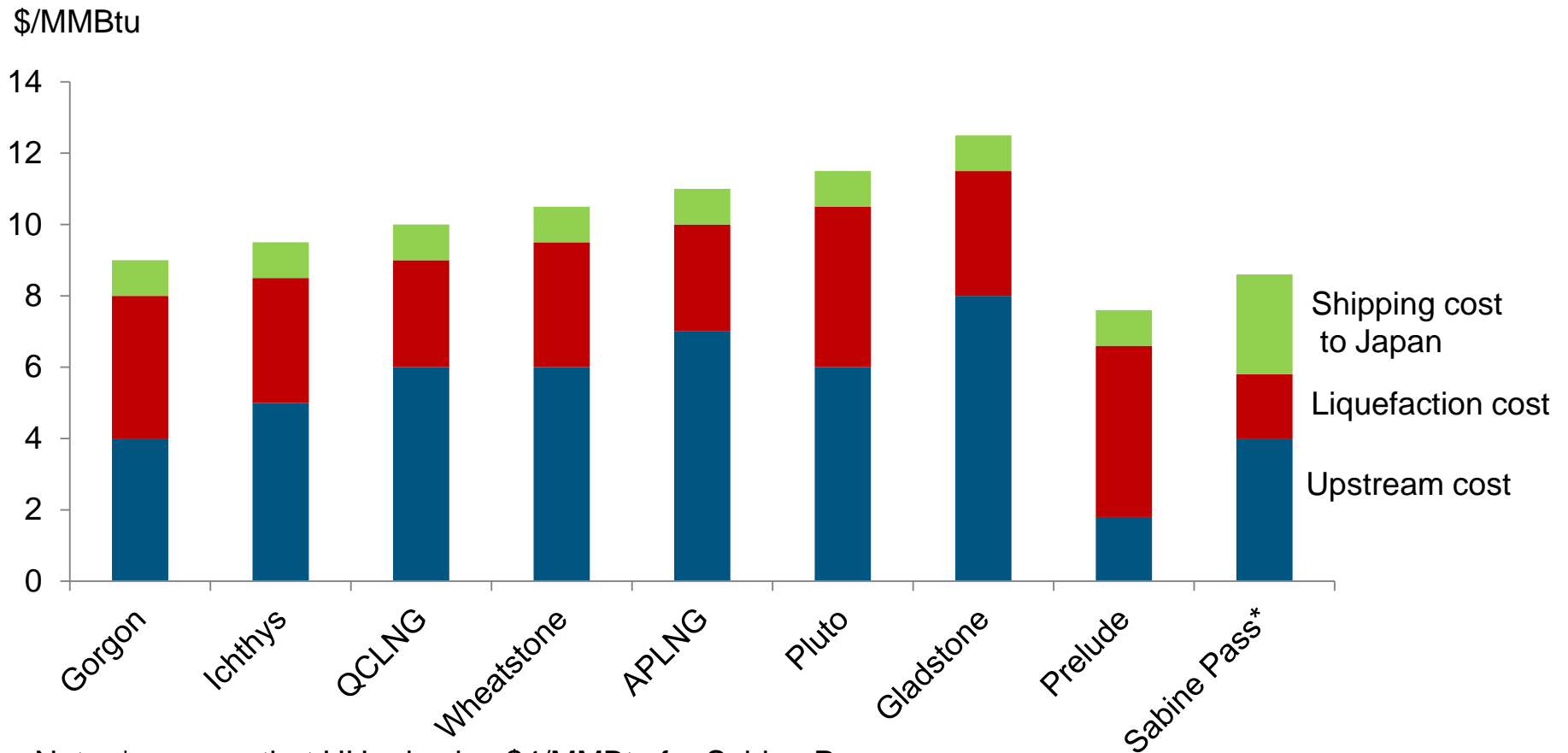
### Fiscal and Political

- Fiscal uncertainties
  - Carbon tax
  - Extended Petroleum Rent Tax
- Political uncertainties
  - Domestic/Export
  - JPDA – E. Timor
  - Native title

While supply projects in other countries face *some* of these challenges, the combined impact in Australia could delay or keep supply from coming online

# And Australian projects are relatively expensive compared to North American LNG export potential

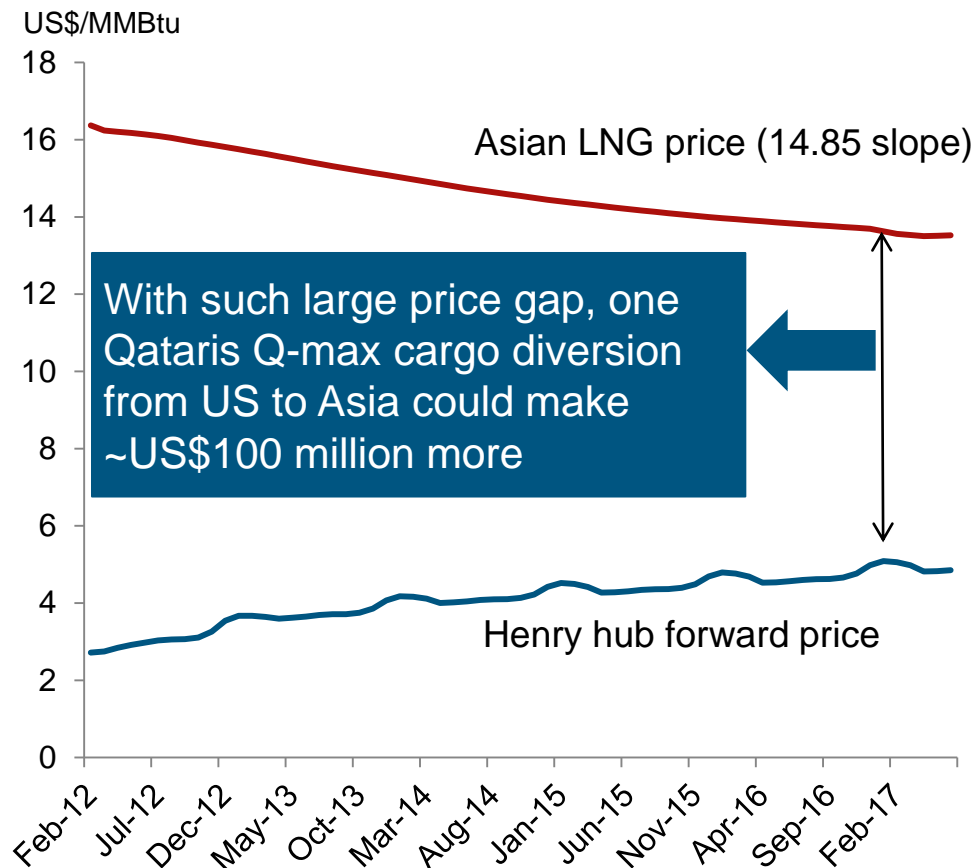
## Australian LNG projects are at the high end of the cost curve



Note: \* assume that HH price is ~\$4/MMBtu for Sabine Pass

With >\$10/MMBtu gap, the potential rewards for success (and costs of failure) are enormous

## Henry Hub Forward Price versus Asian LNG Price Implied by Crude Forward Curve

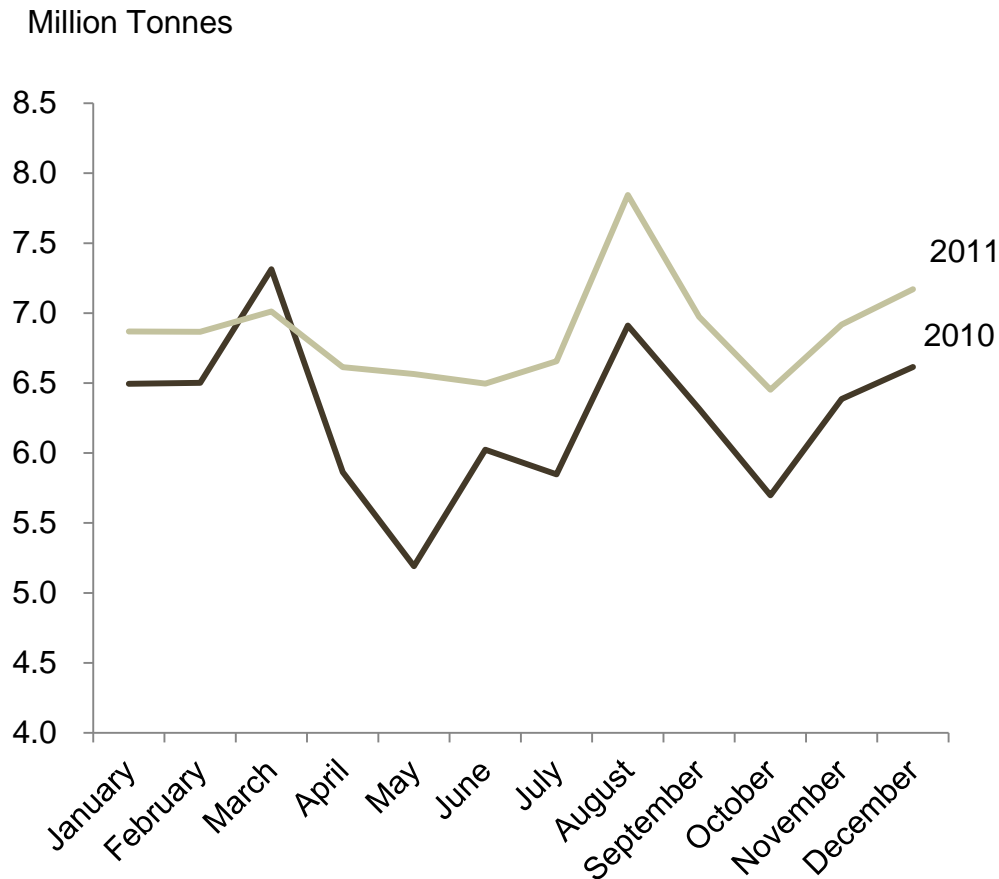


With the large regional price gap, the potential rewards for success (and costs of failure) are enormous

- **Pricing mechanism shifting:** Major LNG buyers, KOGAS and GAIL, have signed HH linked long term contracts with Cheniere. Many new LNG buyers are also interested to get HH linked contracts
- **More trading and arbitrage:** Large surplus in supply is looming after 2015, and it generally leads to more spot trading and arbitrage
  - will Singapore become a LNG trading hub as more LNG is diverted to Asia and more trading companies such as BP, Gazprom, Gunvor and Vitol set up their LNG trading teams in the island

# March 11 Fukushima disasters has lifted LNG demand in Japan and the short term LNG markets in 2011

## Japan Monthly LNG Imports

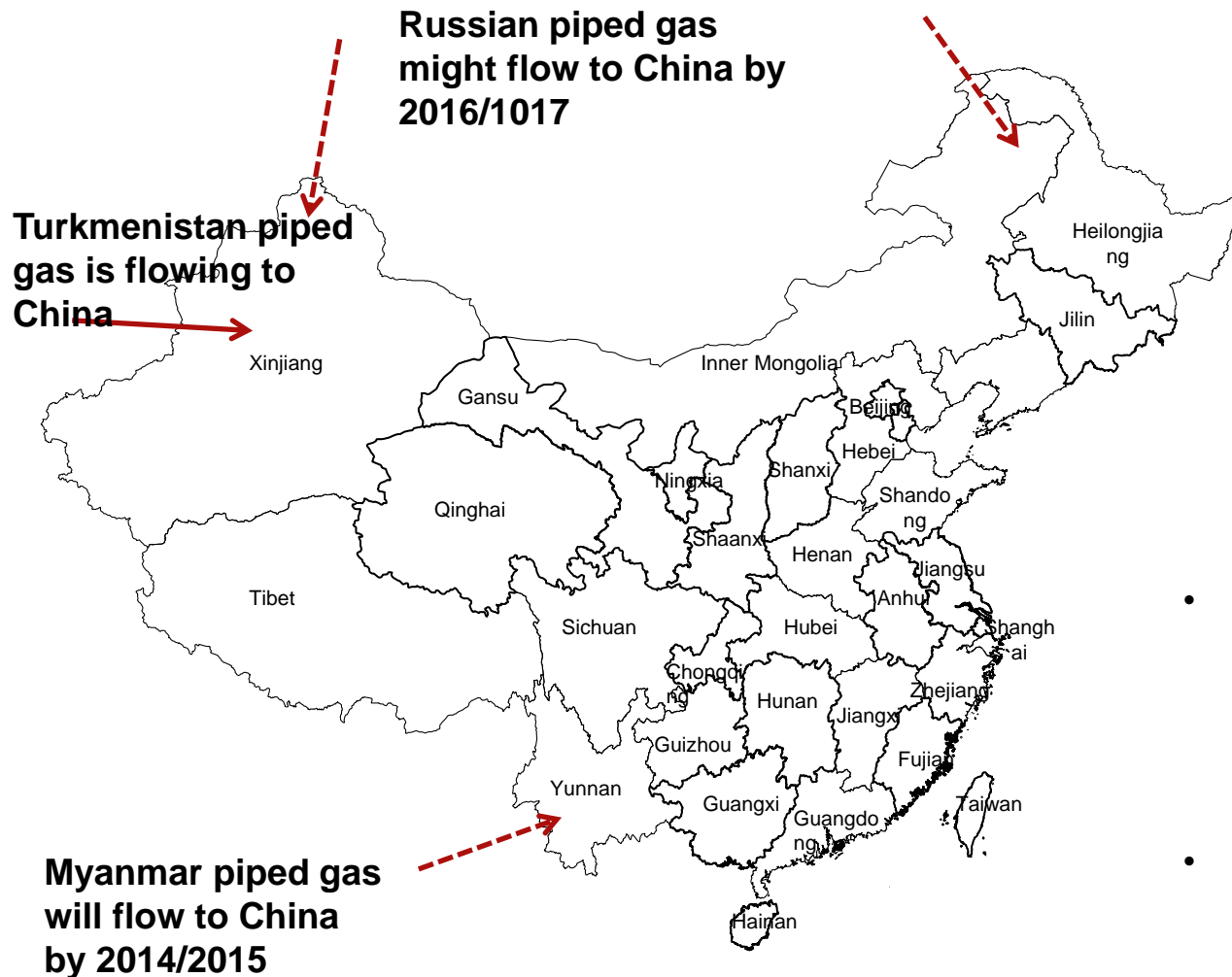


- After Fukushima, Japan LNG imports increased by ~7 million tonnes year-on-year in April-December 2011
- Japanese energy policy has shifted focus from nuclear power investment to reducing dependence on nuclear power
  - No construction of new nuclear reactors
  - Decommission aged reactors (>45 years)
  - Shut down TEPCO's 10 nuclear power units in Fukushima Daiichi and Fukushima Daini (totalled 6.4 GW)
- LNG is expected to be the main alternative fuel to make up lost nuclear capacity in the medium and longer term.

Japan LNG demand will increase by 10-15 Mtpa



On the other hand, China's LNG demand may not increase dramatically due to increases in domestic gas production and pipeline gas imports



- Increased pipeline gas imports
  - 2.9 billion cubic feet/day of Turkmenistan gas imports sale and purchase agreement signed and started since end 2009
  - More central Asian gas (Turkmenistan and Kazakhstan) is expected to go to China
  - Offshore Myanmar gas will export to China by 2014/2015
  - Significant amount of Russian gas is expected to export to China by 2016/2017
- Increased domestic gas production
  - Both conventional and unconventional gas production have significant room to grow in the next decade
- **Comparatively modest LNG imports are needed to bridge the gap between supply and demand, but with high price sensitivity, its LNG import might be high at low price**

# Agenda / Content

---

Shale Gas “Boom”

Disrupting the Global LNG market

**What Next?**

# These many risks are driving a new contracting environment for LNG

## Old model

- Full investment and financial planning for the whole value chain
  - Careful planning/coordination along value chain before commitment
- Long term off-take agreements with stable pricing clauses
- Limited rights on diversions
- Limited recourse project financing

## Emerging reality in more global trading-based environment

- Greater flexibility in pricing
- More spot LNG sales, option quantities
- Diversion and arbitrage as a value stream – “flexible network model”
- Sellers taking more of the market risk
- Equity stakes by buyers
- Project sponsors as off-takers, e.g., BG, BP, Repsol in Atlantic LNG
- Corporate financing, bond markets
- Competition from brown-field developments – Indonesia, Malaysia, Australia – capital advantage

# The gas decision in Asia is particularly complex

## LNG supply glut with global prices converge

**Supply:** US LNG export and Australian projects are executed as planned; shale gas production in US continue to increase significant

**Demand:** China and Poland develop their shale gas resources and scale up production and investment in the near term, leading to less LNG demand

**Prices:** Both buyers and sellers accept new pricing mechanism and more LNG contracts are linked to HH

Which world?

Why?

How to manage if wrong?

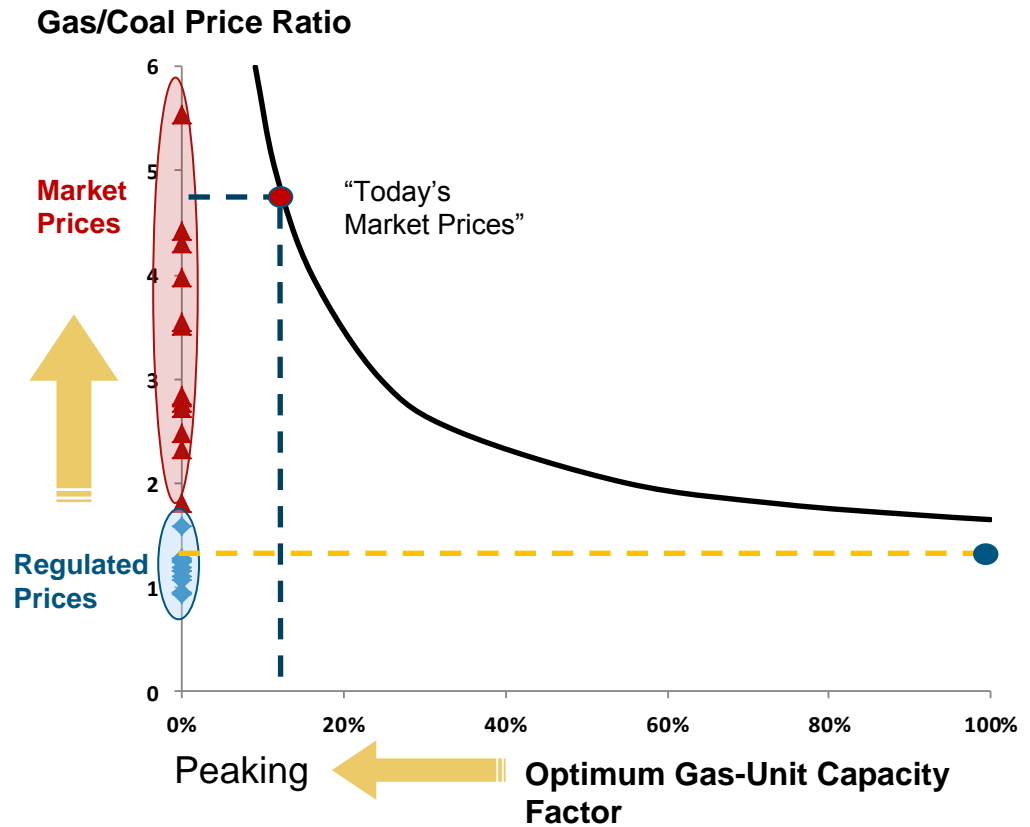
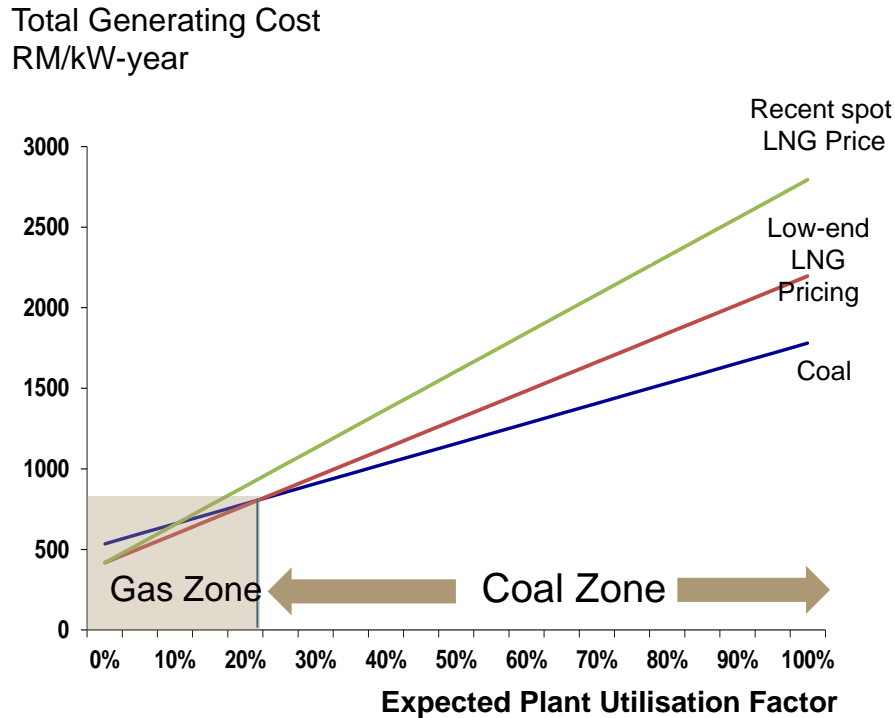
## Seller's market with Asia pays high premium for LNG

**Supply:** US LNG export and Australian projects are delayed because of various challenges

**Demand:** Chinese LNG demand are unexpectedly high as its domestic gas resource (especially shale gas) and pipeline gas imports are developed very slowly; LNG demands in new markets are unexpectedly high

**Prices:** Asian buyers still have to pay high premium for LNG than other regions

Gas versus coal competition favours coal for baseload---unless gas prices fall (a lot), coal prices rise (a lot), or coal entry is constrained....



Will Asia abandon coal for gas (and pay higher electricity prices?)

# Assessing LNG opportunities (buy or sell) requires a wide range of insight

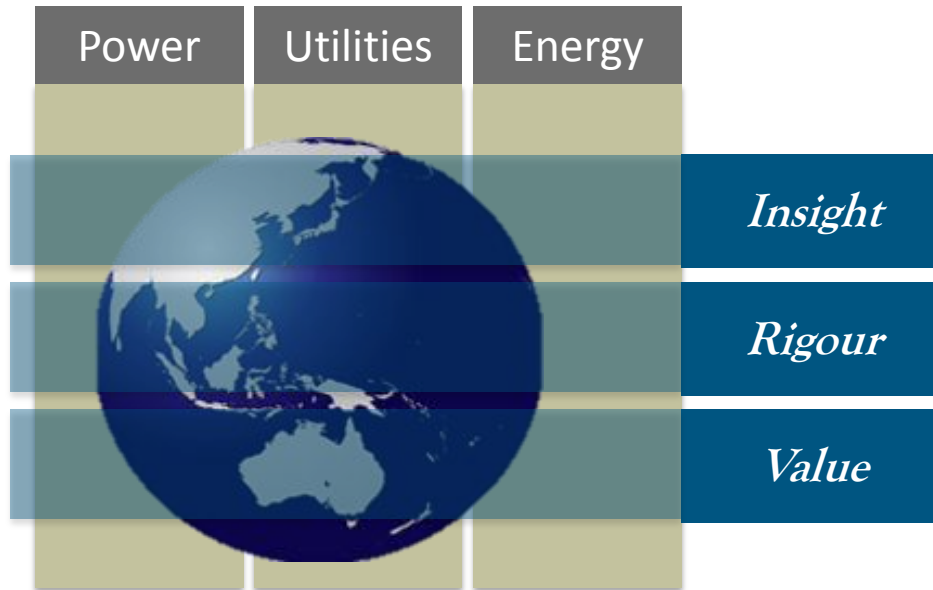
## Key uncertainties

## Key questions to ask

<b>Global Economy</b>	<ul style="list-style-type: none"><li>• What is the relationship between LNG demand and economic growth?</li><li>• How do global growth trends affect intra-regional gas trading and pricing pressures?</li></ul>
<b>Future LNG supply</b>	<ul style="list-style-type: none"><li>• Will LNG export projects from US and Australia be delayed?</li><li>• Will project cost continue to rise?</li><li>• How are projects being approved and, ultimately, financed?</li><li>• Can smaller scale / more flexible LNG facilities penetrate new markets?</li></ul>
<b>Future LNG demand</b>	<ul style="list-style-type: none"><li>• What are the economic fundamentals of LNG versus other fuels?</li><li>• How price sensitive is Chinese and Indian LNG demand?</li><li>• Will environmental regulations and risks affect the use of gas versus coal?</li></ul>
<b>Price</b>	<ul style="list-style-type: none"><li>• How does global gas supply and demand balance influence pricing and pricing paradigms in Asia?</li><li>• Who will capture the inter-regional rents on difference between HH and Asian LNG?</li><li>• What role could a trading hub play in Asia? Shanghai? Singapore?</li></ul>
<b>Stakeholders</b>	<ul style="list-style-type: none"><li>• Will governments allow tariffs to reflect the higher cost of gas?</li><li>• Will the power / gas sectors integrate more deeply?</li><li>• Can the power sector support long-term contracts from merchant markets?</li></ul>

# Contact us

---



For more information please contact us:

## **By email**

General Capabilities Inquiries  
[projects@lantaugroup.com](mailto:projects@lantaugroup.com)

Employment Opportunities  
[careers@lantaugroup.com](mailto:careers@lantaugroup.com)

Direct Communications  
[mthomas@lantaugroup.com](mailto:mthomas@lantaugroup.com)  
[sfairhurst@lantaugroup.com](mailto:sfairhurst@lantaugroup.com)  
[tparkinson@lantaugroup.com](mailto:tparkinson@lantaugroup.com)

## **By phone**

+852 2521 5501 (office)

## **By mail**

1902A Tower Two, Lippo Centre  
89 Queensway  
Admiralty, Hong Kong

## **Online**

[www.lantaugroup.com](http://www.lantaugroup.com)