5th IEF-IGU Ministerial Gas Forum

What JODI Gas Shows
Overview

1. **3+3** Challenges

2. **7** Observations on gas markets

3. What the JODI Gas Data Base Shows

4. **3** Proposals
3+3 Challenges IEF Dialogue help overcome

ECONOMIC GROWTH AND DEVELOPMENT
GLOBAL ARENA
CLIMATE CHANGE ENVIRONMENT
TRANSITION TO GREATER SUSTAINABILITY
REDUCE EMISSIONS AND WASTE
WORLD OF ENERGY
UNIVERSAL ACCESS TO CLEAN ENERGY
MODERATE ENERGY MARKET VOLATILITY
7 Observations on gas markets

1. Gas demand will continue to grow to 2040, especially in Asia growth markets

2. LNG trade and new price signals create a global gas market

3. Abundant gas supplies show reduction in LNG investment

4. Lower spot prices mean higher longer term prices will remain subject to renegotiation

5. Traditional contract clauses on price indexation, destination, nomination and others are eased

6. US exports reduce Asian prices due to hub indexed prices and geography; panama canal

7. Gas is likely to play a larger role for longer in keeping up with future global energy demand
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Producers see gas take the largest share of demand

World Primary Energy Demand Shares Outlook Reference Case to 2040

* Includes nuclear, hydro, biomass and other renewables

Data Source: OPEC World Oil Outlook November 2016
Consumers see more moderate natural gas growth
IEA and OPEC project annual gas growth from 1.5%-1.9% to 2.1% up to 2040

Data Sources: OPEC World Oil Outlook IEA World Energy Outlook November 2016
Asian Pacific gas trade is dominated by LNG

Asian Pacific Pipeline and LNG Import Volumes

BP Cedigaz Data 2011-2016
But growth has peaked and slowed

Asian Pacific Pipeline and LNG Import Volumes

BP Cedigaz Data 2011-2016, Indicative IEF trends lines
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Convergence show transferable prices across regions

Gas is commoditizing but prices continue to reflect regional characteristics

Regional Natural Gas Prices Trends

Source: World Bank Average Annual Commodity Prices to 2015, and Average Monthly Prices from January to October 2016
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Slow down in LNG investment recovers after 2020 with North America and Asia in lead

Sources 2016 Douglas Westwood World LNG Market Forecast 2017-2021
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Short-term LNG demand eased on reduced demand

Asian Short Term LNG Purchases

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LNG - pipeline interactions stage the future

Historical gas trade volumes by pipeline and LNG

Phase I

Phase II

Phase III

Newly Independent States

Financial Crisis

New Borders

New Players

Rising Hubs Liquidity/Price Re-negotiations

BP 2016 Cedigaz 2015 Data

Pipeine | LNG | Total
Chances for gas to deliver transition are historic
More dialogue and new approaches are needed

Net Tradable Volumes Across Key Regions by 2020

<table>
<thead>
<tr>
<th>Region</th>
<th>Deficit</th>
<th>Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>-273 bcm</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>-148 bcm</td>
<td></td>
</tr>
<tr>
<td>Asia Oceania</td>
<td>-78 bcm</td>
<td></td>
</tr>
<tr>
<td>Other Asia</td>
<td>-10 bcm</td>
<td></td>
</tr>
<tr>
<td>Latin America</td>
<td>-1 bcm</td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>51 bcm</td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>78 bcm</td>
<td></td>
</tr>
<tr>
<td>Middle East</td>
<td>128 bcm</td>
<td></td>
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<tr>
<td>Euro Asia</td>
<td>251 bcm</td>
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</tbody>
</table>

IEA 2015 Data
New sources, routes and price discovery mechanisms create more competitive Asian Market
## LNG project launches in Australia

<table>
<thead>
<tr>
<th>Project</th>
<th>Partners</th>
<th>Total Capacity bcm/y</th>
<th>Expenditure $billion</th>
<th>First Start up</th>
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</thead>
<tbody>
<tr>
<td>North West Shel Venture T 1-5</td>
<td>Woodside, BHP Billiton, BP, Chevron, Shell, MIMI</td>
<td>22</td>
<td>50</td>
<td>1989</td>
</tr>
<tr>
<td>Darwin LNG T1/2</td>
<td>ConocoPhillips, Inpex, Eni, Santos, Tokyo Electric, Tokyo Gas</td>
<td>5</td>
<td>1.5</td>
<td>2005</td>
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<tr>
<td>Pluto T1</td>
<td>Woodside, Kansai Electric, Tokyo Gas</td>
<td>5.8</td>
<td>15.3</td>
<td>2012</td>
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<tr>
<td>Arrow</td>
<td>Shell, Petro China</td>
<td>10.2</td>
<td>20</td>
<td>Cancelled in 2015</td>
</tr>
<tr>
<td>Browse FLNG</td>
<td>Wodside, Shell, BP, Japan LNG, PetroChina</td>
<td>n.a.</td>
<td>40</td>
<td>Cancelled 2016</td>
</tr>
<tr>
<td>Queensland Curtis LNG T1/T2</td>
<td>BG Group CNOOC, Tokyo Gas</td>
<td>11.5</td>
<td>23.7</td>
<td>2015</td>
</tr>
<tr>
<td>Gladstone LNG T1/2</td>
<td>Santos, Petronas, Total, Kogas</td>
<td>10.6</td>
<td>21.6</td>
<td>2015/2016</td>
</tr>
<tr>
<td>Australia Pacific LNG T1/T2</td>
<td>Origin ConocoPhillips, Sinopec</td>
<td>12.6</td>
<td>24.7</td>
<td>2015/2016</td>
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<tr>
<td>Wheatstone T1/2</td>
<td>Chevron, Apache, KUFPEC, Kyushu Electric Power Wheatstone</td>
<td>12</td>
<td>29</td>
<td>2016/2017</td>
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<tr>
<td>Gorgon T1-3</td>
<td>Chevron, ExxonMobil, Shell</td>
<td>20</td>
<td>54</td>
<td>March 2016-2017</td>
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<tr>
<td>Ichys T1/2</td>
<td>Inpex, Total</td>
<td>12.1</td>
<td>37</td>
<td>2017</td>
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<tr>
<td>Prelude FLNG</td>
<td>Shell, Inpex, KOGAS, CPC Corporation</td>
<td>4.7</td>
<td>13</td>
<td>2018</td>
</tr>
<tr>
<td><strong>Total Australian LNG Capacity and Expenditure</strong></td>
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<td><strong>116.3</strong></td>
<td><strong>269.8</strong></td>
<td><strong>Total Australian LNG Capacity and Expenditure</strong></td>
</tr>
</tbody>
</table>

Sources: The Australian Petroleum Production & Exploration Association and Individual Company Reports
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Gas can play a larger and longer role in Asia

Total Projected **Asian Gas Consumption** in High Growth Scenario

Source: Howard V. Rogers *Asian LNG Demand Key Drivers and Outlook*. Oxford Institute for Energy Studies NG 106, April 2016
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4. 3 Proposals
The US turned into an LNG exporter in March 2016 bringing a 2\textsuperscript{nd} wave to markets.
Russian gas production picks up from lows caused by weak domestic demand

Russia Natural Gas Production

MCM

40000

50000

60000

70000

Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Russian gas exports have recovered from 5 year lows reached in 2015

Russia Natural Gas Exports

MCM

Range 2011-2015
Avg 2011-2015
2015
2016
Algerian gas production grew steadily
Algerian pipeline exports have increased
Indonesian gas exports are in decline

Indonesia Natural Gas in Million m3 Exports

Jan2010 - Jan2016
Indonesian gas demand has fallen too
Chinese production remains robust despite economic rebalancing.
Australia LNG exports have taken off since October 2015 reaching new record levels.
Unlike Japan and Korea, Taiwan LNG imports remain robust at five year highs
Japanese LNG imports have slowed since April 2015
Korean LNG imports slowed as well at the lower end of the five year range.
Greater supply flexibility push Indian LNG imports beyond five year trend
Overview

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3 Proposals

1. JODI Gas already covers 90% of world gas demand and supply but data reporting timeliness, completeness and use must be improved.

2. Asia needs to move forward with the establishment of a transparent and effective functioning gas pricing hub.

3. A rolling energy dialogue on gas markets enables producers and consumers to improve prosperity in healthy energy markets.