Global gas markets, carbon pricing and the future of natural gas

Robert A. Ritz
Energy Policy Research Group (EPRG)
Judge Business School, University of Cambridge
r.ritz@jbs.cam.ac.uk

2nd International Conference on the Economics of Natural Gas Markets

Université Paris-Dauphine, 21 June 2019
Plan for this talk

① Gas demand, prices and competition

② Coal-to-gas switching in power generation

③ Political economy & carbon pricing

④ Strategic positioning
Gas demand is expected to grow steadily

- Growth driven by non-OECD Asia/China
- LNG trade to grow twice as fast

Projections and growth CAGRs

- EIA Intl Energy Outlook 2016 (2.2%)
- Shell LNG Outlook 2017 (2.0%)
- BP Statistical Reivew 2016 (1.8%)
- IEA Golden Age of Gas scenario – 2011 (1.8%)¹
- IEA - NPS 2016 (1.6%)²

Source: SNAM 2017 Global Gas Report
Forecasts too bullish given climate challenge?

- Gas demand likely **more robust** than coal or oil

<table>
<thead>
<tr>
<th>Energy (petajoules)</th>
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<tr>
<td>1980</td>
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<td>Coal 6 degrees</td>
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<td>Coal 4 degrees</td>
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<td>Coal 2 degrees</td>
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- How to secure **demand**? At which **prices**?

⇒ How much **new investment** in gas/LNG?

Source: Schroders (2018)
Regional price divergence is the historical norm

“Asian premium”:
- Most of last 20 years
- Imperfect competition + limits to arbitrage

Prices:
- **LNG Asia**: +36%
- **Henry Hub**: −20%

→ US LNG exports
→ Security of supply (LNG vs pipeline gas)

⇒ Global convergence to Henry Hub-based pricing?

Source: Calculations based on IMF data from January 2000 to April 2019
### Competition in global LNG: A changing market

**Balance of power:** Shift to gas buyers post-2014
- Global price decline (comparable to crude oil)

**LNG market structure:**

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2012</th>
<th>2017</th>
<th>2022</th>
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</thead>
<tbody>
<tr>
<td><strong>Seller HHI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(# players)</td>
<td>.102</td>
<td>.140</td>
<td>.136</td>
<td>↑? Further US &amp; AUS</td>
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<td></td>
<td>(14)</td>
<td>(18)</td>
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<td><strong>Buyer HHI</strong></td>
<td></td>
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<td>(# players)</td>
<td>.218</td>
<td>.180</td>
<td>.132</td>
<td>↓? Smaller Asian</td>
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<td></td>
<td>(18)</td>
<td>(27)</td>
<td>(39)</td>
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⇒ LNG sell-side now *more* concentrated than buy-side

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*Note: Herfindahl index (HHI) is a measure of market concentration, ranging from 1 (monopoly) to 0 (many small players)*

*Source: Calculations based on 2018 GIIGNL data*
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Coal-to-gas switching from a climate perspective

How much delay in adoption of near-zero carbon technologies (NZCT) is achieved by switching to gas?

**Parity ratio**: Allowable years of gas per year of coal generation avoided
- **Literature**: ≈ 2.4 years
- Coal plant replaced 15 years before otherwise replaced by NZCT
- Gas can operate for ≤ 36 years, helping climate

⇒ **“Bridge fuel”** buys 1.4 years per year of coal displaced

Source: Adapted from Hausfather (2015)
Thought experiment: Global coal-to-gas switch

**Q:** How much existing coal-fired power generation can be replaced with existing *unused* gas generation?

<table>
<thead>
<tr>
<th>Top 5</th>
<th>“Gas potential”</th>
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<tbody>
<tr>
<td>China</td>
<td>6%</td>
</tr>
<tr>
<td>US</td>
<td>47%</td>
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<tr>
<td>India</td>
<td>12%</td>
</tr>
<tr>
<td>Russia</td>
<td>37%</td>
</tr>
<tr>
<td>South Korea</td>
<td>35%</td>
</tr>
</tbody>
</table>

- **European countries:** mostly >100% potential
- **Zero potential:** Japan, Mexico, Poland, Kazakhstan

**A:** Global switching potential ~20% with *existing* assets

⇒ Annual global carbon emissions fall by ~1 GtCO₂

- **Social value:** ~$50+ billion per year

Source: Grant Wilson & Staffell (2018), 2015 data
Potential for coal-to-gas switching in power

Current gas capacity could completely displace coal

Insufficient gas capacity available to switch coal to gas

Source: Grant Wilson & Staffell (2018)
Potential for coal-to-gas switching in power

Source: Grant Wilson & Staffell (2018)

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Potential for coal-to-gas switching in power

Source: Grant Wilson & Staffell (2018)

Current gas capacity could completely displace coal

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Potential additional gas generation (TWh)

Annual generation from coal (TWh)
Potential for coal-to-gas switching in power

Source: Grant Wilson & Staffell (2018)

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UK: Decline of coal-fired generation

- Coal share from 41% (2013) to 6% (2018)

⇒ Policy: Coal phase-out by 2025

Source: Chyong, Guo & Newbery (2019)
UK: Carbon price floor supports gas switch

Carbon Price Support (CPS)
- EU ETS price + £18/tCO₂
- Tax revenue = ~€1bn per year

Direct policy impacts
- Efficient CCGTs run baseload
- 15% point shift from coal to gas
- Emissions reduction: 26.1m tCO₂ over 2013-2016 (-6.2%)
- Abatement cost: ~€18-30/tCO₂

Cross-border effects
- More imports into GB
- Higher power prices in FR & NL
- Impact on global emissions?

Source: Abrell, Kosch & Rausch (2019)

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India: Gas catch-up & optimistic forecasts

- Gas has had **take-off in China**, so is India next?

- **LNG import** forecasts have been bullish…

Source: SNAM 2018 Global Gas Report

Source: IEA 2015 India Energy Outlook
India: Gas squeezed by coal & solar

No clear role for gas/LNG

- Not cost-competitive vs domestic coal
- Limited policy support
  - No carbon pricing
  - Infrastructure constraints

Skipping gas? Coal to RE

- Ambitious 175 GW target for 2022 (esp. solar)
- Large cost reductions & low auction prices

Source: International Institute for Strategic Studies (IISS) & Vivid Economics
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Gas industry *itself* is in the midst of a transition

**Strategic repositioning** around natural gas:

① **Energy majors**: oil → gas/LNG & power/RE  
② **Electricity companies**: coal/gas → RE  
③ **Commodity traders**: oil → LNG  
④ **Private equity**: → “legacy” coal/gas assets  
⑤ **New players**: → LNG export, gas E&P

⇒ Trend to *large integrated* or *niche specialist*?
Conclusions

① Significant downside risk in gas demand forecasts due to climate-related uncertainties

② Global gas prices: regional price convergence unlikely to be permanent

③ Still huge global potential for coal-to-gas switching in power generation

④ Local political economy for gas/LNG in non-OECD (Asia) very different from OECD (Europe)

⑤ Ongoing strategic repositioning reflects companies’ different visions of the future
Abrell, Jan, Mirjam Kosch & Sebastian Rausch (2019). How effective was the UK carbon tax? A machine learning approach to policy evaluation. Working paper at ETH Zurich, April 2019


