Asia-Pacific LNG model

Strategic Behavior in Global LNG Markets: Outlook for the Asia-Pacific Region

Philipp Feister

(philippfeister@gmx.de)

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1) Introduction
2) Model approach
3) Base case results
4) Scenario results
5) Conclusion
1 Global LNG trade and Europe


Source: Own research
1 Differences in gas price indexation
1 Plummeting natural gas prices

Natural gas prices
$ per million Btu

Source: Financial Times (14 March 2016)
Objective

- Interaction of long-term and spot trade (prices and trade flows)
- Equilibrium model based on (strict) Cournot oligopoly

Model Approach

- Interpretation and calculation via GAMS
- Isolated, fundamental model with 19 + 8 + 2 nodes

NOT included:
- Domestic gas markets
- Storage
- Investment decisions
## 2 Model Approach

### Input data
- Liquefaction terminal capacities
- Regasification terminal capacities
- Liquefaction and regasification costs
- Production costs
- Production capacities
- Market power of suppliers
- Demand forecast
- Monthly demand profile
- Demand elasticity
- Shipping routes (distances, canal crossing)
- Distance-related transport costs (fuel, boil-off), vessel charter rates and canal fees
- Vessel capacities of market participants and independent shipping companies for chartering
- Volumes and schedule
- Contract specifications (Take-or-pay obligation, pricing)
- Index price forecast (Oil and gas hub prices)

### Optimization
- Mixed-Complementarity Programming (MCP)
  - Objective:
    - Spatial and intertemporal optimization with demand and infrastructure constraints
    - I. Profit maximization of LNG suppliers
    - II. Cost-minimal transport
  - Time frame:
    - 2014 – 2025 yearly with monthly granularity (no multi-year interdependencies)

### Results
- Export and import of countries
- Intra-/interregional supply dynamics
- Import dependency
- Spot trade prices
- Average import prices
- Switch in preference of spot market and contract based LNG volumes
- Utilization of liquefaction and production facilities
- Regasification terminals
- LNG carriers

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#### Flows
- Export and import of countries
- Intra-/interregional supply dynamics
- Import dependency

#### Prices
- Spot trade prices
- Average import prices
- Switch in preference of spot market and contract based LNG volumes

#### Infrastructure utilization
- Utilization of liquefaction and production facilities
- Regasification terminals
- LNG carriers
2 Implementation of long-term contracts

Max. quantity under contract
Monthly average take-or-pay
Min. take-or-pay quantity

LNG trade from Nigeria to Europe [bcm]

CONTRACTED BUT NOT TAKEN
SPOT
MFLEX
MTOP

Jan 15 Feb 15 Mrz 15 Apr 15 Mai 15 Jun 15 Jul 15 Aug 15 Sep 15 Okt 15 Nov 15 Dez 15
3 Calibration (2015)
3 (Continuous) decline of LNG spot prices 2016-18

Base Case

Source: FGE (2015)
Japanese nuclear power comeback (10 reactors within 18 months)
Japanese nuclear power comeback (10 reactors within 18 months)

4 Japanese nuclear restart shifts spot trade flows

- Increasing trade flow
- Declining trade flow
- Canal
- Exporter
- Net Importer

AU → KR +2.1 bcm
AU → CN +5.4 bcm
AU → JP -10.2 bcm
5 Conclusion

Results

• LNG supply glut and highly uncertain demand
• Spot market becomes more established
• Coal (<2$/MMBtu) remains the strongest competitor of LNG in Asia

Further research

• Continuous calibration process (Conjectural variation, contract data)
• Improve contract approach (consider re-negotiations of expiring contracts)
• “Crude-oil vs. LNG” price sensitivity of model results
• Extend objectives by strategic behavior of shipowners