Changes in the Global Gas Market in the Context of Korea's Natural Gas Supply and Demand

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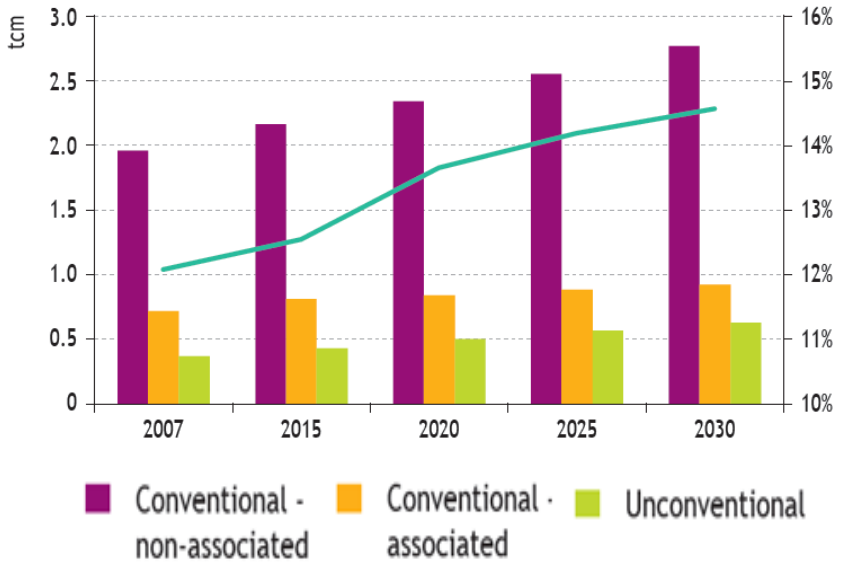
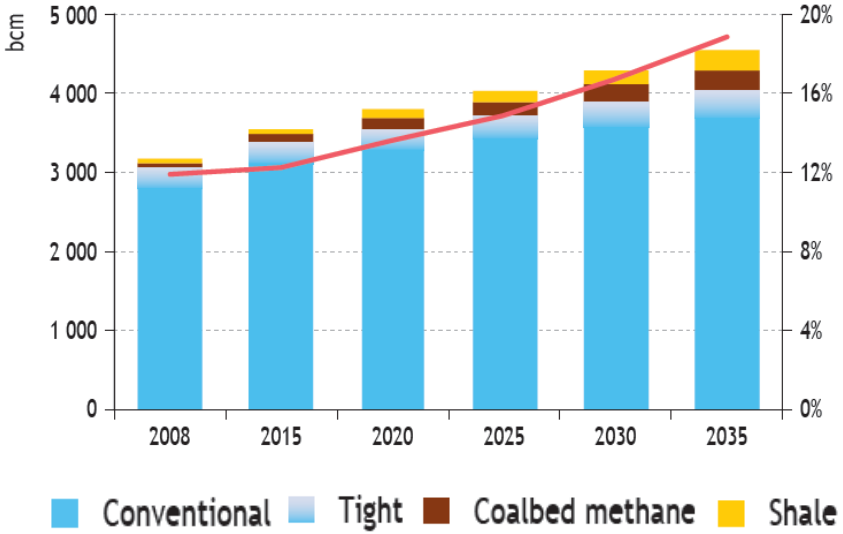
Introduction

- Global Changes
  - Unconventional Gas
  - Japan Earthquake and Tsunami
  - Liquefaction Cost Rises

World Gas Production under IEA's Reference Scenario (2009)



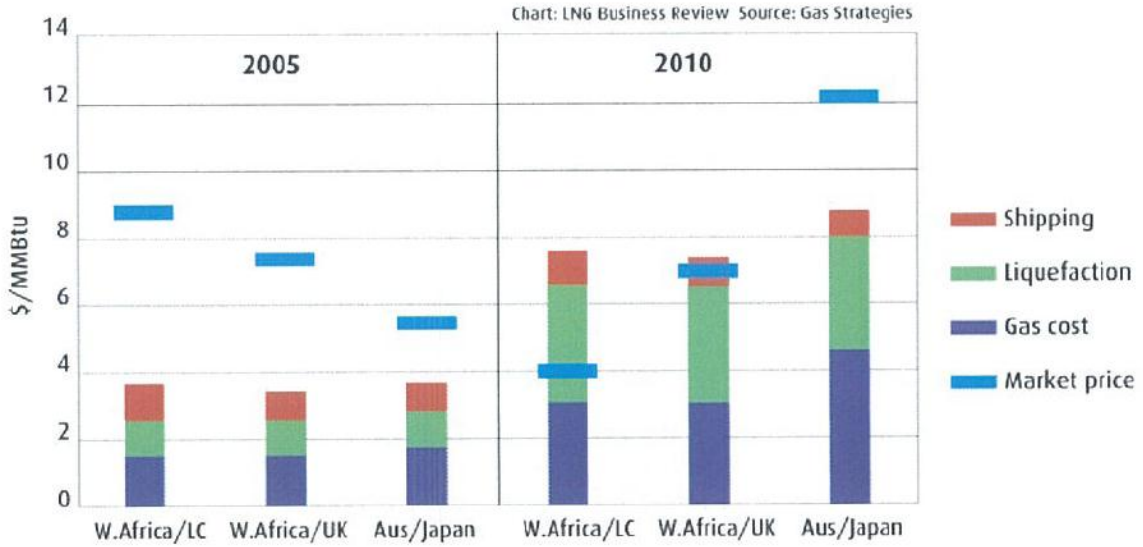
World Gas Production under IEA's New Policies Scenario (2010)



Source: IEA, *World Energy Outlook 2009, 2010*

Introduction

- Shift of Profitability



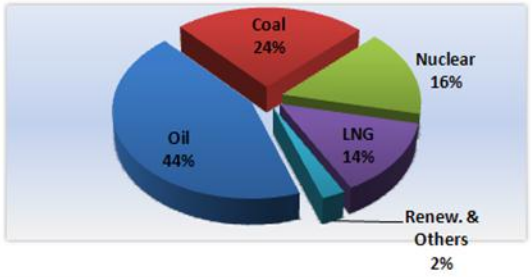
	Oil	HH	NBP	LNG Costs	New Japan LNG Price
2005	$54/bbl	$8.8/MMBtu	$7.4/MMBtu	$300/tpa	10% JCC
2010	$84/bbl	$4/MMBtu	$7/MMBtu	$1,000/tpa	14% JNN

Source: *LNG Business Review*, March 2011

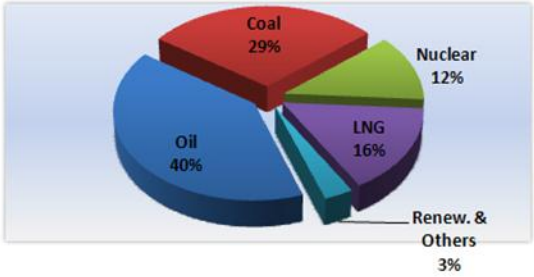
Korean Context

- Status of Natural Gas
  - Long-term Energy Mix in the 1st National Basic Energy Plan (2008)
    - To reduce use of fossil fuels to decrease GHS
    - Reality seems to have been away from the planned trajectory.
    - Coal ↑, nuclear ↓, natural gas ↑
    - As NRE is used more, natural gas demand is likely to increase.

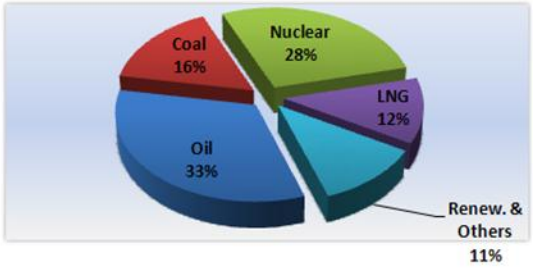
2006



2010



2030



Korean Context

Status of Natural Gas

The5th Basic Electricity Supply and Demand Plan (2010)

- Capacity (MW)

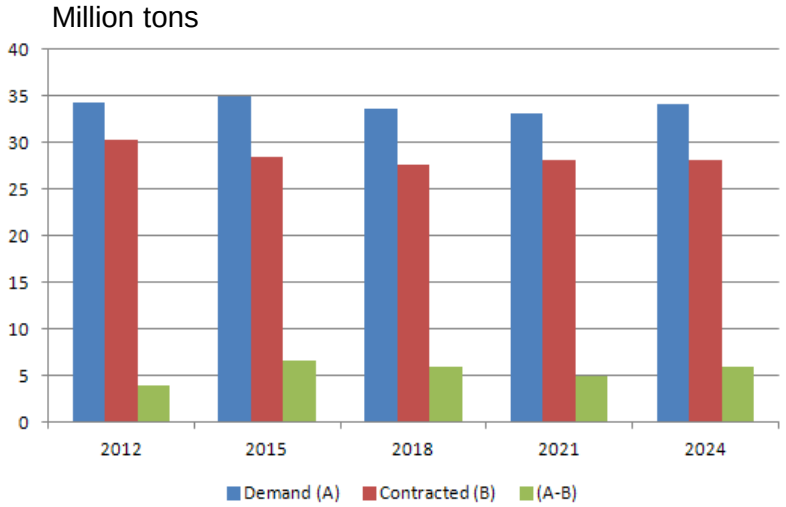
	Nuclear	Bitum.	Anthra.	LNG	Oil	Pumped Storag	NRE	District Heating	Total
2010	18,716 (24.82%)	23,080 (31.97%)	1,125 (1.56%)	17,850 (24.73%)	5,368 (7.44%)	3,900 (5.40%)	1,891 (2.62%)	1,255 (1.74%)	72,185 (100%)
2024	35,916 (31.90%)	30,320 (26.93%)	1,125 (1.00%)	23,517 (20.89%)	4,108 (3.65%)	4,700 (4.17%)	8,061 (7.16%)	4,846 (4.30%)	112,593 (100%)

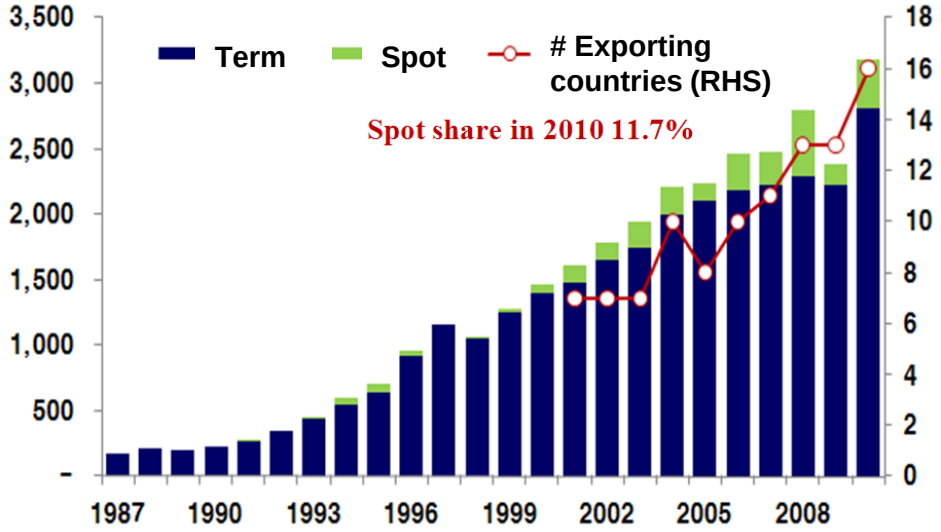
- Generation (GWh)

	Nuclear	Coal	LNG	Oil	Pumped Storage	NRE	Total
2010	144,856 (31.4%)	193,476 (41.9%)	100,690 (21.8%)	14,693 (3.2%)	2,084 (0.5%)	5,949 (1.3%)	461,747 (100%)
2024	295,399 (48.5%)	188,411 (31%)	59,201 (9.7%)	2,912 (0.5%)	8,202 (1.3%)	54,467 (8.9%)	608,591 (100%)

Korean Context

- Demand Outlook and Import Requirements



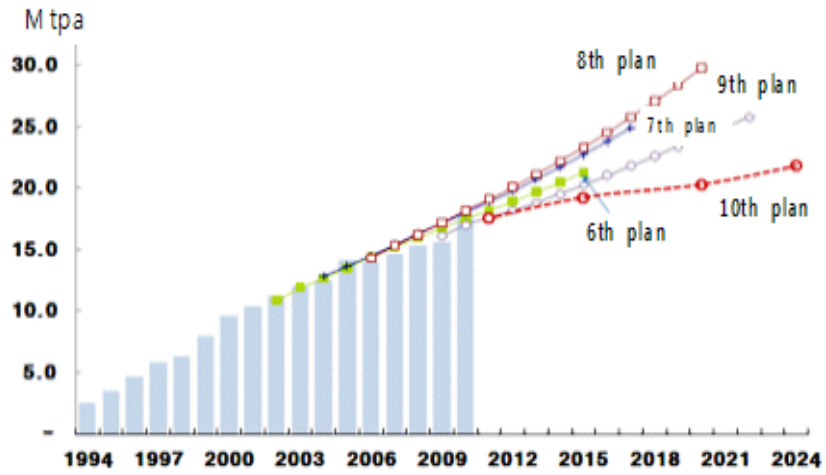


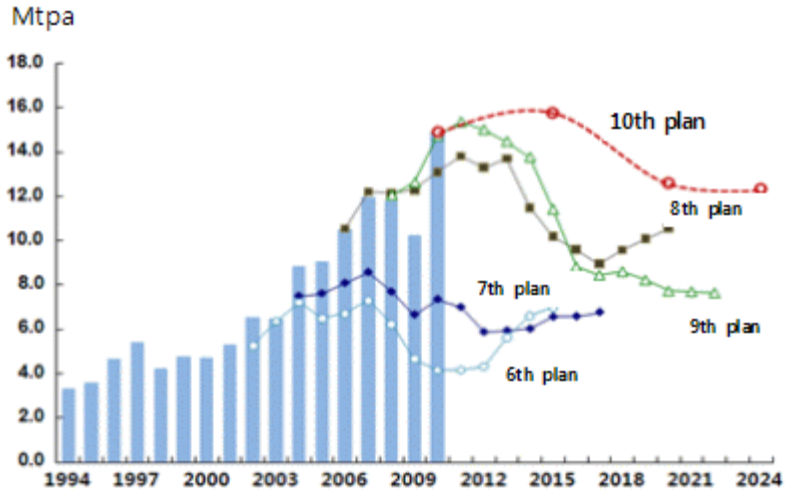
* Demand is based on the 10th Long-term Natural Gas Supply and Demand Plan.

- After 2015, more than 6Mtpa import requirements expected.
  - No big difficulties not anticipated, considering 10%～20% share of spot and short-term volumes
- In addition to 0.7Mtpa (DSLNG) and 3.5Mtpa (GLNG), MKE recently approved two import contracts from Shell (3.64Mtpa) and Total (2Mtpa).

Korean Context

- Uncertain Gas Demand for Power

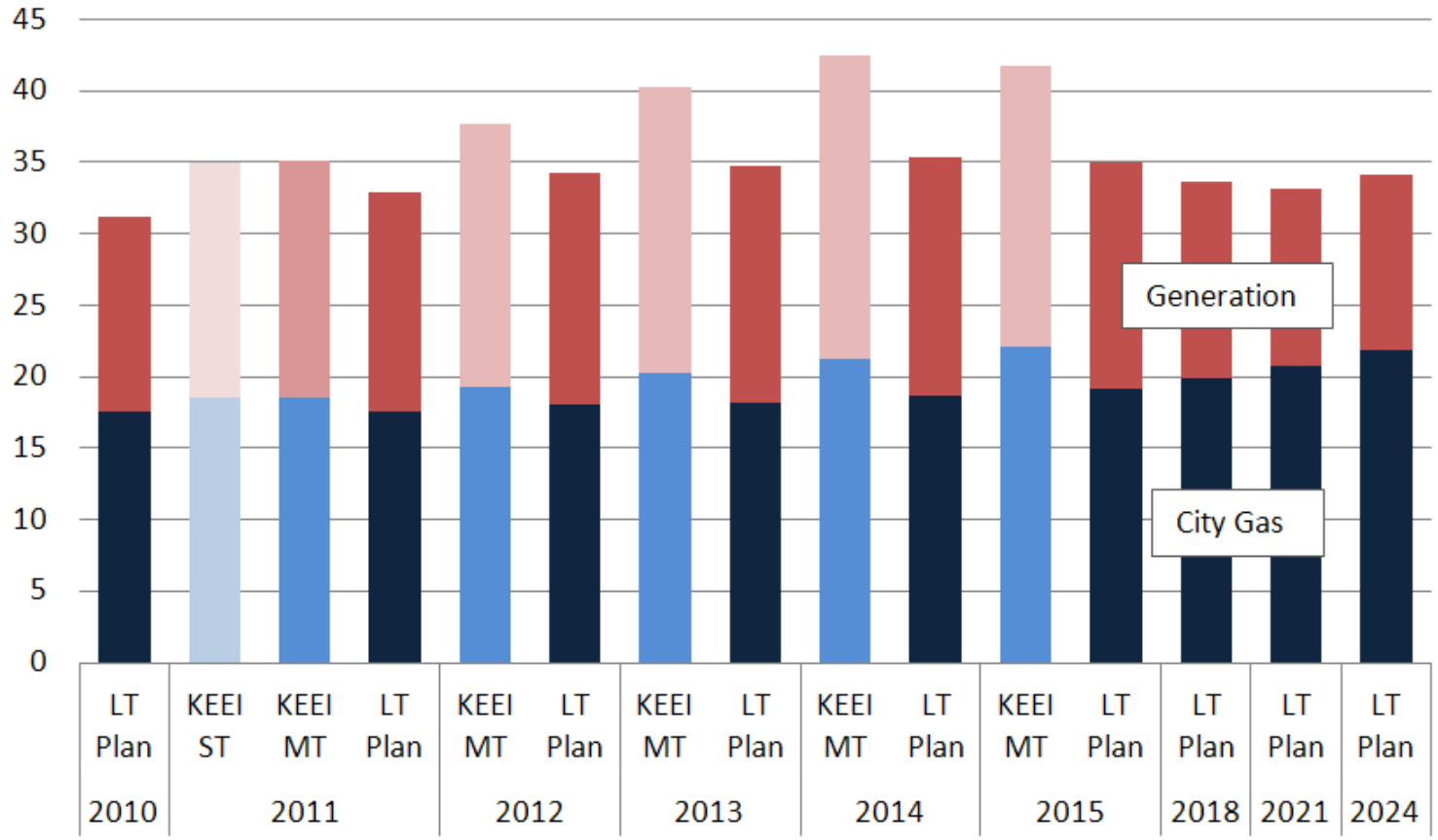




  - City gas
    - Relatively stable demand growth and relatively minor revisions
  - Power generation
    - Tends to show big jumps between plans
    - Large increases in short to medium term and large decreases later
    - New trend for the capacity of a unit gas-fired power plant to get larger
    - Increases of NRE needs back-up plants, which may in turn increase uncertainties of fossil fuel consumption.

Korean Context

- Demand Outlook Comparison



Korean Context

- Russian Gas Imports

- 10bcm after 2017 via 1,100km pipeline from Vladivostock to Pyeongtaek and Incheon through North Korean territory
  - 150km in Russia
  - Over 700km through North Korea
  - Over 200km in South Korea
- Substantial amount of transport cost saving compared with LNG
- Benefits for all three countries involved
  - Russia : Development of East Siberia and Far Eastern Russia through natural gas production and exports. Market expansion toward the Asia-Pacific
  - North Korea : Revenue from transit fee, economic development through natural gas consumption and related infrastructures
  - South Korea : Diversification of import sources of natural gas and savings in transport costs

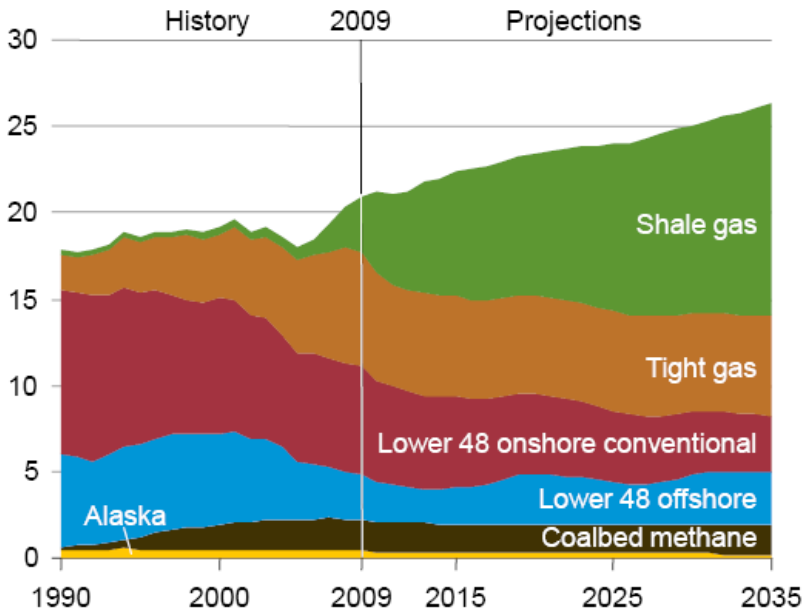
Korean Context

- A Few Issues
  - Firm Supply to All Customers
  - KOGAS, the only wholesale supplier, must meet all demands except a few self-importers.
  - Incentive regarding Off-take Agreement
    - Off-take agreement scheme between KOGAS and LDCs and between KOGAS and power generators
    - Penalties were included in the generation costs in the past. KEPCO, as the sole buyer of wholesale electricity, compensates for the penalties as part of power purchase costs presently.

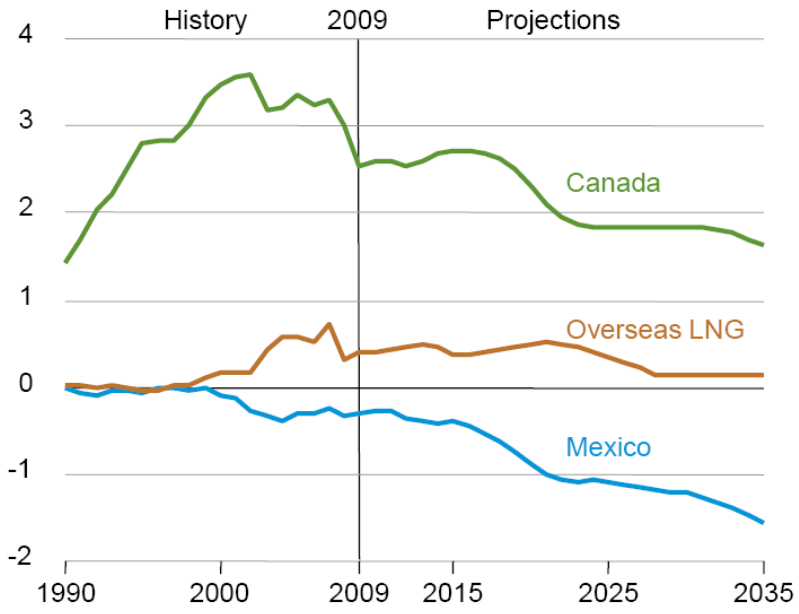
    ⇒ Lack of incentive to optimize between cost (penalty) and off-take
  - Low electricity price raises demand for electric heating demand, increasing gas demand in winter.
  - New trend of demand for higher delivery pressure from generators

Global Changes

- Shale Gas
  - U.S. Unconventional Gas Production (tcf)



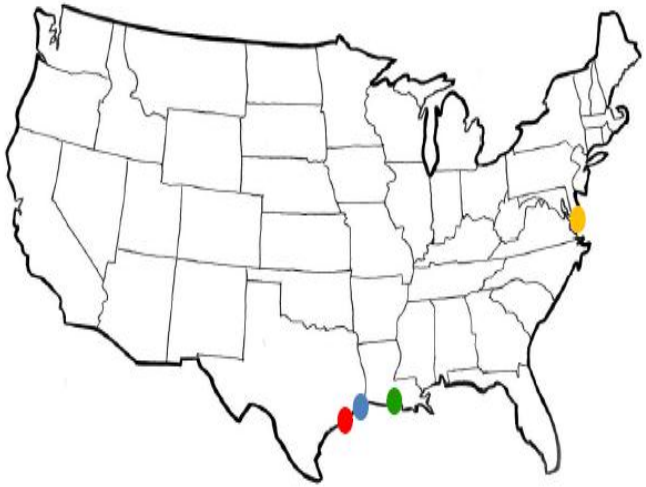
  - Net Import Demand of U.S. (tcf)



Source: EIA, *AEO 2011*

Global Changes

- U.S. Re-exports of LNG
  - Low domestic price of natural gas resulting in re-export of imported LNG
  - 34.5 bcf(720 thousand tons) re-exported in 2010, while only one cargo (2.7bcf) re-exported in 2009
  - 12 cargoes (34.4 bcf) re-exported by July 2011, including two to Korea
  - Prices of re-export volumes tend to be lower than other LNG markets.
    - FOB prices in 2011 are in the range of $6.95~$7.90/MMBtu except for one to India ($9.05/MMBtu) in May and for another to Brazil ($12.05/MMBtu) in July.
- U.S. Export Projects of LNG
  - Sabine Pass (16Mtpa): Approved for bi-directional LNG facilities by DOE. Waiting for approval of environmental impact assessment from FERC
  - Freeport (9Mtpa), Cove Point (8Mtpa), Lake Charles (15Mtpa) filed for similar plans to DOE.
  - A minimum of 7.5 Mtpa could potentially be exported by 2020 (FGE, Sep 2011).

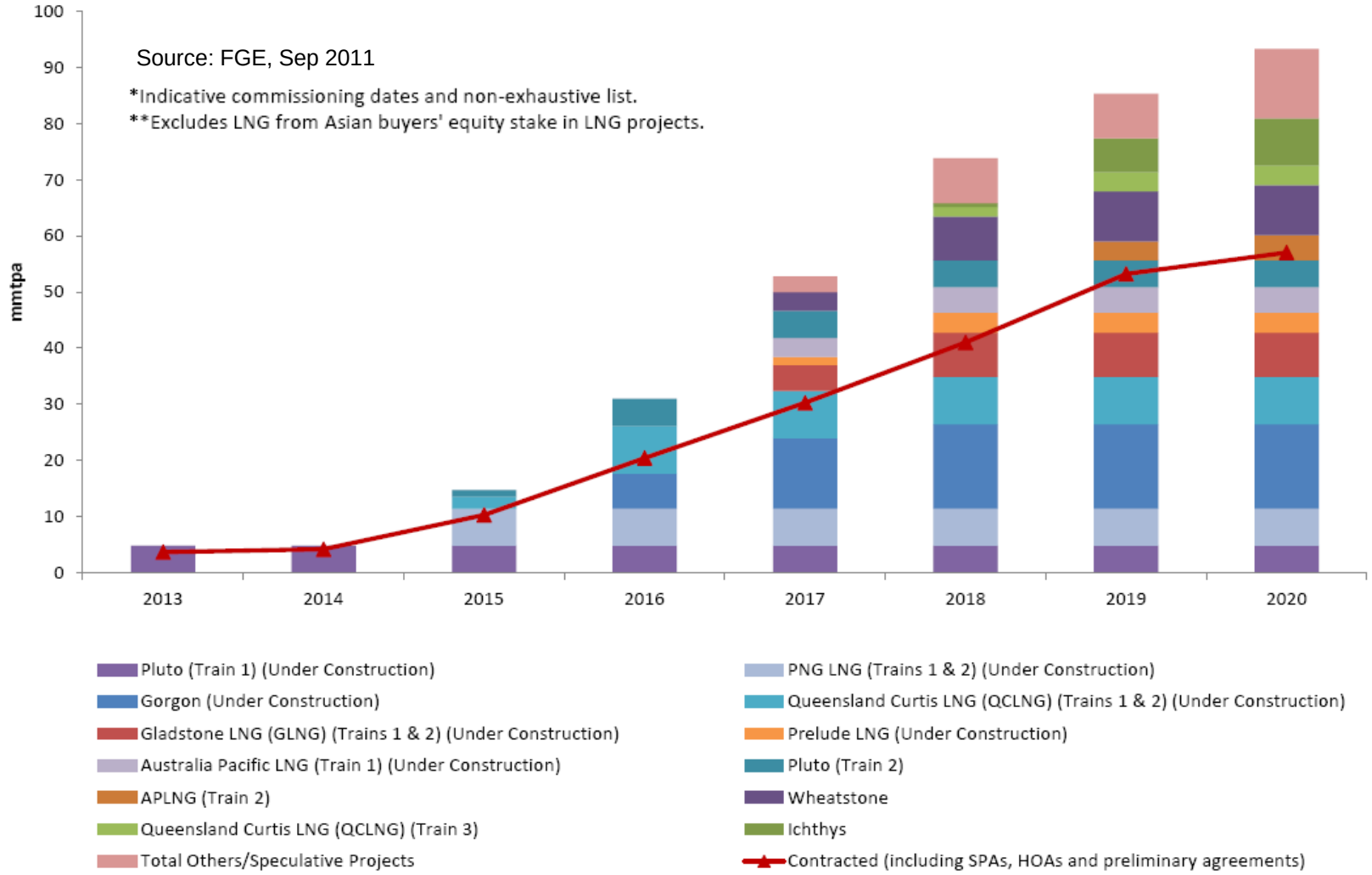


Global Changes

- Good News and Bad News from U.S.
  - Good News
    - Potential large supplier of LNG in the Pacific with 48Mtpa capacity
    - When Panama Canal expanded by 2014, transport costs could go down.
    - More flexible terms of trade for Asian buyers linked to oil price
    - To weaken the power of GECF
  - Bad News
    - Pros and cons around LNG exports
    - Uncertain export destination (good for countries with U.S. FTAs)
    - National supply security clause: problem for long-term buyers
    - Environmental issues surrounding shale gas
      - Fracking banned in New York while its effects are considered
      - Potential $160,000 “impact fee” on each well drilled and doubled penalties for contamination proposed in Pennsylvania
    - Shale gas “reserve” issue, e.g., land access, speed of development/ production
    - Financial crisis and double dip recession may cause financing difficulties.

Global Changes

- A Massive Wave of Australian LNG Projects



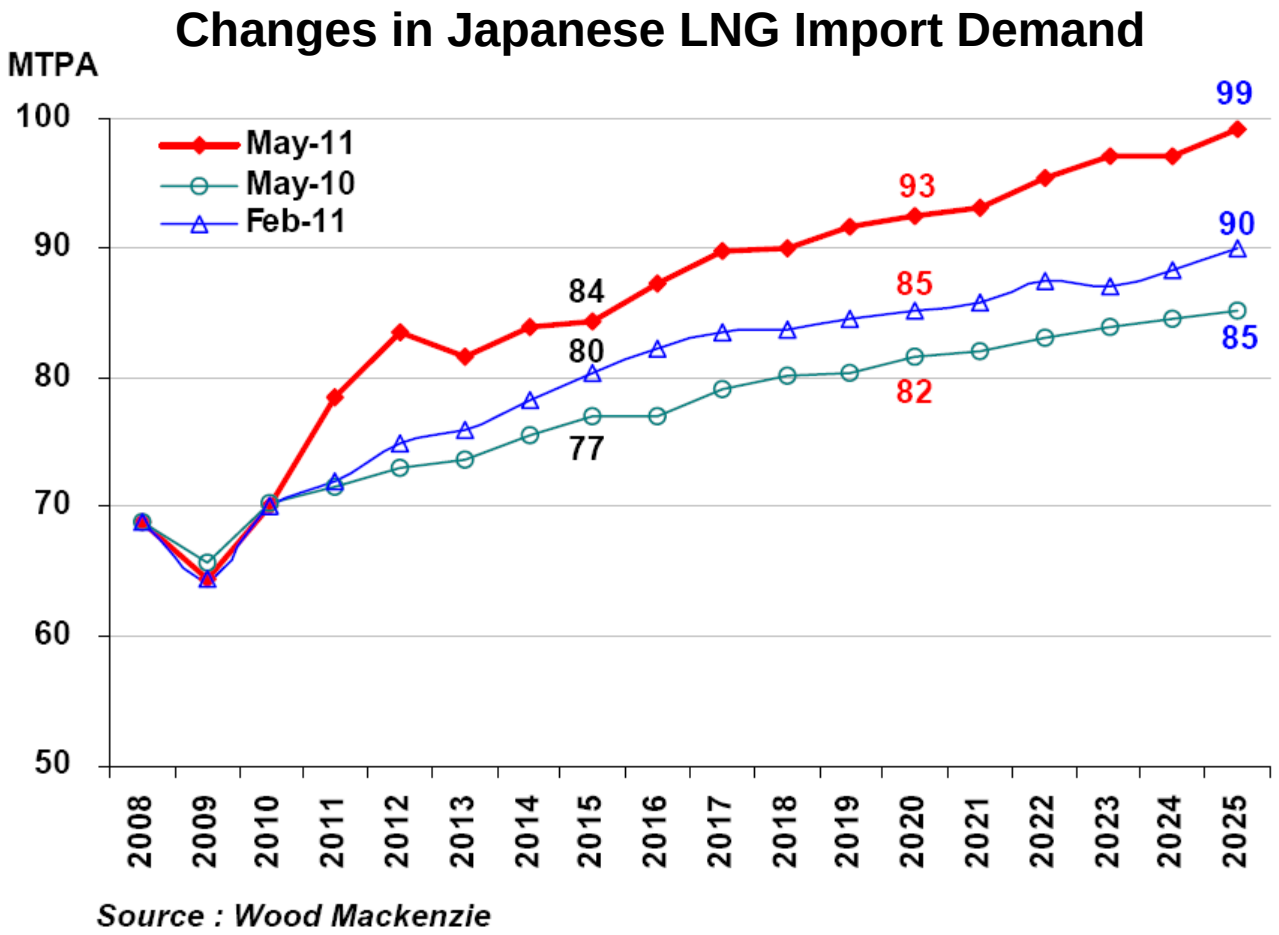
Global Changes

- Risks of Australian LNG Projects
  - Gas reserves
  - Skilled labor
  - Infrastructure
  - Unproven technology
  - Fiscal: carbon tax, extended petroleum rent tax
  - Environmental regulations
  - Political: domestic use vs. export, local content, native title (esp. APLNG)

  ⇒ Possible (some say “inevitable”) delays of project start-up

Global Changes

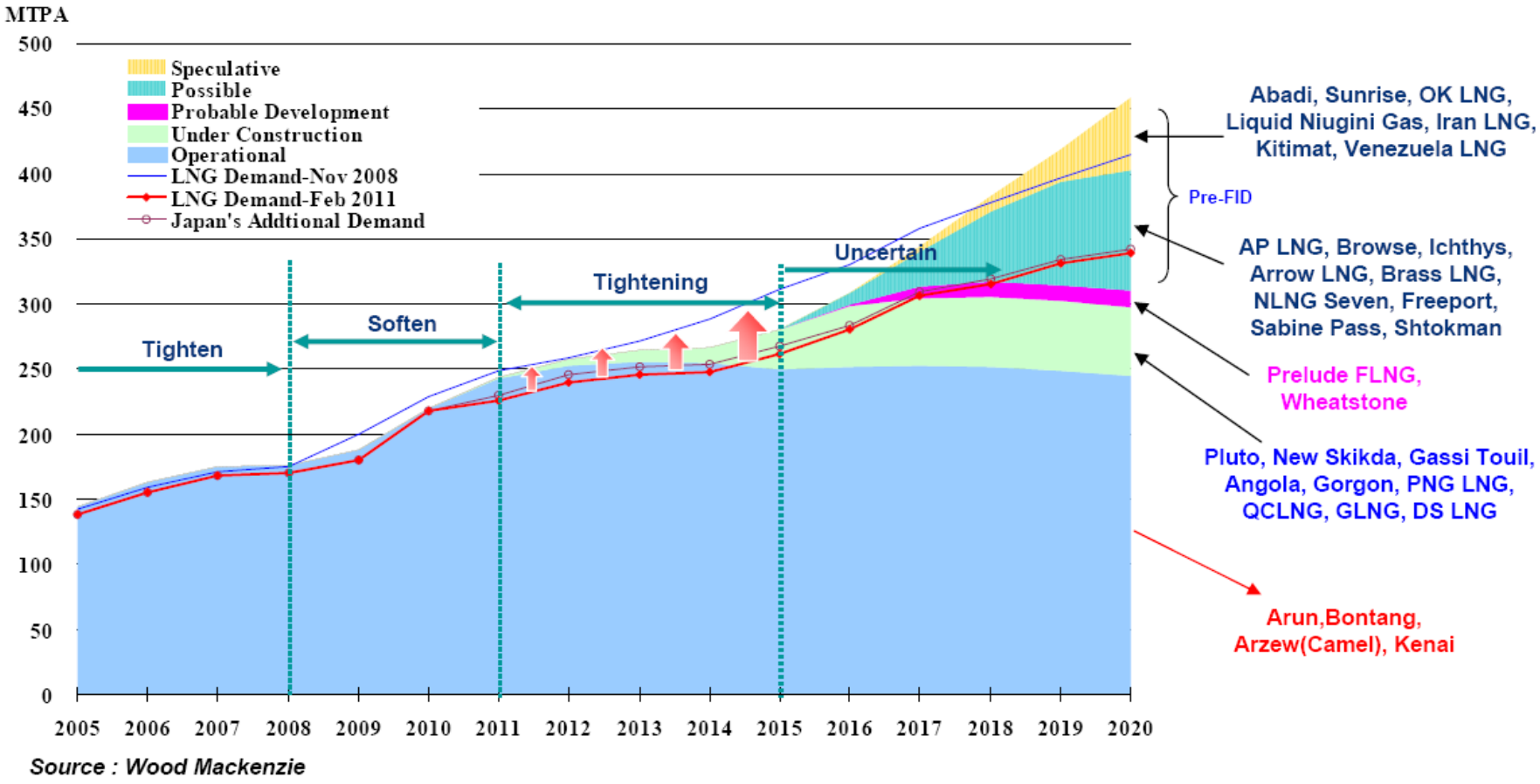
- Impact of Japan Earthquake and Tsunami



Source : Wood Mackenzie

Global Changes

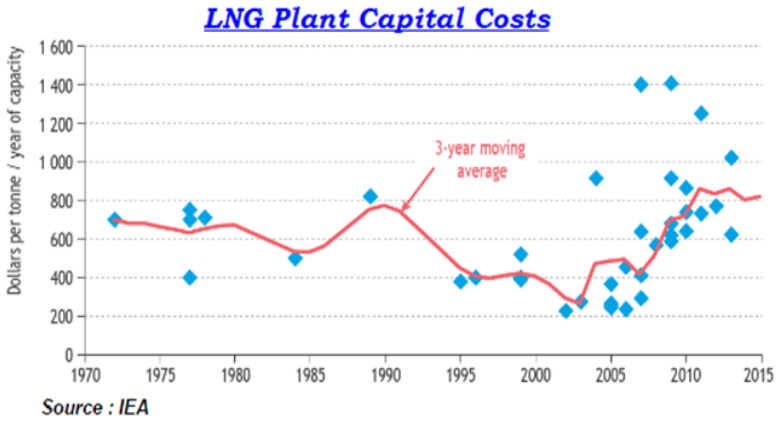
- Outlook of LNG Supply and Demand



Source : Wood Mackenzie

Global Changes

- Liquefaction Cost Rises



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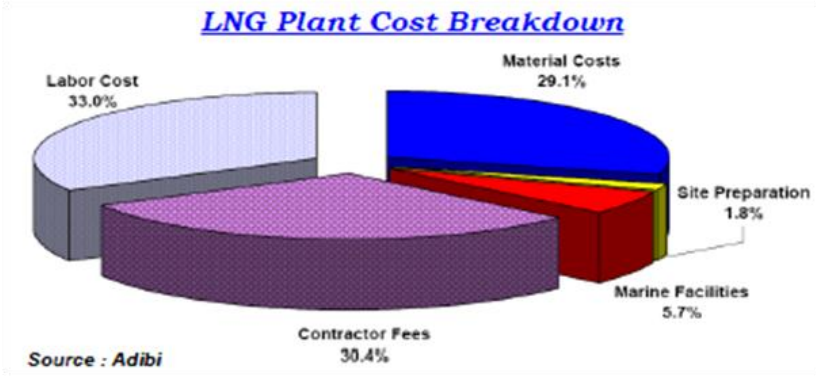

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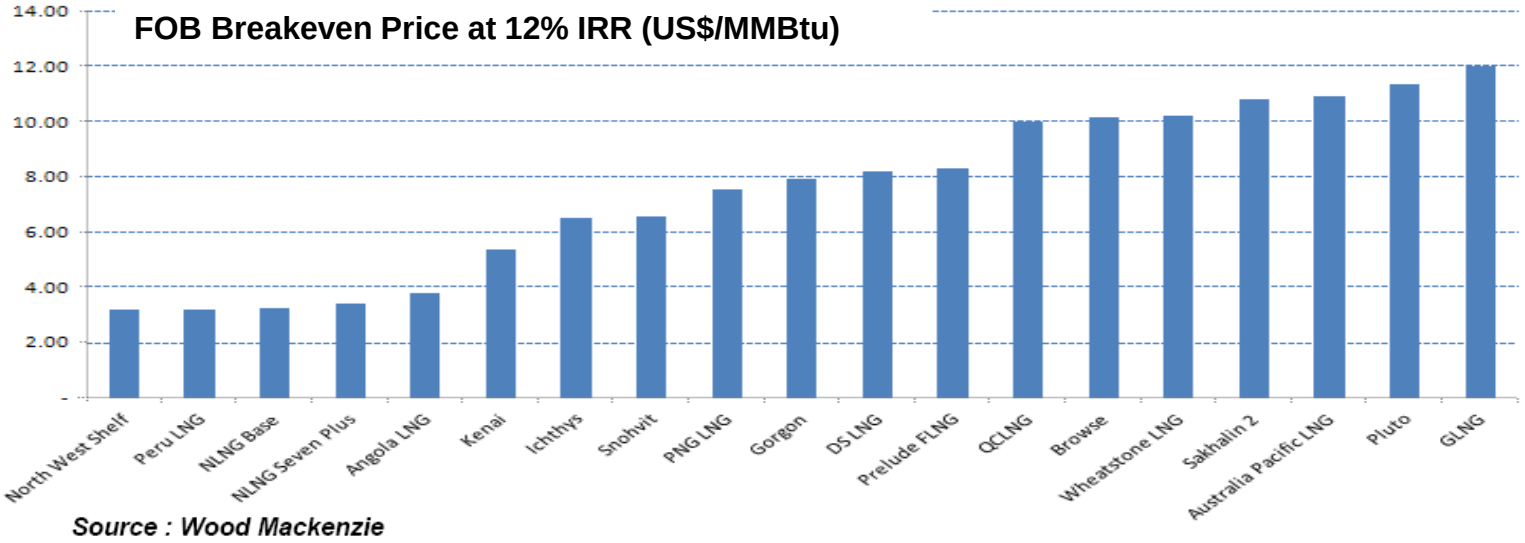

Source : Wood Mackenzie

Implications and Conclusion

- External Uncertainties
  - LNG Supply
    - Possible Delays of Imports from Australia

    ⇒ Bridging volumes to go out of the market
    - U.S. Exports of LNG may take long and may not cover base loads.
  - Risks Surrounding Russian Gas
    - Uncertain start-up date may trouble MKE and KOGAS with timing and volume of term LNG import contracts.
    - North Korean transit-related risk allocation and terms of trade
    - Will price of pipeline gas follow that of LNG?
  - LNG Demand
    - Nuclear policy of Japan and others
    - Recovery from financial crisis

Implications and Conclusion

- Domestic Uncertainty
  - Base-load power plants to come on line as planned
  - NRE back-up capacity requirements
  - Electricity price to reduce winter peak demand
  - Load management issues arising from Russian gas
    - Addition of bulk of base-load volume will push out the same volume of LNG to intermediate and peak loads
    - Pipeline gas interruption and LNG replacement
    - How to allocate the gas to different uses at what prices?
    - Implications for LNG demand growth across end-uses
- Getting over 2015~2017 period is a big homework to Korea.

Thank you.