



# The Shale Revolution and Energy Security

November 18<sup>th</sup>, 2013

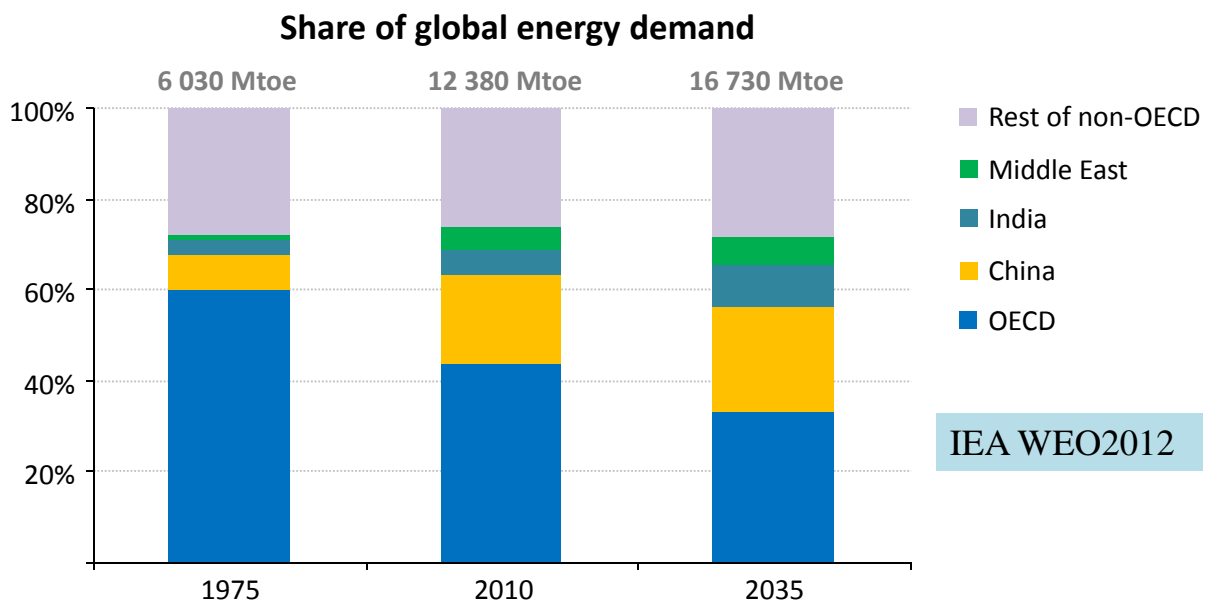
Niigata

Nobuo TANAKA

Former Executive Director of the IEA

Global Associate of Energy Security and Sustainability, IEEJ

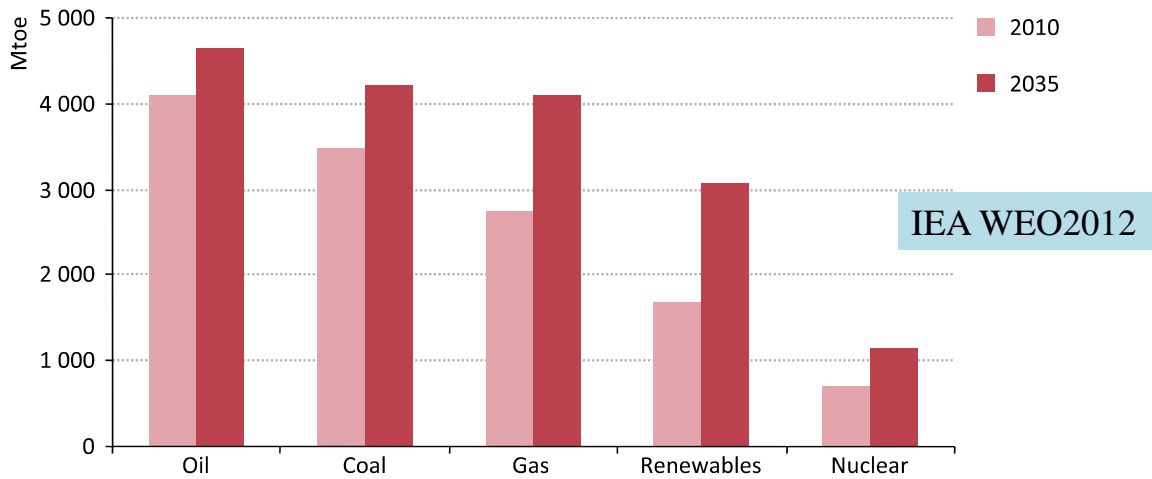
## Emerging economies steer energy markets



**Global energy demand rises by over one-third in the period to 2035, underpinned by rising living standards in China, India & the Middle East**

# We will still be in the Fossil Fuel economy.

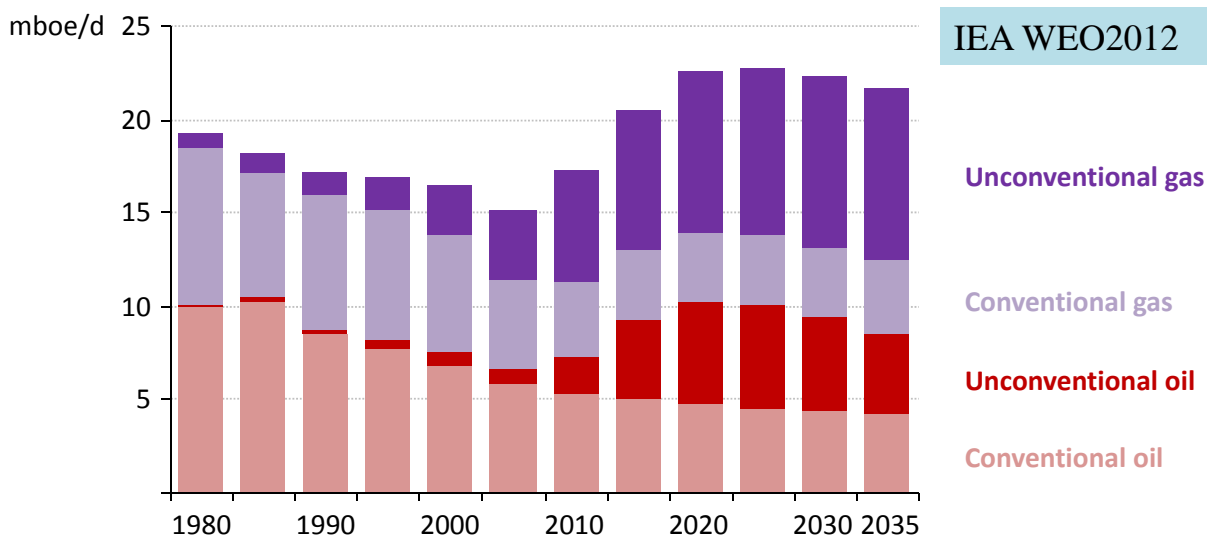
**Figure 2.3** ▶ World primary energy demand by fuel in the New Policies Scenario



Renewables increases by 80%, Nuclear by 60%. But Fossil Fuels continue to be major sources of energy, though their share drops from 81% to 75% in 2035.

# A United States oil & gas transformation

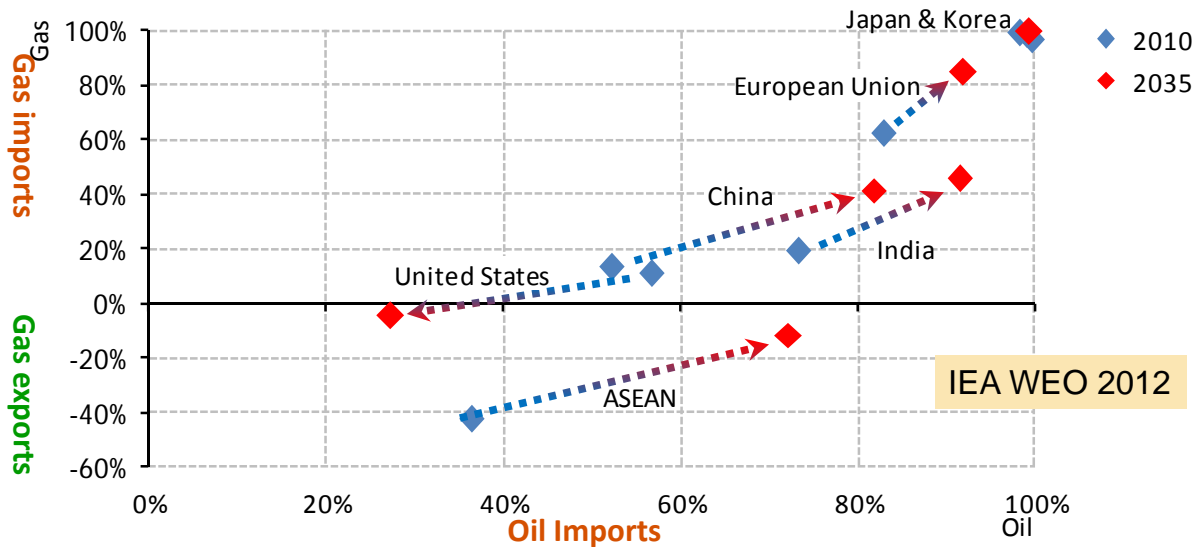
US oil and gas production



*The surge in unconventional oil & gas production has implications well beyond the United States*

# Different trends in oil & gas import ; US is a single winner.

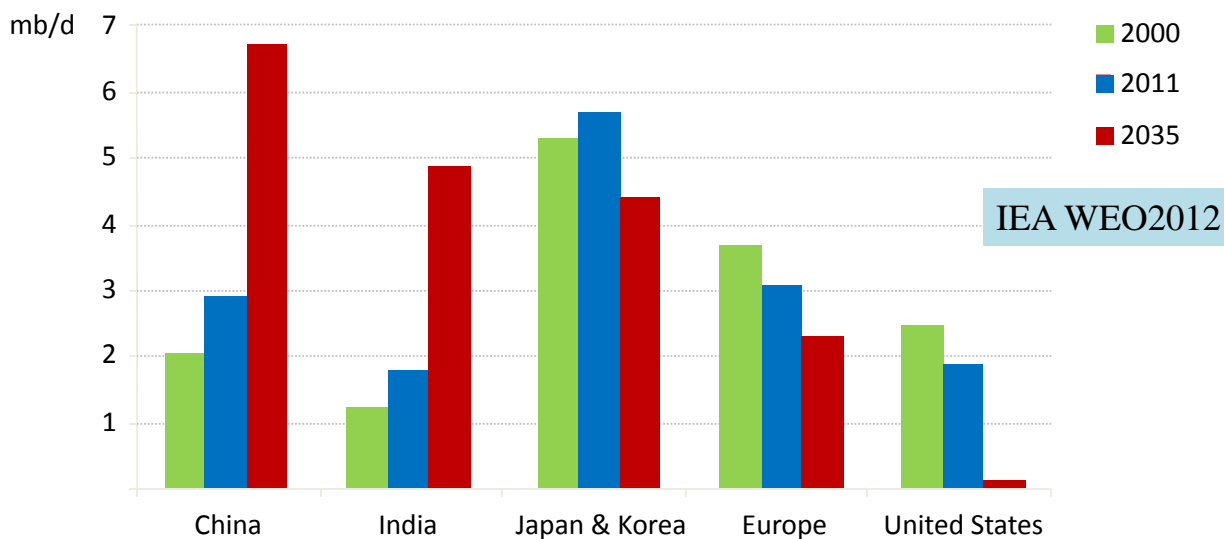
Net oil & gas import dependency in selected countries



*While dependence on imported oil & gas rises in many countries, the United States swims against the tide*

# North American Energy Independence and Middle East oil to Asia: a new Energy Silk Road

Middle East oil export by destination



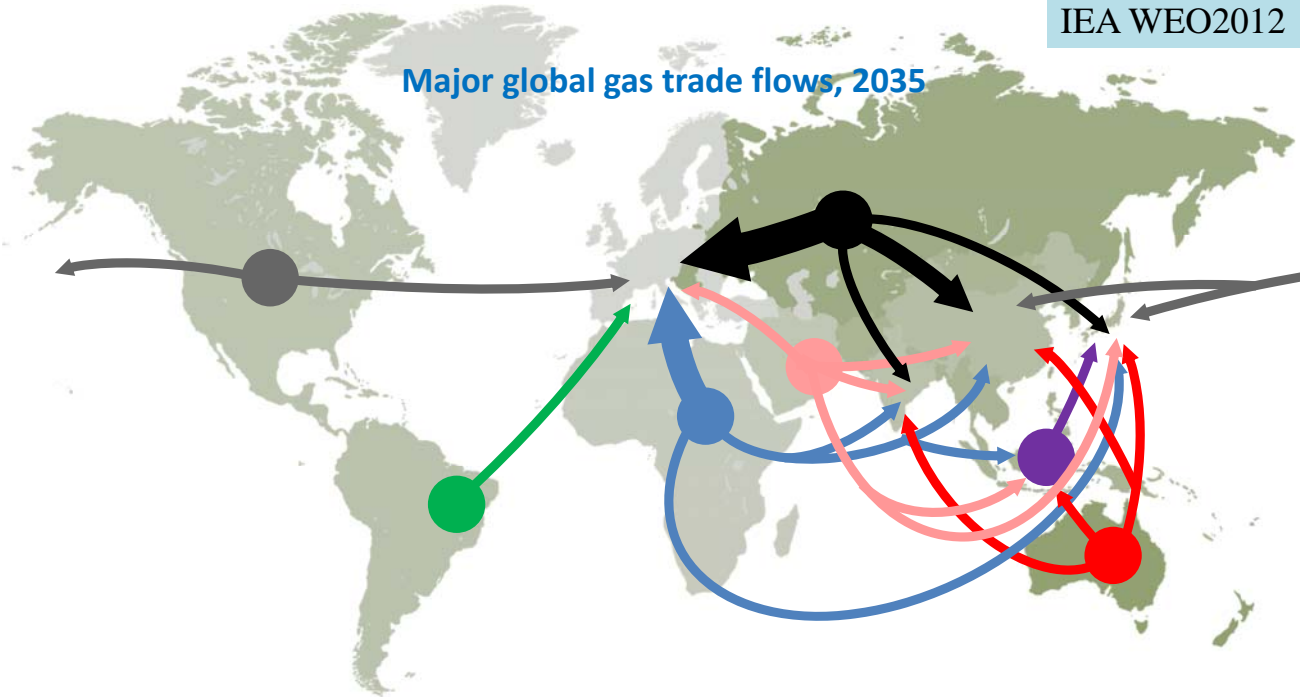
*By 2035, almost 90% of Middle Eastern oil exports go to Asia; North America's emergence as a net exporter accelerates the eastward shift in trade*



## Natural gas: towards a globalised market

IEA WEO2012

Major global gas trade flows, 2035



*Rising supplies of unconventional gas & LNG help to diversify trade flows, putting pressure on conventional gas suppliers & oil-linked pricing mechanisms*

## Russian Gas Pipelines

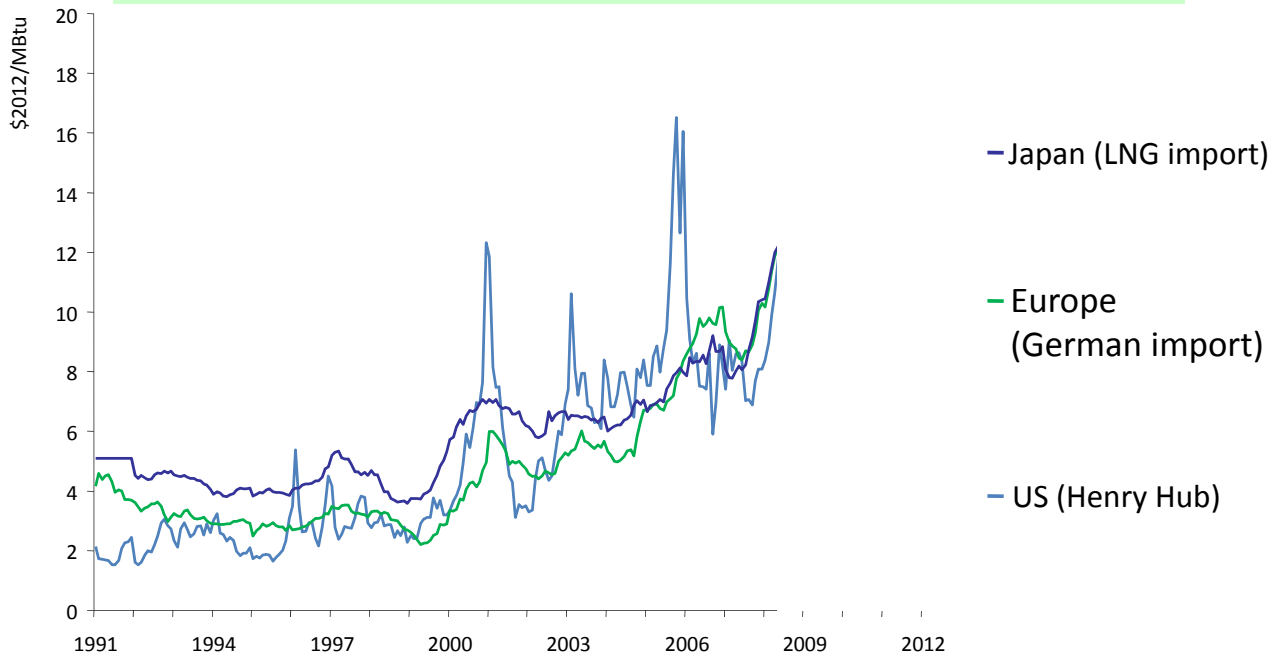
Russian Gas Infrastructure



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: IEA

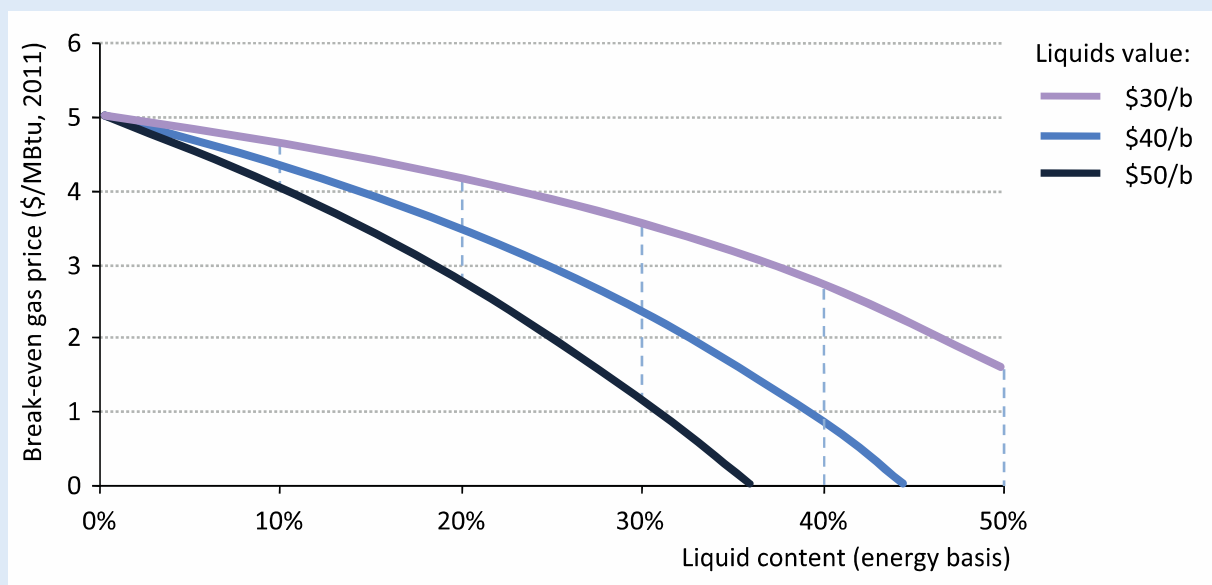
# LNG pricing : a competitiveness burden on Asian economies



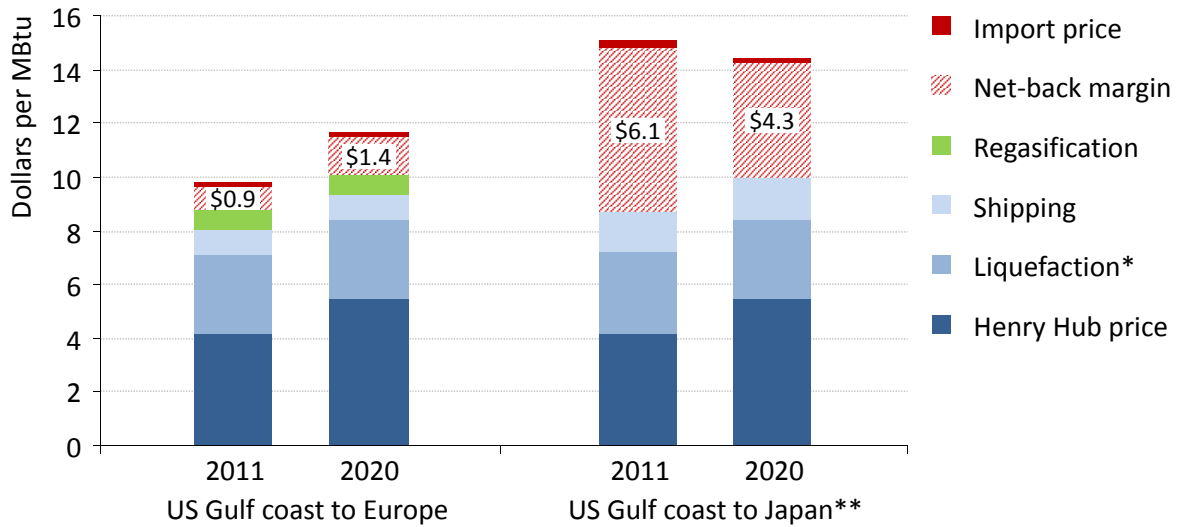
Developing a Natural Gas Trading Hub in Asia (2013 by IEA)

## The higher the oil price goes, the lower the gas price becomes.

**Figure 4.7** Relationship between break-even price (gas price needed to recover well costs) and the liquid content of the gas produced

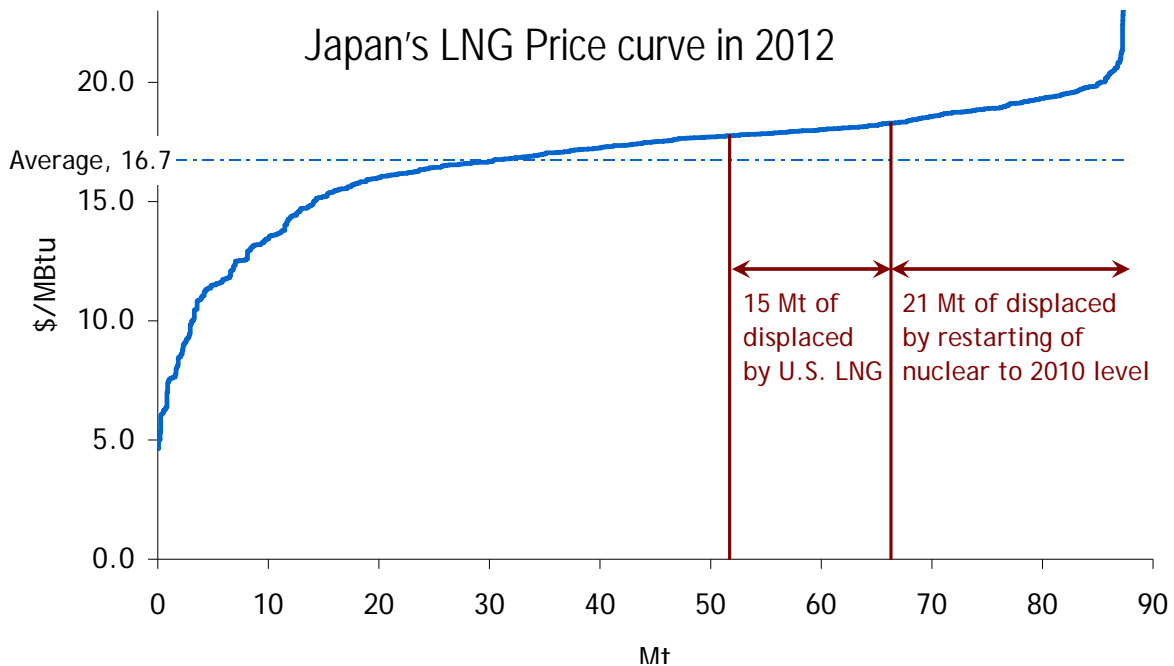


# Indicative economics of LNG exports from the United States



**At both current prices and those assumed for 2020, LNG exports from the US would be profitable, especially to Asian markets**

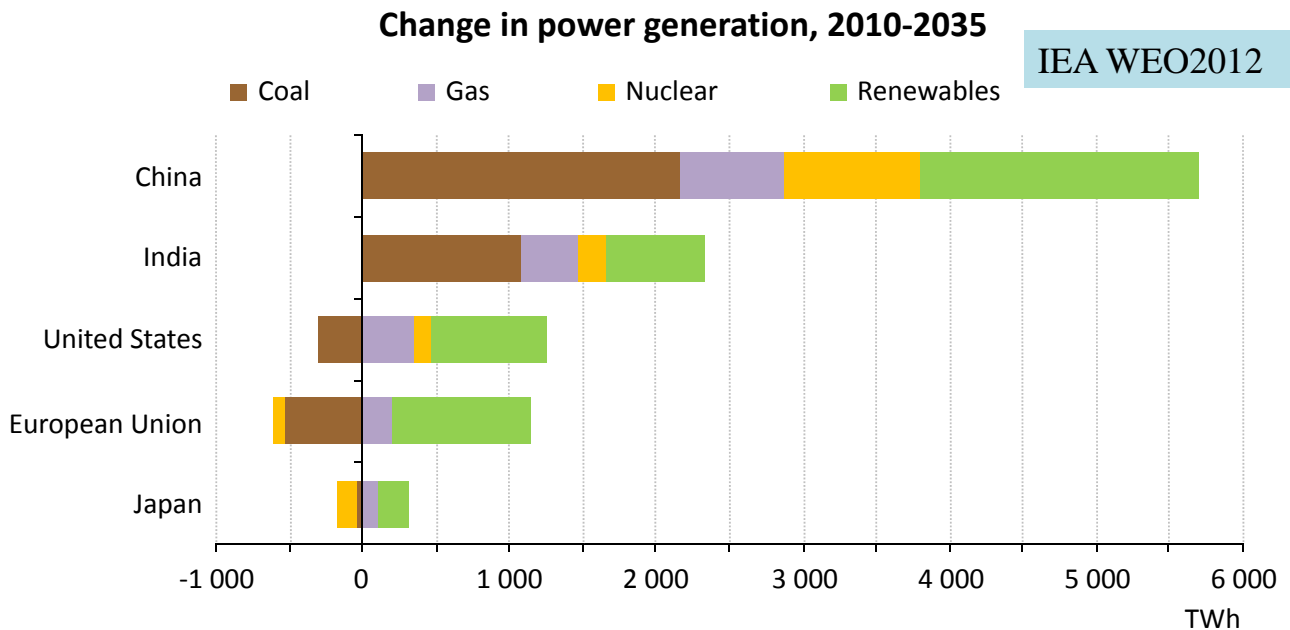
## Impact of US LNG and Nuclear restarting





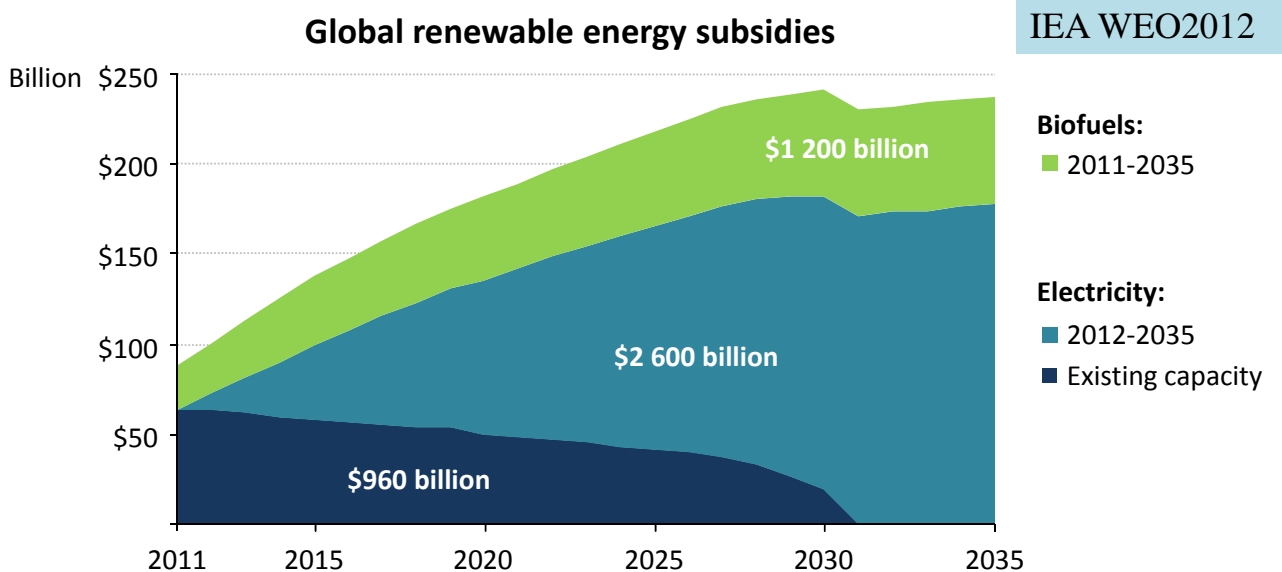


# A power shift to emerging economies



**The need for electricity in emerging economies drives a 70% increase in worldwide demand, with renewables accounting for half of new global capacity**

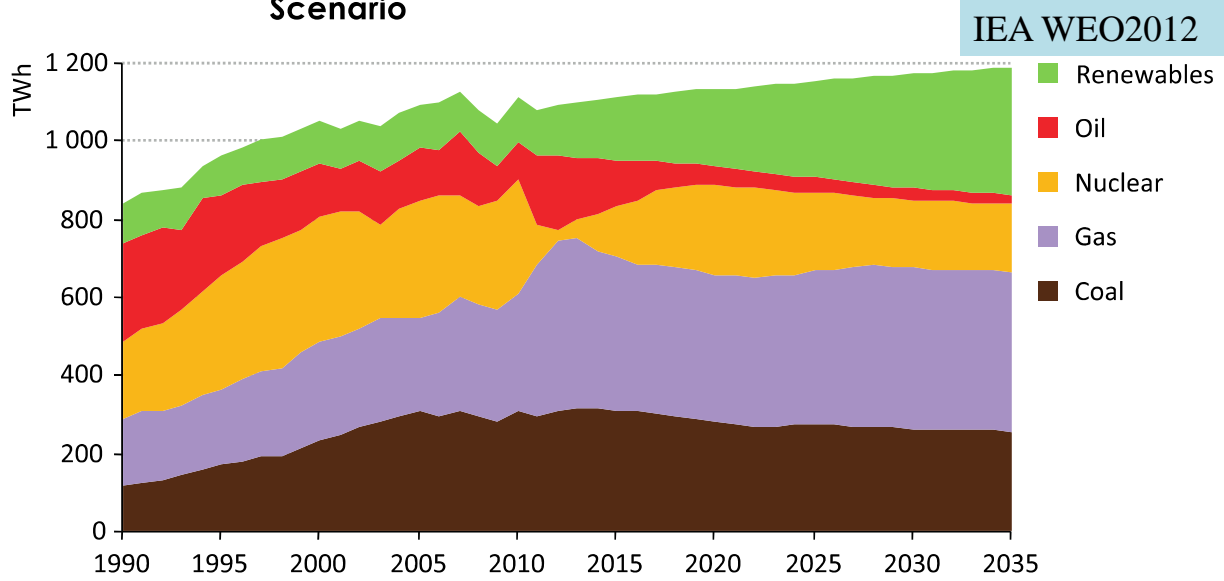
## The multiple benefits of renewables come at a cost



**Renewable subsidies were \$88 billion in 2011; over half the \$4.8 trillion required to 2035 has been committed to existing projects or is needed to meet 2020 targets**

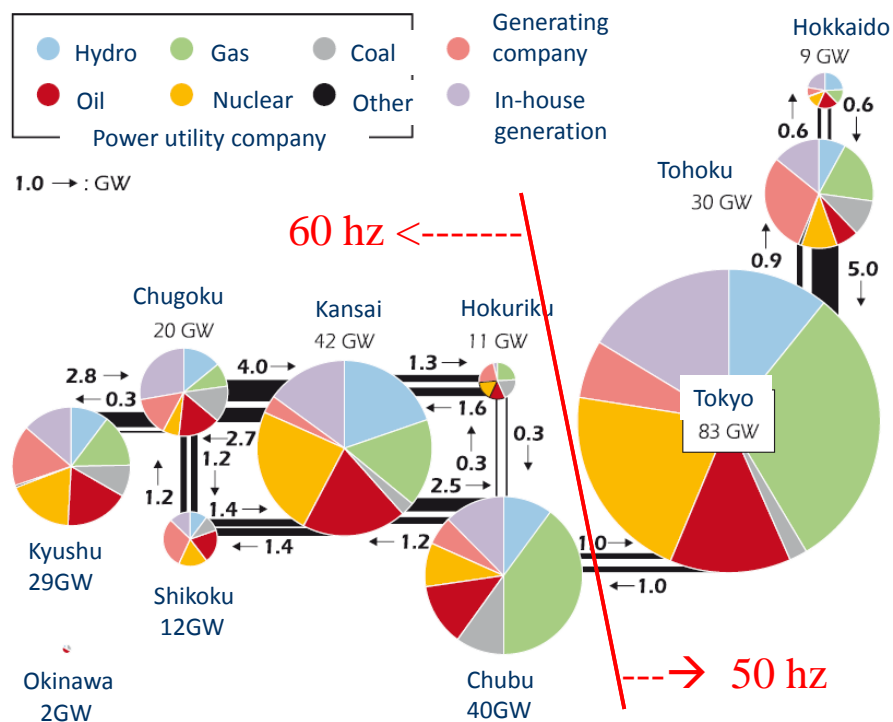
# Japan's Power Sector: Renewables, gas and energy efficiency leading the charge

**Figure 6.13** ▶ Japan electricity generation by source in the New Policies Scenario



*A decline in nuclear is compensated by a 3-fold increase in electricity from renewables, a continued high reliance on LNG imports & improvements in efficiency*

## Power grid in Japan

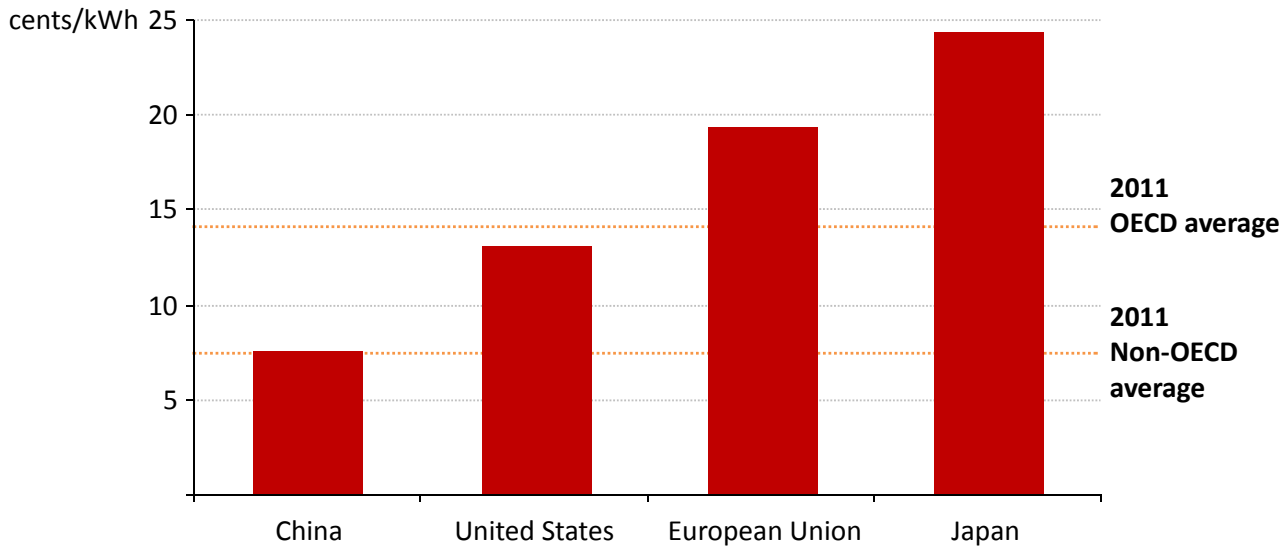


Source: Agency for Natural Resources and Energy, The Federation of Electric Power Companies of Japan, Electric Power System Council of Japan, The International Energy Agency

# Wide variations in the price of power

IEA WEO2012

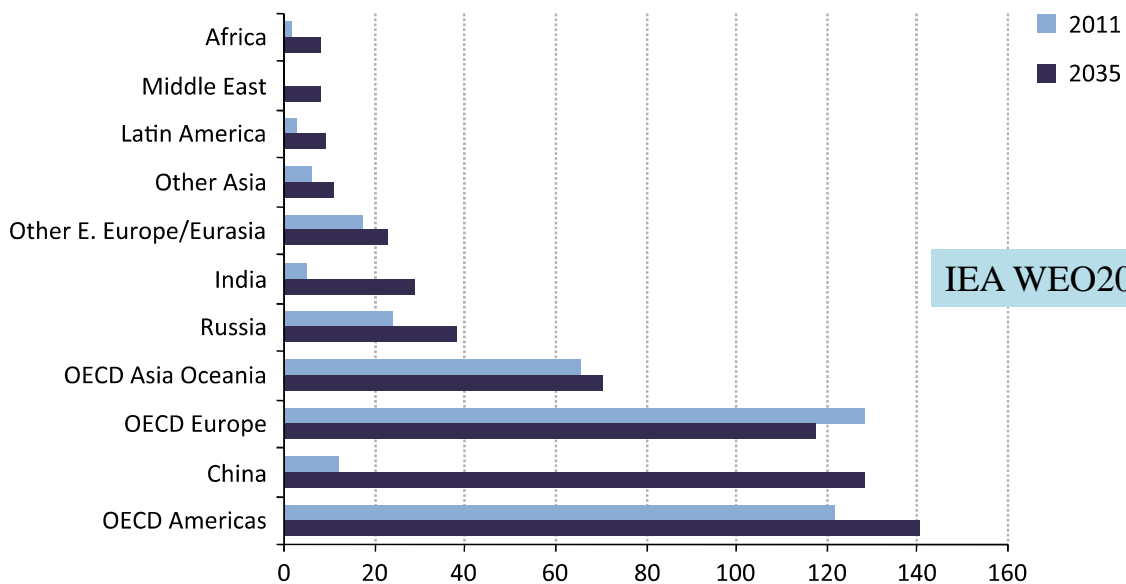
Average household electricity prices, 2035



**Electricity prices are set to increase with the highest prices persisting in the European Union & Japan, well above those in China & the United States**

Nuclear Power will expand even after the Fukushima.  
Safety is the issue.

**Figure 6.7** ▸ Nuclear power capacity by region in the New Policies Scenario



IEA WEO2012

**In aggregate, world nuclear capacity reaches 580GW in 2035, 50GW lower from 2011 WEO. Production rises from 2756TWh to 4370TWh, almost 60% increase, though the share in total generation falls from 13% to 12%.**

## Share the Lessons of the Fukushima

- Lessons to be Shared
  - Think about the unthinkable; Tsunami and Station Black Out. Large scale Blackout. Change total mind set for "Safety".
  - Prepare for the severe accidents by defense in depth, common cause failure & compound disasters.
  - Clarify why it happened only to Fukushima Daiichi and NOT to other sites.
- Safety Principles
  - Fukushima accident was caused by human error and should have been avoided. (Parliament Investigation Commission report )
  - International Cooperation : A nuclear accident anywhere is an accident everywhere.
  - Independent Regulatory authority ; Transparency and Trust, "Back Fitting" of regulation
- Secured supply of Electricity
  - Power station location
  - Strengthened interconnection of grid lines
- Once disaster has happened, Recovery from disaster is at least as important as preparing for it.
  - FEMA like organization and training of the nuclear emergency staff including the self defense force ; integration of safety and security.
- New Technology. New type of Reactors such as Integral Fast Reactor.

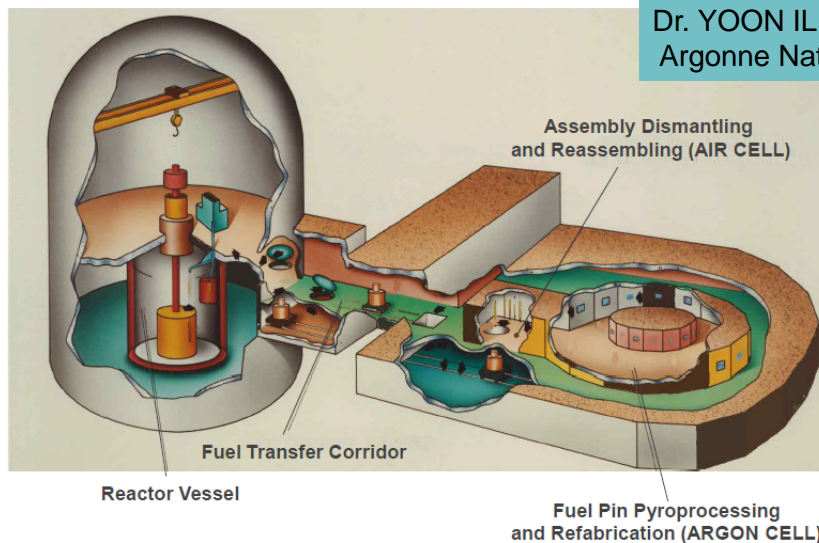
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## Time for G4 Reactors: Integral Fast Reactor and Pyroprocessing

IEE  
JAPAN

Pyroprocessing was used to demonstrate the EBR-II fuel cycle closure during 1964-69

Dr. YOON IL CHANG  
Argonne National Laboratory



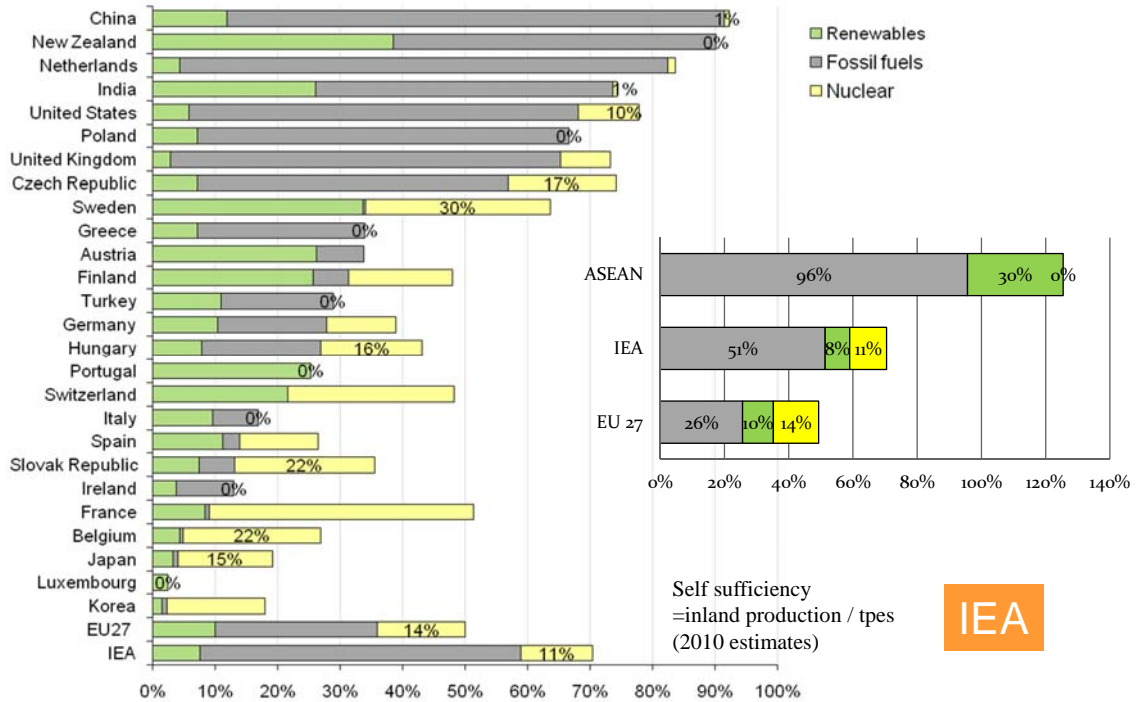
IFR has features as Inexhaustible Energy Supply ,Inherent Passive Safety ,Long-term Waste Management Solution , Proliferation-Resistance , Economic Fuel Cycle Closure.  
High level waste reduces radioactivity in 300 years while LWR spent fuel takes 100,000 years.

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# Diversity and Connectivity for Energy Security

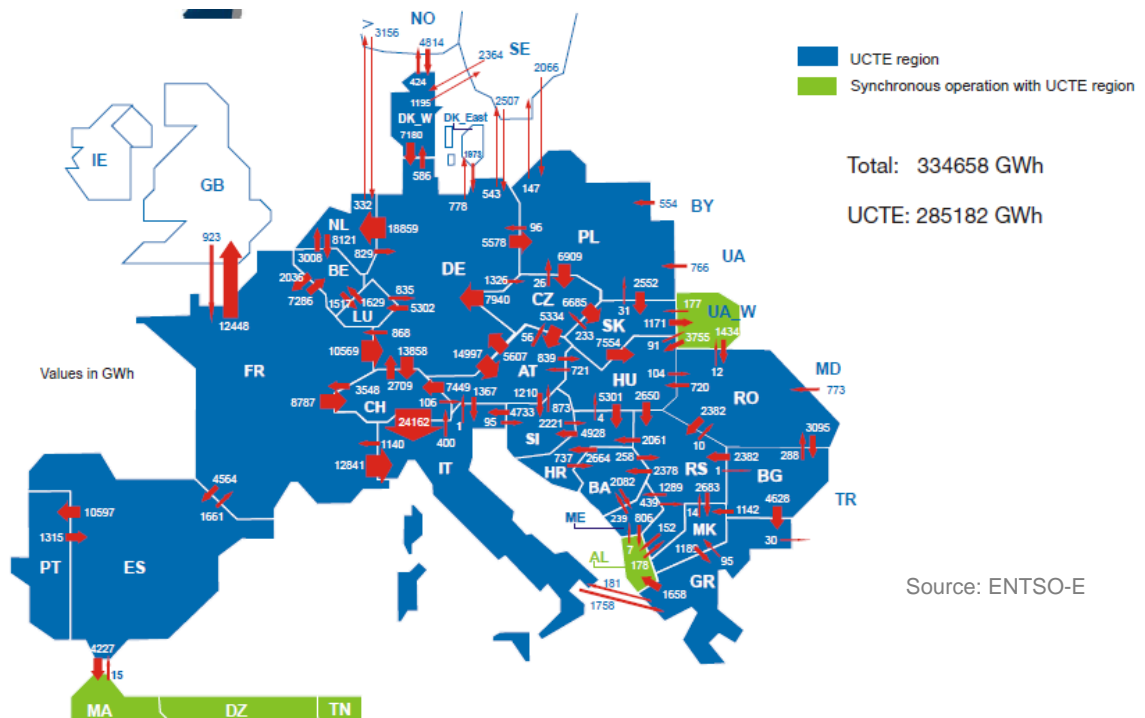
Energy Self-Sufficiency rates by fuels in 2010



**Nuclear is an important option for countries with limited indigenous energy resources .**  
**EU is aiming at Collective Energy Security by power grid and pipeline connections.**

# Power Grid Connection in Europe

Physical energy flows between European countries, 2008 (GWh)

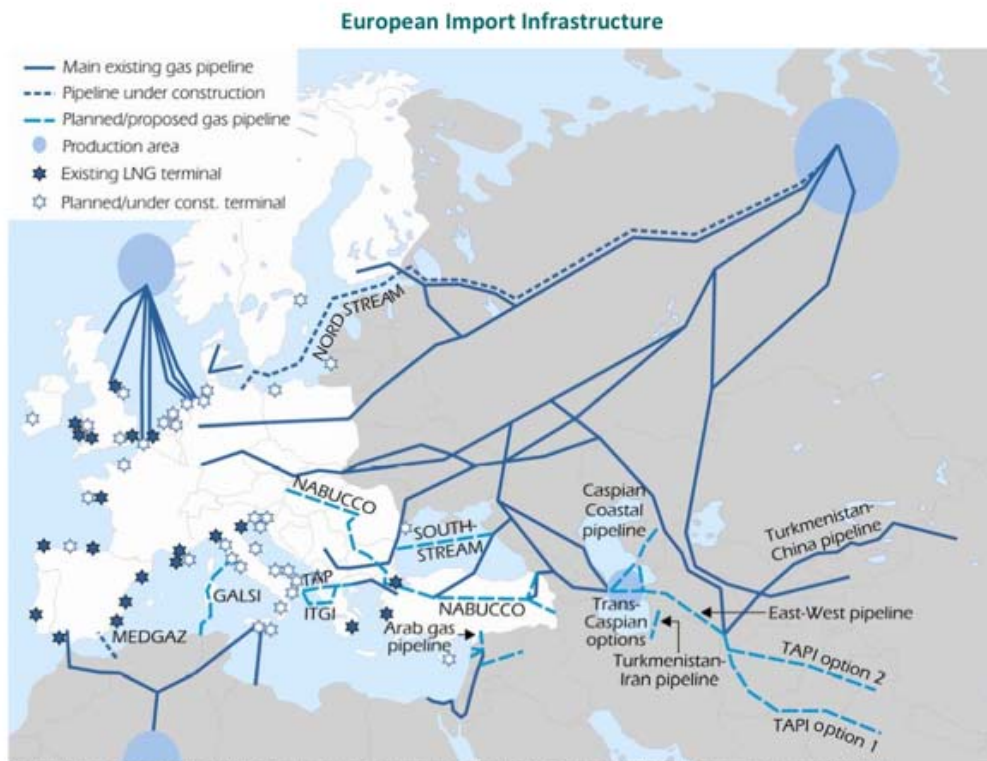


# Connecting MENA and Europe: "Desertec" as visionary "Energy for Peace"



Source: DESERTEC Foundation

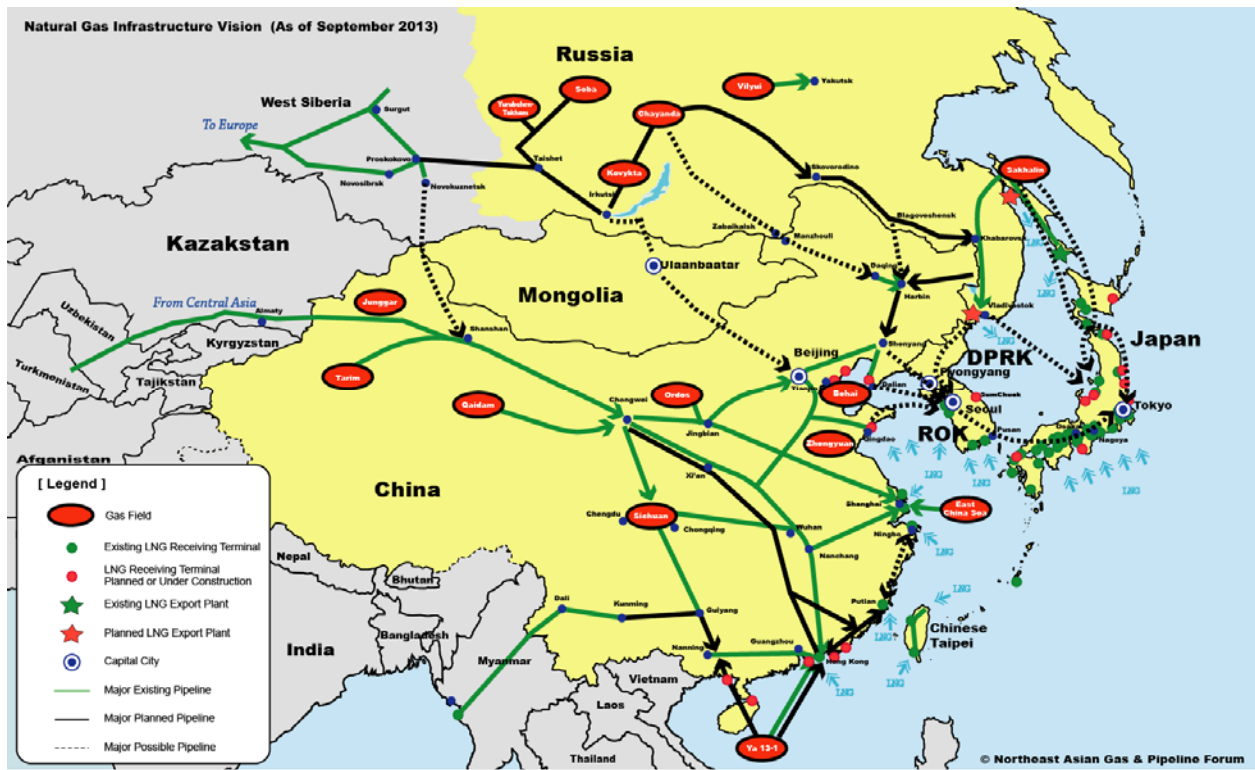
## Natural Gas Import Infrastructure in Europe



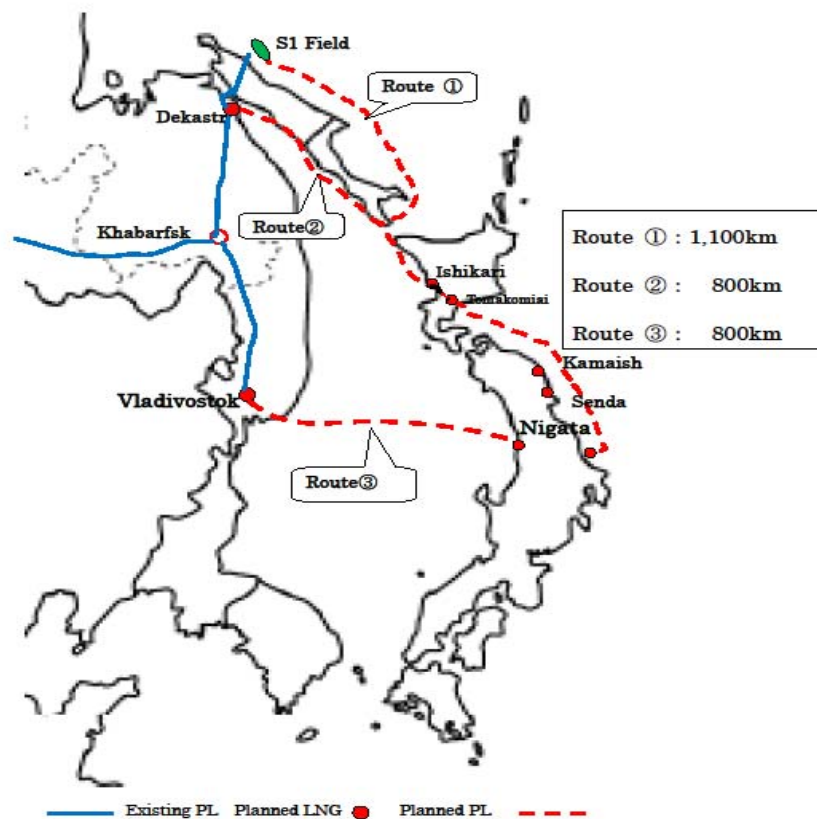
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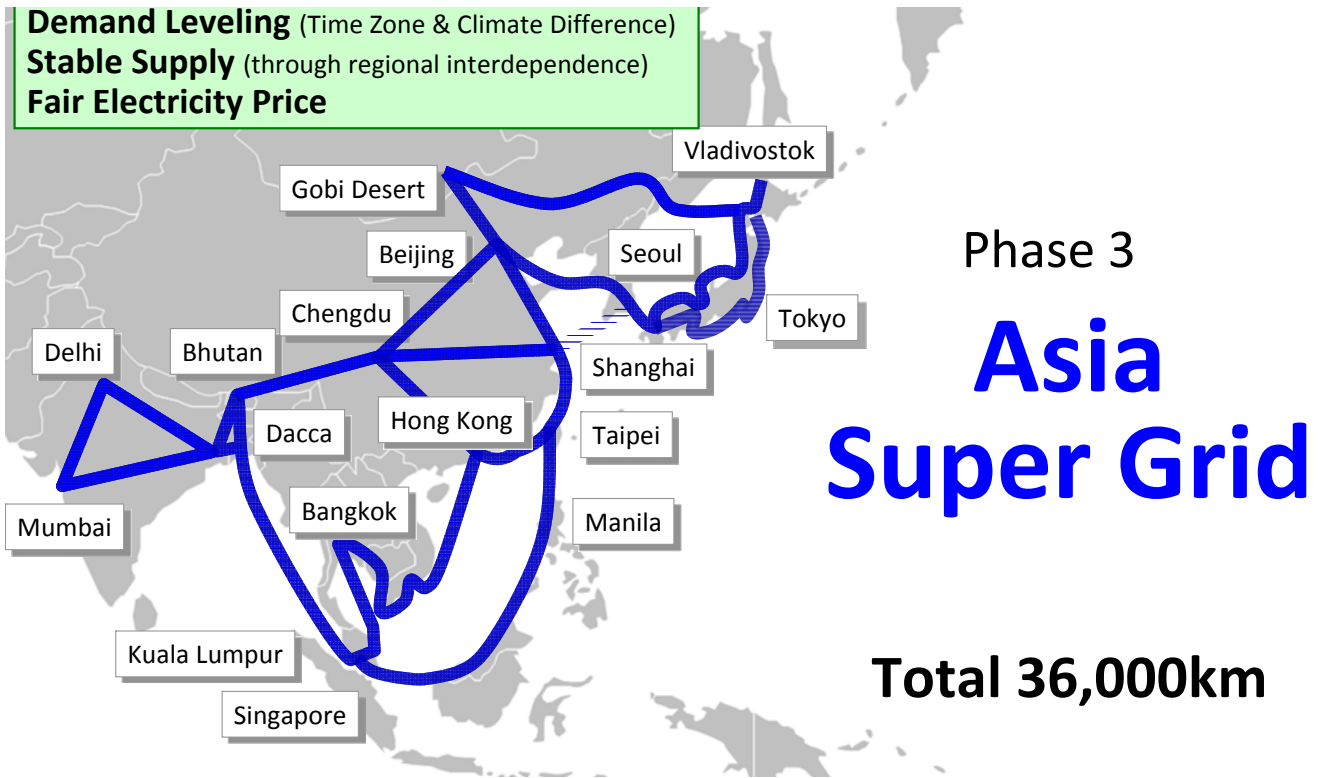
Blue Print for North East Asia Gas & Pipeline Infrastructure.  
Dr. Masaru HIRATA's vision has come true in China.



## Concepts of Natural Gas Pipeline from Russia to Japan



# Energy for Peace in Asia. A New Asian Vision?



Presentation by Mr. Masayoshi SON

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## Conclusions

### Comprehensive Energy Security Policies for Asia

- The Shale Gas Revolution changes the global energy market. Golden Age of Natural Gas will come with golden rules including sustainability requirements and a new pricing formula. Russia remains as a key player through pipelines. LNG exports from North America including Alaska may be a game-changer.
- Energy Security for the 21st Century must be Collective and Comprehensive Electricity Supply Security under sustainability constraints. EU's connectivity approach can be a model especially for Asia. Contingency Plan is needed for imminent Iranian Crisis. China and India should join the IEA. Need for the North East Asian Energy Security Forum
- Nuclear Power will continue to play a major role in the world. Japan's role after Fukushima is to share the lessons learned for safer Nuclear Power deployment in Asia and elsewhere.
- For Coal and to a lesser extent for Gas to remain the backbone of power supply, CCS readiness & highly efficient power plants are needed.
- New technologies help; Hydrogen economy, Methane-hydrate, Super-conductivity grid., EVs, Smart Grids, Storage, 4G Reactors like Integral Fast Reactor, etc.

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