

Challenges to the Energy Security in Asia

“Navigating a stormy energy future” :Messages
from the IEA World Energy Outlook 2014

2015-2-6

Myanmar International Seminar

Nobuo TANAKA

Former Executive Director, IEA

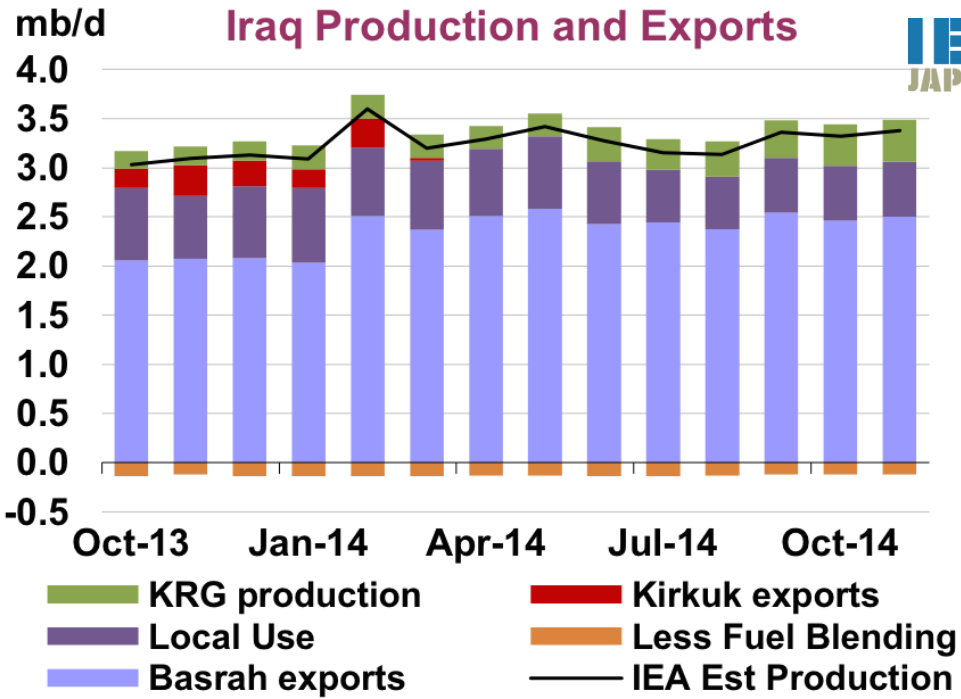
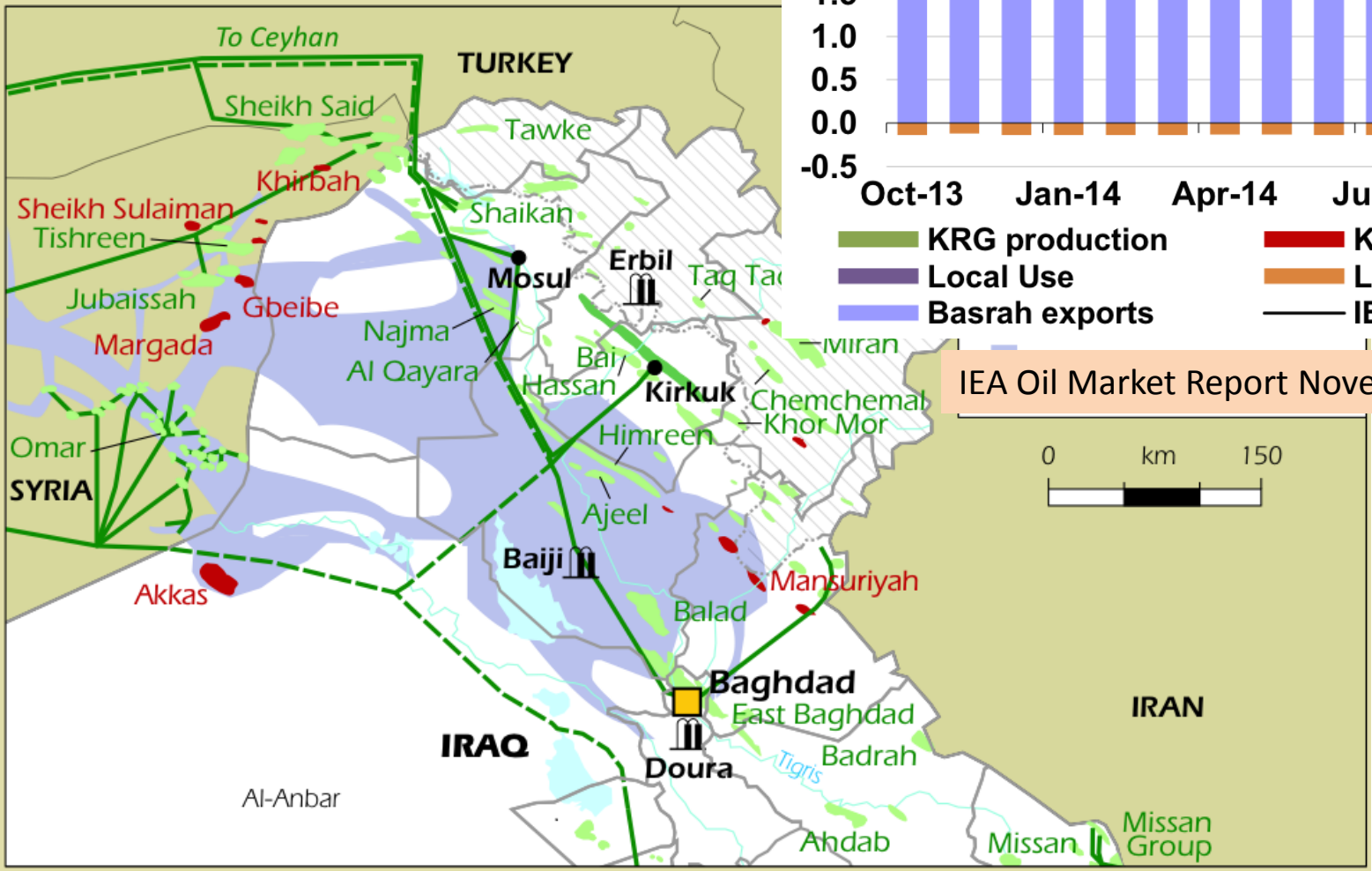
Signs of stress in the global energy system

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- Current calm in markets should not disguise difficult road ahead
 - Turmoil in the Middle East raises doubts over future oil balance
 - Resurgent debate over the security of gas supply to Europe
- Mixed signals in run-up to crucial climate summit in Paris in 2015
 - Global CO₂ emissions still rising, with most emitters on an upward path
 - At \$550 billion, fossil fuel subsidies over four-times those to renewables
 - Increasing emphasis on energy efficiency starting to bring results
- Will change in global energy be led by policies, or driven by events?

No.1 Risk : Iraq

Islamist Oil Operations Set Back in Iraq and Syria

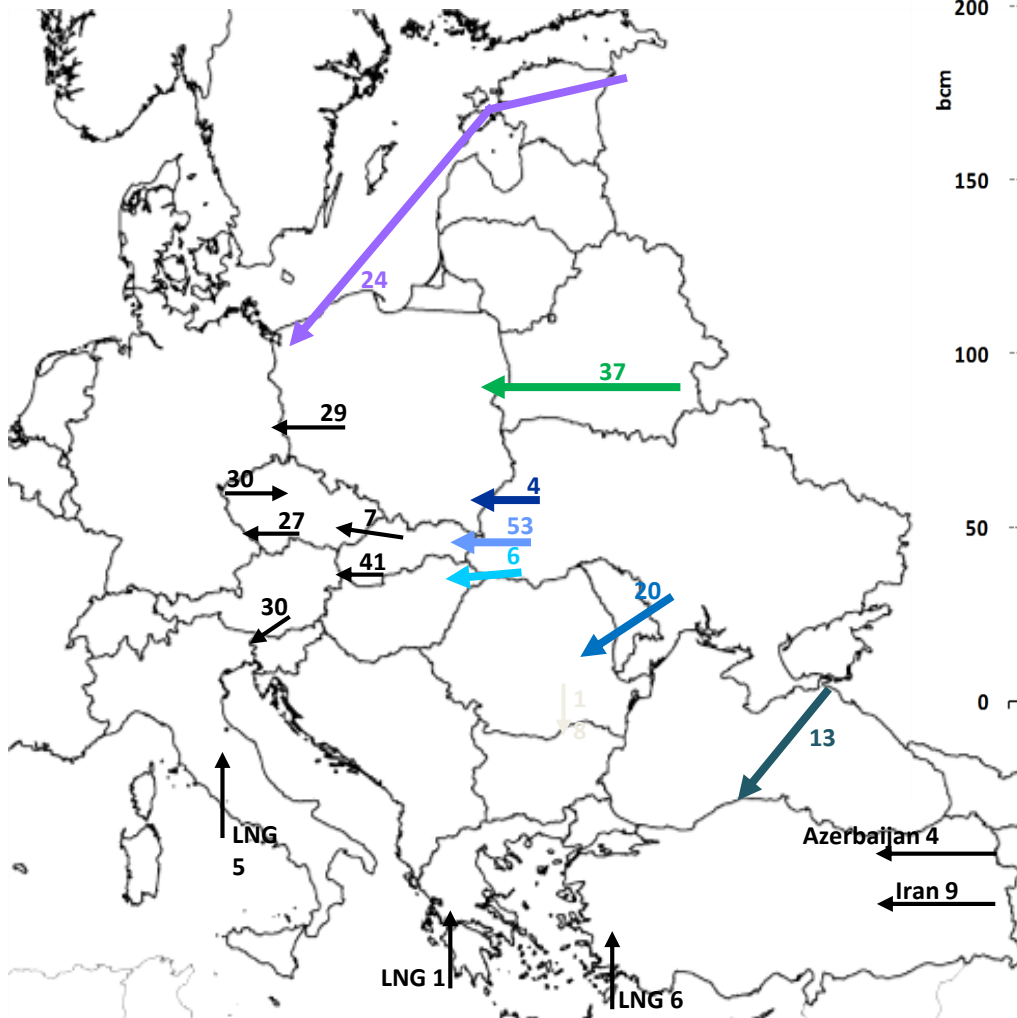


IEA Oil Market Report November 2014

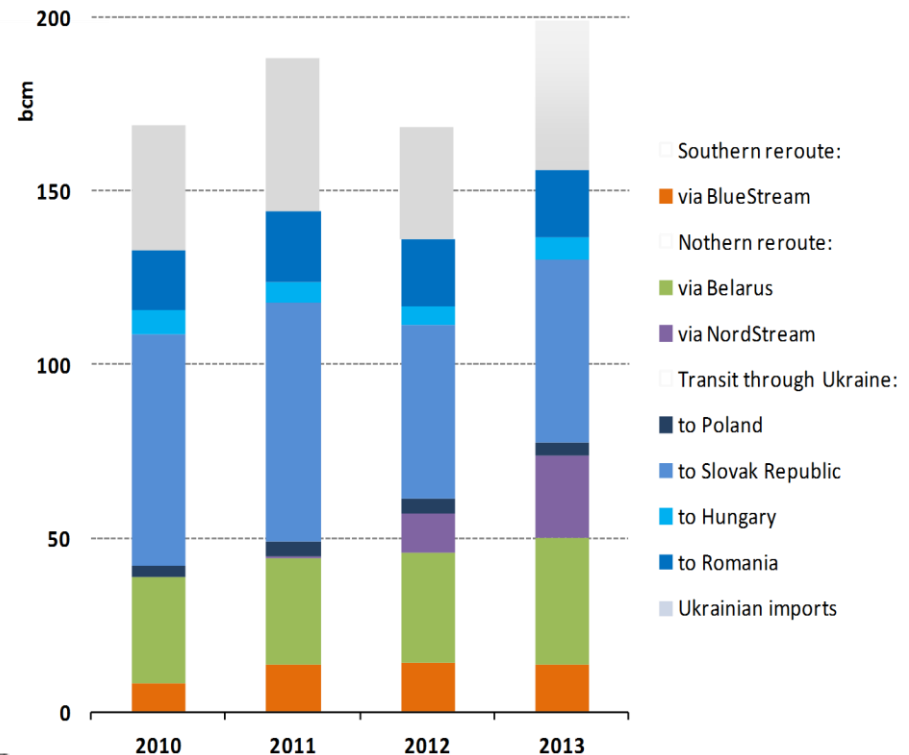
This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

No2. Risk: Ukraine and Russia

Major physical flows in 2013 in bcm



Russian gas exports to Europe



Data from IEA 2014

The
Economist

Reform in Japan

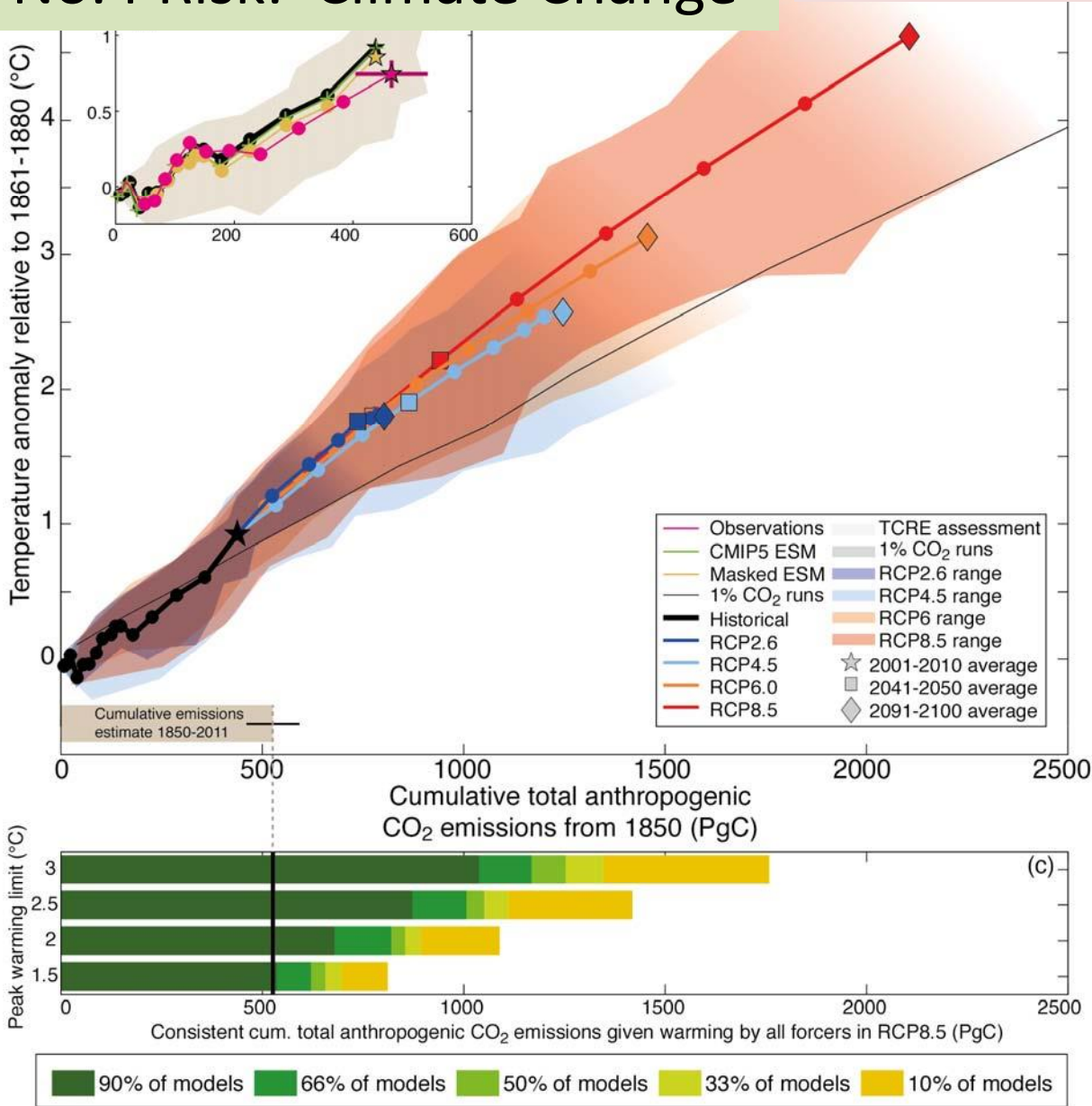
No3. Risk : Japan

The third arrow

Shinzo Abe has the best chance in decades of changing Japan for the better. He seems poised to take it (June 28th 2014)



No.4 Risk: Climate Change



Carbon Budget

515Gt had been emitted by 2011.
 2C scenario needs to stop at 790Gt.(66%).
 790-515=275Gt budget left.

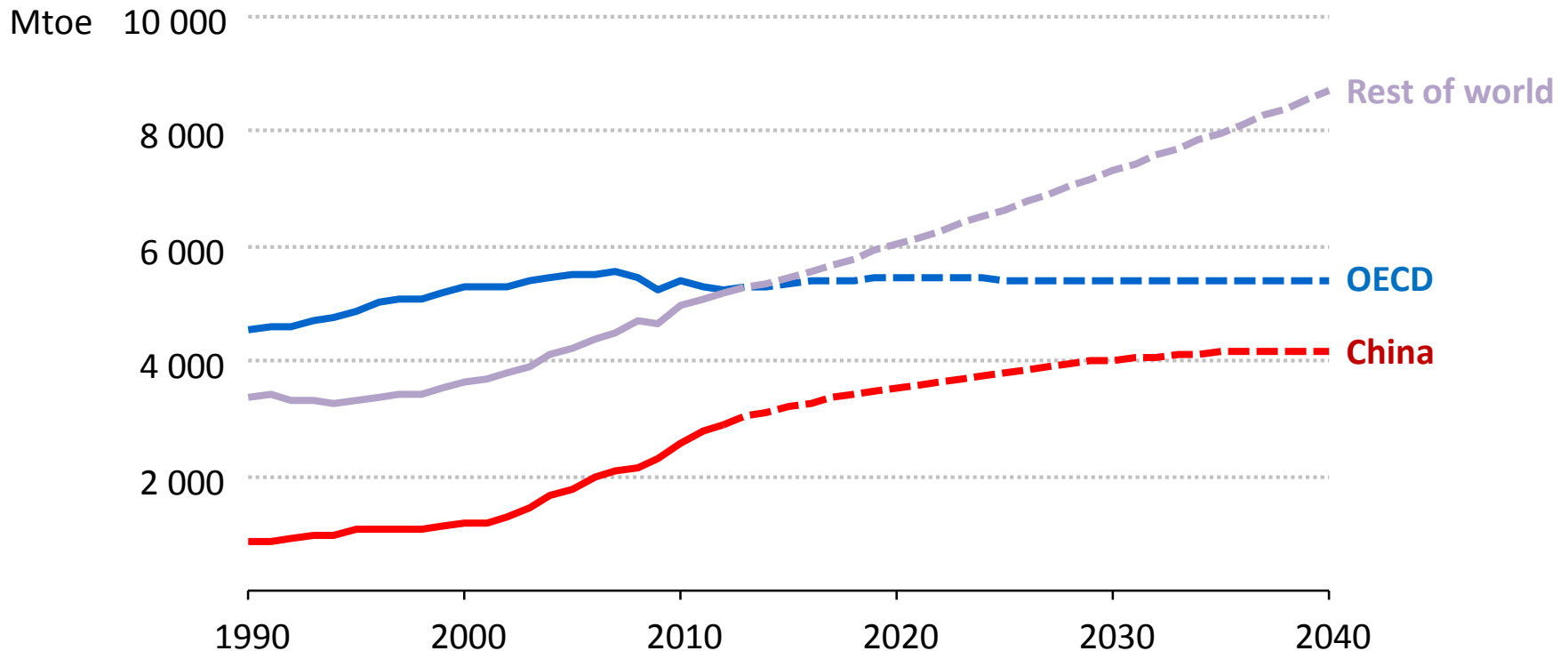
Annual 2012 =9.7Gt

275/9.7=Only 28 years to go!

Changing dynamics of global demand

Energy demand by region

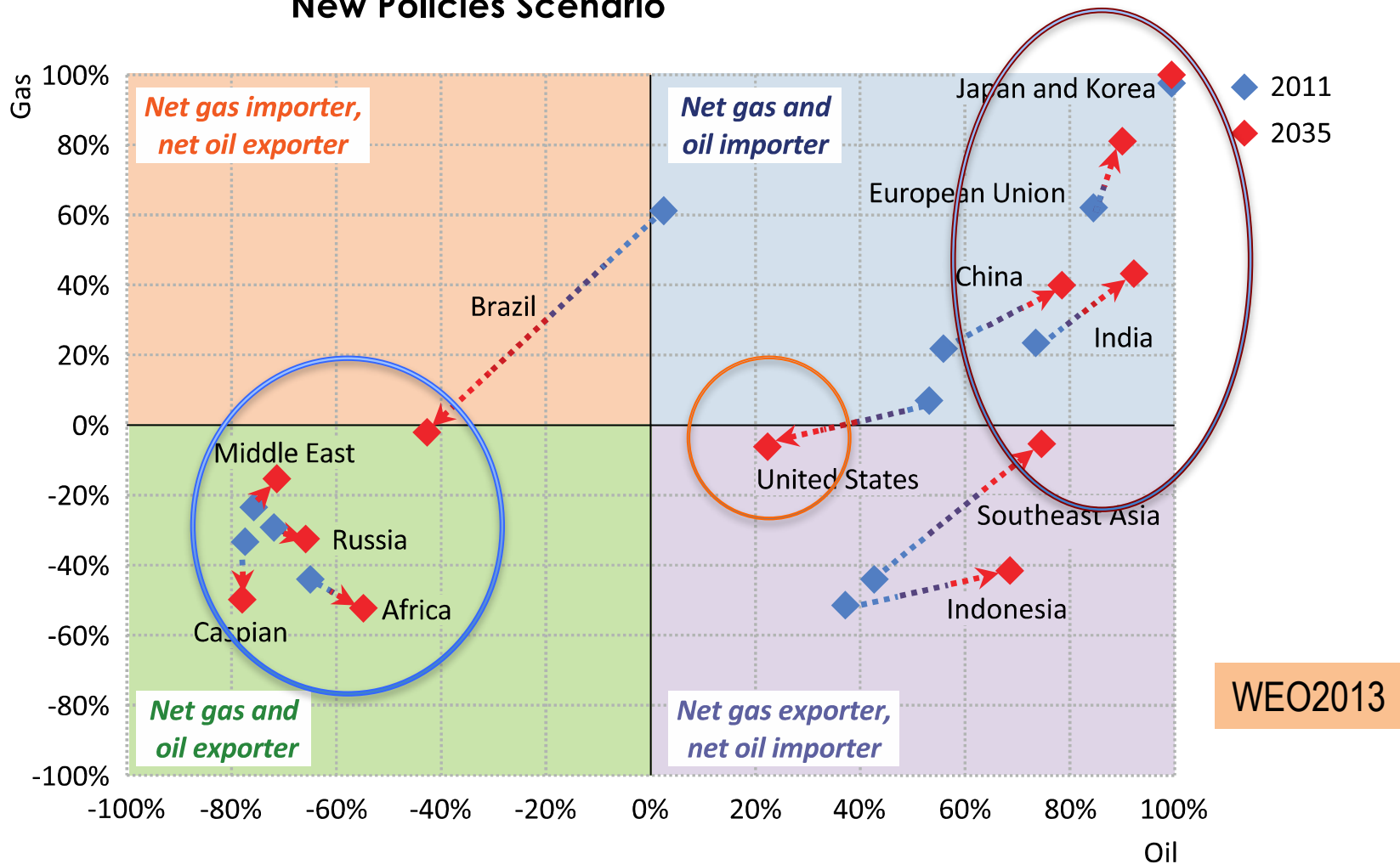
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As China slows, then India, Southeast Asia, the Middle East and parts of Africa & Latin America take over as the engines of global energy demand growth.

Geopolitics of the Shale Revolution: Dichotomy between Oil / Gas exporters and importers.

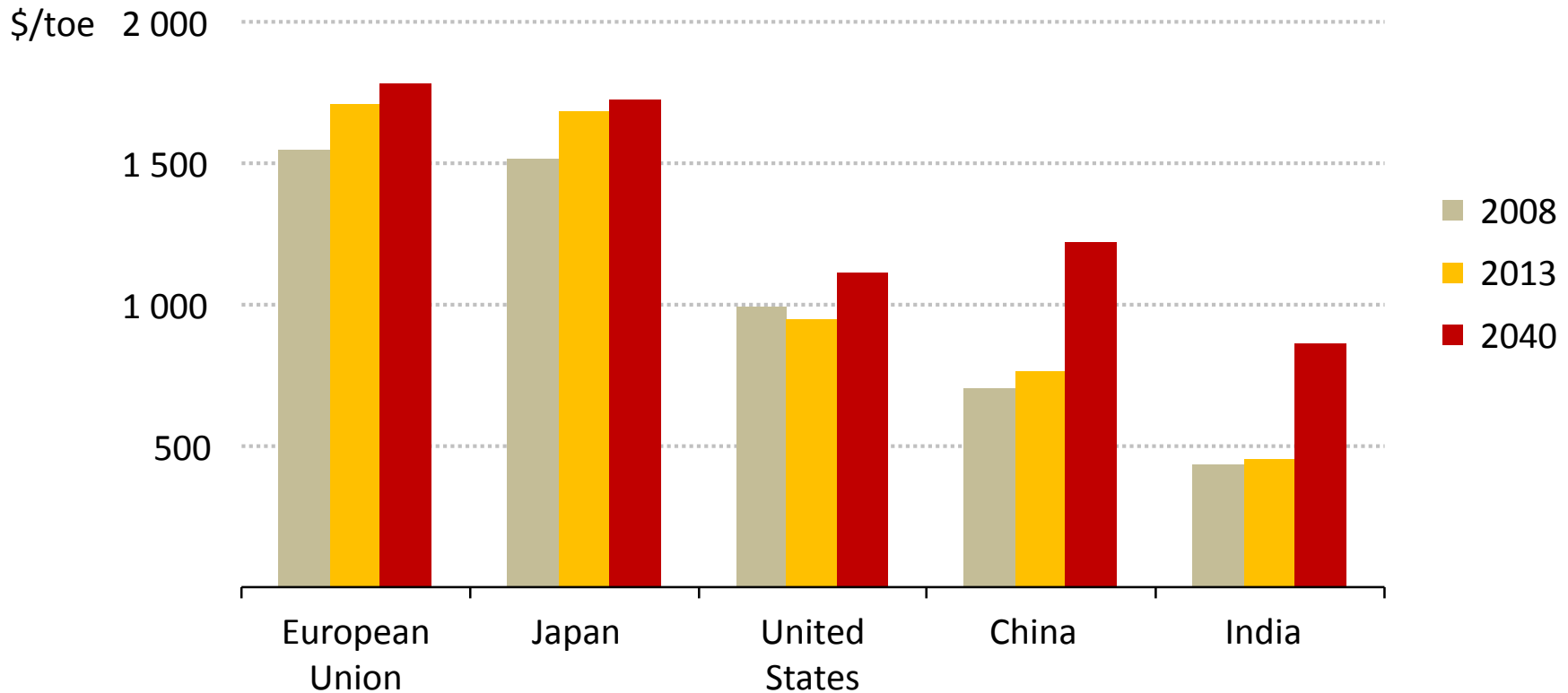
Figure 2.12 ▶ Net oil and gas import/export shares in selected regions in the New Policies Scenario



United States holds a strong position on energy costs

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Weighted average cost of energy paid by consumers



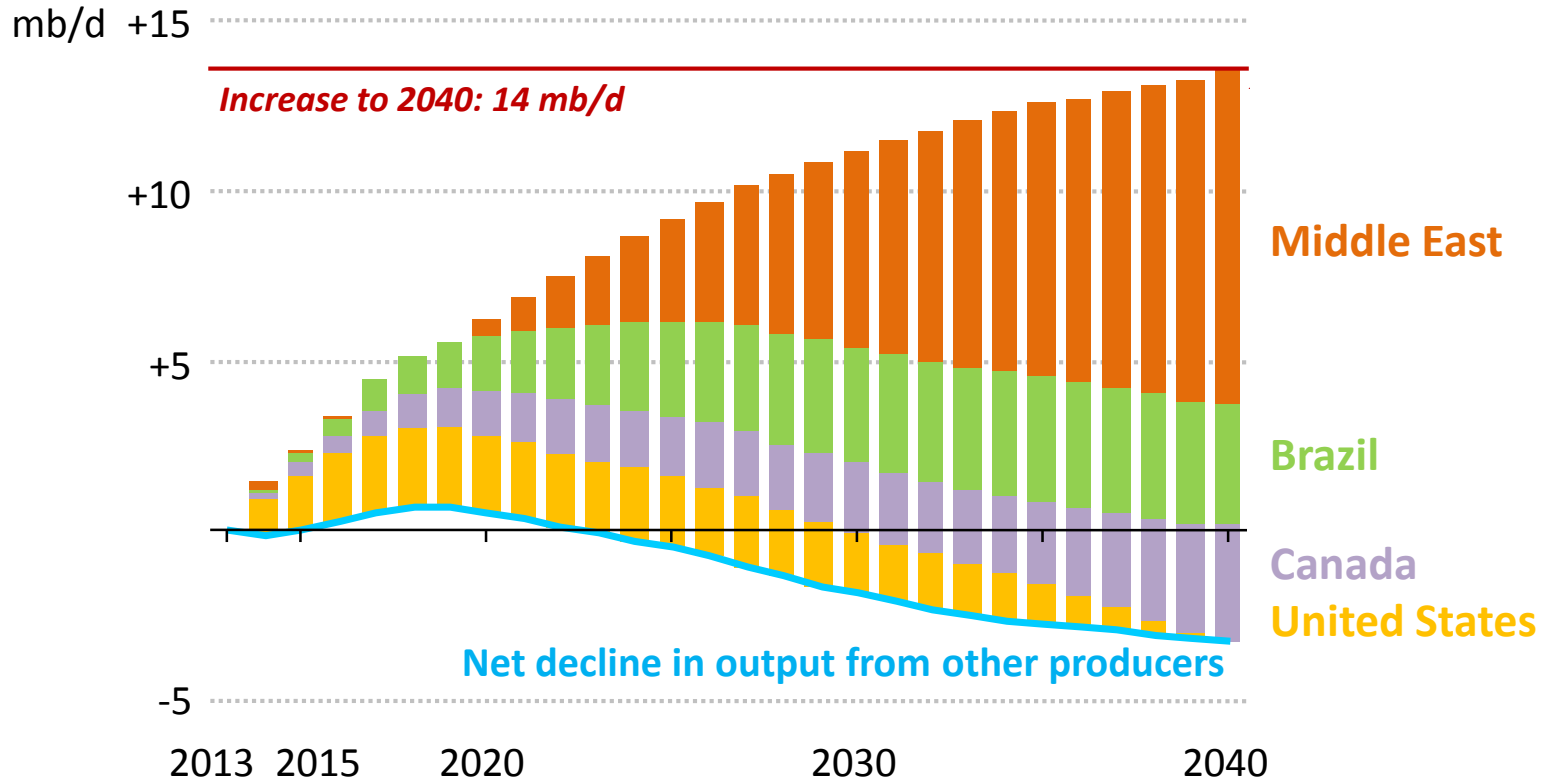
Economies face higher costs, but the pace of change varies: China overtakes the US, costs double in India & remain high in the European Union & Japan

Instability in the Middle East a major risk to oil markets

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Oil production growth

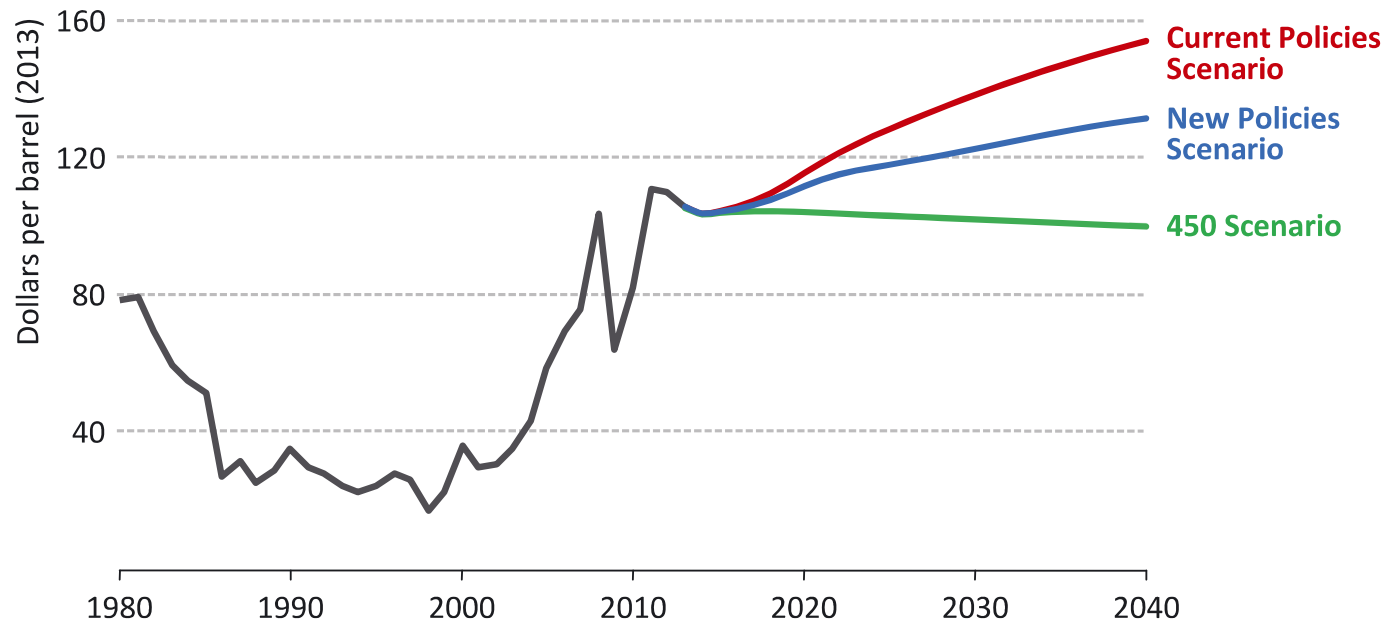
in United States, Canada, Brazil & the Middle East



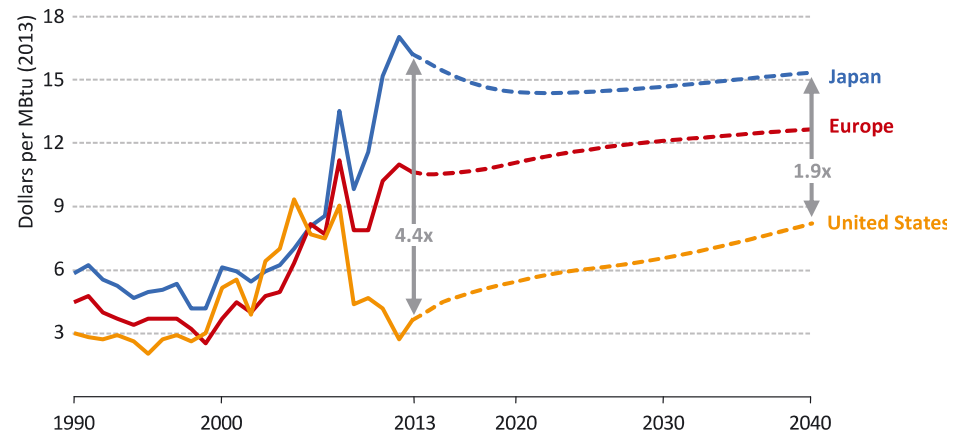
The short-term picture of a well-supplied market should not obscure future risks as demand rises to 104 mb/d & reliance grows on Iraq & the rest of the Middle East

Oil price will rise in the longer term.

Figure 1.2 ▽ Average IEA crude oil import price by scenario

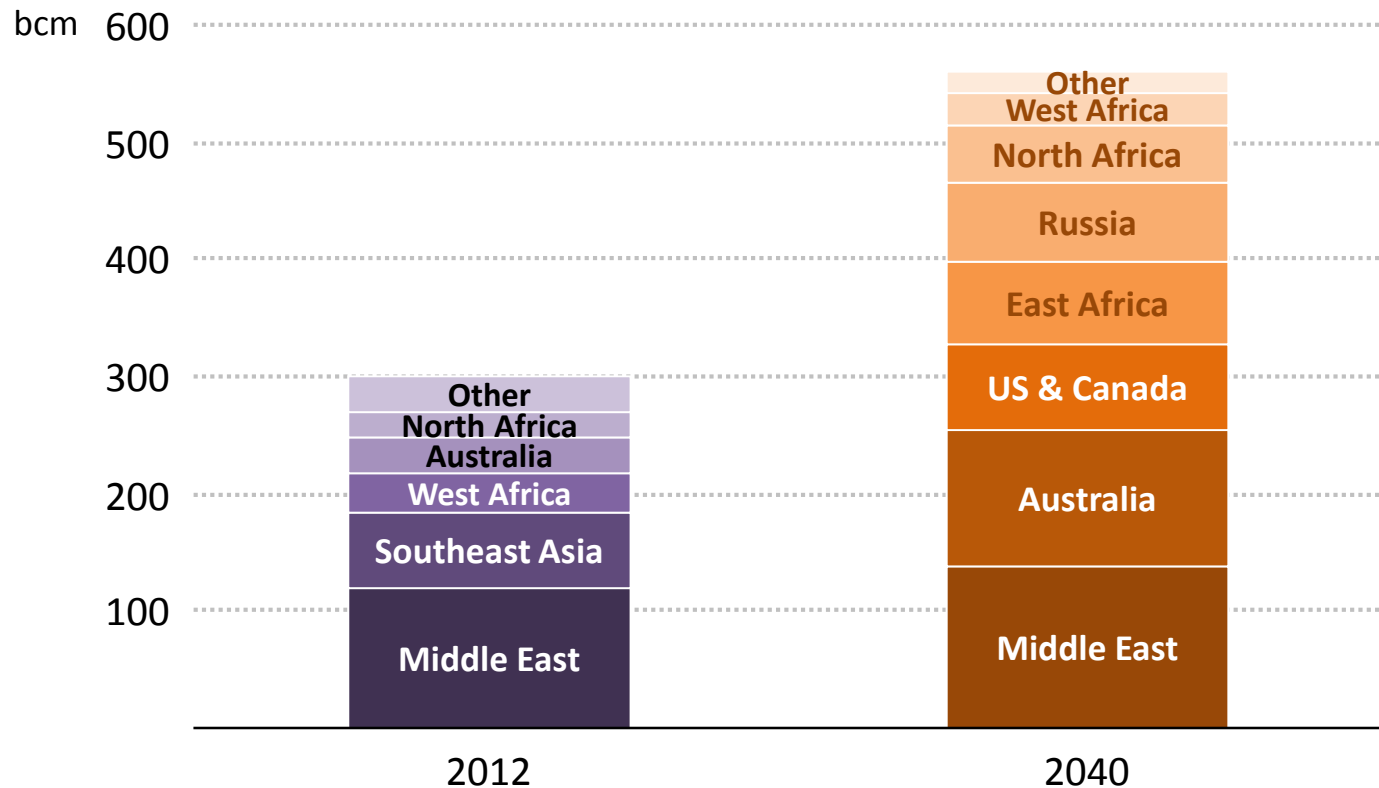


So does Gas price .



Gas on the way to become first fuel, with role of LNG on the rise

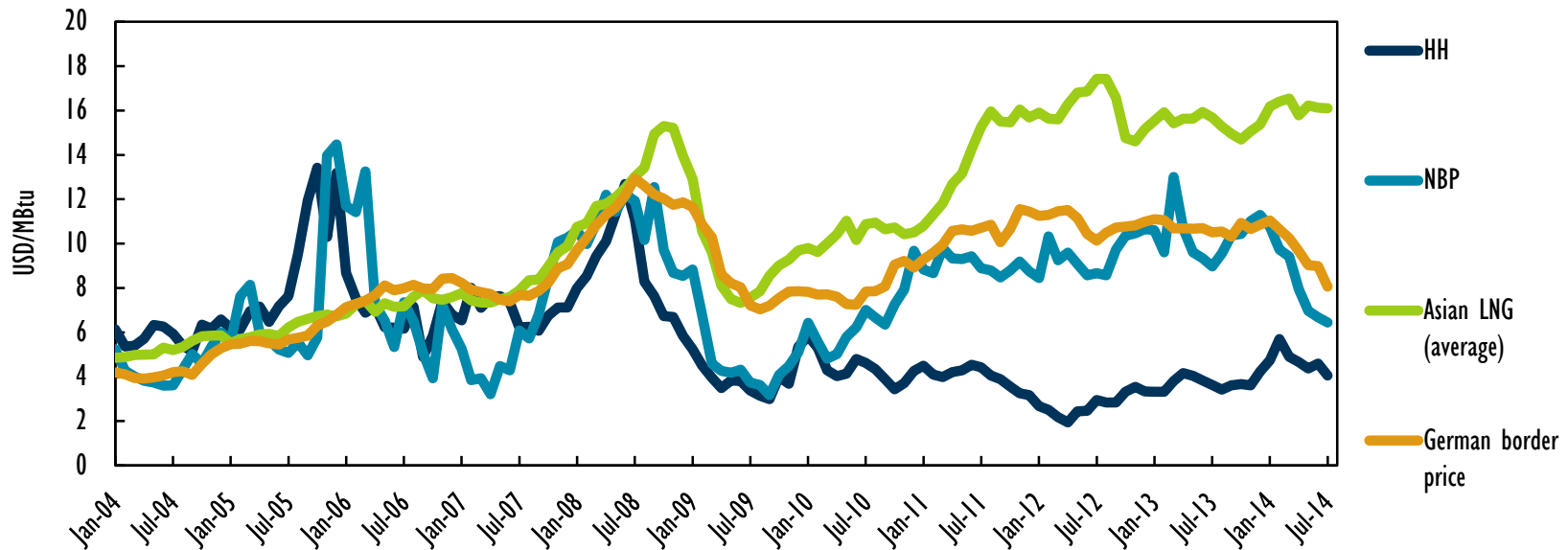
Main sources of regional LNG supply



**Share of LNG rises in global gas trade, pushed by a near-tripling in liquefaction sites:
LNG brings more integrated & secure gas markets, but only limited relief on prices**

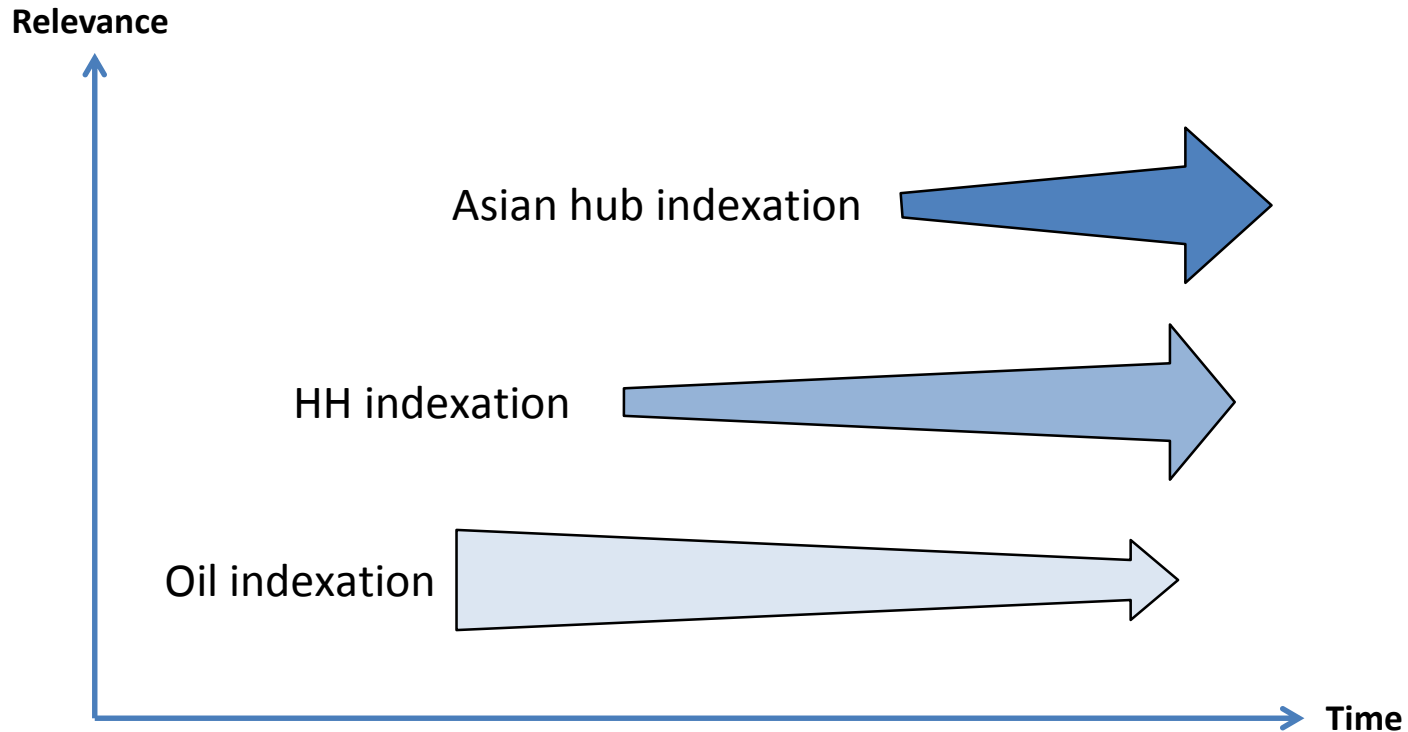
What is making Asian gas price so high?

Evolution of regional gas prices



- Wide price gap has been seen for several years among major regional gas markets with no convergence.
- Not only as being the fastest-growing gas market, Asia is even more attractive for producers as Asian buyers pay the highest prices.

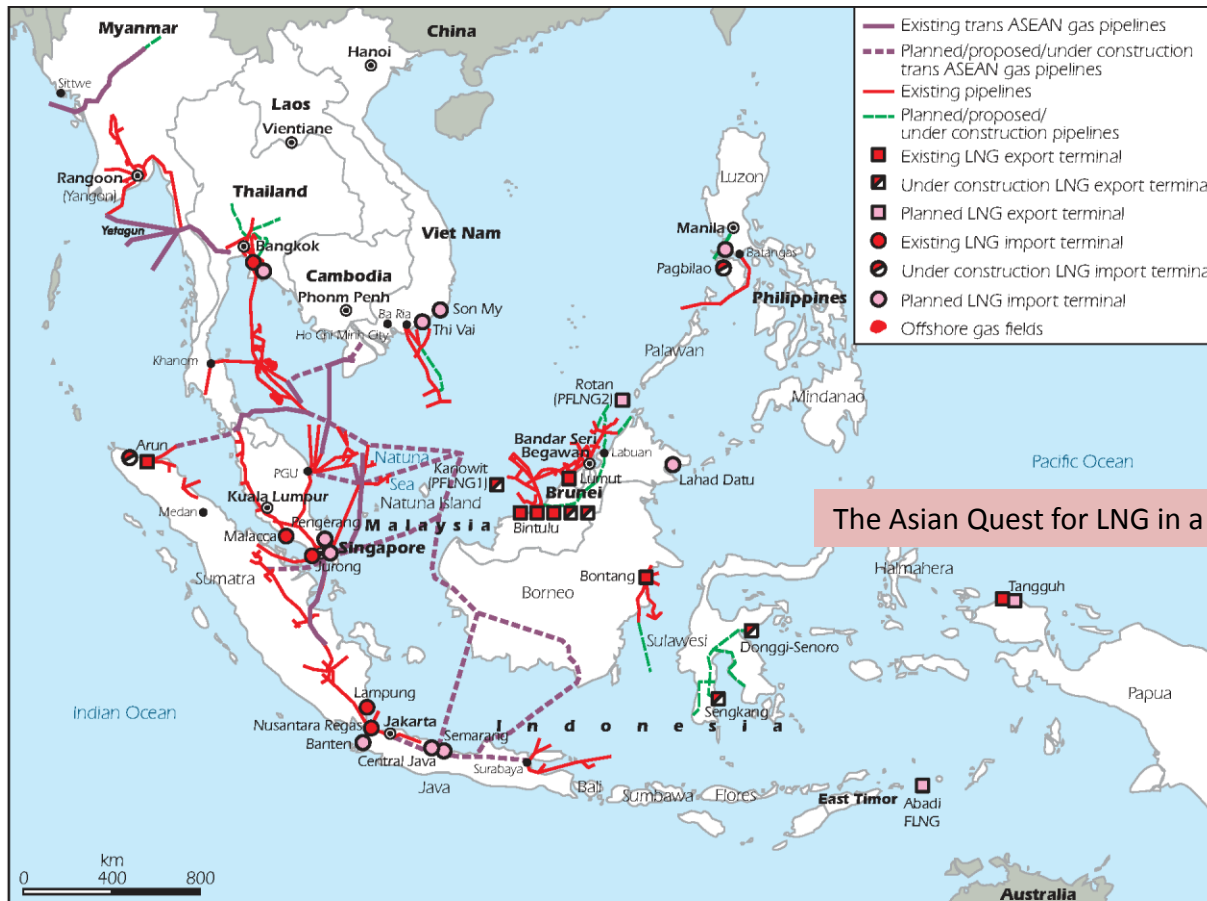
Henry Hub indexation in new contracts is not the final solution



- US Henry Hub reached as high as USD 8/Mbtu in early 2014, whereas Asian spot prices went down to below USD 11/Mbtu during this summer.
- In longer term, a mix of oil, Henry Hub and Asian hub indexation could govern LNG contracts.

Trading hub – Asian-tailored solution?

TAGP and LNG terminals in Southeast Asia



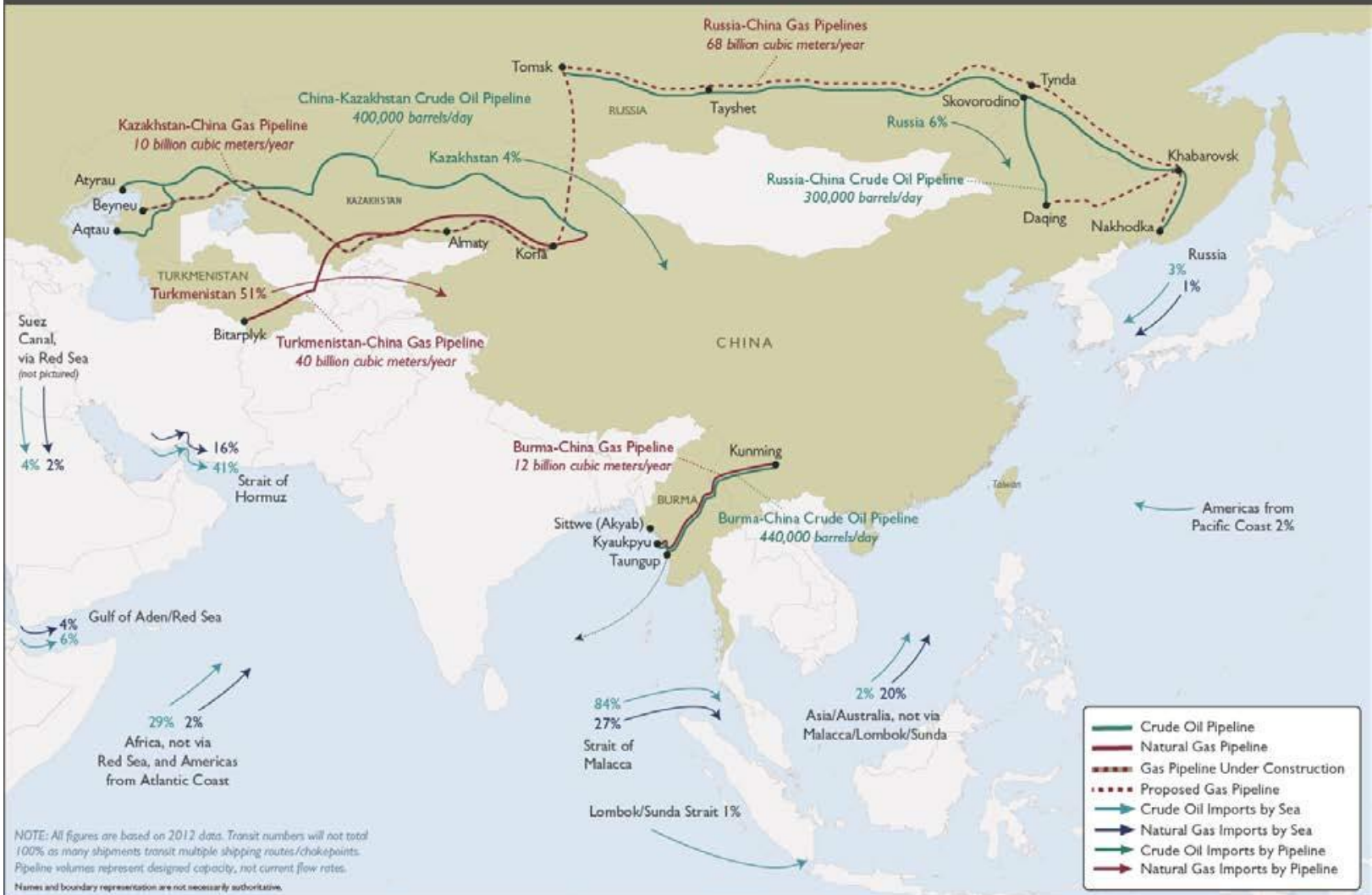
The Asian Quest for LNG in a Globalising Market

- Southeast Asian countries are already interlinked by pipeline and plan to increase these linkages through Trans ASEAN Gas Pipeline (TAGP) and LNG.

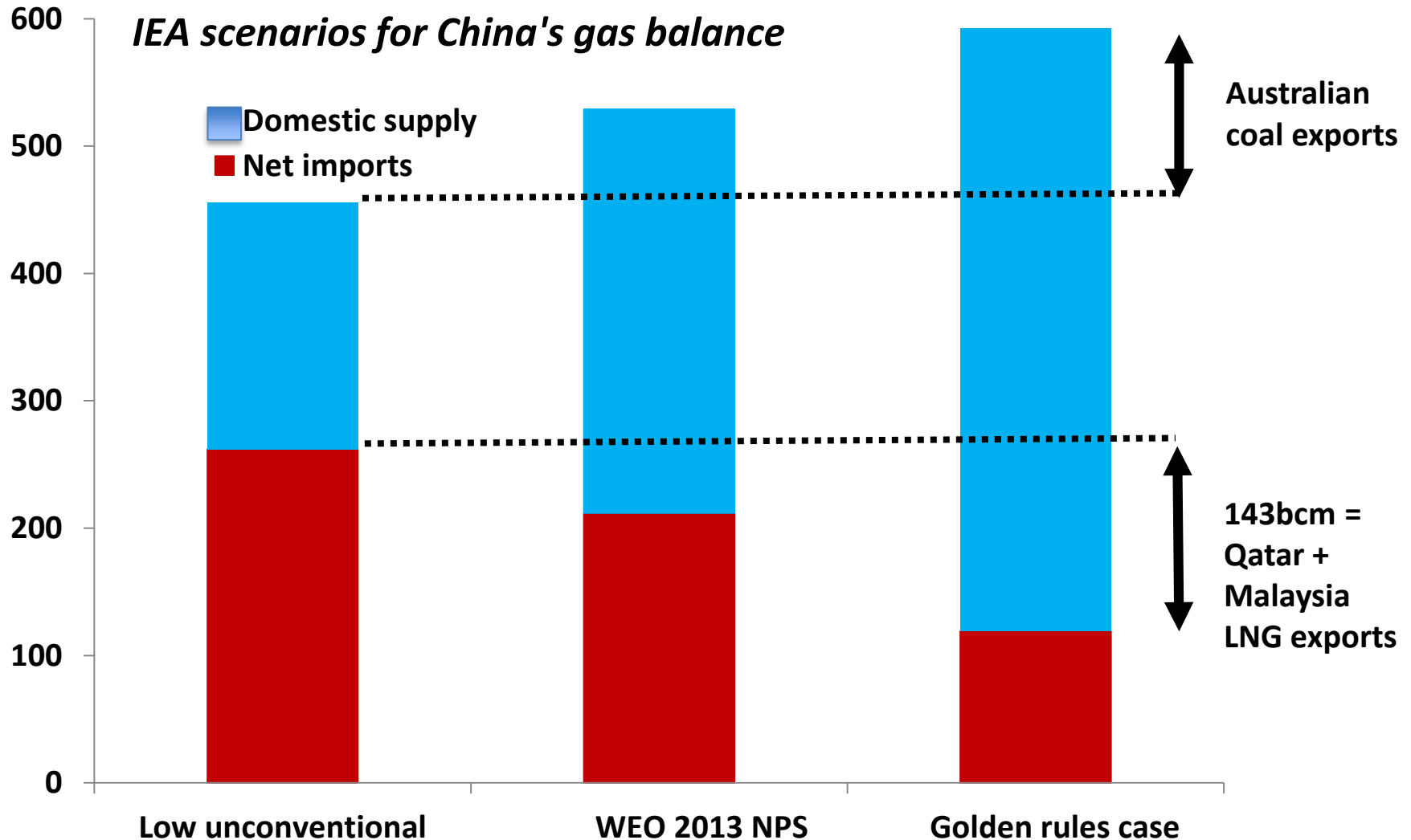
China's Oil & Gas Import Transit Routes

UNCLASSIFIED

(U) China's Import Transit Routes/Critical Chokepoints and Proposed/Under Construction SLOC Bypass Routes



Chinese shale gas: the No 1 uncertainty in global energy markets



Russian Gas Pipelines Will Extend to the East: Recent China Deal

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

Mid-Term Oil & Gas Market 2010, IEA

Possible Pipeline Project from Russia to Japan

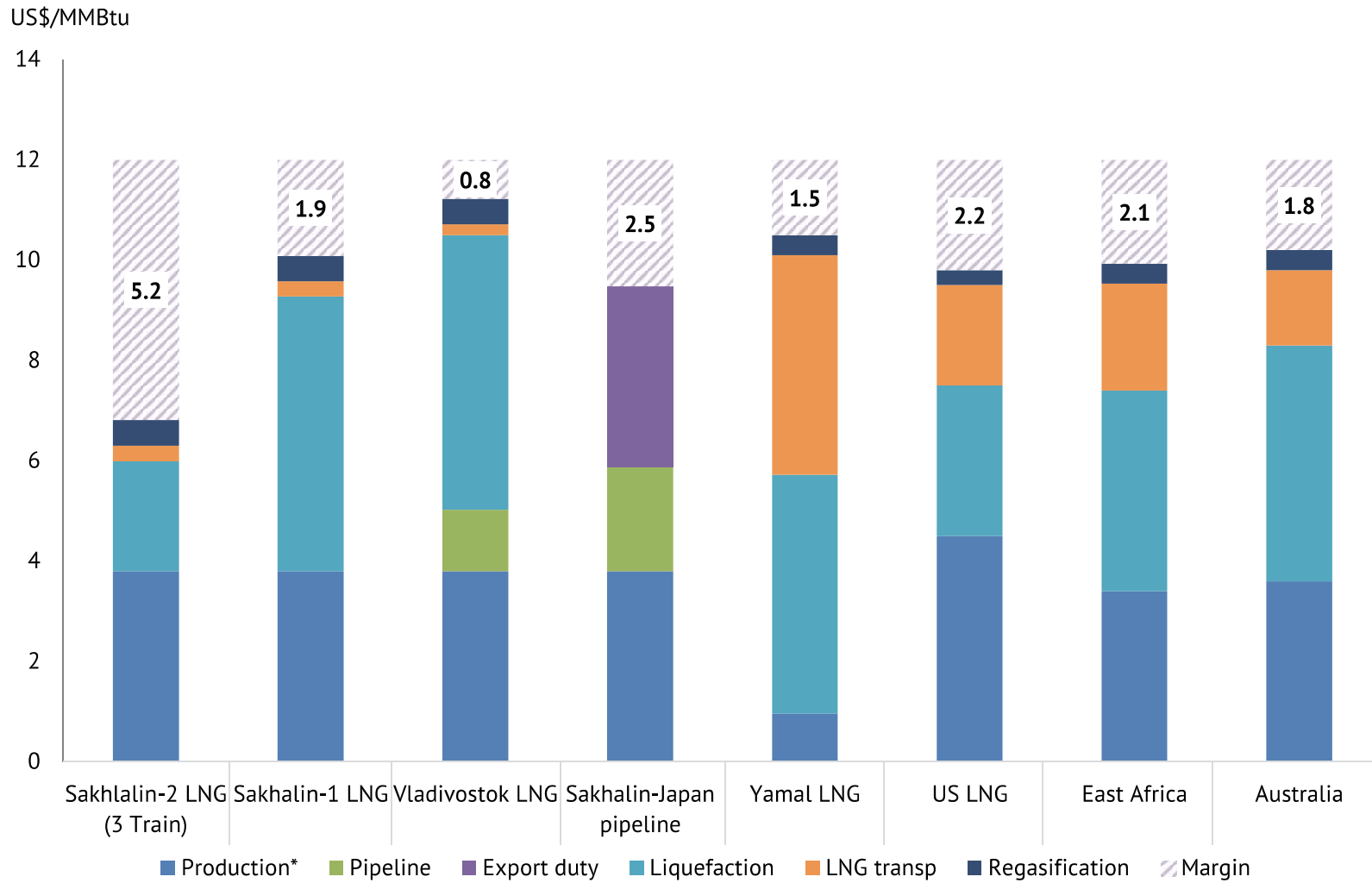
Figure 1. Proposed Subsea Pipeline Route*



* Only the Ishikari-Tomakomai section has onshore PL.

Estimated volume of 8bcm pa

Figure 2. International Comparison of LNG Projects' Costs under Planning (est.)

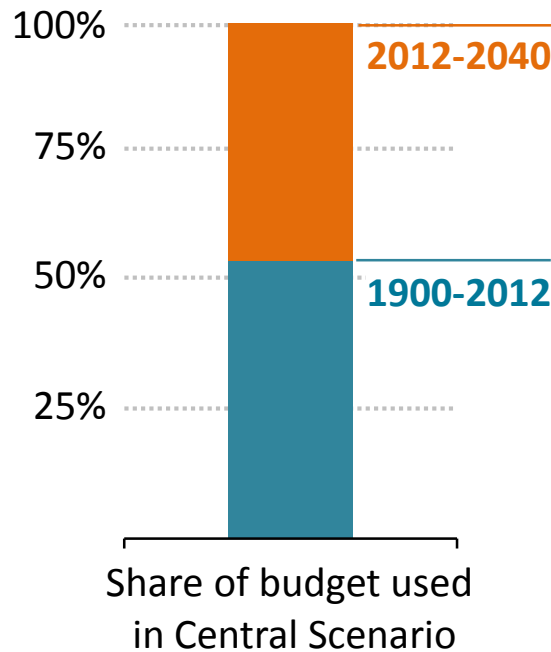


*Production tax included, except for the Yamal project.

Source: Compiled by ERI and IEEJ, based on various sources.

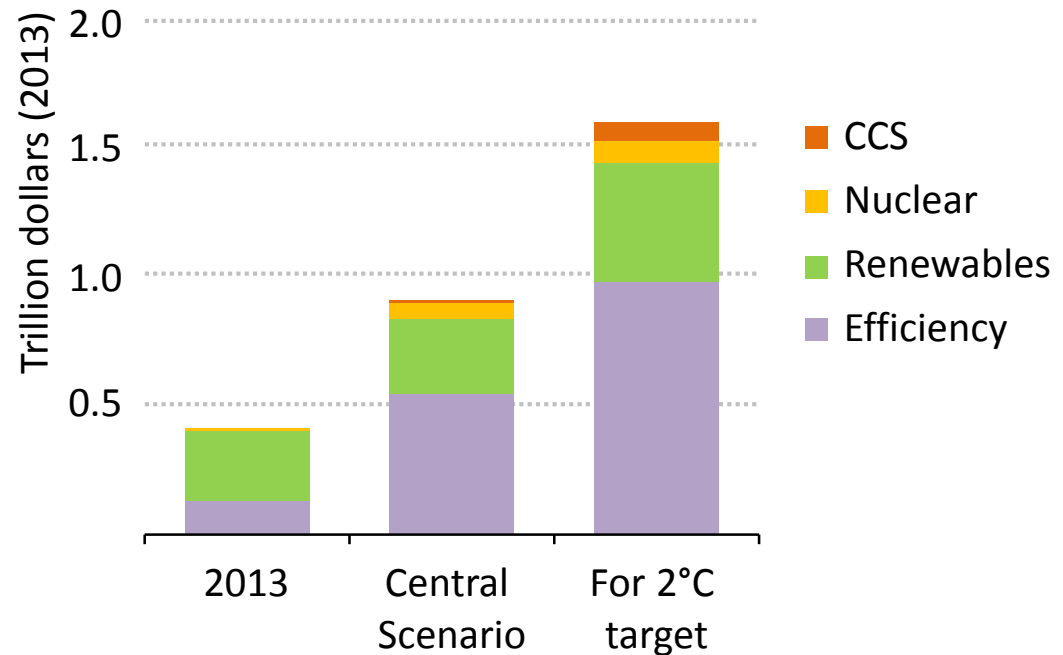
The 2 °C goal – last chance in Paris?

World CO₂ budget for 2 °C
~2300 Gt



Average annual low-carbon investment, 2014-2040

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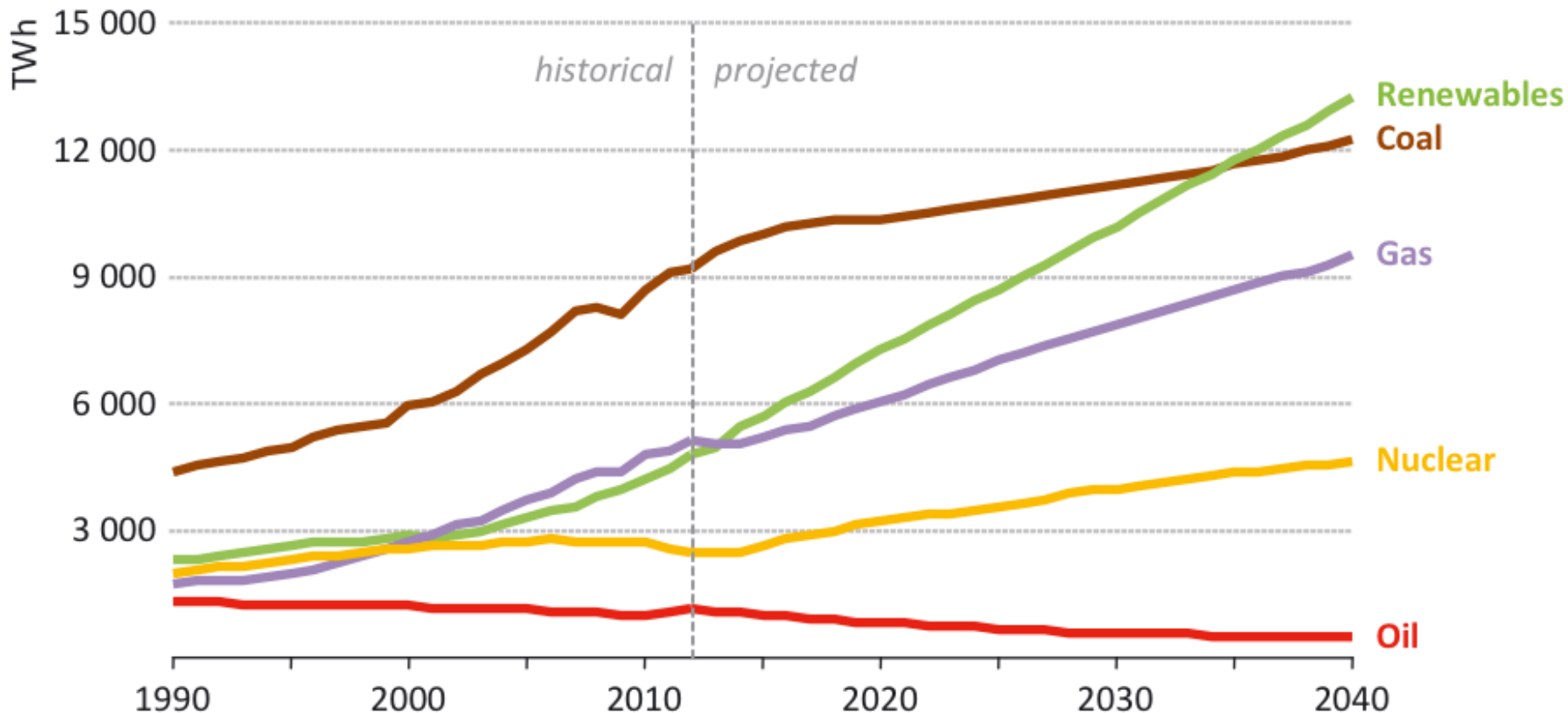


The entire global CO₂ budget to 2100 is used up by 2040 – Paris must send a strong signal for increasing low-carbon investment four times beyond current levels

Global Electricity Generation grows by 77% Renewables will be No. 1 source.

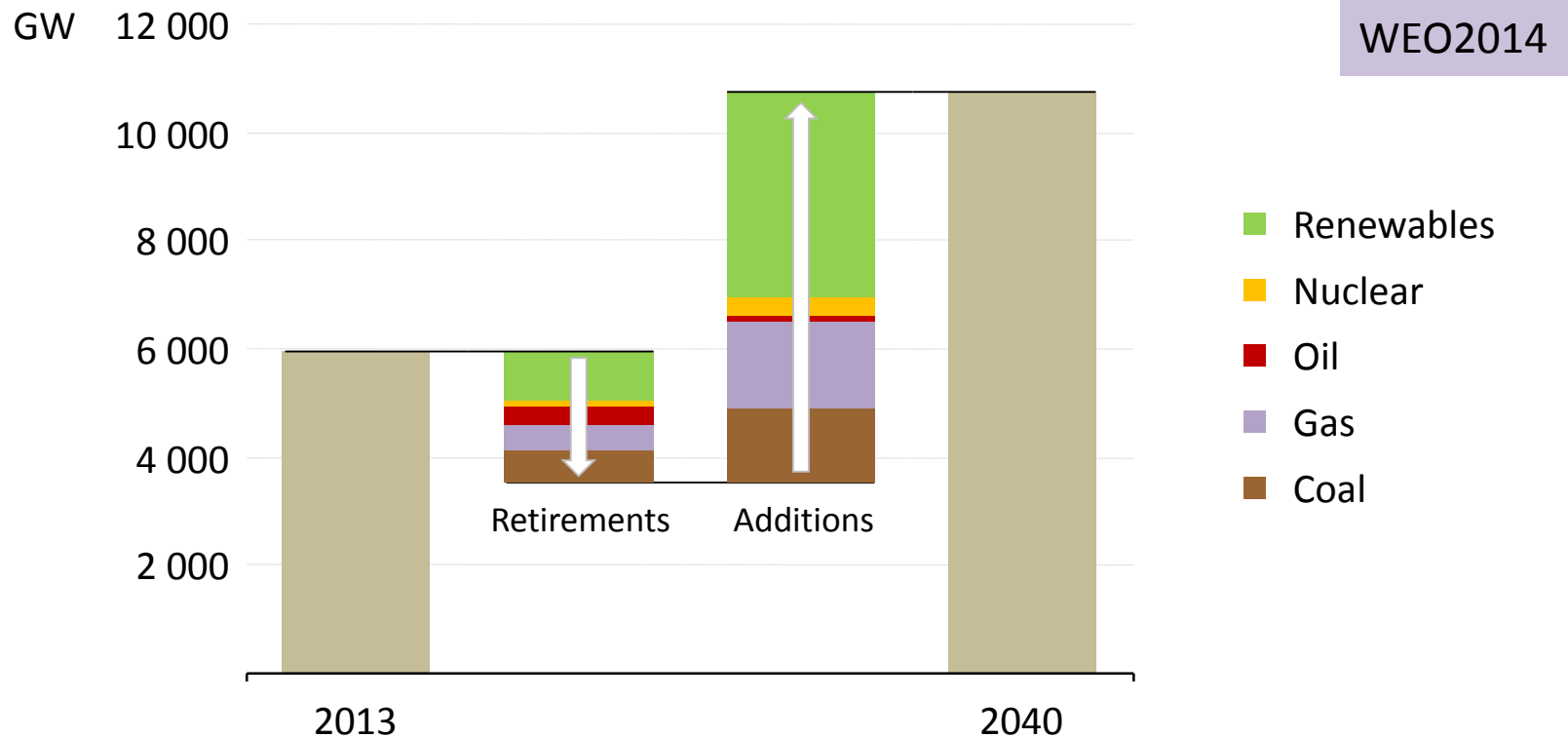
Figure 6.7 ▶ World electricity generation by source in the New Policies Scenario

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Retirements add to the investment challenge in the power sector

Power capacity by source, 2013-2040



Despite limited demand growth, OECD countries account for one-third of capacity additions – to compensate for retirements & to decarbonise

Is coal an option?

The
Economist

Coal

The fuel of the future, unfortunately

A cheap, ubiquitous and flexible fuel, with just one problem

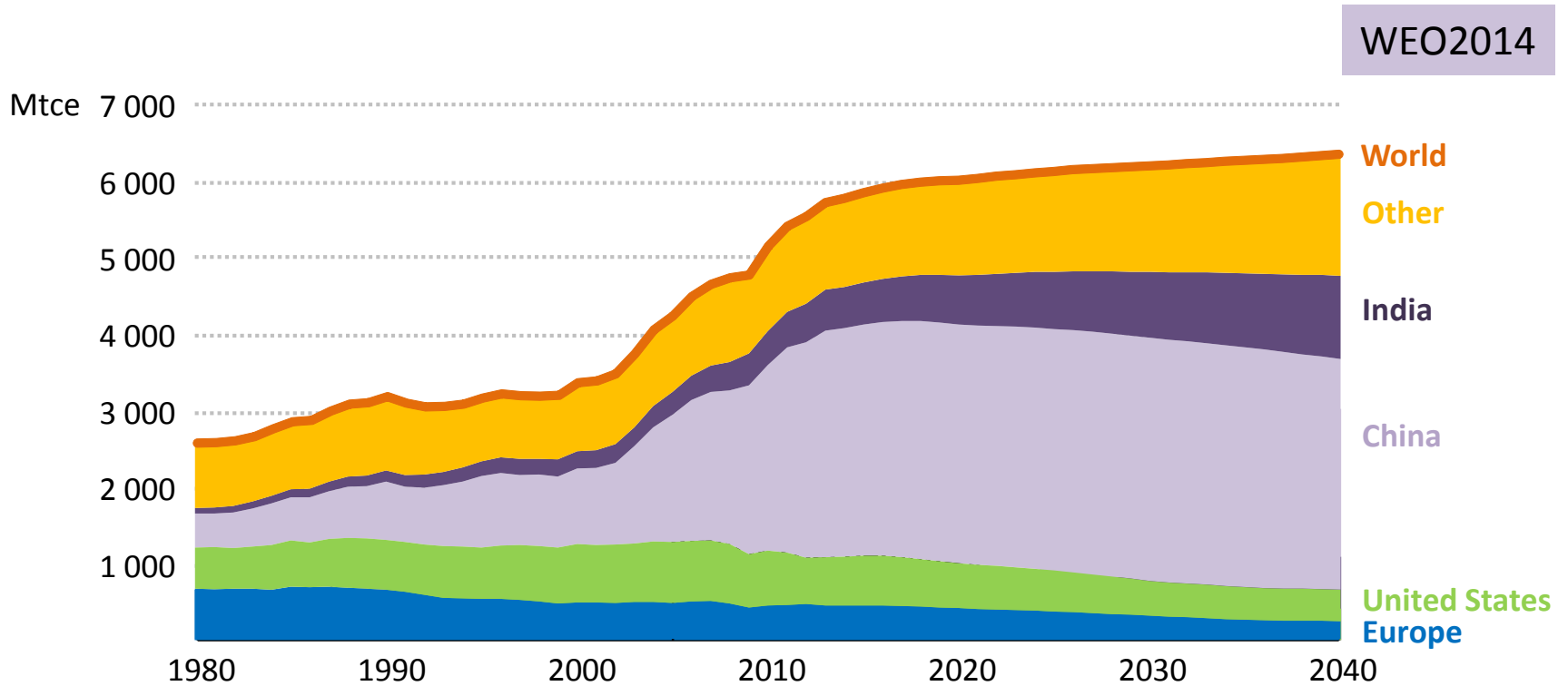
Apr 19th 2014 | From the print edition

WHAT more could one want? It is cheap and simple to extract, ship and burn. It is abundant: proven reserves amount to 109 years of current consumption, reckons BP, a British energy giant. They are mostly in politically stable places. There is a wide choice of dependable sellers, such as BHP Billiton (Anglo-Australian), Glencore (Anglo-Swiss), Peabody Energy and Arch Coal (both American).



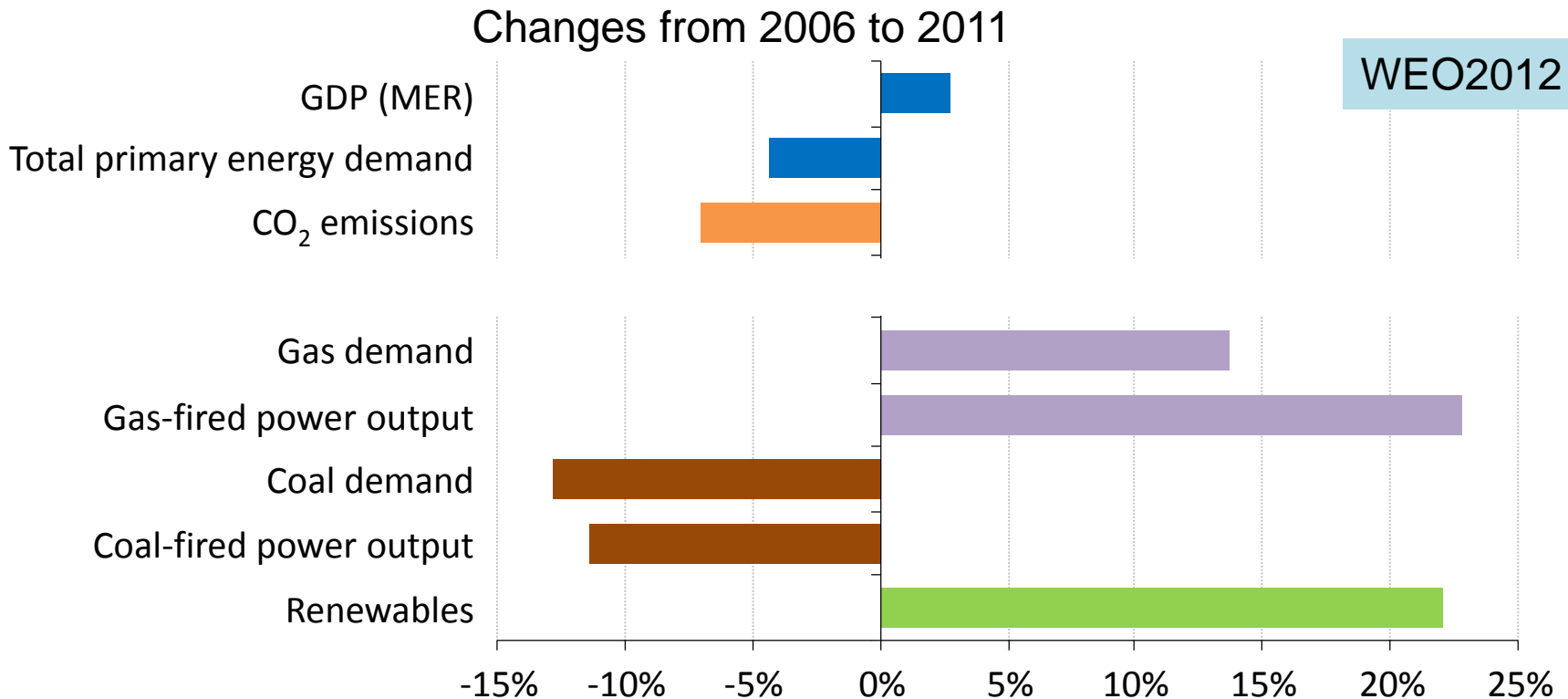
Global coal demand leveling off

Global coal demand by key region



Global coal demand growth slows rapidly due to more stringent environmental policies, underlining the importance of high-efficiency plant & CCS to coal's future

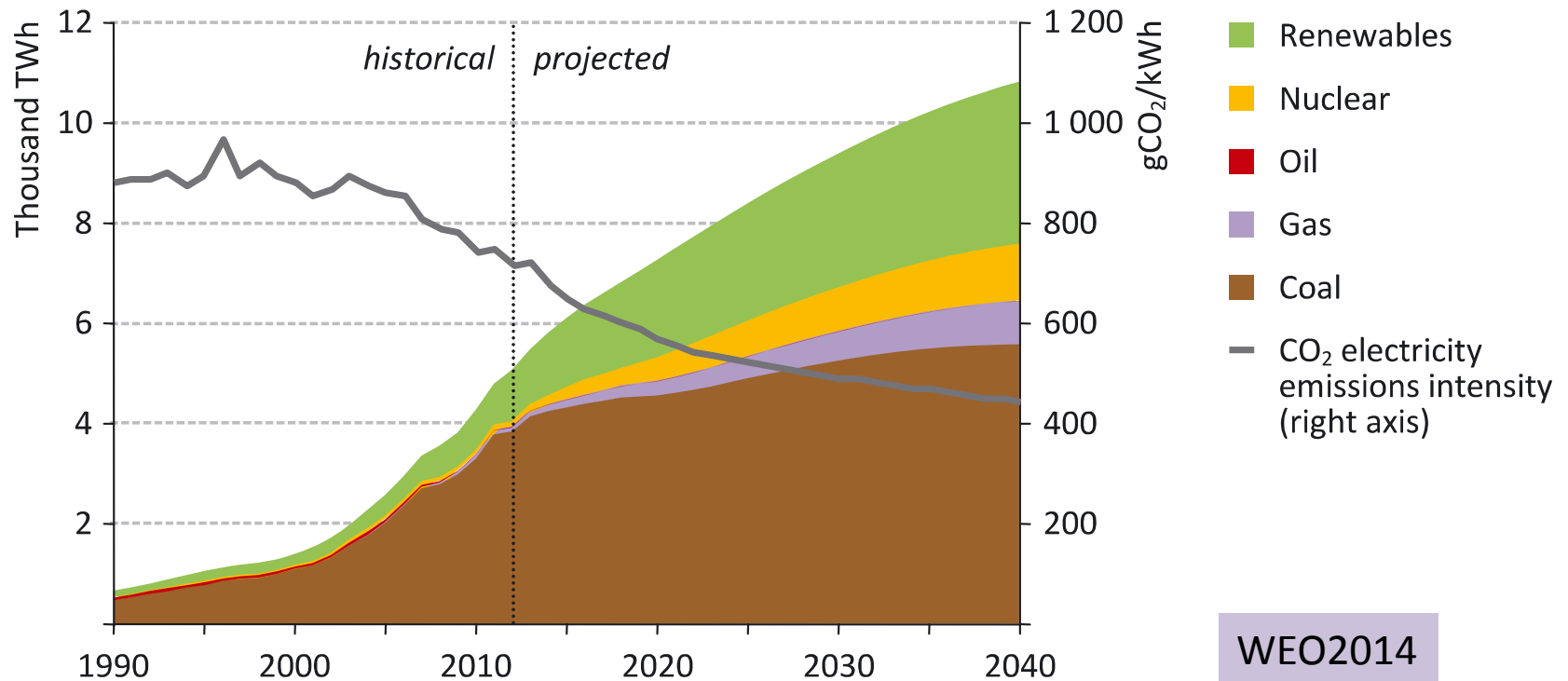
Shale revolution brought win-win-win for the US



From 2006-2011, United States CO₂ emissions went down by 7% due to coal-to-gas fuel switching, power generation efficiency gains & increased renewables output . It enhanced economic growth and energy security.

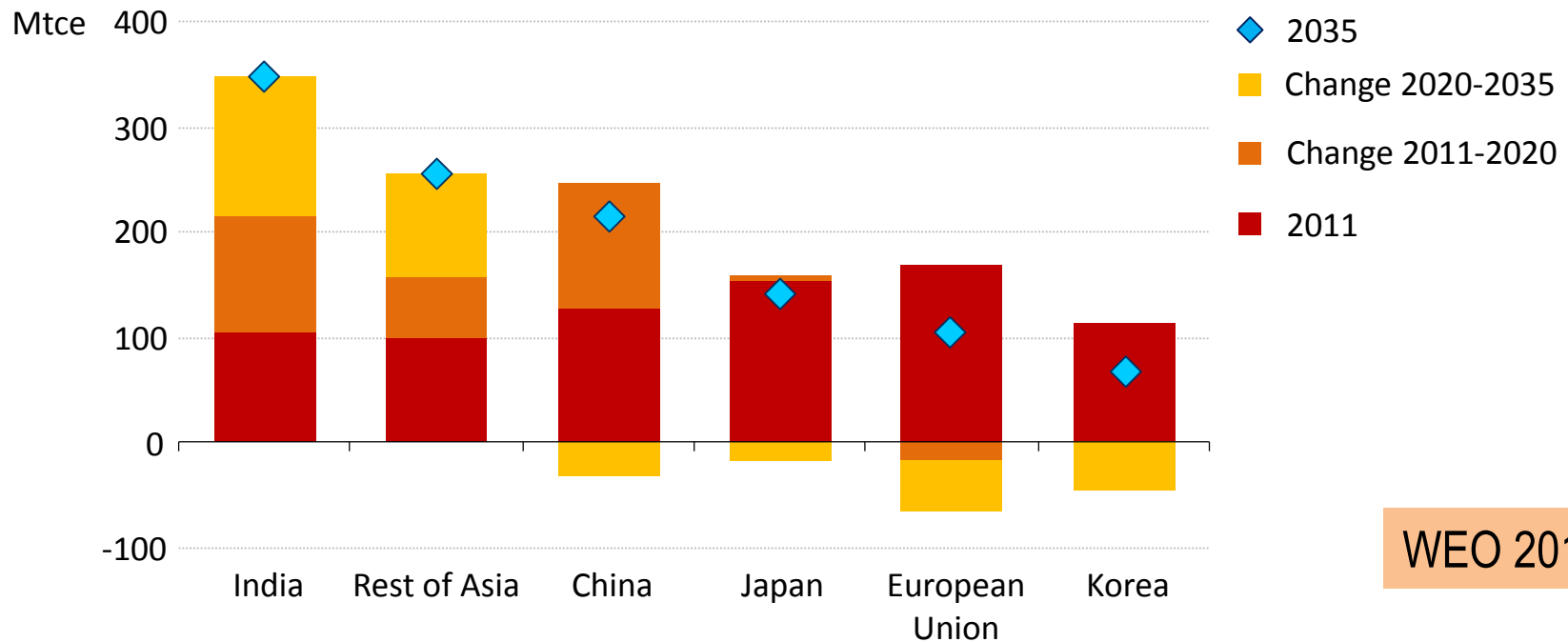
China needs cleaner power mix with more Renewables, Nuclear and Gas.

Figure 6.21 ▶ China electricity generation by source and CO₂ intensity in the New Policies Scenario



The centre of coal trade is shifting to developing Asia

Major net importers of coal

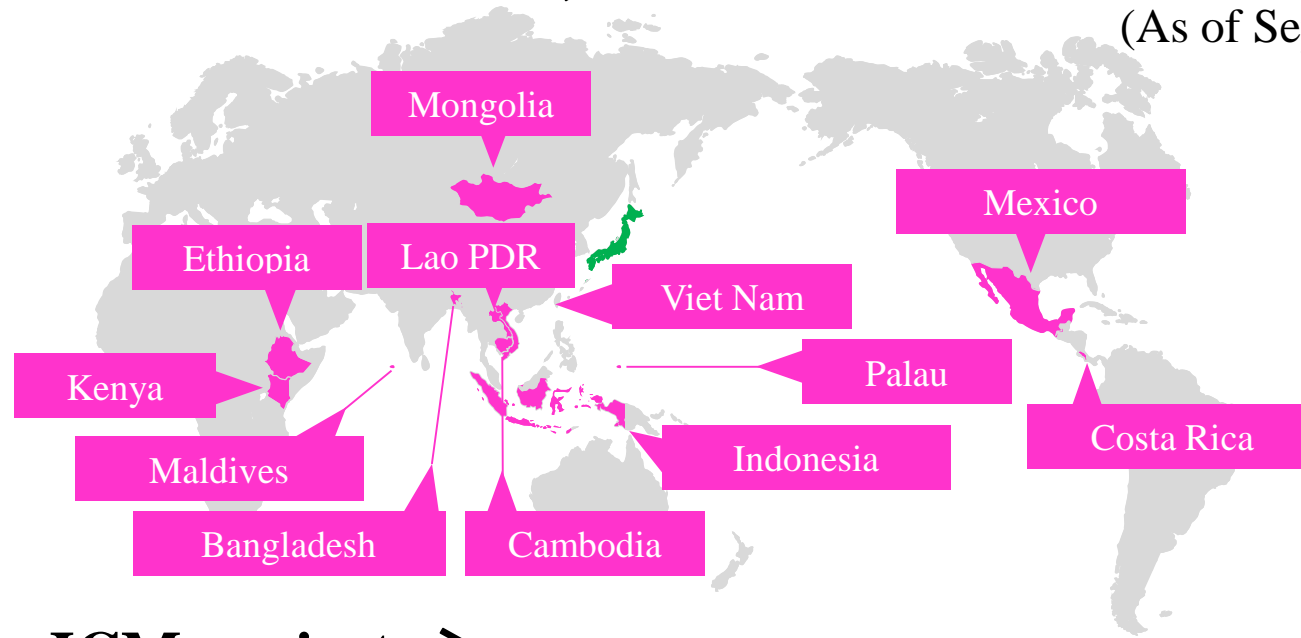


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The role of key OECD coal importers declines further, while Asian importers gain in importance, with India becoming the largest net importer early in the next decade

< JCM Host Countries : 12 >

(As of September, 2014)



< Future JCM projects >

◆ Renewable Energy

- Solar Power Plant
- Micro Hydro Power Plant
- Biomass Power Generation

◆ Energy-Saving

- Integrated Steel Works
- Building Energy Management System
- Energy Efficient Air Conditioner

◆ High Efficient Thermal Power Plant

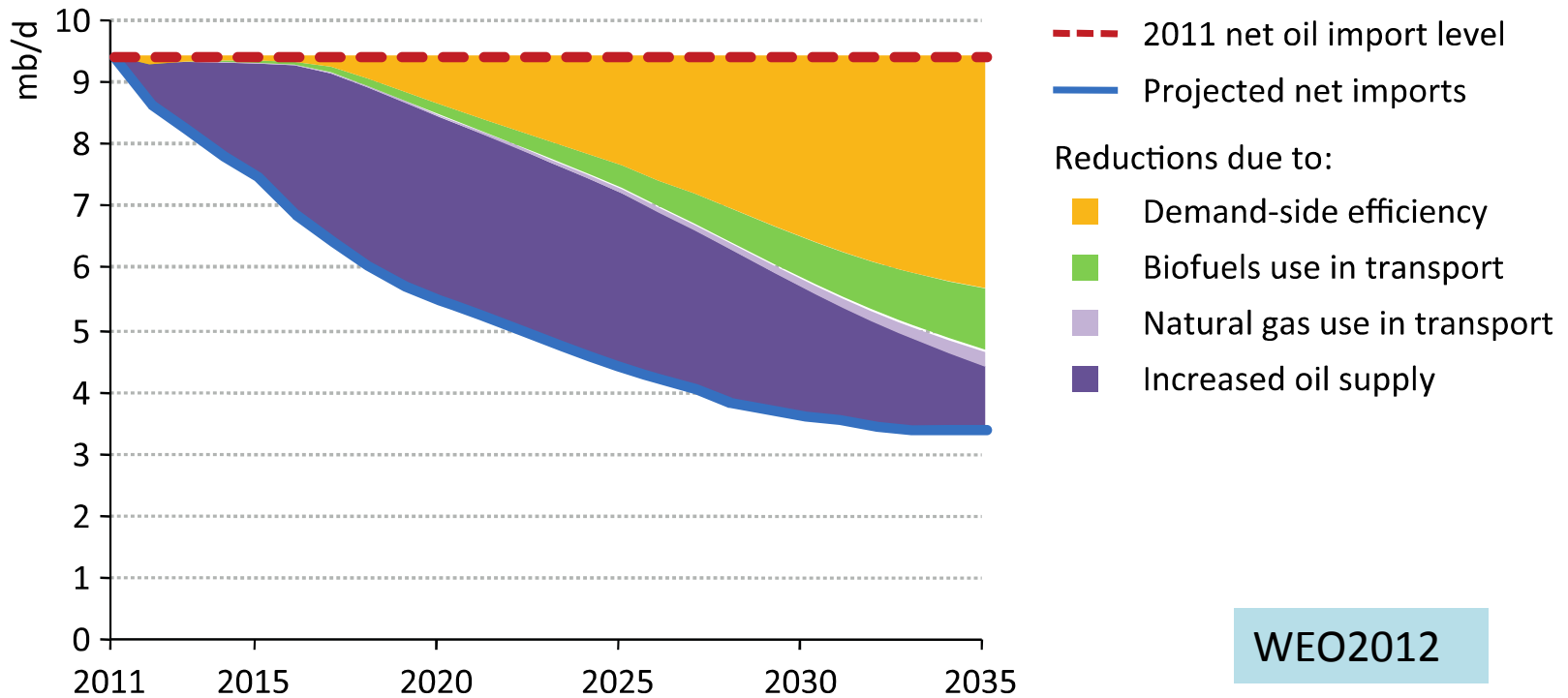
- CCGT(Combined Cycle Gas Turbine) : Natural Gas

◆ CCS (Carbon dioxide Capture and Storage)

- CO2-EOR (Enhanced Oil Recovery)

What enables US Energy Independence ?

Figure 2.17 ▷ Reductions in net oil imports in the United States by source in the New Policies Scenario



450 ppm Scenario (2DS) enables Demand Peaks in Oil and Coal

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Figure 2.5 ▶ World primary energy demand by fuel in the New Policies Scenario

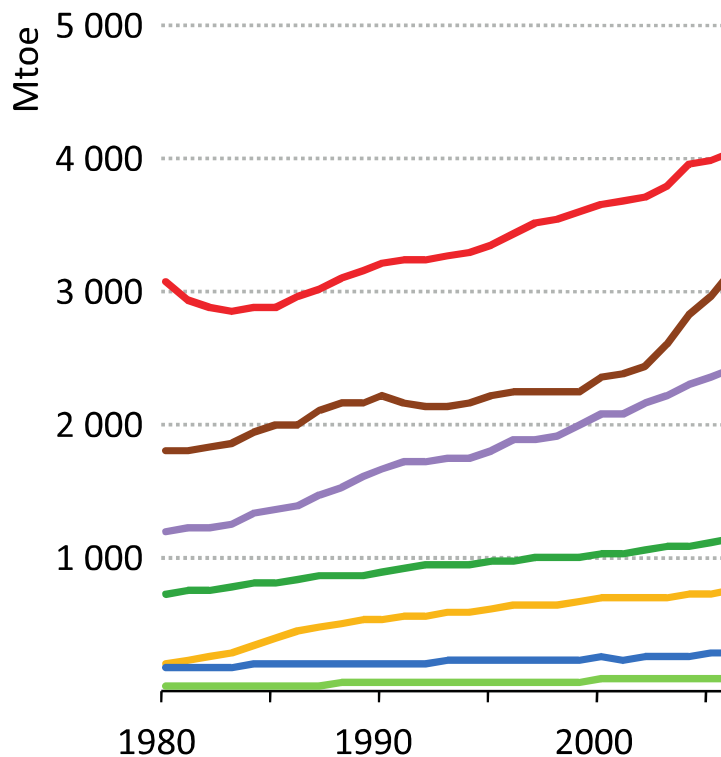
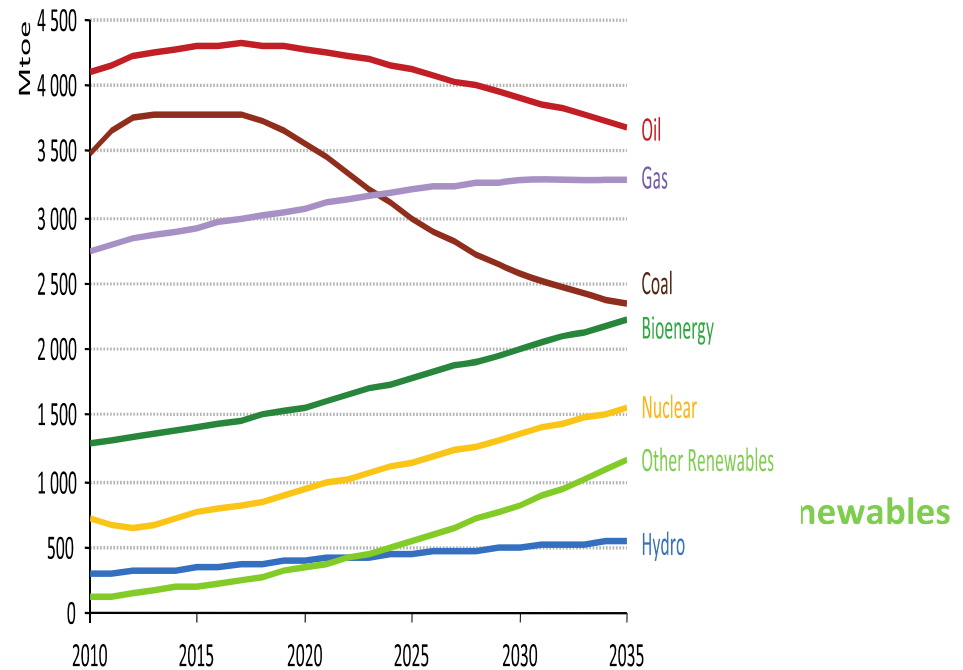


Figure 8.5 ▶ Primary energy demand in the 450 Scenario by fuel

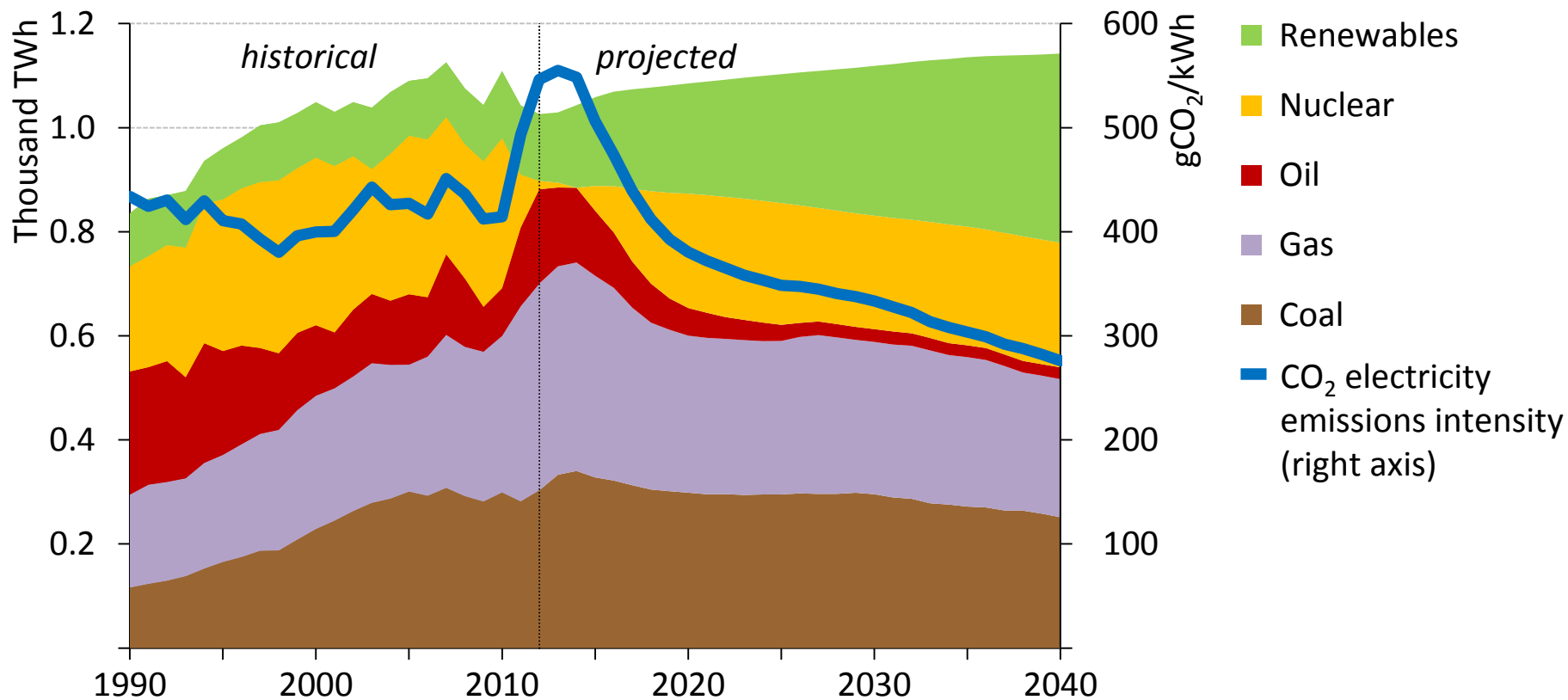


The Stone Age didn't end because we ran out of stones.

Japan's power system: moving to a more diverse & sustainable mix

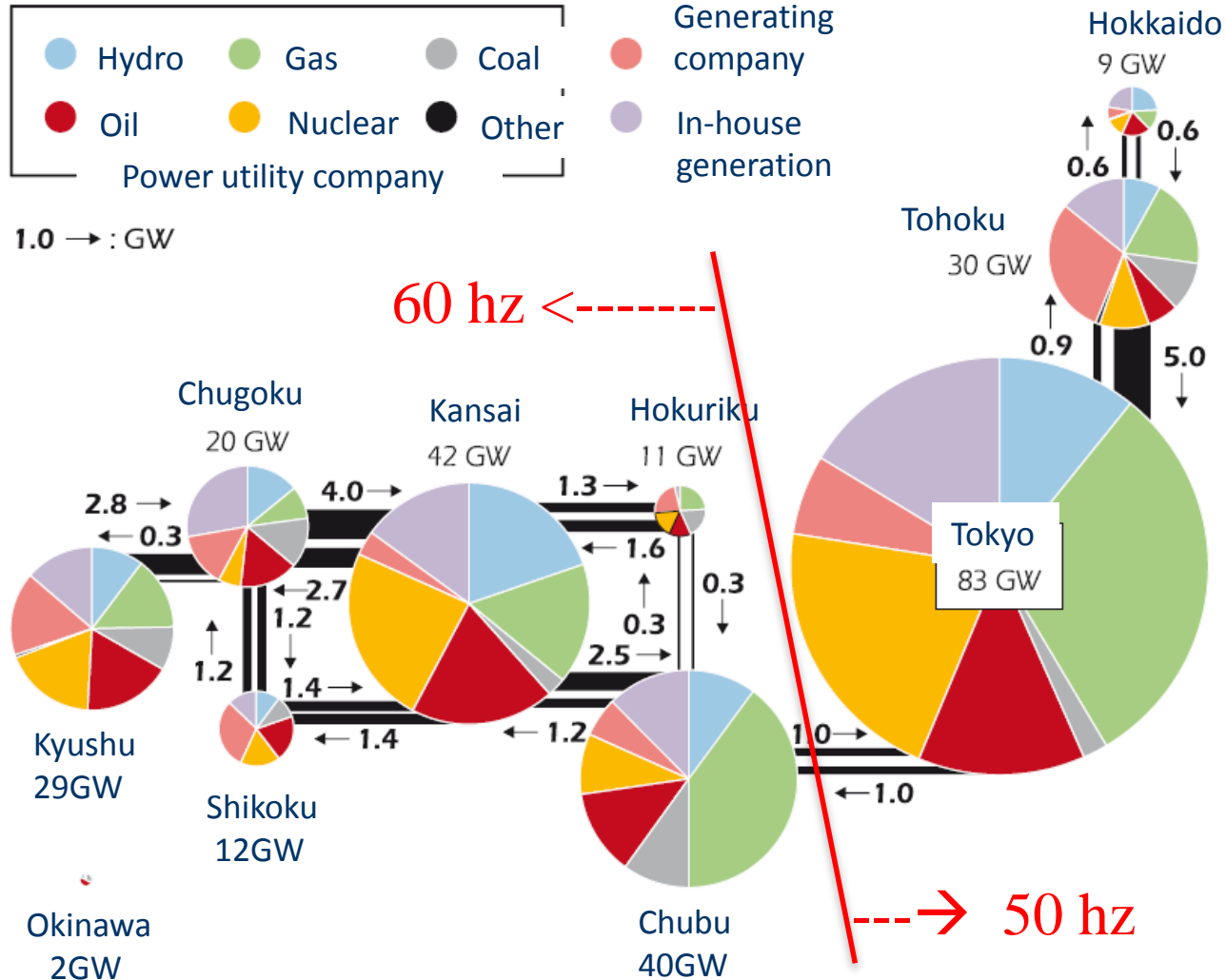
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Japan electricity generation by source and CO₂ intensity



With nuclear plants expected to restart & increased use of renewables, Japan's electricity mix becomes much more diversified by 2040 (Renewables 32%, Nuclear 21%, gas 23%, coal 22%)

Power grid in Japan

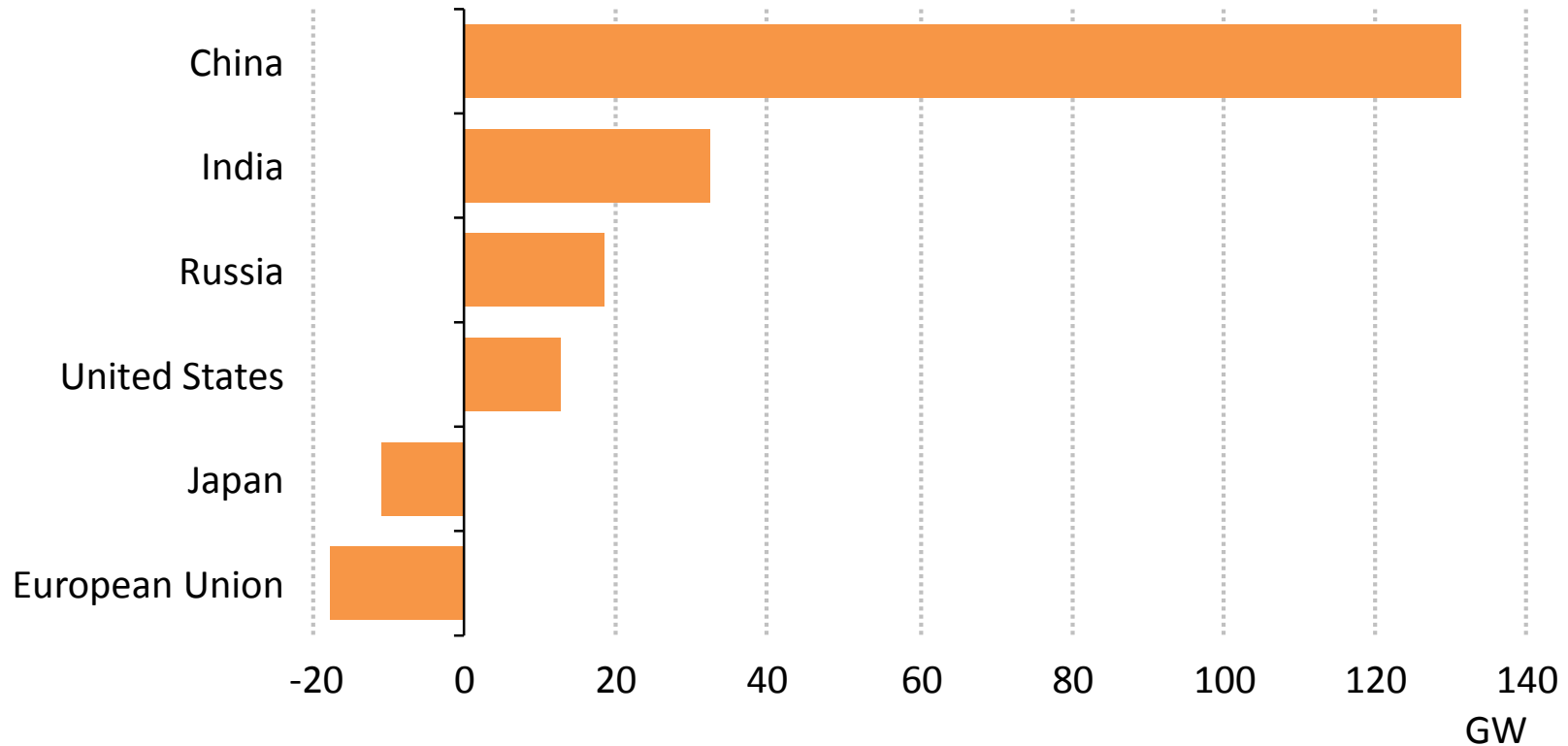


Source: Agency for Natural Resources and Energy, The Federation of Electric Power Companies of Japan, Electric Power System Council of Japan, The International Energy Agency

Nuclear capacity grows by 60%, but no nuclear renaissance in sight

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Net capacity change in key regions, 2013-2040

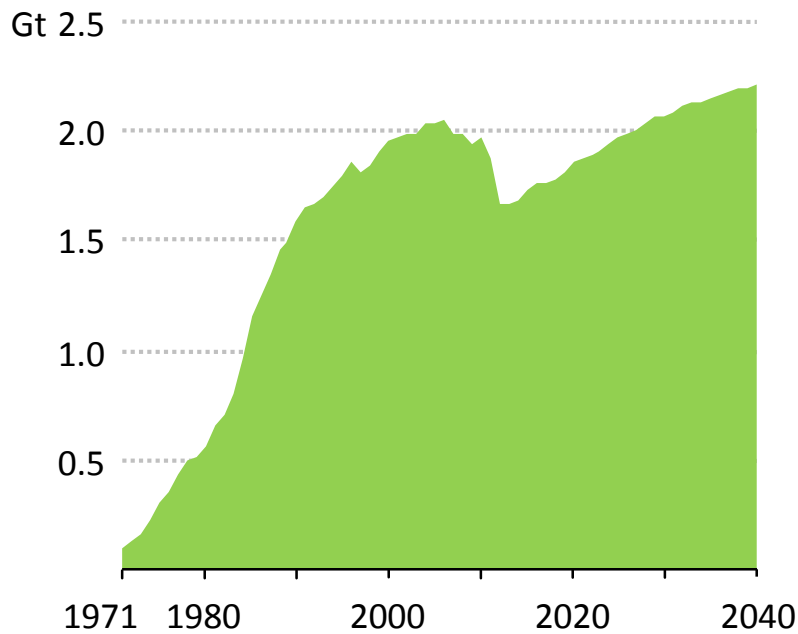


Capacity grows by 60% to 624 GW 2040, led by China, India, Korea & Russia; yet the share of nuclear in the global power mix remains well-below its historic peak

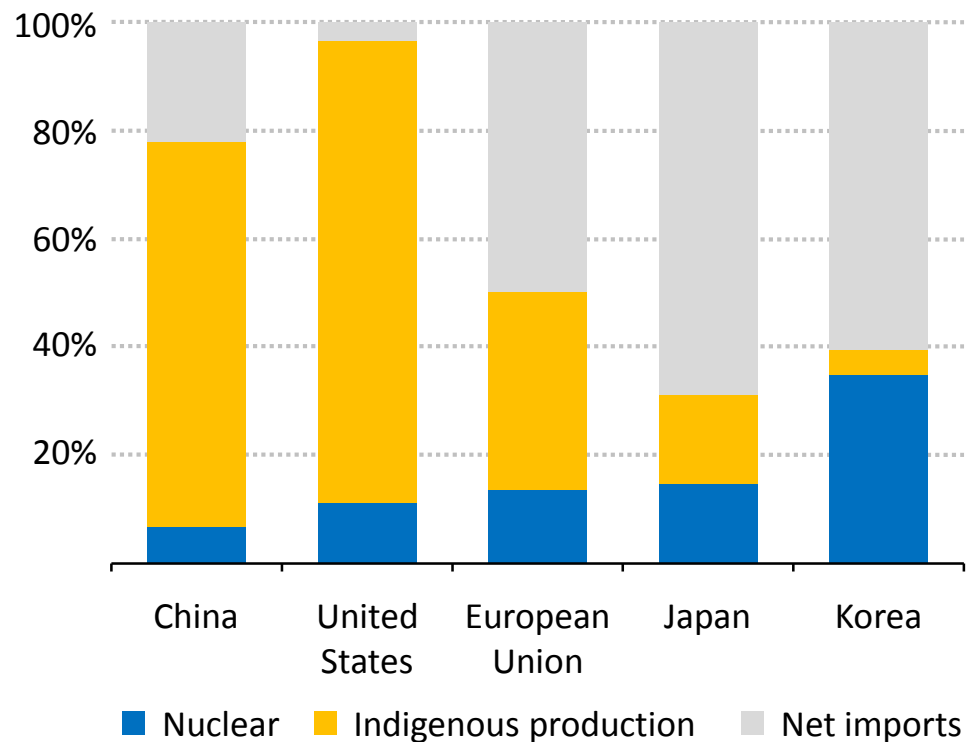
Nuclear power can play a role in CO₂ abatement & energy security

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CO₂ emissions avoided annually by nuclear power 1971-2040



Share of energy demand met by domestic sources and nuclear power in 2040

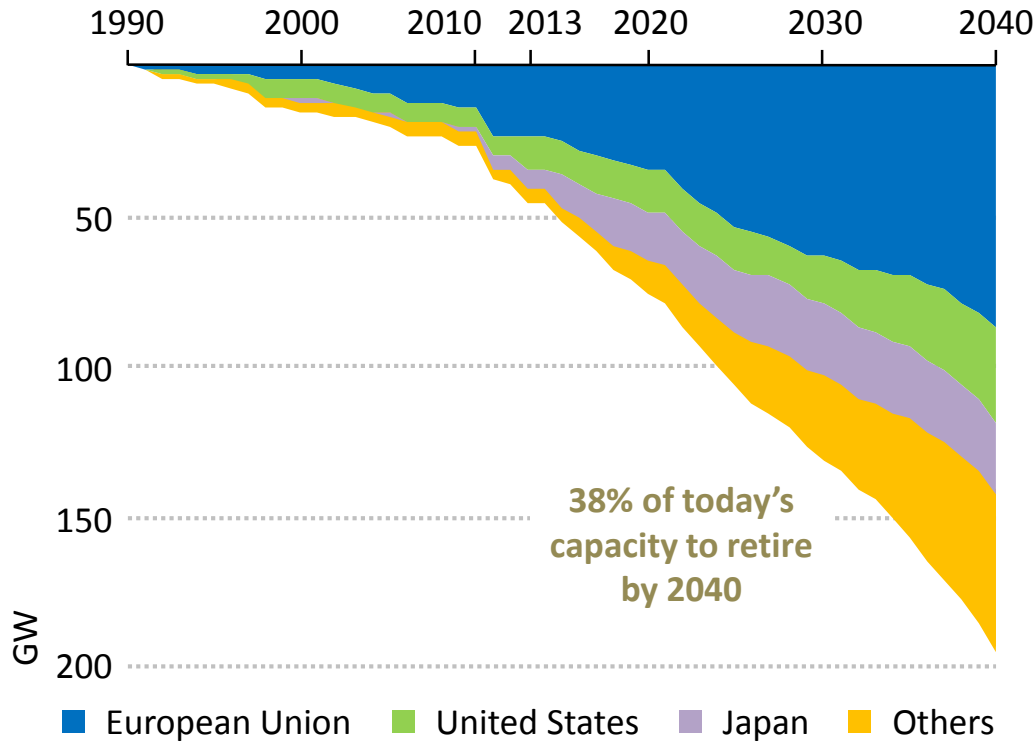


By 2040, an expanded nuclear fleet has saved almost 4 years of current CO₂ emissions & for some countries has improved energy security & balances of energy trade

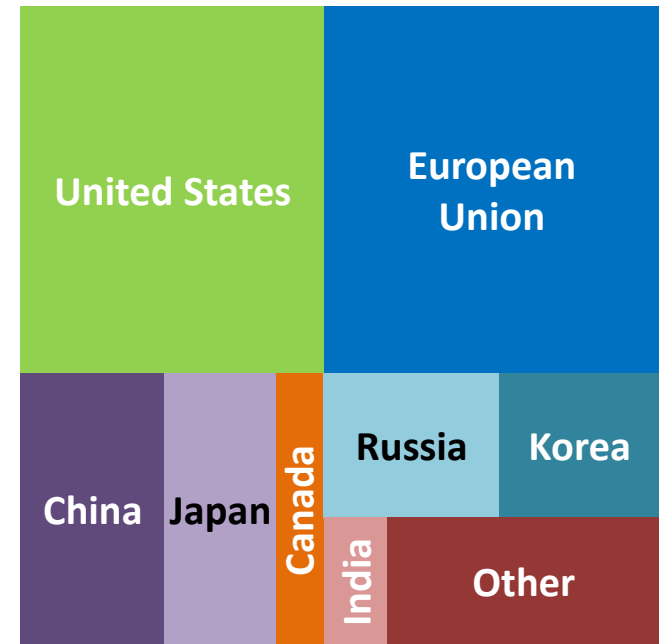
Nuclear power: public concerns must be heard and addressed

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Retirements of nuclear power capacity
1990-2040



Spent nuclear fuel
1971-2040: 705 thousand tonnes



Key public concerns include plant operation, decommissioning & waste management; & the amount of spent fuel doubles
By 2040, almost 200 reactors are retired



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OWEN GLEIBERMAN, *ENTERTAINMENT WEEKLY*



(ACTUAL SIZE)

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FROM ACADEMY AWARD[®] NOMINATED DIRECTOR ROBERT STONE

PANDORA'S PROMISE

AT THE BOTTOM OF THE BOX SHE FOUND HOPE.

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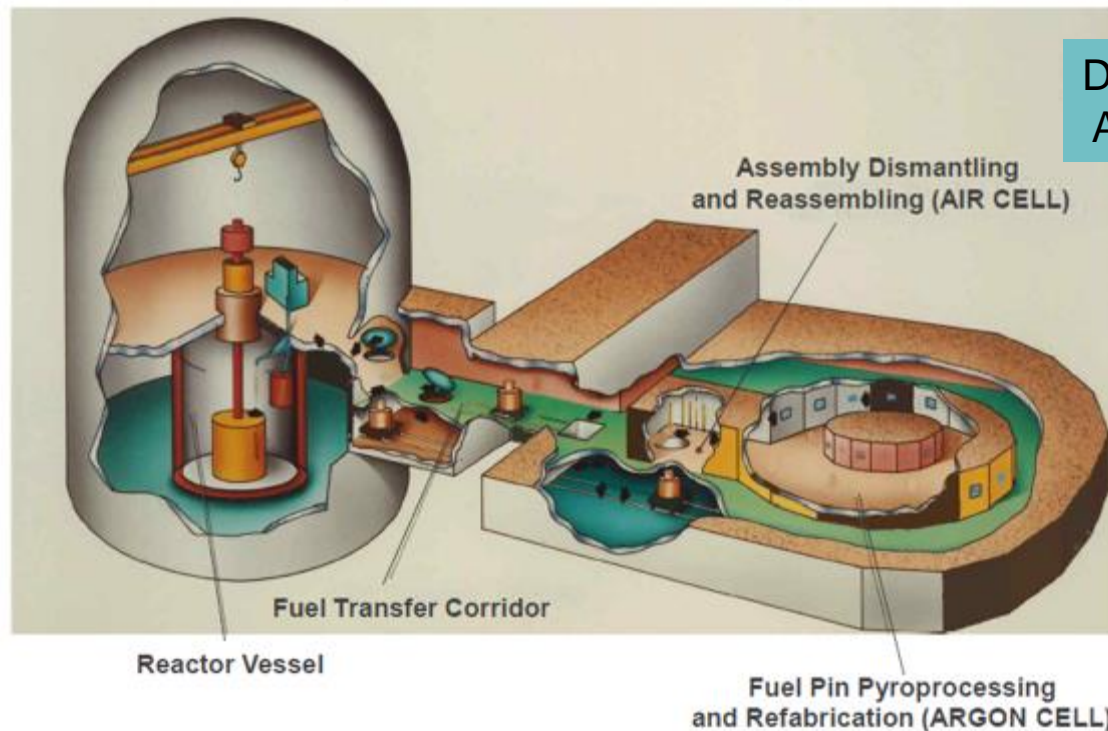
www.pandoraspromise.com

“Pandora’s Promise”, a movie directed by Robert Stone, is a documentary of environmentalists who changed their views about Nuclear Power.

You can see it at Youtube-> <https://www.youtube.com/watch?v=F0esvuLeRFI>

Time for Safer, Proliferation resistant and Easier Waste Management Paradigm: Integral Fast Reactor and Pyroprocessing

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

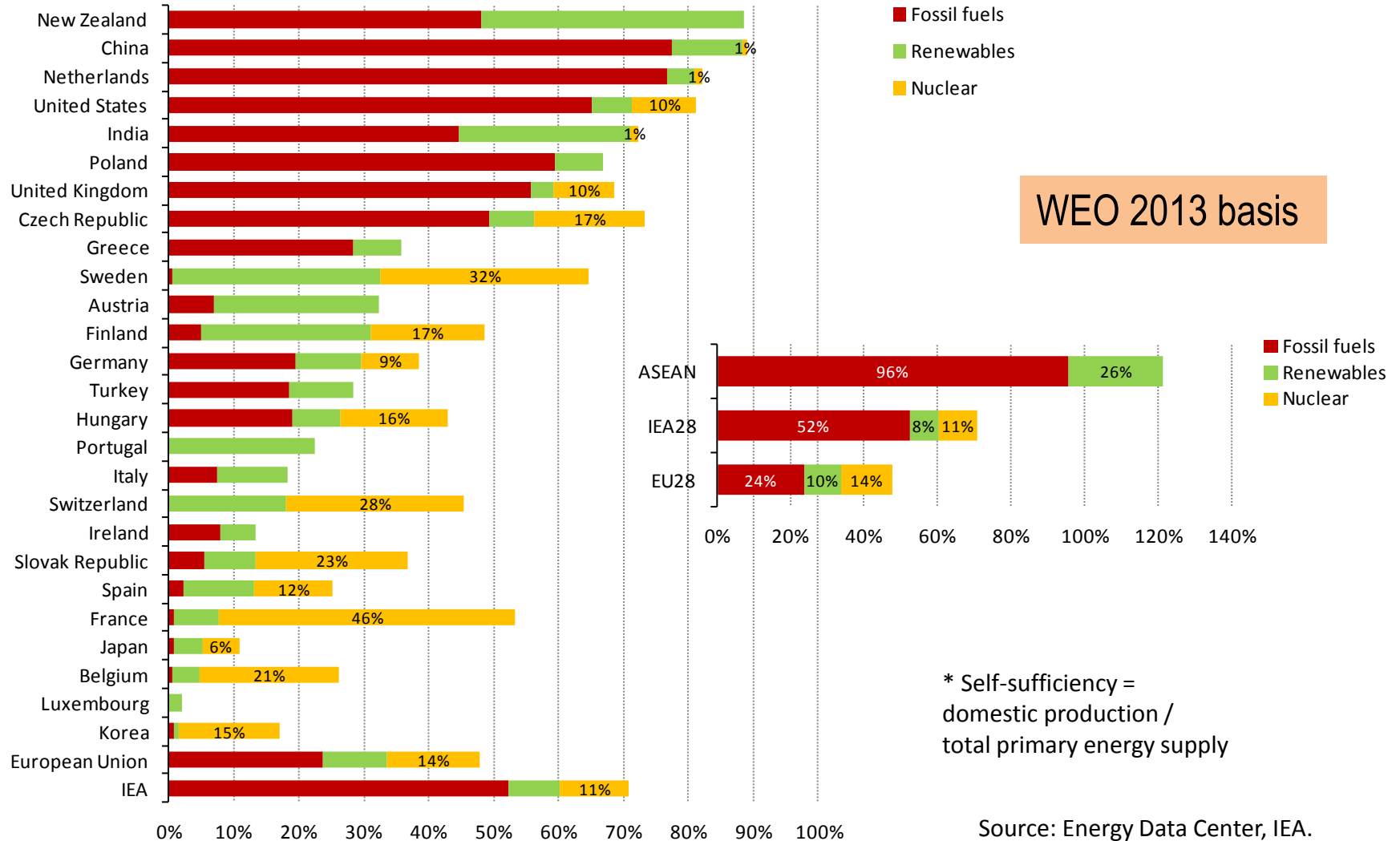


Dr. YOON IL CHANG
Argonne National Laboratory

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.

Collective Energy Security and Sustainability by Diversity, Connectivity and Nuclear

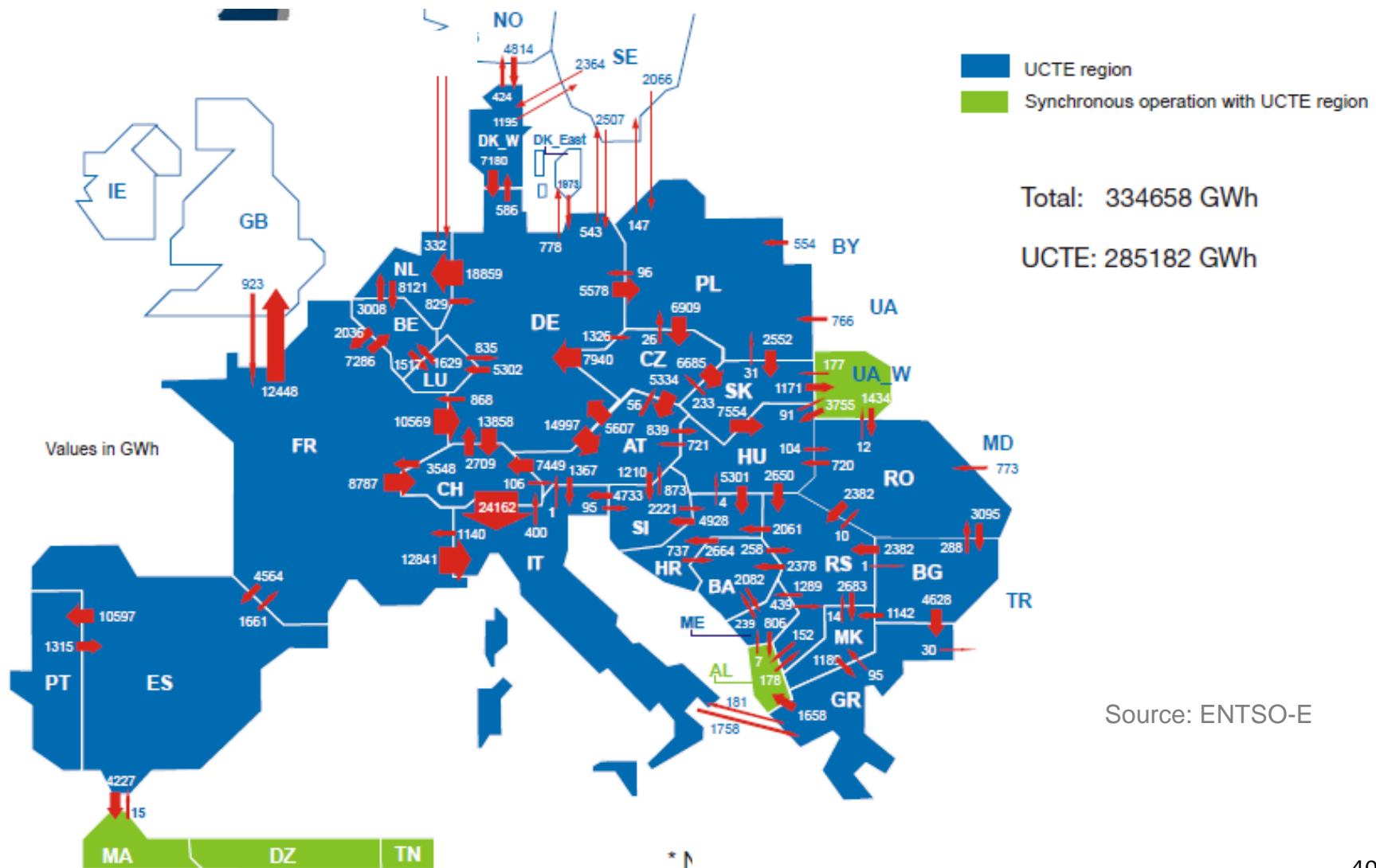
Energy self-sufficiency* by fuel in 2011



Note: Does not include fuels not in the fossil fuels, renewables and nuclear categories.

Power Grid Connection in Europe

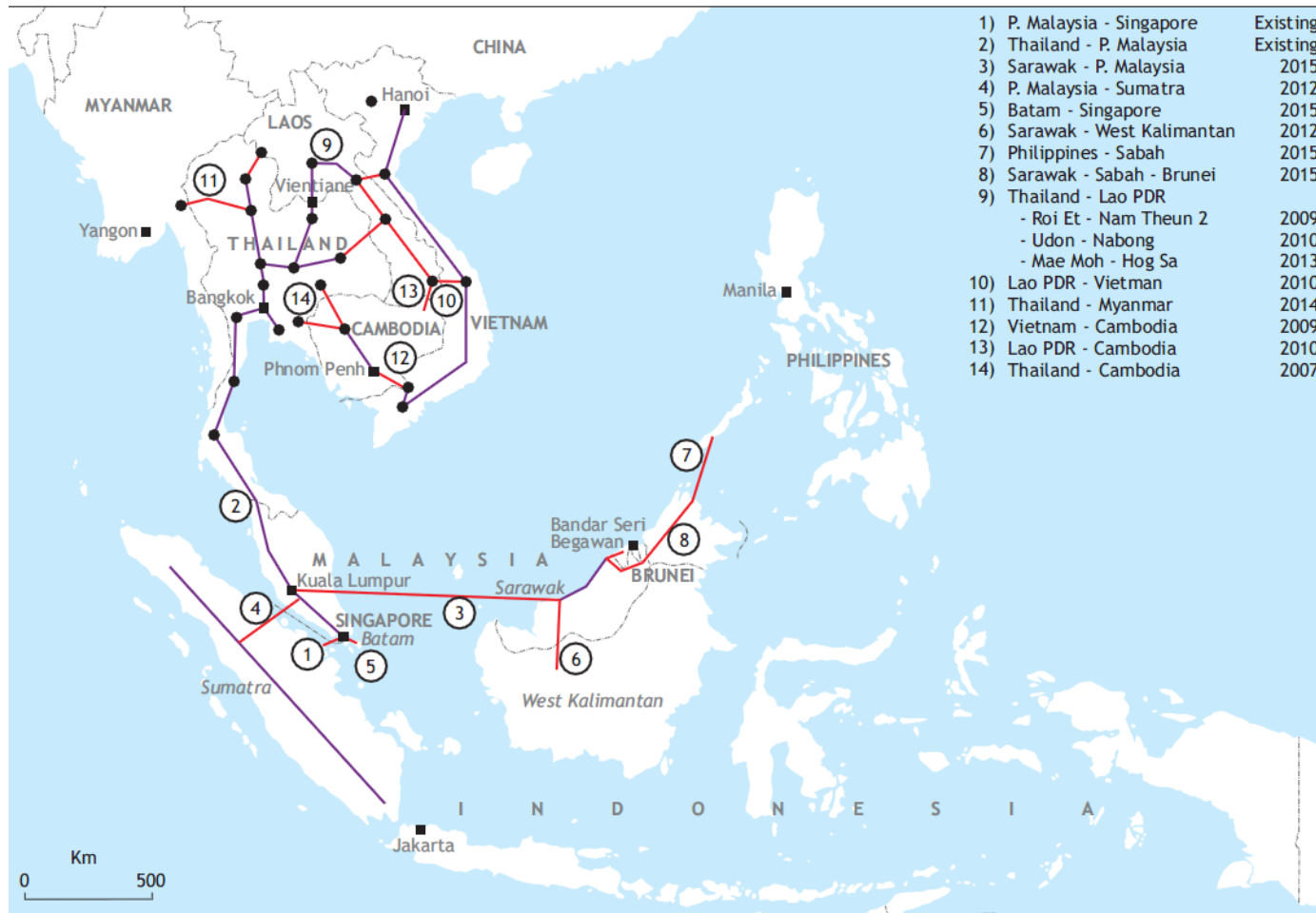
Physical energy flows between European countries, 2008 (GWh)



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



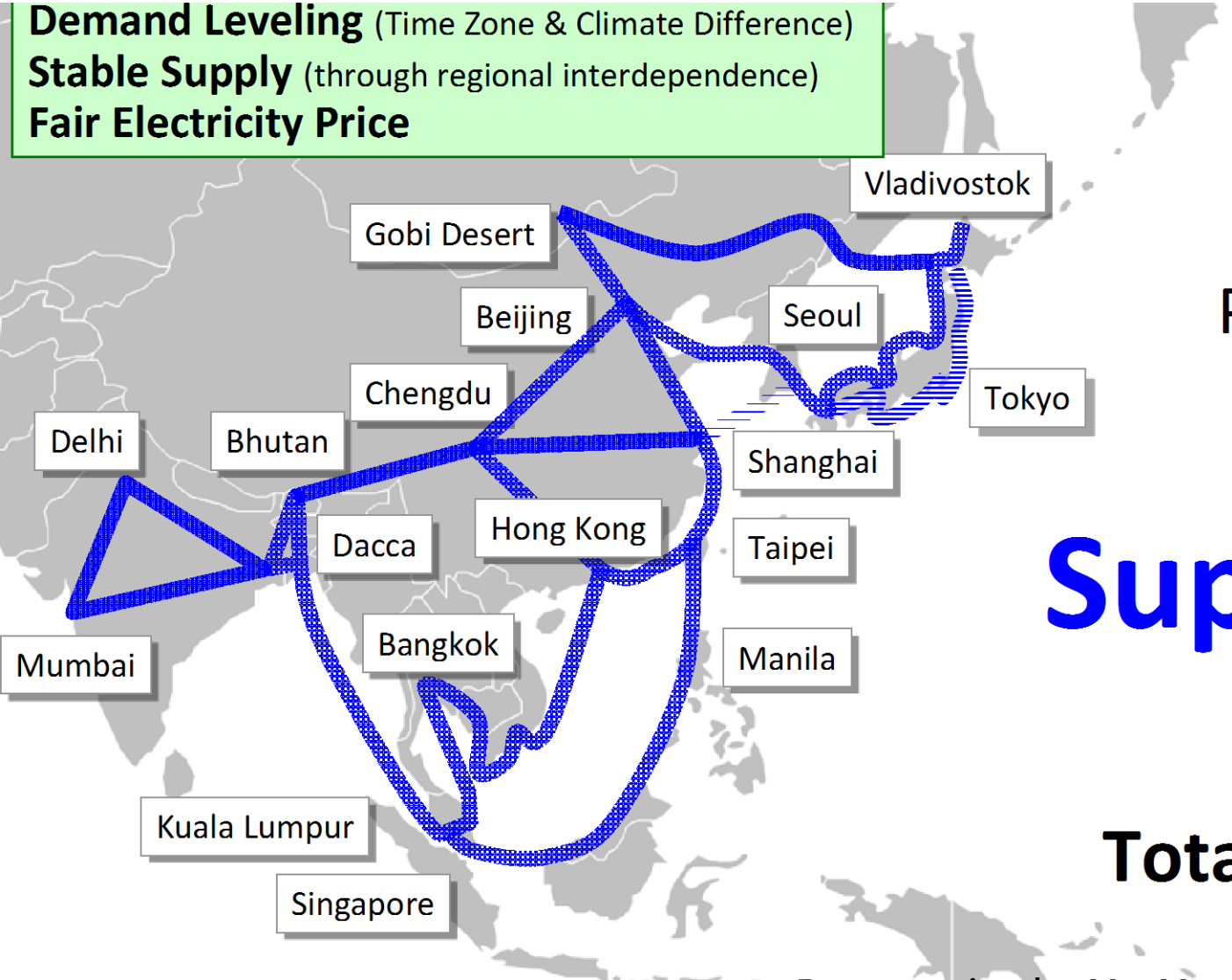
ASEAN power grid connection



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“Energy for Peace in Asia” New Vision?

Demand Leveling (Time Zone & Climate Difference)
Stable Supply (through regional interdependence)
Fair Electricity Price

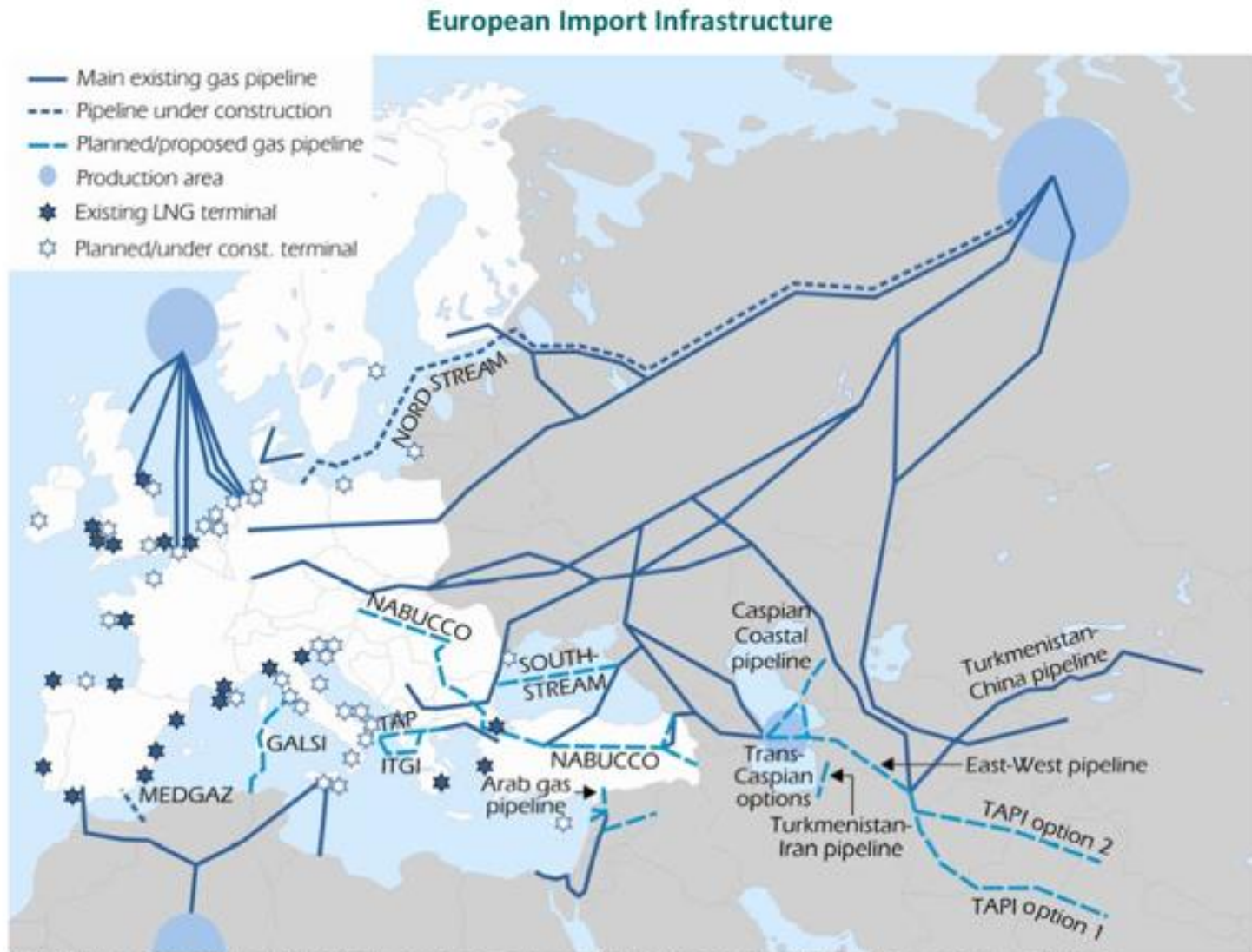


Phase 3 **Asia Super Grid**

Total 36,000km

Presentation by Mr. Masayoshi SON

Natural Gas Import Infrastructure in Europe

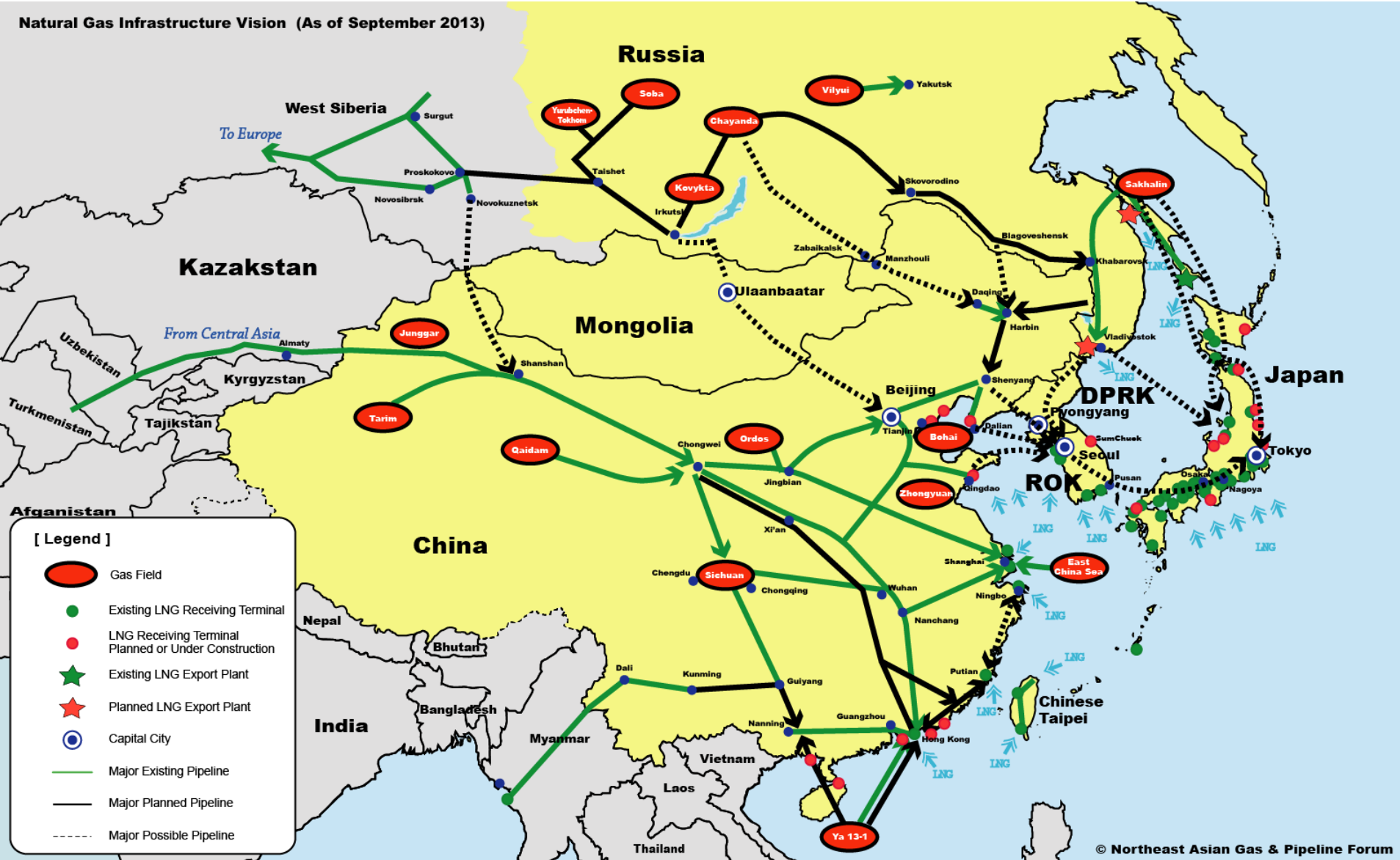


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Source: IEA.

Blue Print for North East Asia Gas & Pipeline Infrastructure

Natural Gas Infrastructure Vision (As of September 2013)



Navigating a stormy energy future

- Geopolitical & market uncertainties are set to propel energy security high up the global energy agenda
- Volatility in the Middle East raises short-term doubts on investment & spells trouble for future oil supply
- Nuclear power can play a role in energy security & carbon abatement – but financing & public concerns are key issues
- Without clear direction from Paris in 2015, the world is set for warming well beyond the 2 °C goal
- Far-sighted government policies are essential to steer the global energy system on to a safer course