

Energy Security in the Uncertain Energy World

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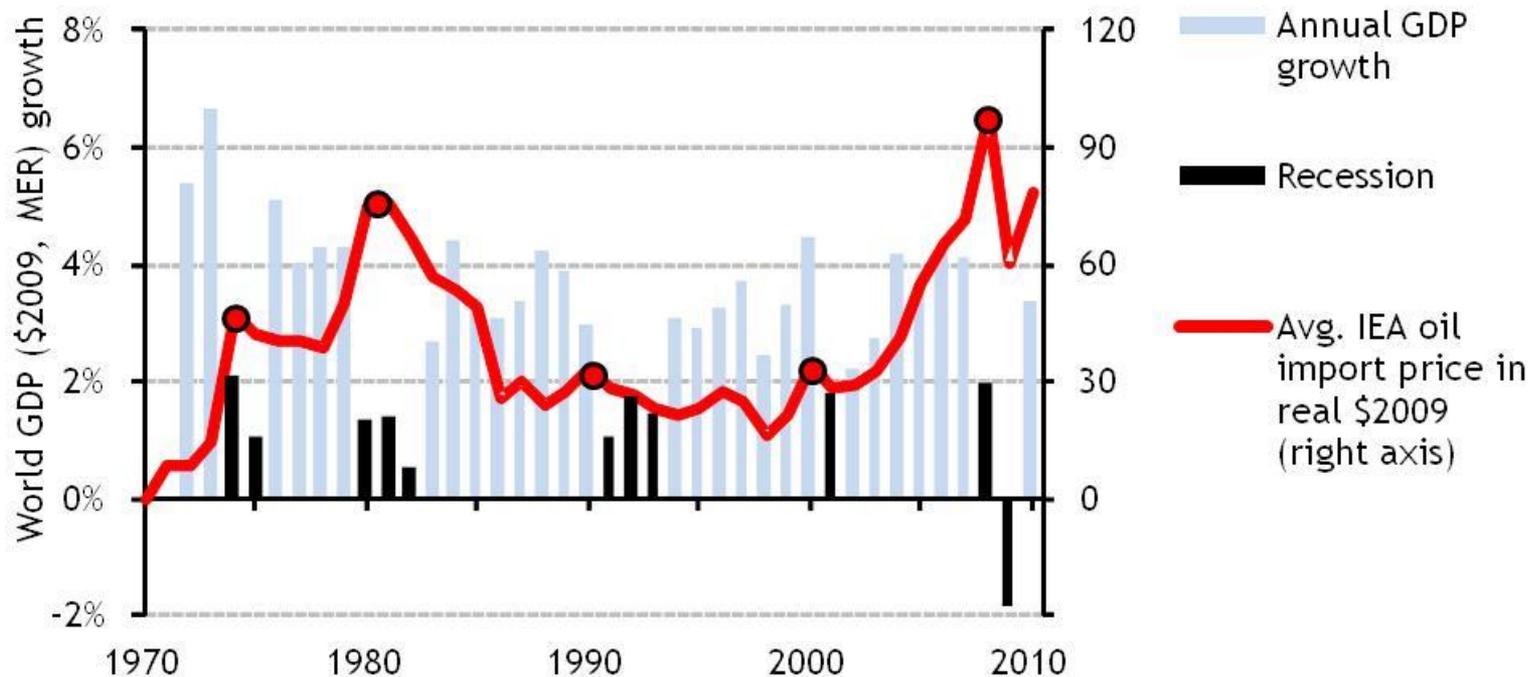
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The context: A time of unprecedented uncertainty...

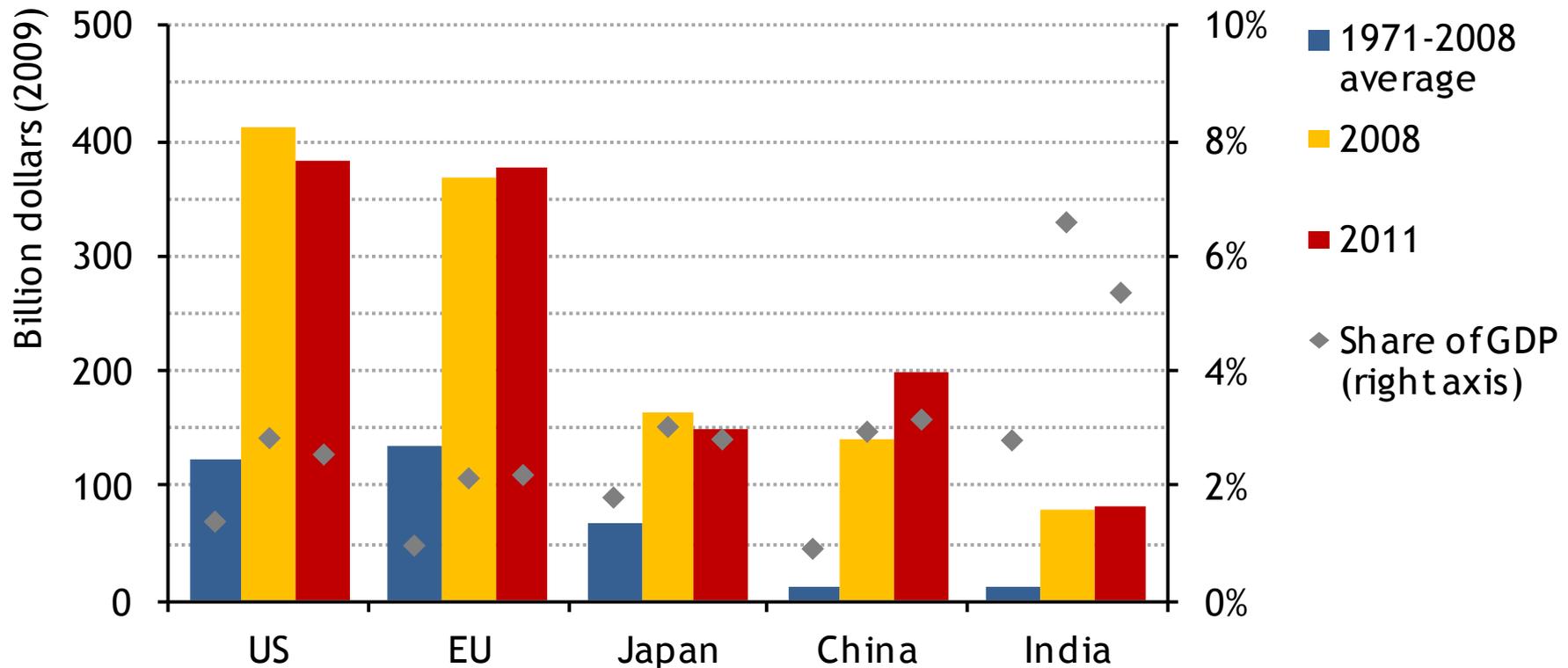
- Is the worst of the global economic crisis over?
- Oil demand & supply are becoming less sensitive to price – what does this mean for future price movements ?
- Tightening oil market plus political unrest in producing regions – how vulnerable is the market to even small disruptions?
- Natural gas markets are in the midst of a revolution – will it herald a golden era for gas?
- Climate Change Mitigation, Fossil Fuel Subsidy Phase Out by G20– do they go far enough & will they be implemented ?
- Growing Asian economies will shape the global energy future – where will their policy decisions lead us ?
- What is the implication of Fukushima Nuclear accident to the global energy landscape?

Oil prices affect the global economy



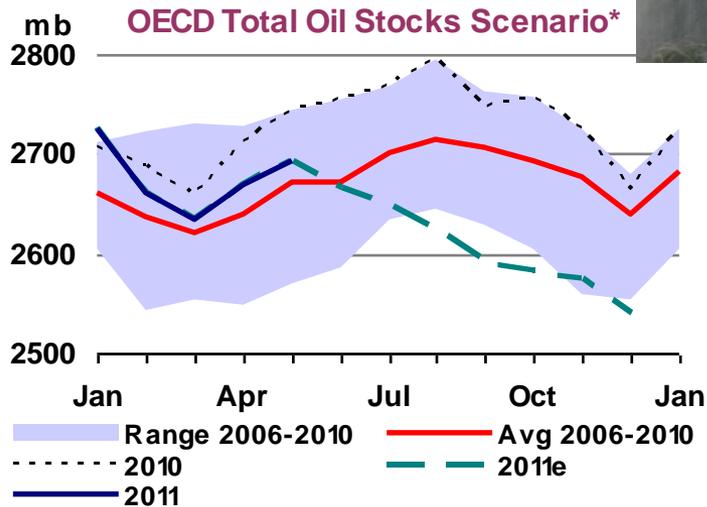
Oil price spikes have preceded each global recession since the early 1970's

Annual expenditure on net imports of oil

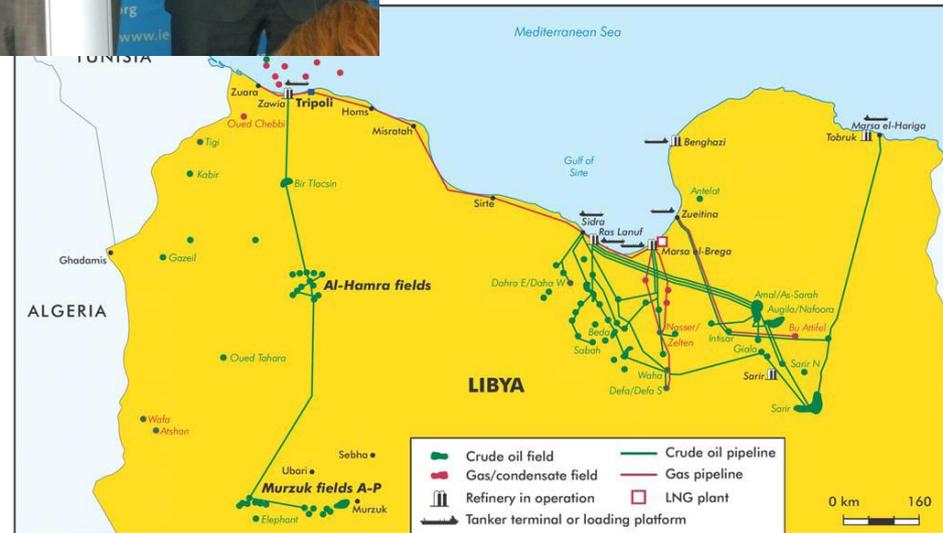


If oil prices average US\$100 a barrel in 2011, spending on oil imports in many countries will reach or surpass the record levels of 2008

The watchdog sometimes has to bite



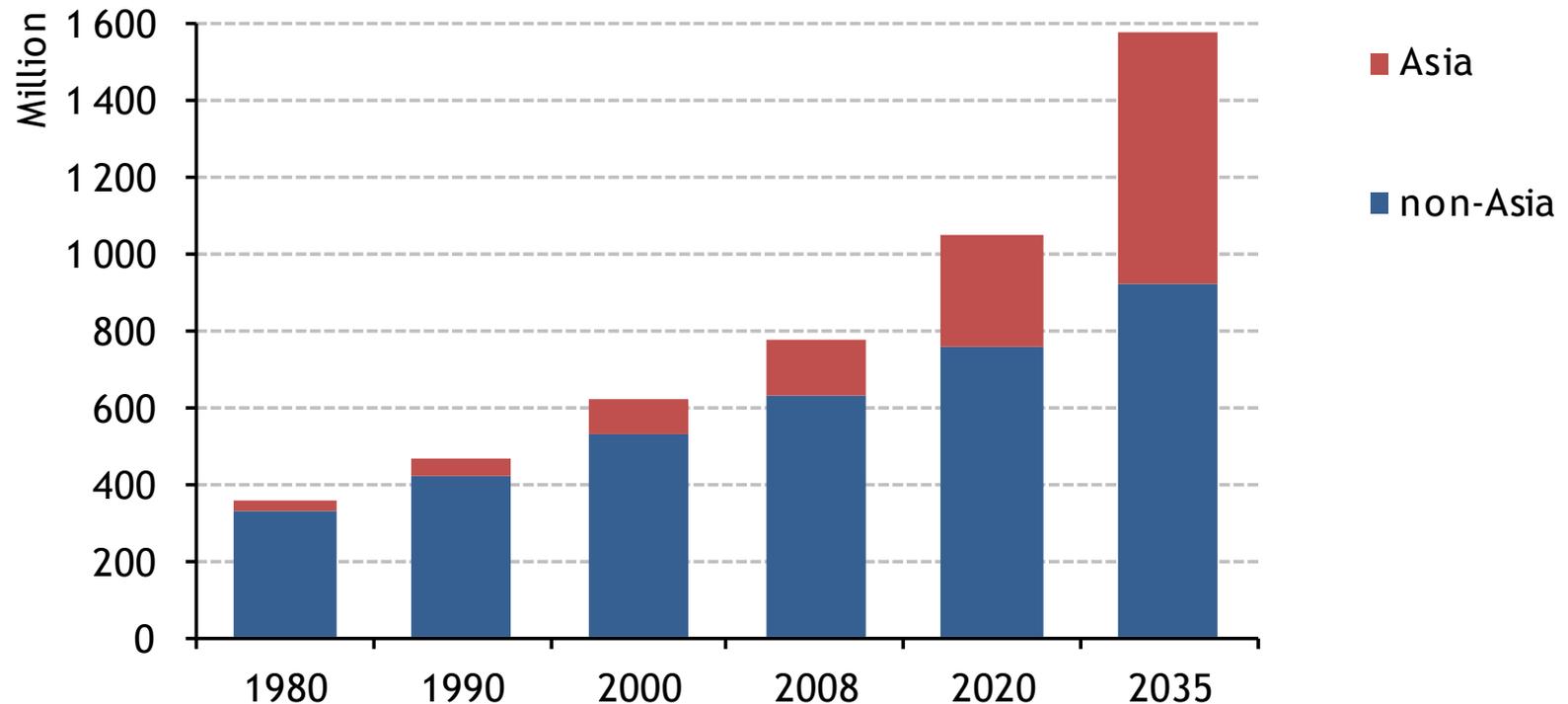
* OPEC crude production assumed flat at 29.18 mb/d from June 2011 onwards



- On 23 June, for the third time in its history, the IEA announced its member countries would release 60 million barrels of emergency stocks of oil for a period of one month, in response to the ongoing disruption of oil supplies from Libya.

Booming demand for mobility in Asia drives up oil use

Passenger vehicles in the New Policies Scenario

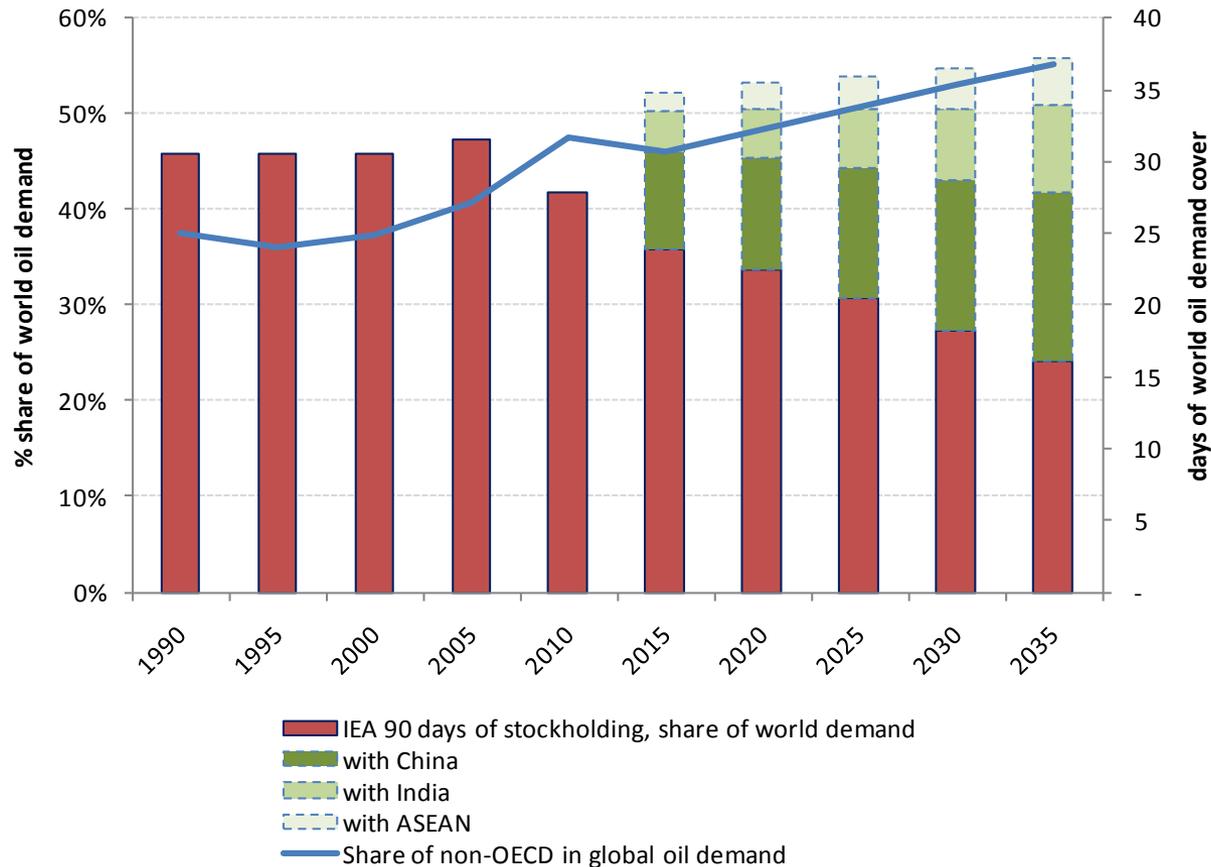


The global fleet will double by 2035 to 1.6 billion vehicles as more & more people – particularly in developing Asia – buy a car

Petroleum Supply Security as Energy Security of the 20 C

Need for cooperation during oil supply disruptions

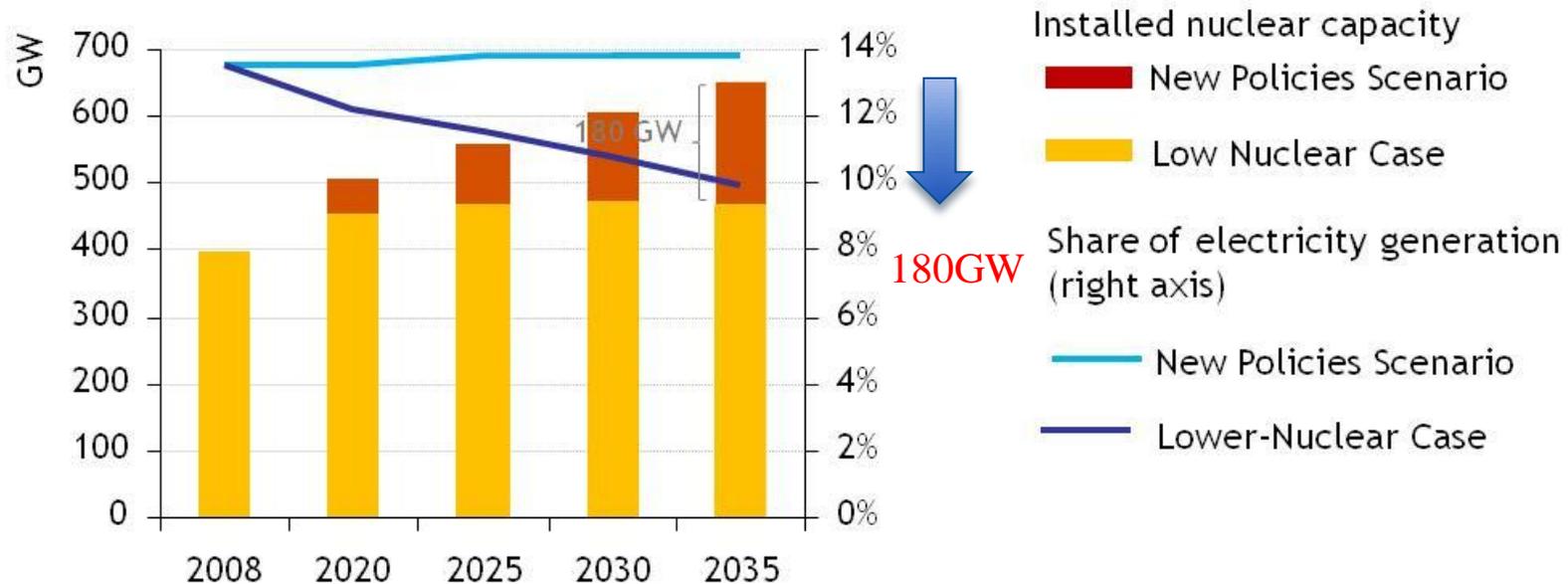
IEA stockholding cover of global oil demand



Growing share of non-OECD oil demand results in declining global demand cover from IEA oil stocks

Post Fukushima: New Energy Security of the 21 C

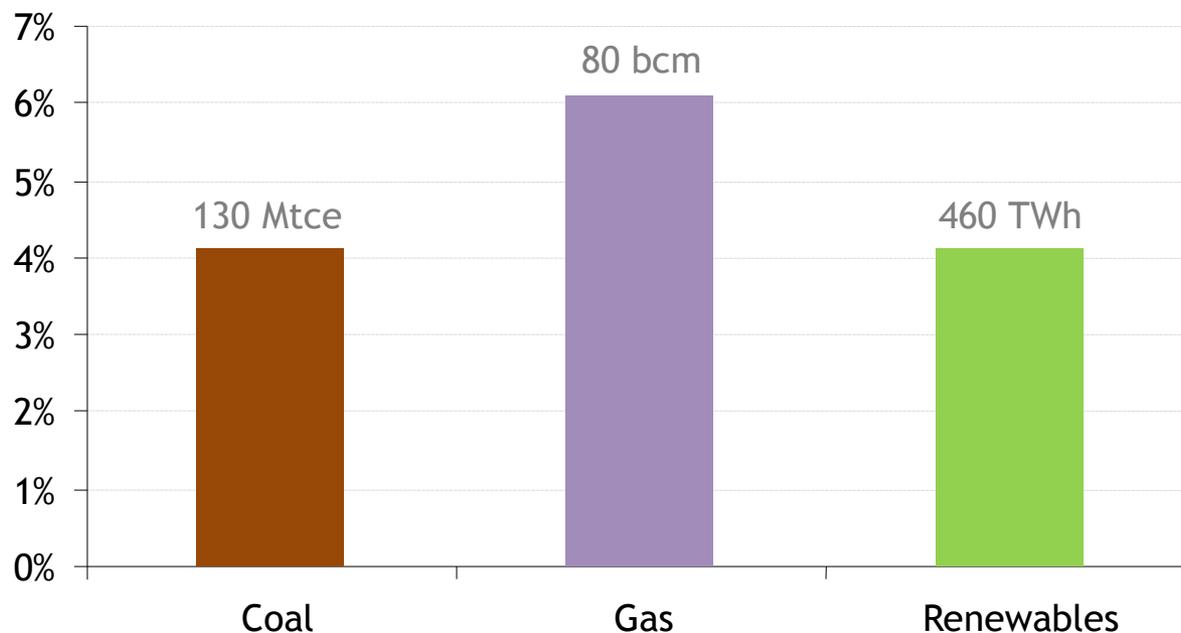
Lower-Nuclear Case: implications for electricity generation from nuclear



In the Lower-Nuclear Case, capacity additions are just half the level of the New Policies Scenario of WEO-2010, reducing nuclear's share of generation to 10% in 2035 from 14% today

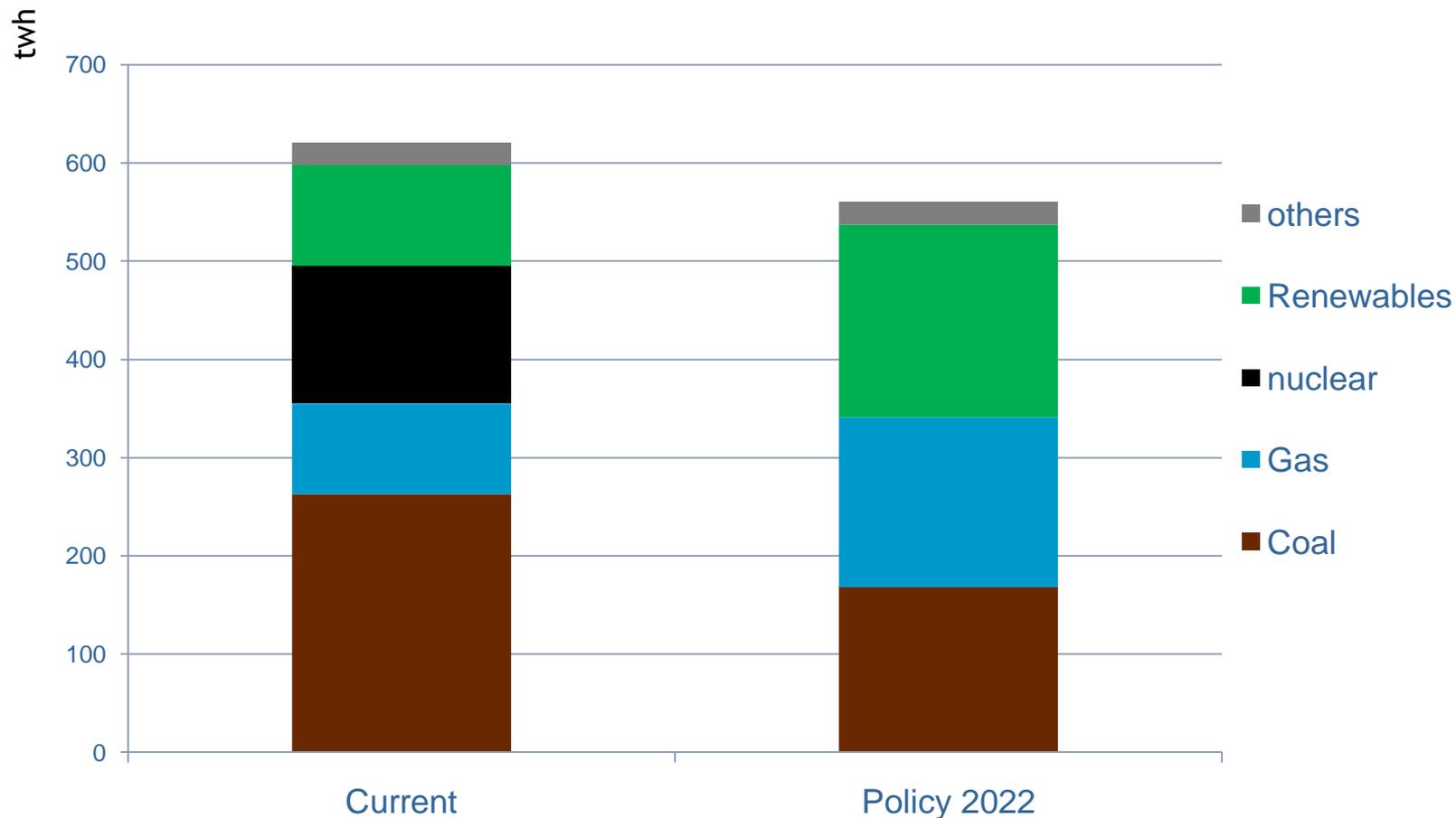
Lower-Nuclear Case: implications for the fuel mix

Increase of coal-, gas- and renewables-based electricity generation in 2035
compared with the New Policies Scenario



*The Lower-Nuclear Case would push up demand for coal, natural gas & renewables,
and have a corresponding knock-on effect on energy prices*

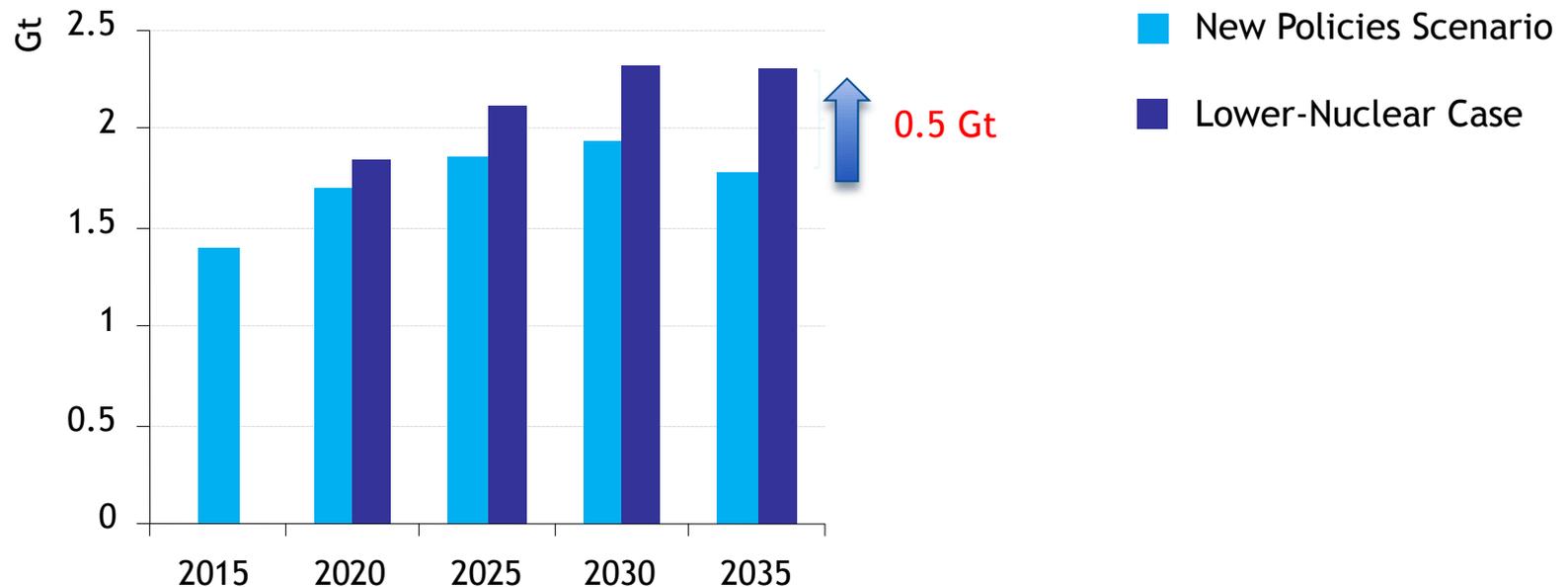
Gas will be needed to deliver CO2 reductions



German electricity mix with 10% demand reduction, no nuclear, 35% renewables and CO2 at the target level

Lower-Nuclear Case: implications for CO₂ emissions

Growth in CO₂ emissions from power generation compared to current levels

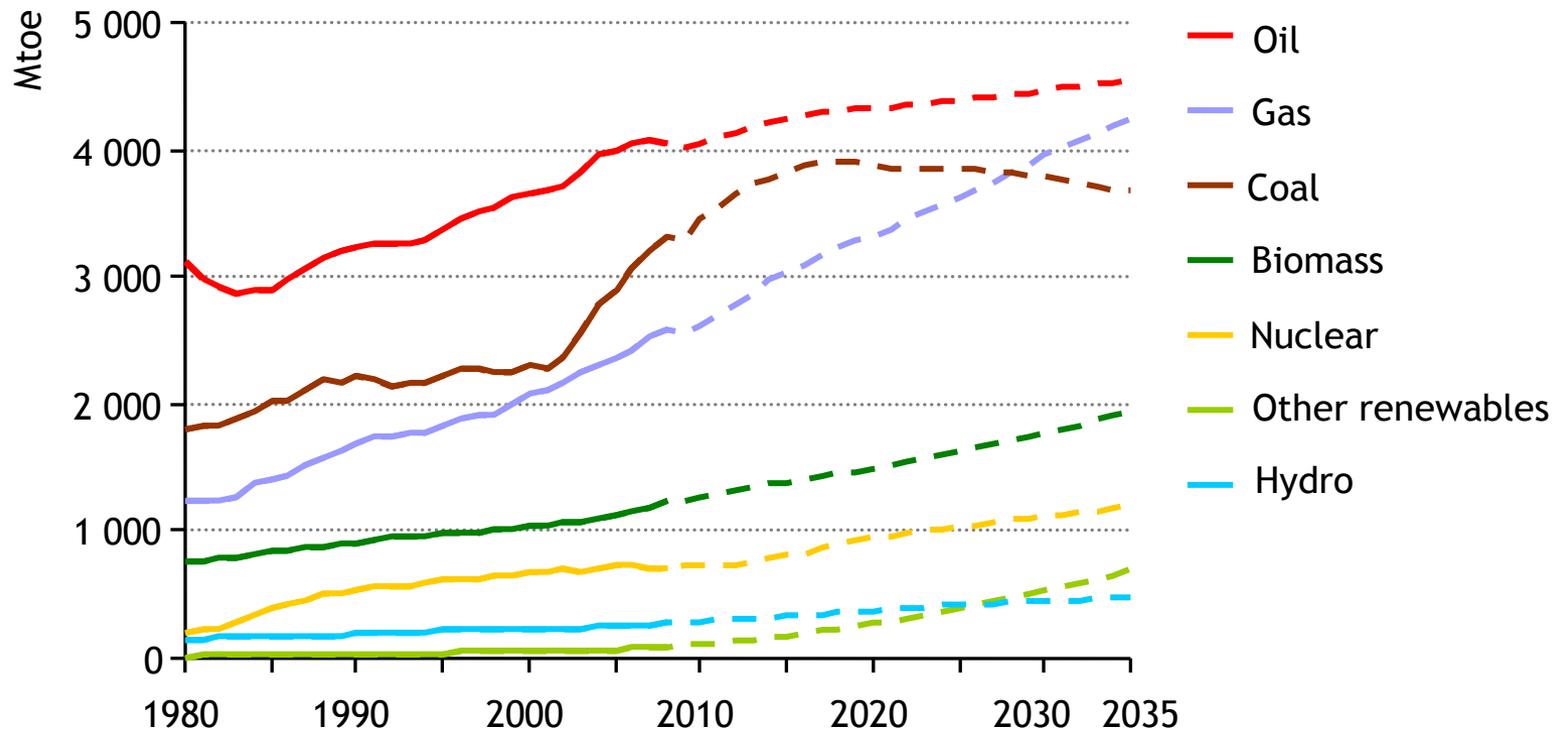


The growth in emissions from the power sector in 2008-2035 is almost 30% higher in the Lower-Nuclear Case than in the New Policies Scenario

Growing role of Gas in Energy Security

“Golden Age of Gas” Scenario

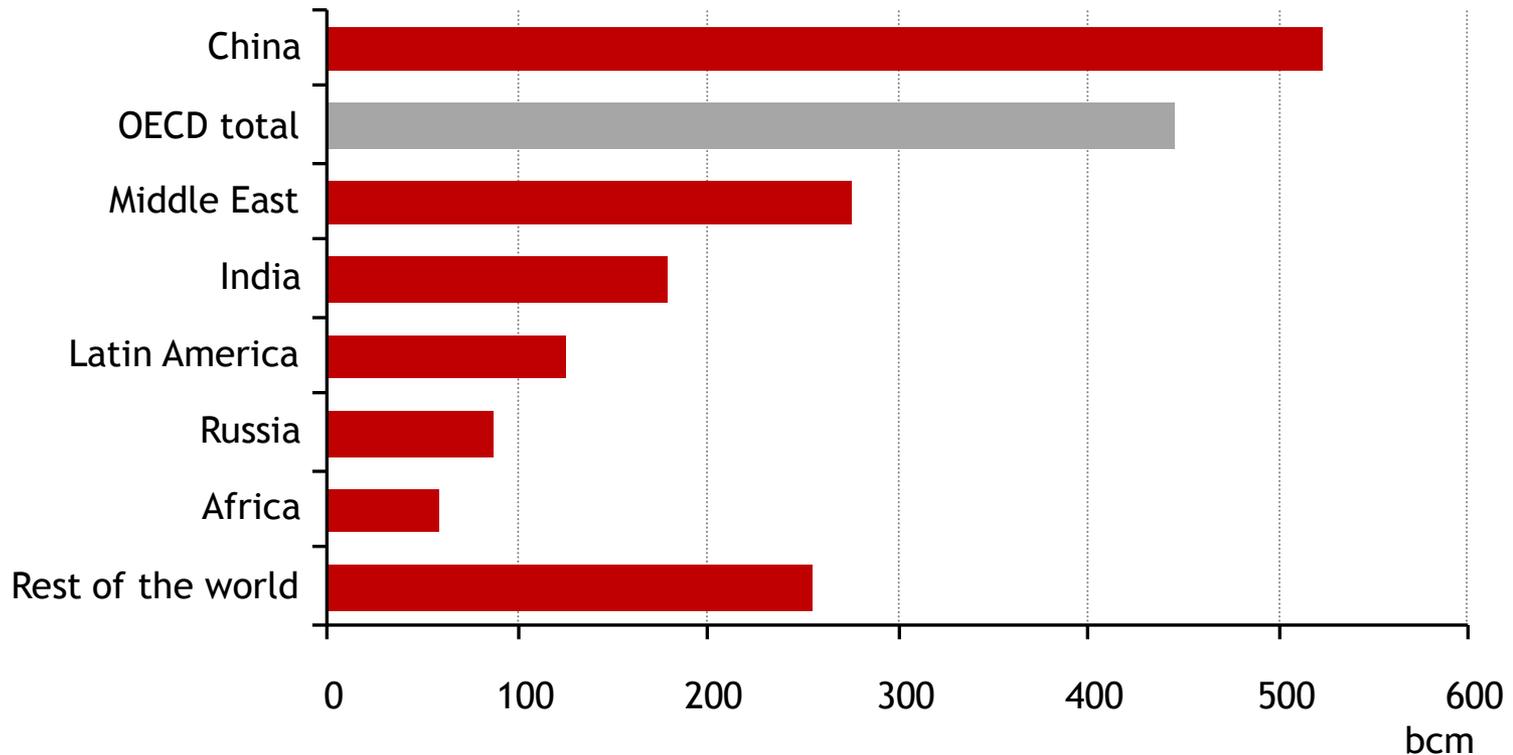
World primary energy demand by fuel in the GAS Scenario



Gas overtakes coal before 2030 and meets one quarter of global energy demand by 2035 – demand grows by 2% annually, compared with just 1.2% for total energy

Consumption grows most in developing economies

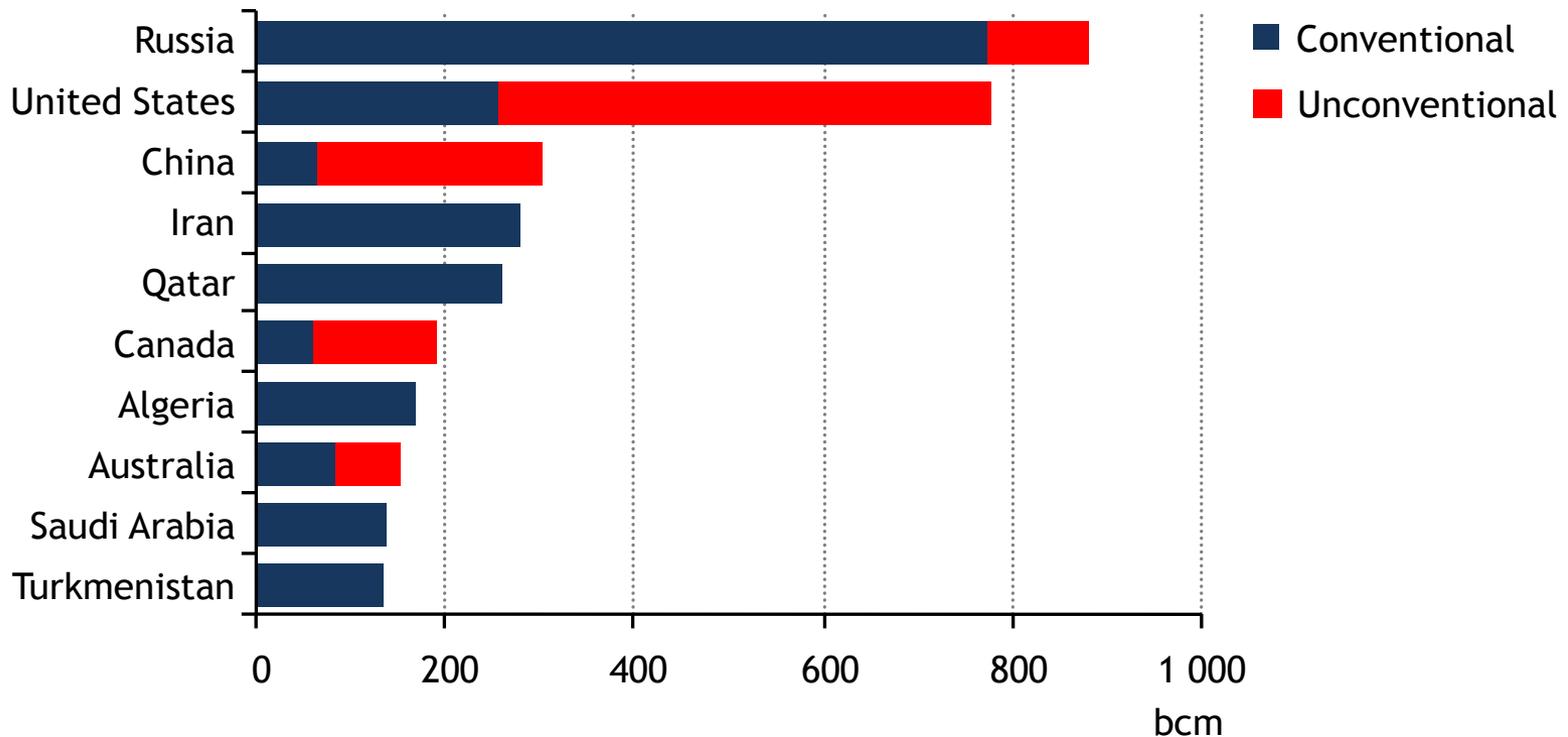
- Increase in natural gas consumption in the GAS scenario, 2010-2035



- Non-OECD countries account for 80% of demand growth – China alone makes up nearly 30% of global growth & uses as much gas as the EU by 2035

Production of unconventional gas becomes widespread

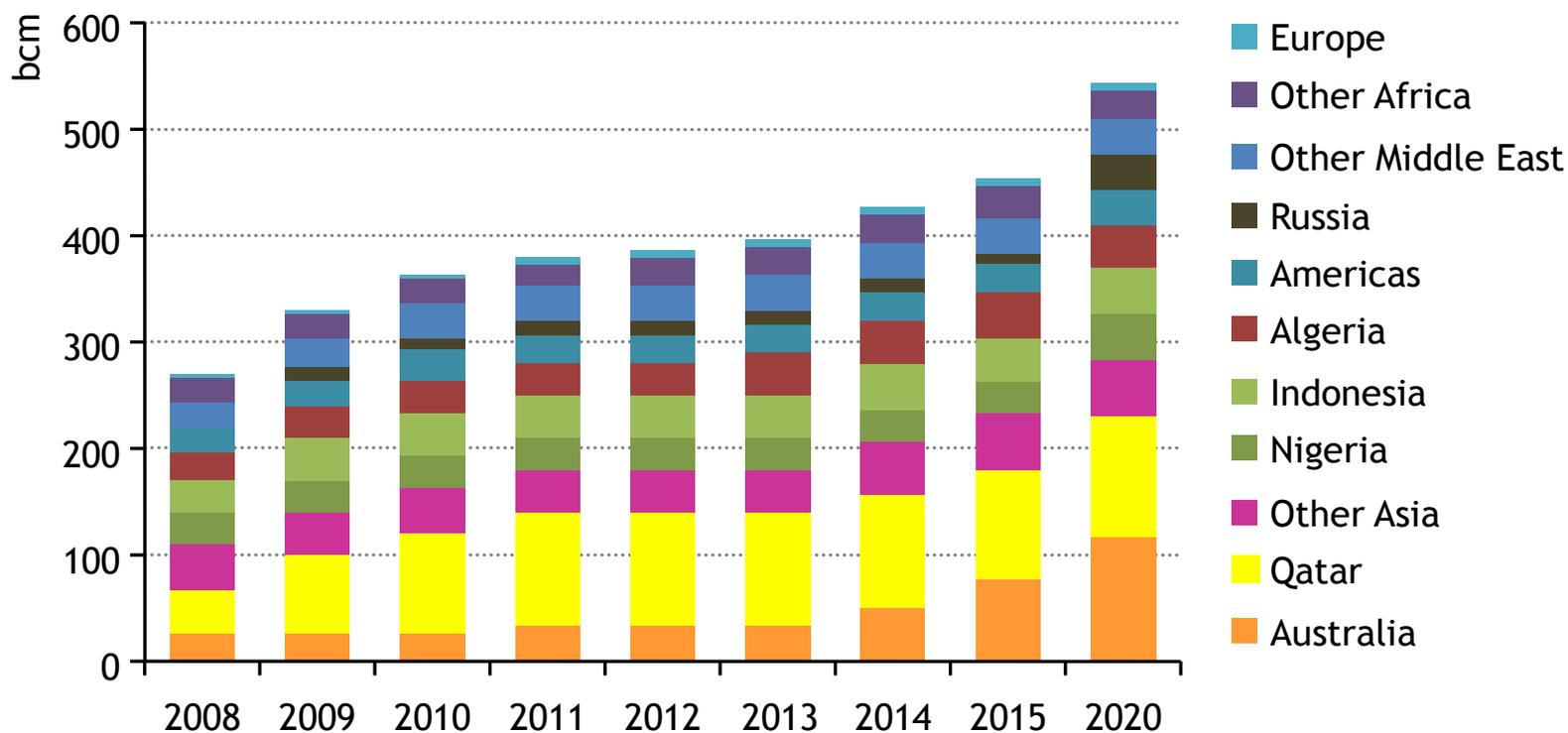
Largest gas producers in the GAS Scenario, 2035



Unconventional gas supplies 40% of the 1.8 tcm increase in gas demand to 2035, making up nearly one quarter of total production

Growing LNG enhances supply security & market flexibility

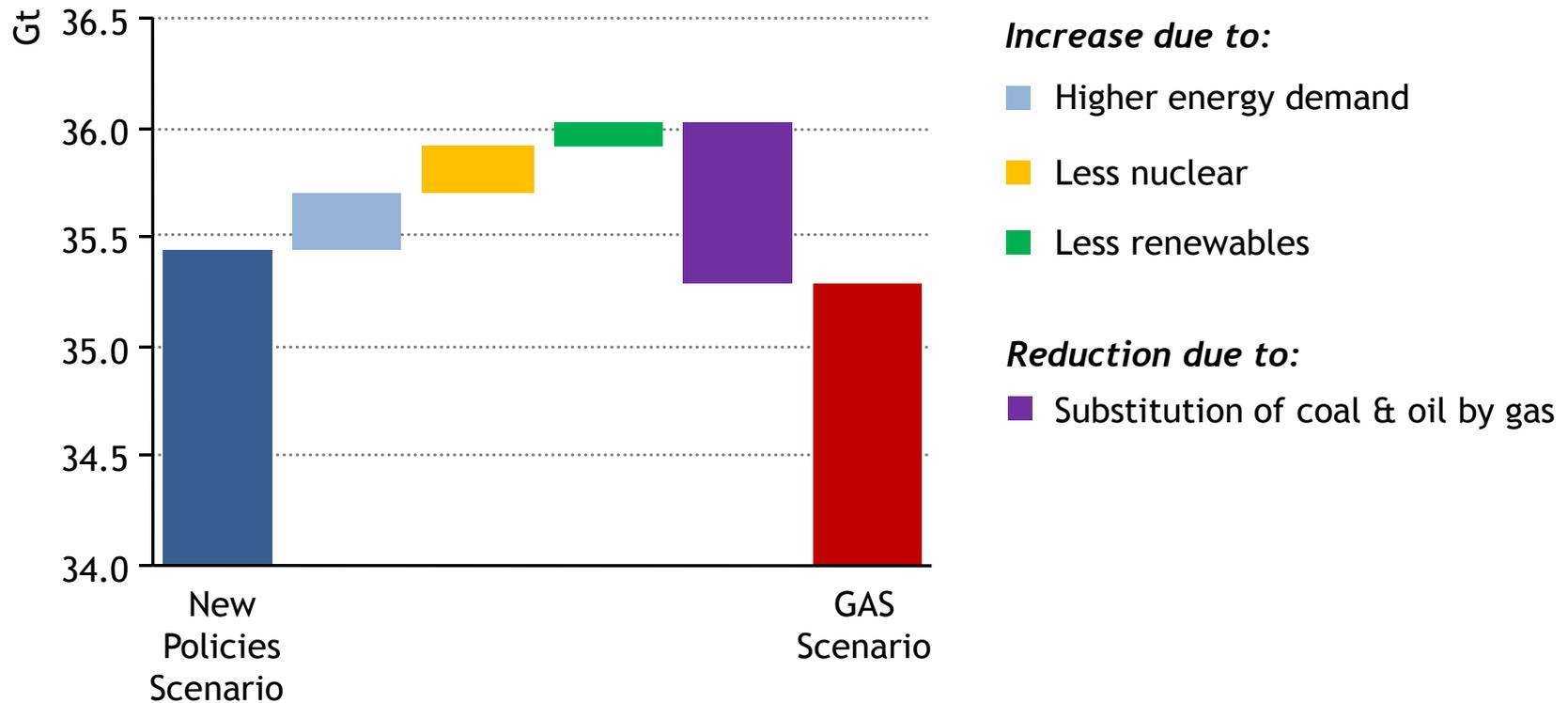
- Projected LNG liquefaction capacity by country



- Trade in natural gas between major regions doubles to over 1 tcm by 2035, with Australia becoming a leading LNG supplier

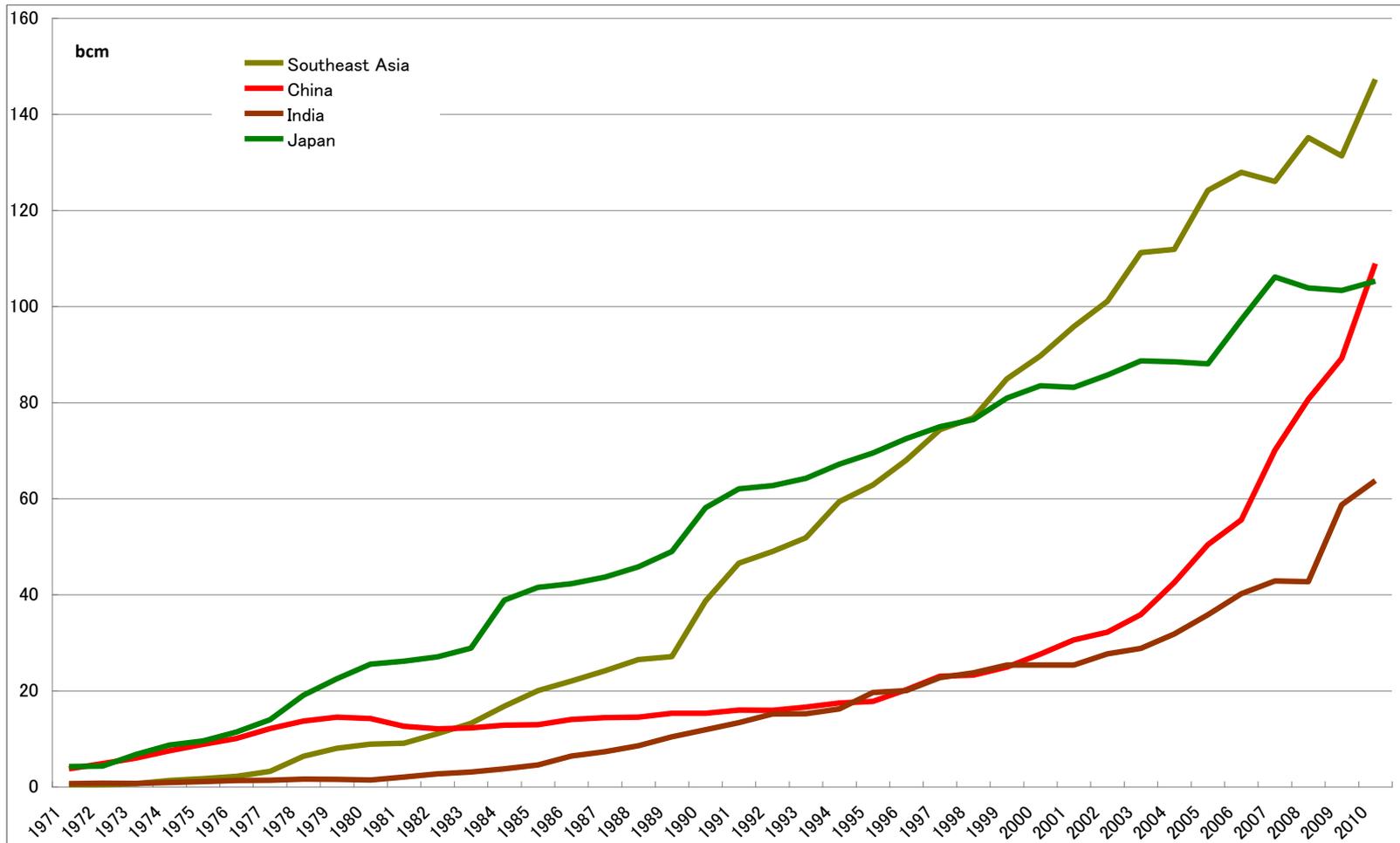
CO₂ emissions drop, but only slightly

CO₂ emissions in the GAS Scenario compared with the New Policies Scenario, 2035

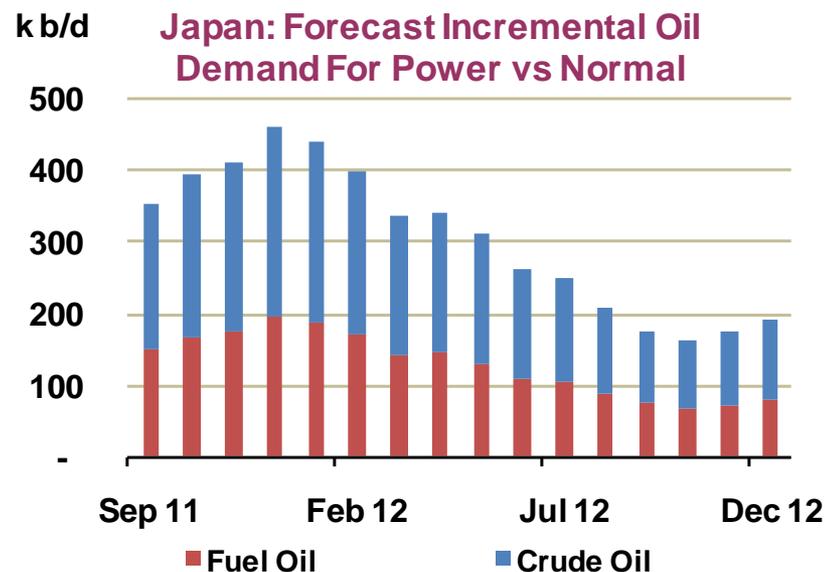
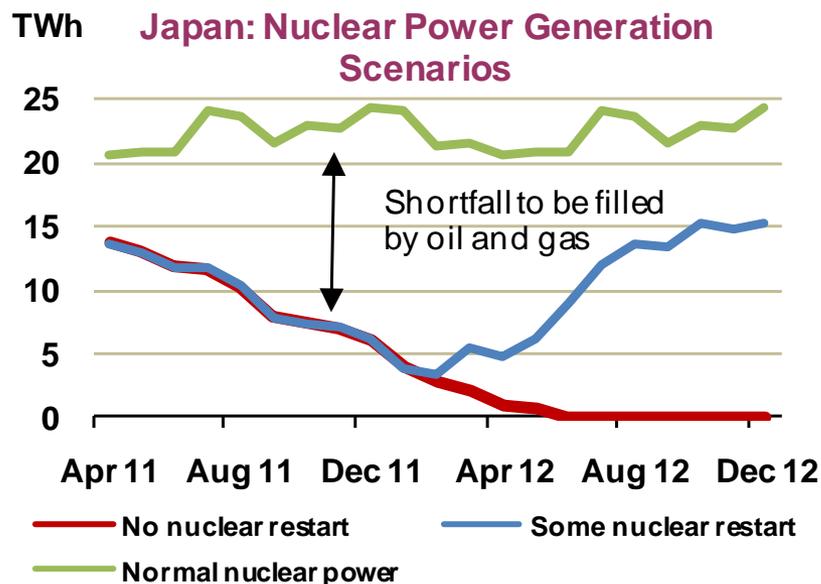


CO₂ emissions are just 160 Mt lower than in the New Policies Scenario in 2035. Substitution of coal & oil by gas cuts emissions by 740 Mt, but this is largely offset by other effects

Asia is depending on Natural Gas



Gas Glut disappearing? Nuclear Outages See Japan's Power Sector Turn to Thermal

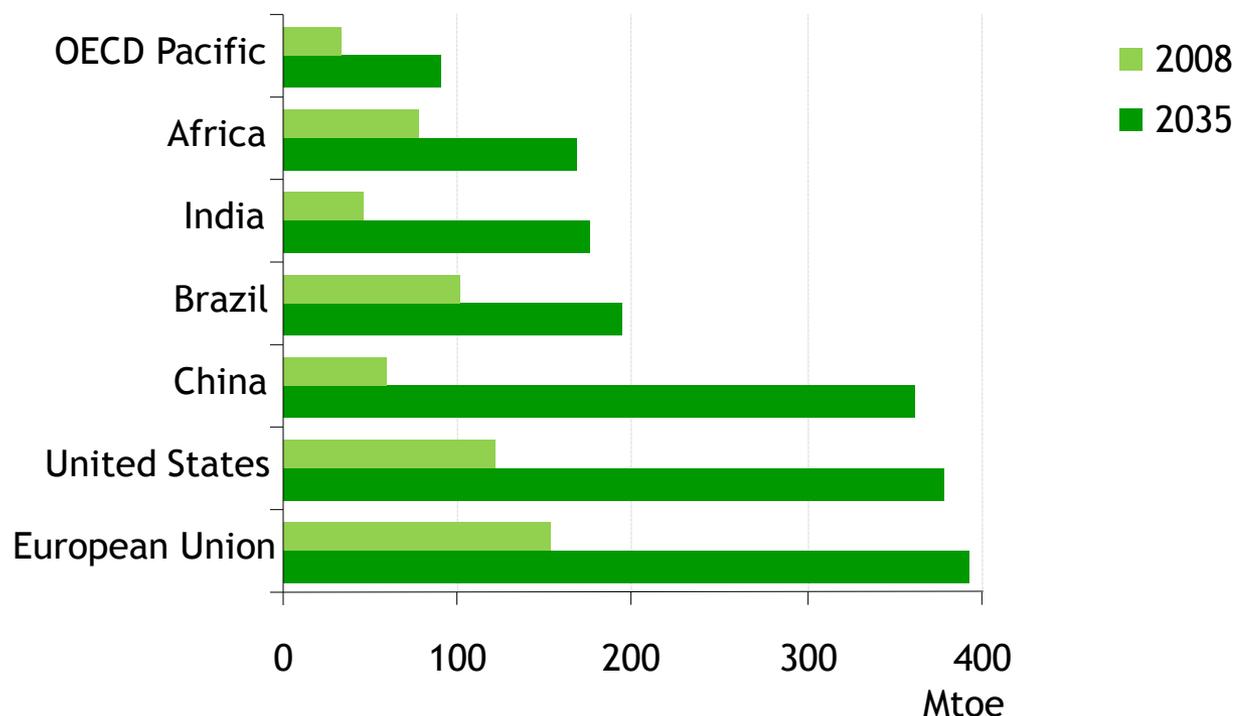


“Some nuclear restart” case suggests additional annual 230 kb/d of oil and 10 bcm of LNG demand in 2011 and an extra 270 kb/d and 18 bcm in 2012 versus an outlook of normal nuclear generation.

*Under “No nuclear restart” case, requirements for additional oil and gas would stand at **460 kb/d and 30 bcm** respectively.*

Renewables enter the mainstream....

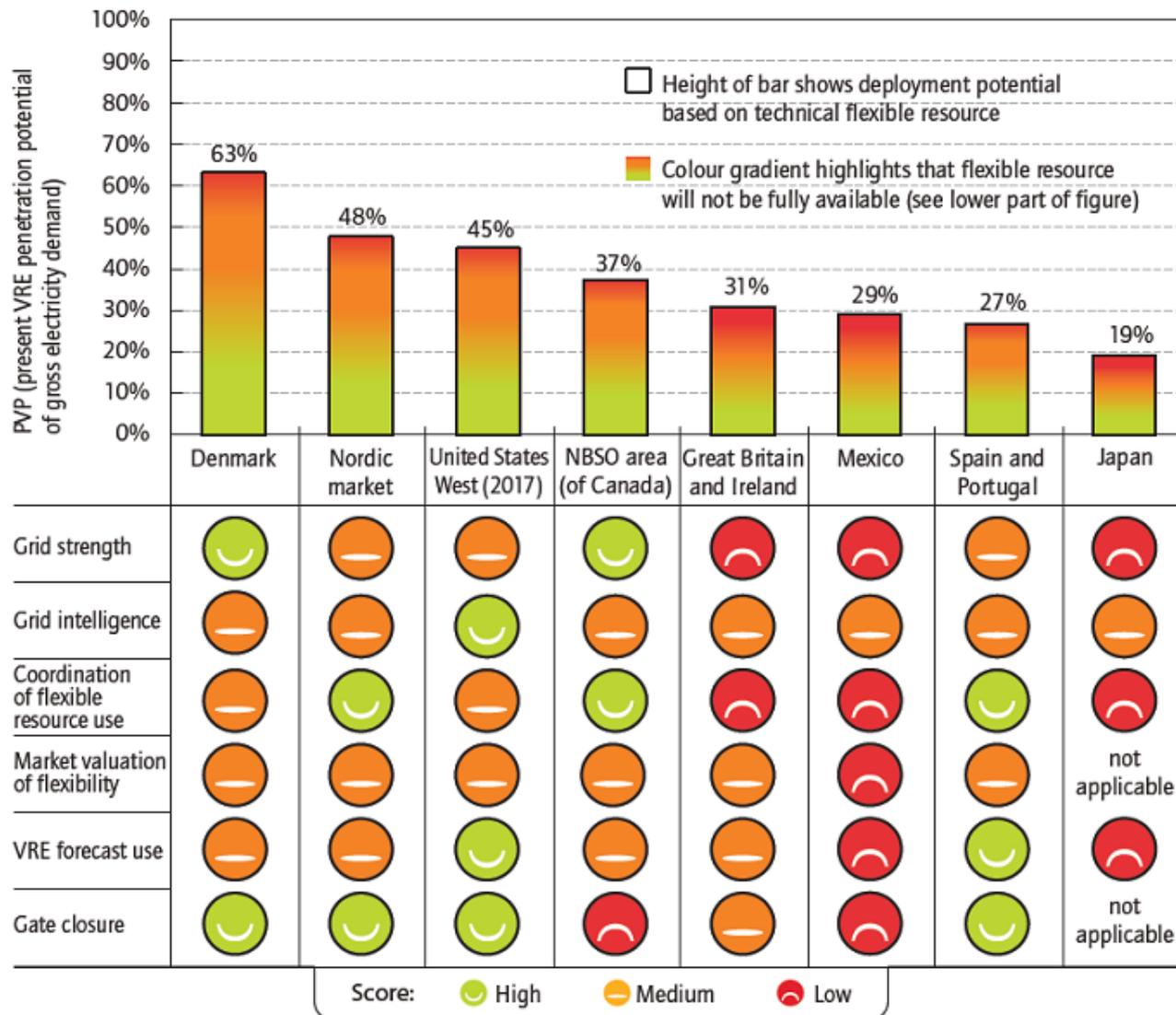
Renewable primary energy demand in the New Policies Scenario



The use of renewable energy triples between 2008 & 2035, driven by the power sector where their share in electricity supply rises from 19% in 2008 to 32% in 2035

Harnessing Variable Renewables

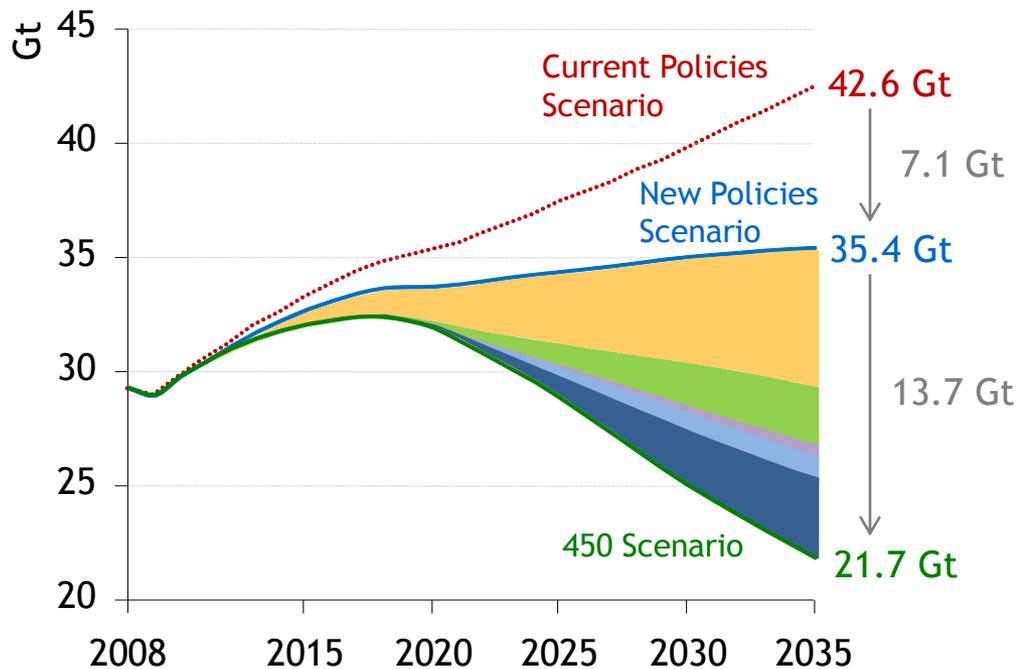
Figure 31 • VRE potentials today, from the balancing perspective



Sustainability Constraint

The 450 Scenario: *Abatement by technology*

World energy-related CO₂ emission savings by technology in the 450 Scenario relative to the New Policies Scenario



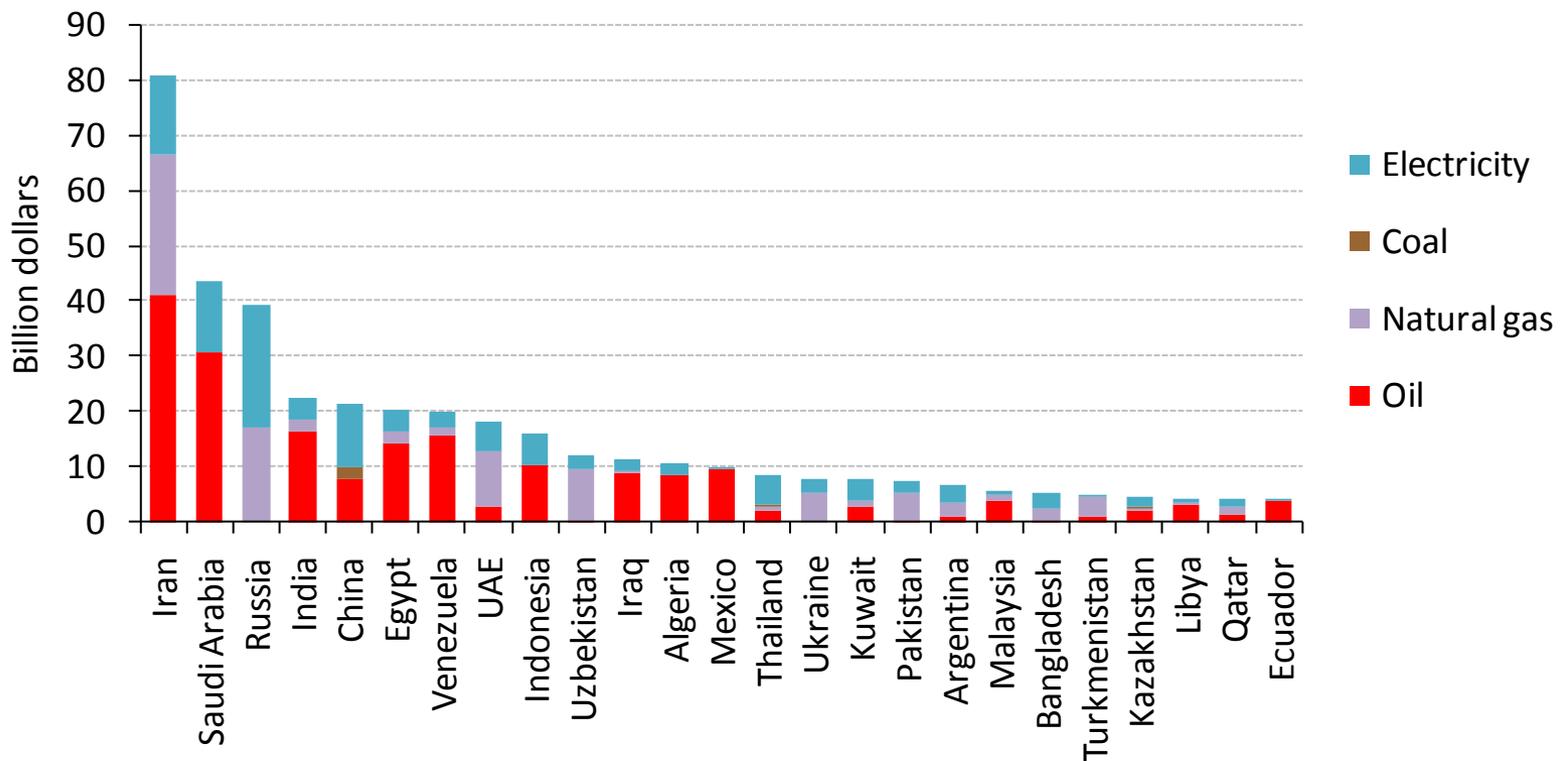
Share of cumulative abatement between 2010-2035

Efficiency	50%
Renewables	18%
Biofuels	4%
Nuclear	9%
CCS	20%

Low Nuclear : NPS + 0.5Gt
High Gas : NPS - 0.2Gt

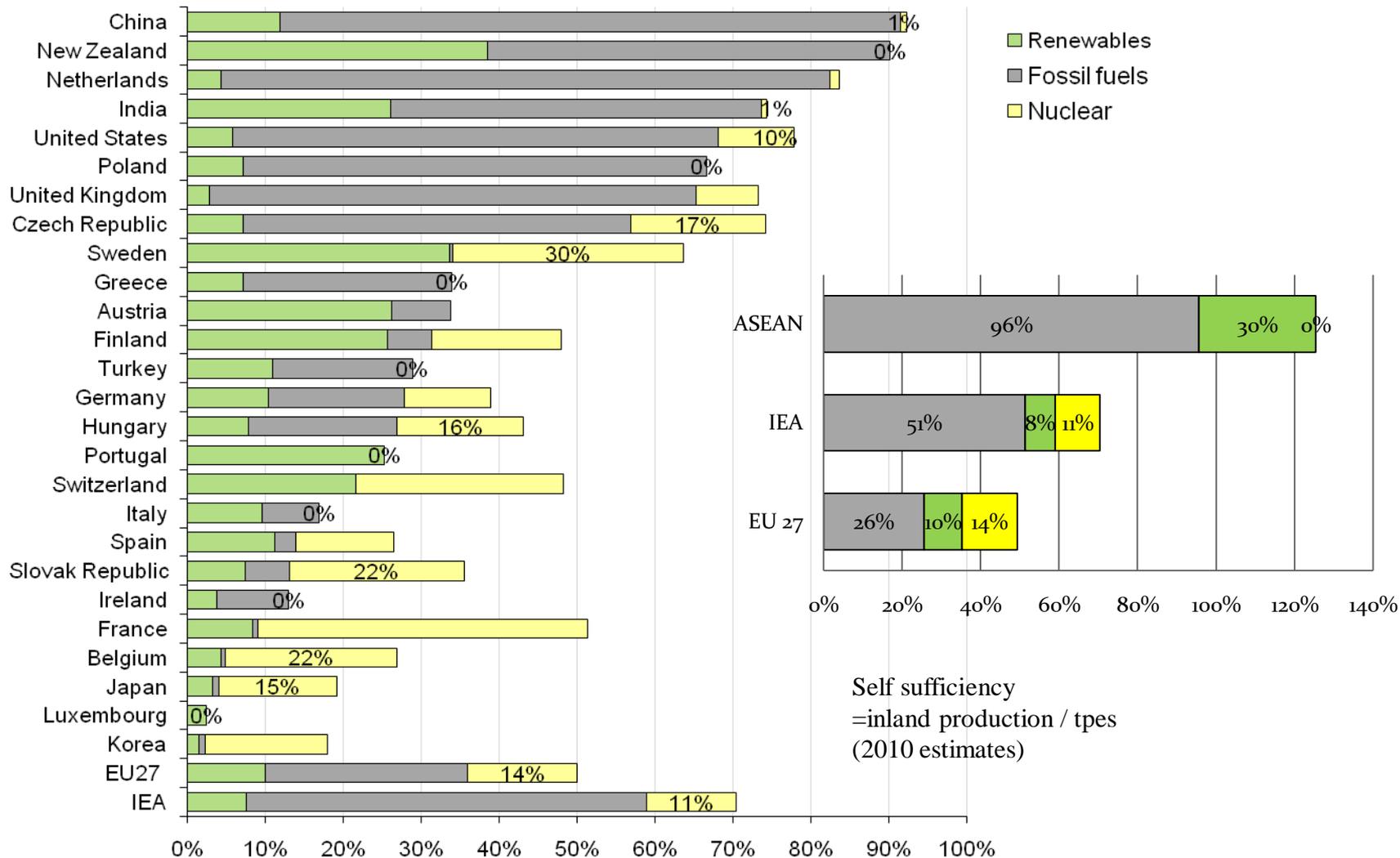
In moving from the New Policies Scenario to the 450 Scenario, more expensive abatement options such as CCS play a growing role

Fossil-fuel consumption subsidies for top twenty-five countries, 2010



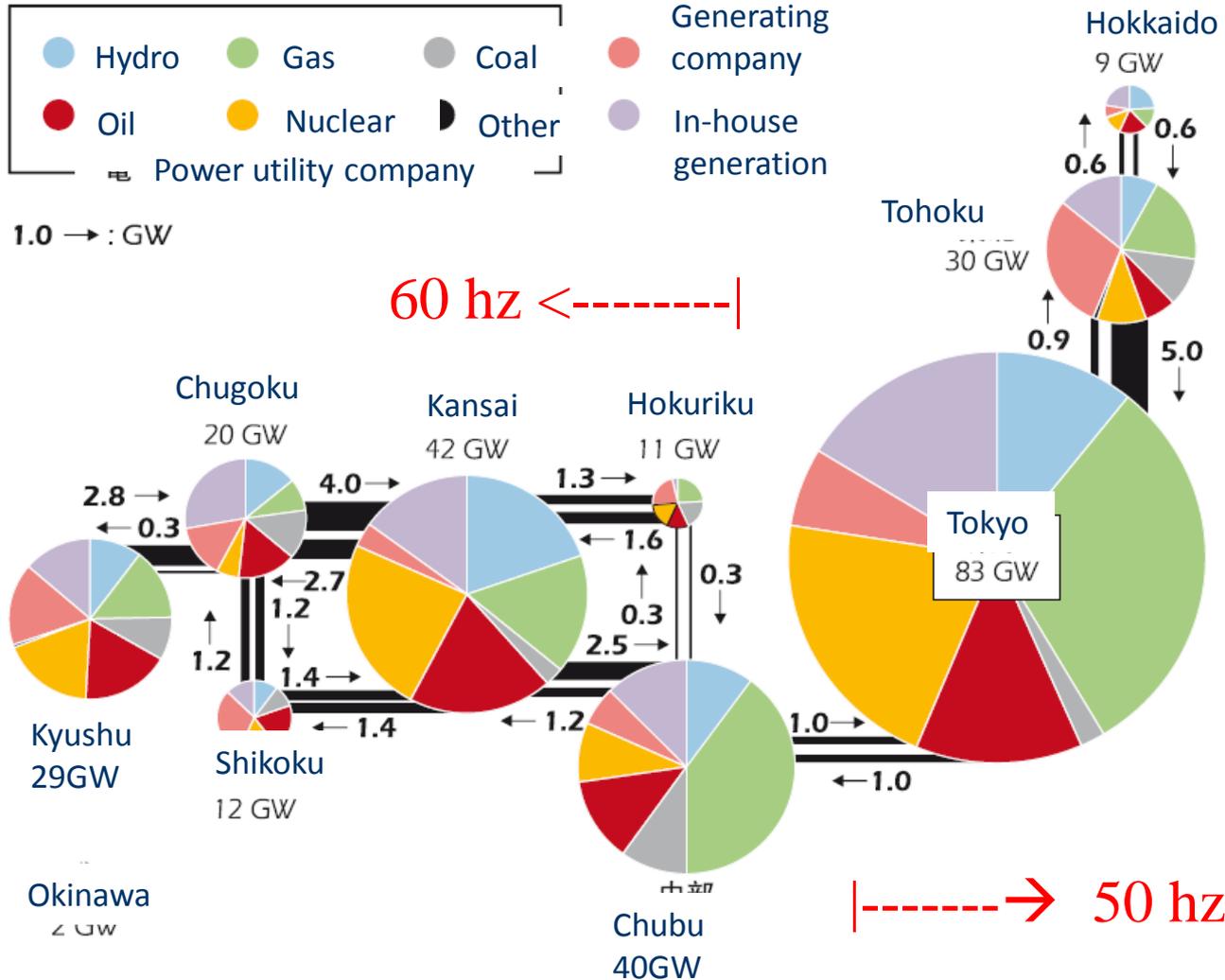
Oil products had the largest subsidies at \$193 billion, followed by natural gas at \$91 billion, while fossil-fuel subsidies resulting from the under-pricing of electricity reached \$122 billion

Energy mix as Energy Security Mix



Nuclear is an important option for countries with limited indigenous energy resources (low energy sustainability).

Power grid in Japan

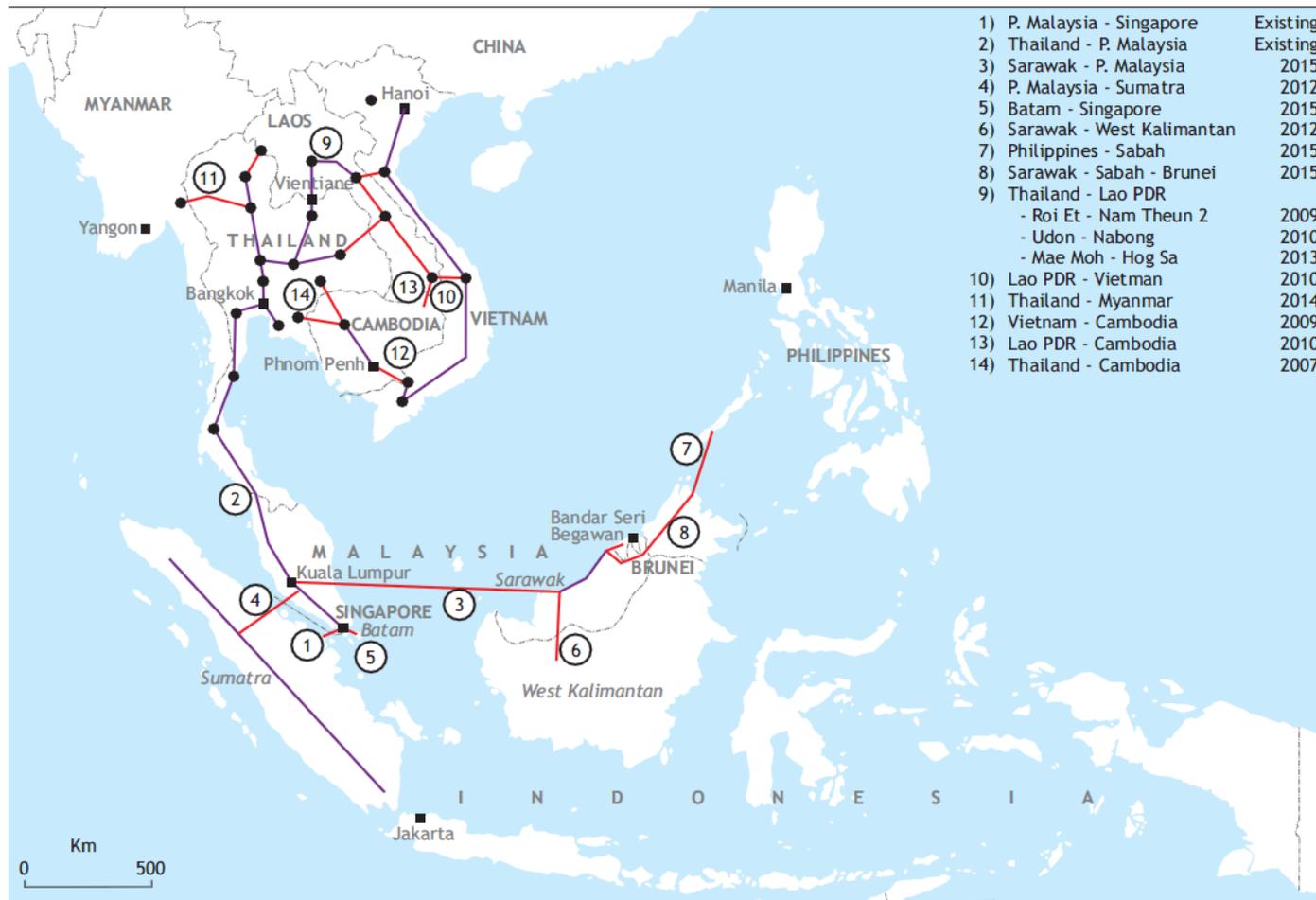


Connecting MENA and Europe "Energy for Peace"

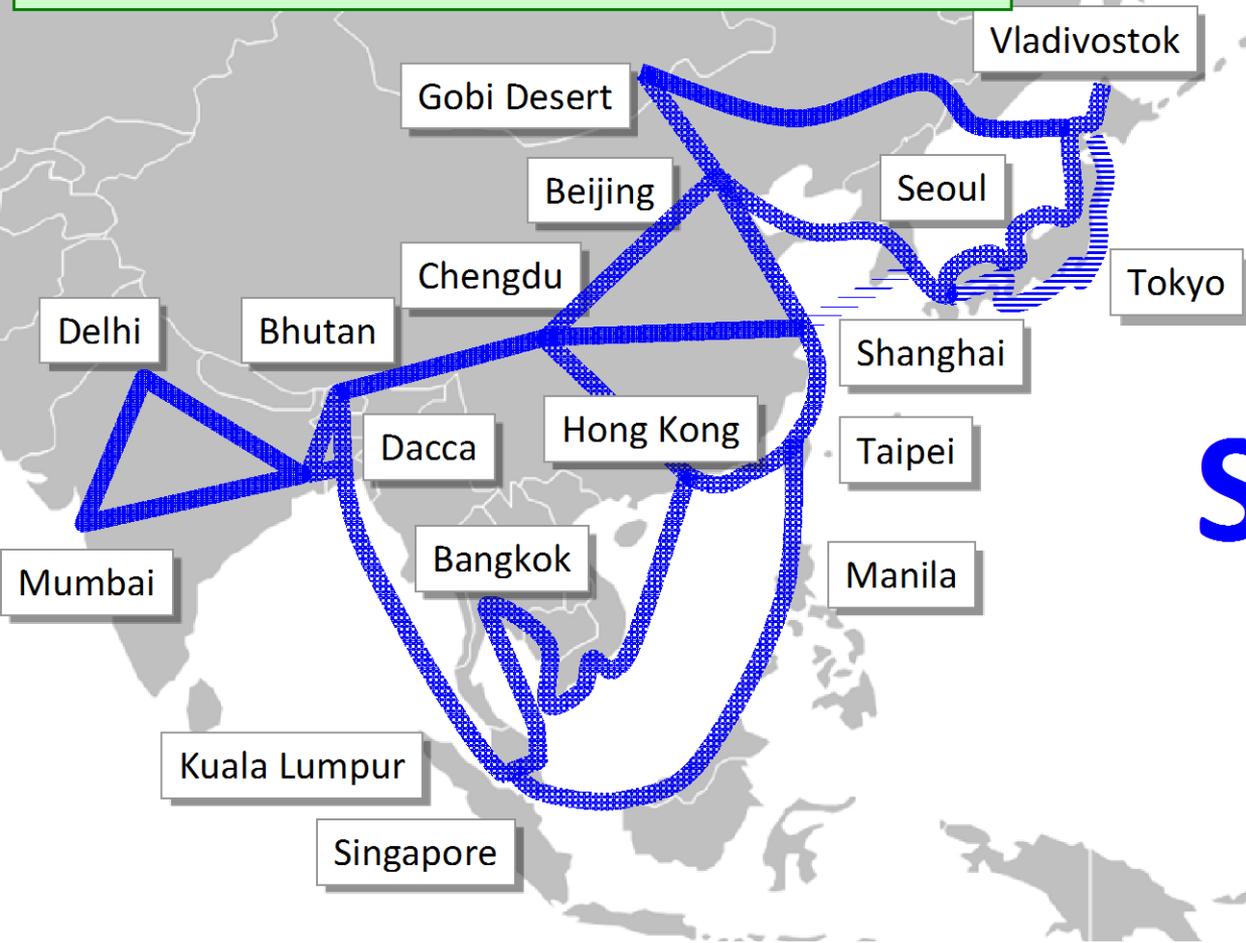


Source: DESRETEC Foundation

Existing and proposed ASEAN Power Grid Interconnections



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

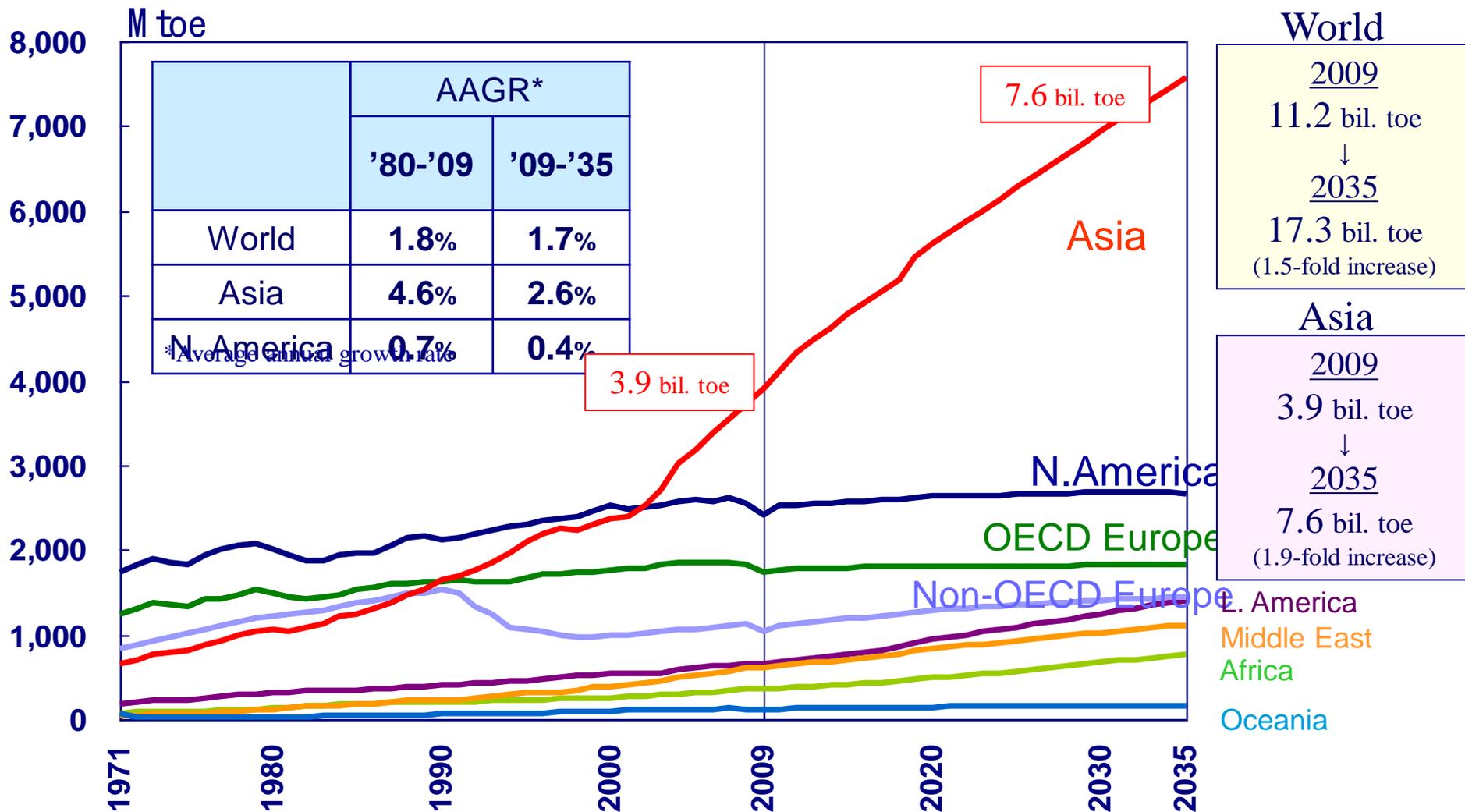


Phase 3
**Asia
Super Grid**

Total 36,000km

Primary Energy Demand by Region (World)

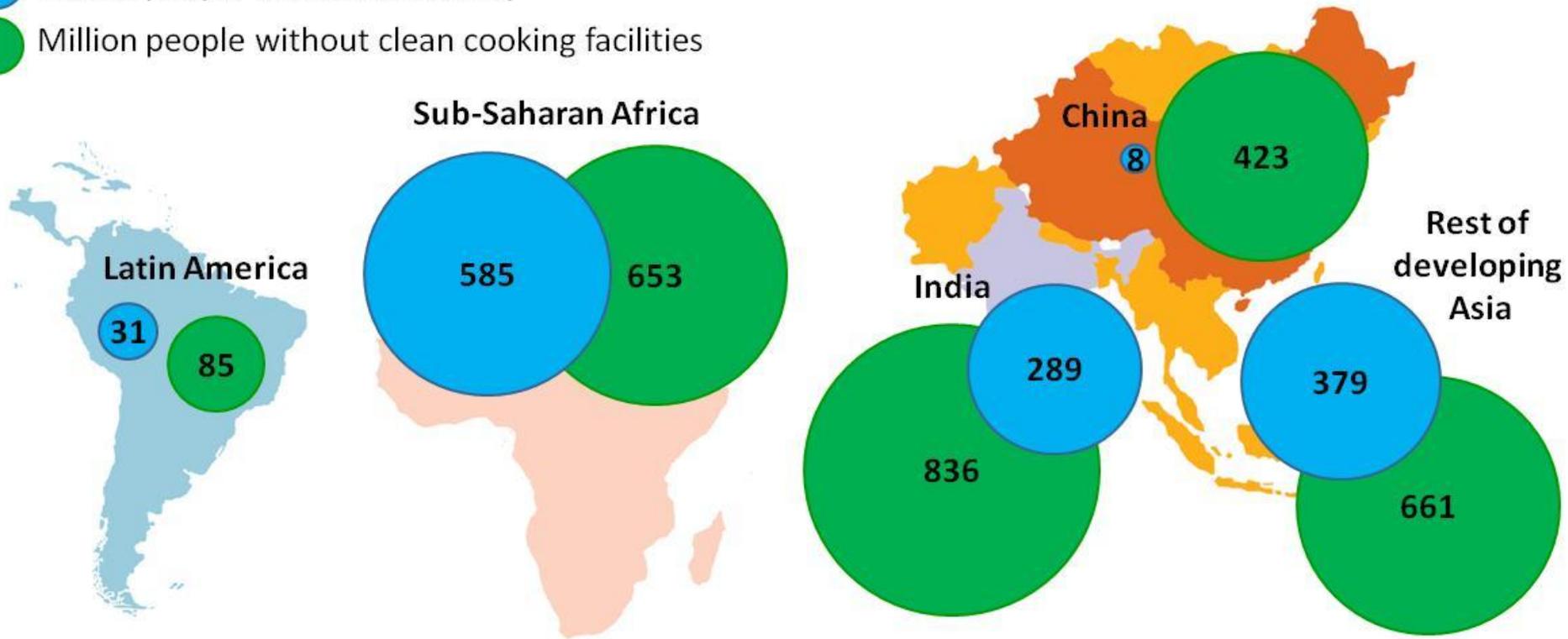
Reference Scenario



- By 2035, primary energy demand of Asia will double from the current level, reflecting high economic growth; 3.9 billion toe(2009) → 7.6 billion toe(2035).
- Non-OECD will represent 90% of incremental growth of global energy demand toward 2035.

Energy poverty is widespread

- Million people without electricity
- Million people without clean cooking facilities

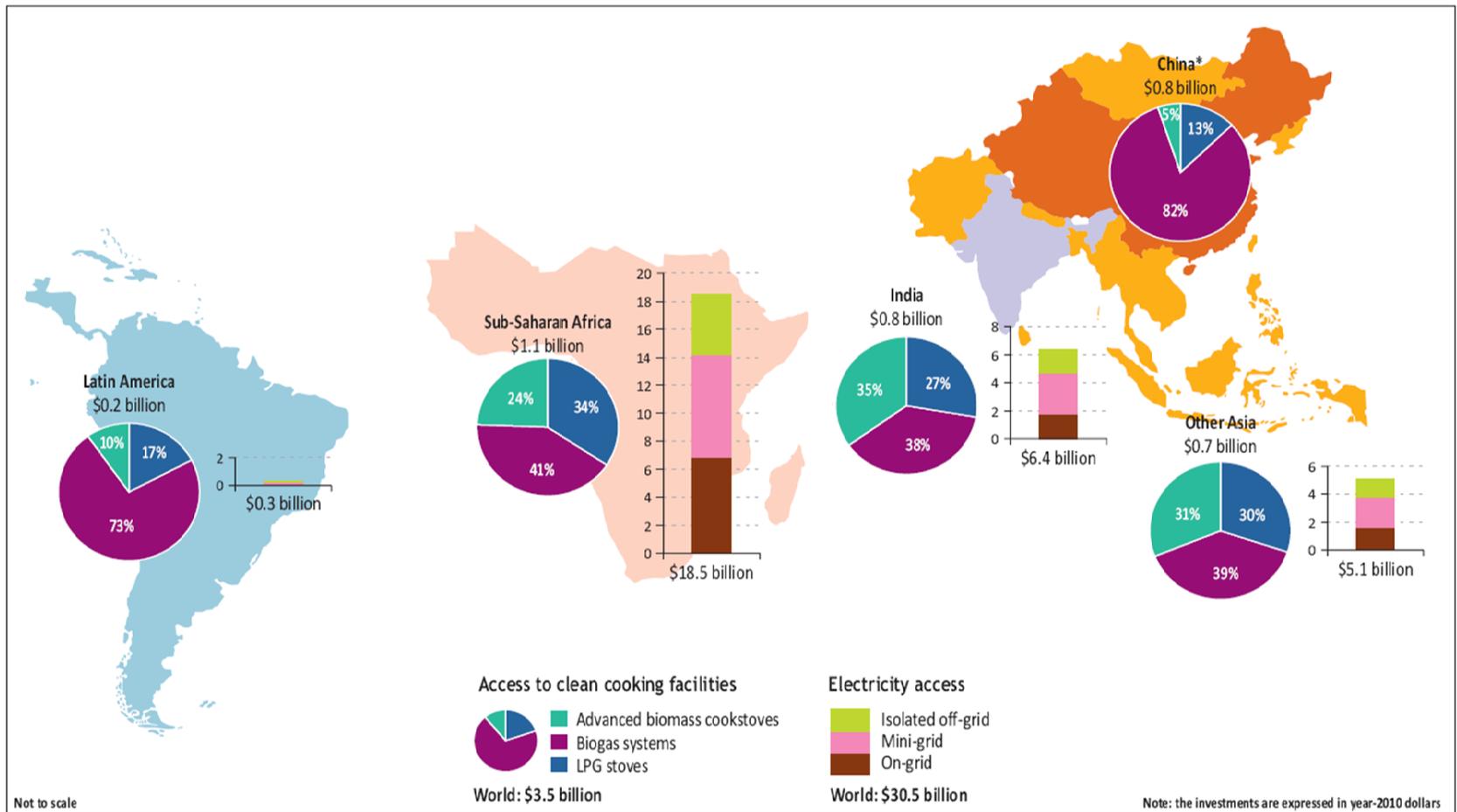


Source International Energy Agency

- 1.3 billion people in the world live without electricity
- and 2.7 billion live without clean cooking facilities

Energy for All: Annual Investment of \$34 billion

Figure 7: Average annual investment required by region and technology in the Energy for All Case



Not to scale

This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

* In the Energy for All Case, China's investment in access to electricity is zero and therefore not shown on the map.

Note: World total includes Middle East countries.

One cannot enhance energy security by risking someone else's

- Need for Collective Energy Policy Making in growing Asia
- Adopt a green growth paradigm by Efficiency, Renewables, Nuclear, EVs, Smart Grids etc.
- Develop unconventional gas resources and infrastructure
- For coal to remain the backbone of power supply, CCS & higher efficiency plants are needed
- Focus on “Comprehensive Energy Security “
 - Enlarge IEA's oil emergency preparedness
 - Develop Regional Power Grid interconnection & Gas Pipelines
- Energy access can be improved via decentralised solutions

Overview of WEO-2011...

- ***Launch on 9 November in London, Beijing event to follow***
- ***A full update of energy projections to 2035***
 - > ***Oil markets – deferred investment scenario***
 - > ***Low nuclear case***
- ***Objective & comprehensive analysis of topical issues:***
 - > ***Financing energy access for all***
 - > ***Country focus on Russia***
 - > ***Coal – in-depth market outlook***
 - > ***Climate change – “lock-in” & the “room to manoeuvre” to meet the 2⁰C goal***
 - > ***Energy subsidies***