

The Role of Coal & LNG in Asia's Future Energy Mix

- with Introduction of IEEJ Outlook 2018 -

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- IEEJ Outlook 2018
 - Prospects & Challenges up to 2050 –



- Today's Topic

The Role of Coal & LNG in Asia's Future Energy Mix
: Defying the odds?

- Introduction of Panelists

Asia/World Energy Outlook 2018

– Prospects and Challenges up to 2050–

Available soon on our website



The Institute of Energy Economics, Japan (IEEJ)

Overview of the current global energy market

- Although the trend of Asia as leading **the global energy market remains unchanged**, developments in the **US and China**, which accounts for **40%** of the energy market, must be carefully monitored.
- **World coal demand dropped for two years** in a row (**US and China** largely) while **oil and gas grew**. China's coal consumption declined for the third consecutive year (2016, BP).
- Discussions on **Peak Oil** (supply) of the 2000s are now changing to **Peak Demand**. Note the recent movements that aim to ban the sale of internal combustion engine vehicles.
- **CO₂ emissions dropped in 2015** but **increased again in 2016**. **India and ASEAN** showed big increases despite the declined observed in the **US and China**.
- Paris Agreement calls for "**Long-term low greenhouse gas emission development strategies**" **by 2020**. This Outlook expands its estimation period to 2050.

Scenarios in this Outlook

#Reference Scenario

Reflects past trends with current energy and environment policies.
Does not reflect any aggressive policies for low-carbon measures.

#Advanced Technologies Scenario

Assumes the introduction of powerful policies to enhance energy security and address climate change issues.
It promotes utmost penetration of low-carbon technologies.

#Oil Demand Peak Case

Assumes a more rapid introduction of electric drive vehicles than in the reference scenario, to analyze the possibilities of oil demand peak.

Examples for Technology

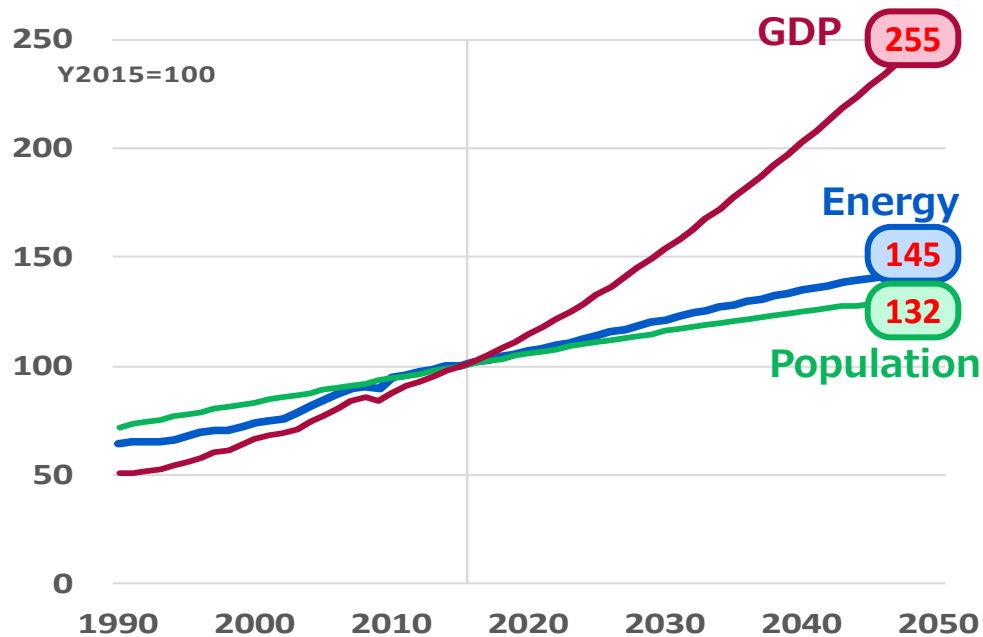
		Reference	Advanced Technologies	Peak Oil Demand
Energy efficiency	Vehicle technology (ZEV* ¹ sales share)	9% in 2030 20% in 2050	21% 43%	30% 100%
	Coal-fired power generation (CCT share in newly installed capacity)	30% in 2030 90% in 2050	70% 100%	Same as Reference
Carbon free technology	Installed capacity PV Wind Nuclear	(2015 to 2050) 0.2 to 1.5 TW 0.4 to 1.9 TW 0.4 to 0.6 TW	(2050) 2.5 TW 3.0 TW 1.0 TW	
	Thermal power generation with CCS (Only countries and regions with CO ₂ storage potential excluding aquifers)	none	Newly installed after 2030	

A light gray world map is centered in the background of the slide.

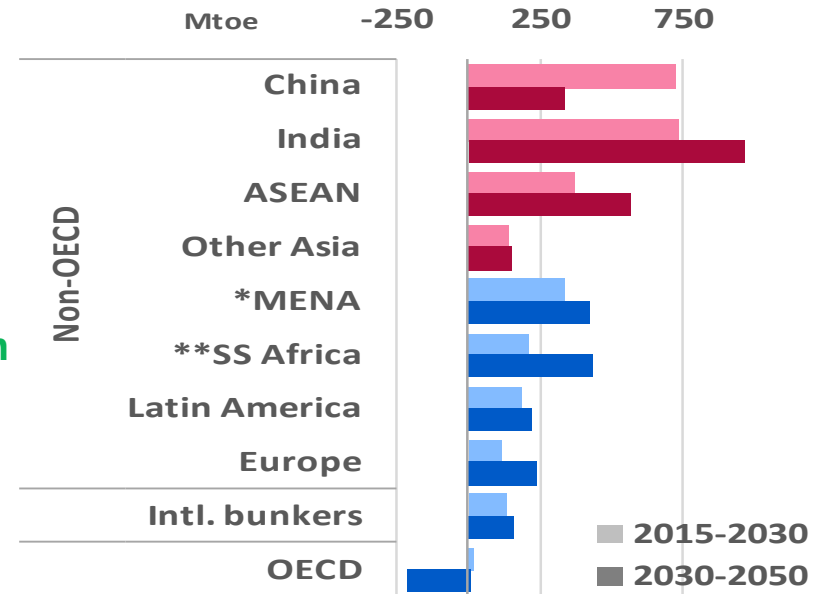
Energy Outlook up to 2050

Energy market shifting to southern Asia

❖ Global Population, GDP and Energy



❖ Growth in Primary Energy

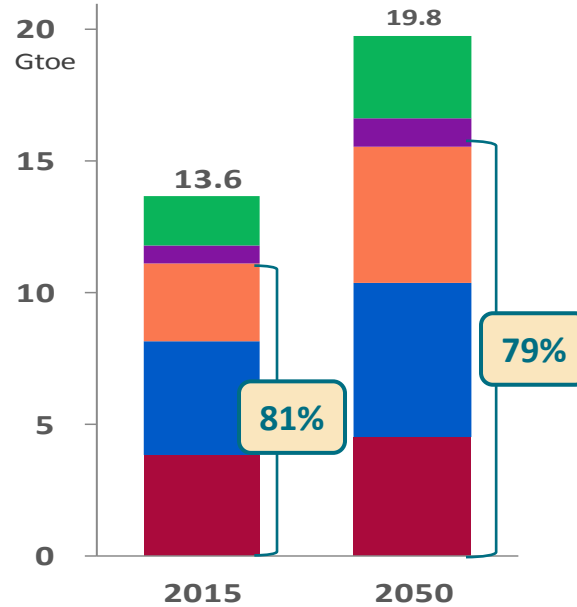
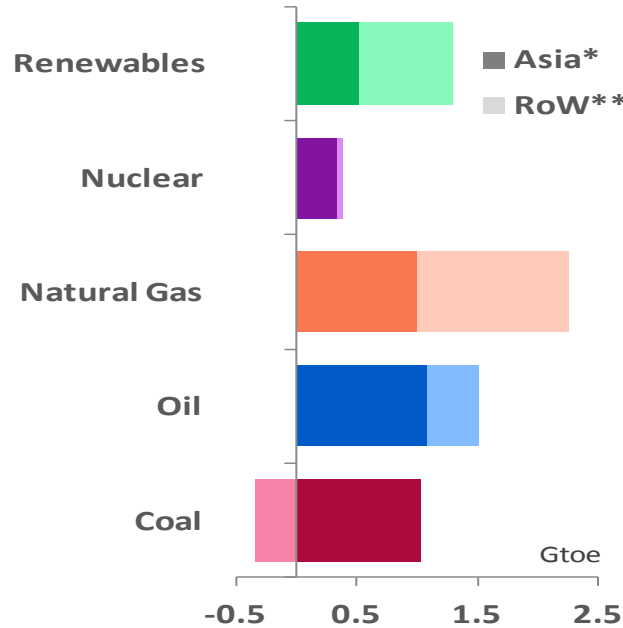


* Middle East and North Africa, **Sub-Saharan Africa

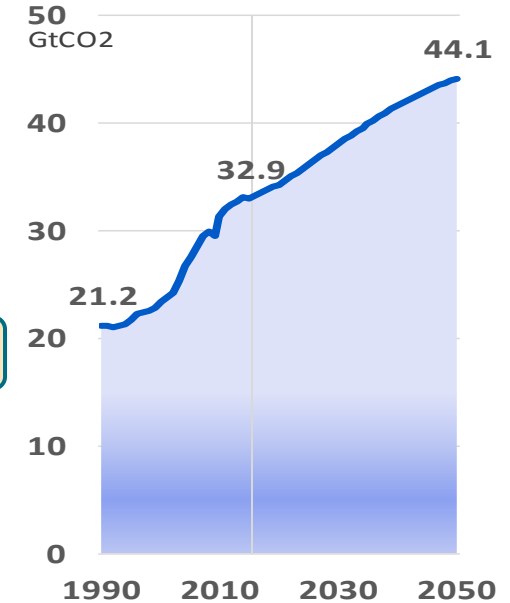


High dependence on fossil fuels continues

❖ Growth in Primary Energy ❖ Energy Mix



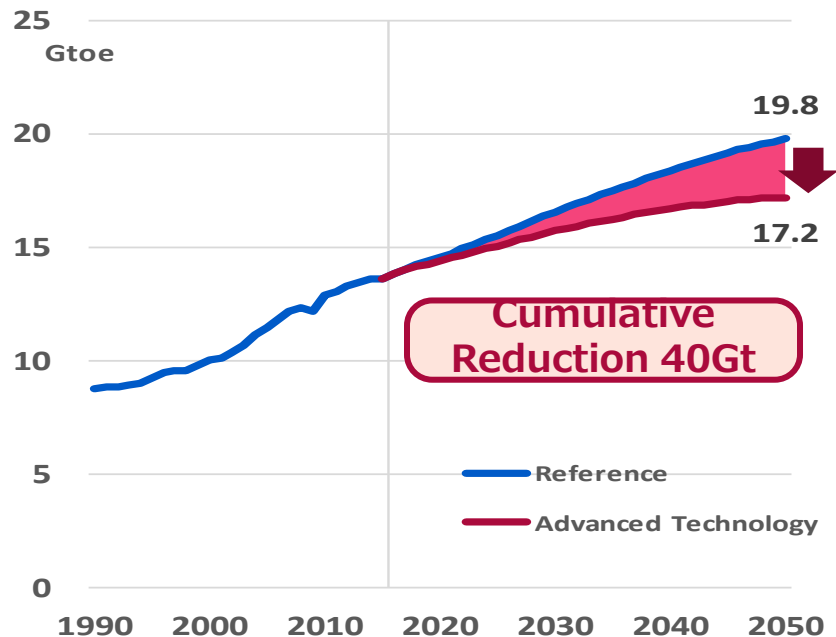
❖ Energy-related CO₂



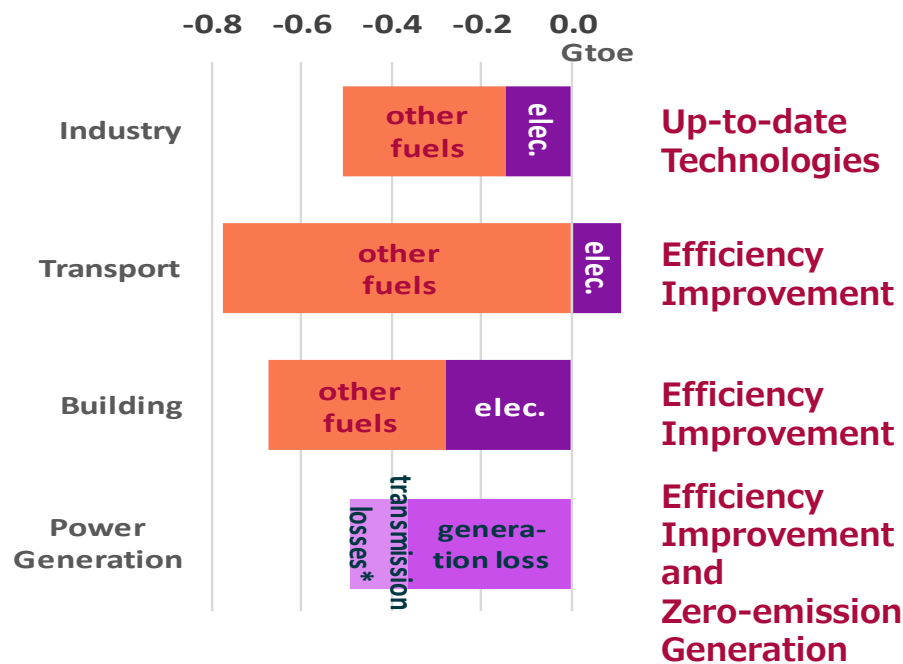
* Non-OECD Asia, **Rest of the world

Drawing another path – Advanced Technologies Scenario

❖ Global Primary Energy



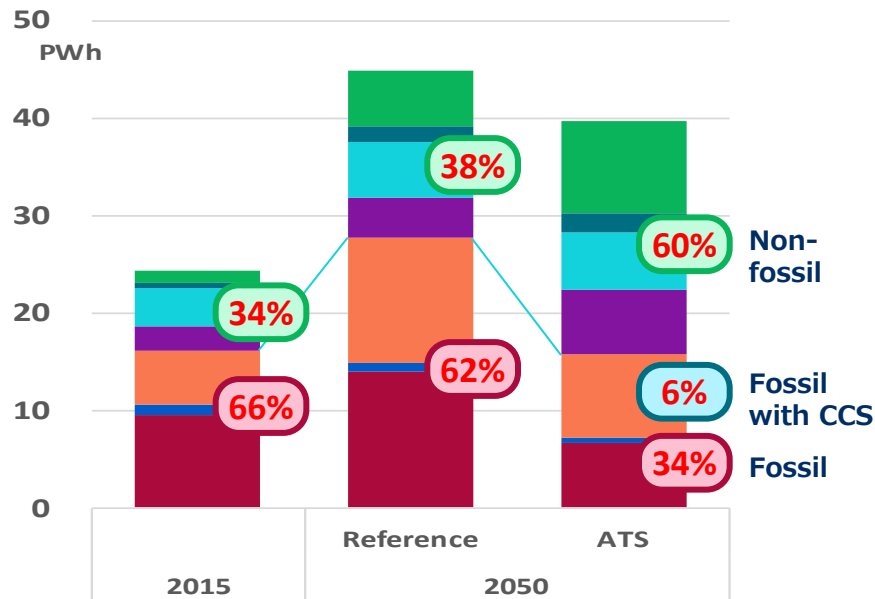
❖ Reduction Effects by ATS in 2050



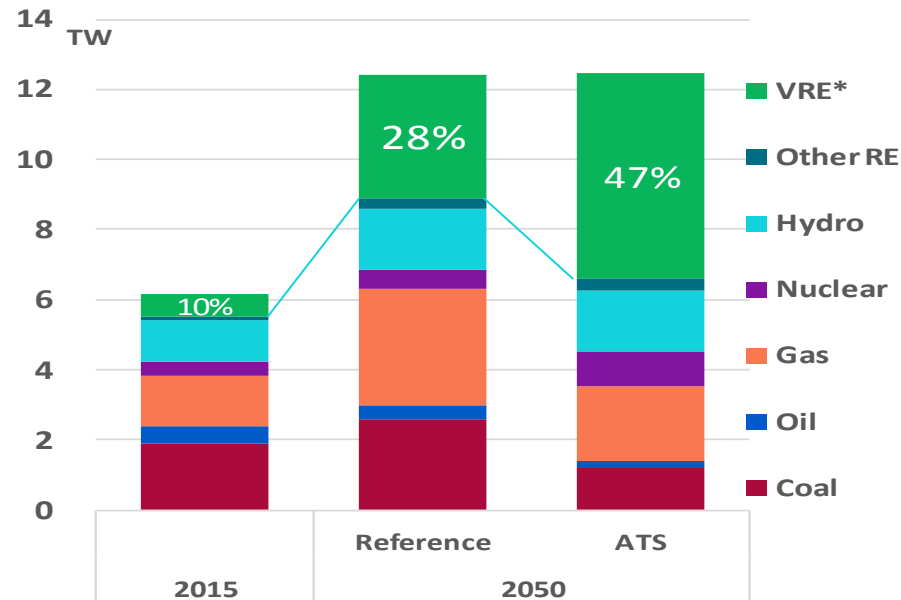
* Including station service power

Zero-emission Generation occupies two thirds

❖ Global Power Generation



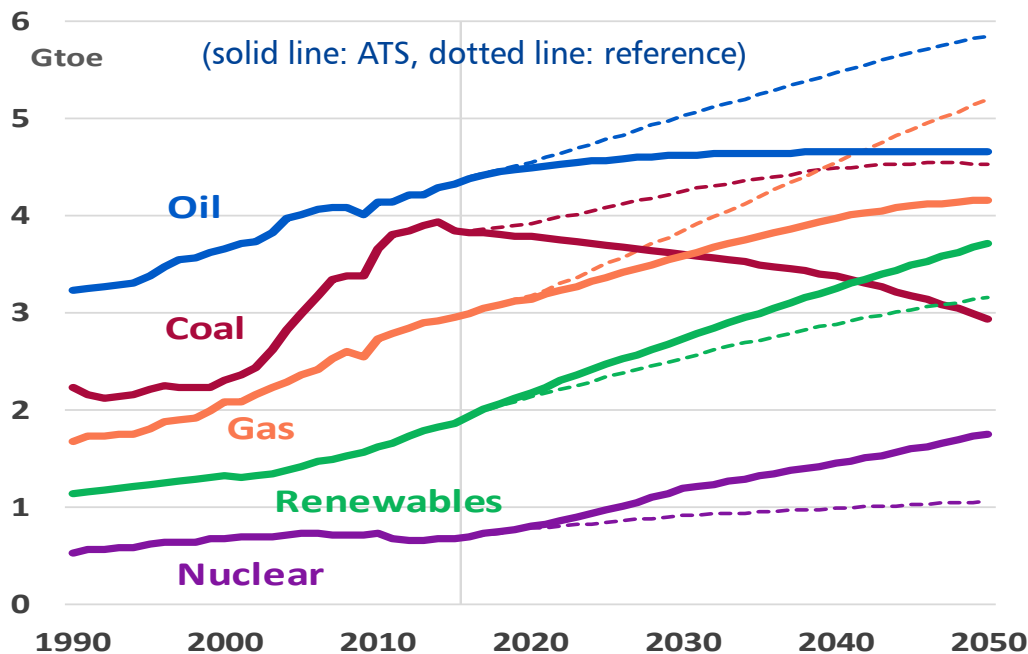
❖ Global Power Capacity



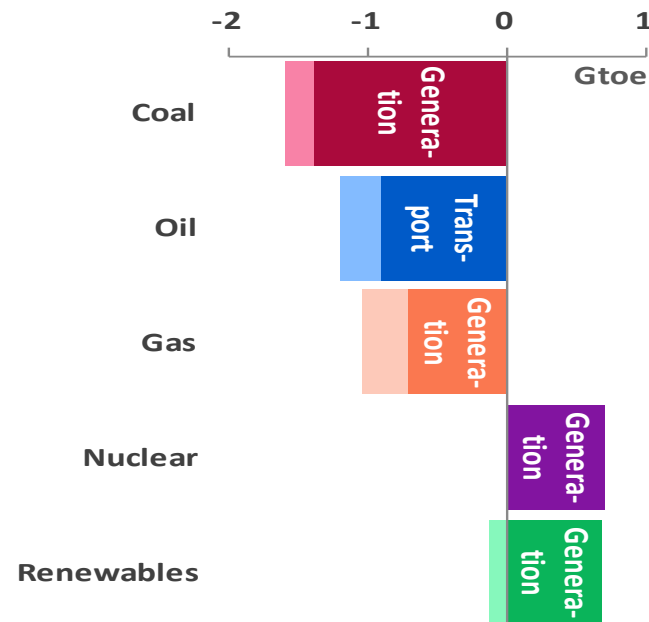
* Variable Renewable Energy includes PV, CSP, wind and marine.

Coal falls significantly and below renewables

❖ Primary Energy

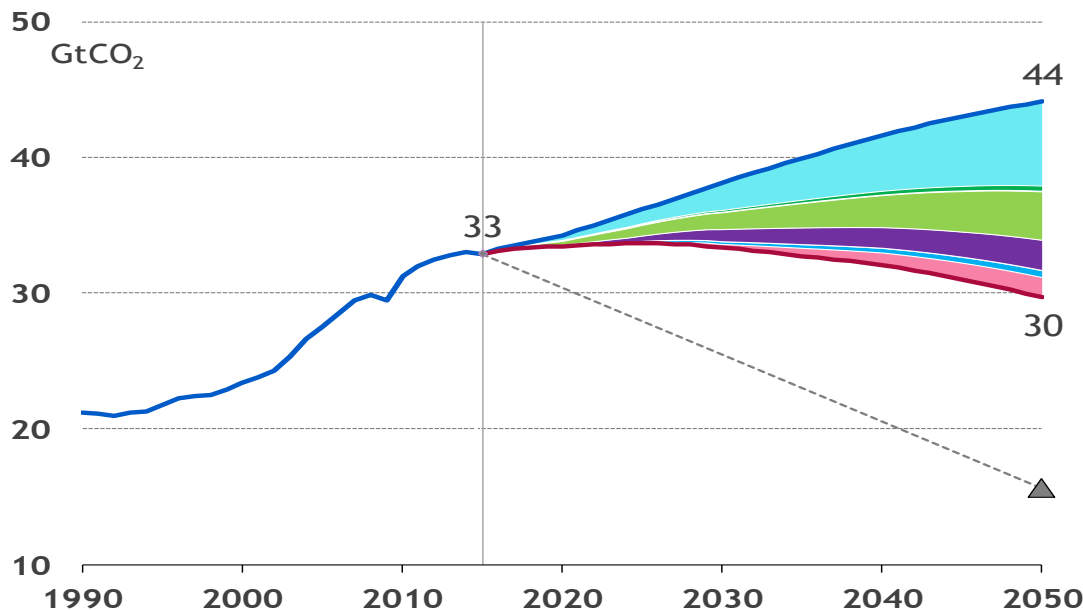


❖ Effects by ATS in 2050

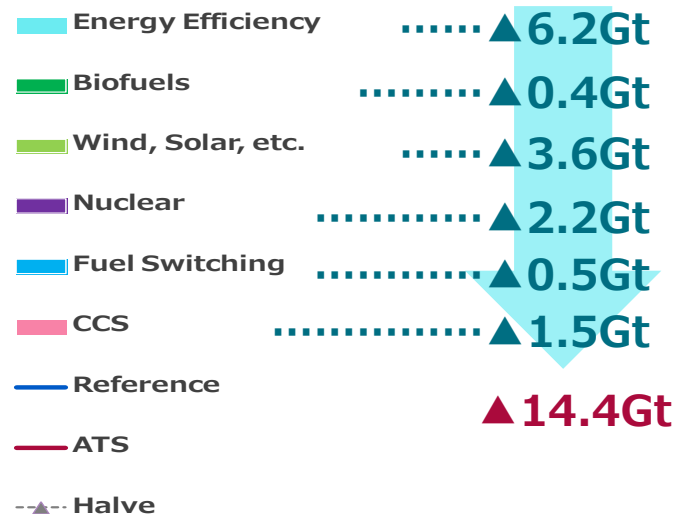


CO₂ emissions peak in the middle of 2020s

❖ Energy-related CO₂ Emissions



❖ Reductions by technology

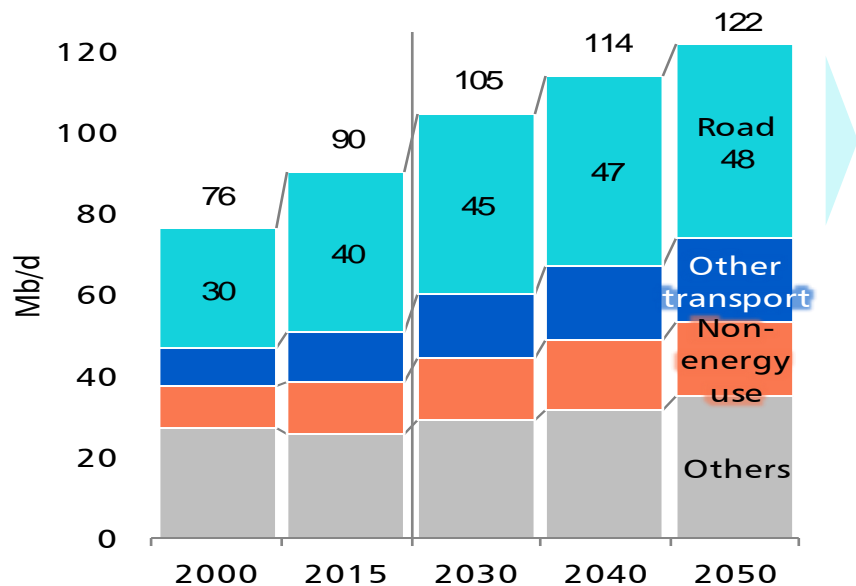


A light gray world map serves as the background for the slide. The continents are clearly visible, and the map is centered on the Atlantic Ocean.

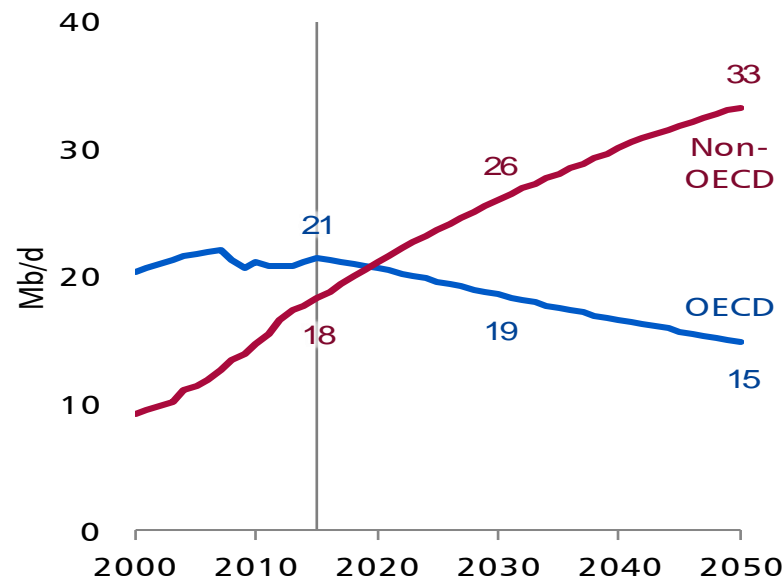
Peak Oil “Demand” Case

Transportation, especially cars, drives oil demand

 Oil consumption [Reference Scenario]



 Oil for Road [Reference Scenario]



The time for car electrification has come?

Selected recent movements by governments/assemblies and car makers



Germany

A resolution to ban conventional car sales in the European Union by 2030 was passed by the Bundesrat of Germany (2016)



Norway

The ruling and opposition parties proposed the abolition of conventional vehicles by 2025 (2016)



France

The Government announced that it would ban conventional car sales by 2040 (2017)



United Kingdom

The Government announced that it would ban conventional car sales by 2040 (2017)



India

Minister said that all new car sales after 2030 would be electric vehicles (2017)



China

Deputy Minister mentioned that the ban on the sale of conventional vehicles was under investigation (2017)



Toyota

The target for FCV sales is more than 30,000/year in 2020 (2015). Reported of full-scale entry into EVs in 2020 (2016)



Volkswagen

Announced the strategy to increase EV share in its total sales to 25% with more than 30 models of EVs by 2025 (2017)



Renault-Nissan

Introducing 12 models of EVs by 2022. The target of 30% of its total sales as EVs (2017)



Hyundai

The plan to prepare EVs at all line up by 2020 (2015)



Ford

Announced that eco-cars combined with EVs and HEVs will be raised to 70% by 2025 (2017).

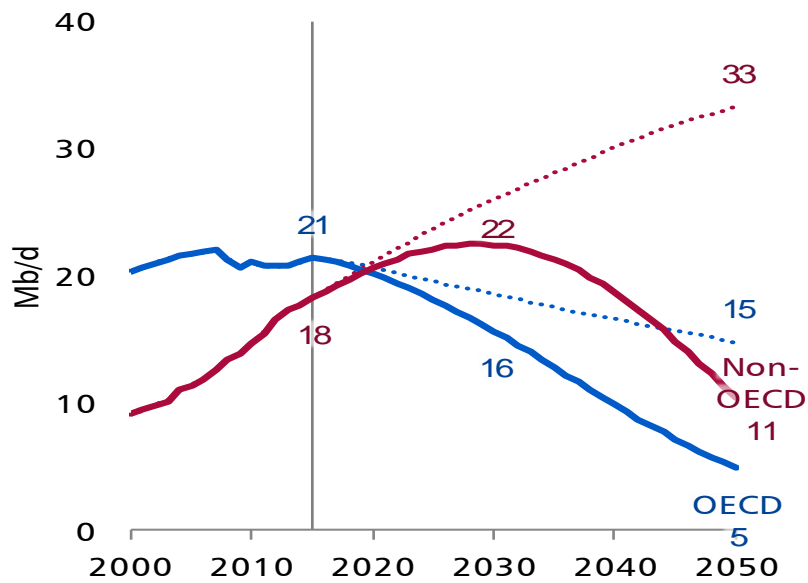


Honda

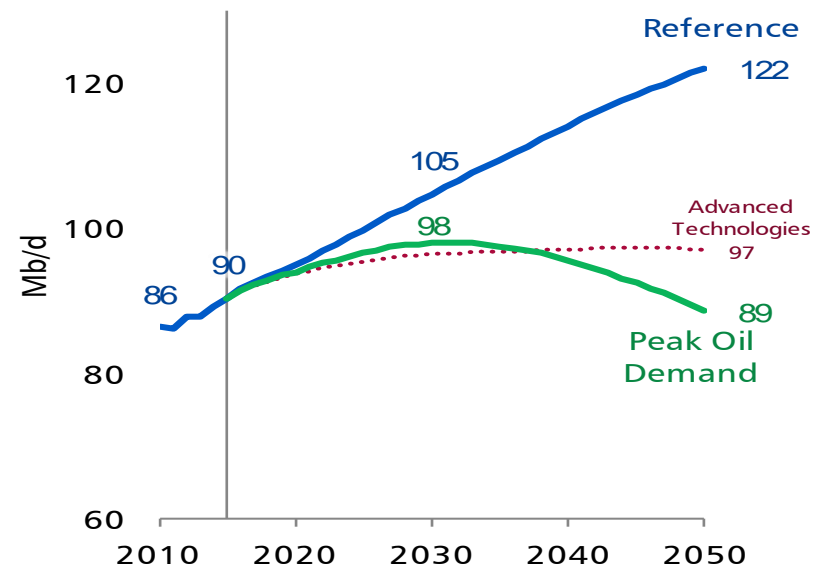
In 2030, two-thirds of automobile sales will be electrified. EVs will be released in China in 2018 (2017).

Oil peaks around 2030 by rapid penetration of ZEVs

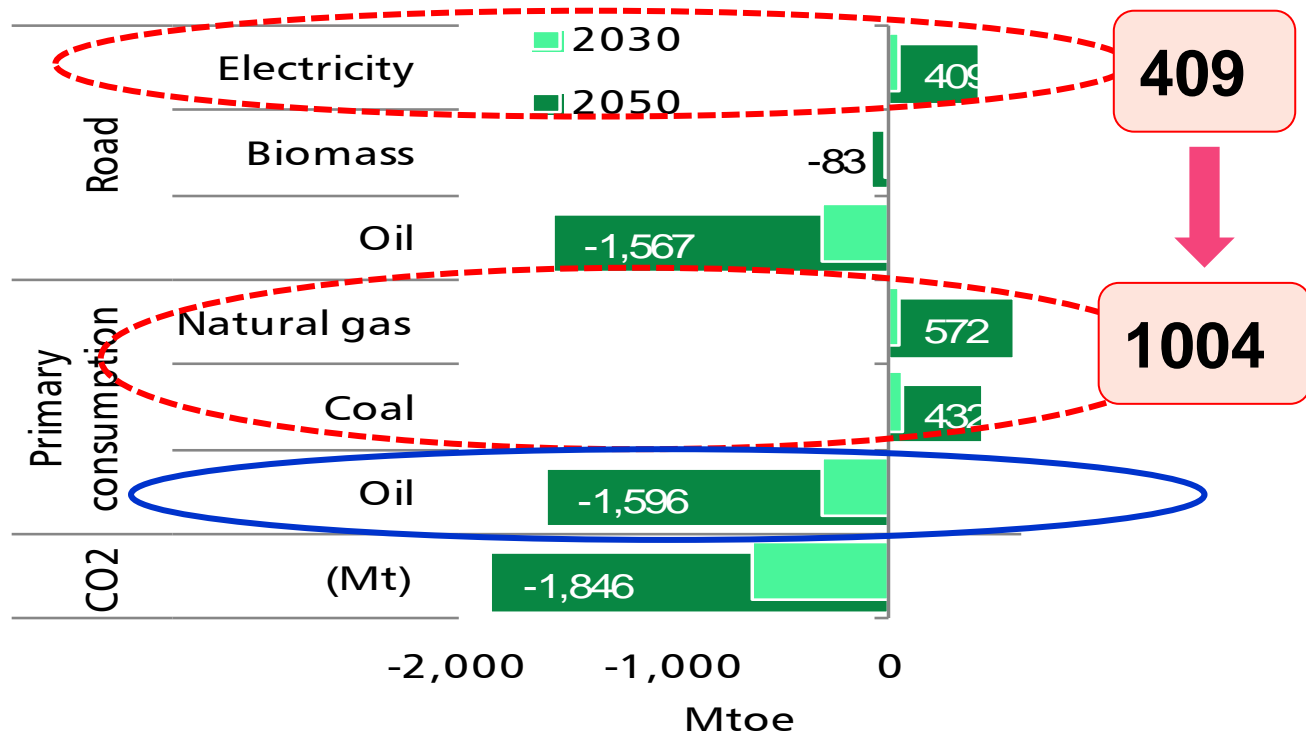
 Oil for Road [Peak Oil Demand Case]



 Total Oil Consumption



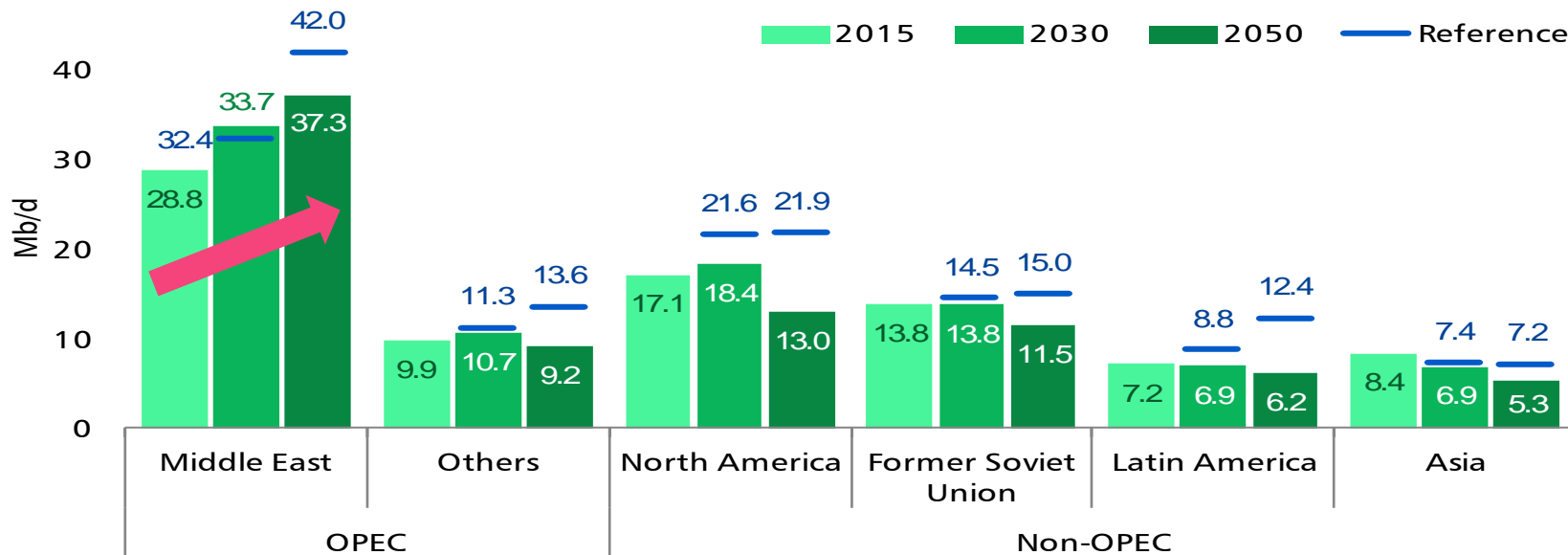
Note: Dotted lines are the Reference Scenario



Note: Excluding own use

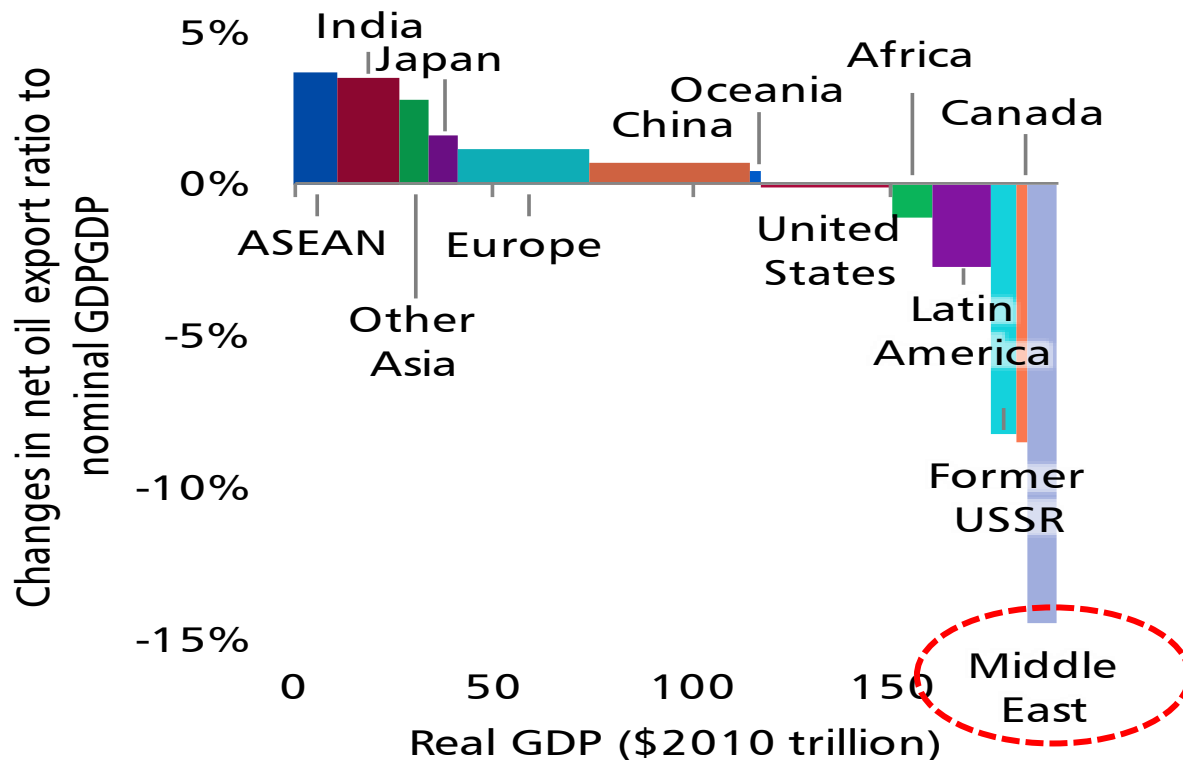
Crude oil production shifts to low-cost regions...

🛢️ Crude oil production [Peak Oil Demand Case]



Due to lower prices, Middle East will suffer the largest economic downturn

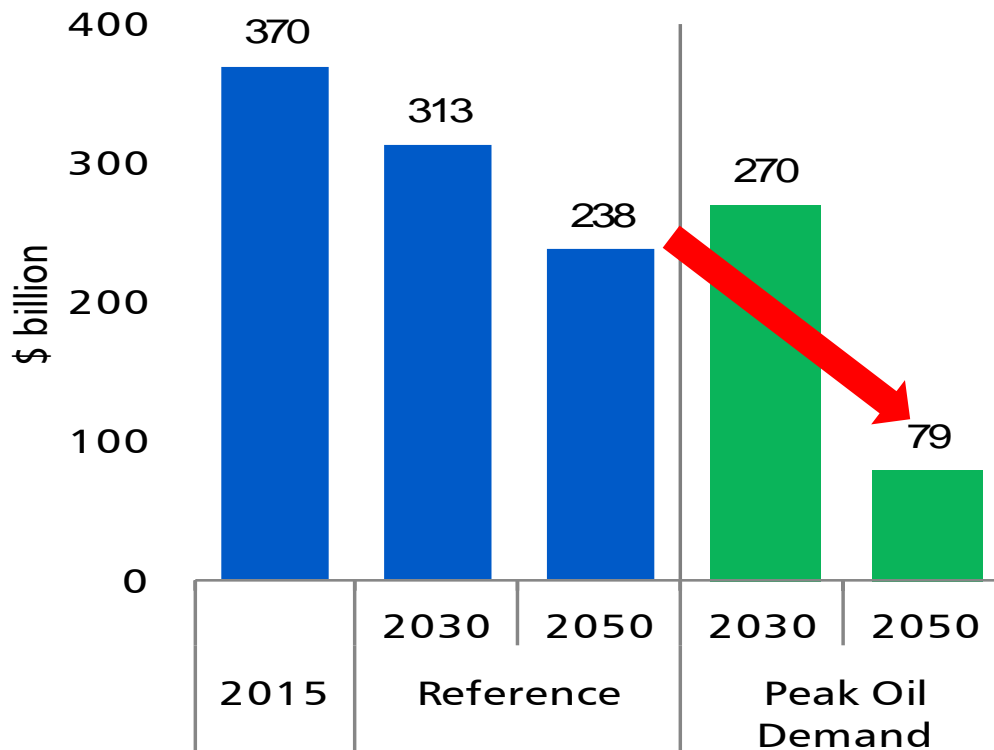
The ratio of net oil exports/imports to nominal GDP [2050]



Note: Europe excludes the former Soviet Union

Less pollution but less revenues from excise taxes

Excise taxes on gasoline and diesel oil for automobiles in OECD



- Under certain circumstances, oil consumption can turn into a decline in the not too distant future.
- The extreme assumption on the penetration of ZEVs is challenging. Oil consumption may not easily peak out.

Oil is required even at the same scale of today in 2050 .

- The lack of supply investment because of pessimism could threaten energy security and that would further decrease oil demand. The rising dependence on the Middle East will increase geopolitical risk.
- Collaboration between consuming and producing countries will become even more important. Supporting efforts such as Saudi Arabia's "Vision 2030" is essential.

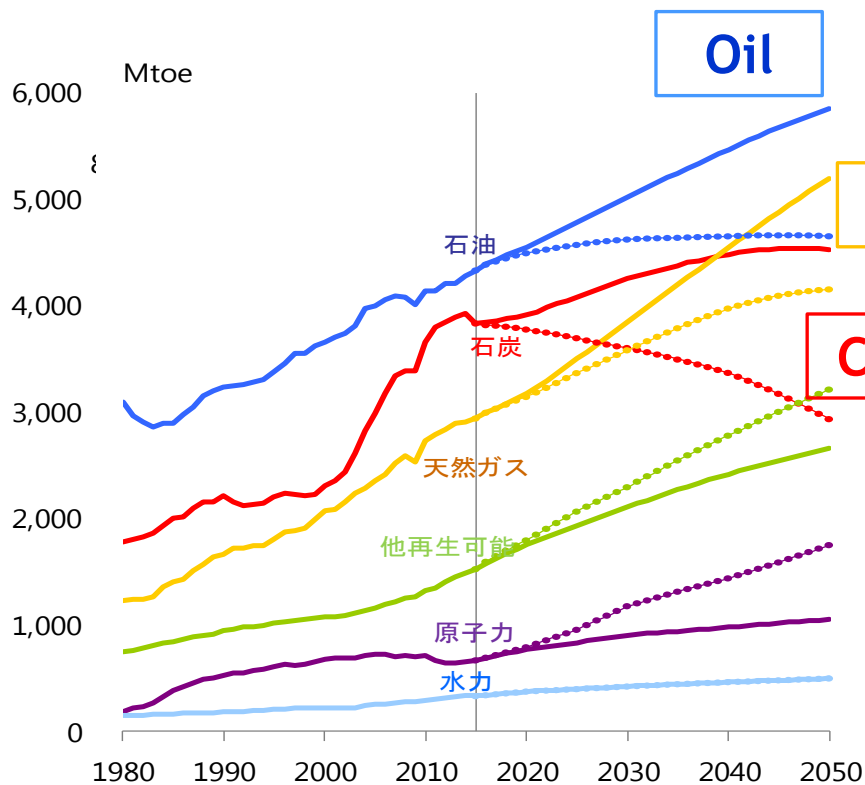
Today's Topic

Role of Coal & LNG in Asia's Future Energy Mix : Defying the odds?

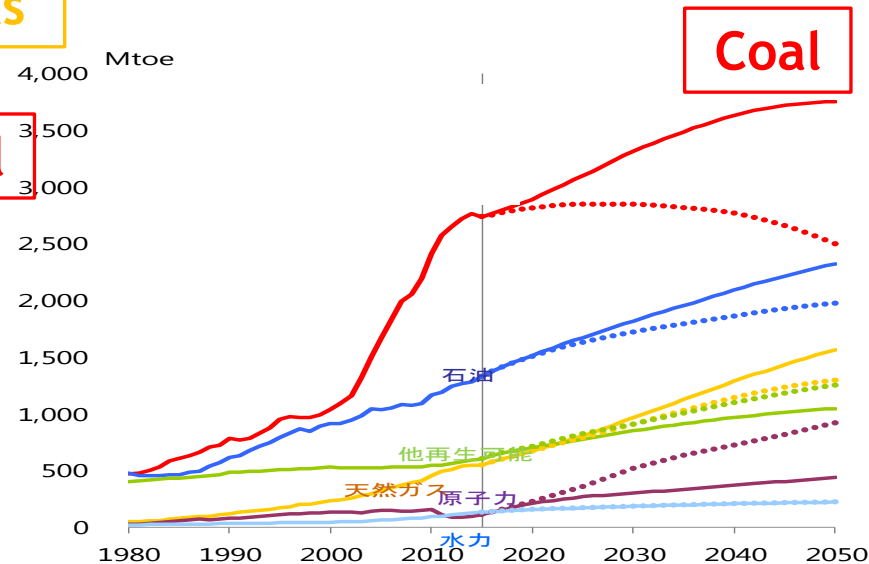
Primary Energy Demand

— Reference Scenario
... Advanced Tech Scenario

World



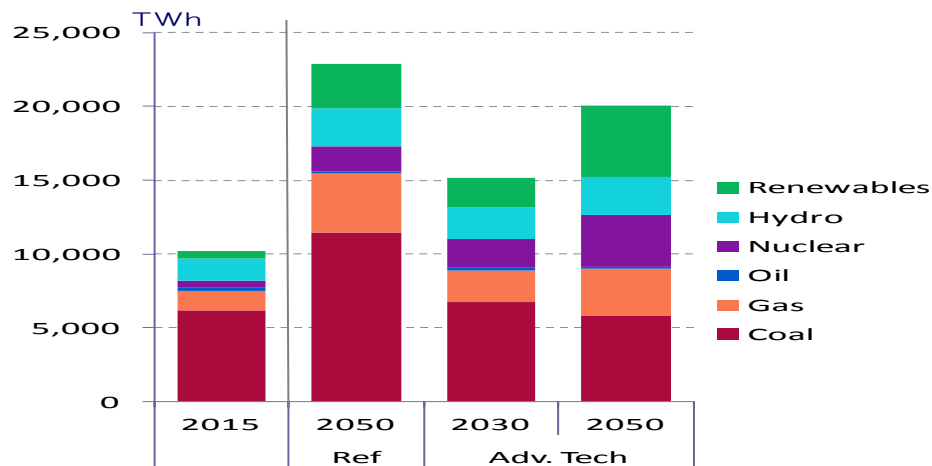
Asia



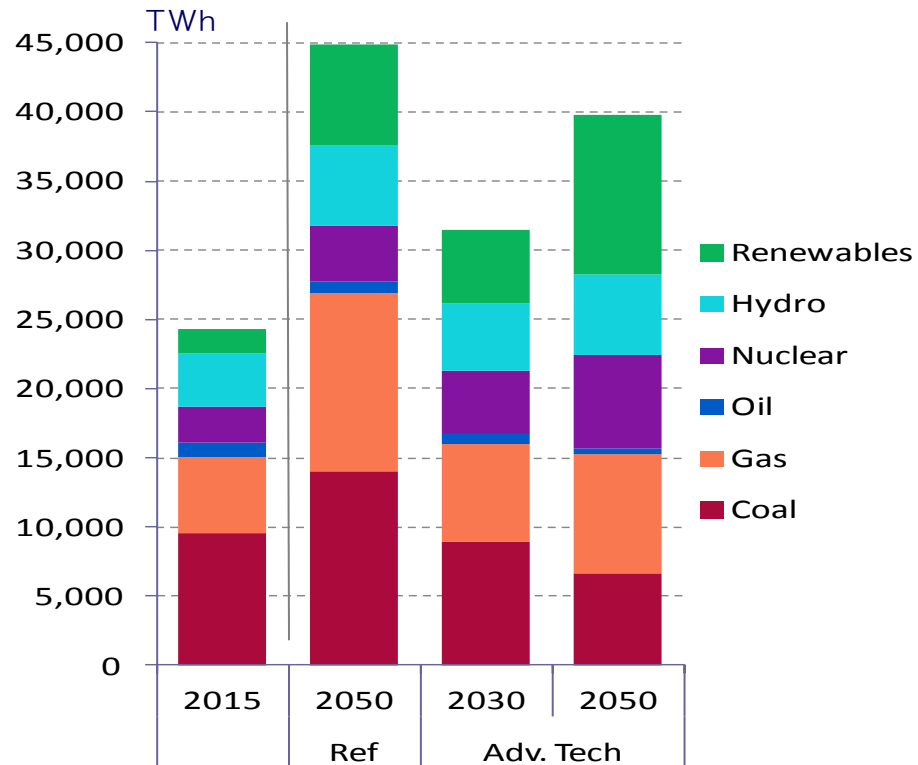
Power generation mix

Reference Scenario
Advanced Technologies Scenario

Asia



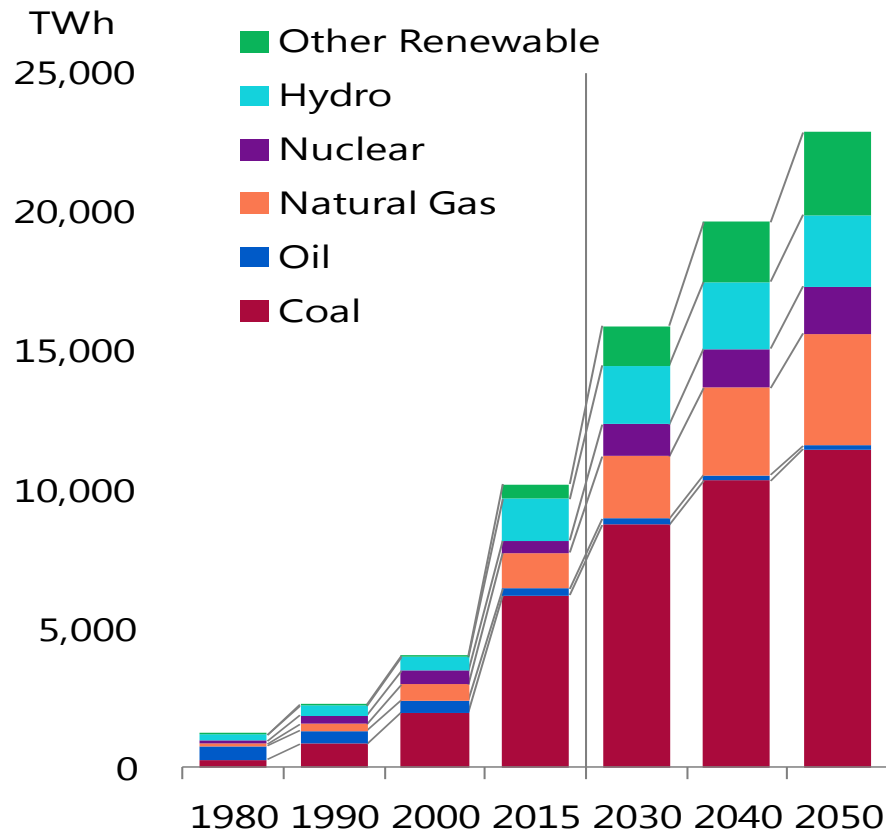
World



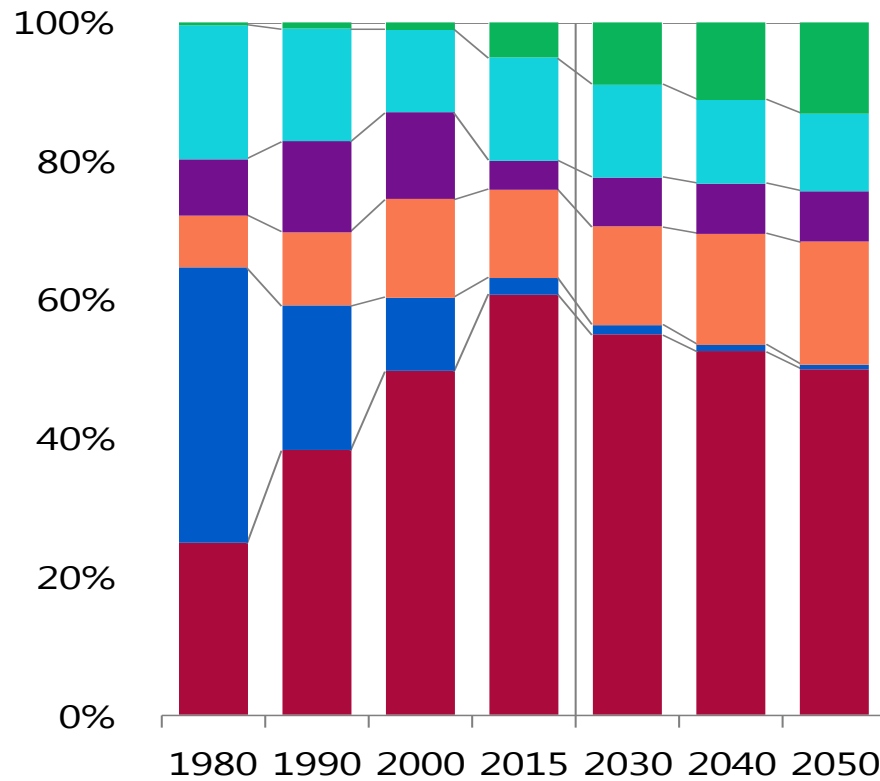
Power Generation Mix (Asia)

Reference Scenario

Power Generation



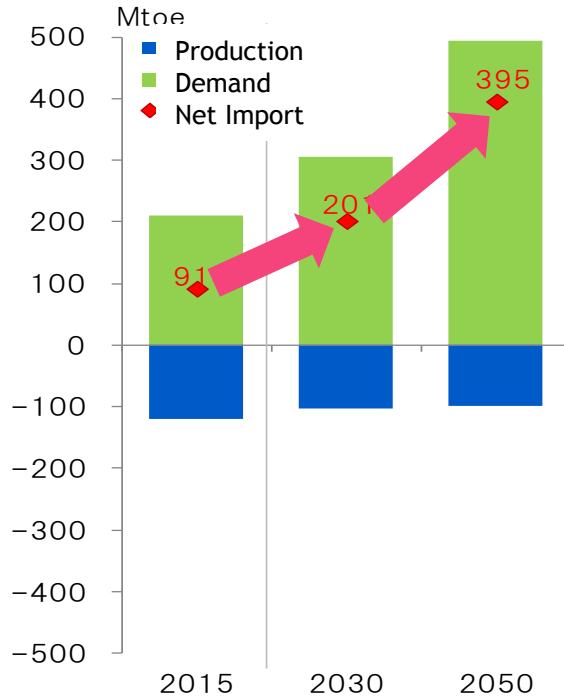
Share



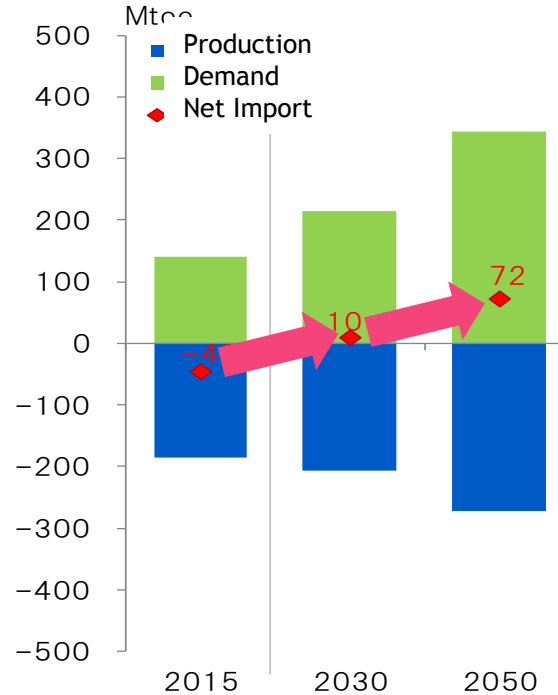
ASEAN Will Become Net Importer of Gas and Coal

Reference scenario

Oil



Gas



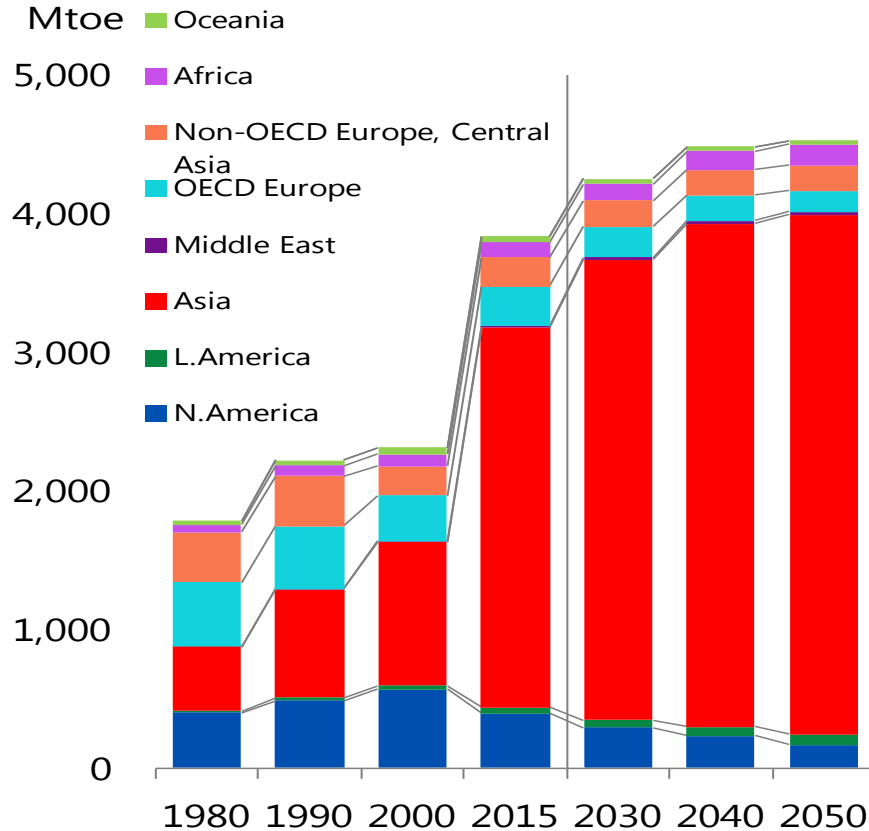
Coal



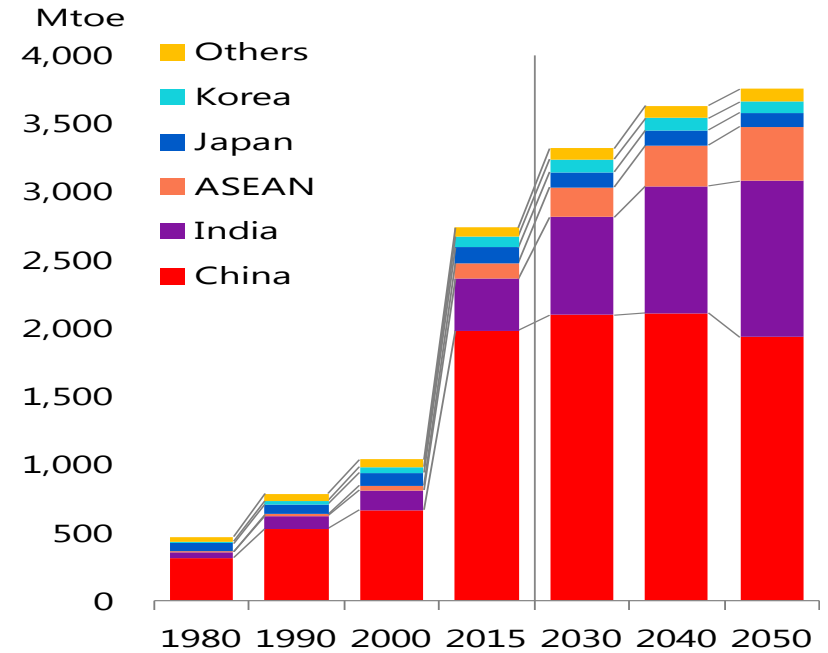
Coal Consumption

Reference Scenario

World



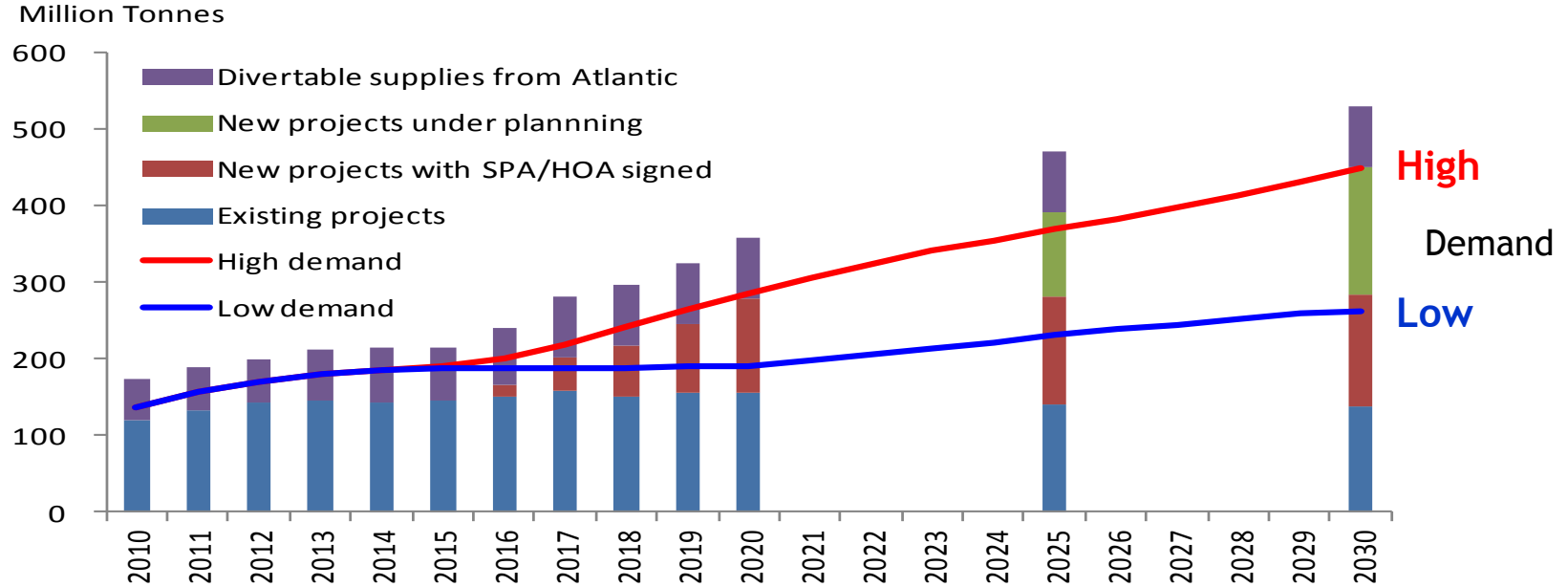
Asia



- Led by **Europe, China and the US**, global demand for coal has been declining in recent years. Should we anticipate that the **rest of Asia** will soon follow a similar trend and **further decline the demand for coal?** Will it be in response to economic or environmental (local / global) concerns?
- For the fast growing countries/economies, their **industrial use of coal** (coking and steam coal) , such as **for steel and cement**, are **expected to increase**. How do you envision **their transition?**
- **Will coal remain the cheapest energy option** despite the promising or anticipated cost decline of renewable and LNG?
- Should importing high quality coal make sense for those countries endowed only with low calorie domestic coals? Is the timing correct for those countries to **start investing and introducing CCT** such as super-critical or ultra-super critical?

LT LNG Supply-Demand Outlook for Asia

Supply potentials can continue to exceed demand up to around 2020



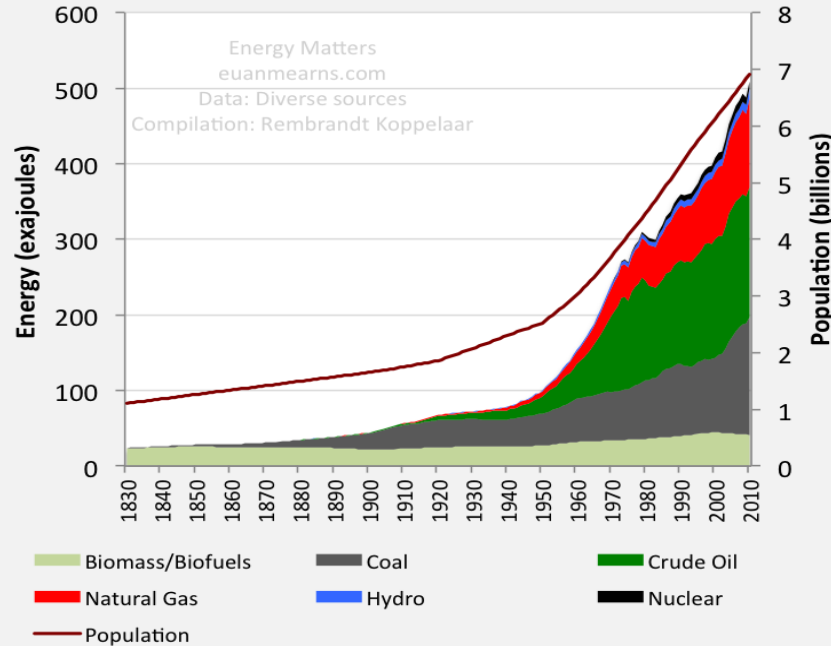
Source: IEEJ

- LNG will be oversupplied at least till 2020.
- Timely upstream investment is required for the balance beyond 2030

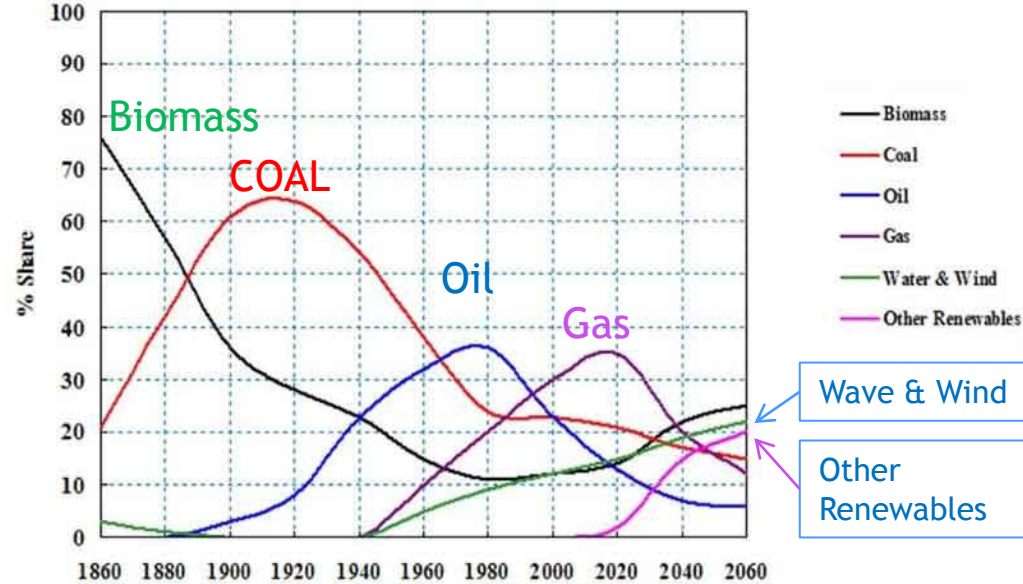
- Despite an increasing demand for LNG, it seems that abundant future supplies from new projects are putting downward pressures on prices. Because of this competitive situation, do you foresee the LNG market to eventually face a supply shortage accompanied with price increases?
- Many refer to Natural gas and LNG as playing a major role as a “bridging fuel”; if so, how long can it last?
- How will LNG (Natural gas) compete with the other components of the energy mix?

How it was and how it will look

Global energy and populaiaon



Energy Transition



Source: Staudt, Larry, "Assisting the World's Transition to a Sustainable Energy Future"

Source: Energy Matters website
Data from Vaclav Smil and BP as compiled by Rembrandt Koppelaar.

- Do you **foresee Asia** as pursuing and **achieving zero-emissions?**

What will be the **position of coal and LNG** in a de-carbonized society?

- Given the current (and anticipated) environmental policies,
is it an **appropriate time to invest in either coal or LNG industry?**

- If we pursue zero-emission, how big of **a role can CCS play?**

For example, given that one ton of coal emits more than 3 tons of CO₂, is CCS at \$50 to 100 per ton CO₂ still an option?

At which CCS costs will the industry remain competitive?

We are Still in "Transition"

