

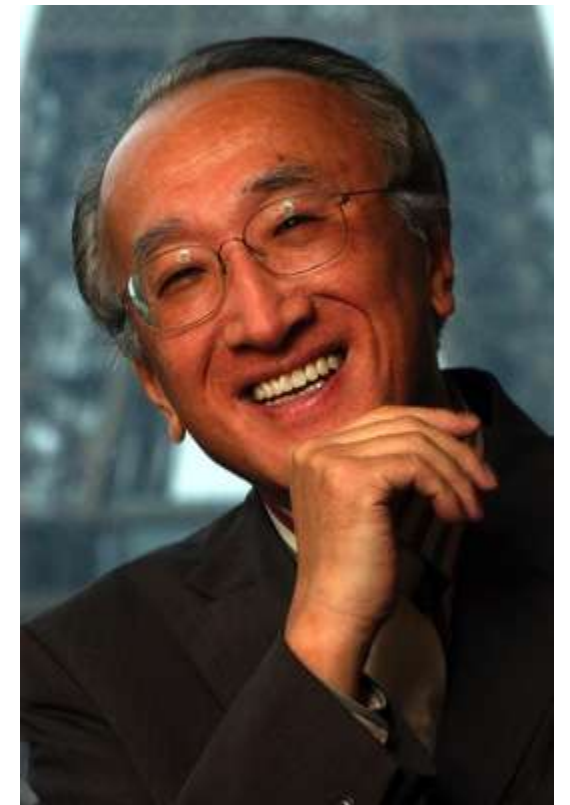
# Is a Golden Age of Hydrogen coming?

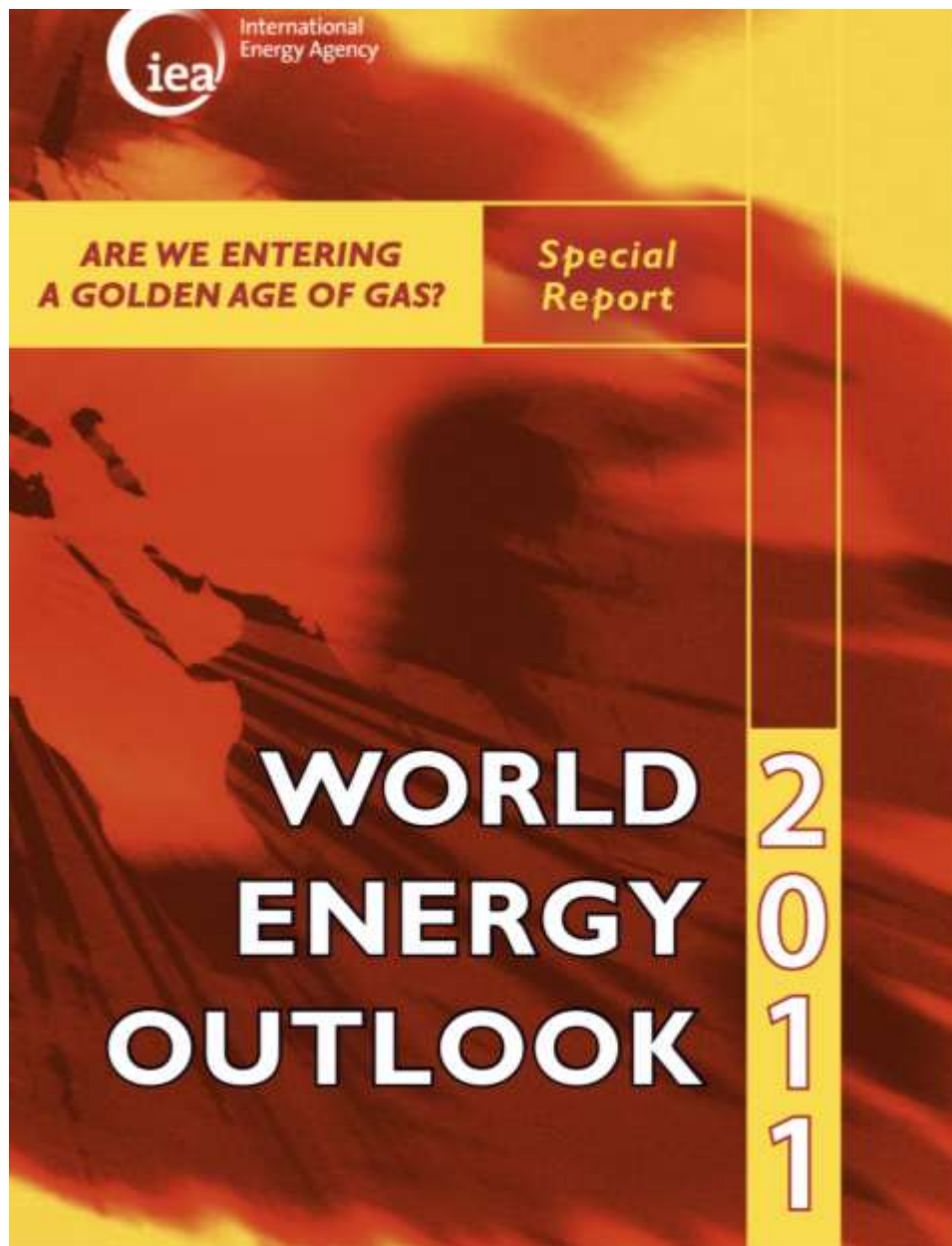
2021-11-16 India World Hydrogen Energy Summit

Nobuo TANAKA

Former Executive Director, International Energy Agency (IEA) 2007-2011

Chairman, Steering Committee, Innovation for Cool Earth Forum(ICEF)





# A Golden Age of Natural Gas

**Figure 4.17** ▶ Selected global gas trade flows in the New Policies Scenario (bcm)



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.

*The strong import growth in Asia underpins a fundamental shift in trade flows away from the Atlantic basin to the Asia-Pacific region*

# Net Zero by 2050

## A Roadmap for the Global Energy Sector

Net Zero by 2050 Interactive  
[iea.li/nzeroadmap](https://www.iea.org/net-zero/interactive)

Net Zero by 2050 Data  
[iea.li/nzedata](https://www.iea.org/net-zero/data)

iea

Energy groups must stop  
new oil and gas projects  
to reach net zero by 2050,  
IEA says

Radical move would have to be compensated by  
huge investment in clean energy

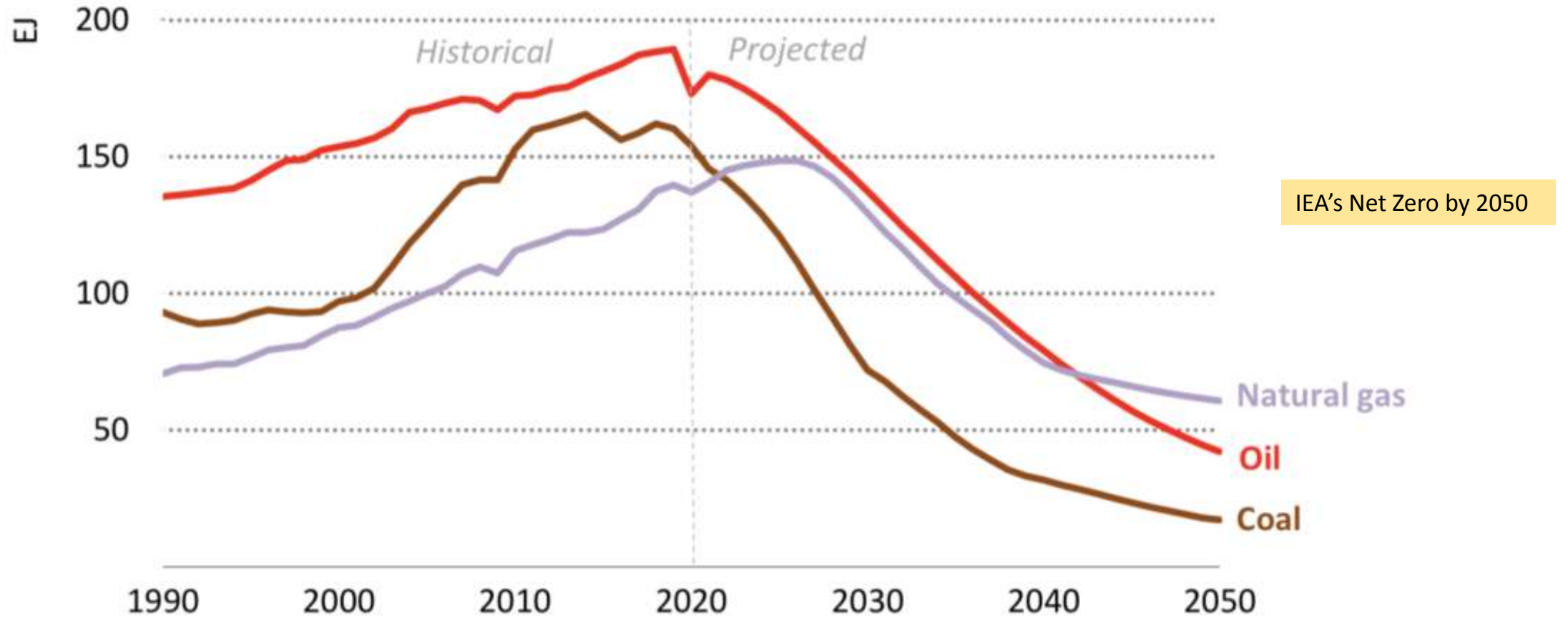


**Saudi Energy Minister Prince Abdulaziz bin Salman has already dismissed the IEA road map, which would limit the average increase in global temperatures to 1.5 Celsius, calling it a "la-la-land" scenario. When asked on Thursday if oil is dead, he responded by saying the kingdom is increasing its production capacity.**



Saudi energy minister Abdulaziz bin Salman

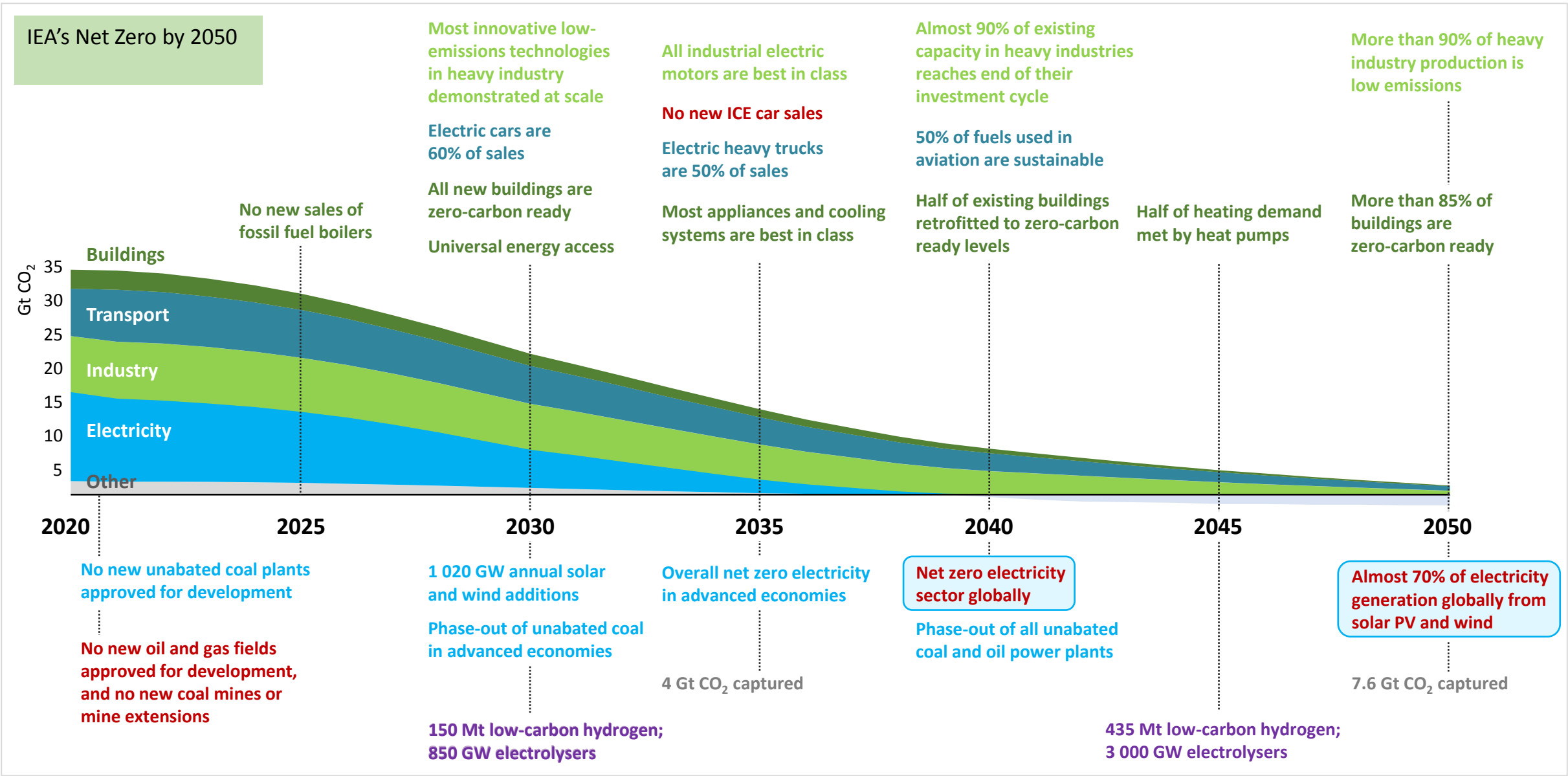
**Figure 3.2** ▶ Coal, oil and natural gas production in the NZE



IEA. All rights reserved.

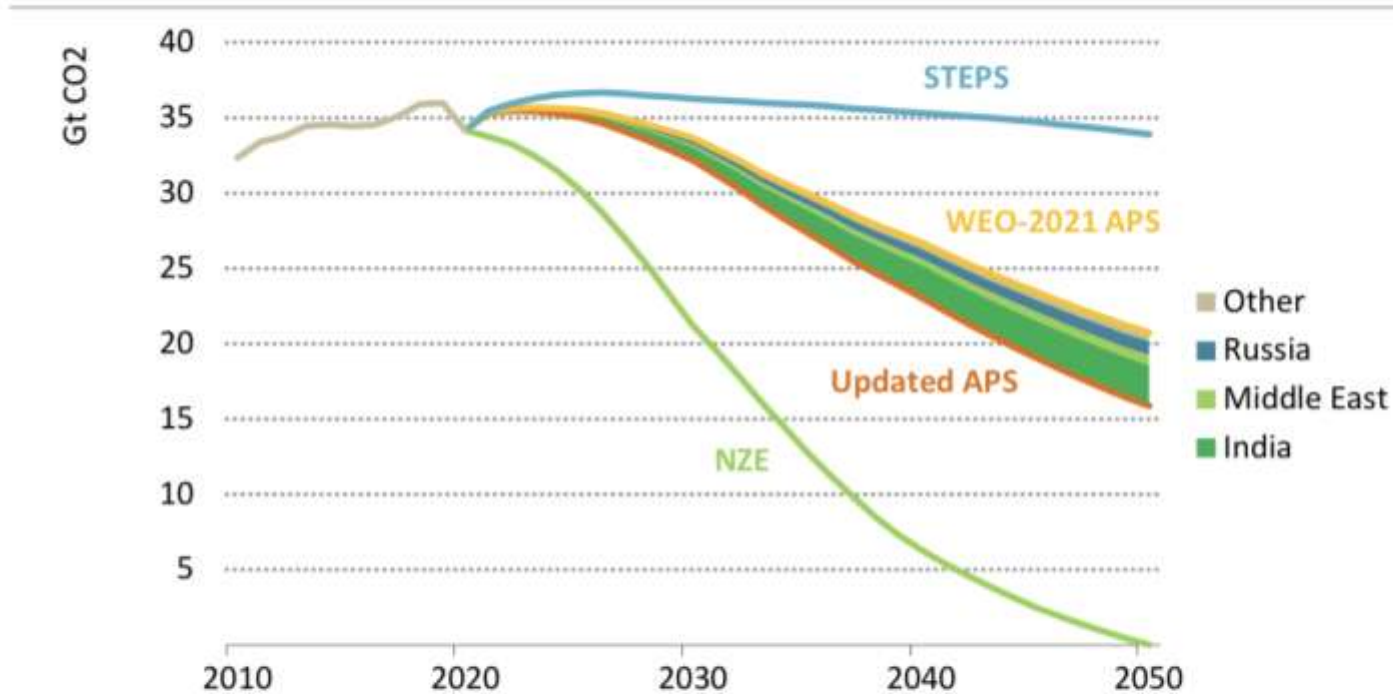
*Between 2020 and 2050, demand for coal falls by 90%, oil by 75%, and natural gas by 55%*

# Set near-term milestones to get on track for long-term targets



**COP26: All the climate pledges announced to date, if met in full and on time, would be enough to hold the rise in global temperatures to 1.8 °C by 2100 (IEA said on Nov 4th)**

**Figure 1.1** ▶ CO<sub>2</sub> emissions in the WEO-2021 scenarios and emissions reductions from recent pledges



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Note: Other = net zero pledge by Australia and commitment to the Global Coal to Clean Power Transition Statement by Indonesia. Middle East = net zero pledges by Saudi Arabia and the United Arab Emirates.

Technical note



Company	Announcement	Target year
Google	Carbon free	2030
Amazon	Renewable 100% Net zero carbon	2025 2040
Facebook	Net zero emission for entire value chain	2030
Apple	Net Zero Carbon all supply chain	2030
Microsoft	Carbon negative all supply chain Historical Carbon Neutral	2030 2050

**Demand-side driven and  
Financial sector pushing  
Energy Transformation is  
happening!**

Sony warns it could move  
factories over Japanese energy  
policy

CEO pushes for renewable rules  
revamp to meet green  
manufacturing pledges of its  
client Apple



## Supply Chain

### Mercedes-Benz supply chain to become CO2 neutral by 2039

Mercedes-Benz announces its next milestone ambitions to make its supply chain carbon neutral by 2039



Georgia Wilson | Dec 8 | 10 min read

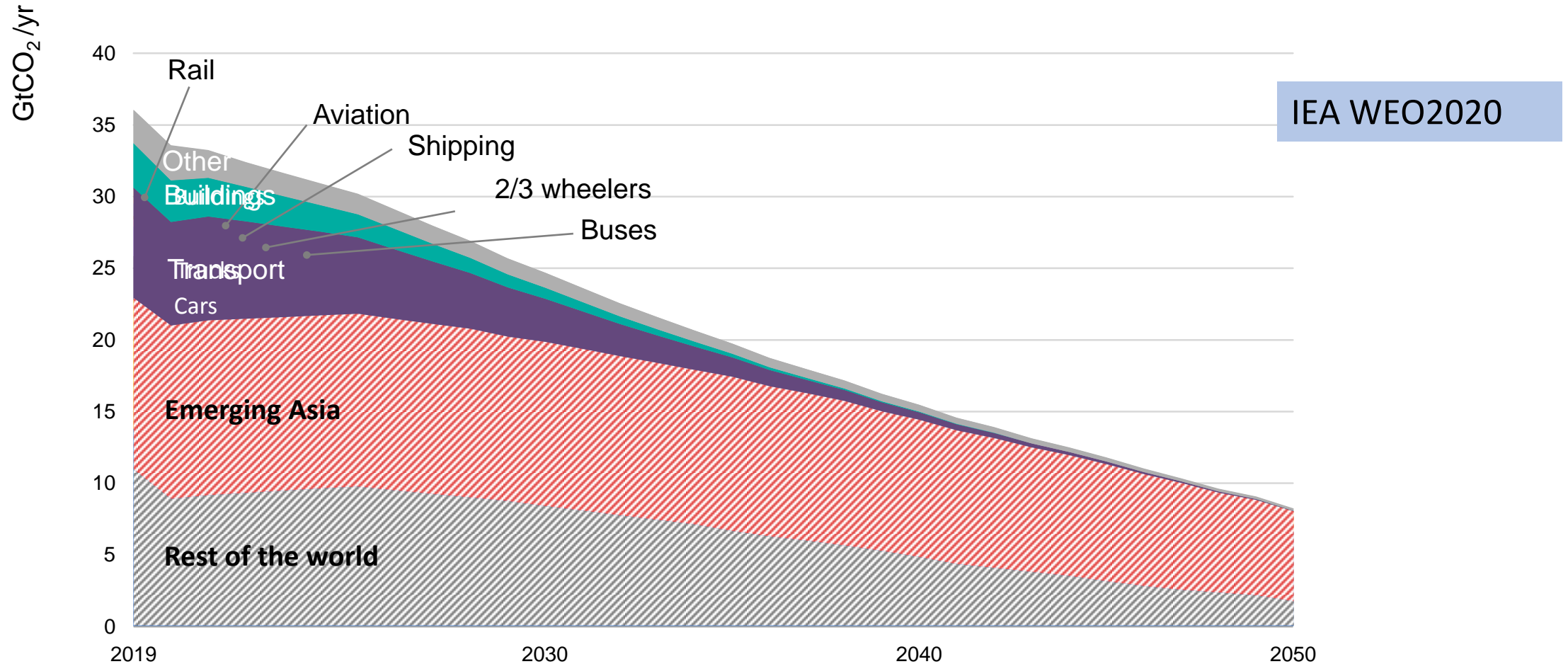


### BlackRock pushes companies to adopt 2050 net zero emissions goal

World's largest asset manager warns it may drop climate  
laggards from active portfolios



# Our existing energy infrastructure is too big to ignore



Reaching net-zero emissions requires tackling emissions from long-lived assets in power generation and heavy-industries. In emerging Asia, 80% of existing coal power capacity was built in the past 20 years.

# Four key opportunities for scaling up hydrogen to 2030: A Common solution for Energy Transition



- More Renewables
- Decarbonize hard-to-abate sectors
- Enhance security
- Help fossil fuel exporters' decarbonization

## The Future of Hydrogen

Seizing today's opportunities

Report prepared by the IEA  
for the G20, Japan



June  
2019

# Japanese Government's manifest for A Golden Age of Hydrogen

## Energy

Offshore wind power  
Windmill, parts, floating wind turbine

Fuel ammonia  
Combustion burner  
(as fuel in transition period to hydrogen society)

Hydrogen  
Turbine for power generation,  
hydrogen reduction steelmaking,  
carrier ships, water electrolyzer

Nuclear power  
SMR (Small Modular Reactor),  
nuclear power for hydrogen production

## Transport / Manufacturing

Mobility and battery  
EV (electric vehicle), FCV (fuel cell vehicle),  
next generation batteries

Semiconductor and ICT  
Data center, energy-saving semiconductor  
(demand-side efficiency)

Maritime  
Fuel-cell ships, electric propulsion ships, gas-fueled ships

Logistics, people flow and infrastructure  
Smart transportation, drone for logistics,  
fuel-cell construction machine

Foods, agriculture, forestry and fisheries  
Smart-agriculture, wooden skyscraper, blue carbon

Aviation  
Hybrid electric, Hydrogen-powered Aircraft

Carbon Recycling  
Concrete, biofuel, plastic materials

## Home / Office

Housing and building, Next generation PV  
(perovskite solar cell)

Resource circulation

Lifestyle-related industry  
Local decarbonization business

**Dec, 2020.**  
**METI**

# JERA announced Carbon Neutral target for 2050 by Ammonia and Hydrogen Co-firing

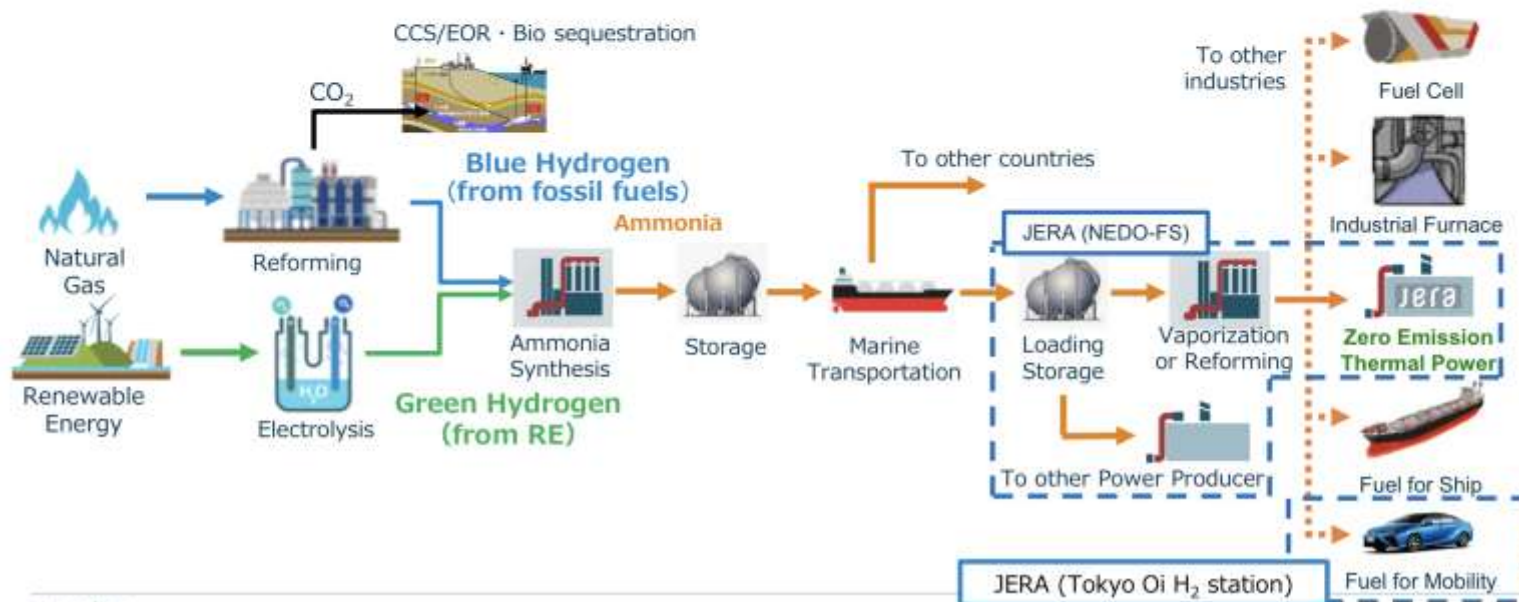
## Efforts for hydrogen and ammonia

- ✓ To promote the use of hydrogen, it is important to reduce costs in the value chain, including transportation. Selecting ammonia as a hydrogen energy carrier leads to an increase in consumption and a reduction in price.
- ✓ Participation in NEDO commissioned work for ammonia co-firing in thermal power plants
- ✓ "Tokyo Oi Hydrogen Station" opened as a joint project to promote the use of hydrogen.

Upstream Development

Transportation and Storage

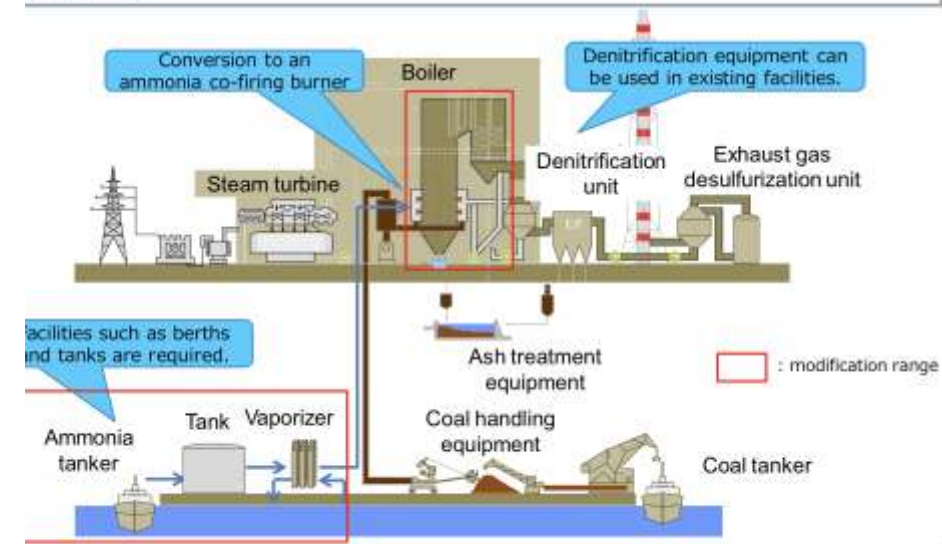
Utilization



## JERA's Activities ①

### Ammonia co-firing at thermal power plants

- ✓ JERA, together with IHI, Marubeni, and Woodside, participated in the NEDO commissioned project "FS for mixed combustion of ammonia at commercial thermal power stations"



Page 4

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## JERA's Activities ②

### Market Prospects: Hydrogen for mobility fuel

- ✓ In Japan, the hydrogen market is in the early stages, driven by the use of hydrogen for mobility fuel.
- ✓ In August 2020, ENEOS Corporation and JERA opened the Tokyo Oi Hydrogen Station, a joint project to promote the use of hydrogen located on the site of the JERA-operated Oi Thermal Power Station.

#### [Overview of Tokyo Oi Hydrogen Refueling Station]



# Building the supply chain is the key for a Golden Age of Hydrogen

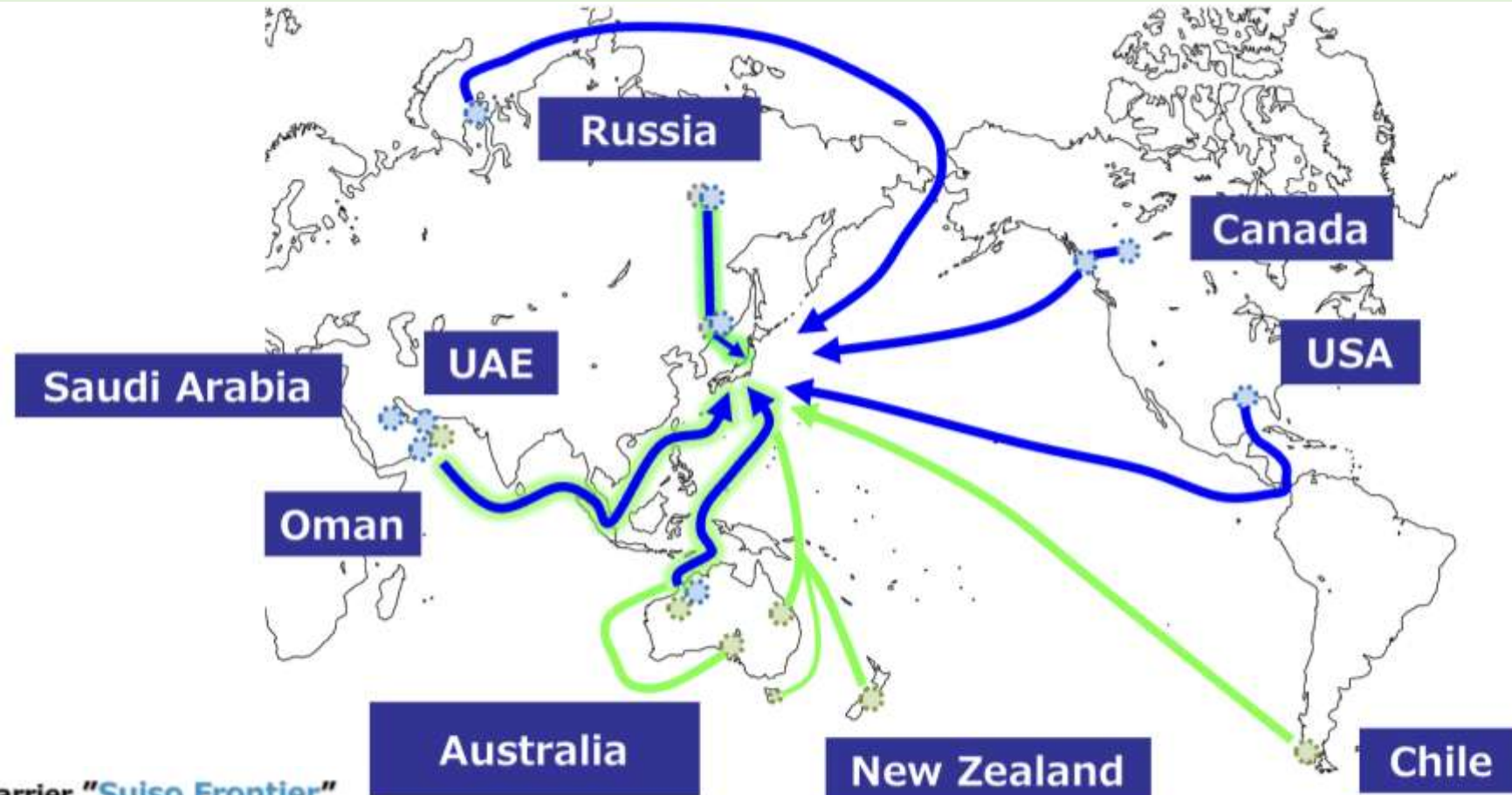
Long-term hydrogen production costs from solar & wind systems



3.0 The Status of CCS 2020  
3.1 Global CCS Facilities Update and Trends



# Possible Supply Chain of Clean Hydrogen: Liquefied H<sub>2</sub>, Ammonia, Organic Hydrate (MCH), Pipeline



Liquefied Hydrogen Carrier "Suiso Frontier"

Launch ceremony (11 December 2019)  
at KHI Kobe Shipyard



Cargo Tank Installation (7 March 2020)  
at KHI Harima Works



**→ Natural Gas (Blue)**  
**→ Renewables (Green)**  
**CLEAN FUEL AMMONIA ASSOCIATION**

# Europe further strengthens Collective Energy Security and Sustainability by Hydrogen Pipeline Highway adding to RE based Power Grid connectivity.

## 2040 A European hydrogen highway

A pan-EU backbone stretching into all directions, with a length of almost 23,000 km

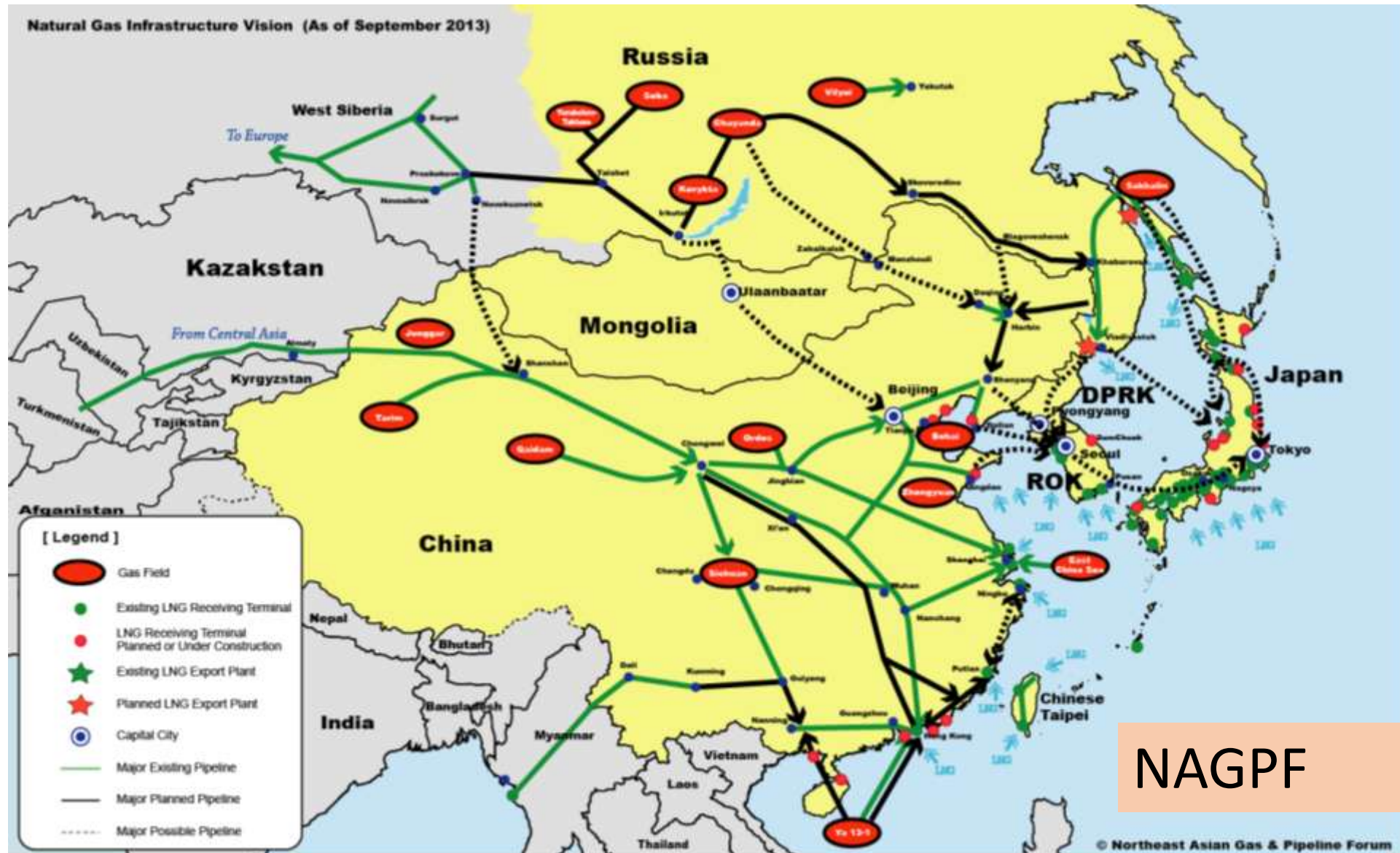


### Important developments and corridors

- 1 A core, pan-EU hydrogen infrastructure of almost 23,000 km, with large corridors connecting most of Western Europe with valuable extensions into Central and Eastern Europe.
- 2 The backbone will consist of 75% retrofitted pipelines, with diameters ranging from 24-48 inch, providing 3-13 GW<sub>LHV</sub> transport capacity per pipeline. Combined with a fit-for-purpose compression system, the backbone should be able to meet currently expected annual hydrogen flows in Europe by 2040.<sup>1</sup>
- 3 The EHB enables connection to global hydrogen flows, including North Africa, the North Sea (UK and Norway), possibly Ukraine and Russia
- 4 The 2040 backbone can be considered as a critical milestone, but not a final product. It represents a foundational network upon which further developments can be built beyond 2040

# North East Asia Clean Energy Platform

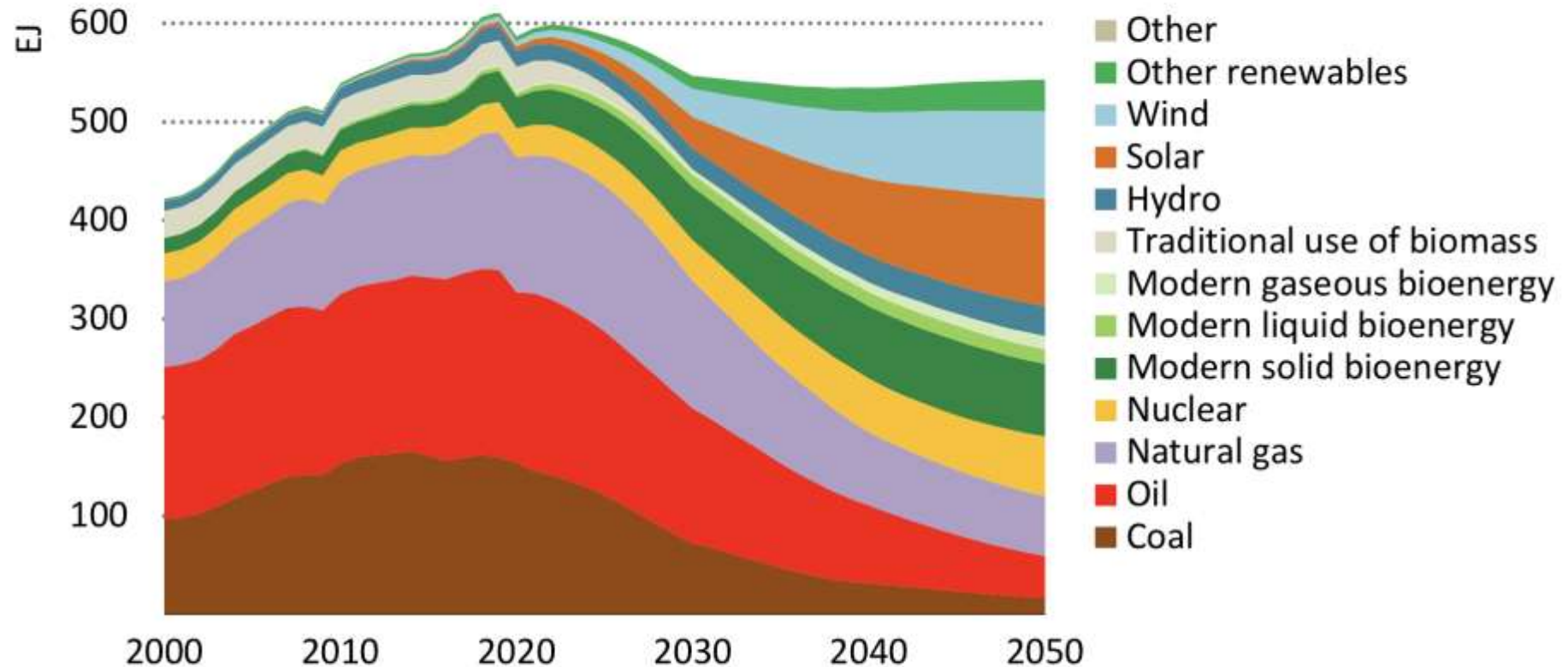
North East Asia Gas & Pipeline Infrastructure(NAGPF) can be transformed to Hydrogen Pipeline.



NAGPF

# What is the Energy Security Policy when fossil fuel is 20 % of total energy supply?

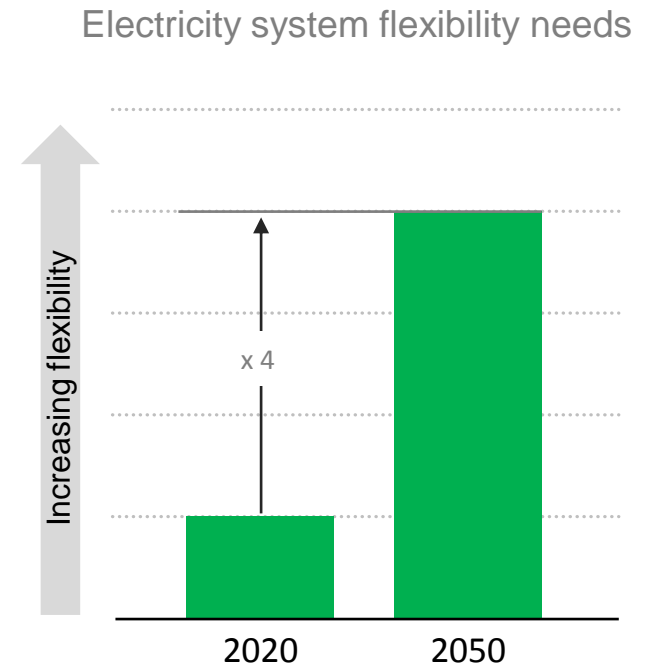
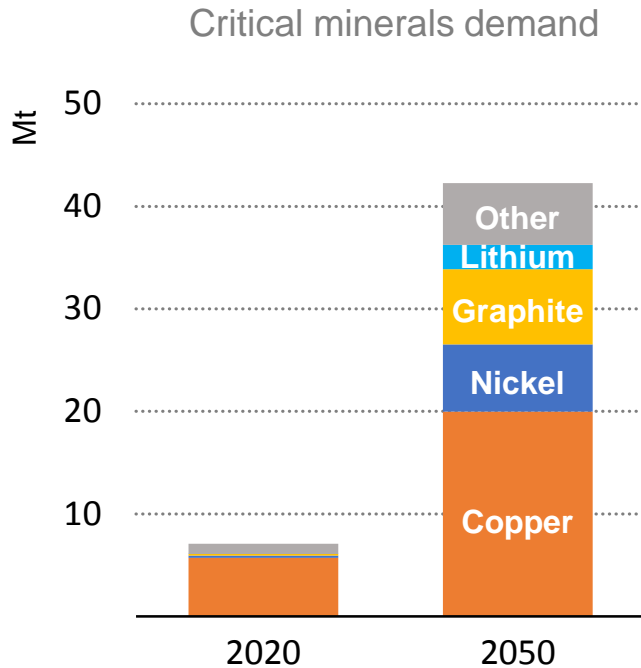
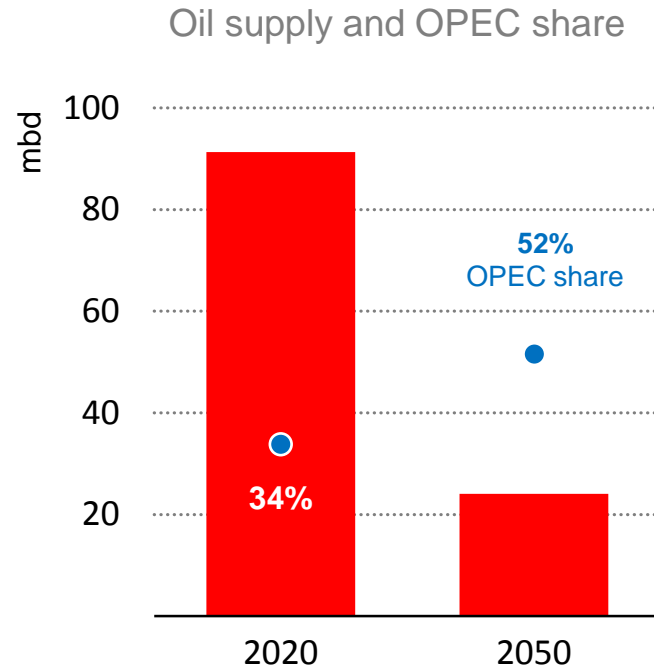
**Figure 2.5** ▶ Total energy supply in the NZE



IEA. All rights reserved.

*Renewables and nuclear power displace most fossil fuel use in the NZE,  
and the share of fossil fuels falls from 80% in 2020 to just over 20% in 2050*

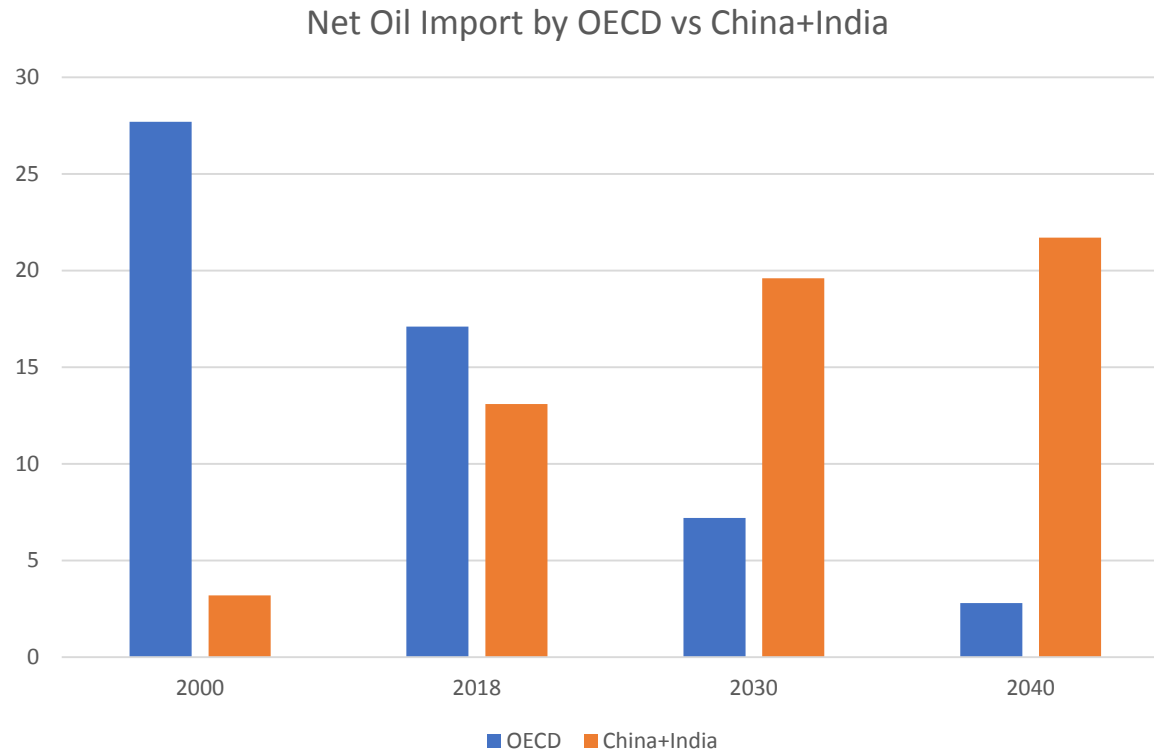
# Address emerging energy security risks now



Electrification will increase from 20% to 50% in 2050

New energy security concerns emerge, and old ones remain; governments need to proactively plan for energy security risks related to market concentration, critical minerals and electricity systems.

**Net oil imports of selected countries in the Stated Policy Scenario (mb/d)  
WEO2019**



***Asia becomes the unrivalled centre of the global oil trade as the region draws in a rising share of the available crude.***

***In 2019 India has officially requested to become a full member to the IEA.***

**China and India must join the IEA.**



# Climate change is NOT Gender Neutral!



2020

# 2021



# Youth ICEF 2021



Innovation for Cool Earth Forum  
8th Annual Meeting



Thetis Georgiou



Natalie Jones



KAWASAKI Rena



Antonina Scheer



Rakhim Rakhimov



Ejeong Baik



OTSUKI Takashi



Odseheg Myagmarjav



Aditi Verma



Shuchi Talati



Brian Bosire



Kari Dahlgren