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The Role of Gases in the Energy Transition: should we consider Europe a special case?

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The role of gases in the European energy transition

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Abstract

The role of gases in the energy transition is a different, and much more immediate, issue in the EU, compared with other global regions. Net zero targets for 2050 mean that in

COP21 AND NET ZERO EMISSION REDUCTION TARGETS: EUROPEAN COMMITMENTS

2020 was `The Year of Net Zero' (carbon neutrality) for many (but certainly not all) countries

- Potential for COVID to accelerate the Energy Transition – but a huge increase in government intervention and finance needed to make this happen
  - EU 2050 carbon neutrality via `Green Deal'; `at least 55% emissions reduction by 2030 (cf 1990)
  - CHINA – 2060 carbon neutrality commitment
  - JAPAN: 2050 carbon neutrality commitment
  - KOREA: 2050 carbon neutrality commitment
- US: Biden commitments to: 2050 carbon neutrality, net zero electricity by 2035
- Other important energy markets: Russia, Brazil, India, Indonesia, have commitments to COP21 but actions??

Governments have made net zero announcements, but must develop detailed roadmaps for energy sector change backed by financing commitments

Why is Europe Different? Political/voter pressure on governments to achieve decarbonisation targets

- European energy policy is obsessed with decarbonisation due to public pressure on governments: `climate emergency', Extinction Rebellion, Greta, etc.

- In many (possibly most) other regions (Eurasia, Asia-Pacific , Latin America, Africa) impression is that other issues – affordability, air quality, security – may be more important than decarbonisation

In some European countries, climate policy may increasingly determine election success

Decarbonisation Pathways: time frames

For Net Zero 2050 targets:

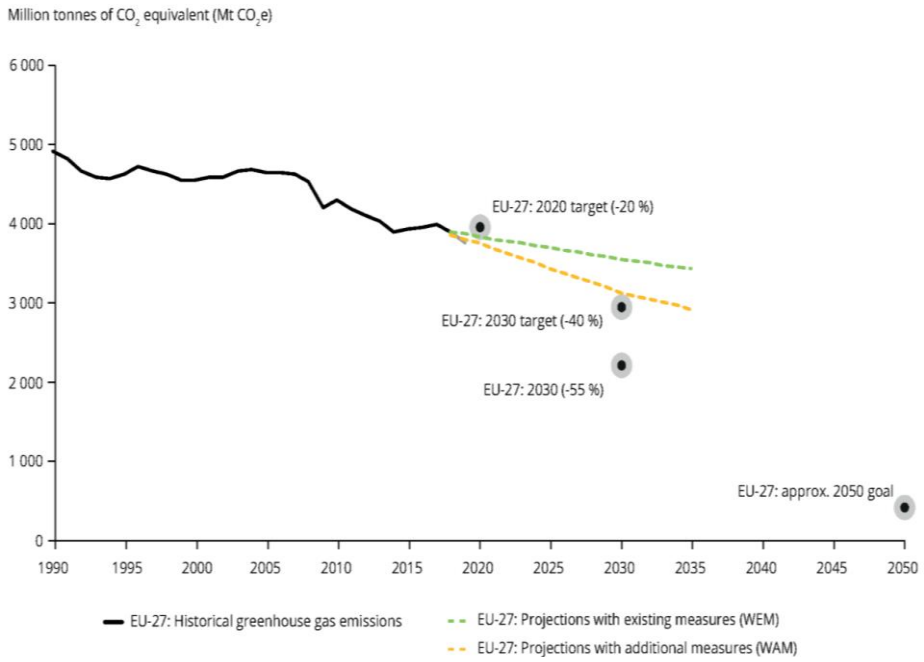
- 2030 a is key date especially for Europe: pathways must be chosen and funded, and technologies must advance significantly
- Modelling can allow `cheating' by assuming much faster progress post-2030 but lead times for developing technologies, and then large scale adoption/roll out, mean this is likely to be unrealistic

COP 21 targets:

- Allow more time to fully decarbonise (around 2070) and develop more advanced technologies eg direct air capture
- Are lower cost because of less urgency to implement policies eg higher carbon taxes

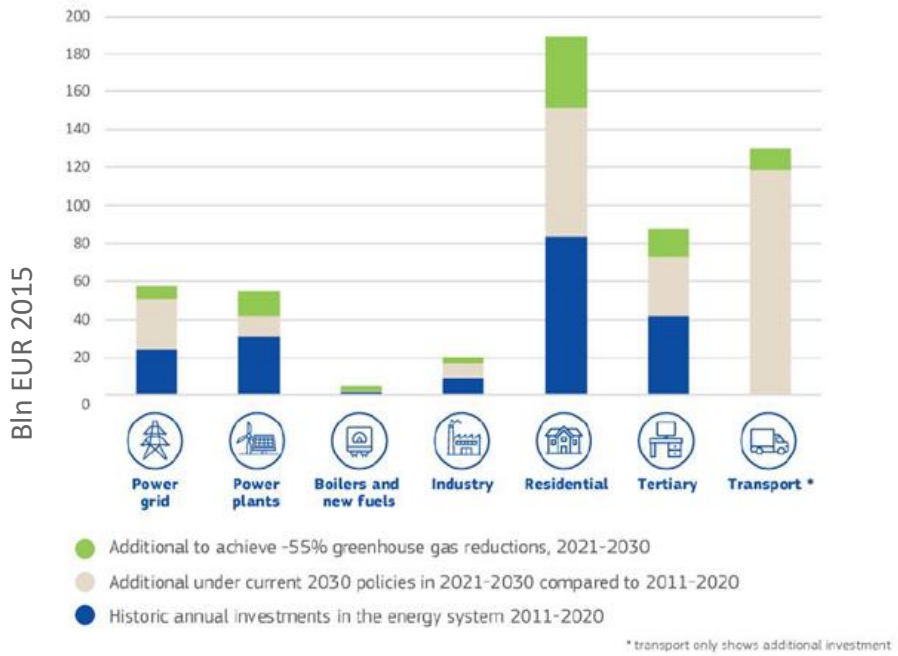
2030 and 2050 Carbon Reduction Targets: Europe is not on track

GHG emission targets & trends in the EU, 1990-2050



Source: European Energy Agency, 18.12.20

Investments 2011-30 under existing policies and to meet -55% GHG emissions reduction by 2030



Source: European Commission COM (2020) 564 final

- The EU (and the UK) are not yet on track towards the 2030 target of reducing emissions by 40% from 1990 levels, let alone -55%
- If this continues – what will be the policy response from governments and voters?

Decarbonisation Pathways: options, and policies

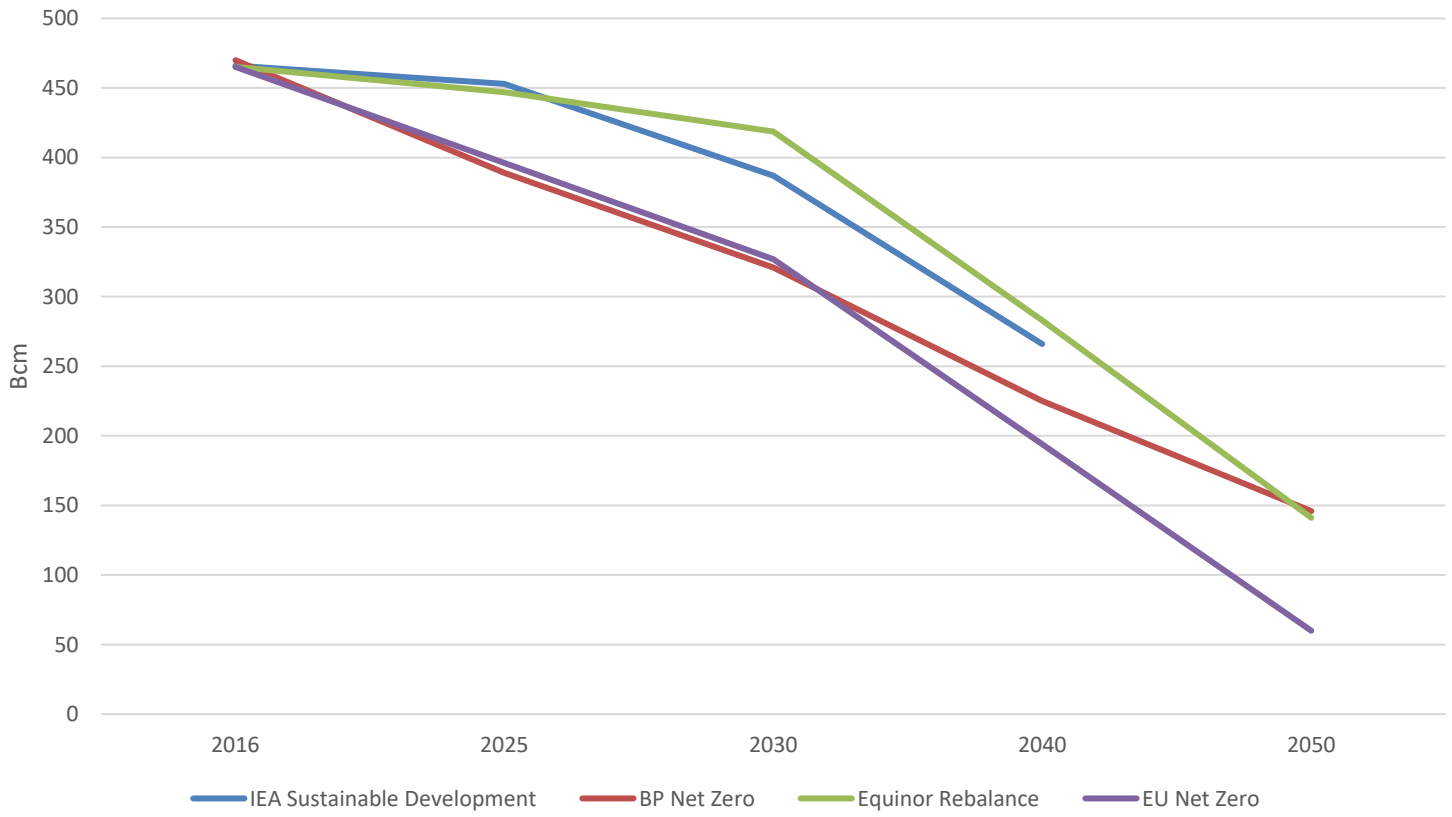
OPTIONS:

- Full electrification versus electricity and gases - most studies see full electrification as a more expensive pathway
- Electrification = only renewables or also nuclear power?
- Efficiency and demand management are key
- Coal (and oil) phase-out are `quick to implement' options

POLICIES – Net Zero by 2050:

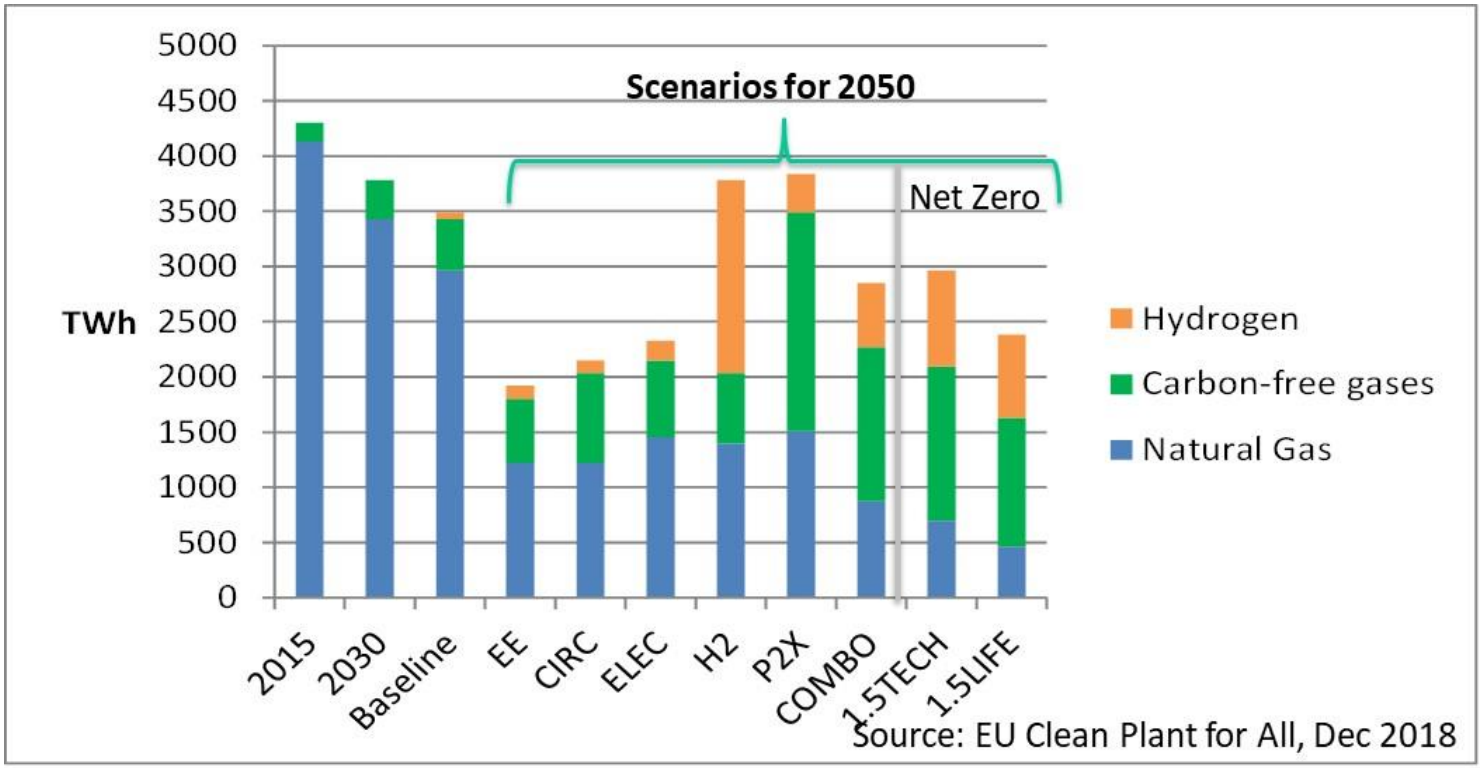
- Technology choices, governments must `pick winners' because `allowing the market to decide' will take too long(?):
  - Large scale hydrogen – from electrolysis or natural gas (possibly coal?) pyrolysis
  - Batteries, Carbon Capture (Utilisation and) Storage,
- Rapid and substantial increases in carbon taxes and prices will be needed

EU Gas Demand to 2050 Under COP21 and Net Zero Scenarios



COP21+ means stable demand up to 2025-2030 then sharp decline; Net Zero means decline of 25-33% by 2030 and accelerating decline

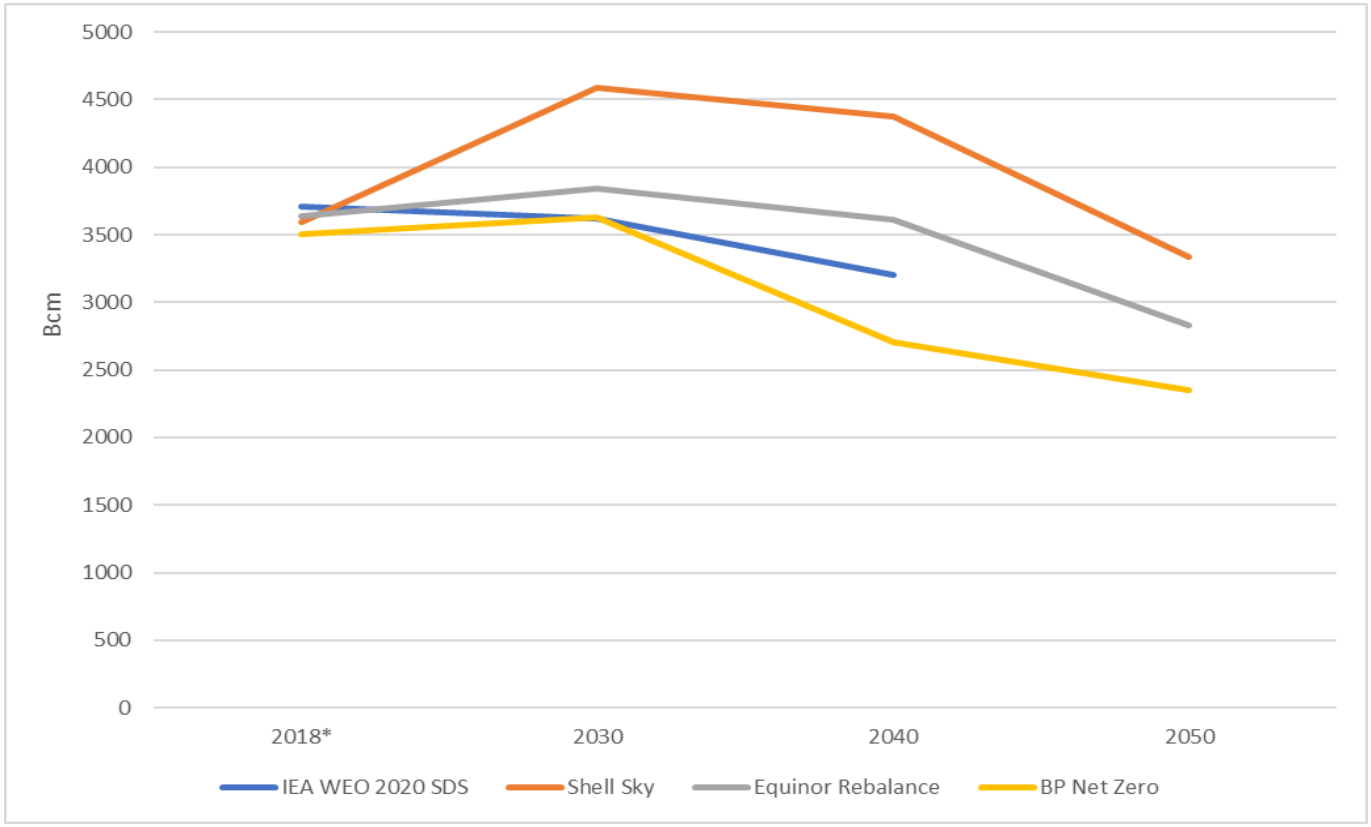
Scenarios show little role for unabated gas by 2050 under a Net Zero target



- Total gaseous fuels in 2050 likely to be half/two thirds of 2019 natural gas demand
- Unabated methane is 50-60 bcm in 2050; biogas/biomethane and hydrogen dominate
- Significant cost and scale-up challenges if these targets are to be achieved

THE IMPACT OF DECARBONISATION ON GAS DEMAND OUTSIDE EUROPE AND GLOBAL GAS/LNG TRADE

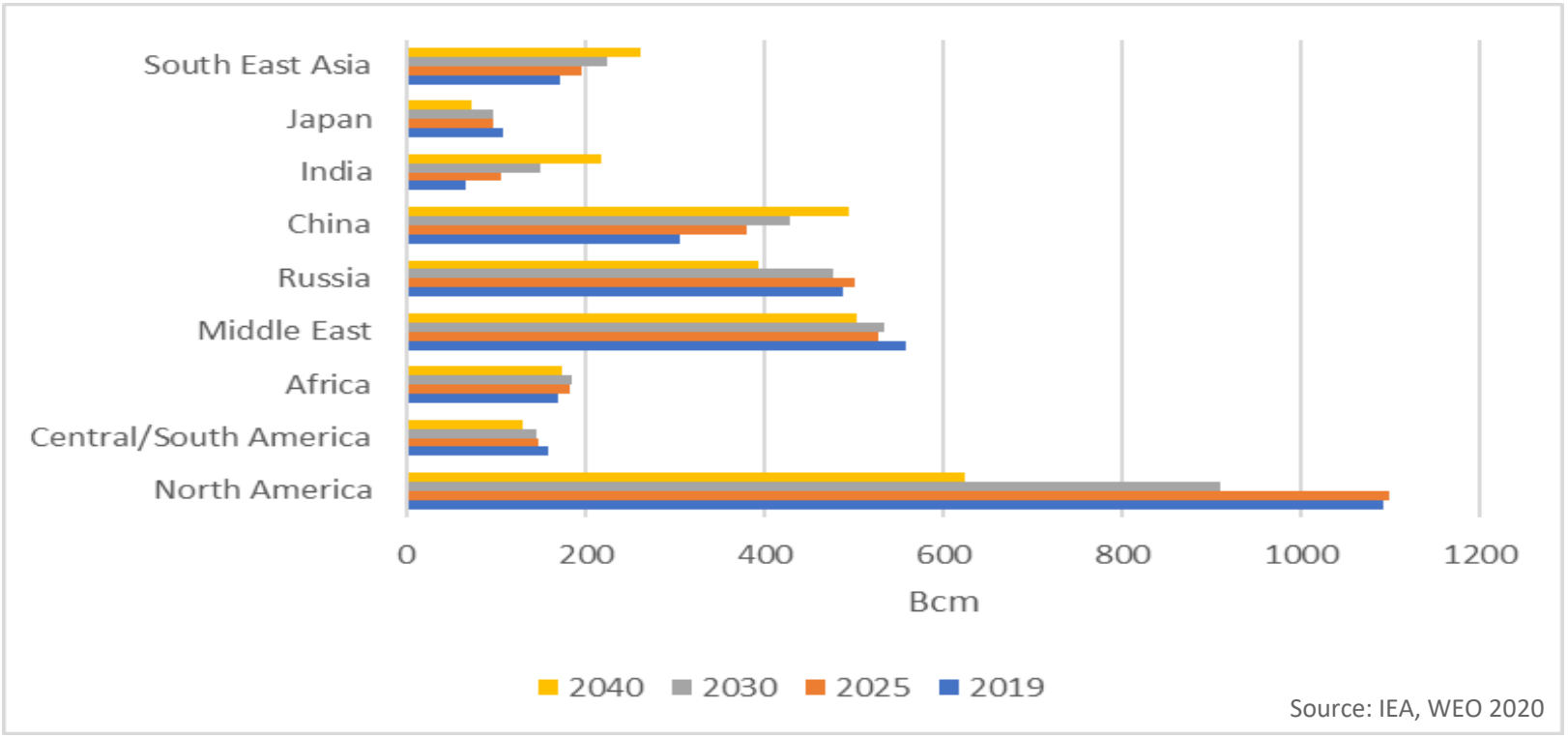
Global Gas Demand Under COP21 and Net Zero Targets



*NOTE: start dates are not identical

Models show global gas demand peaks around 2030 and declines (slower or faster) thereafter

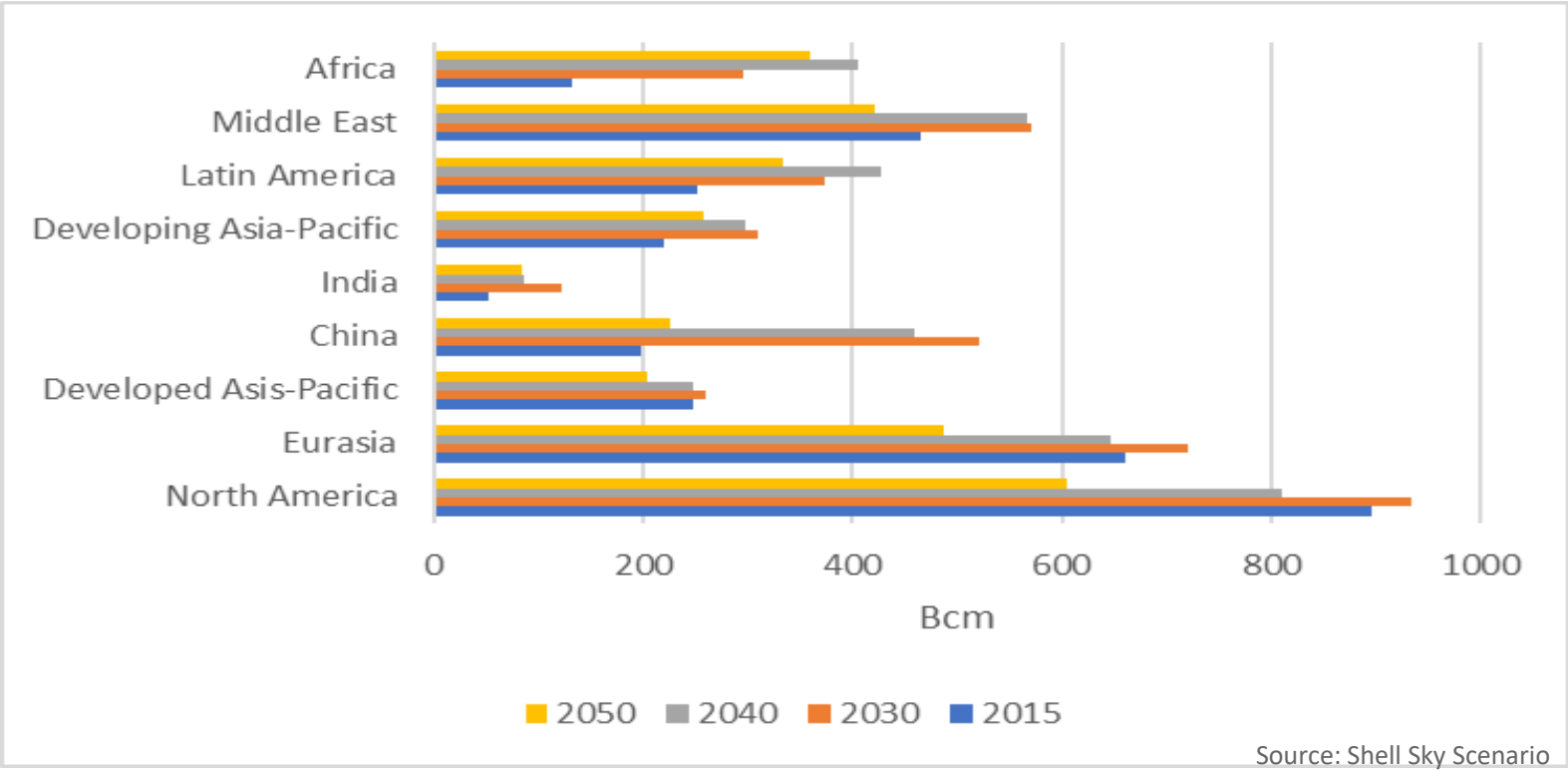
IEA Sustainable Development Scenario for Non-European Gas Demand



Source: IEA, WEO 2020

Note Indian demand over 200 bcm by 2040, Middle East demand steady over 500 Bcm, North America collapses post-2030, Russia maintains at 500bcm (falls to 400 bcm in 2050)

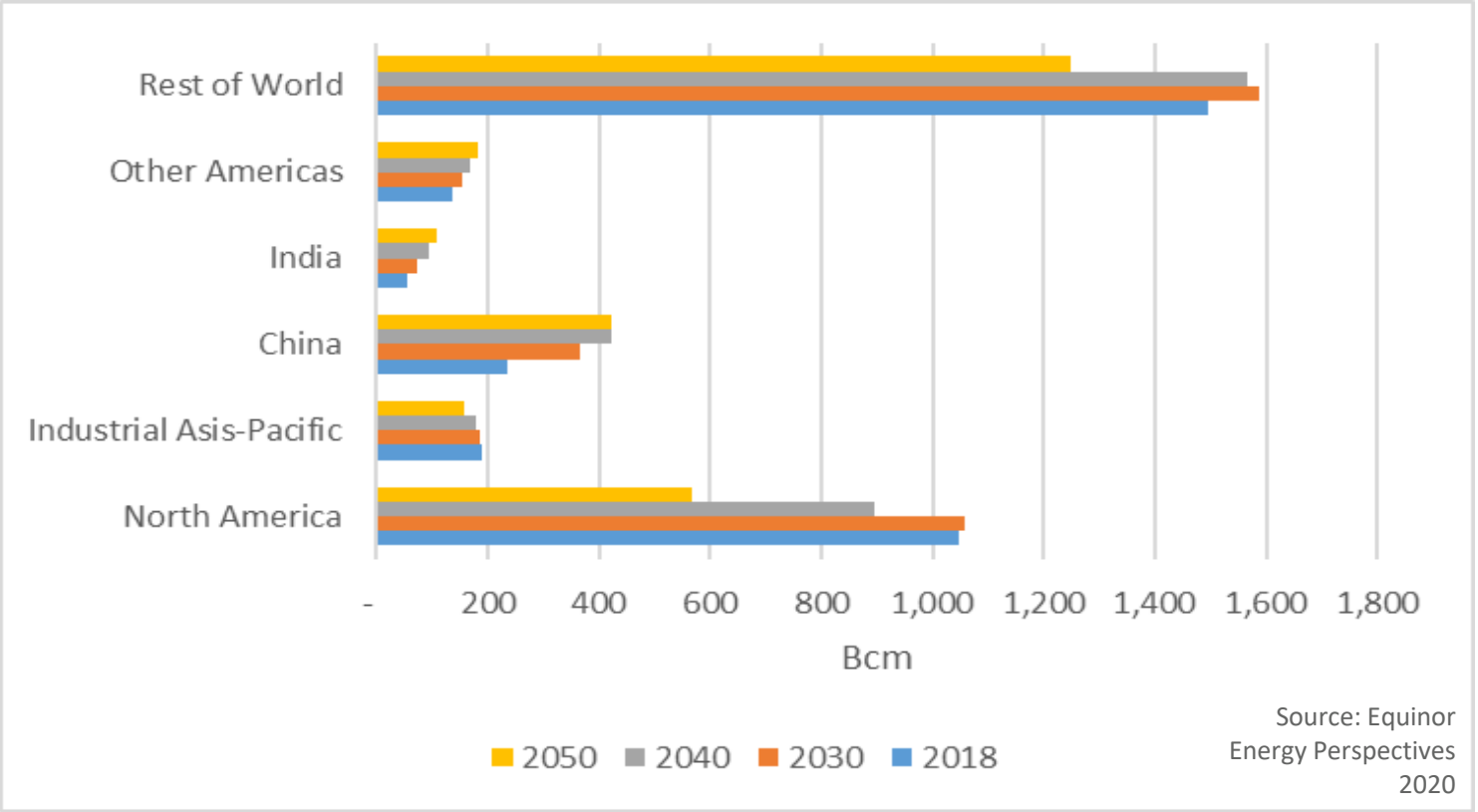
Shell Sky Scenario for non-European Gas Demand



Source: Shell Sky Scenario

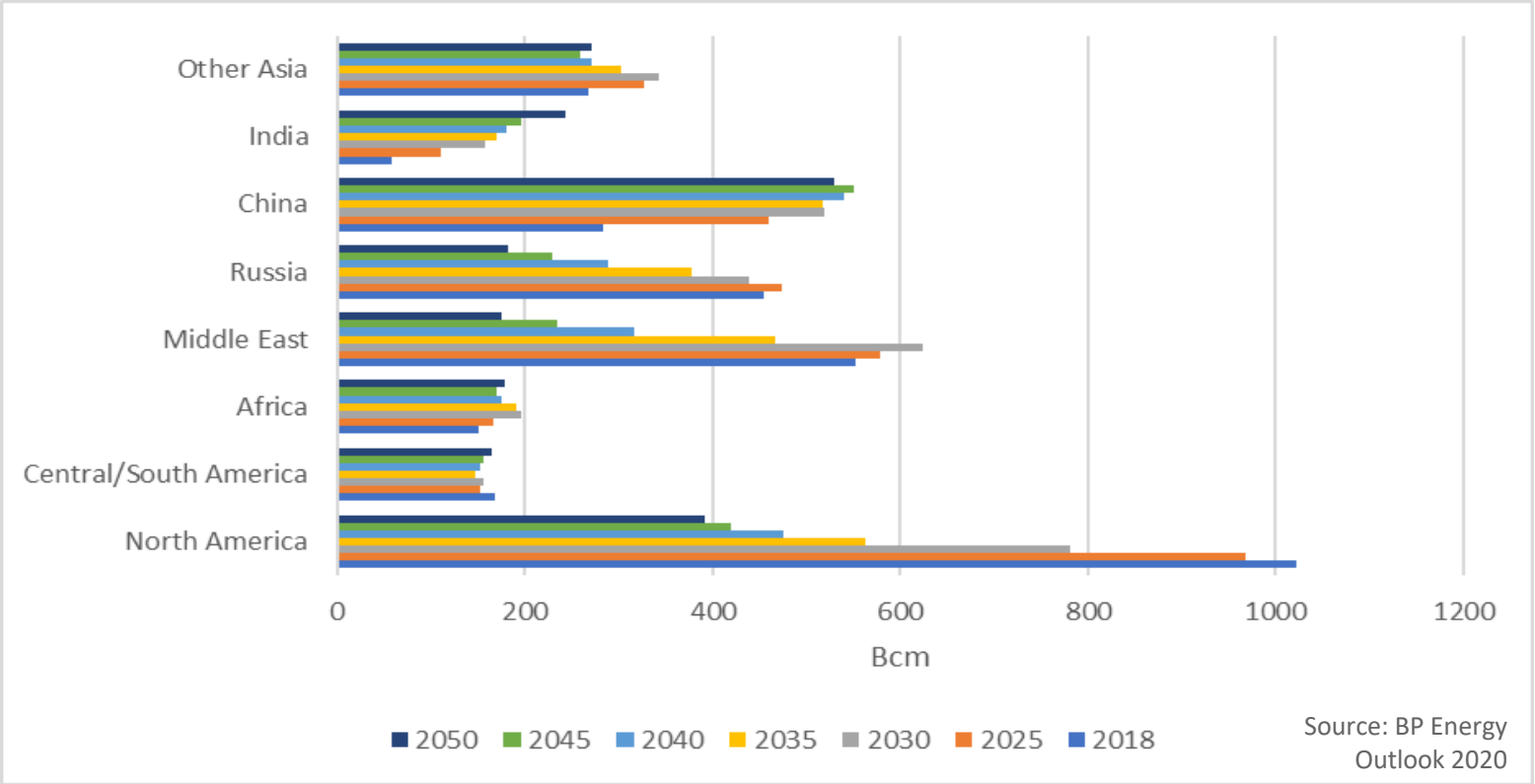
Indian demand barely rises above 100 bcm; Chinese demand collapses post-2040, Middle East over 400 Bcm in 2050; Latin America much higher than other scenarios

Equinor `Rebalance' Scenario for Non-European Gas Demand



China only just exceeds 400 bcm, India only just over 100 bcm in 2050, North American demand collapses post-2040

BP Net Zero Scenario for Non-European Gas Demand



Note Indian demand is 250 bcm by 2050, China steady at >500 Bcm; Middle East below 200 Bcm; North America and Russia much lower by 2040 than in other scenarios

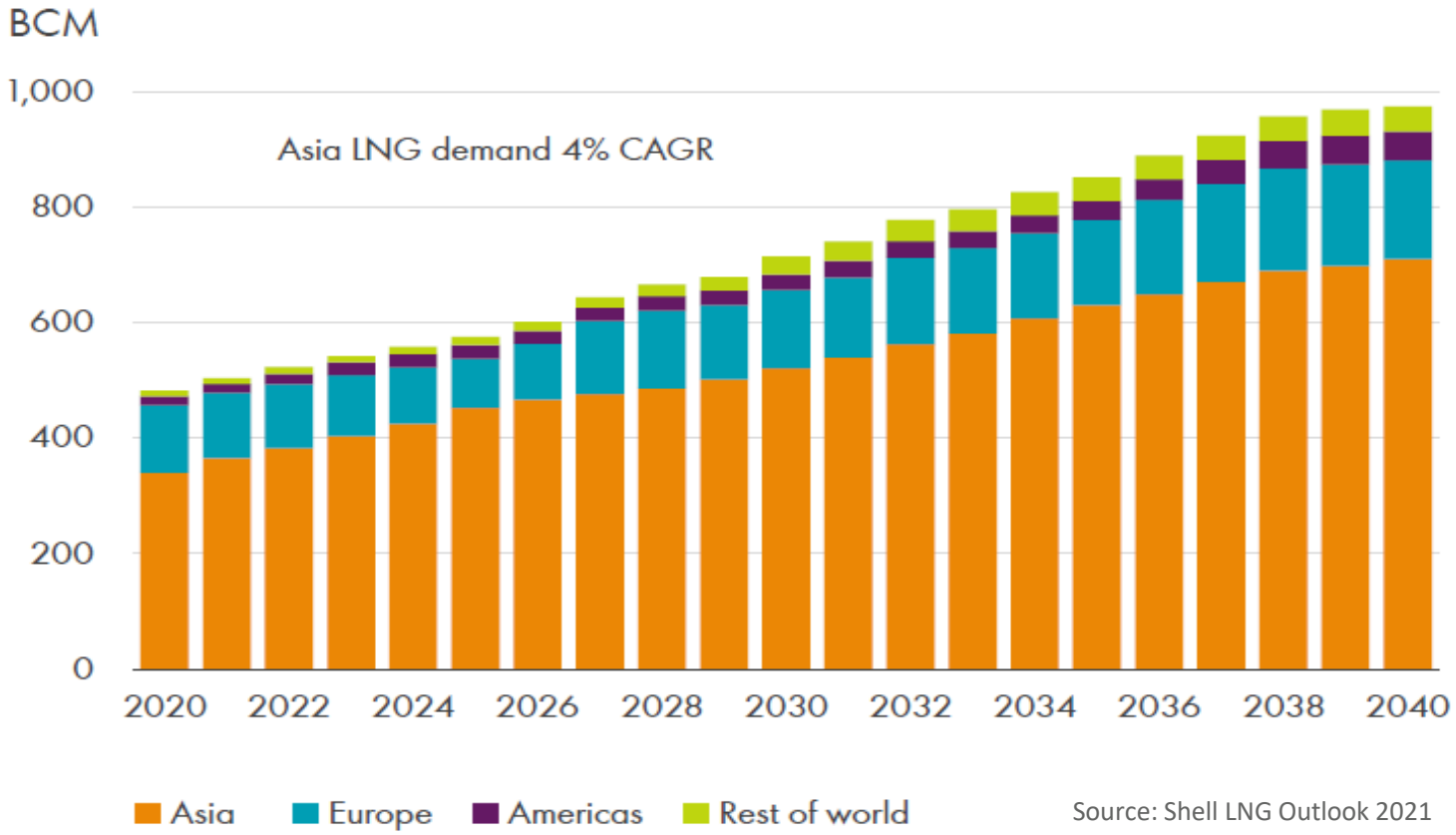
What do the Models Tell us?

- That global models achieve COP21/Net Zero global emission targets:
  - with different demand outcomes for gas
  - with very different impacts on regional gas demand
- That all models suggest a good future for gas up to 2030 and in most regions up to 2040, but divergences for big markets: China, North America, Middle East, Russia significantly impact the global picture
- That all models see Asia – and especially China – as the major growth region at least up to 2040

Regional demand divergencies will have major impacts on pipeline gas and LNG trade

THE IMPACT OF REGIONAL GAS DEMAND OUTCOMES ON GLOBAL GAS AND LNG TRADE

“Business as Usual” (BAU) Projection for LNG Trade to 2040

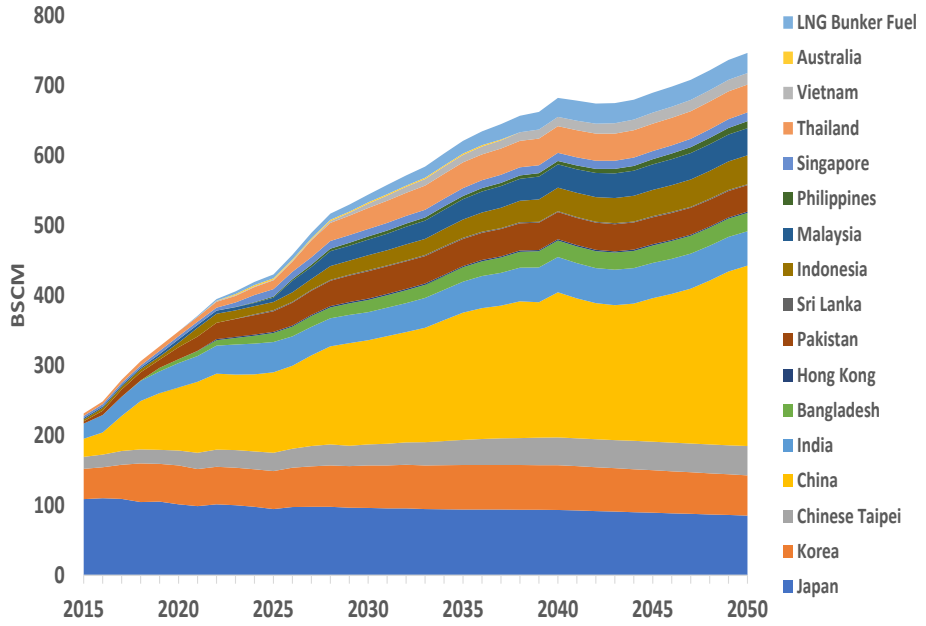


Source: Shell LNG Outlook 2021

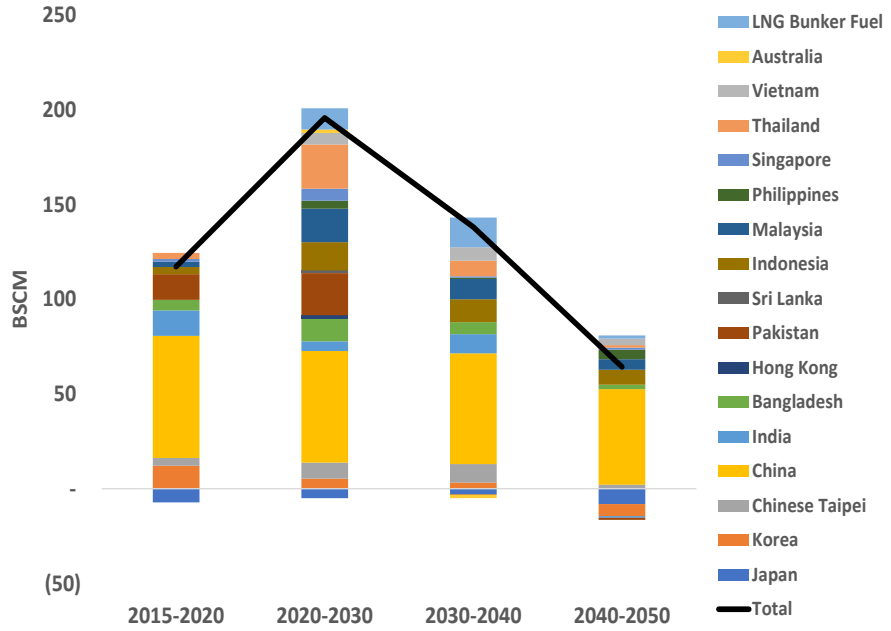
Asian imports are around 70% of global LNG imports and will maintain that position over the next 20 years; major incremental importers – China, India and south/SE Asia.

Asia LNG Import Projections to 2050 (BAU)

Imports by Country



Growth by Decade



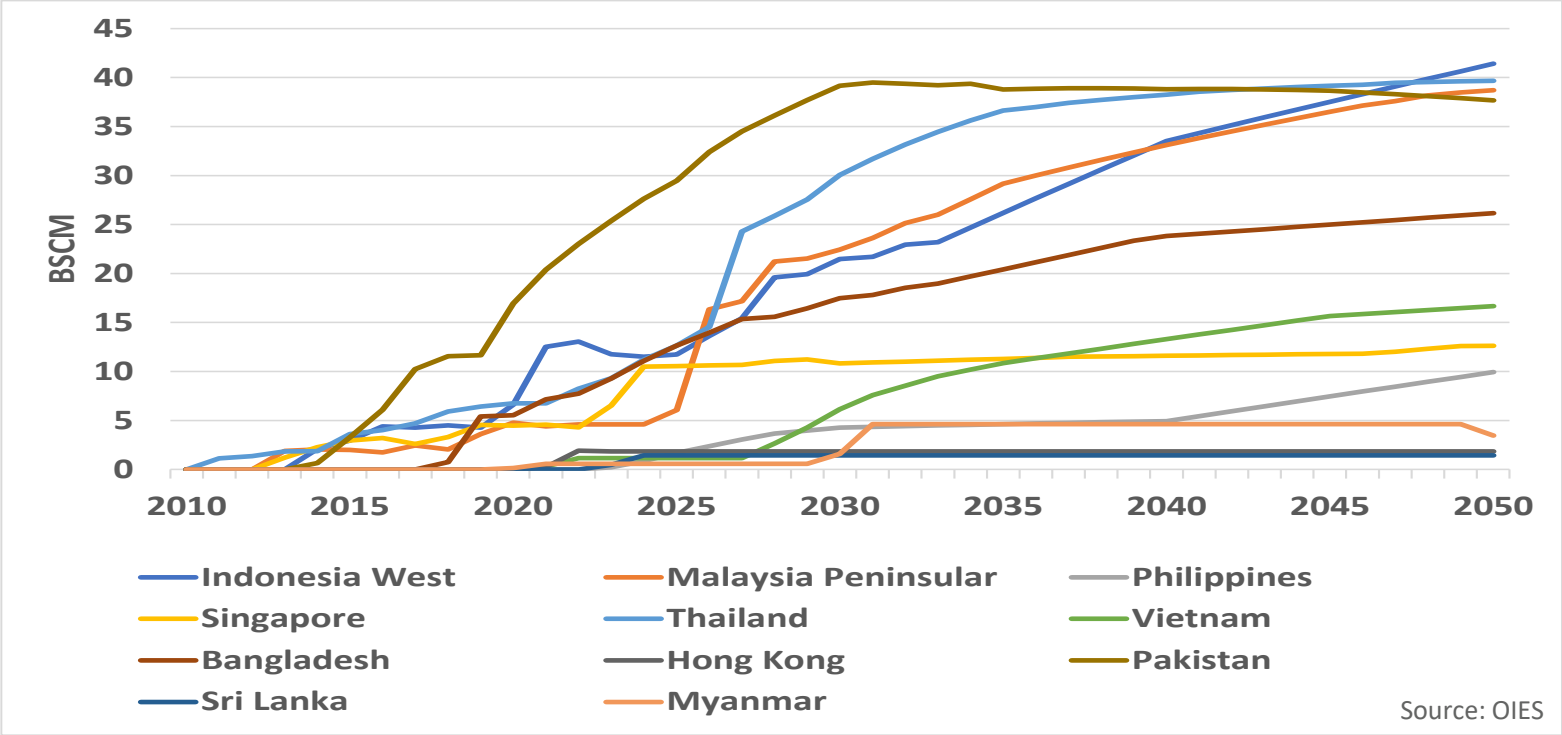
Source: OIES gas model

2020-2030:

- China is single largest contributor to growth overtakes Japan as largest LNG importer; Indian growth but weaker than many expect
- South and south east Asia grow to ~100 bcm/yr

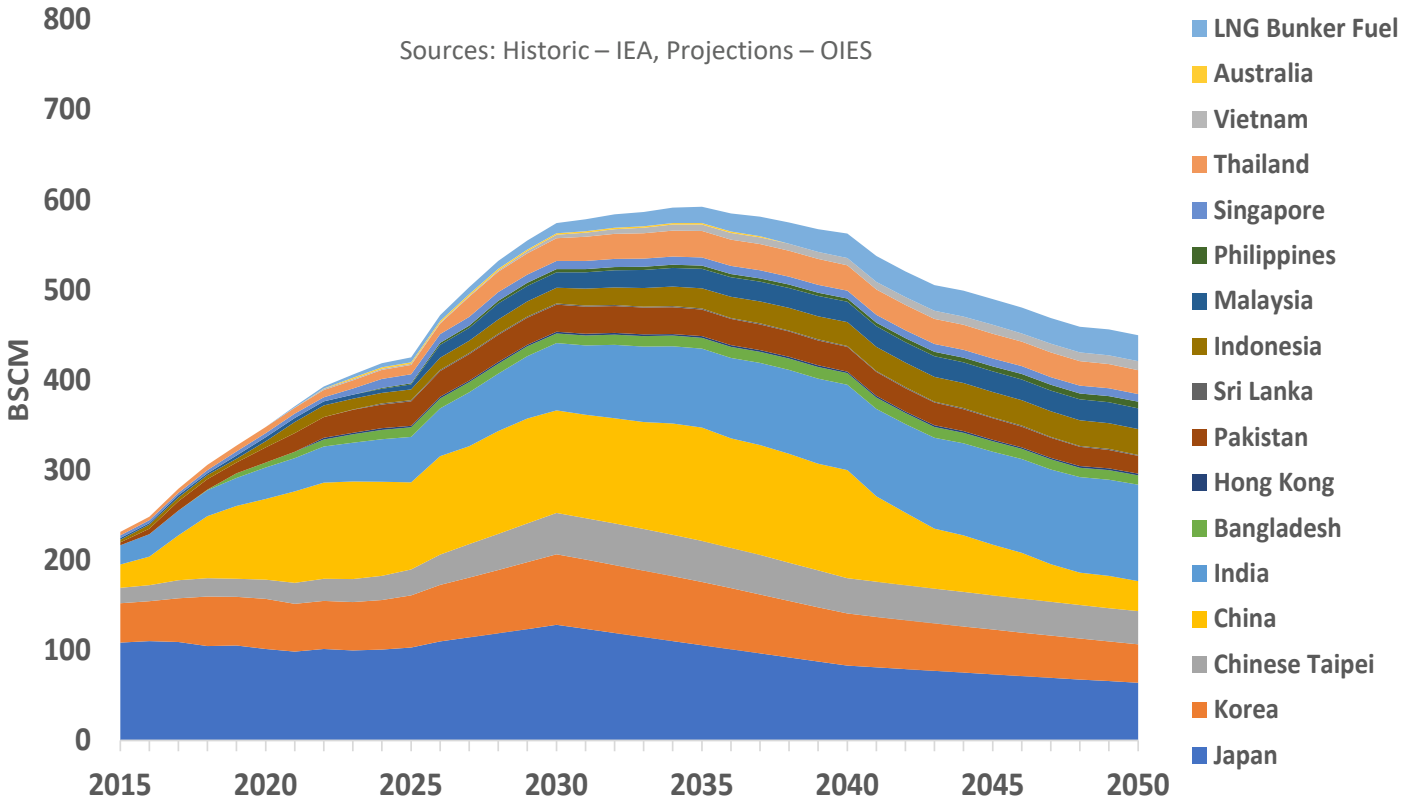
- **2030-2040s: China and South/South East Asia provide most of the growth**
- **2040s: most of the growth is in China**

Emerging Asian LNG Importers (BAU)



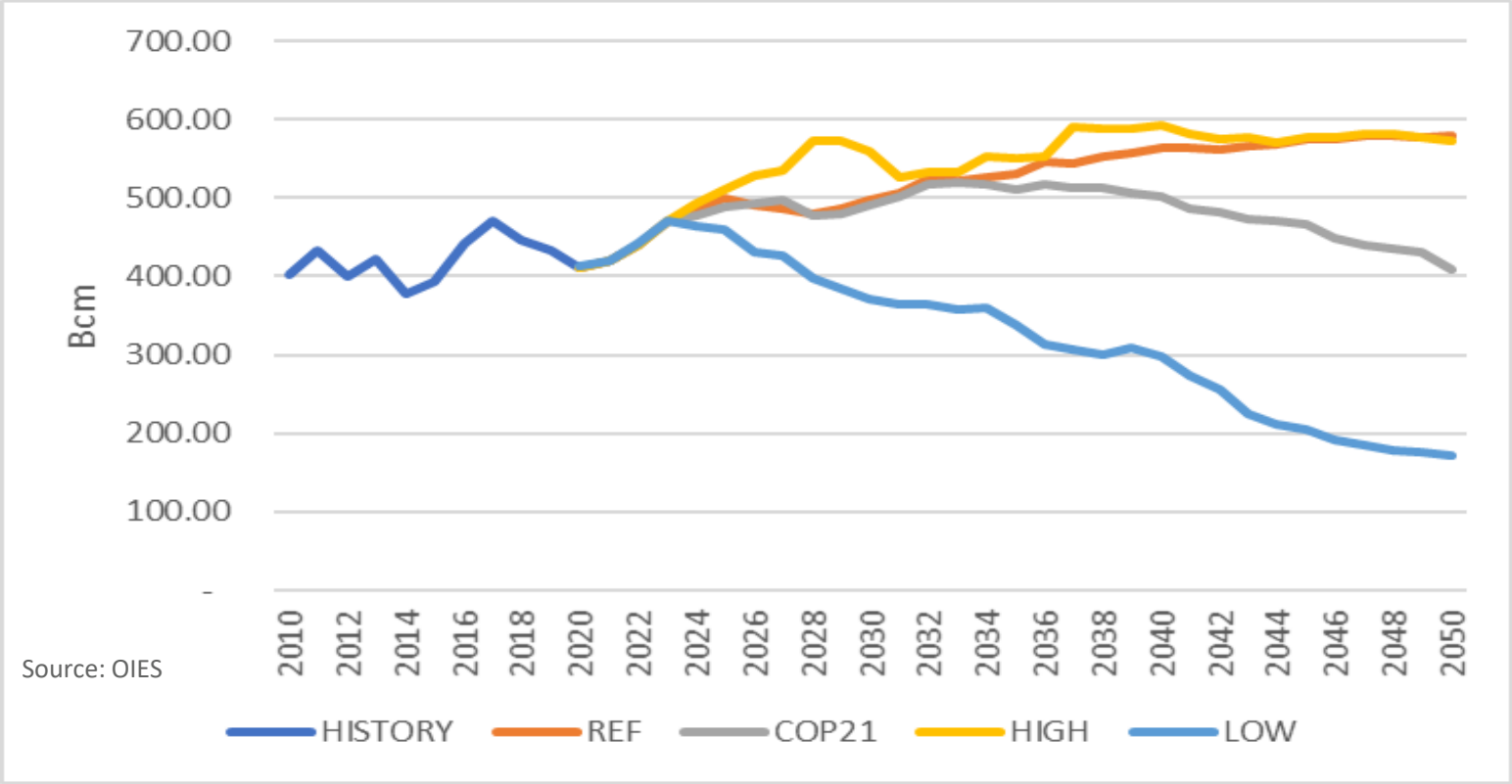
- Up to 200 bcm by 2050
- Sustained growth in Pakistan through 2030
- Singapore and Thailand growth as pipe contracts end
- Malaysia and Indonesia – rising demand, static production

Asia LNG Imports – Decarbonisation (COP 21) Scenario



- **LNG imports peak around 2035 with India and JKT growing more strongly, with gas displacing coal**
- **By 2050, LNG imports are 40% below the BAU case with China falling sharply post-2040**

Global Inter-Regional Pipeline Gas Imports



Source: OIES

- **Relatively narrow range: very few large scale projects are built and operate at full capacity**
- **Europe, China, Pakistan/India are key potential pipeline importers**

Impacts of European Targets on Natural Gas Exporters

- If Europe really does reduce natural gas demand and imports on this schedule then pipeline exporters must consider:
  - supplying natural gas with nature-based offsets
  - supplying hydrogen either via reformed natural gas with CCUS or pyrolysis
- LNG suppliers have options to sell in other markets, but reduced European imports mean a surplus of LNG resulting in lower prices unless…
- LNG is used to develop blue hydrogen with CCS on a large scale

If other countries are to achieve Net Zero by 2050-60 does this mean a similar reduction of gas and LNG?

KEY POLICY, REGULATORY, ECONOMIC AND TECHNOLOGY ASSUMPTIONS WHICH WILL DETERMINE OUTCOMES FOR GAS(ES)

Key assumptions for natural gas and LNG in the energy transition:

- Regulation of methane emissions especially in relation to:
  - EU `Methane Strategy'
  - LNG trade (carbon neutral cargos)
  - Coal to gas switching
- Renewable gas availability and cost especially:
  - Biomethane
  - Development of hydrogen with carbon capture and storage
- Affordability of pipeline gas and LNG imports
- Carbon pricing

Elements of the EU Methane Strategy (2020)

- The Strategy covers energy, agriculture and waste
- Energy: all sources – oil, fossil gas, coal, pipeline gas, LNG, storage
- Biogas must be based on waste/residues, not food or feed crops
- Make Tier 3 the `benchmark standard'– satellite data sharing (using Copernicus) can identify and eliminate super-emitters
- Voluntary initiatives: Oil and Gas Methane Partnership (OGMP) is the best existing framework – extend through the value chain
- Create a global Methane Observatory to establishment an `independent and qualified international methane emissions mechanism' (UNEP based on OGMP principles) within the CCAC
- Legislation will require: obligations to report, repair (LDAR improvement), transparency of methodology and data; `routine' venting and flaring to be banned by 2025, transportation and coal mines to be addressed later
- Proposes a coalition of importing countries (China, Japan, South Korea) to `coordinate energy sector methane emissions'

Likely timeline: publication of draft legislation end-2021, agreement by Council end 2022, transposed into national legislation 2024-25

The EU Methane Strategy: persuasion versus compulsion

EXPORTERS:

Persuasion: “The EU will lead a diplomatic outreach campaign to fossil fuel producer countries and companies… technical assistance..”

Compulsion: “the Commission will propose to use a default value for volumes that do not have adequate MRV systems in place..[it] will be applied where necessary until a compulsory MRV framework for all energy-related methane emissions..is implemented…In the absence of significant [MRV] commitments from international partners, the Commission will consider proposing legislation on targets, standards or other incentives for fossil energy consumed and imported in the EU.”

Persuasion is likely to work better (and faster!) than compulsion; compulsion means there is potential for years to be spent on extra-territoriality/WTO discrimination legal arguments

Approaches to Decarbonising LNG: `Carbon-Neutral' Cargos 2019-21*

- Shell – 8/9 cargos to Asia (China, South Korea, India, Taiwan)
- Jera – 1 cargo to India
- Total – 1 cargo to China**
- Vitol offering C-N cargos, Mitsui to Hokkaido Gas, Japanese Carbon Neutral LNG Buyers' Alliance***
- Gazprom (from Novatek) to Shell – 1st European cargo
- RWE to Posco (South Korea) – 1 cargo
- Mitsubishi – 1 cargo Toho gas

*The Shell and Total cargoes offset emissions from extraction to regasification; the Jera cargo only offset emissions from the regas terminal downstream **part forest/part wind power offset ***15 companies formed by Tokyo Gas

HOW TO DEFINE CARBON-NEUTRAL:

- **are cargos carbon-neutral or GHG-neutral?**
- **details of: measurement methodologies, emissions per cargo, volume/value of offsets, verification of data**

Are offsets realistic on a large scale for LNG contracts?

LNG Cargos with a Defined GHG Content

PAVILION TENDER – starting 2023:

- Not `carbon neutral' but defined GHG content from wellhead to delivery point
- First contract won by Qatar Petroleum Trading 1.8mt/year for 10
- Second contract with Chevron 0.5mt/year for six years
- Standardised measurement and verification methodology to be published

To be credible, LNG will need detailed and transparent measurement, reporting and (independent) verification of GHG emissions for each cargo

Can Switching from Coal to Natural Gas and LNG Substantially Reduce GHG Emissions?

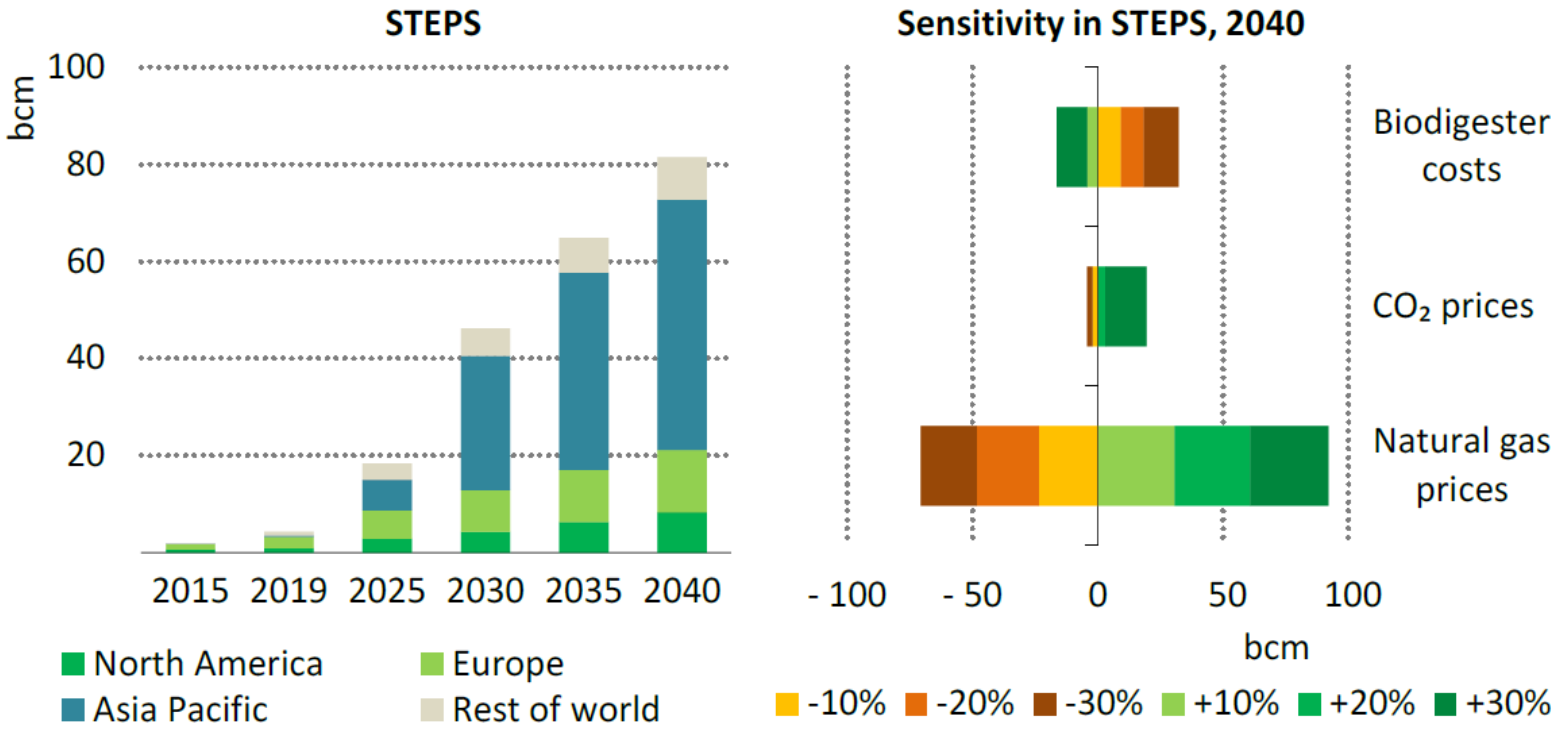
- Combustion of natural gas emits 45% less CO2 than coal and 25% less CO2 than oil, BUT..adding methane emissions (to gas and coal) will impact these figures. Taking methane emissions into account on average:
  - coal-to-gas switching reduces emissions by 50% when producing electricity and by 33% when providing heat for industry/buildings;
  - electricity produced from gas that has been transported as LNG results on average in 45% lower GHG emissions than coal.

But `average' is not sufficient, what importers need to know is:

- What is the GHG content of the coal (or oil) that they are currently using compared with..
- the GHG content of the natural gas or LNG imports which will be replacing the coal (or oil)

Very important for coal/gas switching in Asia

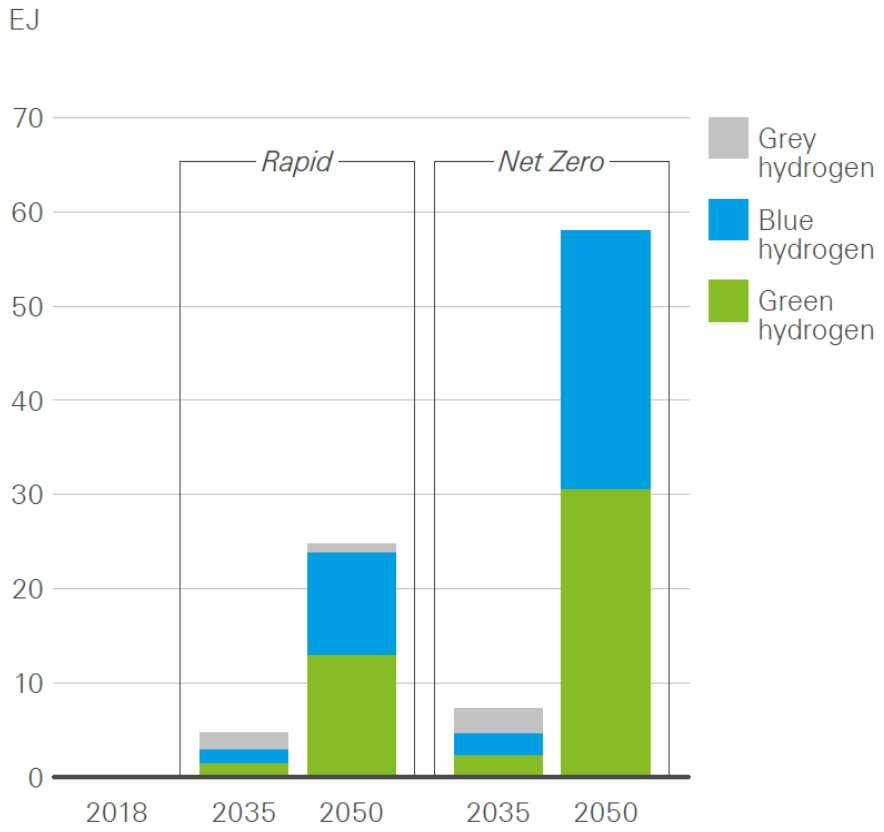
Biomethane Production by Region and Sensitivity of Cost-Competitive Volumes

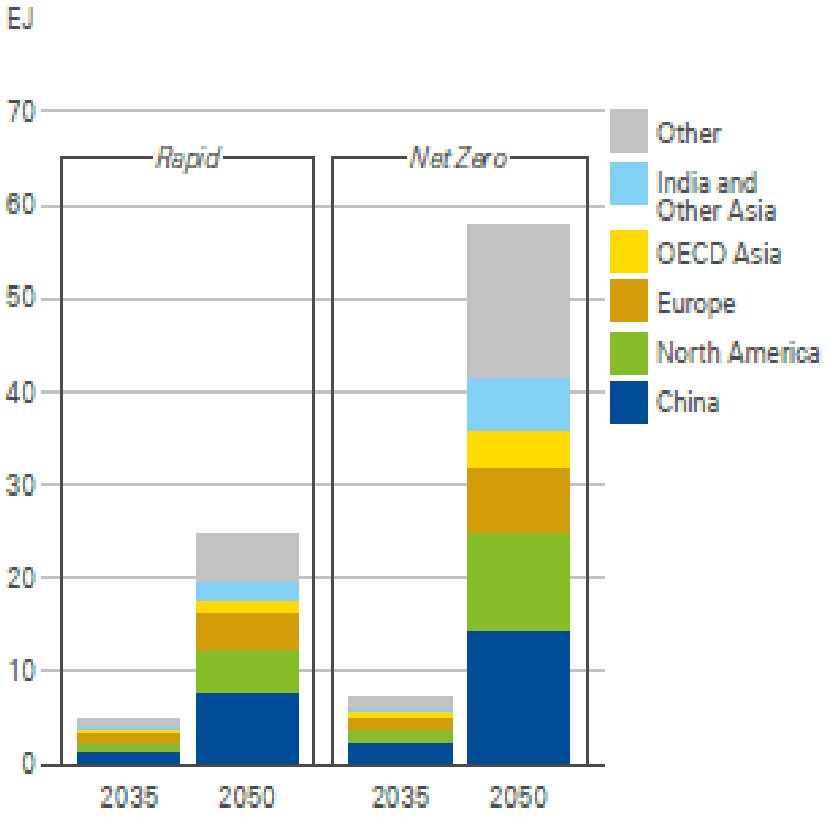


Source: WEO 2020, figure 7.2, p.288

Not large enough to make a material difference but could be significant in some countries eg India

Global Hydrogen Development by Region and Source to 2050

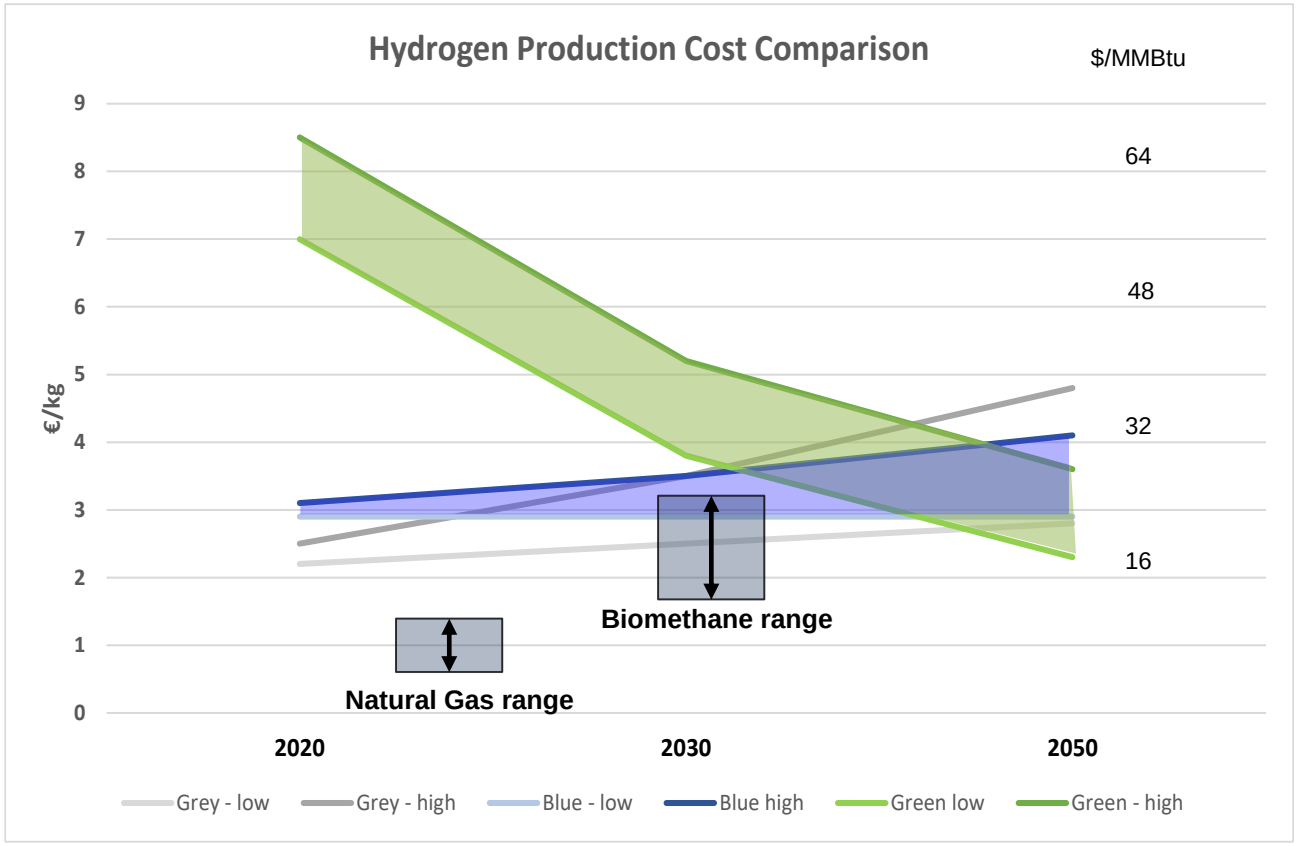




Source: BP Energy Outlook 2020, pp 103-4

- **Major hydrogen markets: China, North America, Europe and Asia**
- **Net Zero 2050 `blue' hydrogen still nearly 50% of total**

Green and Blue hydrogen costs expected to converge



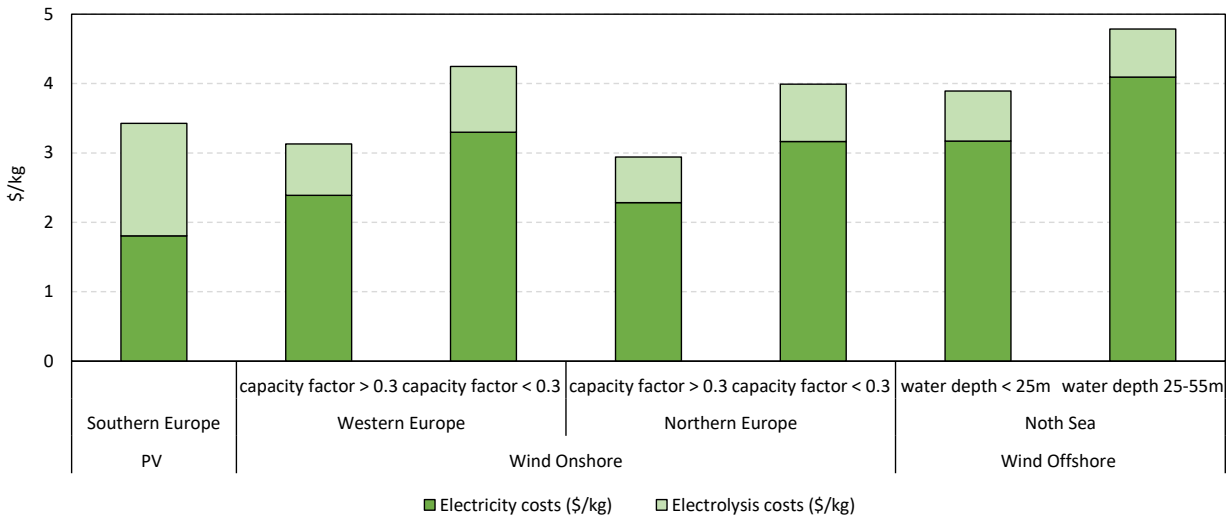
Source: OIES analysis, Zero Emissions Platform Nov 2019, includes assumed carbon price

- Green hydrogen currently small scale and high cost
- Blue hydrogen relatively small premium over Grey

"Grey" = SMR without CCS
"Blue" = SMR with CCS
"Green" = Electrolysis from renewable energy

1 EUR/kg =~25 EUR/MWh
= ~ 8$/MMBtu

Green hydrogen production costs dominated by cost of electricity – 75 to 125 EUR/MWh in 2030



LCOH for Green Hydrogen Production in 2030

($3/kg =~ 75 EUR / MWh)

Source: Brändle et al, 2020

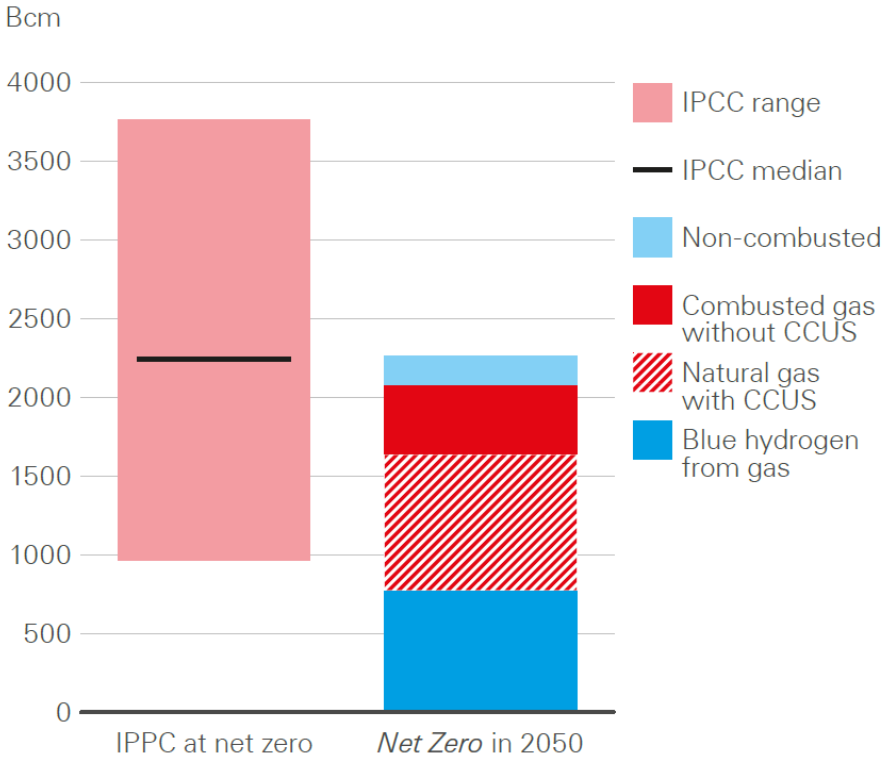
- Significant fall in electricity prices needed: cheaper electrolysers will also help
- Little merit in using grid electricity to produce hydrogen until average CO2 emissions fall substantially
- Only Germany has significant negative day ahead electricity prices

Source: Martin Lambert (OIES)

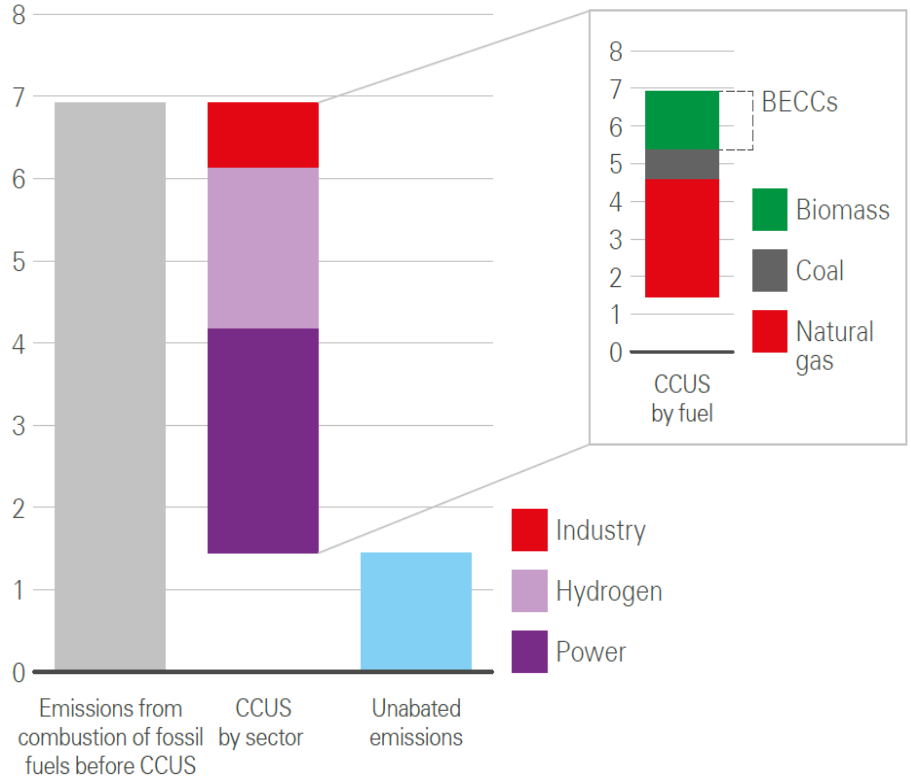
	DE	ES	FR	IT	NL	UK
Average CO_2 emission factor in electricity mix in 2019 (g CO_2e/kWh)	338	207	52	233	390	228
Average electricity wholesale price 2019 (day-ahead) (euro/MWh)	37.7	47.7	39.4	41.2	51.2	48.9
Number of occurrences of negative day-ahead prices in 2019	211	0	27	0	3	1

The Role and Importance of CCUS

Natural gas Demand in IPCC Scenarios and BP Net Zero



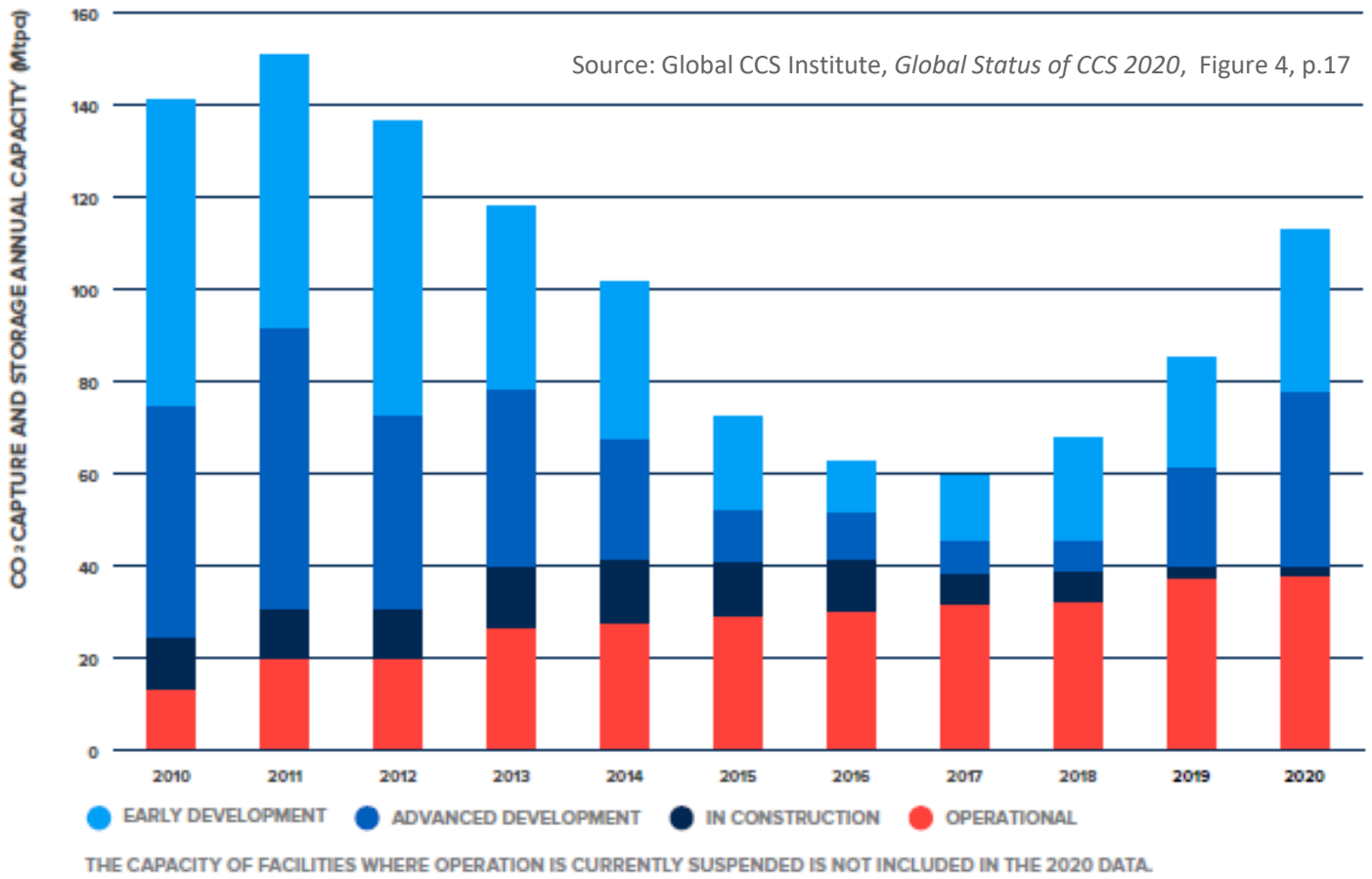
CCUS by Sector and Fuel Type in BP Net Zero Scenario 2050 (Gt)



Source: BP Energy Outlook 2020, p.127 and 131

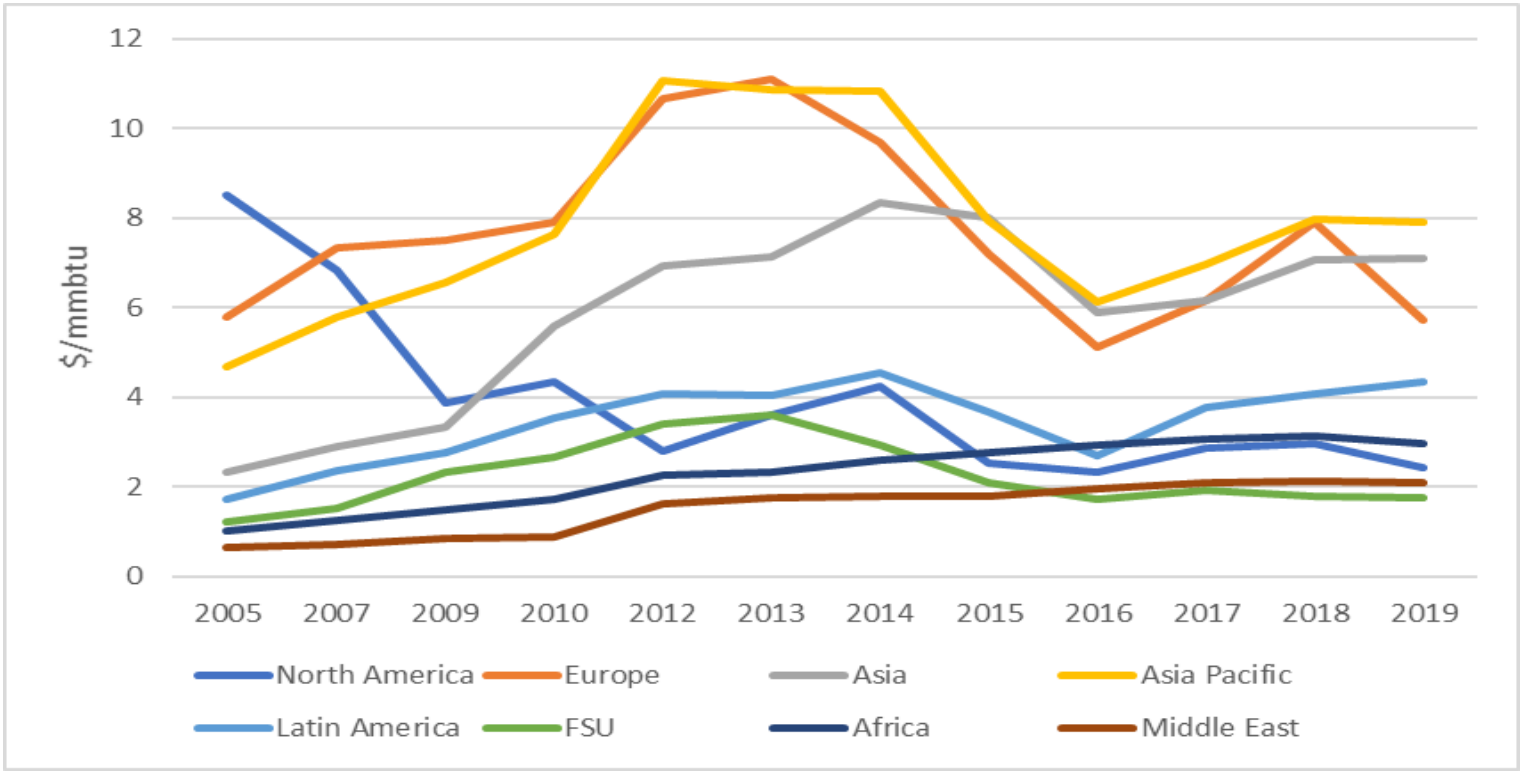
BP Net Zero requires around three quarters of natural gas to be used with CCUS which means 5.5Gt CO2

Commercial CCS Facilities Worldwide 2010-20



Capacity of operational CCS facilities is <40mt; all capacity under construction and development is <120mt

Wholesale Gas Prices in Different Regions 2005-19

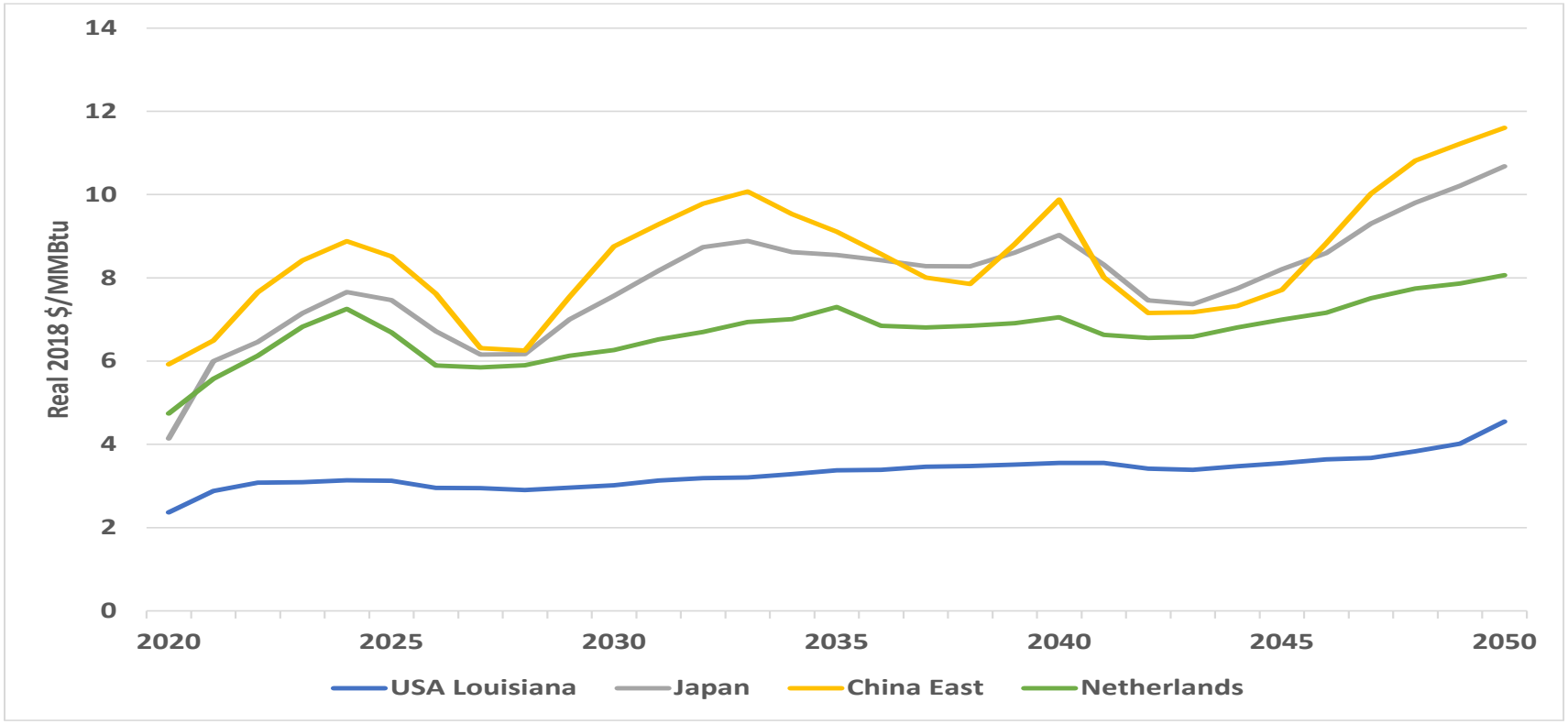


Source: International Gas Union, *Wholesale Gas Price Survey 2020 Edition,* Figure 31, p.37

Two groups: Europe+Asia (post-2009) paid $6-11/MMbtu; Latin America, Africa, Middle East paid less than $4/MMbtu, but country granularity is essential

Note: $1/MMbtu = €2.9/MWh

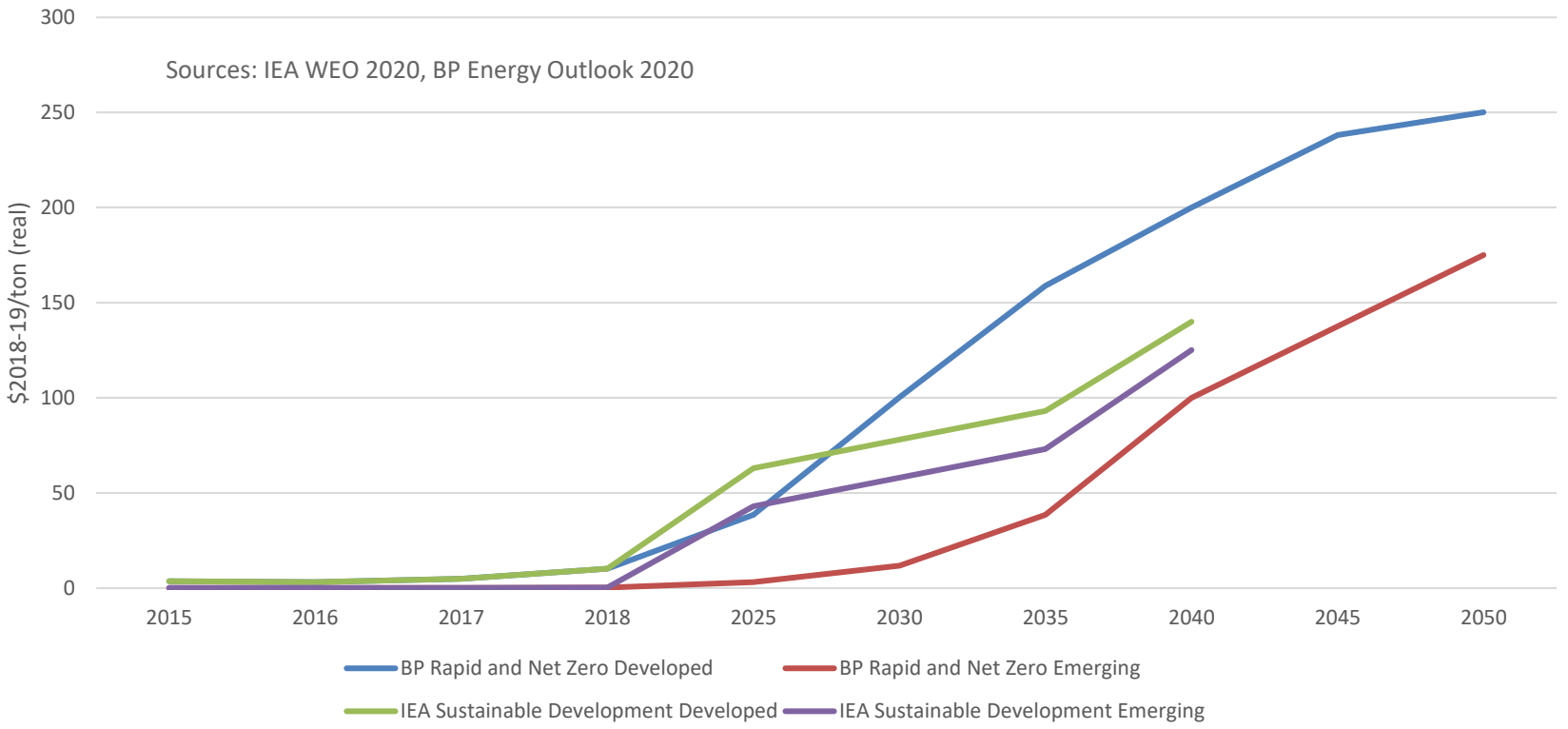
Longer Term Spot Gas Prices to 2050: a signal for affordability and profitability of projects in Asia



Sources: Historic – Argus Media; Projections – OIES

- **In the 2020s, price waves of $6-8 Japan and $6-9 in China should work for both LNG affordability and profitability**
- **Henry Hub must be at $3 or less for profitable US LNG exports**
- **In the 2030s, Asia at $8-10 may be too high if European LNG is declining; threatens blue hydrogen/CCS development**

IEA and BP Carbon Price Assumptions (COP21 targets) Developed and Developing Countries, 2025, 2040, 2050



Carbon price requirements in developed countries (real 2018/19):
2025 - $40-63/t; 2030 - $78-100/t; 2040 - $140-200/t
Lack of sufficient carbon prices globally results in a carbon border adjustment mechanism in the European Union

SUMMARY AND CONCLUSIONS

What will COP21/Net Zero targets mean for gas(es)?

- Aside from renewables and efficiency, which all countries will pursue, governments need to decide very soon on options and policies which can be sufficiently advanced by 2030 to achieve their 2050 targets:
  - Coal (and oil) to gas/LNG switching
  - Nuclear development – maintaining existing and/or new reactors
  - Hydrogen – green, blue/CCS, pyrolysis – and ammonia
  - Carbon prices and taxes at $50-200/tonne
  - Sectoral targets (power, industry, transport); behavioural targets
- Global Gas and LNG demand looks robust up to 2030, post-2030 targets will require decline – different in each country SO…
- the gas and LNG companies must demonstrate serious efforts to decarbonise backed by transparent data which will depend on cooperation through the value chain especially with LNG suppliers
- Gas/LNG use will become concentrated in `hard to abate' sectors which means: industry, residential/ commercial and maybe (heavy trucks/marine) transport
- Carbon pricing/taxation will be increasingly important for gas/LNG

The Future Role of Gases in the Energy Transition: should we consider Europe a special case?

- European governments – and especially the major European gas markets (UK, Germany, France, Italy, Netherlands, Spain) – have the most aggressive commitments
- European gas demand in Europe may decline in the 2020s, but imports will not decline (and may increase); post-2030 demand decline will be steep (but gas-based hydrogen may increase)

Post-2030 global natural gas demand must fall if targets are met BUT in:

- North America: potentially the most similar to Europe especially Canada and some US states: peak late 2020s/early 2030s
- South/South East Asia, China, India: gas demand could continue to grow significantly and peak later, probably in the 2040s
- Middle East similar to Asia: slower demand increase, slower decline
- Russia and CIS: little demand increase but slow decline

Europe is a special case and if it meets targets – the role of gas(es) could be a model for other regions

Thank you

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