

# Introduction to strategic decision-making in energy companies

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# Outline of the course

## **Overall objective – understand how senior management use economic models to make investment decisions**

1. Oil and gas company decision-making during the energy transition
2. Introduction to financial modelling as a management tool
  1. Understanding some key concepts
3. Building the asset – estimating costs
4. Generating revenues – production and prices
5. Operating costs – running the plant and paying the government
6. Calculating a discounted cashflow
  1. Why is it important
  2. How is it used to make decisions
7. Testing the investment decisions: running some numbers under different assumptions
8. Answering your questions



# Assessment

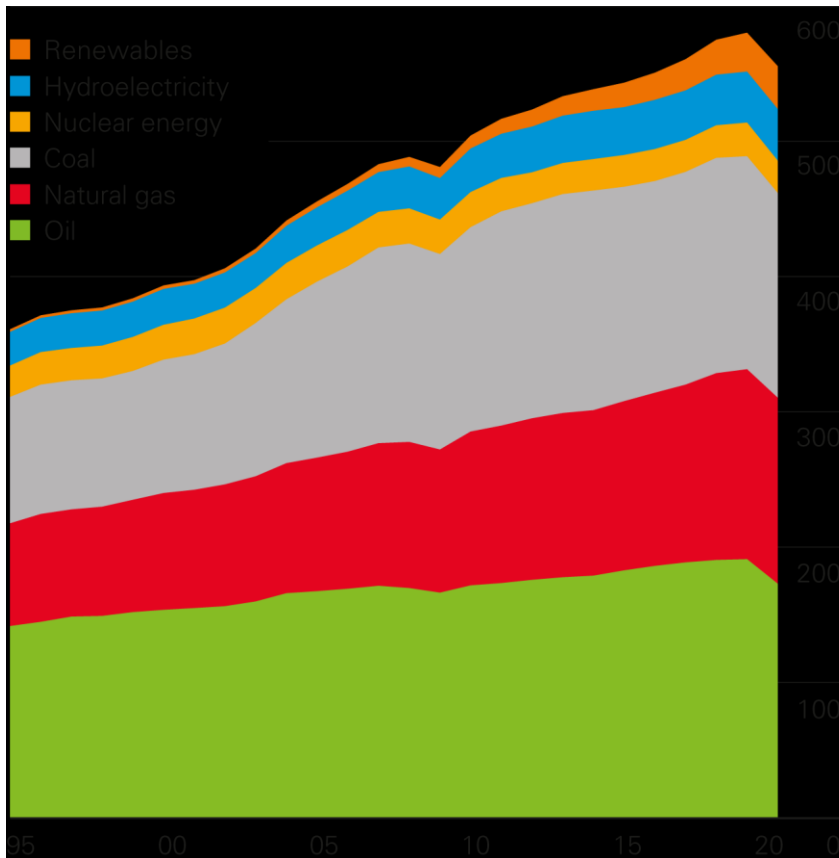
**Overall objective – demonstrate understanding of cashflow models and output**

1. Create a simple cashflow model, given set assumptions
2. Generate NPV and other results
3. Provide an analysis of simple scenarios
4. Write up results in short review (one page)

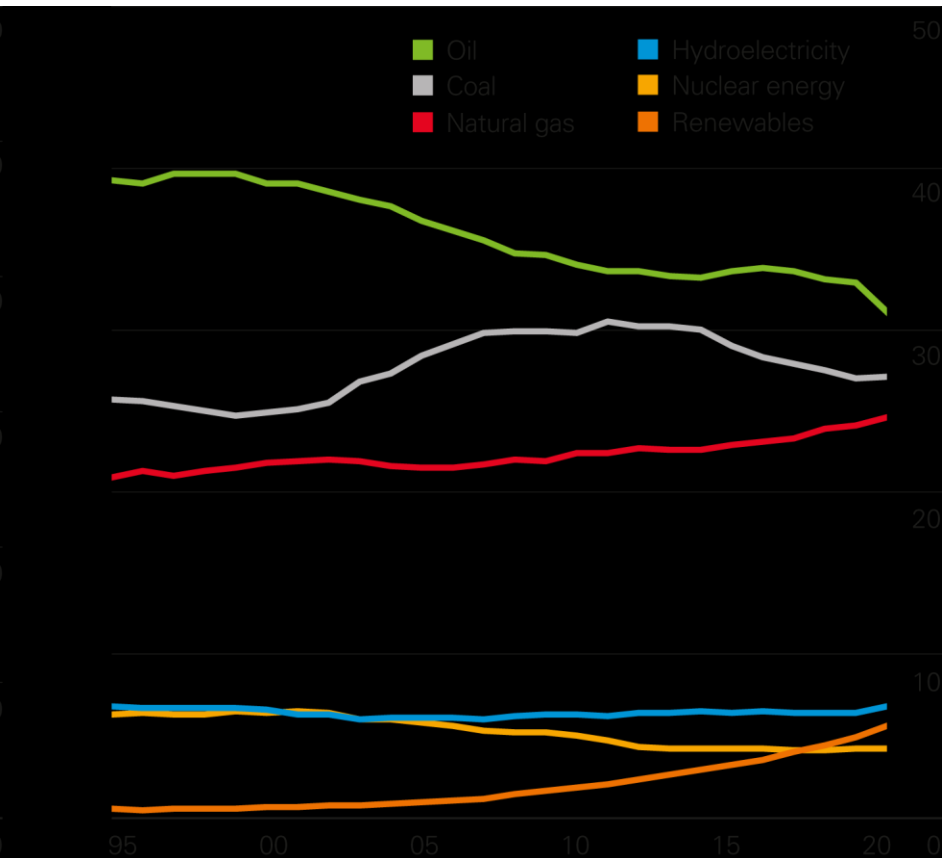


# Primary energy consumption since 1990 (mmtoe)

World Consumption (Exajoules)



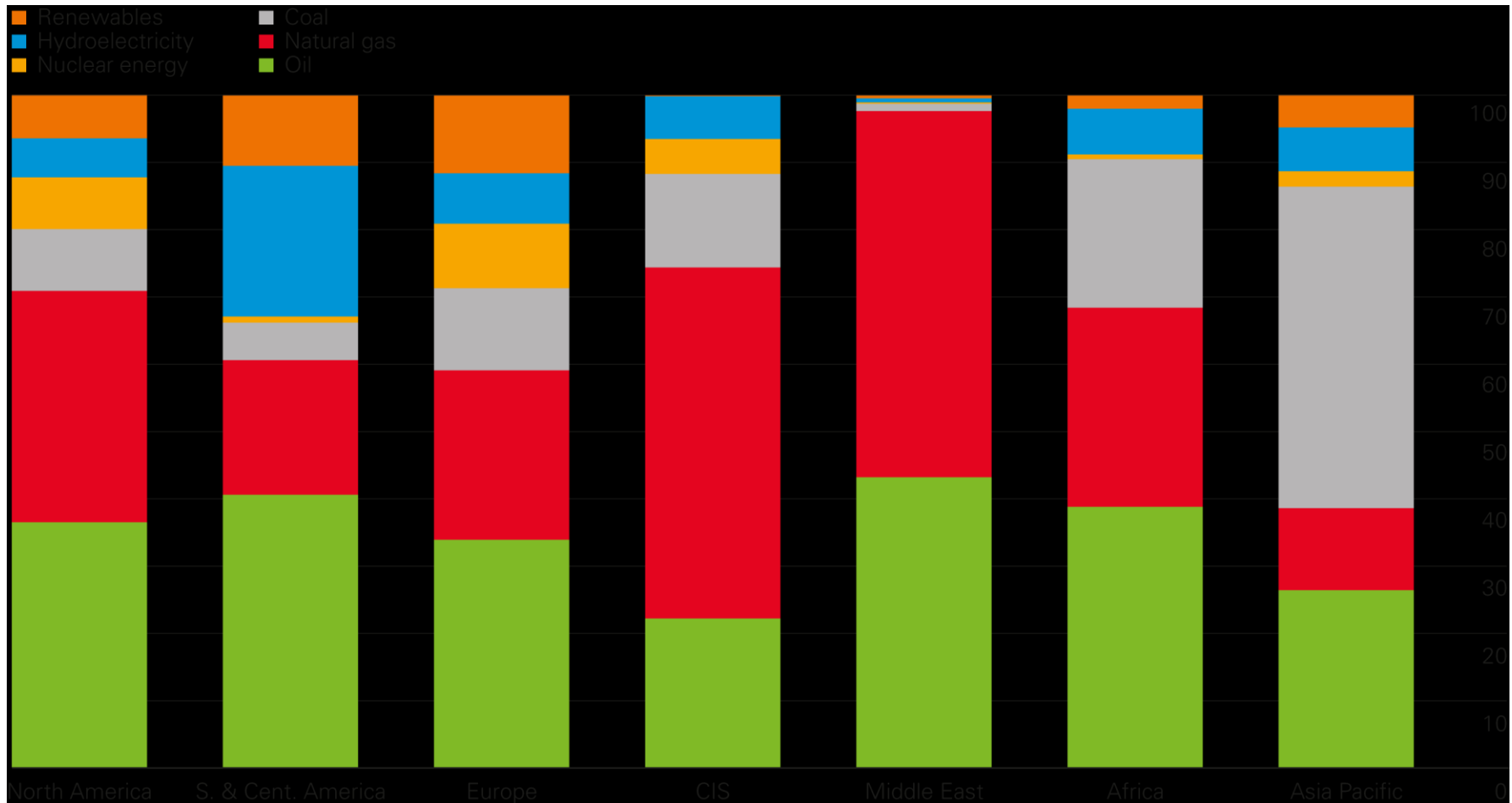
Share by Fuel (%)



- Overall energy demand has been growing by around 1% per annum
- The key primary fuels have been hydrocarbons, which account for 80%+ of total energy consumption
- Renewables are growing fast but from a very low base



# Primary energy regional consumption by fuel (2020, %)



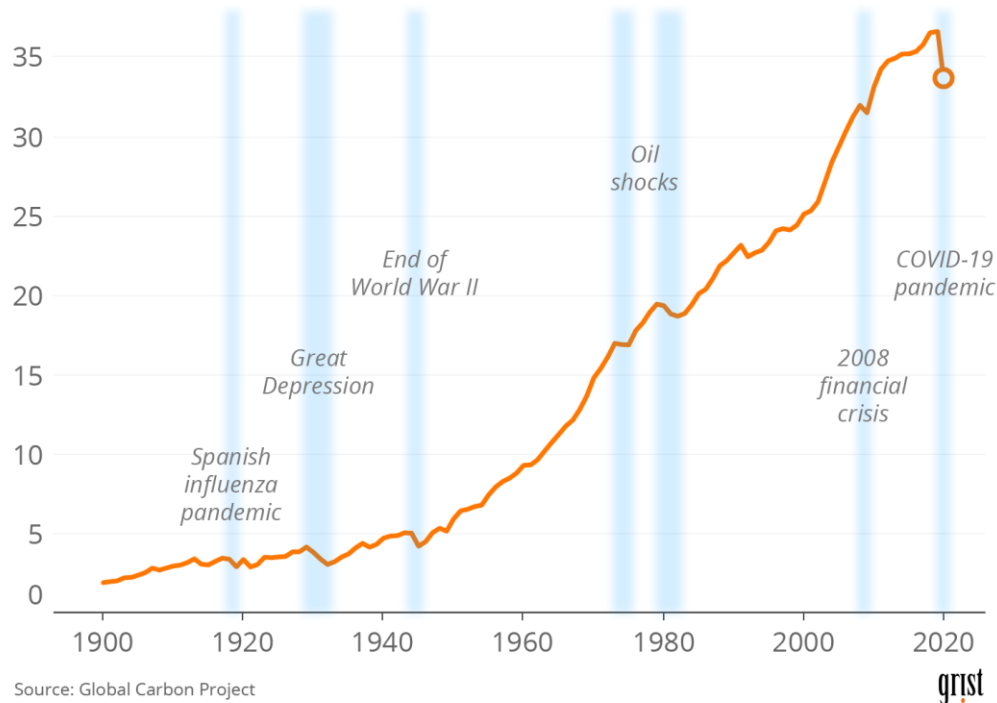
- Fuel split is very different by region, and is generally driven by indigenous supply
- Countries are reluctant to be over-committed to imports



# CO2 emissions – will they ever peak?

## A familiar pattern

Annual global fossil emissions, billion metric tons of CO<sub>2</sub>

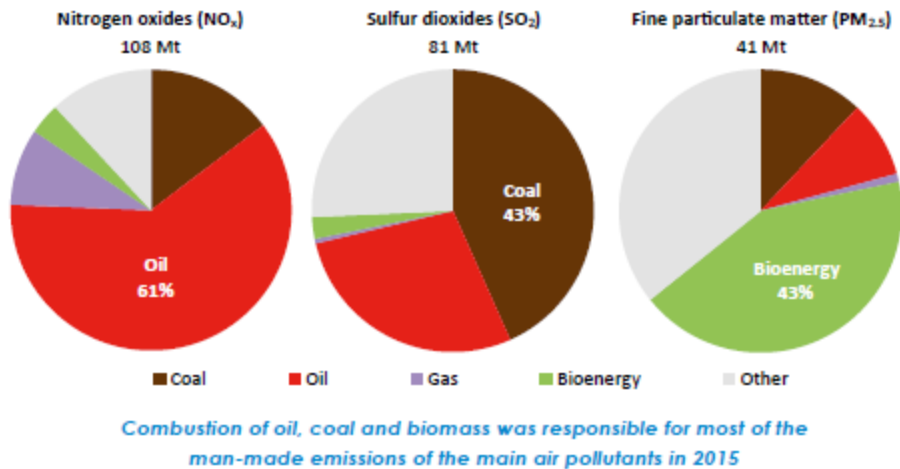


- Economic crises the main brake on carbon emissions (2008, 2014 2020)
- Otherwise the increase continues, led by China and India
- Decline in the USA driven by economics (coal to gas switch) not policy

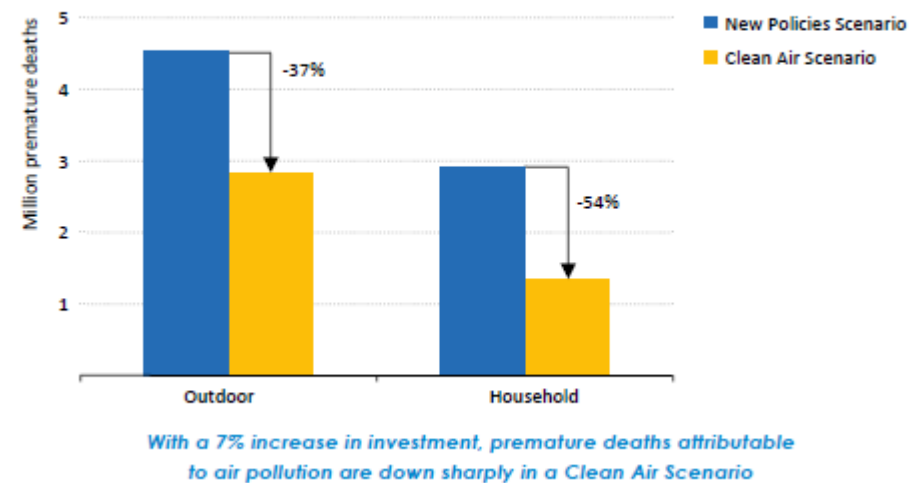


# Air pollution is becoming an almost more important short-term issue

**Figure 2.10** ▶ Estimated anthropogenic emissions of the main air pollutants by source, 2015



**Figure 2.12** ▶ Premature deaths attributable to global air pollution in the New Policies and Clean Air Scenarios, 2040

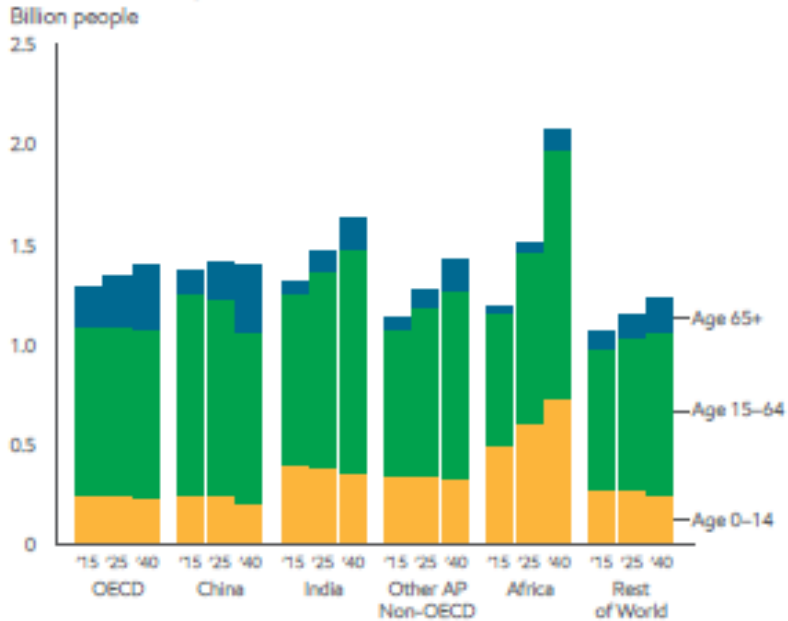


- Air pollution is a more immediate social and political issue than carbon emissions
- China is well known for its poor air quality in many cities, but even in Europe a number of regions are well below acceptable levels
- Governments are aware that a failure to react on a key health issue could lead to a violent backlash
- Air pollution could therefore be a key driver towards a cleaner energy economy



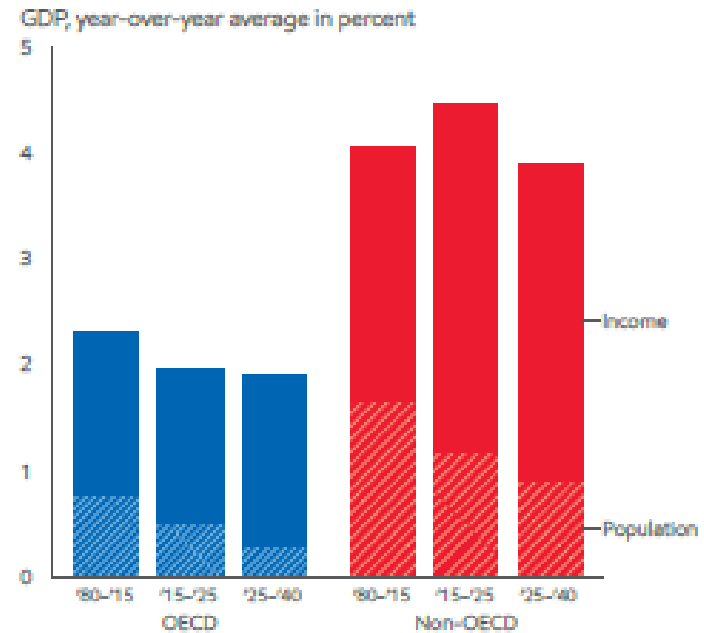
# Key drivers of energy consumption

## World demographics continue to shift



Source: World Bank, EcoinMobil estimates

## Non-OECD leads economic expansion

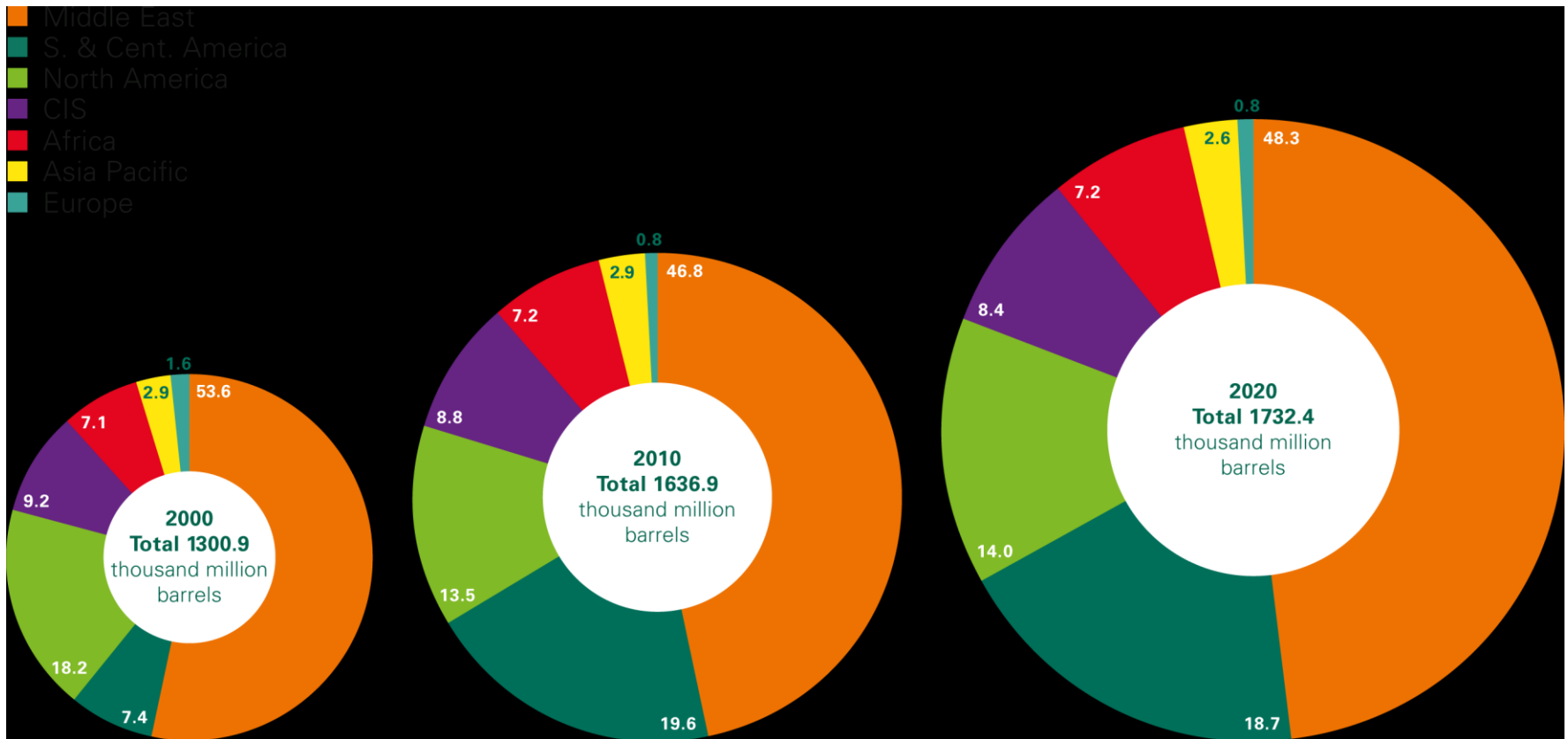


- Global population currently 7.3 billion, expected to reach 9.1 billion by 2040
- Population mainly in non-OECD countries, in many of which the alleviation of energy poverty is a huge issue
- Economic growth is another key driver, leading to increased personal wealth and greater use of energy intensive products
- Again non-OECD countries dominate growth, with their share of global GDP set to rise from 35% to 50% by 2040





# The growth in oil reserves and the regional split

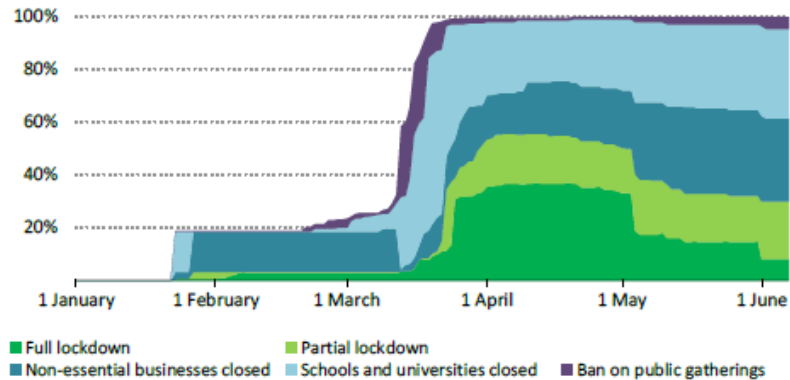


- Oil is not running out – proved reserves are up by 50% since 1995
- Middle East continues to dominate, but other regions are growing – the Americas in particular



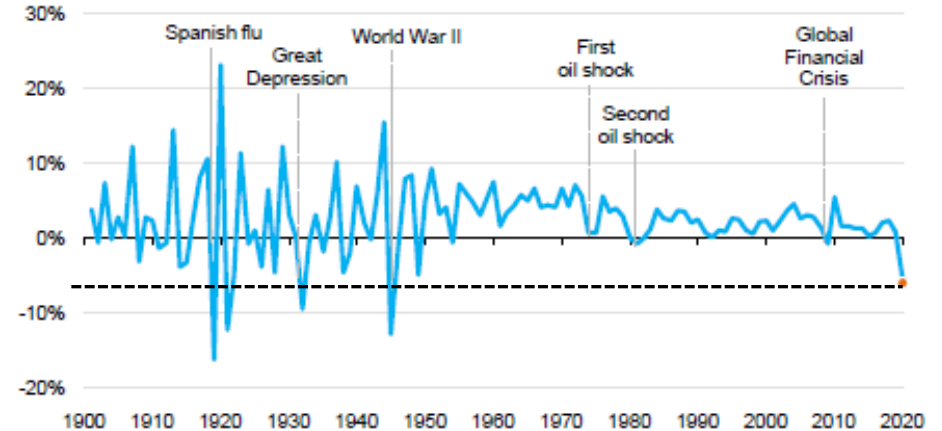
# Economic impact of COVID 19 the worst since World War 2

**Figure 1.1** ▶ Share of global population under containment measures, 2020



*Measures to contain the spread of the pandemic started at the end of January. In mid-May, around one-third of the global population remained under full or partial lockdown.*

**Rate of change in global primary energy demand, 1900-2020**

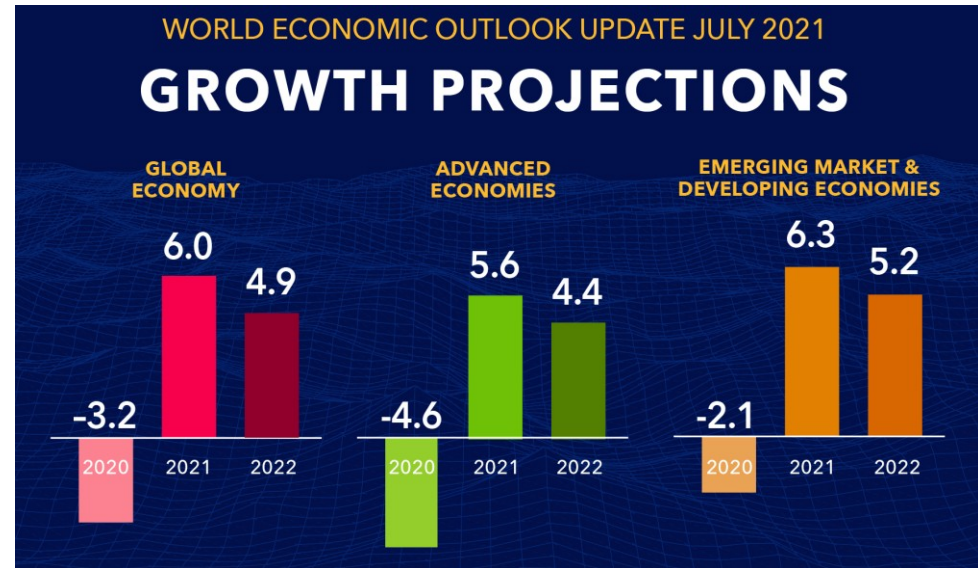
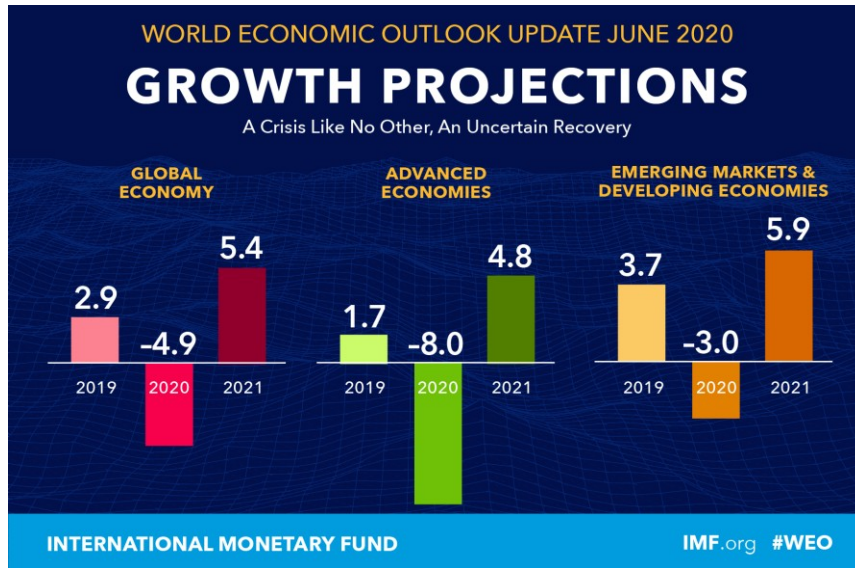


IEA 2020. All rights reserved.

- This market balancing mechanism works in “normal” conditions
- However, a major economic or social shock creates an uncontrollable outcome
- The COVID 19 pandemic is a classic example of this – containment measures dramatically reduced travel and caused a sharp decline in overall energy demand
- This affected all forms of energy consumption, but the most immediate impact was on oil demand



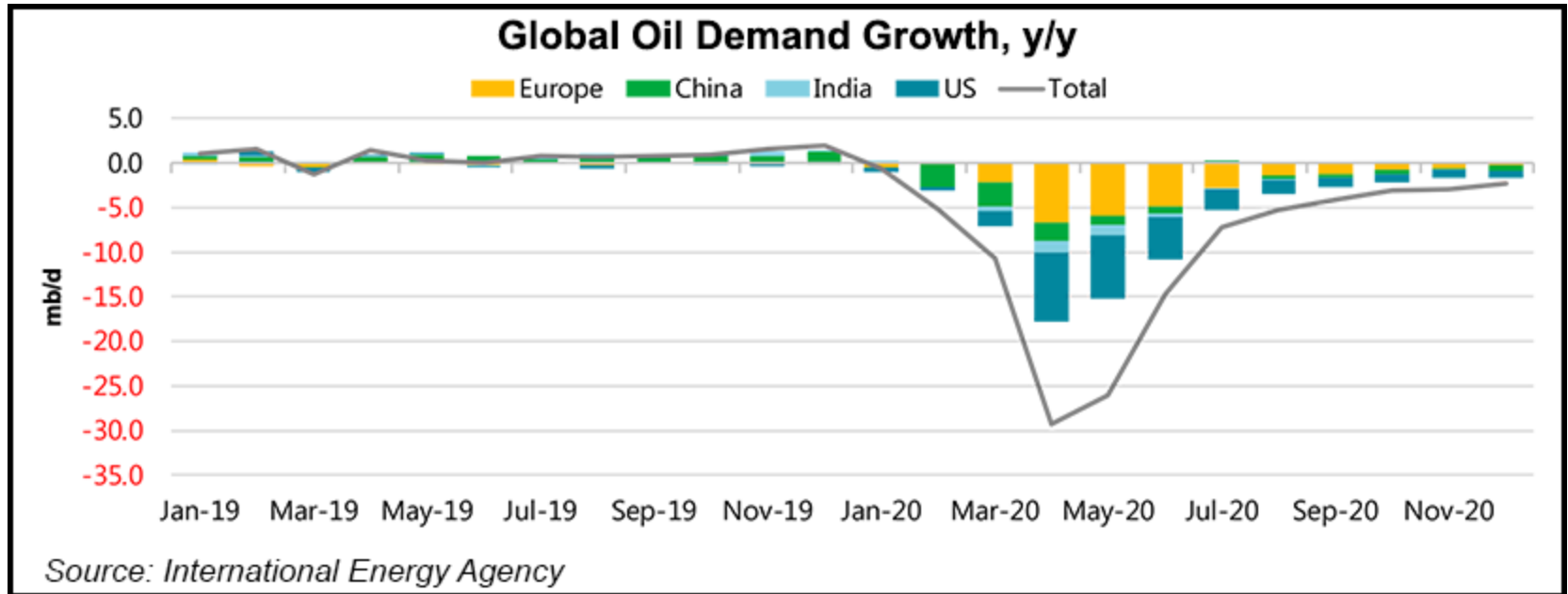
# The outlook for the global economy



- A key question was whether the global economy would recover rapidly or over an extended period
- Initial estimates were quite optimistic, and China led the way by experiencing something of a V-shaped recovery
- Overall the global economic impact was not as bad as expected, and forecasts look stronger for 2021 and 2022



# COVID impact on oil demand



- The impact on transport was immediate, as economies locked-down and people were forced to stay at home
- Oil demand collapsed immediately and the oil price fell from around \$70 to around \$20 per barrel
- There has now been a partial recovery to c.\$40 per barrel, but the outlook remains very unclear



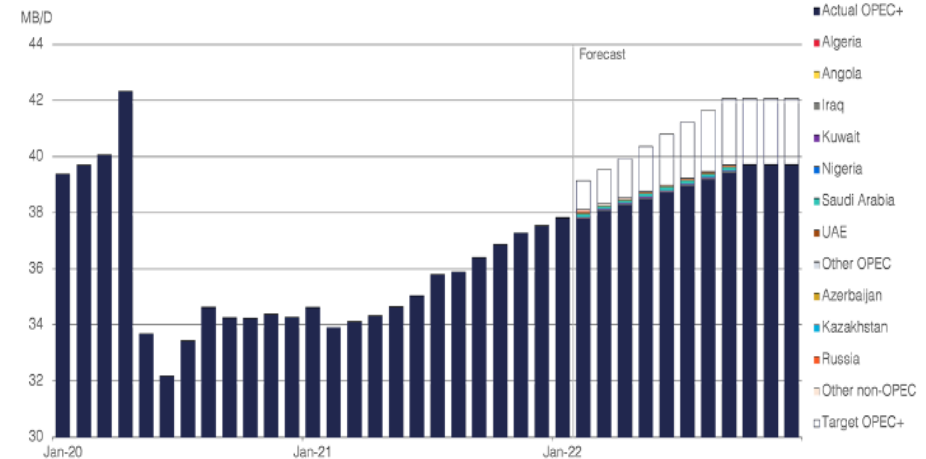
# The outcome was rather more positive

*Brent oil price (US\$/bbl)*



*OPEC output restraint a key factor in 2020 but now a problem*

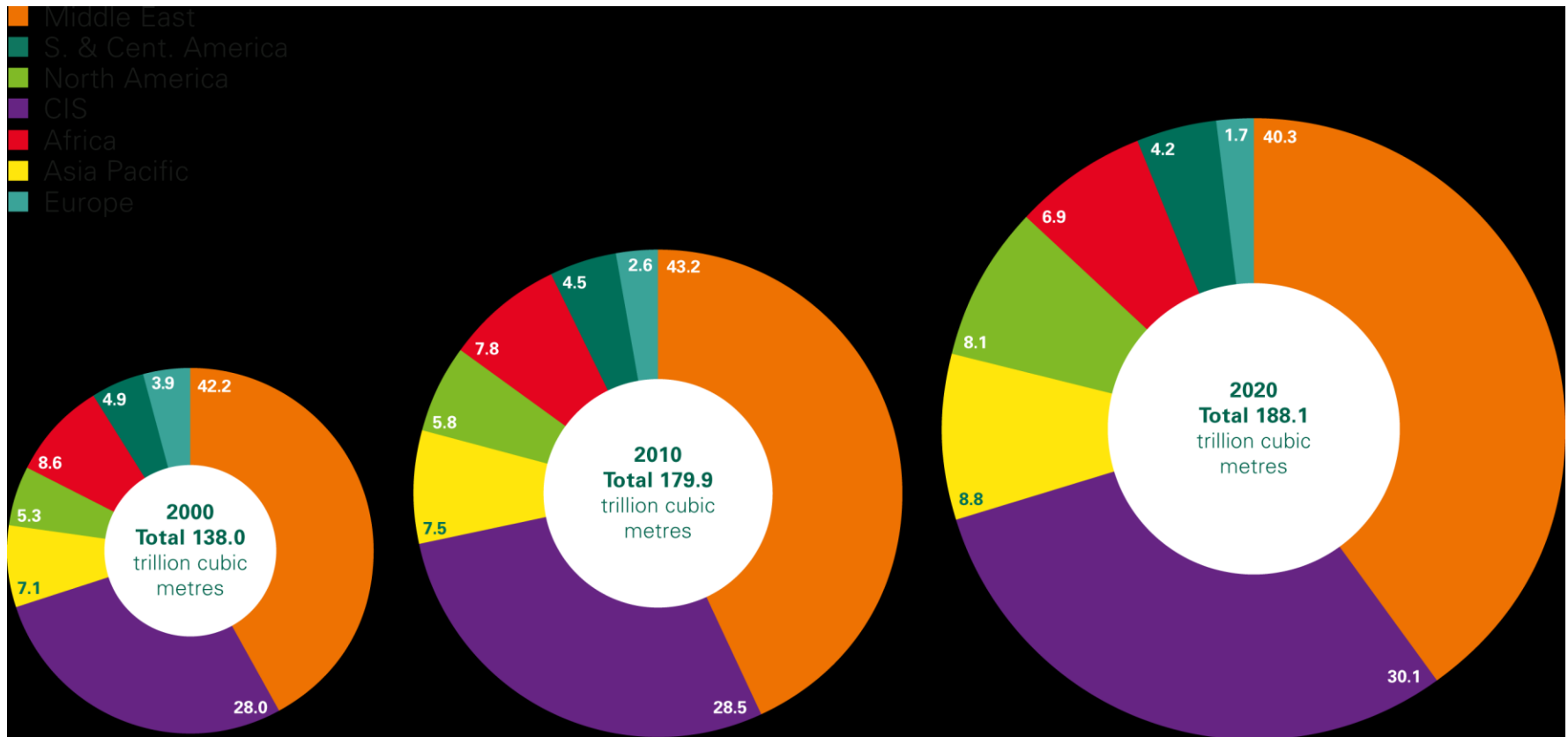
**Target versus projected OPEC+ production**



- Oil price has rebounded to \$120 per barrel, but this has recently been driven by the war in Ukraine
- OPEC cartel (plus Russia) had reduced supply to balance the market
- With economic growth and a rebound in demand this led to higher prices
- Cartel members now being asked to increase production again, due to the risk to Russian oil exports, but there is a question as to what is possible



# Gas reserves by region (2000, 2010, 2020)



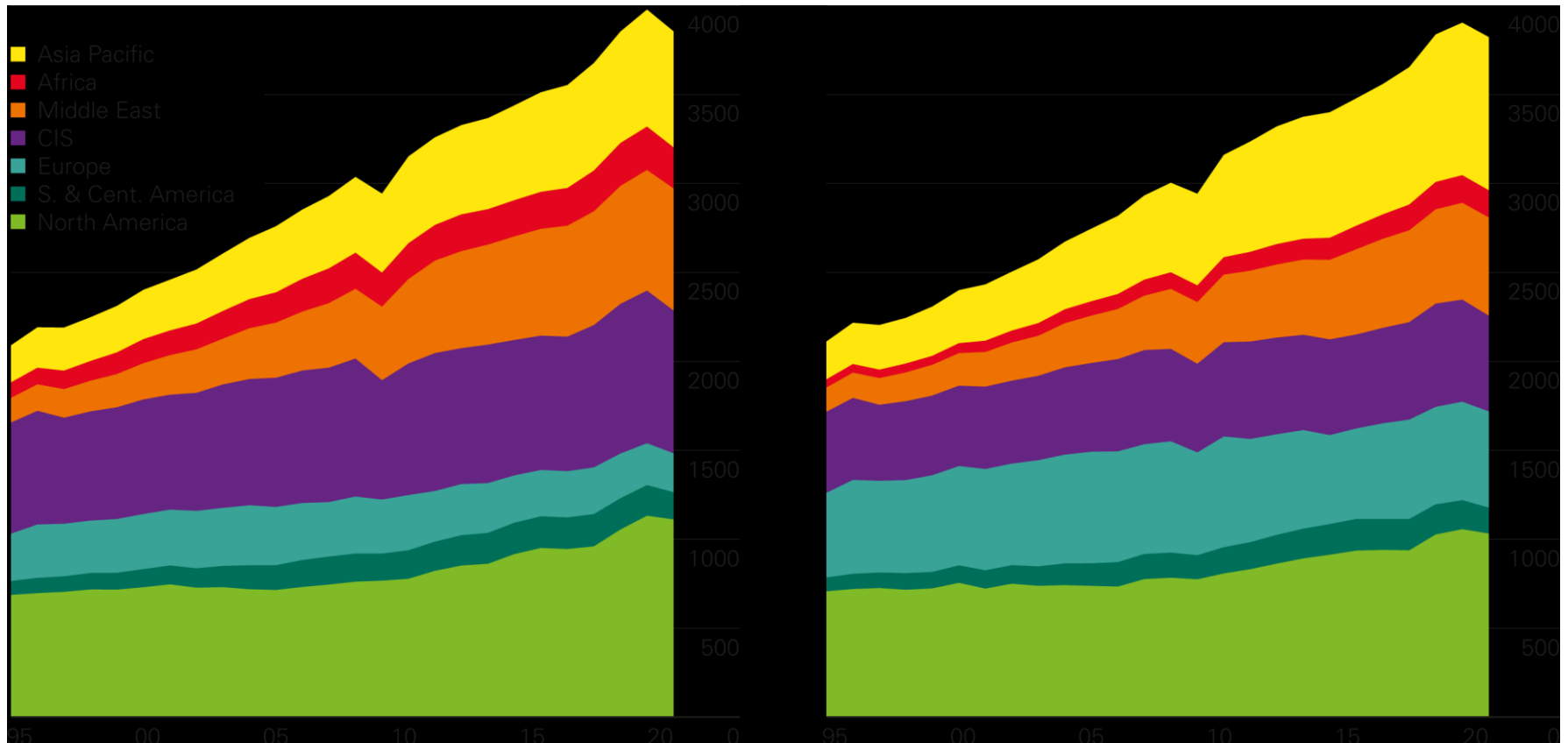
- The Middle East also contains huge amounts of gas, although Russia is the main exporting country
- Gas reserves have grown dramatically as it has increasingly become an important fuel for power generation



# Gas production and consumption by region (bcm)

*Production*

*Consumption*

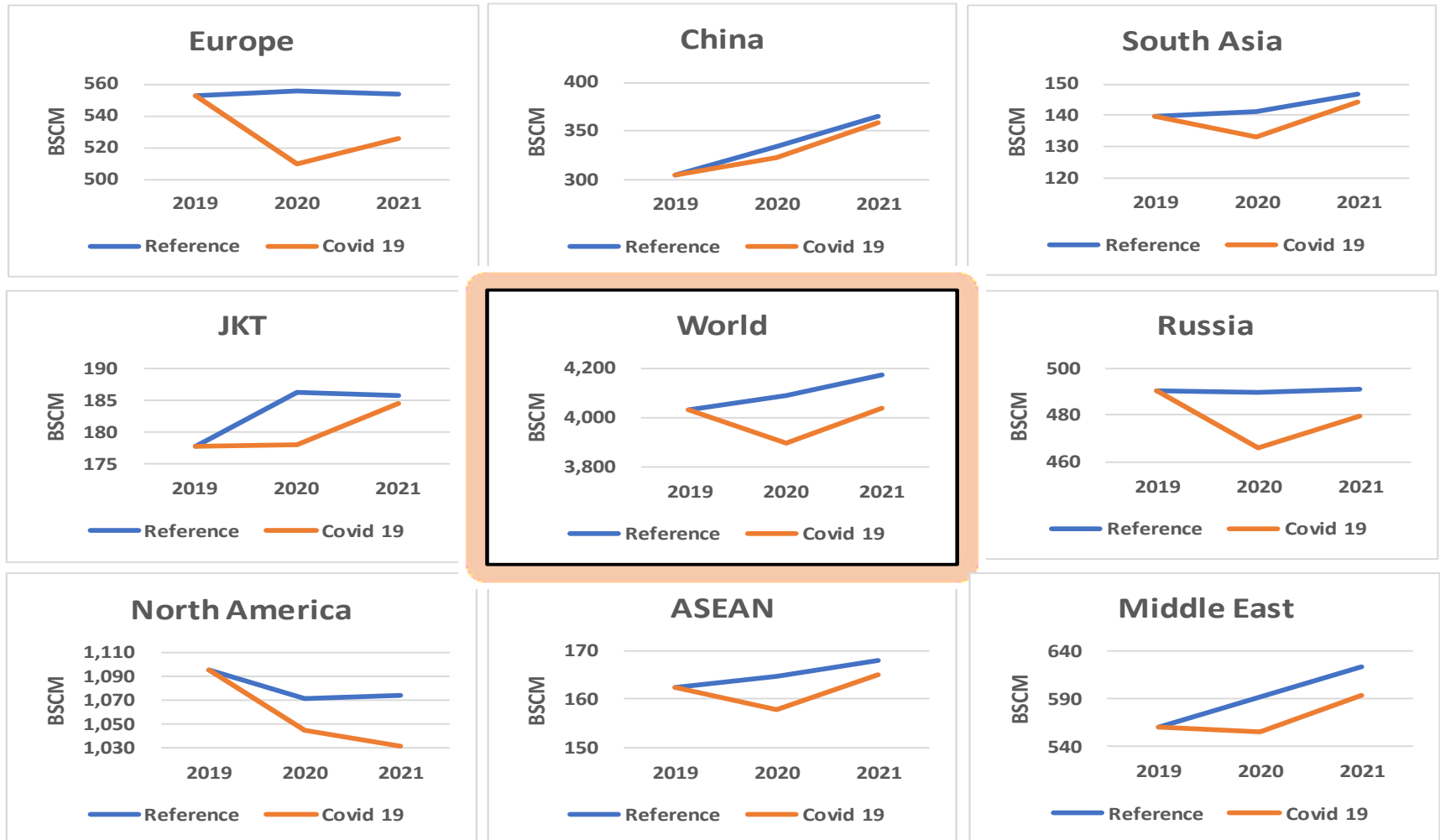


- Europe and North America have traditionally been the largest consumers of gas
- Major infrastructure in both regions facilitates indigenous production and imports
- Asia, the Middle East and Latin America are growing fast, however





# Global consumption declined 3.5% in 2020, bounced back 4% in 2021



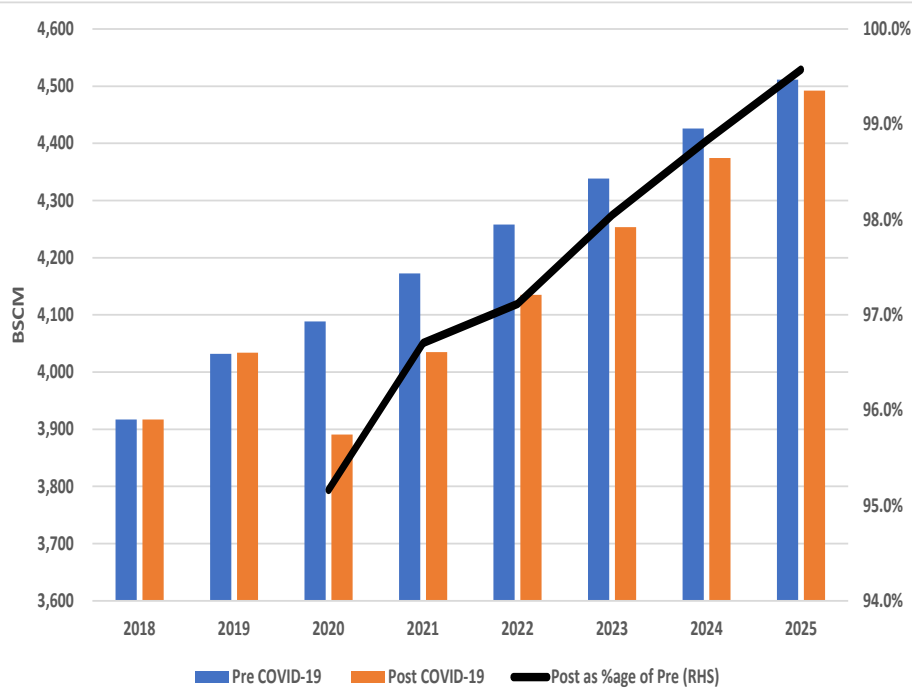
Source: OIES, Nexant WGM



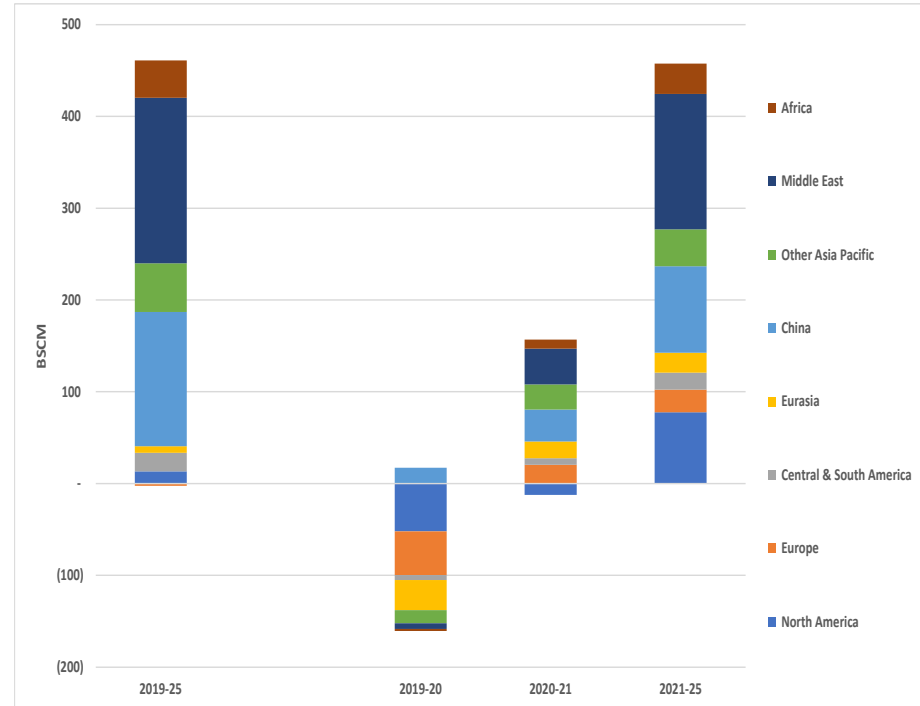


# 5 Year Demand Outlook post COVID

## Pre and Post COVID-19 Demand



## Regional Breakdown

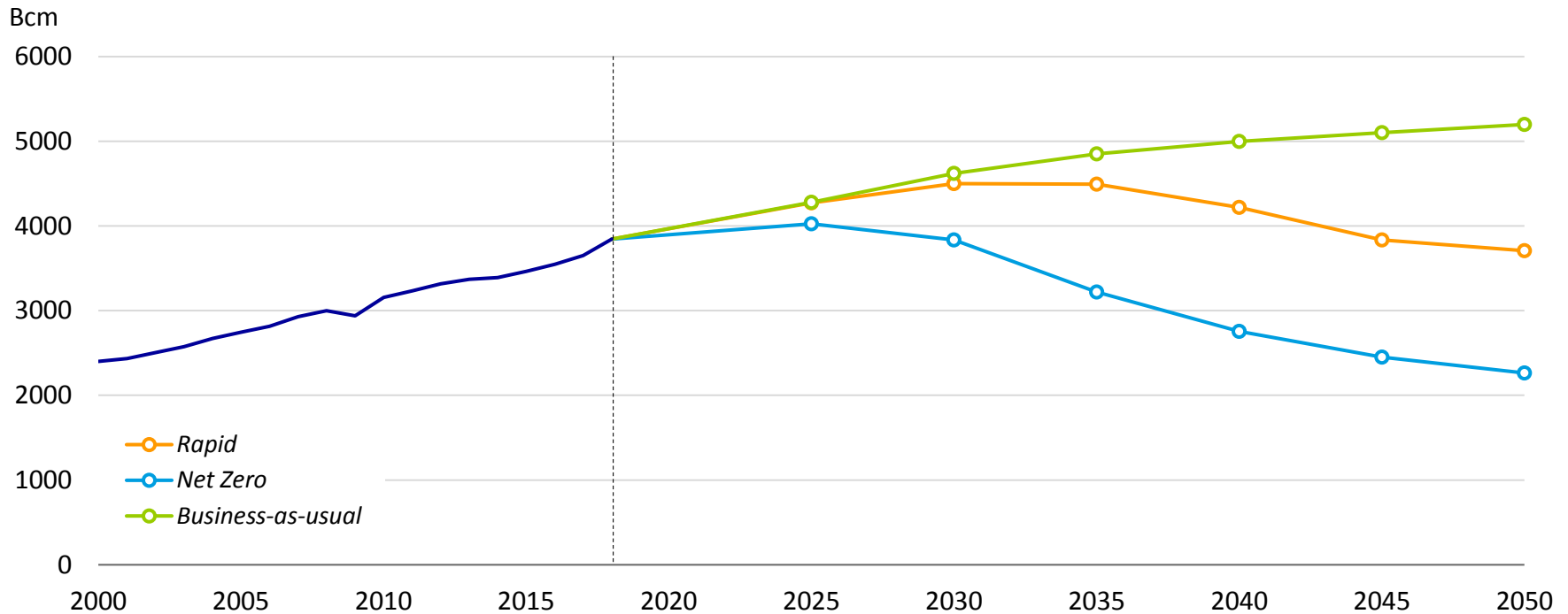


- 3.5% decline in gas demand on 2020 – return to 2019 levels in 2021
- Demand grows 2.5% a year to 2025 almost reaching the pre-COVID-19 projection
- Largest declines in 2020 in Europe, North America and Russia
- Across the board rebound in 2021 – Europe sluggish growth
- Asia and Middle East lead the growth post 2021

Sources:  
Historic - IEA  
Projections – OIES,  
Nexant WGM

# Long-term outlook for gas consumption is positive

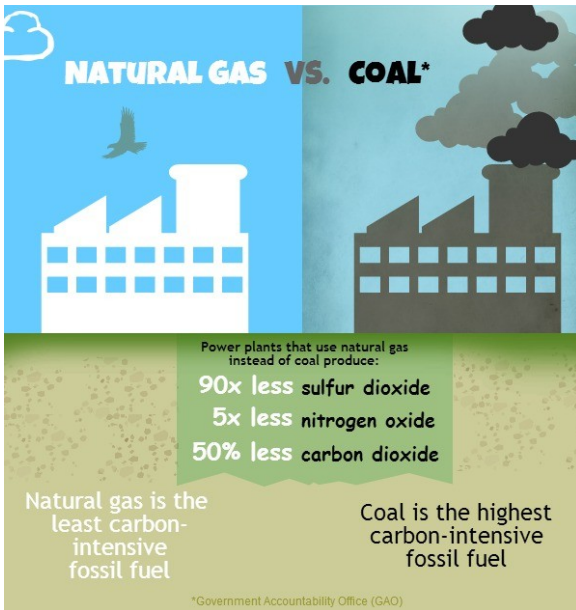
## Natural gas consumption



- The outlook for gas is relatively positive compared to other hydrocarbons
- In Europe and the US there may be decline as decarbonisation strategies take priority, but growth is expected in Asia, the Middle East and Africa
- Net zero strategies present a threat, unless gas can offer a decarbonised alternative such as hydrogen



# Key issues for Gas in the longer term

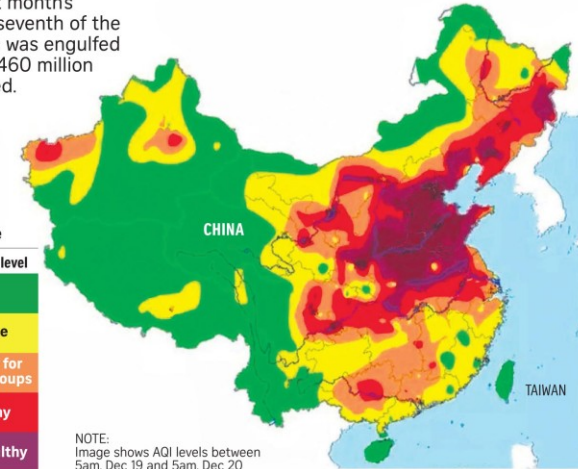


## China's worst air pollution in 2016

At the height of last month's "airpocalypse", one-seventh of the country's land mass was engulfed by smog. A total of 460 million people were affected.

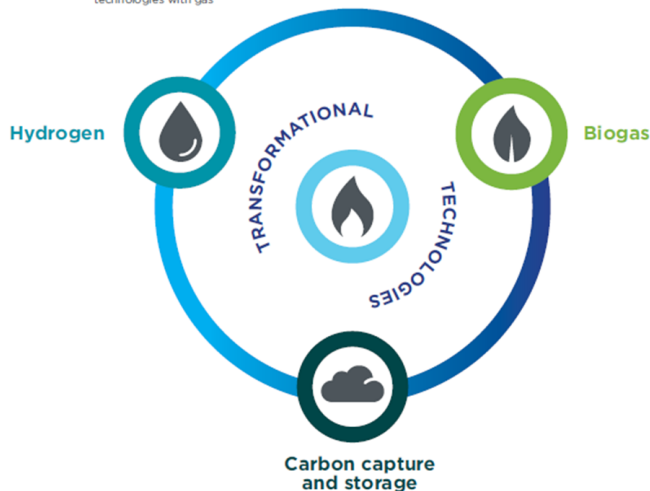
Air Quality Index (AQI) scale

AQI	Air pollution level
0 - 50	Good
51 - 100	Moderate
101 - 150	Unhealthy for sensitive groups
151 - 200	Unhealthy
201 - 300	Very unhealthy
300+	Hazardous



Source: CHINA METEOROLOGICAL ADMINISTRATION STRAITS TIMES GRAPHICS

Figure 4: Integration of low emission transformational technologies with gas

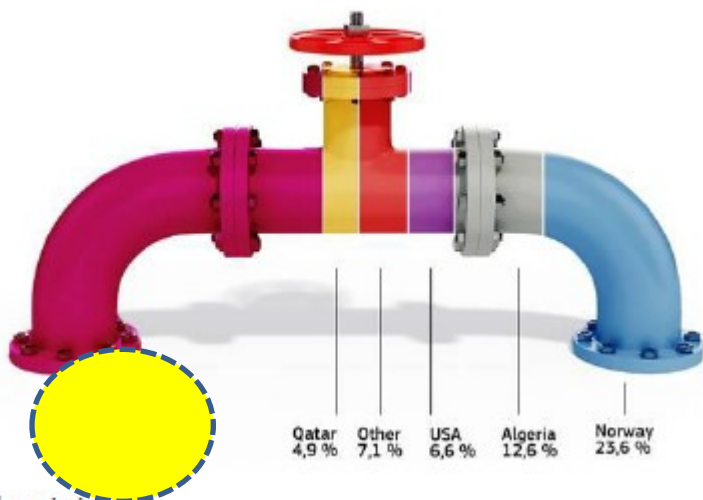


- Gas demand can continue to rise as it displaces coal in the energy mix
- In Asia, air quality is a key issue, and gas can have a major role to play
- In Europe, net zero CO<sub>2</sub> emissions is a major theme – gas is part of the long-term problem unless it finds a pathway to decarbonise

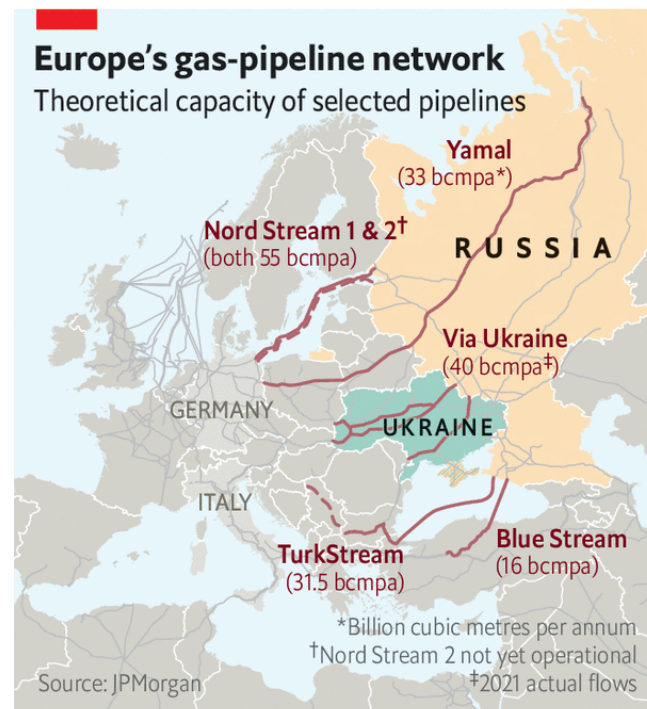


# Security of supply is now the main short-term issue

Share in EU natural gas imports, 2021



Source: European Commission



The Economist

- Concern over gas supply is now the critical issue for the EU
- Russian gas exports are now threatened by politics and by contractual issues
- Replacing Russian imports to Europe would be very challenging in the short-term
- Europe's attempts to diversify are affecting the global gas market as prices everywhere have risen



# The EU and IEA plans for diversification could accelerate the Energy Transition

## A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas

Measures implemented this year could **bring down gas imports from Russia by over one-third**, with additional temporary options to deepen these cuts to **well over half while still lowering emissions**.

### Action 1



#### No new gas supply contracts with Russia

Impact: Taking advantage of expiring long-term contracts with Russia will reduce the contractual minimum take-or-pay levels for Russian imports and enable greater diversity of supply.

### Action 2



#### Replace Russian supplies with gas from alternative sources

Impact: Around 30 bcm in additional gas supply from non-Russian sources.

### Action 3



#### Introduce minimum gas storage obligations to enhance market resilience

Impact: Enhances the resilience of the gas system, although higher injection requirements to refill storage in 2022 will add to gas demand and prop up gas prices.

### Action 4



#### Accelerate the deployment of new wind and solar projects

Impact: An additional 35 TWh of generation from new renewable projects over the next year, over and above the already anticipated growth from these sources, bringing down gas use by 6 bcm.

### Action 5



#### Maximise generation from existing dispatchable low-emissions sources: bioenergy and nuclear

Impact: An additional 70 TWh of power generation from existing dispatchable low emissions sources, reducing gas use for electricity by 13 bcm.

### Action 6



#### Enact short-term measures to shelter vulnerable electricity consumers from high prices

Impact: Brings down energy bills for consumers even when natural gas prices remain high, making available up to EUR 200 billion to cushion impacts on vulnerable groups.

### Action 7



#### Speed up the replacement of gas boilers with heat pumps

Impact: Reduces gas use for heating by an additional 2 bcm in one year.

### Action 8



#### Accelerate energy efficiency improvements in buildings and industry

Impact: Reduces gas consumption for heat by close to an additional 2 bcm within a year, lowering energy bills, enhancing comfort and boosting industrial competitiveness.

### Action 9



#### Encourage a temporary thermostat adjustment by consumers

Impact: Turning down the thermostat for buildings' heating by 1°C would reduce gas demand by some 10 bcm a year.

### Action 10

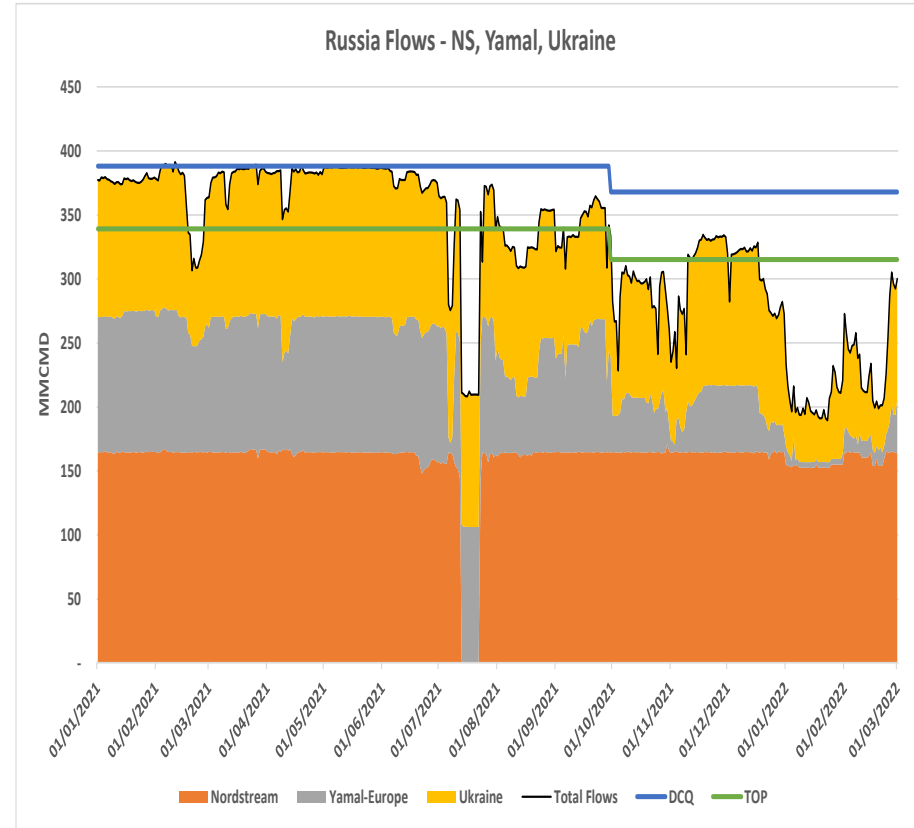
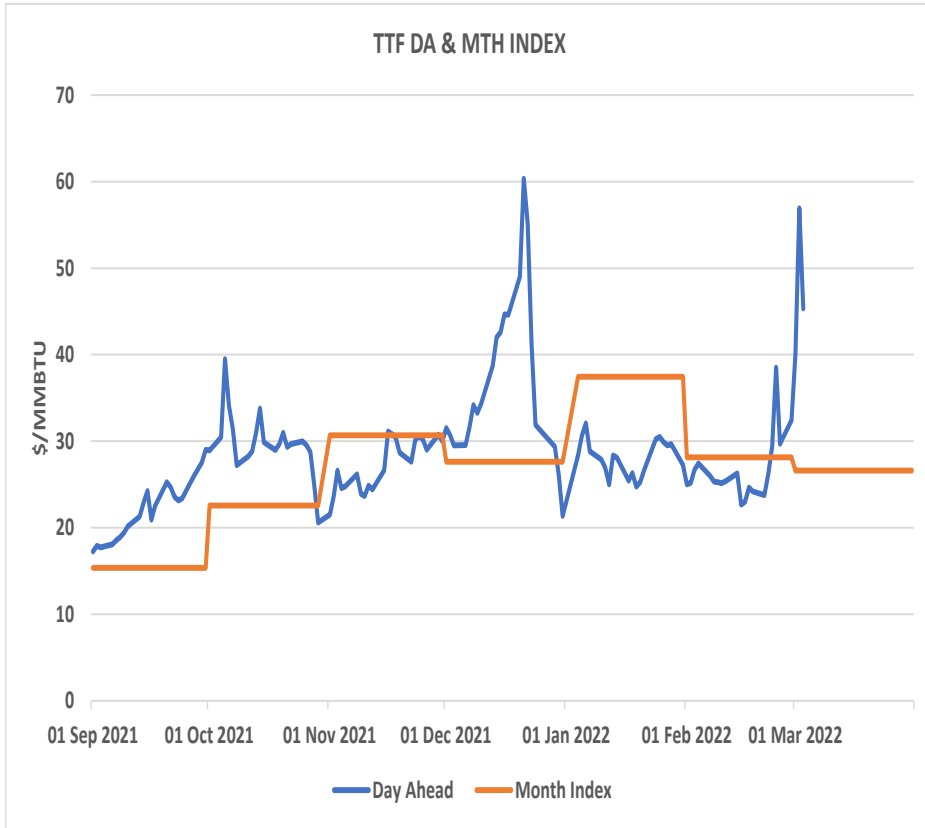


#### Step up efforts to diversify and decarbonise sources of power system flexibility

Impact: A major near-term push on innovation can, over time, loosen the strong links between natural gas supply and Europe's electricity security. Real-time electricity price signals can unlock more flexible demand, in turn reducing expensive and gas-intensive peak supply needs.



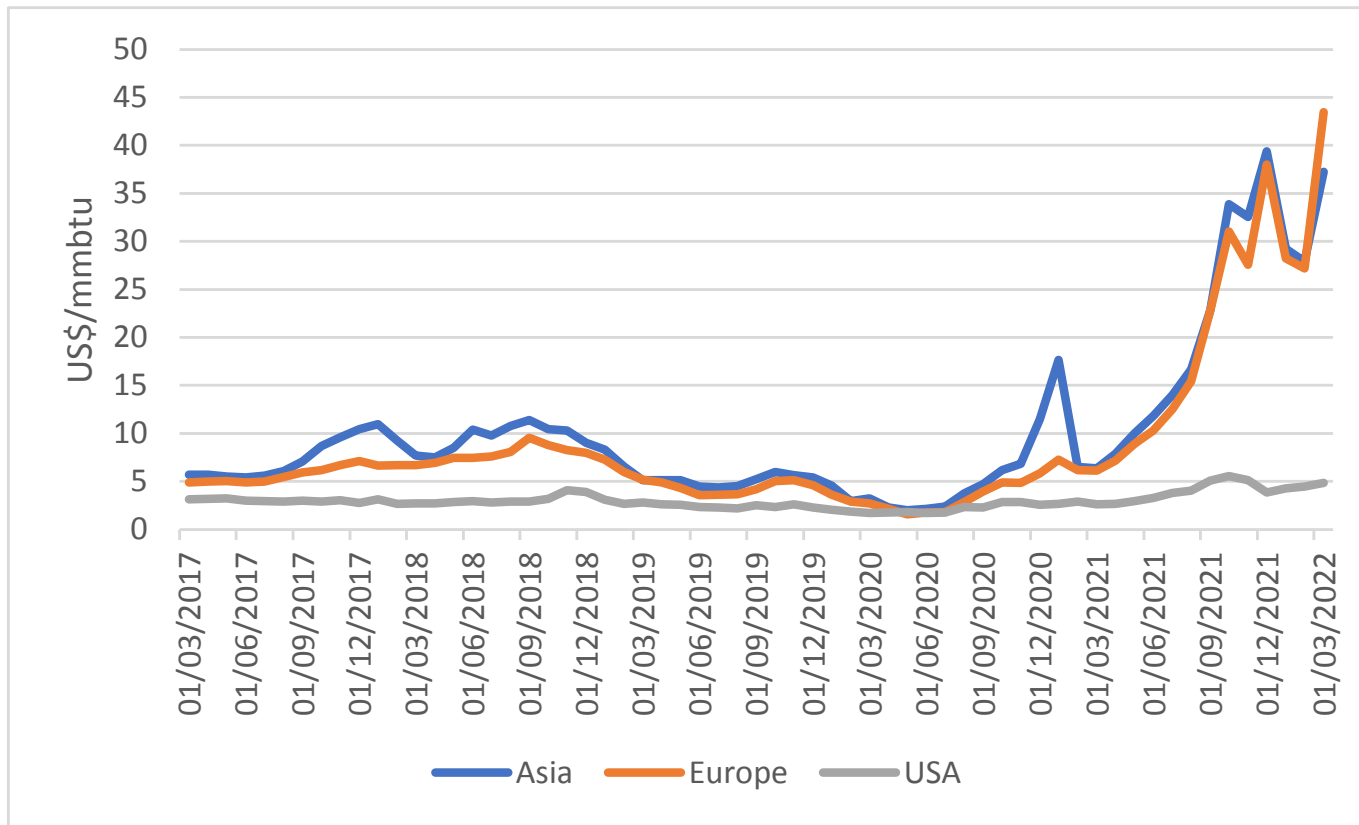
# Gas prices have rebounded dramatically after sharp fall in 2020



- Gas price collapsed during the pandemic but then spiked ahead of winter 2021/22 as storage levels were very low
- In 2022 the market has been scared by the war in Ukraine and falling Russian gas flows to Europe
- Uncertainty has meant that gas prices are very volatile and the long-term outlook is very uncertain



# Gas prices in Asia have also surged as competition for gas increases



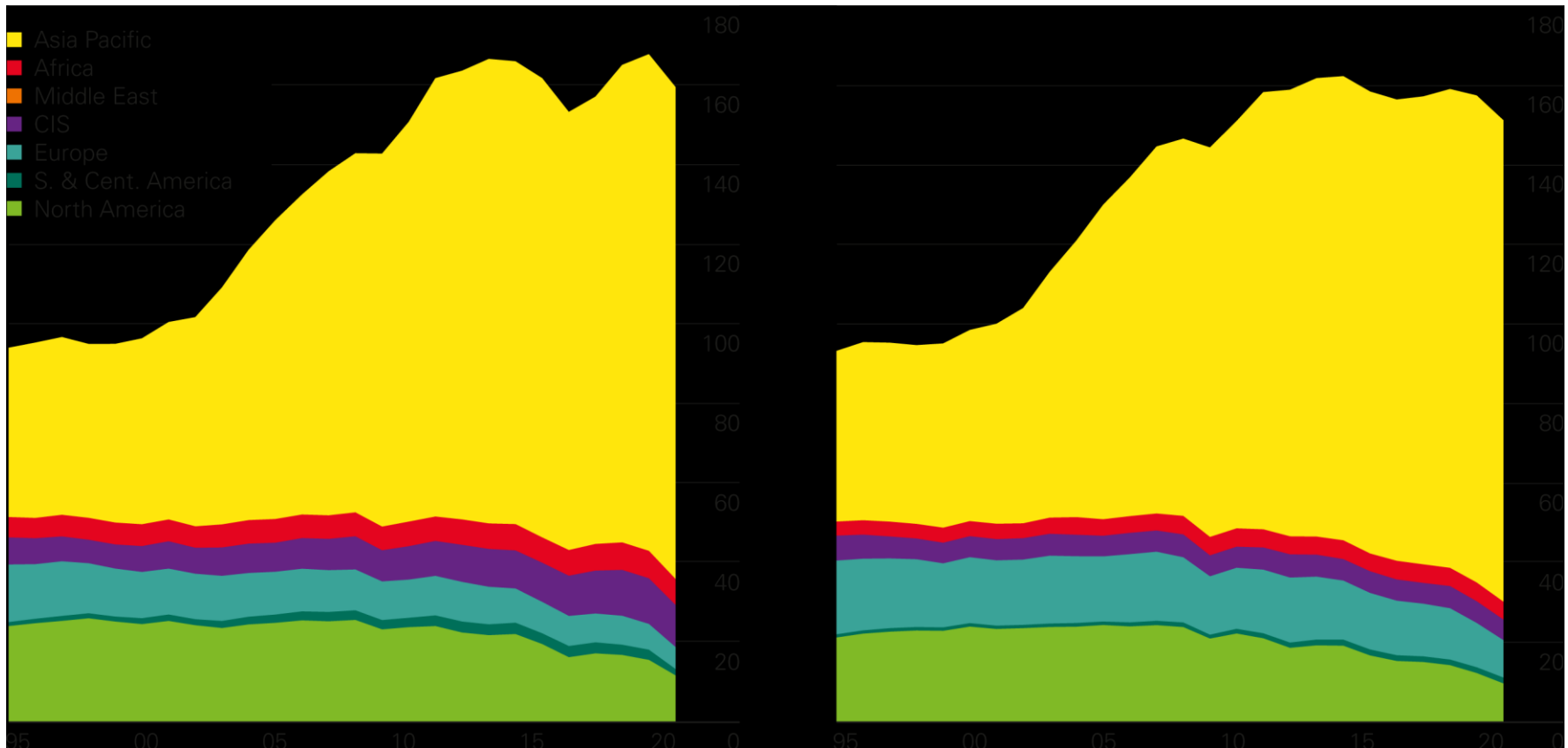
- European gas price surged due to a cold winter in 2021, economic rebound, low wind in Q3 and low storage levels at start of winter 2021/22
- Demand for LNG increased, dragging gas from Asia and increasing prices there as demand has also risen due to COVID rebound
- US price remains low because of shale gas, but increased exports has seen prices more than double since Q1 2021



# Coal production and consumption by region (mt)

*Production*

*Consumption*



- The majority of production and consumption is in Asia, and has grown rapidly
- China and India are the key players, as coal is both countries' major indigenous energy resource
- Decline in North America driven by the arrival of shale gas



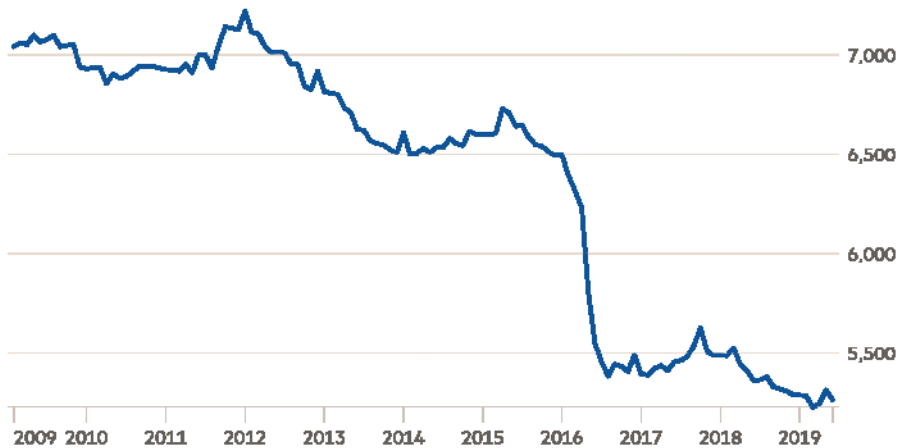


# Decline in US coal industry

## *Employment in US coal industry*

### Coal employment declines in top-producing US state

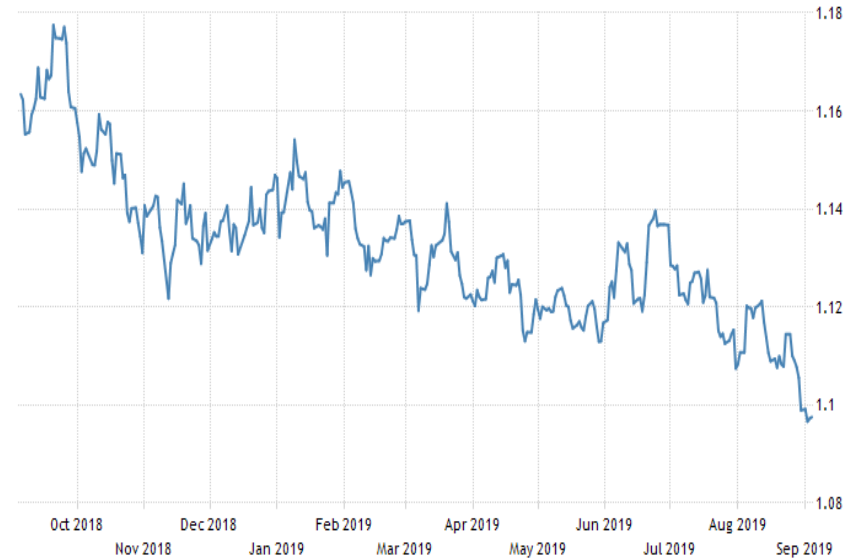
Wyoming payroll jobs in coal mining industry



Source: US Bureau of Labor Statistics

© FT

## *Dow Jones US Coal Index 2018/19*



- The US coal industry has collapsed over the past five years
- Although the environment has been a background cause, in fact it has been all about economics – cheap gas prices
- Ironically, US coal has been exported to regions where gas is more expensive – Europe being a prime example



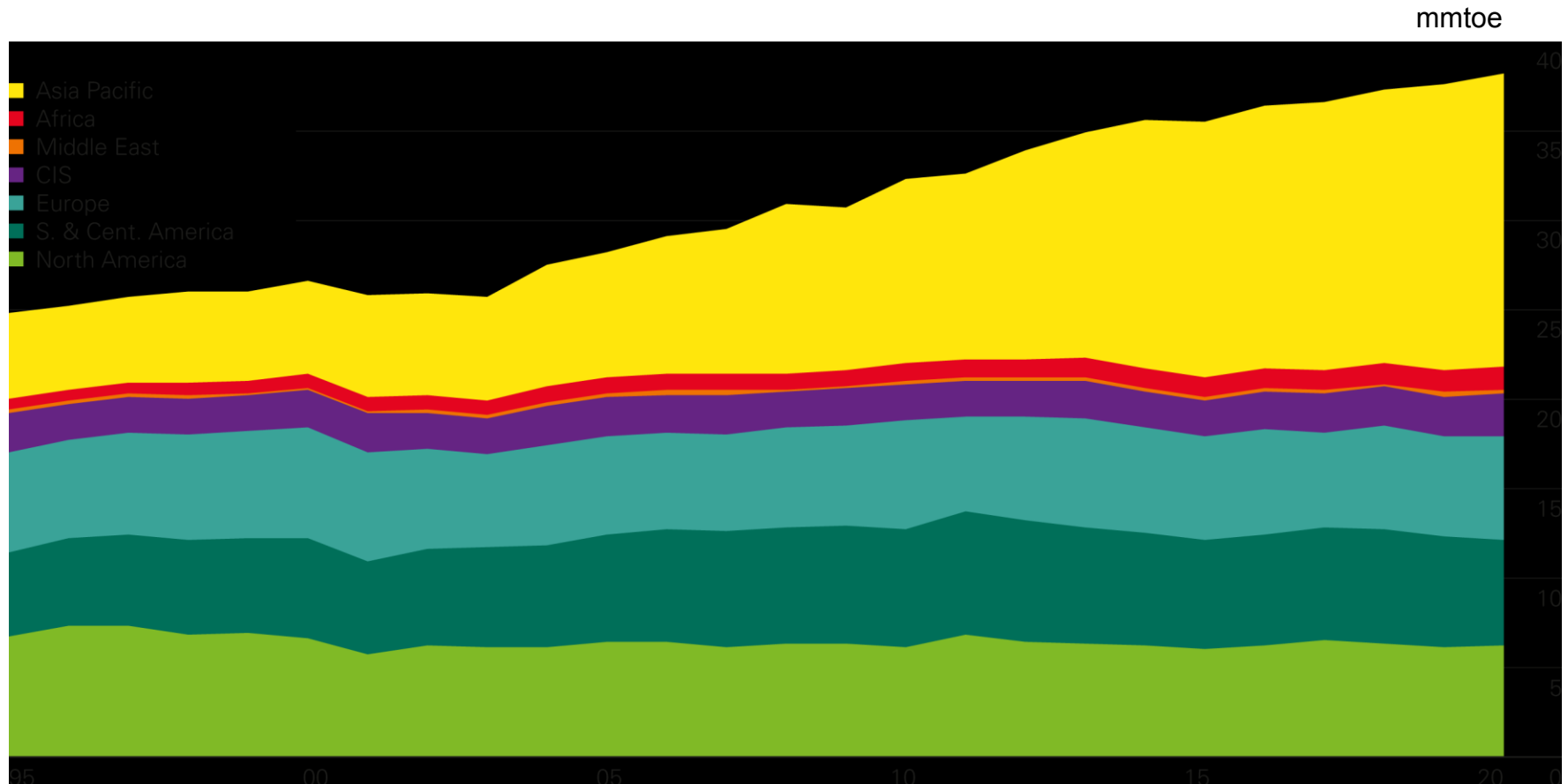
# Nuclear Energy – A Relatively Stagnant Story



- 1.3%pa growth since 2015, but long-term trend is flat
- Trend is away from traditional regions of Europe and US towards Asia
- China is at the forefront of new nuclear growth, in the search for indigenous energy production



# Hydro-electric – reaching its limits?



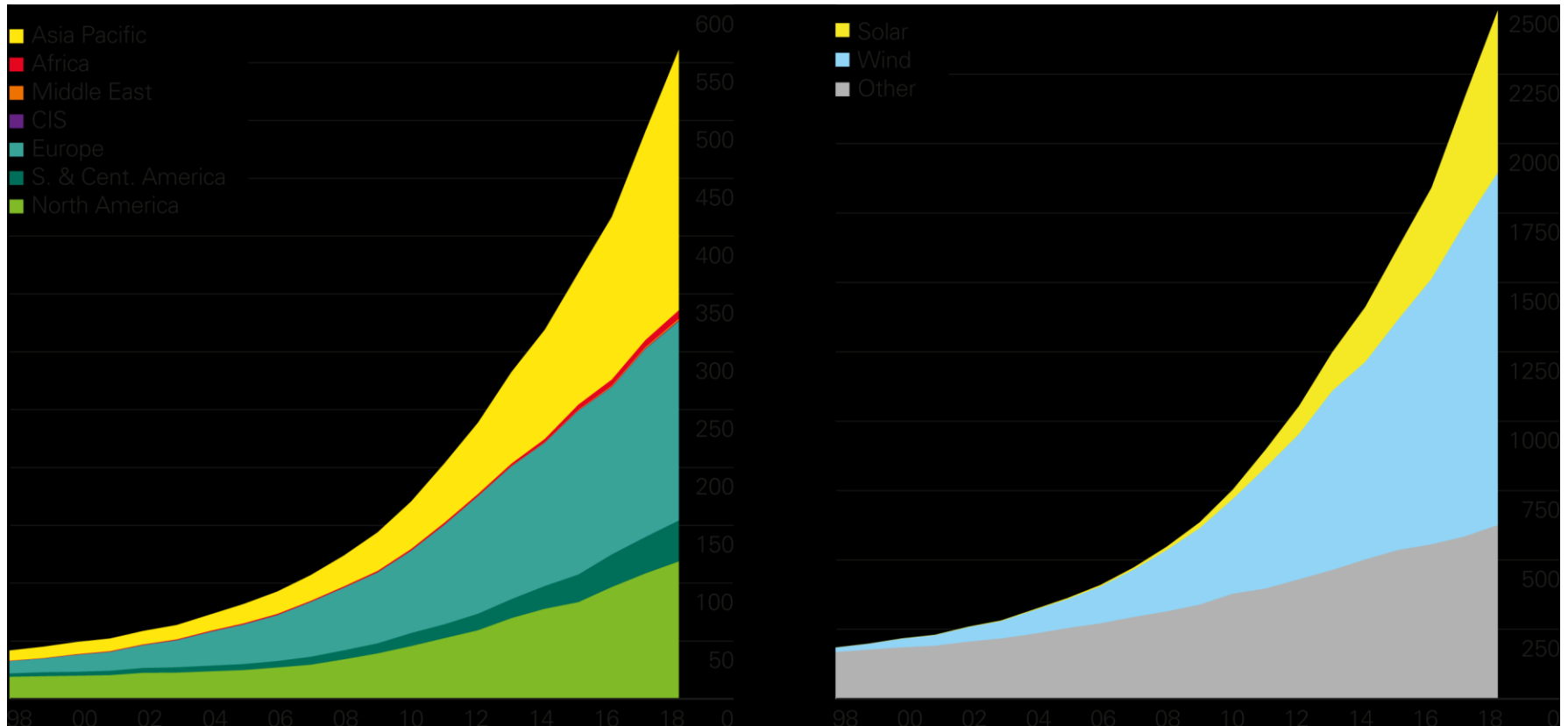
- A similar story for hydro, with more growth
- 1% growth overall in 2015, held back by drought in South America and some parts of Central Europe
- Upside potential limited from here, other than in Asia



# Renewable energy consumption by region and source

*Consumption (MMTOE)*

*Source of Renewable Energy*

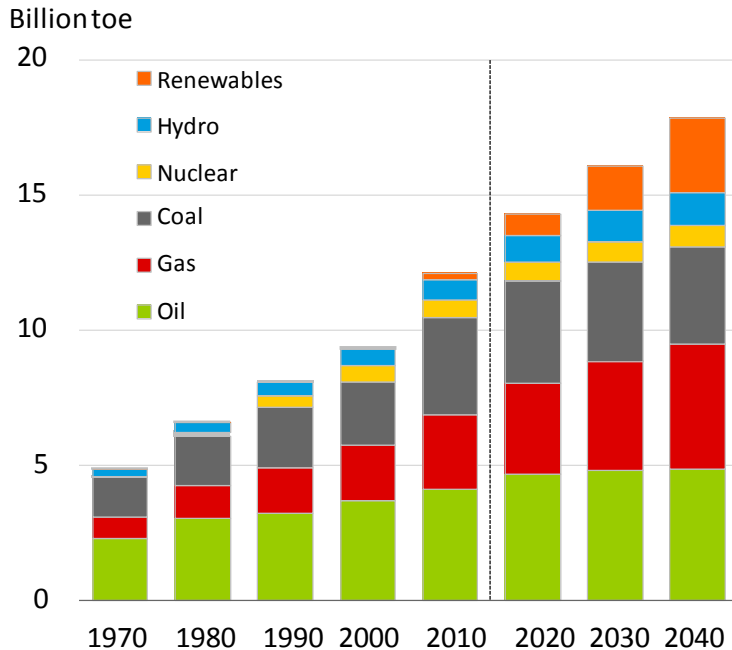


- Growth in renewable energy has been dramatic – it now accounts for around 9% of the global input to electricity
- Europe has been leading the way, catalysed by policy initiatives in Germany
- Growth in Asia accelerating, as search for indigenous energy continues

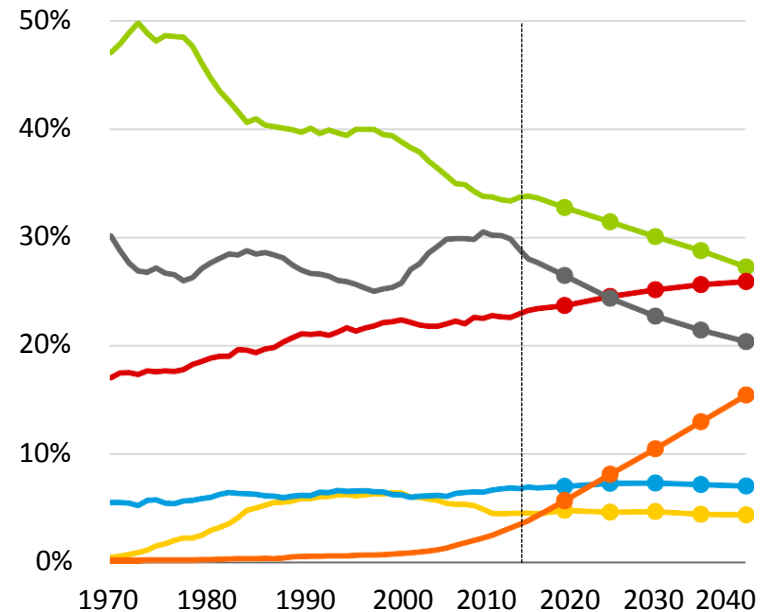


# The shifting global energy economy

Primary energy consumption by fuel



Shares of primary energy



- Rise of renewables now having a noticeable impact on hydrocarbons
- Incremental demand growth is increasingly being accounted for by non-fossil fuels, leading to oversupply and lower prices
- Are we seeing a new paradigm for oil, gas and coal pricing, with significant commercial and political consequences?

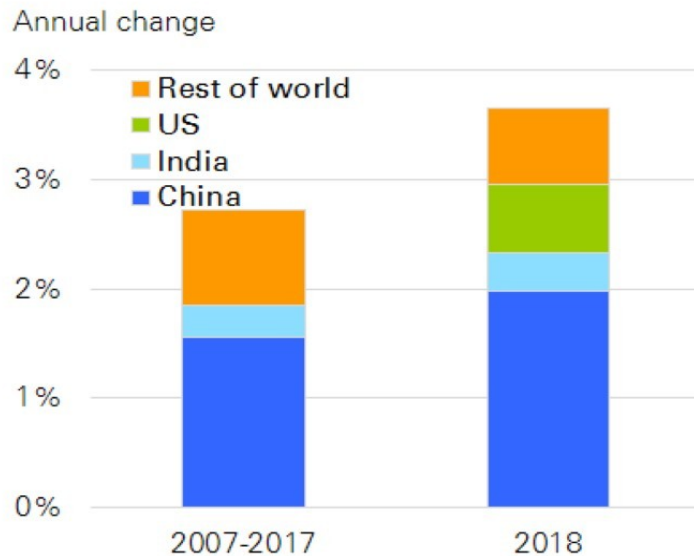


# Power Sector Trends

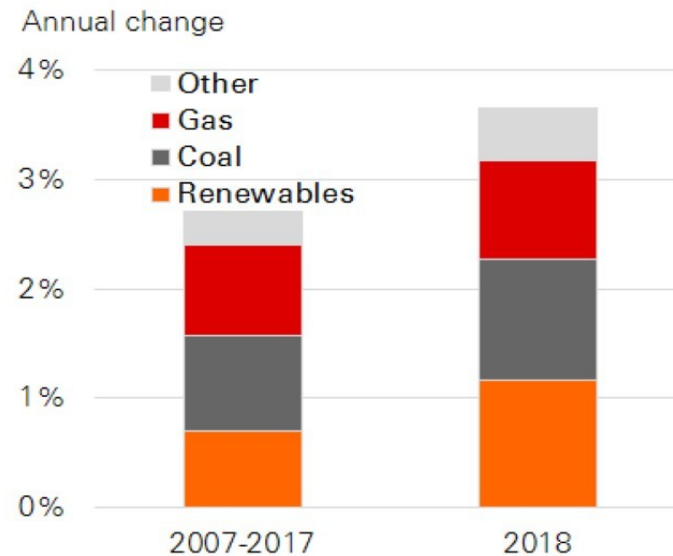


## Growth in power generation

Contributions by region



Contributions by fuel



BP Statistical Review of World Energy

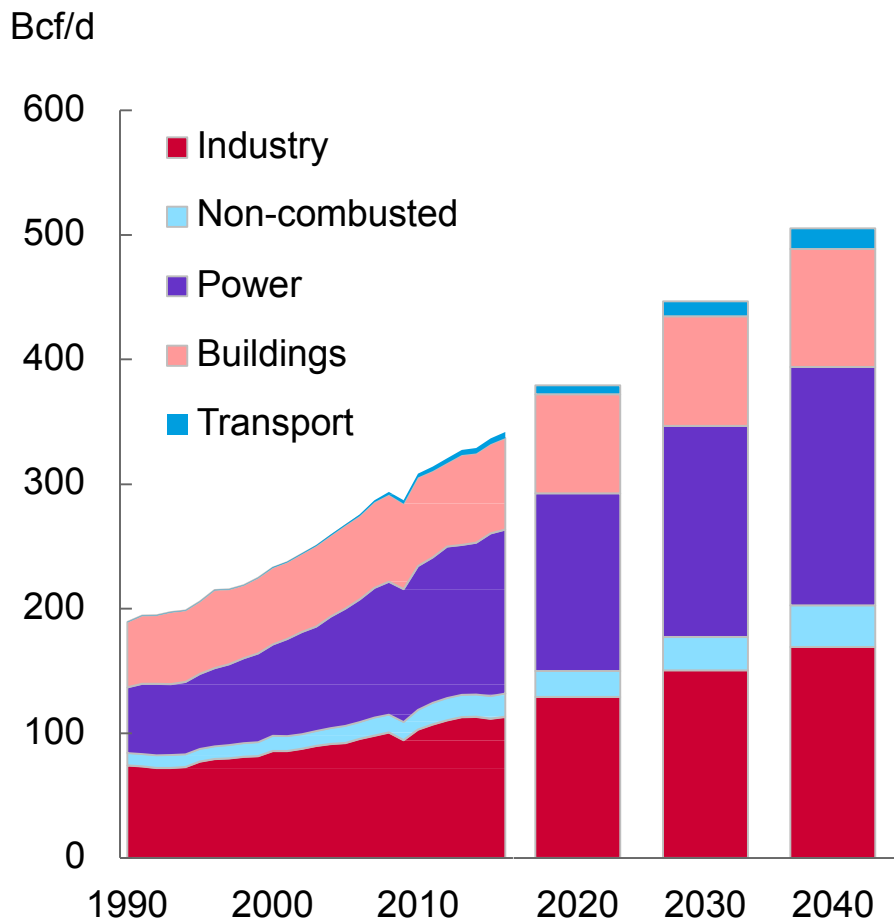
© BP p.l.c. 2019

- GDP growth and power demand are closely correlated
- Electricity demand continues to grow but mix of fuels is changing
- Renewables the largest growing segment, but hydrocarbons still playing a major role
- Existing capacity is cheap to use, even if new capacity is less welcome

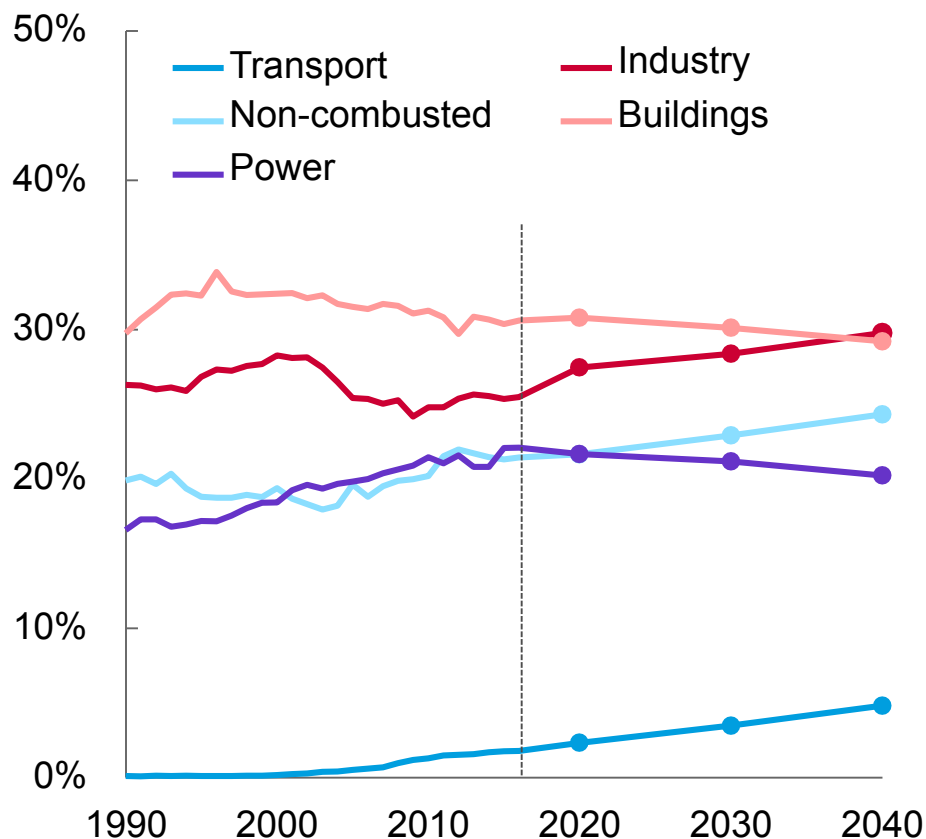


# Natural gas demand growth driven by power and industry

## Gas consumption by sector



## Gas share by sector



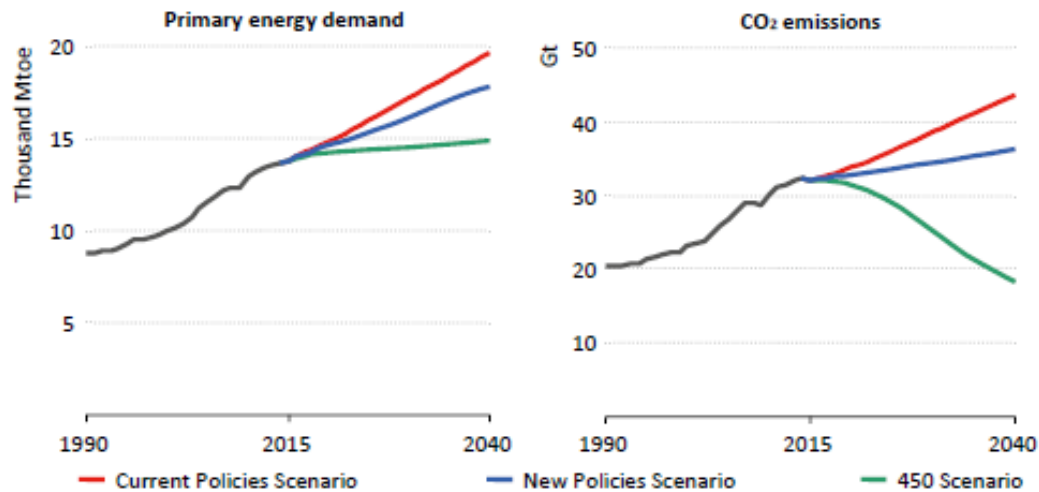
- Industrial demand is key to gas growth, especially petrochemicals
- Demand from power sector also grows, although overall share falls



Having said that, in the longer term global warming is the key issue, and things clearly need to change if we are to meet 2 degree target

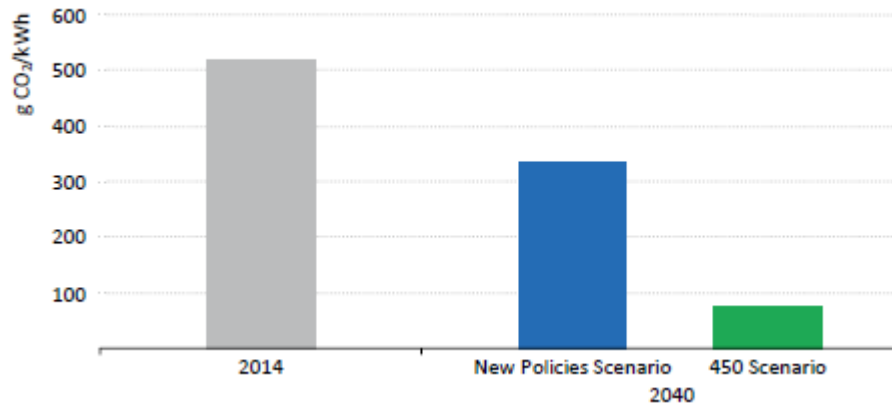
### *Energy demand and CO2 emissions in different IEA scenarios*

Demand must not grow...



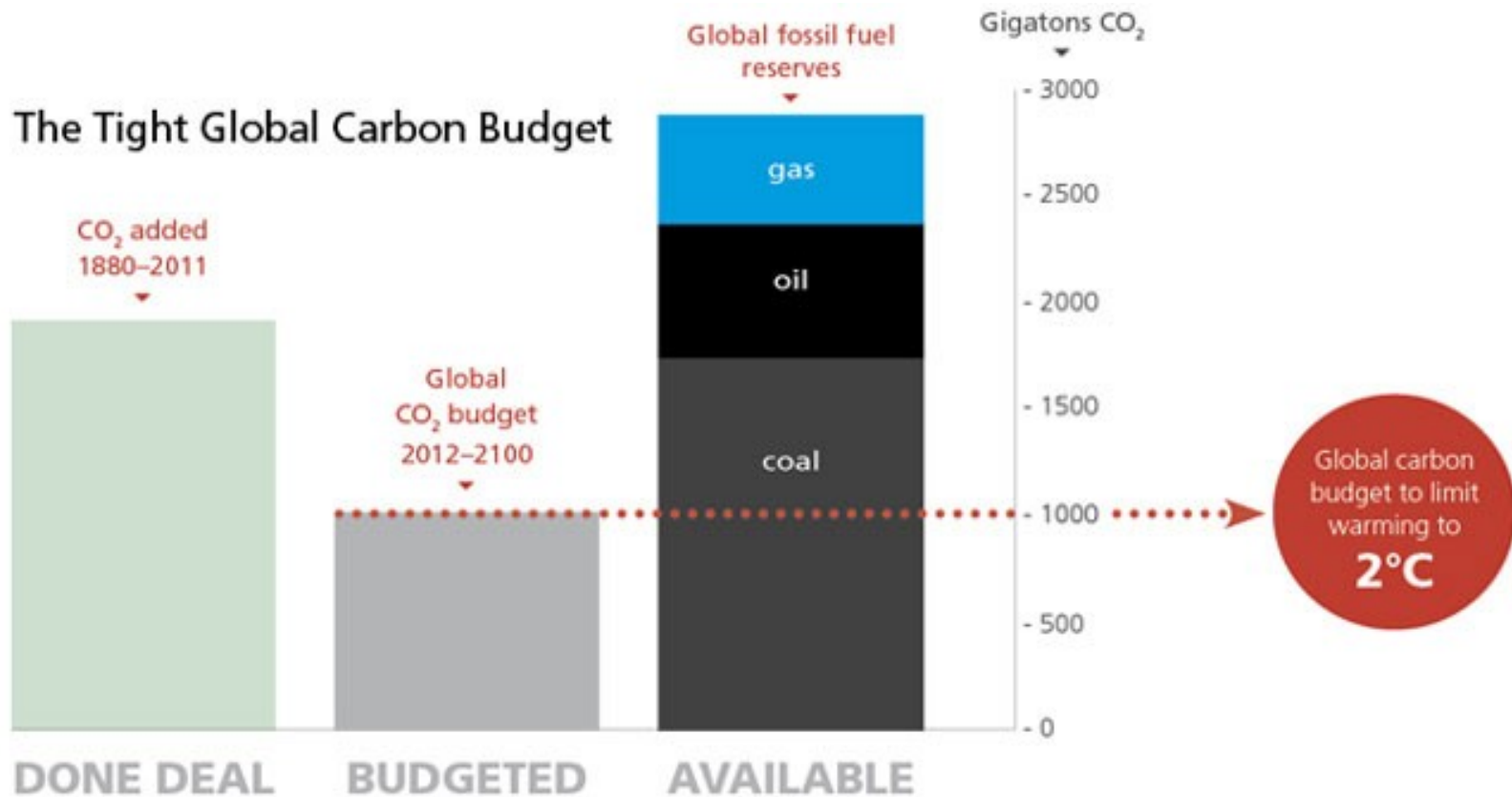
### *Emissions intensity from power sector*

...and renewable output must





# Looking at the global carbon budget, the race is on to produce fossil fuels while you can



- This has vast political and commercial consequences, as countries and companies have to react to a fast changing energy economy
- The futures of Russia and the Middle East are closely bound up to the issue of whether this carbon budget will or can be enforced



# World Energy Demand by Fuel and Scenario

			New Policies		Current Policies		450 Scenario	
	2000	2014	2025	2040	2025	2040	2025	2040
Coal	2 316	3 926	3 955	4 775	4 361	5 327	3 175	3 326
Oil	3 669	4 266	4 577	4 775	4 751	5 402	4 169	3 326
Gas	2 071	2 893	3 390	4 775	3 508	4 718	3 292	3 301
Nuclear	676	662	888	1 181	865	1 032	960	1 590
Hydro	225	335	420	536	414	515	429	593
Bioenergy*	1 026	1 421	1 633	1 883	1 619	1 834	1 733	2 310
Other renewables	60	181	478	478	420	809	596	596
<b>Total</b>	<b>10 042</b>	<b>13 684</b>	<b>15 340</b>	<b>17 866</b>	<b>15 937</b>	<b>19 636</b>	<b>14 355</b>	<b>14 878</b>
<i>Fossil-fuel share</i>	<i>80%</i>	<i>81%</i>	<i>78%</i>	<i>78%</i>	<i>79%</i>	<i>79%</i>	<i>74%</i>	<i>74%</i>
<b>CO<sub>2</sub> emissions (Gt)</b>	<b>23.0</b>	<b>32.2</b>	<b>33.6</b>	<b>36.3</b>	<b>36.0</b>	<b>43.7</b>	<b>28.9</b>	<b>18.4</b>

- The outcomes for hydrocarbons are very different in scenarios that look at current likely outcomes versus outcomes needed to meet climate targets
- In a world where we meet the 2 degree target, coal demand would halve from current levels and oil demand would fall by 25%
- However, fossil fuel share would still be 58% in 450 Scenario



# Conclusions from COP26



- Future of hydrocarbons, especially coal but also oil and gas
- Future of transport – zero emissions for all new vehicles by 2035/40
- Establishment of global carbon trading
- Agreement on limiting methane emissions
- Setting of net zero targets – how serious are these?
- Removal of energy price subsidies – impact on hydrocarbon demand?
- Technology neutrality for reducing carbon emissions – can carbon capture and nature-based solutions play a role and what is impact on hydrocarbon demand?
- Funding for developing nations – impact on pace of transition



# Capital Spending in the Energy Sector

	2010-15*	New Policies		Current Policies		450 Scenario	
	Per year	Cumulative	Per year	Cumulative	Per year	Cumulative	Per year
Fossil fuels	1 112	26 626	1 065	32 849	1 314	17 263	691
Renewables	283	7 478	299	6 130	245	12 582	503
Electricity networks	229	8 059	322	8 860	354	7 204	288
Other low-carbon**	13	1 446	58	1 259	50	2 842	114
<b>Total supply</b>	<b>1 637</b>	<b>43 609</b>	<b>1 744</b>	<b>49 098</b>	<b>1 964</b>	<b>39 891</b>	<b>1 596</b>
Energy efficiency	221	22 980	919	15 437	617	35 042	1 402

\* The methodology for energy efficiency investment derives from a baseline of efficiency levels in different end-use sectors in 2014, the annual figure for energy efficiency in this column is the figure only for 2015. \*\* Includes nuclear and CCS.

- Uncertainty creates a reluctance to invest, but huge amounts of capital will be required to provide energy for a growing population
- Two interesting questions emerge:
  - Will sufficient capital be found to maintain growth in renewables, especially if subsidies start to be removed?
  - Will there be sufficient incentive to invest in the hydrocarbons that will still be needed, if competition drives prices down?
- How much should be left to markets and how might governments intervene?



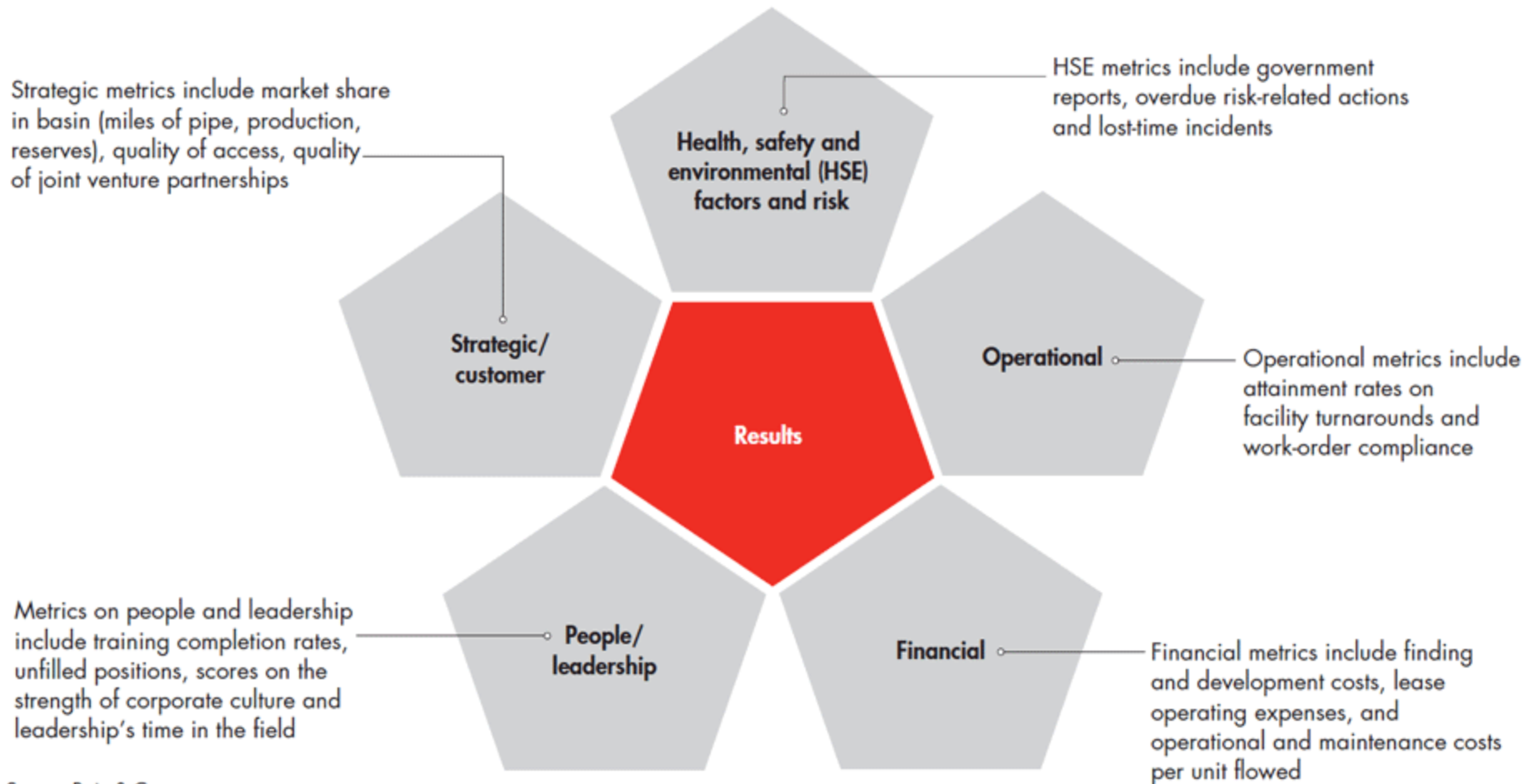
# Key Questions for Company Management

- How much profit can I generate?
- How can I grow the business?
- Where can I grow the business?
- What are the long-term prospects for my industry?
- What are my competitors doing?
- What rules must I abide by?
- What government support can I expect?
- What do my owners / shareholders want out of their investment?
- Have I got enough money to invest in my business?
- How do I stay competitive?
- How important is public opinion and how do I keep it on my side?



# Managements have a broad range of responsibilities

*Figure 1:* KPIs should provide a balanced view of the business to give a complete picture of a company's health and performance

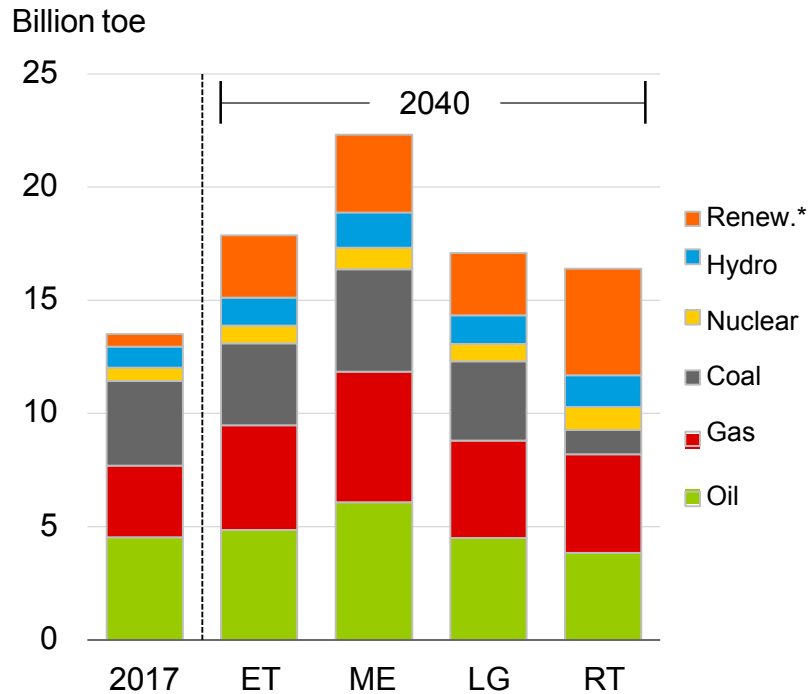


Source: Bain & Company

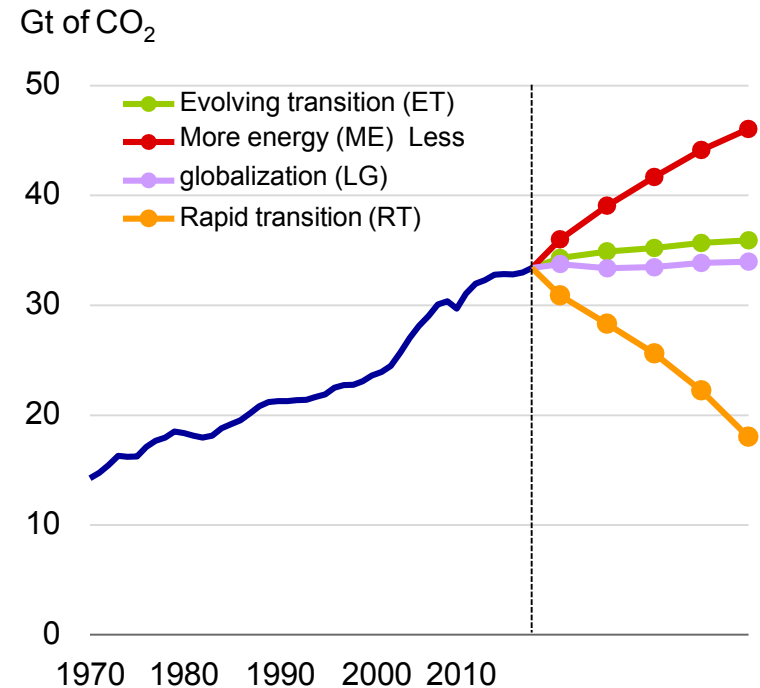


# Which scenario are we heading for?

Primary energy consumption by fuel



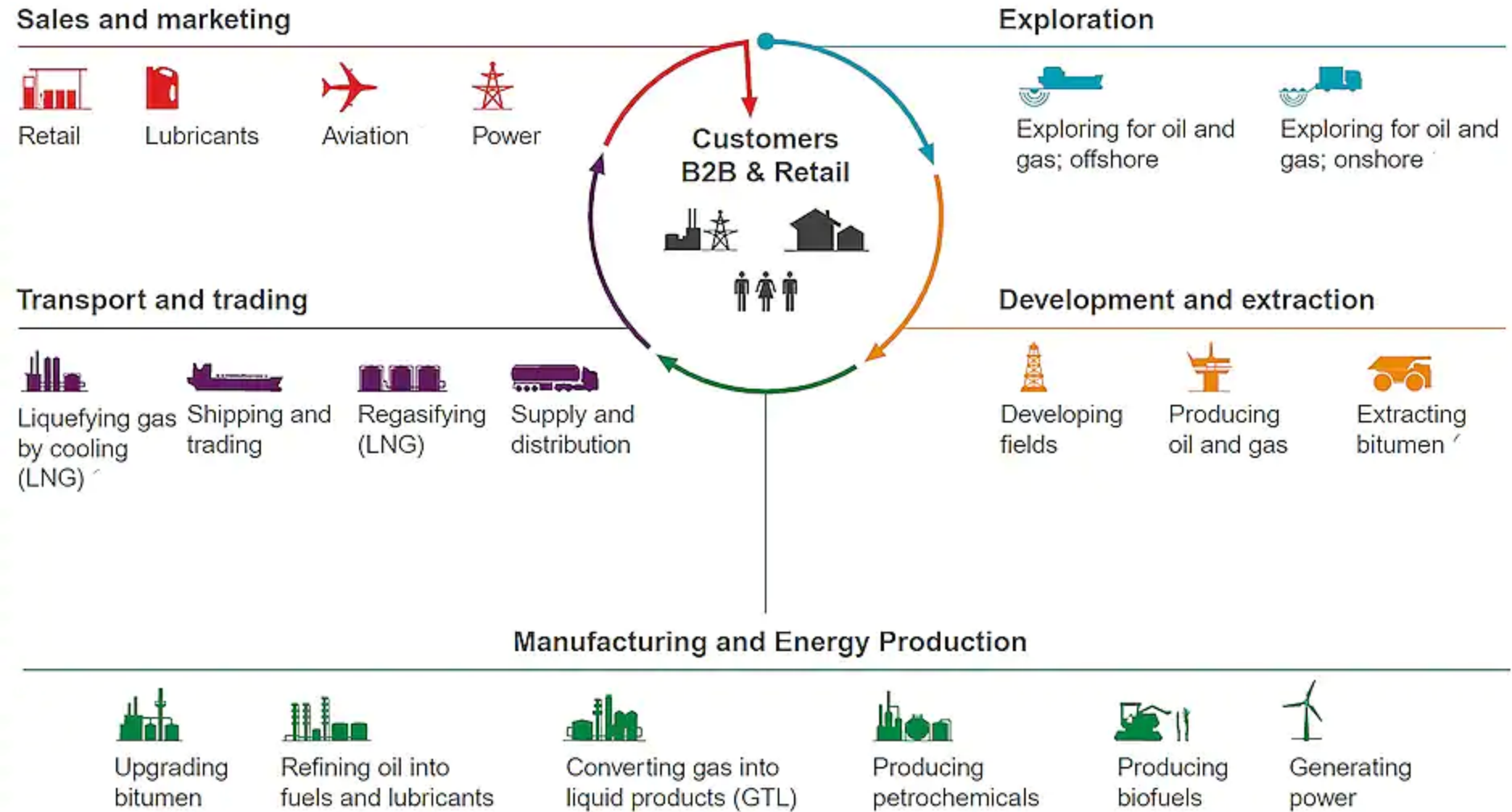
CO<sub>2</sub> emissions



- What level of overall energy demand will there be?
- How much policy implementation will there be to achieve climate targets?
- What will the energy mix be?
- Many of these questions will be answered by politicians, not the market



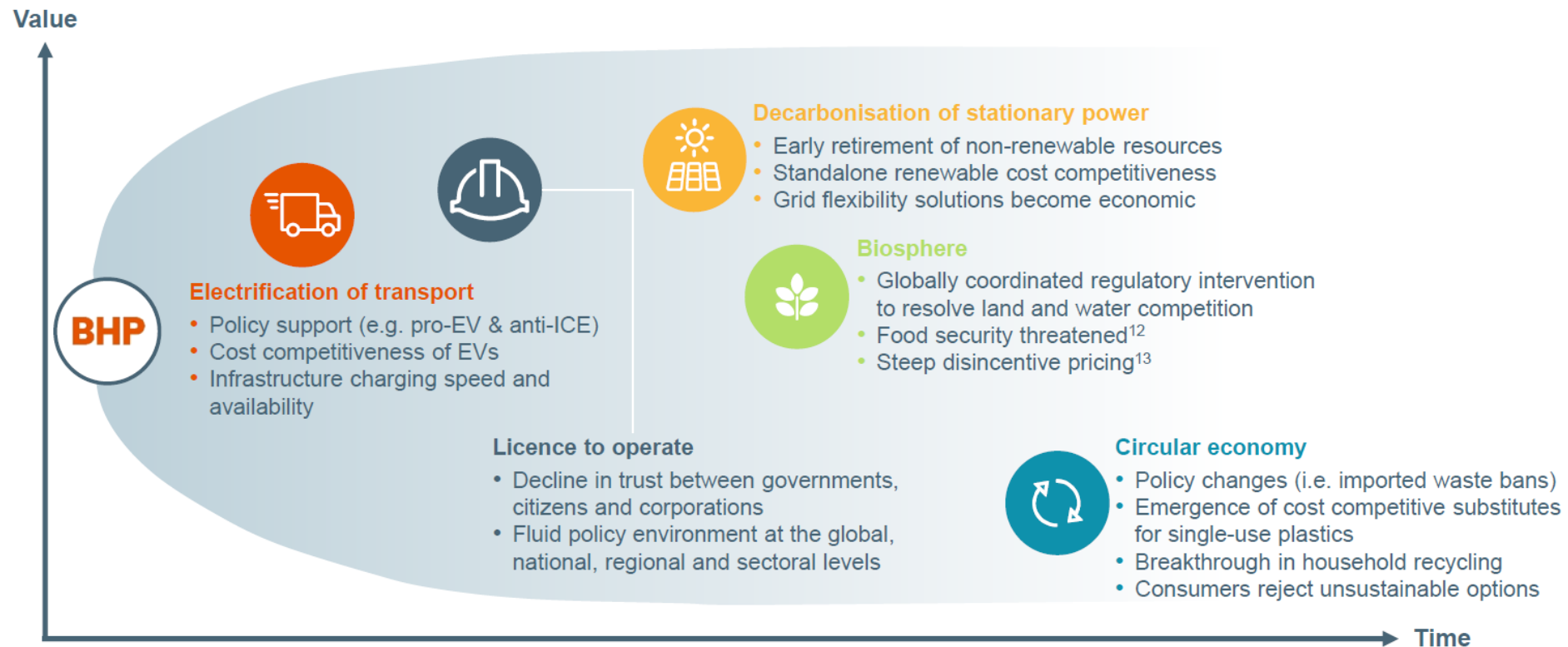
# Strategic thinking for the Energy Transition





# What are the key signposts to tell us which scenario we may be facing?

Understanding the signposts allows us to identify common no-regret actions and future decision points



Note: Represents possible impact on our portfolio if no action is taken to mitigate against risks or seize opportunities. Themes are not mutually exclusive or exhaustive, outcomes from one theme could impact our view on severity, timeframes, or strategic considerations for other themes.

Strategy briefing  
22 May 2019

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**BHP**

- Key differences in timescale and potential cost to the business
- For example, EVs are a relatively short-term risk to the oil business with a fairly significant impact



# Net zero target now a major company objective for BP

Three focus areas where we can make the most difference



*Get to net zero*

Become a net zero company by 2050 or sooner, and help the world get to net zero

*Care for our planet*

Make a positive difference to the environment where we operate


*Improve people's lives*

Support a just energy transition, promoting wellbeing for our workforce and communities where we work

**SUSTAINABLE DEVELOPMENT GOALS**

- Sustainable development goals now a priority
- What will this do to investor returns?
- What are the priorities for key shareholders?

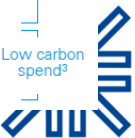
Get bp to net zero



	2025 Targets	2030 Aims	2050, or sooner Aims
Aim 1 <i>Net Zero operations</i>	20%	30-35%	100% <sup>1</sup>
Aim 2 <i>Net Zero oil and gas</i>	20%	35-40%	100% <sup>2</sup>
Aim 3 <i>Halving intensity</i>	5%	>15%	50%
Aim 4 <i>Reducing Methane</i>	0.20% <small>Measurement approach in place by 2023</small>		Timeline to achieve 50% reduction to follow
Aim 5 <i>More \$ for new energies</i>	\$3-4bn	~\$5bn	↑

Emissions reductions

Low carbon spend<sup>3</sup>



(1) Net zero across operations (2) Net zero for oil and gas (3) Methane Reduction

# Equinor is slightly more nuanced – keep production growing while shifting business model

## Key messages

### Growing production, cash flow and returns

- Around 3% annual production growth 2019-2026
- Organic cash flow around USD 30 billion 2020-2023
- RoACE around 15% in 2023

### Driving long term value creation, in line with the Paris Agreement

- Industry leading carbon efficiency
- Value driven growth in renewables
- Reducing net carbon intensity by at least 50%

### Delivering competitive capital distribution

- Quarterly dividend of 27 cents per share
- Second tranche of share buyback around USD 675 million



16 |

- Equinor is rather between BP and Exxon – use current business to fund transition strategy
- Logical but could cause conflict of interest over capital allocation



# The ExxonMobil View

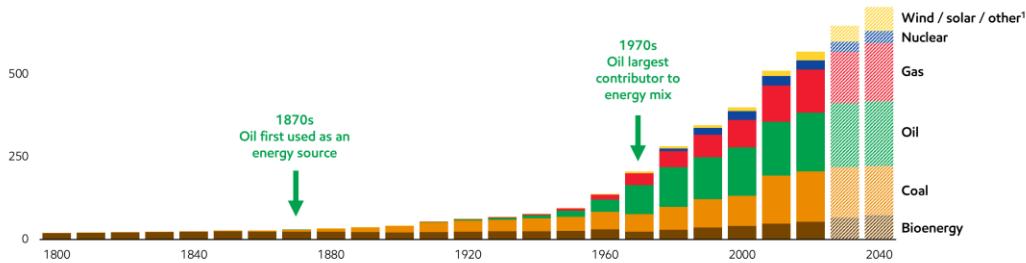
## ENERGY EVOLUTION

Scale and infrastructure requirements limit pace of energy transition

PRIMARY ENERGY DEMAND, IEA STATED POLICIES SCENARIO

Quadrillion BTUs

750



- Evolution of energy system will require time given scale, complexity, and society's needs
- Availability and affordability critical for wide-scale adoption

Source: 1800 - 1960 from Smil; 1970 - 2000 from IEA and ExxonMobil analysis; 2010 - 2040 from IEA World Energy Outlook STEPS scenario

<sup>1</sup>Other includes geothermal and hydro  
See supplemental information

- The world is going to continue on a similar path
- Energy demand will rise and hydrocarbons will continue to have a vital role
- Change will be slow and incremental

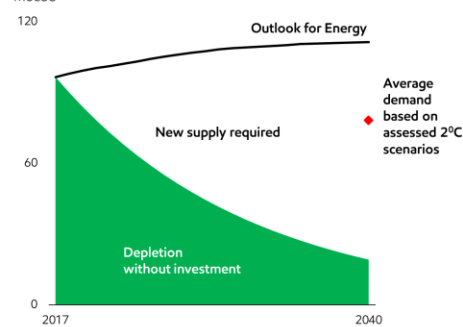
- Oil and gas demand are in natural decline from existing assets
- Demand still needs to be met, even if it does start to fall
- The most efficient and low cost companies can prosper

## LIMITED ALTERNATIVES SUPPORT INVESTMENTS

Depletion drives level of investments

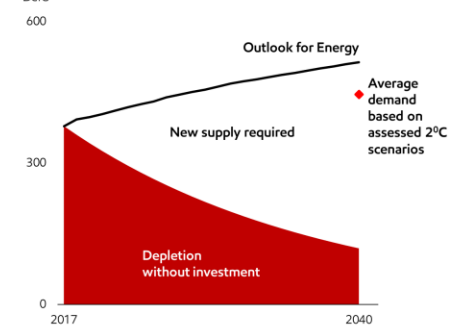
GLOBAL OIL SUPPLY AND DEMAND

Moebd



GLOBAL NATURAL GAS SUPPLY AND DEMAND

Bcfd



Source: 2019 ExxonMobil Outlook for Energy

- Significant new supplies needed across range of demand scenarios
- IEA estimates approximately \$20 trillion<sup>1</sup> of oil and natural gas investment needed by 2040

# NOCs in Asia also see growth to fuel developing economies

## ONGC: Growth Pursuits



### ➤ Aggressive Investment in Upstream

- E&P expenditure of about ₹ 1,50,000 Crore in last 5 years
- 10 Projects costing ₹ 13,000 Crore completed during FY'19

### ➤ 25 Projects under execution

- 18 Development and 7 Infrastructure Projects - Investment more than ₹ 83,000 Crore
- Envisaged lifecycle Gains of 72 MMT (Oil) and 116 BCM (Gas)

- India's ONGC is very keen to find new hydrocarbons to reduce the country's import bill and to supply growing domestic demand
- In addition, gas to replace coal and also improve the environment



# RWE is diversifying its asset base away from hydrocarbon-fired power

## Business model fully aligned with our strategic focus on the energy transition

### Core

**Offshore wind** 


- Global offshore activities



**Onshore wind/Solar** 

- Onshore and solar operations in
  - Europe & APAC
  - Americas



**Hydro/Biomass/Gas** 

- Hydro, biomass and gas plants in Germany, UK, Netherlands
- Kelag stake



**Supply & Trading** 

- Trading/origination
- Gas & LNG
- Commodity solutions
- Principal investments
- Gas storage business



### Coal/Nuclear

- German lignite operations; mines and plants
- German hard coal plants
- German nuclear power plants
- Holding in Dutch EPZ (nuclear)



**~28 GW**

Installed capacity<sup>1</sup>

**299 g/kWh**

Carbon factor<sup>2</sup>

**23%**

Share of coal in Group revenues

<sup>1</sup> Pro rata installed capacity of core business. | <sup>2</sup> Calculated for pro forma generation portfolio of core business. | Note: Figures for FY 2019.

- RWE manages a significant part of Germany's lignite-fuelled power fleet
- However, it is gradually reducing its exposure and selling off nuclear assets
- Renewables becoming a the main focus of the business, but trading activity is also growing in order to offset volatility and intermittency risks



# ENEL, Italy's main power company, has committed to leadership in renewable power

Our positioning

## Enel's leadership in the new energy world



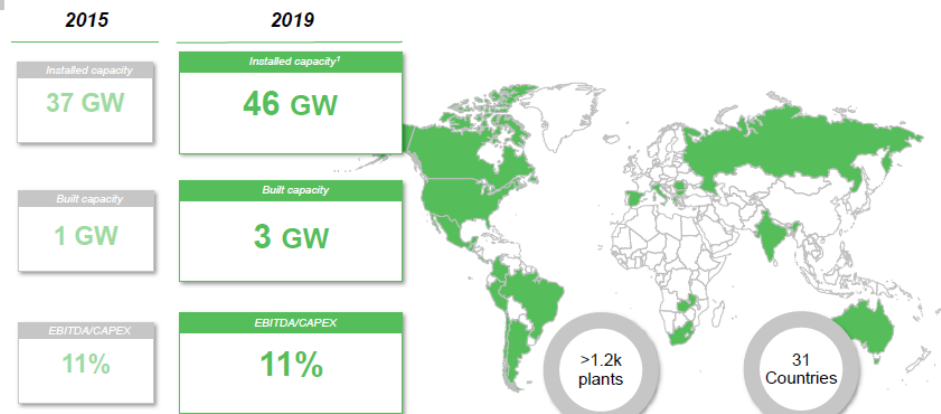
1. By number of end users. Publicly owned operators not included  
 2. By installed capacity. Includes managed capacity for 3.7 GW  
 3. Including customers of free and regulated power and gas markets

5

- Global renewables business model
- Operates across the electricity value chain
- Rapid increase in capacity and output

Sustainability = Value

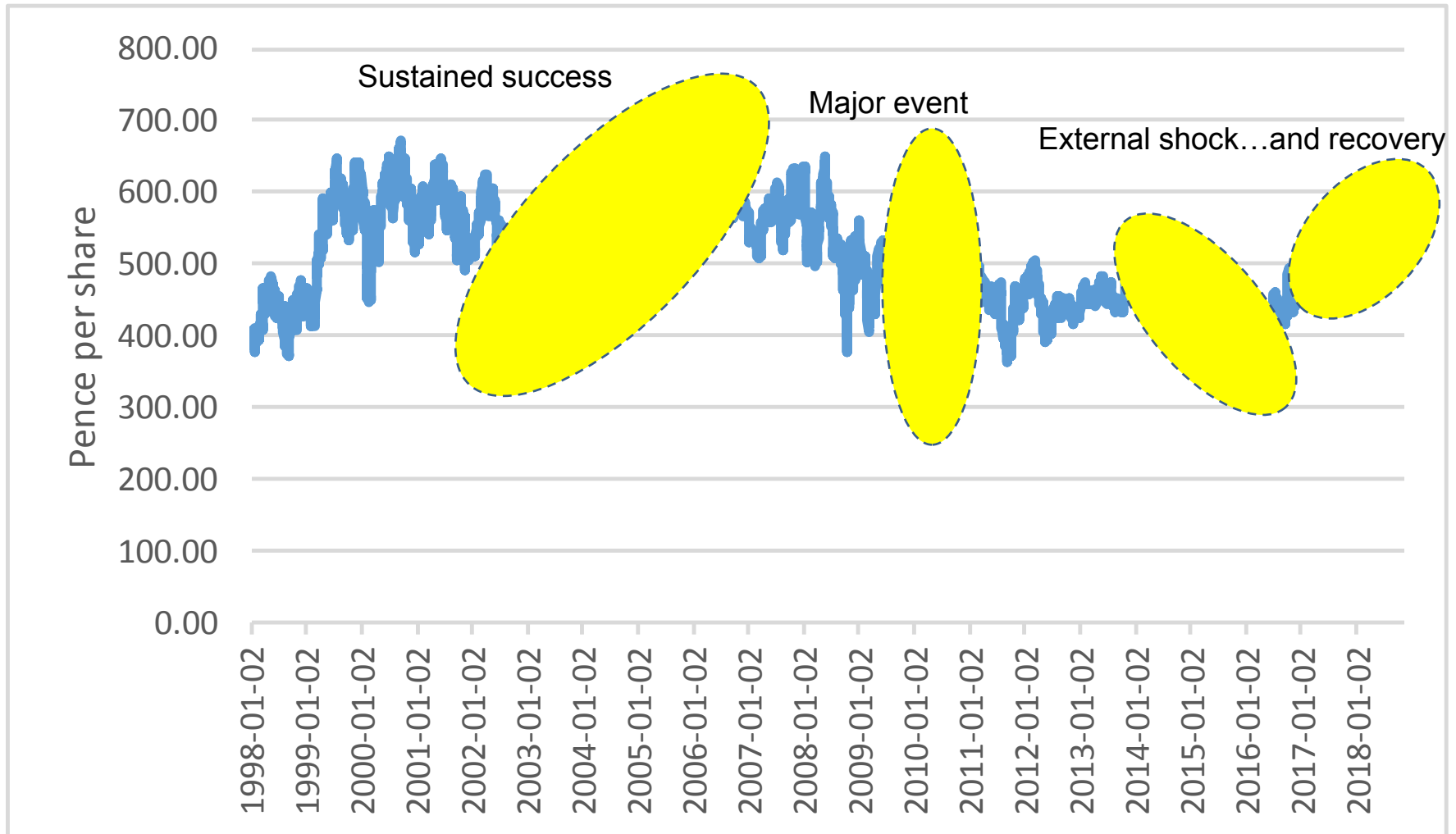
## ...to become the world leader in renewables



1. Including managed capacity by 3.7 GW

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# Key Management Driver = The Share Price

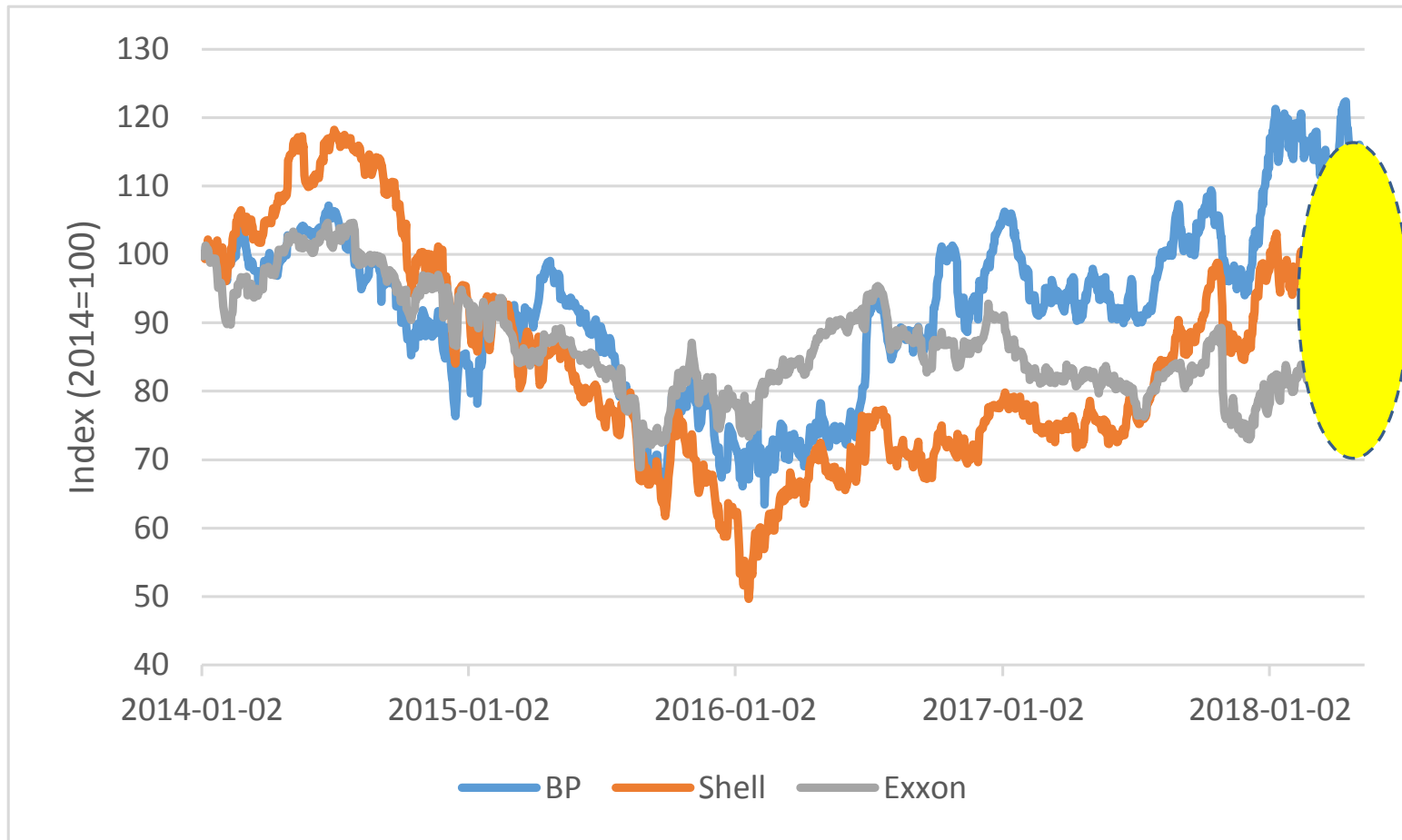


- Management incentives often driven by the share price as one key objective





# Share price relative to Peer Group



- In the shorter term, BP has outperformed its major European and US competitors
- BP has been in recovery mode, but the final settlement of US court action has provided a boost



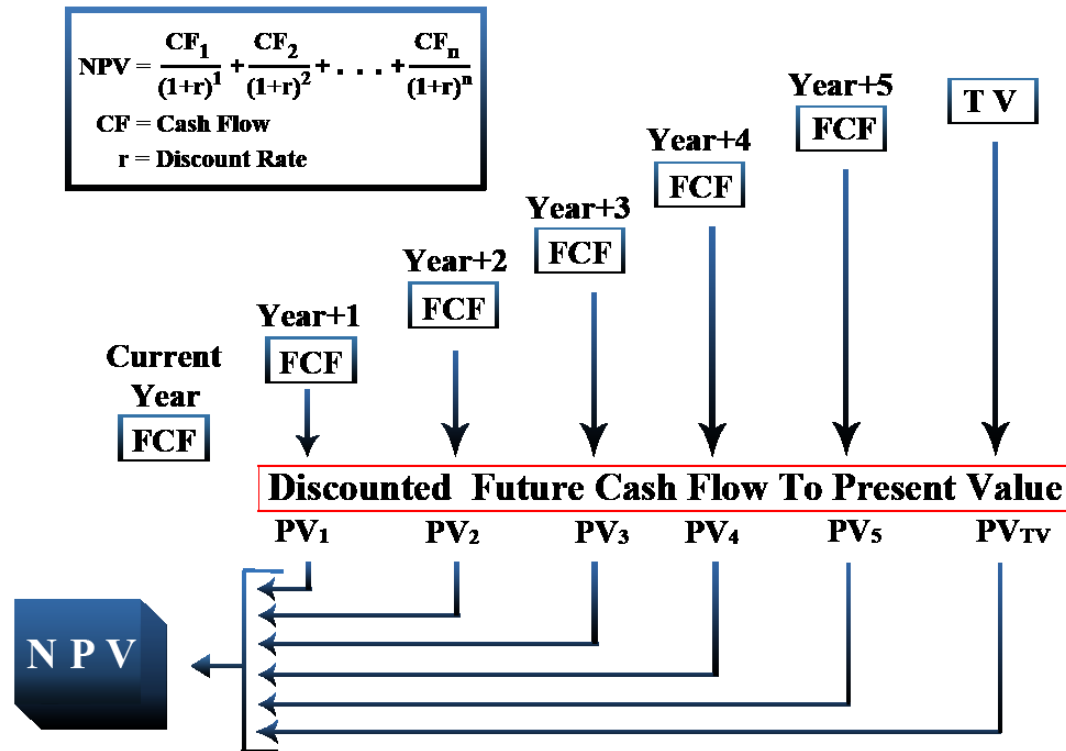
# Credit Agencies and Banks also have to be convinced



- Any project has to pass the scrutiny of banks who may be involved in financing it or lending to the company as a whole
- Credit Agencies can influence the cost of debt, and will also test the robustness of a company and its investments



# The DCF Calculation as a foundation

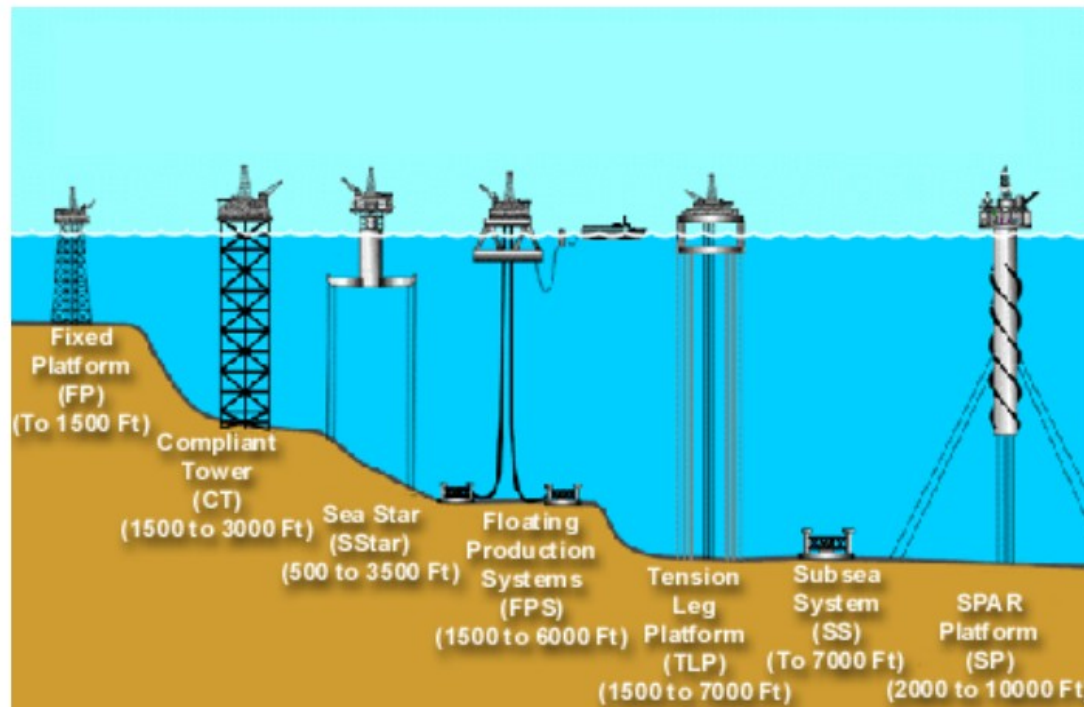


- Management thought process is encapsulated in the DCF model
  - Key assumptions include price, cost, tax, long-term outlook, short-term cashflow and the value of money
- Management must ensure at all times that the combined value of their assets remains NPV positive, and should aim to maximise the return on their assets

# What is the management thought process?

## Development of an oil discovery

### WATER DEPTH AND TYPE OF PLATFORM



# Key Issues

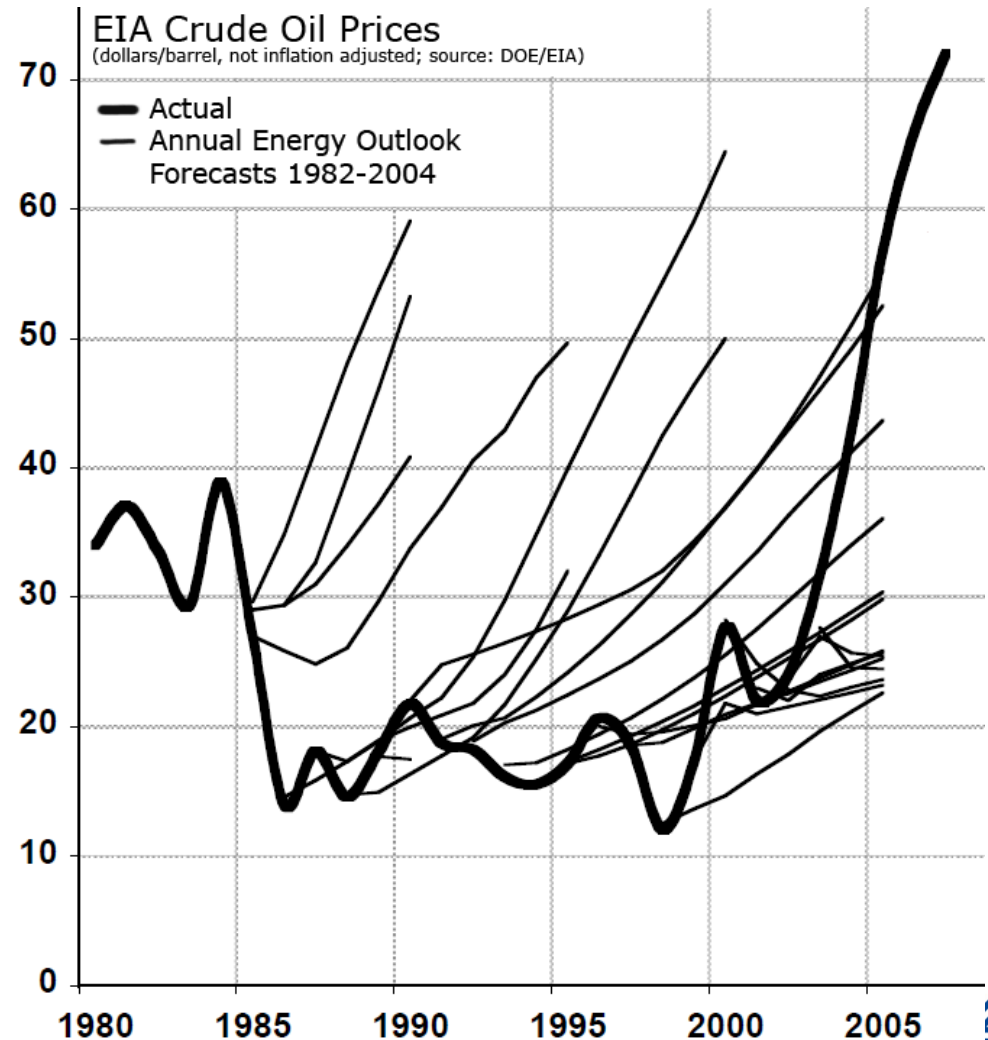
- Size of discovery
- Location / access to infrastructure
- Tax regime
- Local content requirement
- Development cost
- Net present value
- Future oil price expectation
- Future oil demand expectation
- Local politics
- Legal and institutional framework
- Type of financing
- Partner credit-worthiness
- Time to cost recovery
- Breakeven oil price



# Oil price forecasting – an imprecise art largely based on optimism

## *Various US oil price forecasts*

- Consensus is normally that prices will rise from current levels
- Companies plan using a “worst case” scenario assumption – any project must be viable at “US\$xx/bbl
- Scenario planning attempts to create alternative outcomes
- Safest assumption is that the consensus will always be wrong



# Topics of interest

- Impact of new technology
- Cost inflation/deflation and the oil price
- Changing tax regimes
- Political risk
- Partner risk
- Oil companies and their local responsibilities
- Health and Safety
- Shareholder responsibilities
- Corporate and social responsibility
- Oil spill risk
- Electric and gas-fuelled cars



# What is the management thought process?

## Development of a gas field





# Key Issues

- Access to market
- Export technology
- Total cost
- Outlook for medium and long-term gas demand
- Outlook for coal demand and price
- Competing sources of gas supply
- Breakeven gas price
- Associated liquids
- Length of sales contract available
- Price formation mechanism
- Securing finance
- HSE issues



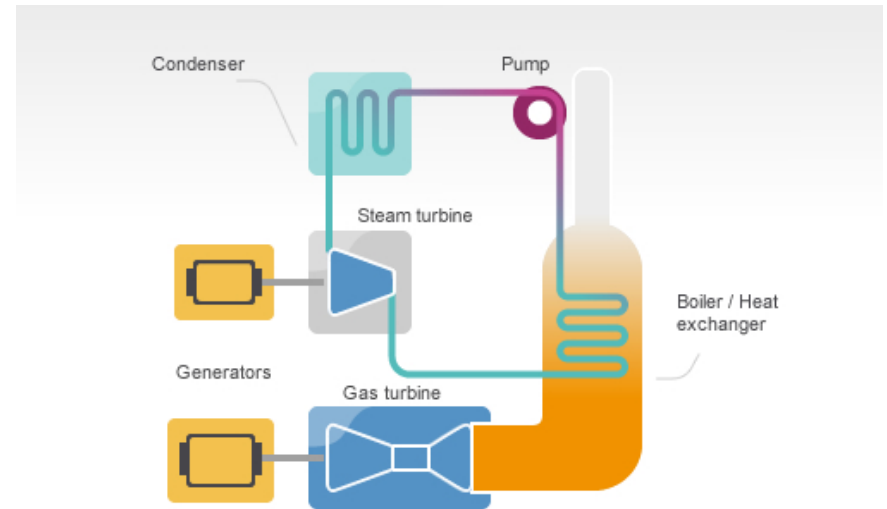
# Topics of interest

- Is the gas market becoming like the oil market
- Is gas the cleanest fossil fuel?
- Will methane demand be displaced by other forms of gas?
- Can CCUS be developed in time?
- The impact of Russia on security of supply concerns
- Shale gas – a good or bad thing?
- Can anywhere else replicate US shale gas success?
- Pipeline gas versus LNG – which to choose?
- Domestic versus export markets
- Subsidised prices



# What is the management thought process?

## Construction of a fossil fuel power station



# Key Issues

- Economics of project
- Pricing mechanisms
- Likely plant utilisation
- Availability of government support
- Security of supply for fuel input
- Expected cost of fuel input
- Availability of renewable energy at zero marginal cost
  - Domestic
  - Imported
- Grid infrastructure requirements
- Country plan for power generation mix to 2050
- Possible carbon capture technology
- Development of off-grid power sources



# Topics of interest

- Biogas as an alternative power source
- Carbon capture and storage – will it ever be viable?
- Coal versus gas power – the energy trilemma
- Is gas-fired power the ideal back-up for renewables?



# Carbon capture and storage

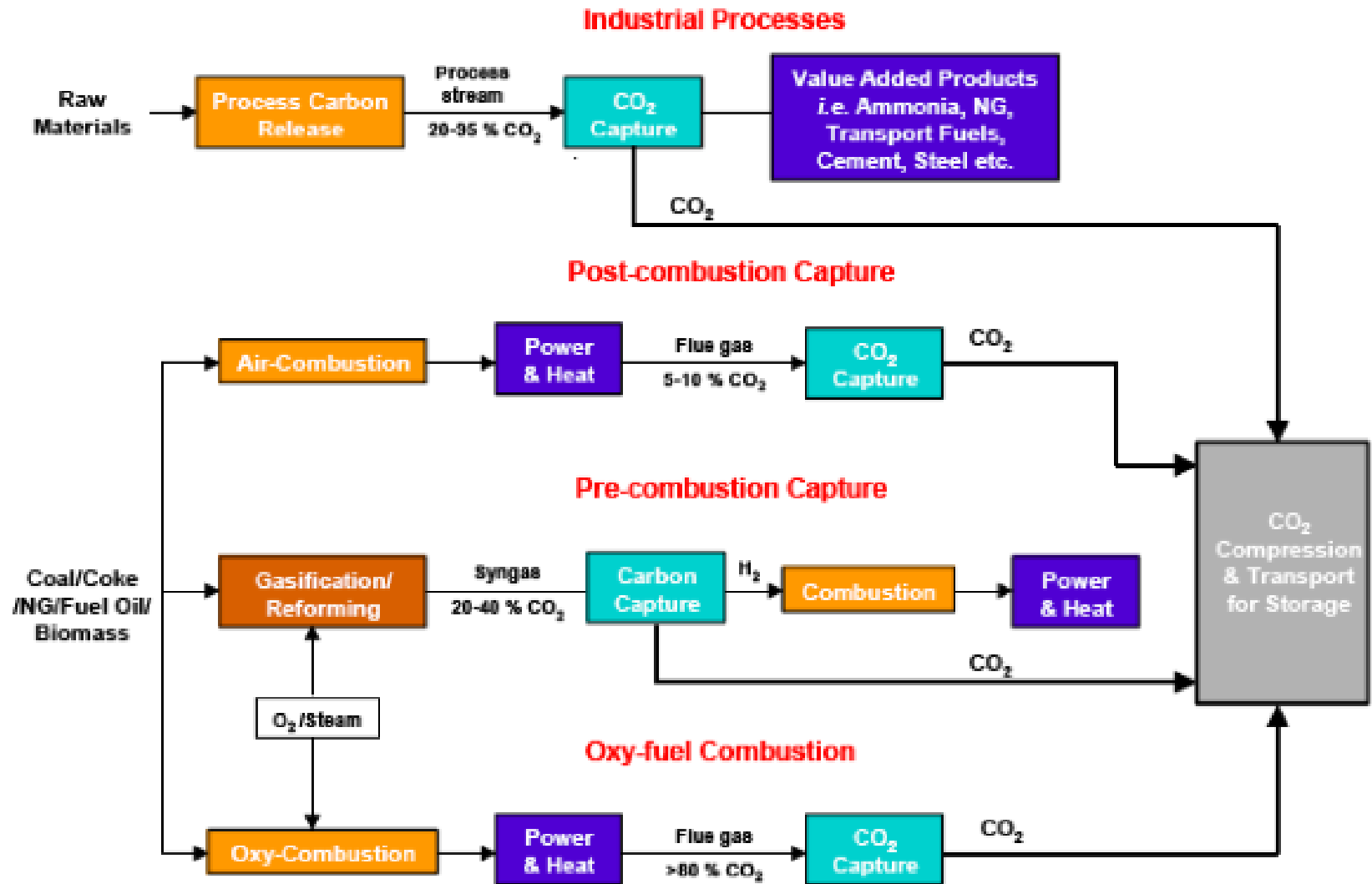
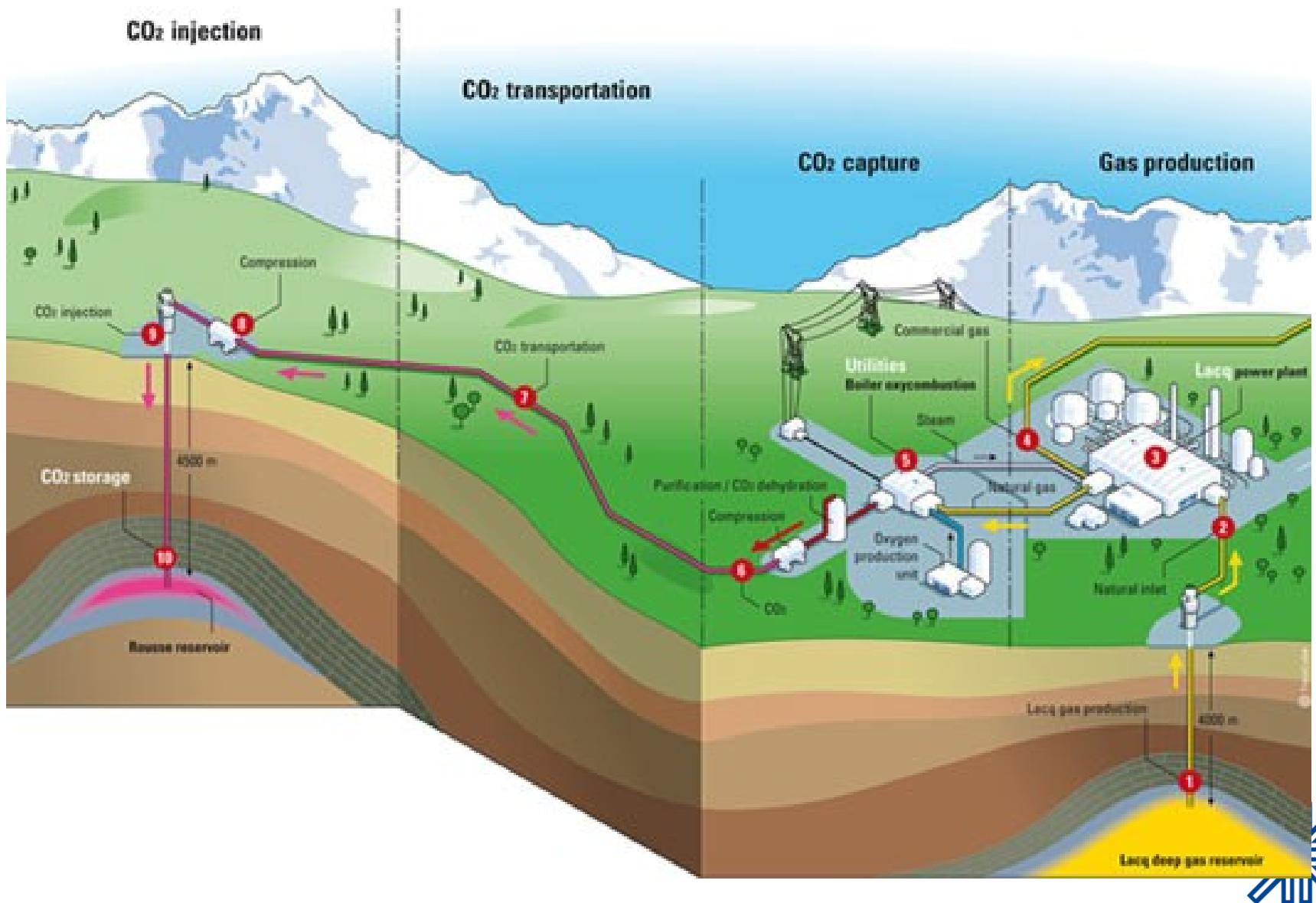


Figure 3: Technology CO<sub>2</sub> capture pathways in fossil fuel conversion and industrial processes (Courtesy of Gupta and Pearson, NRCan)

# Carbon capture and storage



# What is the management thought process?

**Major truck fleet owner or shipping magnate**





# Key Issues

- Relative fuel prices (short and long-term)
- Distance driven before re-fill / re-charge
- Environmental legislation
- Customer demands (public opinion)
- Cost of changing technology
- Re-fuelling infrastructure
- Commitment of truck/car/ship manufacturers
- Longer term technology advances
- Competitor activity (what is everyone else doing?)
- Social responsibility

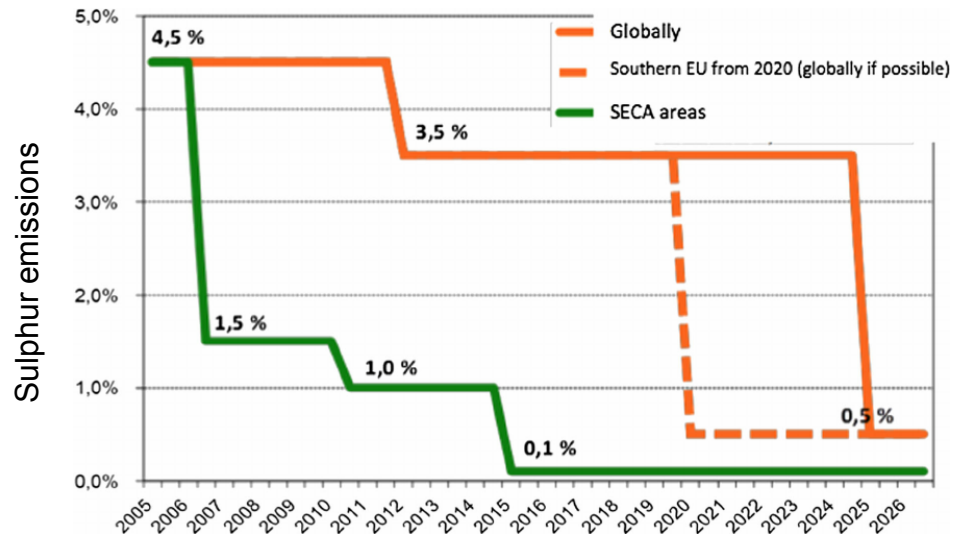


# Topics of interest









- Maritime shipping emissions legislation (IMO)
- Power of engines (LNG trucks versus electric vehicles)
- Trucking fleets with own infrastructure and standard routes
- Commitment of vehicle manufacturers – when does the market demand change
- Battery technology a key constraint
- Fuel efficiency versus change in fuel
- Impact of lower oil prices – reduces incentive to change
- Status quo effect – no-one ever got fired for choosing IBM



# IMO Worldmap for ECA's (Emission Control Areas)



# LOWER GREENHOUSE GAS EMISSIONS

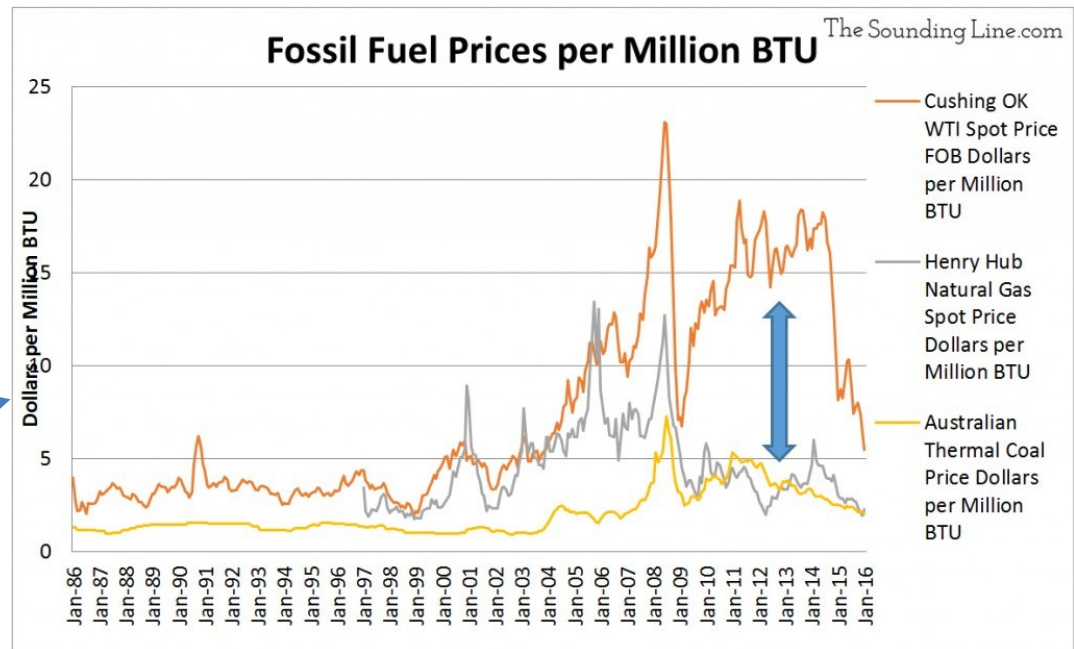
	Extraction	Processing	Transportation and storage	Emissions at end use	Total life cycle
Natural gas (LNG)	 <b>94 g/km</b>	 <b>25 g/km</b>	 <b>55 g/km</b>	 <b>842 g/km</b>	<b>1016 g/km</b>
Diesel	 <b>148 g/km</b>	 <b>132 g/km</b>	 <b>6 g/km</b>	 <b>1079 g/km</b>	

Based on Natural Resources Canada's GHGenius model, version 3.15.  
Assumes use of Westport Innovations 15 litre HD engine system.



The environmental case is relatively clear....

...but is only of interest to companies if the oil and gas price differential is wide



# What is the management thought process?

## Construction or maintenance of a gas pipeline



# Key Issues

- Sources of throughput
- Long-term future of fuel
- Payback timescale
- Government support (regulated prices)
- Alternative uses for pipeline
- Security of gas producing company
- Security of gas buyer
- Availability of finance
- Cost of dismantling asset



# Topics of interest

- Alternative uses for gas pipelines
  - Hydrogen (electrolysis or methane conversion)
  - Biogas (local grids)
  - CO2 (if CCS works)
- Pipeline networks are major national assets with strategic implications
- Pipeline tariffs may rise if the assets useful life shortens
  - Need to recover cost sooner



# Conclusions

- The Energy Trilemma – Price versus Environmental Impact versus Security of Supply
- Economics normally trumps everything else
- Uncertainty creates a disincentive to invest, which creates its own security of supply risks
- Government support beyond renewables is almost inevitable – what does this say for free markets?
- As fossil fuels near the end-game, declining prices will affect energy companies but will also affect consumer choices
- Government revenues will also be significantly affected, with potential serious geo-political impacts
- Shareholders of energy companies have some interesting choices to make – what returns do they want from their investments?
- Renewables are causing huge disruption to the global energy economy – they are necessary to reduce global warming, but have potential security of supply implications

