Energy Career and Leadership Webinar Series – Spring 2023

Dilemmas in the Energy Transition, and How They Shape My Energy Career

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Dilemmas in the Energy Transition, and How Th

Rich Howe

Senior Vice President, Upstream Transformation

Shell Upstream

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The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this presentation "Shell", "Shell Group" and "Group" are sometimes used for convenience where references are made to Shell plc and its subsidiaries in general. Likewise, the words "we", "us" and "our" are also used to refer to Shell plc and its subsidiaries in general or to those who work for them. These terms are also used where no useful purpose is served by identifying the particular entity or entities. ''Subsidiaries'', "Shell subsidiaries" and "Shell companies" as used in this presentation refer to entities over which Shell plc either directly or indirectly has control. Entities and unincorporated arrangements over which Shell has joint control are generally referred to as "joint ventures" and "joint operations", respectively. "Joint ventures" and "joint operations" are collectively referred to as "joint arrangements". Entities over which Shell has significant influence but neither control nor joint control are referred to as "associates". The term "Shell interest" is used for convenience to indicate the direct and/or indirect ownership interest held by Shell in an entity or unincorporated joint arrangement, after exclusion of all third-party interest.

Forward-Looking Statements

This presentation contains forward-looking statements (within the meaning of the U.S. Private Securities Litigation Reform Act of 1995) concerning the financial condition, results of operations and businesses of Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "aim", "ambition", ''anticipate'', ''believe'', ''could'', ''estimate'', ''expect'', ''goals'', ''intend'', ''may'', "milestones", ''objectives'', ''outlook'', ''plan'', ''probably'', ''project'', ''risks'', "schedule", ''seek'', ''should'', ''target'', ''will'' and similar terms and phrases. There are a number of factors that could affect the future operations of Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this presentation, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for Shell's products; (c) currency fluctuations; (d) drilling and production results; (e) reserves estimates; (f) loss of market share and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets, and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, judicial, fiscal and regulatory developments including regulatory measures addressing climate change; (k) economic and financial market conditions in various countries and regions; (l) political risks, including the risks of expropriation and renegotiation of the terms of contracts with governmental entities, delays or advancements in the approval of projects and delays in the reimbursement for shared costs; (m) risks associated with the impact of pandemics, such as the COVID-19 (coronavirus) outbreak; and (n) changes in trading conditions. No assurance is provided that future dividend payments will match or exceed previous dividend payments. All forward-looking statements contained in this presentation are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Additional risk factors that may affect future results are contained in Shell plc's Form 20-F for the year ended December 31, 2021 (available at www.shell.com/investor and www.sec.gov). These risk factors also expressly qualify all forward-looking statements contained in this presentation and should be considered by the reader. Each forward-looking statement speaks only as of the date of this presentation, **10 February 2023**. Neither Shell plc nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this presentation.

Shell's net carbon footprint

Also, in this presentation we may refer to Shell's "Net Carbon Footprint" or "Net Carbon Intensity", which include Shell's carbon emissions from the production of our energy products, our suppliers' carbon emissions in supplying energy for that production and our customers' carbon emissions associated with their use of the energy products we sell. Shell only controls its own emissions. The use of the term Shell's "Net Carbon Footprint" or "Net Carbon Intensity" are for convenience only and not intended to suggest these emissions are those of Shell plc or its subsidiaries.

Shell's net-Zero Emissions Target

Shell's operating plan, outlook and budgets are forecasted for a ten-year period and are updated every year. They reflect the current economic environment and what we can reasonably expect to see over the next ten years. Accordingly, they reflect our Scope 1, Scope 2 and Net Carbon Footprint (NCF) targets over the next ten years. However, Shell's operating plans cannot reflect our 2050 net-zero emissions target and 2035 NCF target, as these targets are currently outside our planning period. In the future, as society moves towards net-zero emissions, we expect Shell's operating plans to reflect this movement. However, if society is not net zero in 2050, as of today, there would be significant risk that Shell may not meet this target.

Forward Looking Non-GAAP measures

This presentation may contain certain forward-looking non-GAAP measures such as cash capital expenditure and divestments. We are unable to provide a reconciliation of these forward-looking Non-GAAP measures to the most comparable GAAP financial measures because certain information needed to reconcile those Non-GAAP measures to the most comparable GAAP financial measures is dependent on future events some of which are outside the control of Shell, such as oil and gas prices, interest rates and exchange rates. Moreover, estimating such GAAP measures with the required precision necessary to provide a meaningful reconciliation is extremely difficult and could not be accomplished without unreasonable effort. Non-GAAP measures in respect of future periods which cannot be reconciled to the most comparable GAAP financial measure are calculated in a manner which is consistent with the accounting policies applied in Shell plc's consolidated financial statements.

The contents of websites referred to in this presentation do not form part of this presentation.

We may have used certain terms, such as resources, in this presentation that the United States Securities and Exchange Commission (SEC) strictly prohibits us from including in our filings with the SEC. Investors are urged to consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov.

Source: *Shell Definitions & cautionary note*

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Source: *Marathon Petroleum El Paso Refinery, https://www.marathonpetroleum.com/*

Dilemmas in the Energy Transition, and How Th

Some macro-truths

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- Climate impact from human activity is real.

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- Energy Transition to a lower-carbon system is a given.

Dilemmas in the Energy Transition, and How Th

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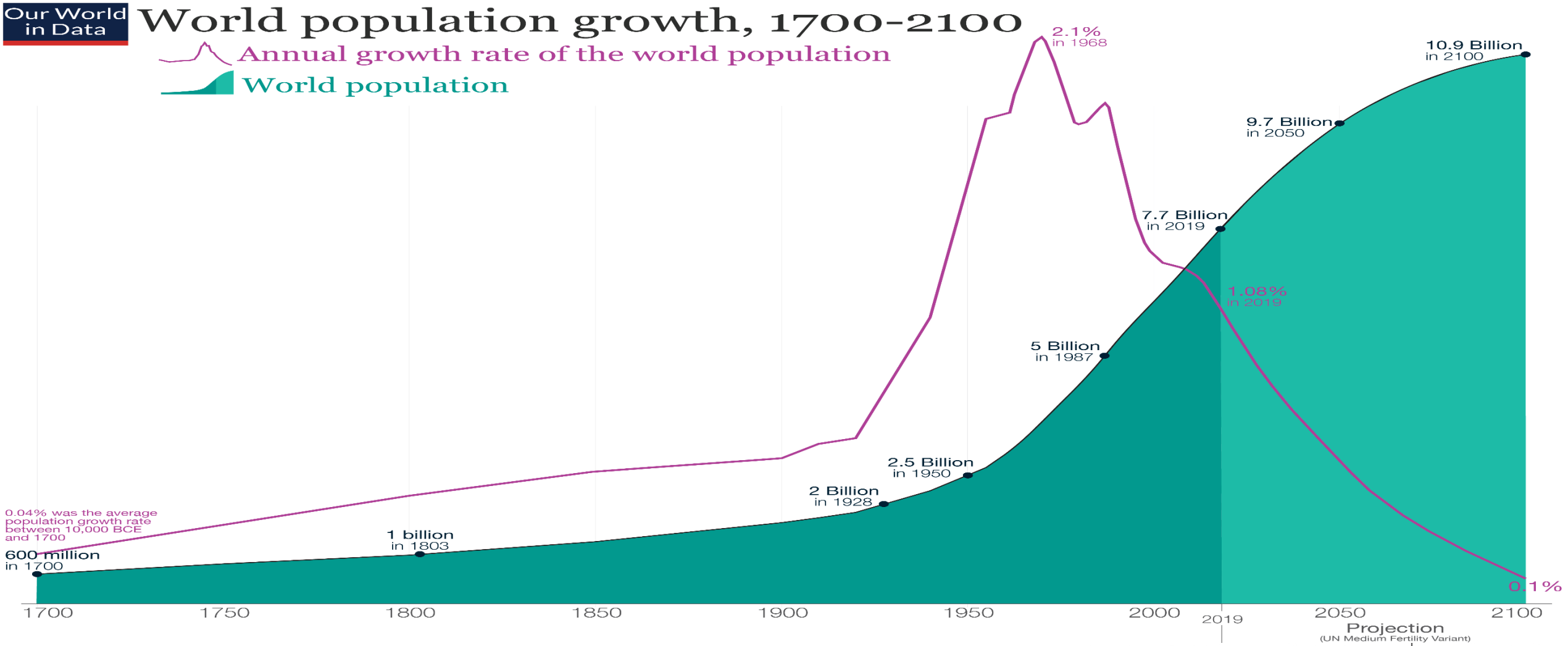
- Energy Transition to a lower-carbon system is a given.
- It’s not yet clear on the exact path from here to there.
- This transition will open some career doors and close others.

Dilemmas in the Energy Transition, and How Th



Source: *Our World in Data based on HYDE, UN, and UN Population Division, 2019*

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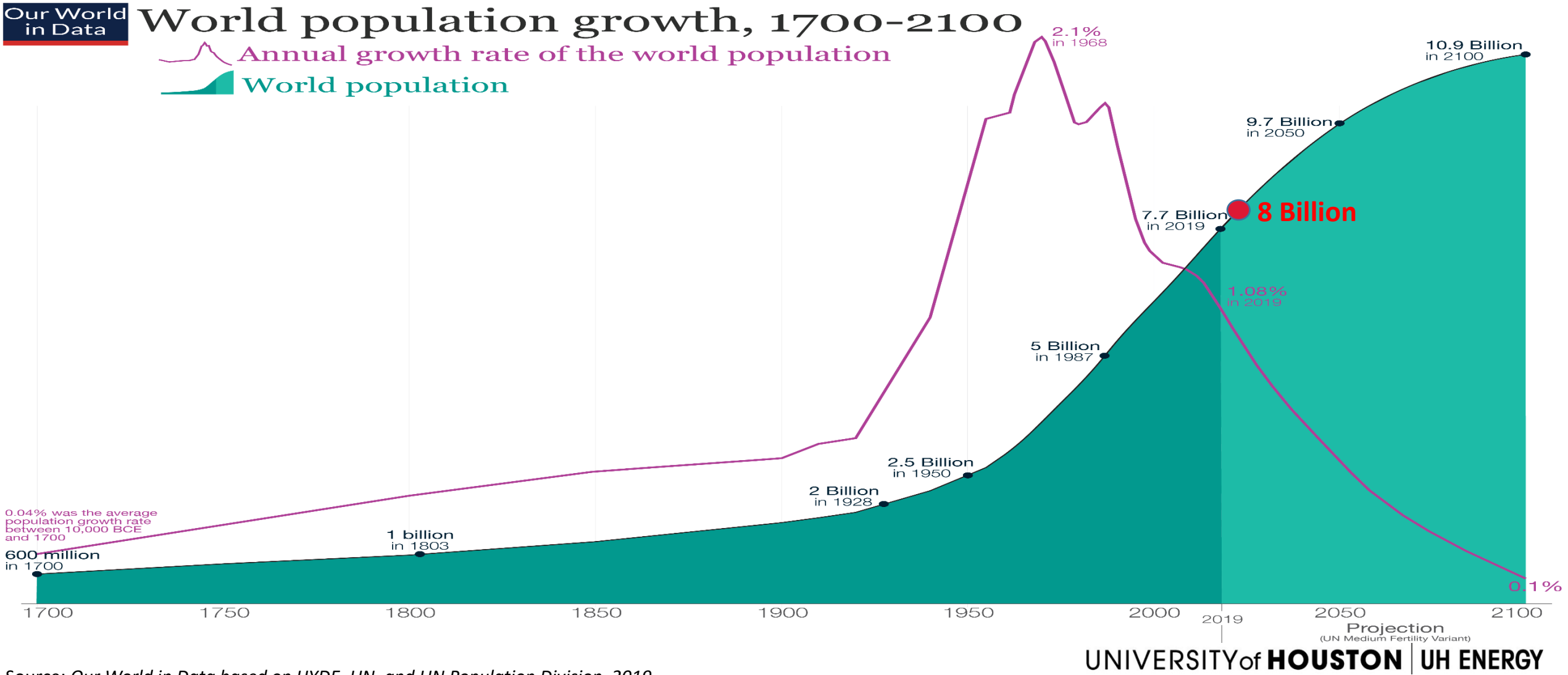
Dilemmas in the Energy Transition, and How Th



Source: *Our World in Data based on HYDE, UN, and UN Population Division, 2019*

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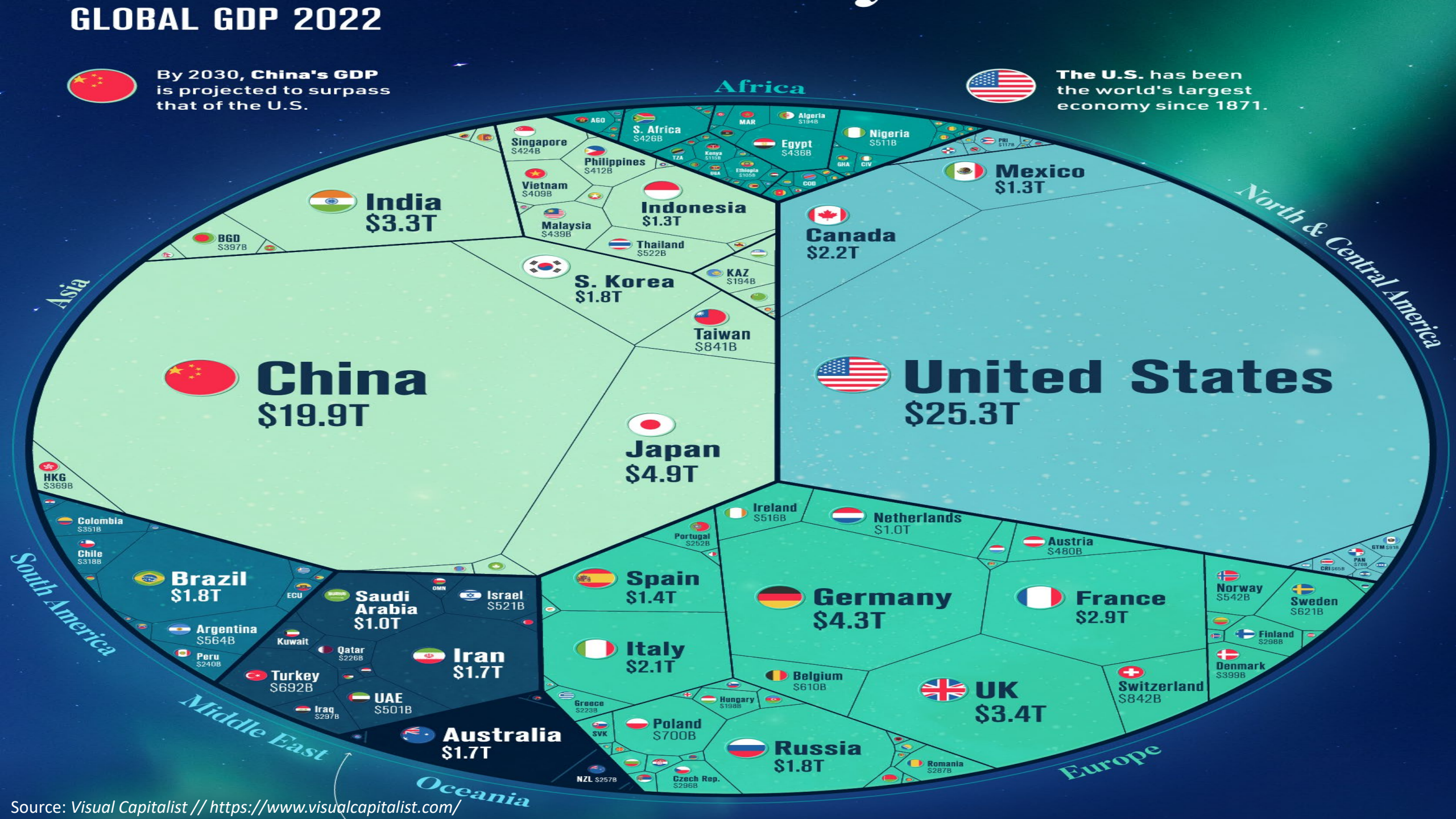
GLOBAL GDP 2022

By 2030, **China's GDP** is projected to surpass that of the U.S.

The U.S. has been the world's largest economy since 1871.



Source: *Visual Capitalist // https://www.visualcapitalist.com/*

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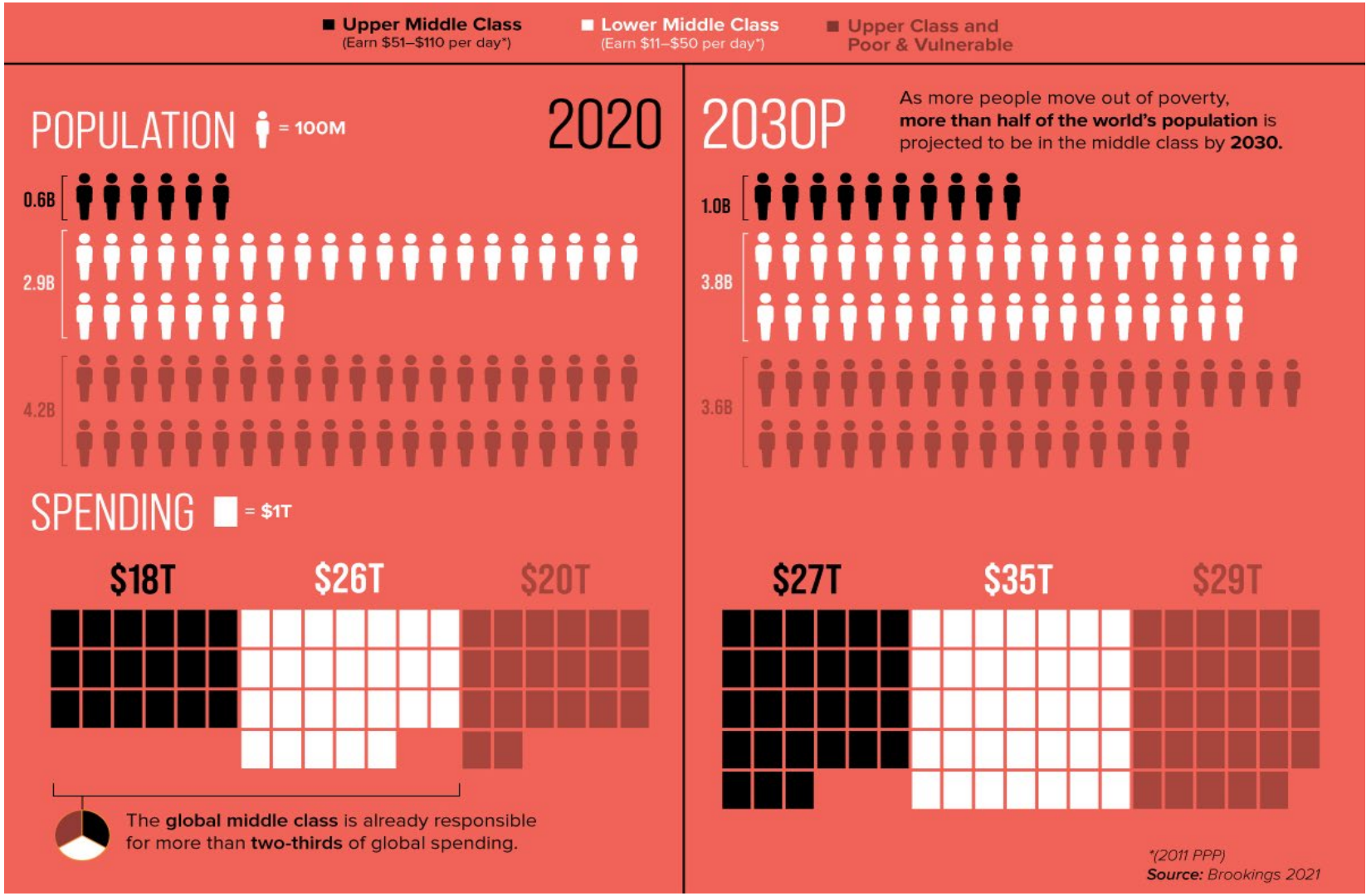
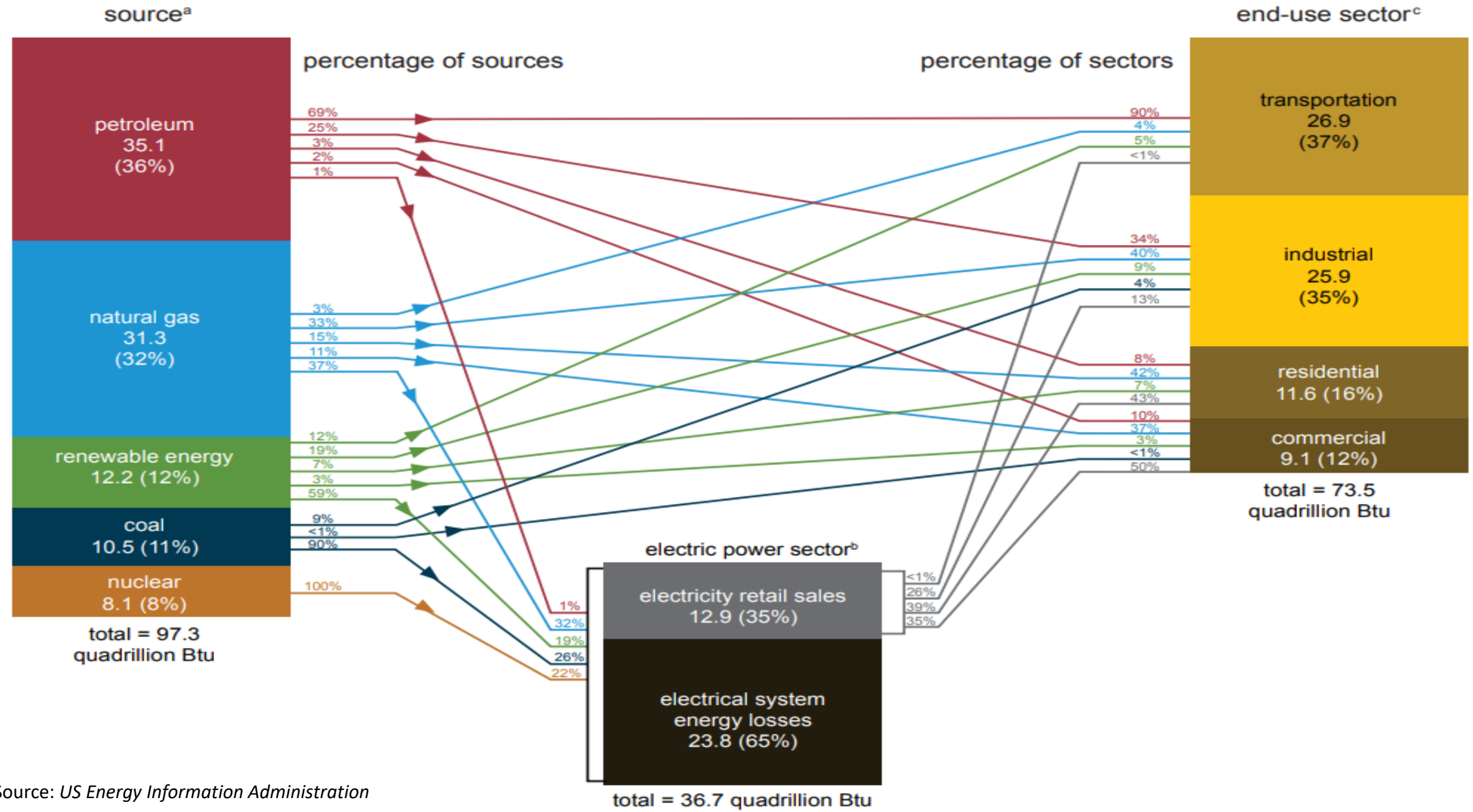


Consumer Group	Total Spending (2020) trillion	Total Spending (2030P) trillion	Growth %
Combined Middle Class	$44	$62	41%
Upper Class + Poor/Vulnerable	$20	$29	45%
Total	$64	$91	42%

Source: *Visual Capitalist // https://www.visualcapitalist.com/*

U.S. energy consumption by source and sector, 2021

quadrillion British thermal units (Btu)

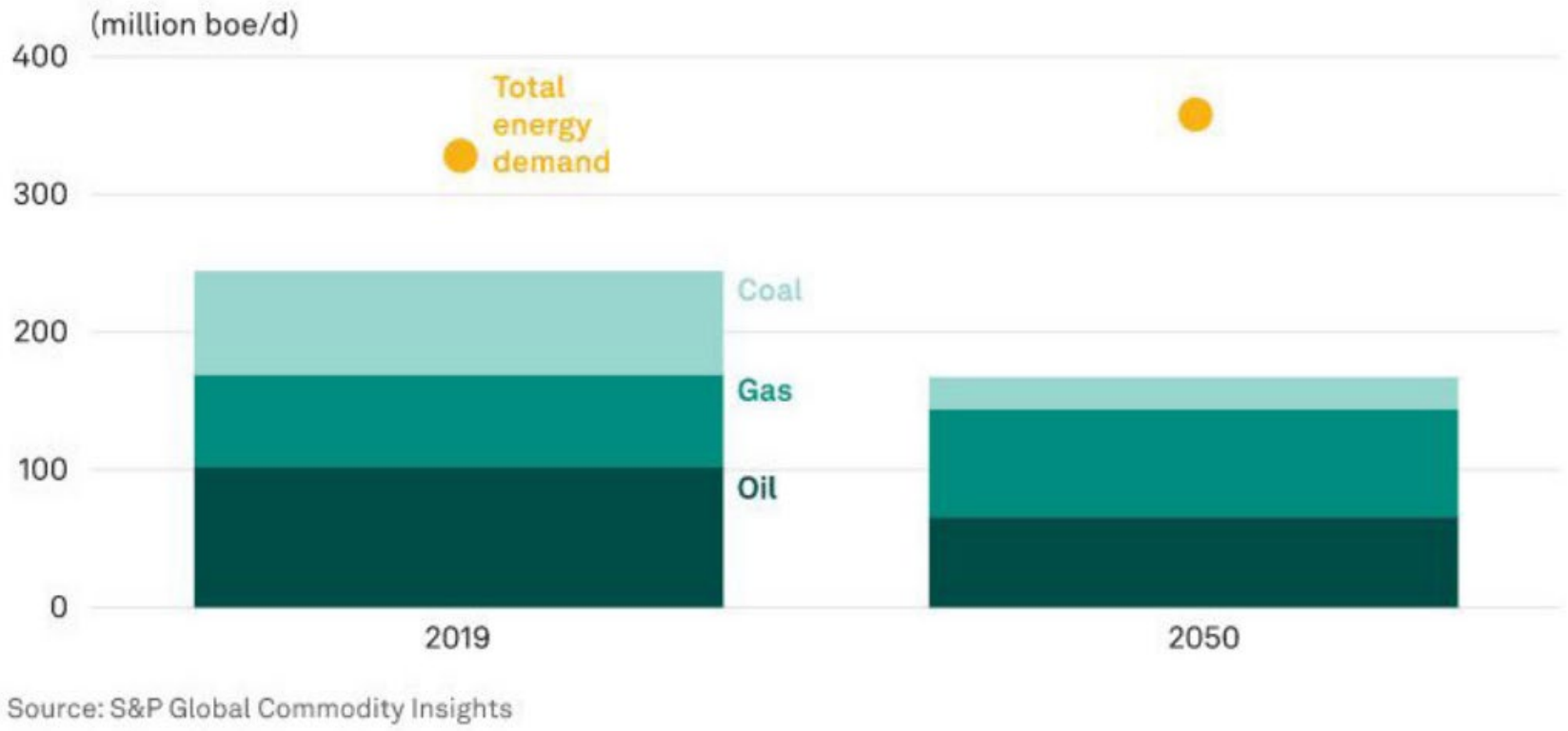


Source: *US Energy Information Administration*

Dilemmas in the Energy Transition, and How Th

To achieve 2°C warming targets, fossil fuel use must decline by over 30% from 2019 levels while meeting demand growth

Three features to note:



Source: *S&P 2022, "COP 27 Special Report: Advancing Climate Objectives Amidst Conflict"*

Dilemmas in the Energy Transition, and How Th

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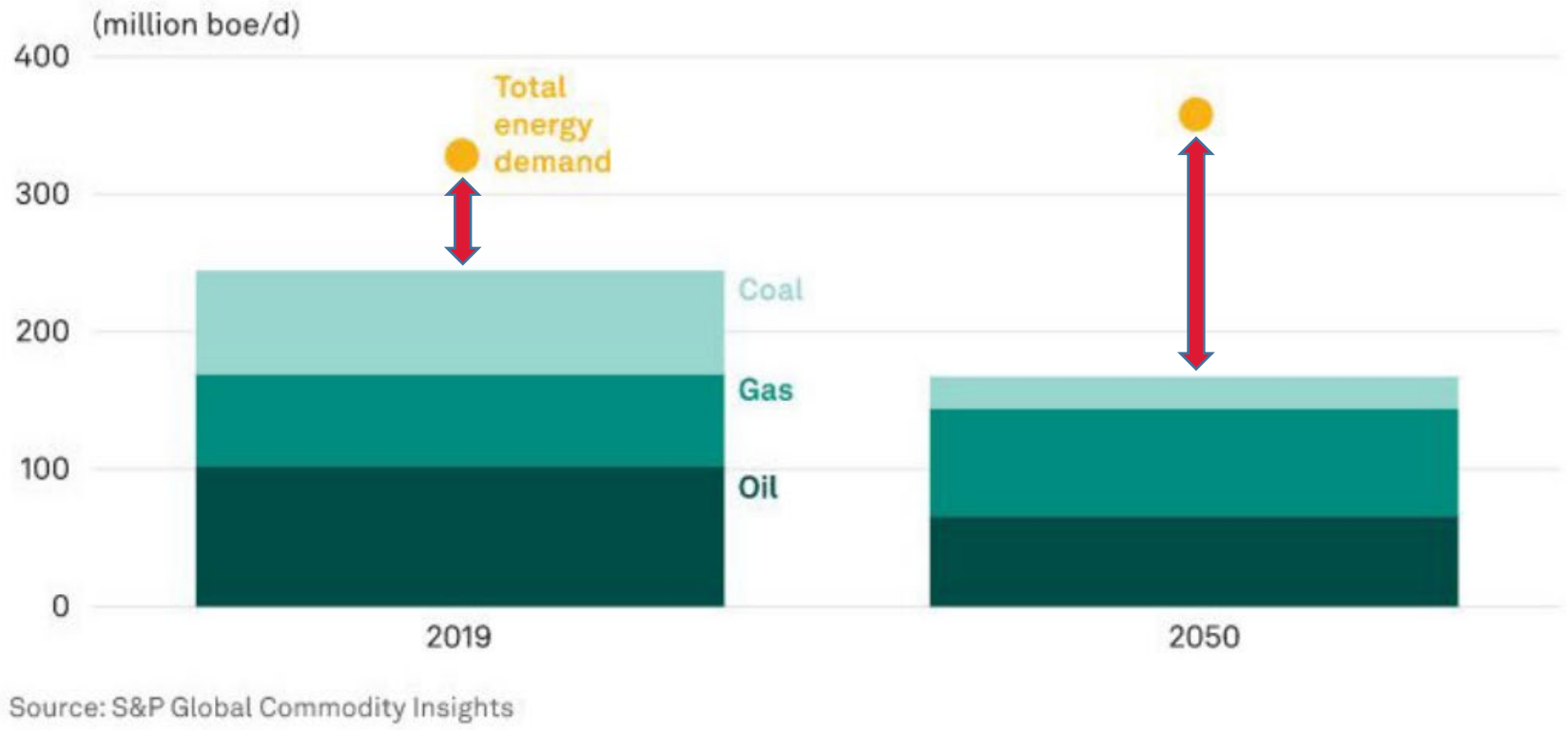
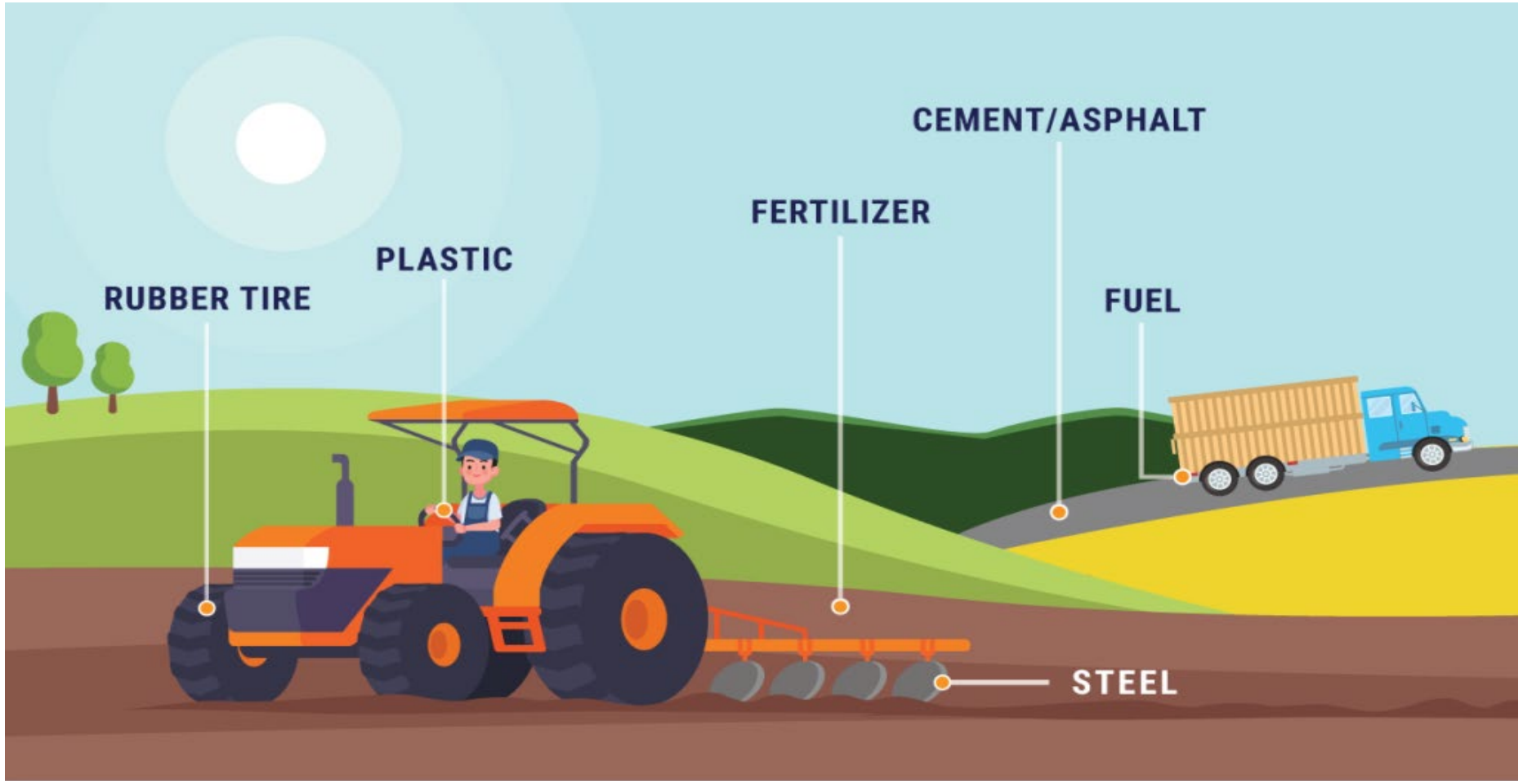


Three features to note:

- Demand increases
- Traditional energy consumption decreases but still far from zero
- The supply-demand gap grows; renewables backfill is vital

Source: *S&P 2022, "COP 27 Special Report: Advancing Climate Objectives Amidst Conflict"*

Dilemmas in the Energy Transition, and How Th



Source: *Energyindepth.org, May 2022*

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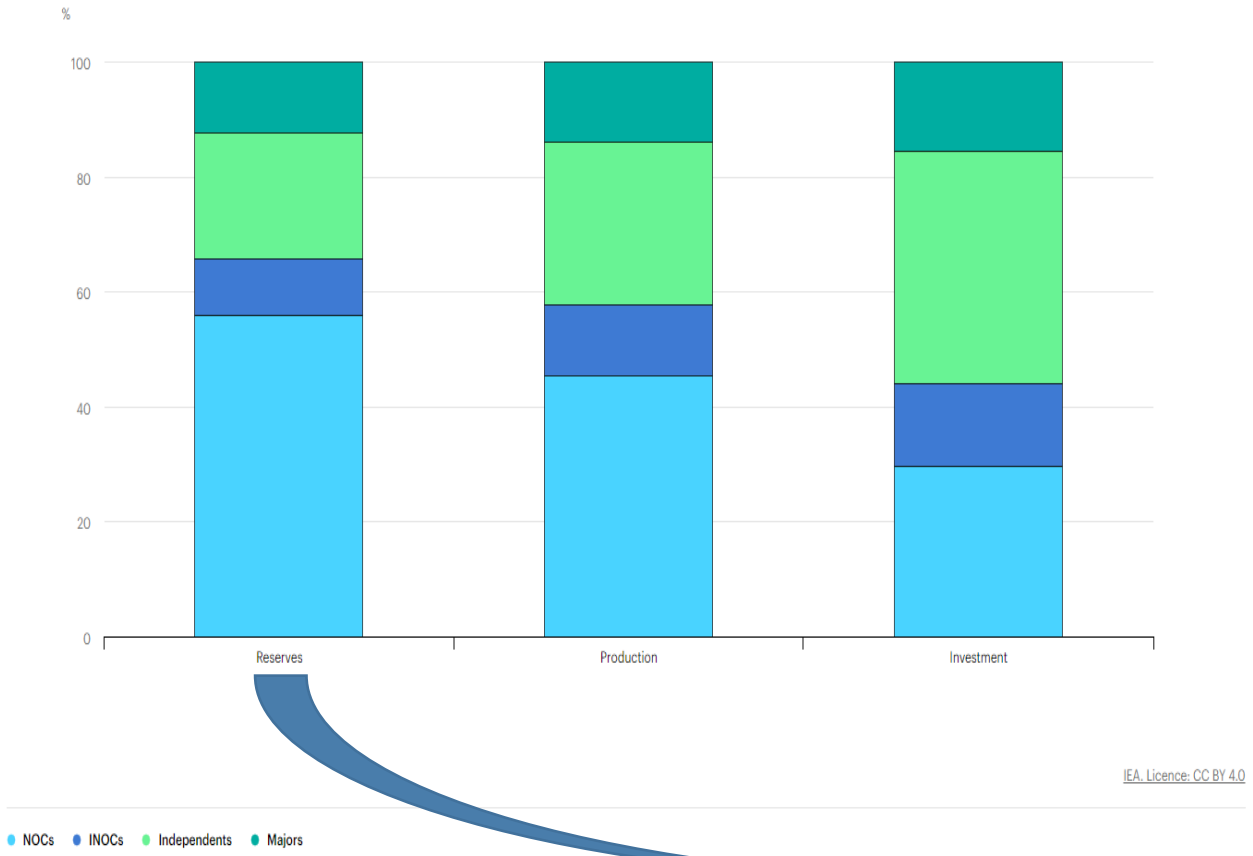
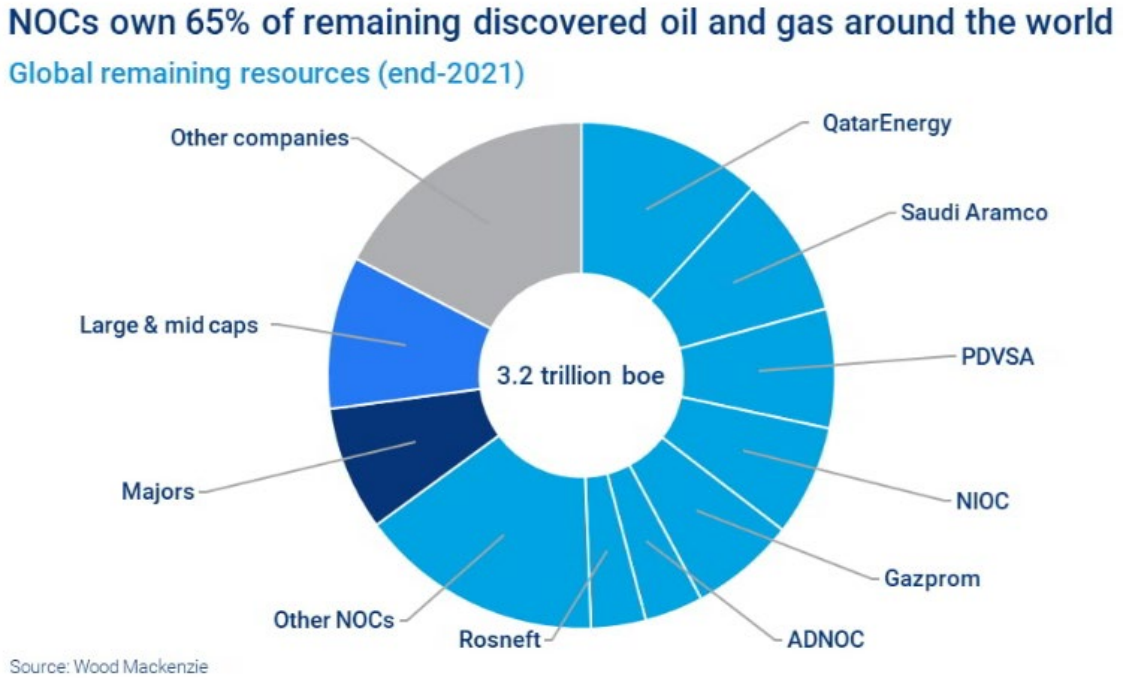
Source: *5w Infographics; Data Sources: World Peace Foundation, Tufts; Food and Agriculture Organization, U.N. // Smithsonian Magazine, Charles C Mann, January 2018*

Dilemmas in the Energy Transition, and How Th

Share of oil reserves, oil production and oil upstream investment by company type, 2018





Source: *IEA, "The Oil and Gas Industry in Energy Transitions" // WoodMac "How NOCs' exploration strategies are evolving" July 2022*

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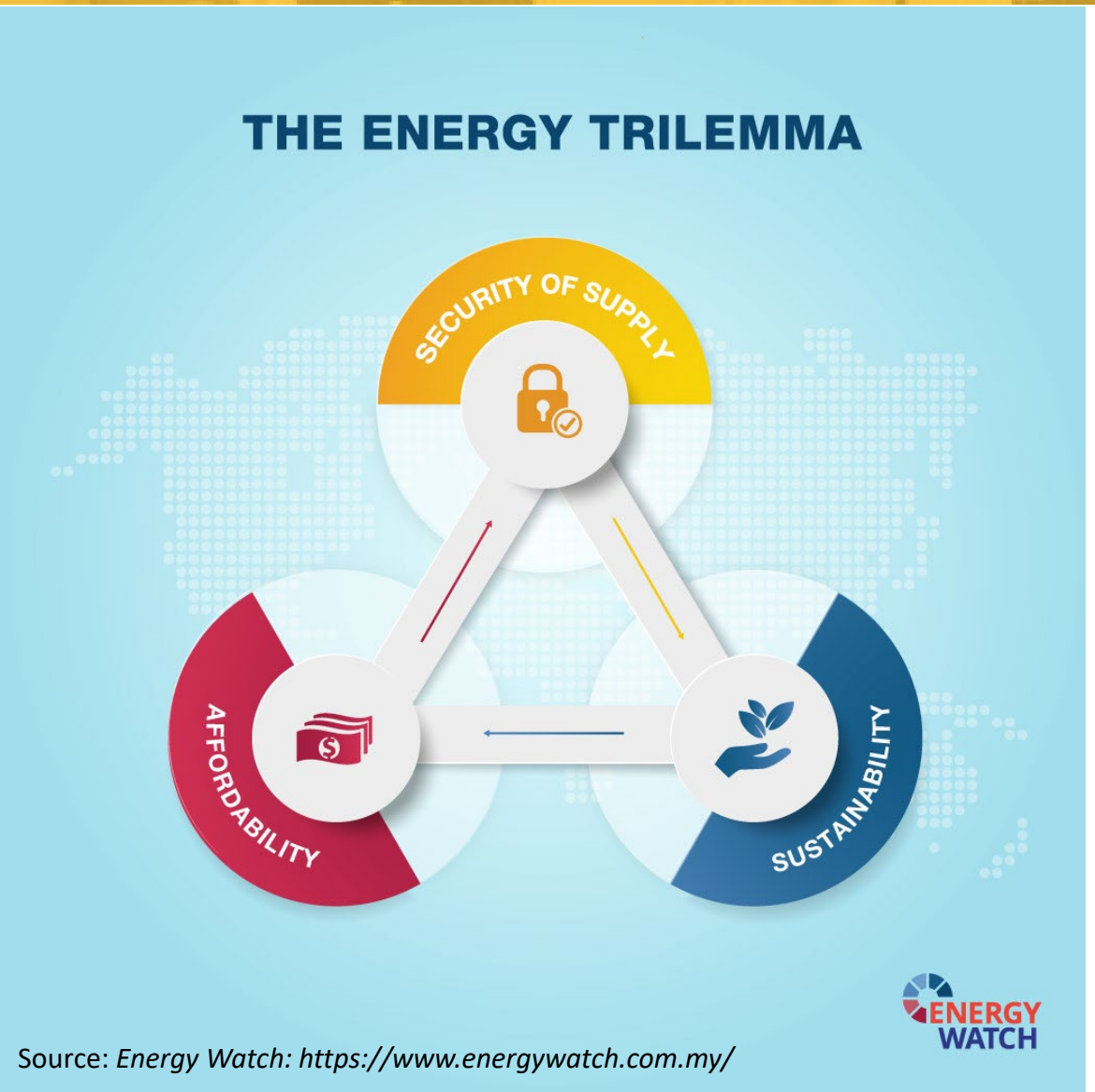
Dilemmas in the Energy Transition, and How Th



Source: *Energy Watch: https://www.energywatch.com.my/*

A mission to balance

- Can we afford it?
- Can we access it?
- Are we responsible?

Dilemmas in the Energy Transition, and How Th

Scenarios // Pathways // Trajectories // Journeys

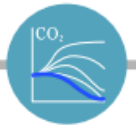
"…what the scenarios seek to do is to enable readers to compare different possible versions of the future and the levers and actions that produce them, with the aim of stimulating insights about the future of global energy…" (*IEA (2022), Global Energy and Climate Model, IEA, Paris https://www.iea.org/reports/global-energy-and-climate-model, License: CC BY 4.0*)

Scenarios usually include:

Major economies' GDPs
National emissions profiles
Sectoral emissions profiles
Consumption evolution
Source energy production mix
Carbon pricing
O&G pricing
Buildout of critical infrastructure
Economy maturations: developed & developing
Major policy & regulatory influences
Associated global average temperature Δ

Source: *McKinsey & Company, "Global Energy Perspective 2022"*

Scenarios center around pace of technological progress and level of policy enforcement

Speed of energy transition	*Slower*			Modelled bottom - up as part of GEP 2022	*Faster*
					
Scenario description	**Fading Momentum** Fading momentum in cost reductions, climate policies, and public sentiment will lead to prolonged dominance of fossil fuels	**Current Trajectory** Current trajectory of renewables cost decline continues, however active policies currently remain insufficient to close gap to ambition	**Further Acceleration** Further acceleration of transition driven by country-specific commitments, though financial and technological restraints remain	**Achieved Commitments** Net-zero commitments[3] achieved by leading countries through purposeful policies; followers transition at slower pace	**1.5° Pathway** A 1.5° pathway is adopted globally, driving rapid decarbonization investment and behavioral shifts
Required CO_2 price[1] €/tCO_2, 2030-50	*< € 50*	*€ 55 - 130*	*€ 75 - 140*	*€ 100 - 180*	*€ 200+*
Global temp. increase linked to expected emission levels[2]	*>2.4 °C*	*2.4 °C* (1.9 - 2.9)	*1.9 °C* (1.6 - 2.4)	*1.7 °C* (1.4 - 2.1)	*<1.5 °C*

1. Global average CO_2 prices required in 2030 and 2050 to trigger decarbonization investments sufficient to fulfil the scenario. Prices are weighted by country and sector emissions and are holistic in that they include both explicit costs (eg, carbon tax, emission trading system) and implicit costs (eg, subsidies, feed-in-tariffs) to incentivize abatement
2. Warming estimate is an indication of global rise in temperature by 2100 versus pre-industrial levels (median - 17th/83rd percentile), based on IPCC assessments given the respective emission levels and assuming continuation of trends after 2050 but no net-negative emissions
3. Excluding international bunkers

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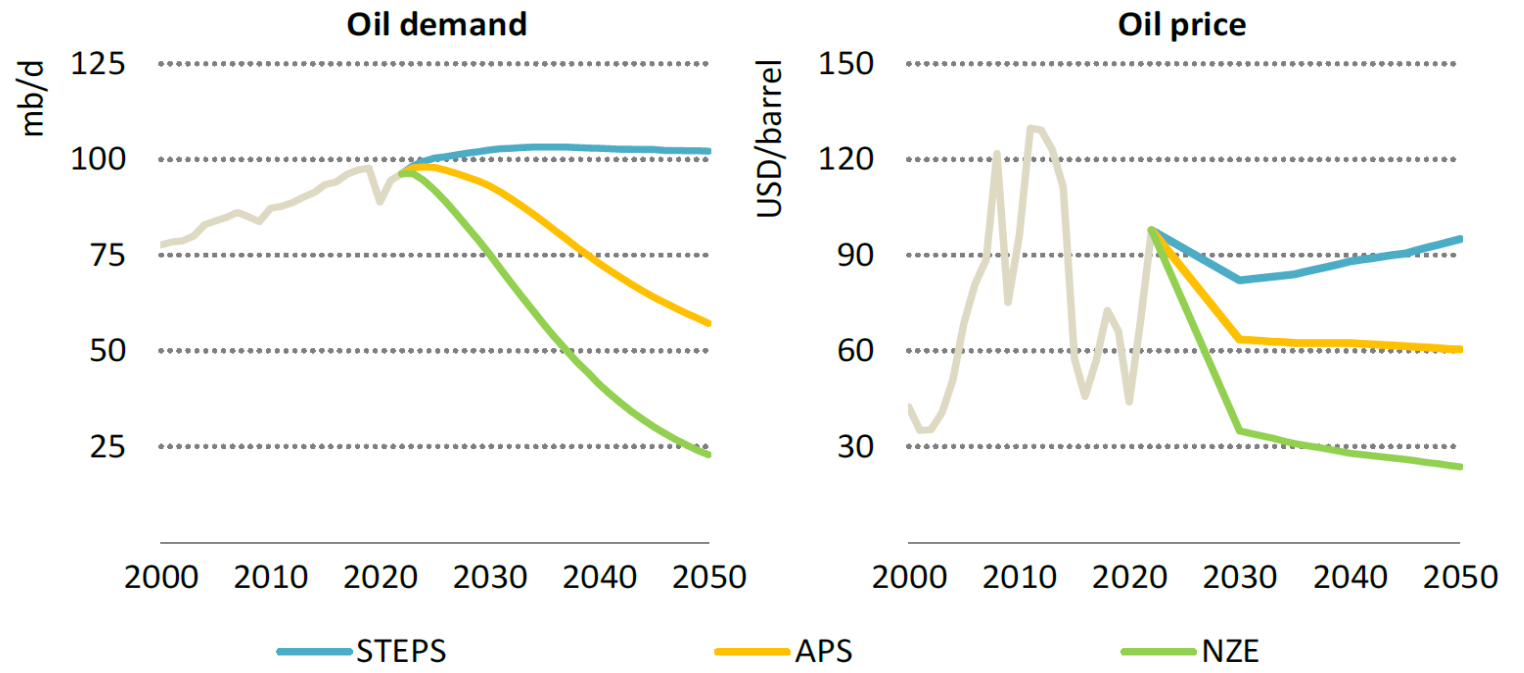
Figure 7.1 ▷ **Global oil demand and crude oil price by scenario**



Demand peaks in the mid-2030s in the STEPS, in the mid-2020s in the APS, and policy-led declines in demand in the NZE Scenario mean a radically different future for oil markets

Notes: STEPS = Stated Policies Scenario, APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario; mb/d = million barrels per day.

Source: *IEA, "World Energy Outlook 2022" fig 7.1, pg. 330/524*

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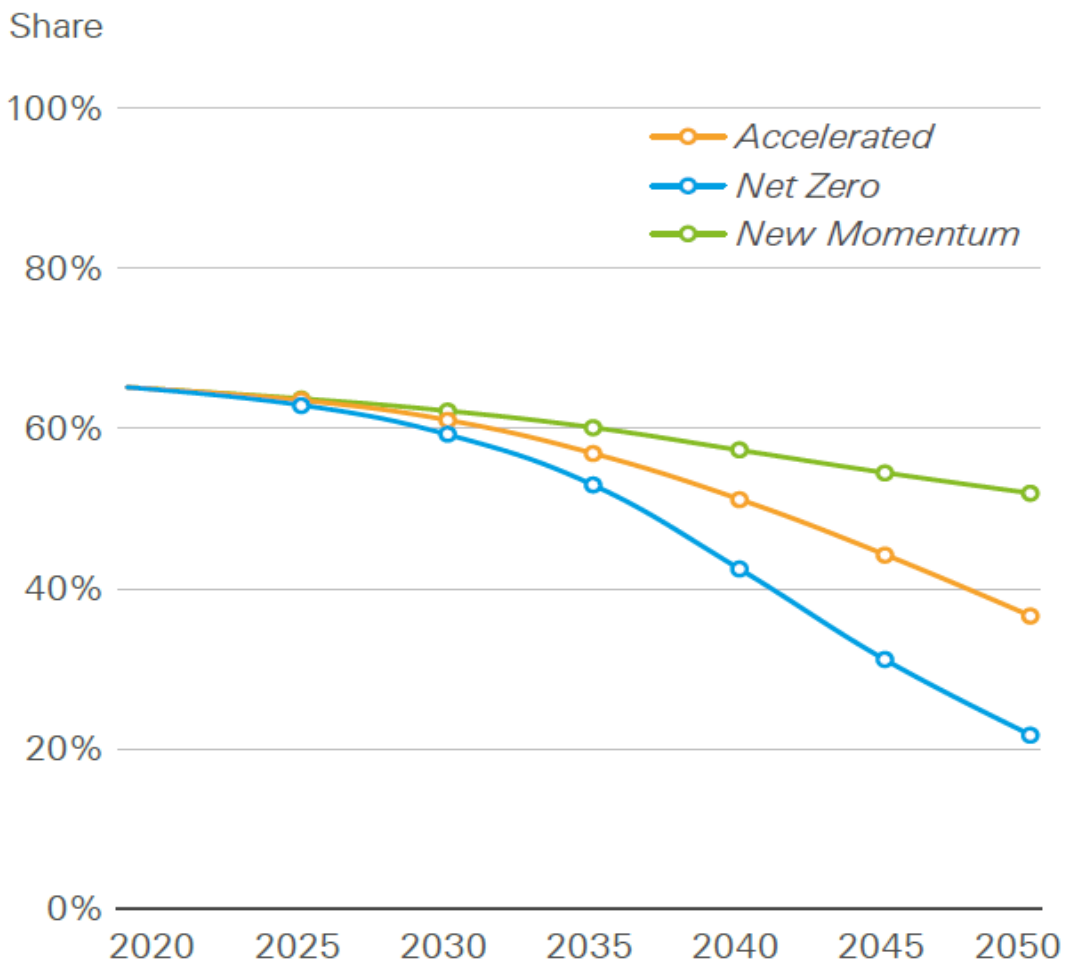
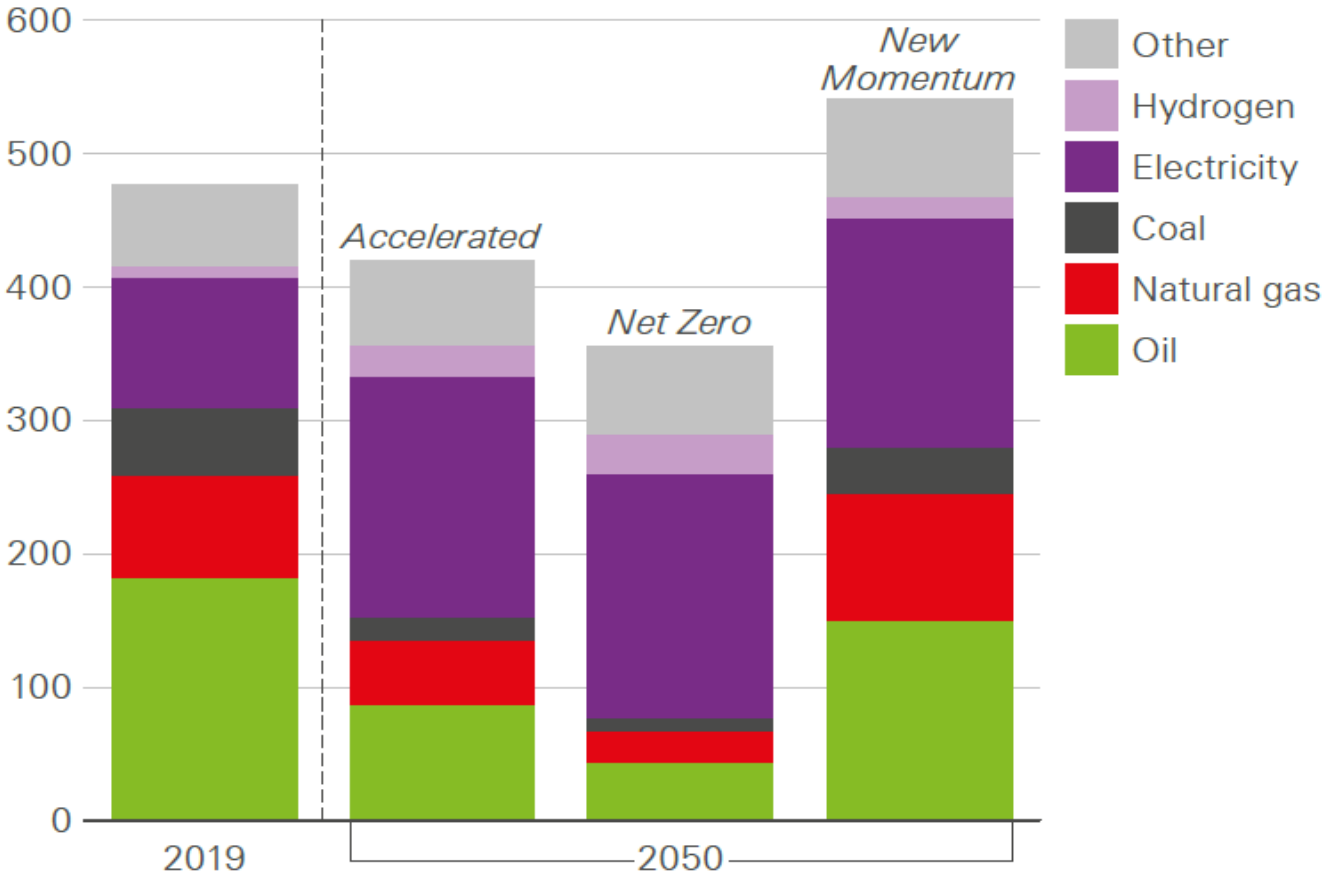
Fossil fuels as a share of final consumption



Fuel composition of final consumption



Source: "*BP Energy Outlook", 2022 Edition*

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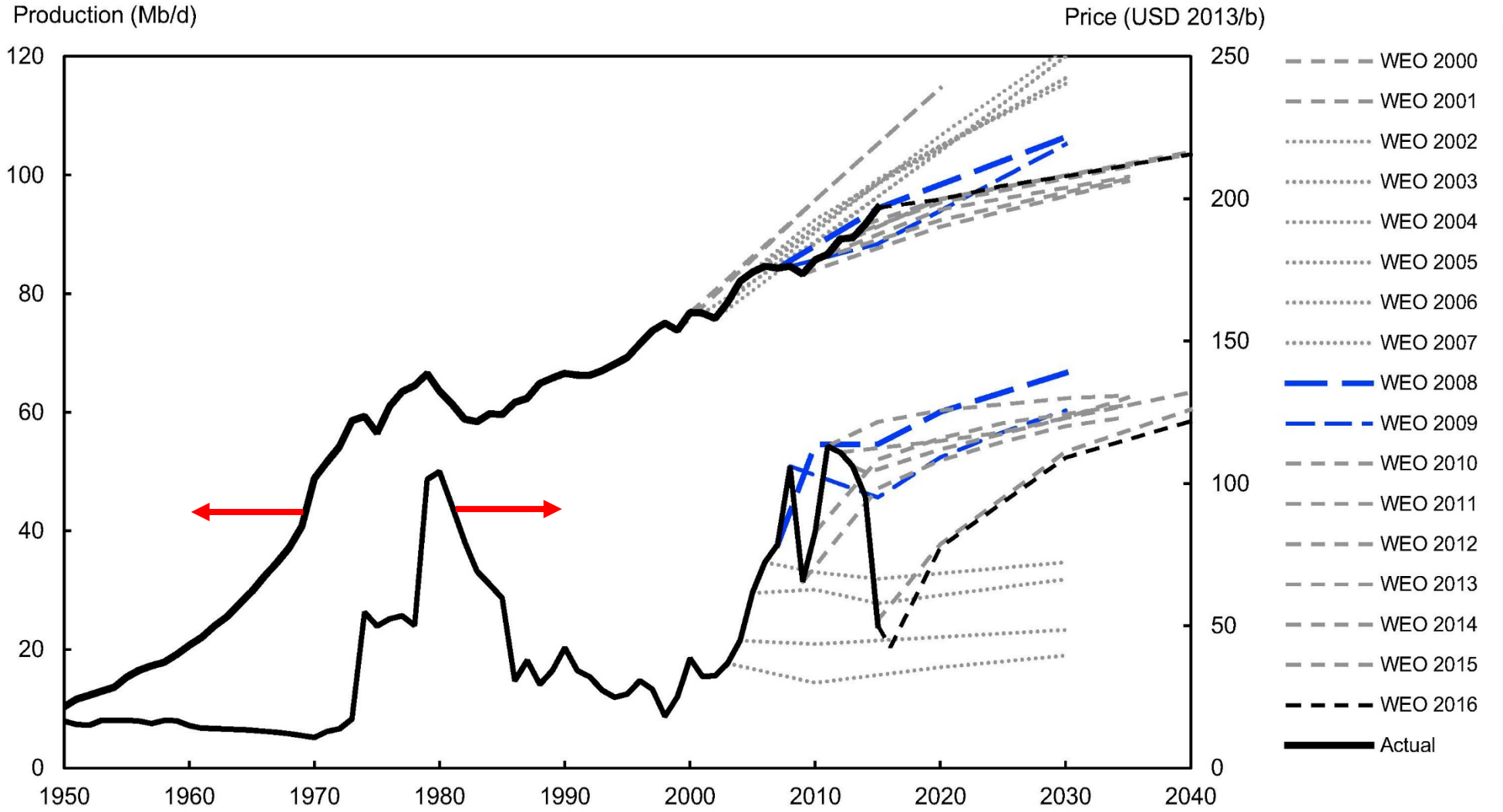

"…Revisions of world oil production, price and investments have been motivated by a combination of demand and supply factors. Downward revisions are mainly allocated to OPEC, while recent upward revisions are due to unconventional oil, in particular US tight oil. Non-OPEC conventional projections have been stable. Price and investments have been revised mostly upwards. Projection accuracy follows the size and directions of these revisions, with high accuracy for Non-OPEC (mean absolute percentage error of 4.8% on a 5 year horizon) and low for OPEC (8.9%) and unconventional (37%). Counteracting error directions contribute to accurate total World oil supply projections (4%) while price projections have low accuracy (37%). **Scenario users should be aware of implied uncertainty of current oil projections…"**

Source: *Journal of Applied Energy, "Oil projections in retrospect: Revisions, accuracy and current uncertainty", Wachtmeister, Henke, Hook, 15 June 2018*

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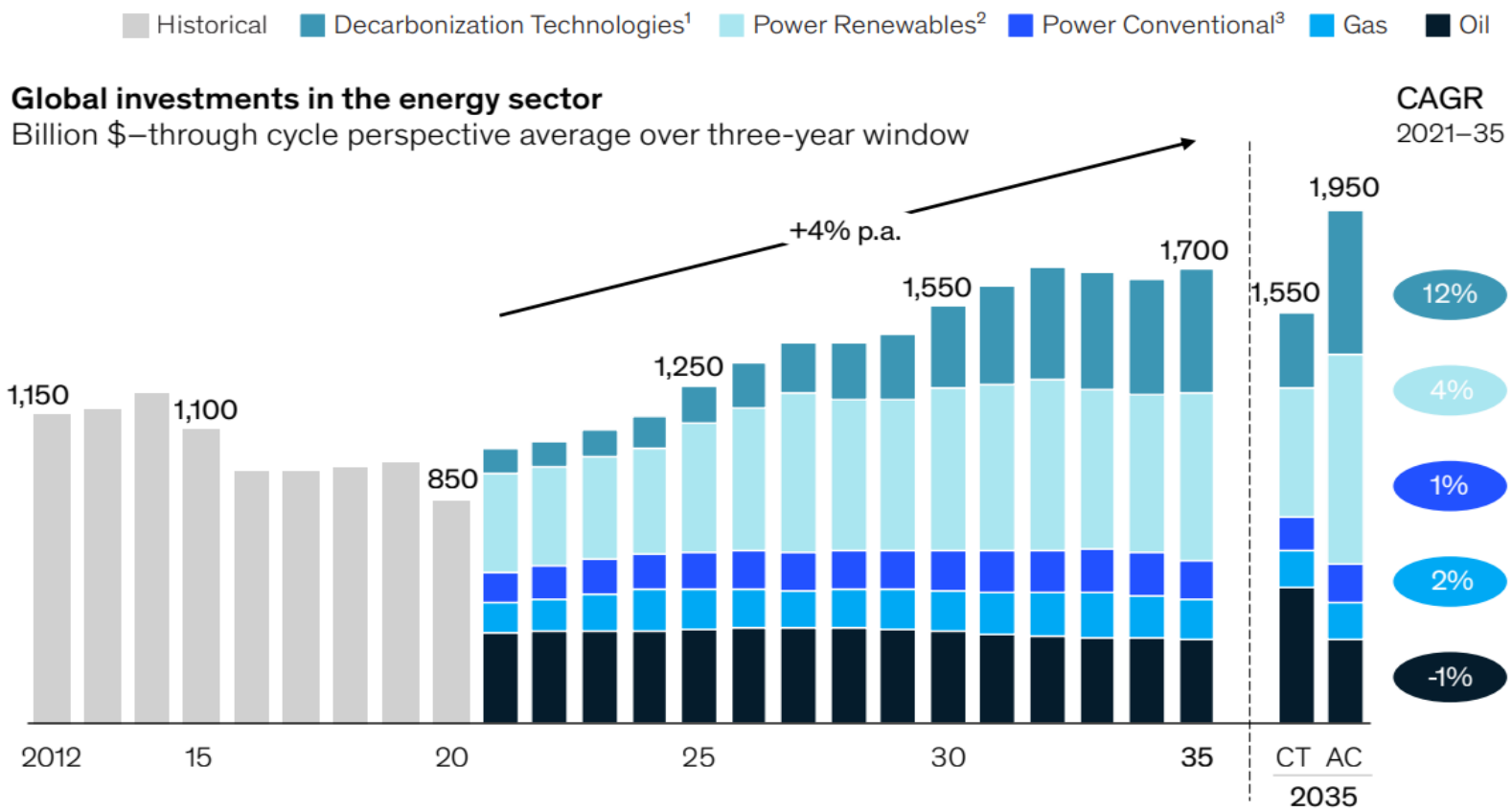
Further Acceleration[4]



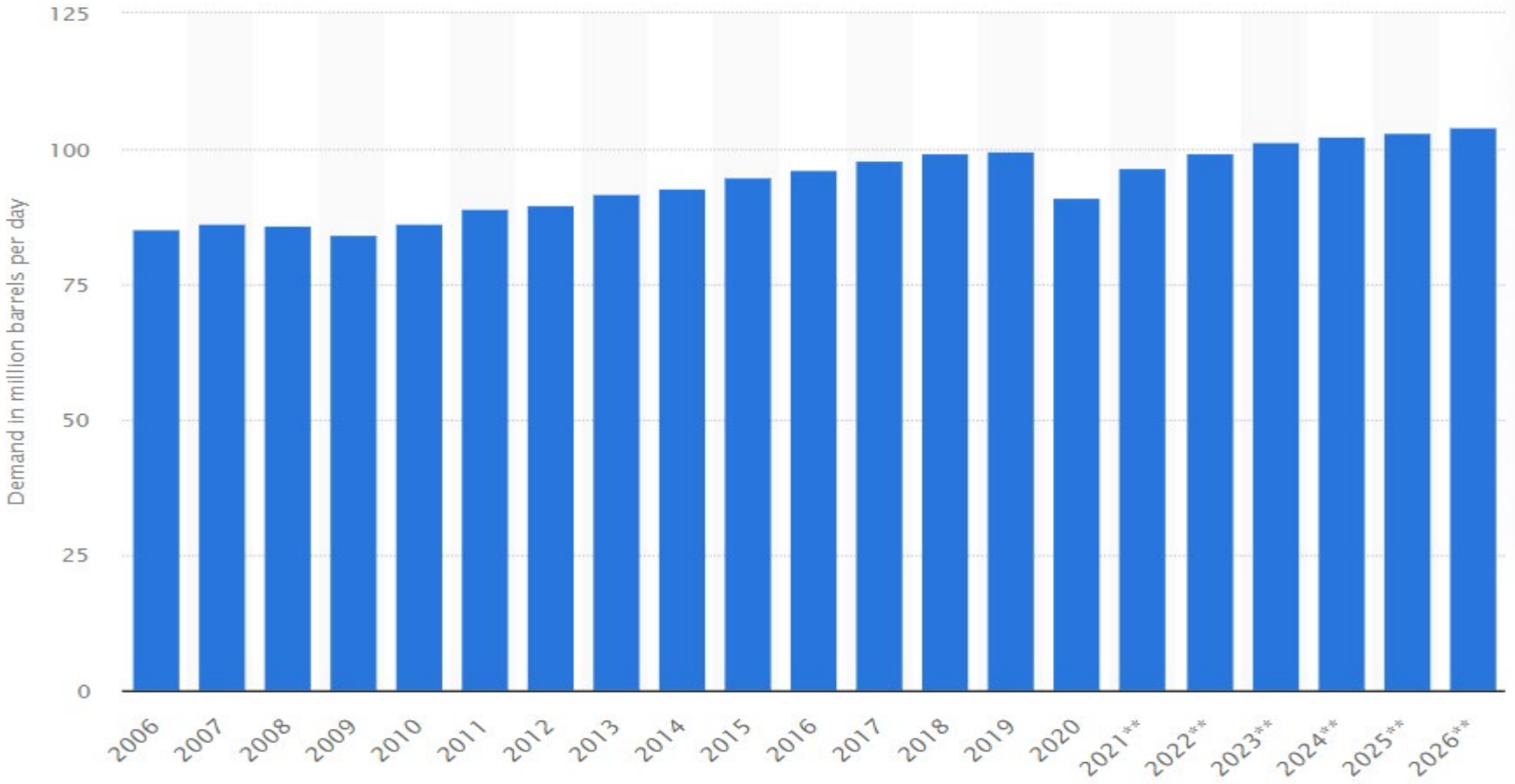
Energy continues to attract investment – and accelerating

1. Includes sustainable fuels, CCUS, hydrogen, and EV charging
2. Includes solar, onshore wind, offshore wind, hydro, and other
3. Includes coal, gas, nuclear, and other
4. For the O&G segments the 2021 Accelerated Transition Scenario is used in combination with Further Acceleration and Achieved Commitments, and the 2021 Reference Case Scenario with Current Trajectory

Source: *McKinsey & Company, "Global Energy Perspective 2022"*

Dilemmas in the Energy Transition, and How Th

Daily demand for crude oil worldwide from 2006 to 2020, with a forecast until 2026 (*million barrels per day)*



Source: *Statista 2023, IEA Oil Market Reports, https://www.statista.com/statistics/271823/daily-global-crude-oil-demand-since-2006/*

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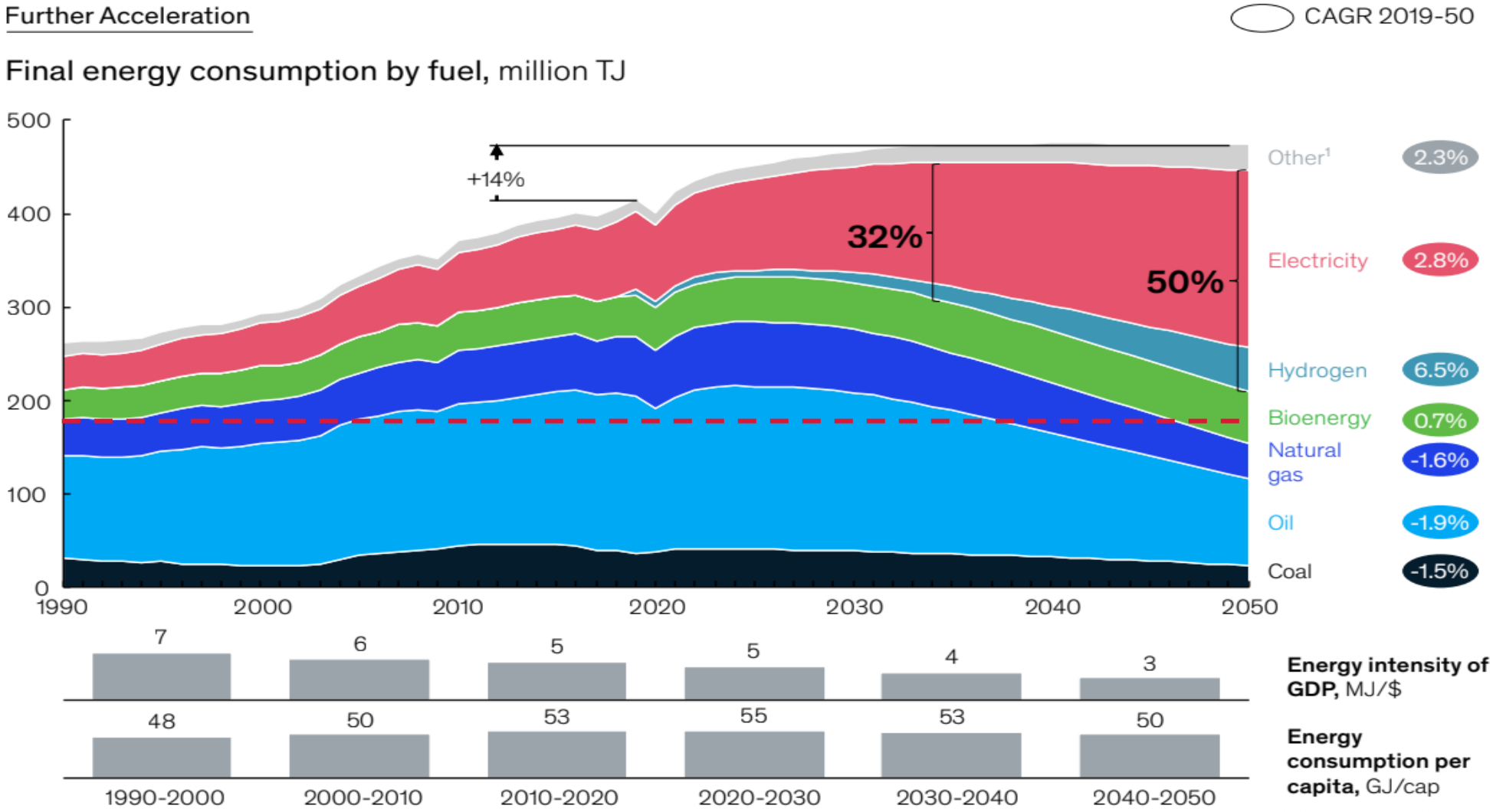

Source: *McKinsey & Company, "Global Energy Perspective 2022"*

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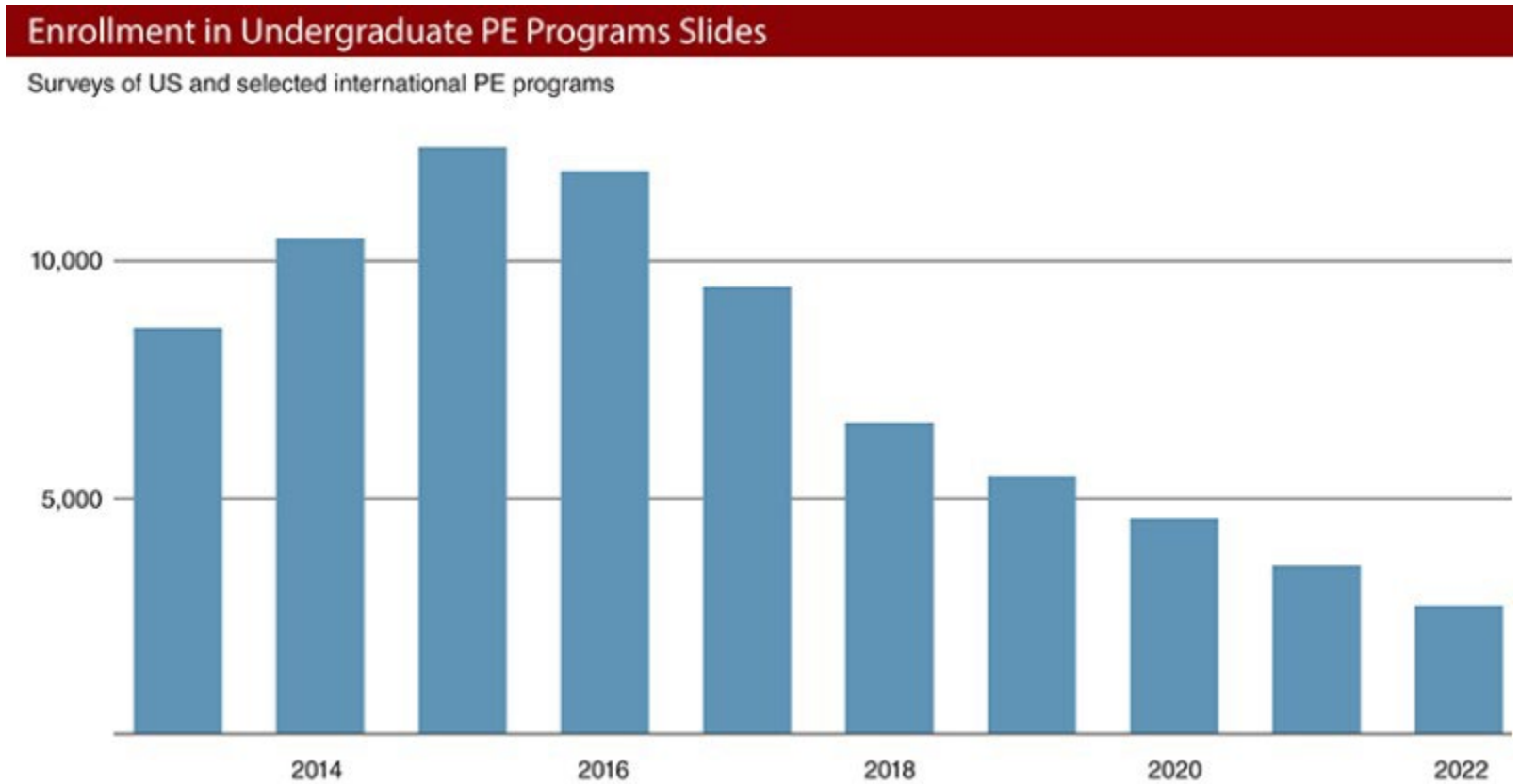

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Source: *Lloyd Heinze / Texas Tech University / reported via https://jpt.spe.org/petroleum-engineering-continues-to-drop-but-there-is-talk-of-better-times-ahead*

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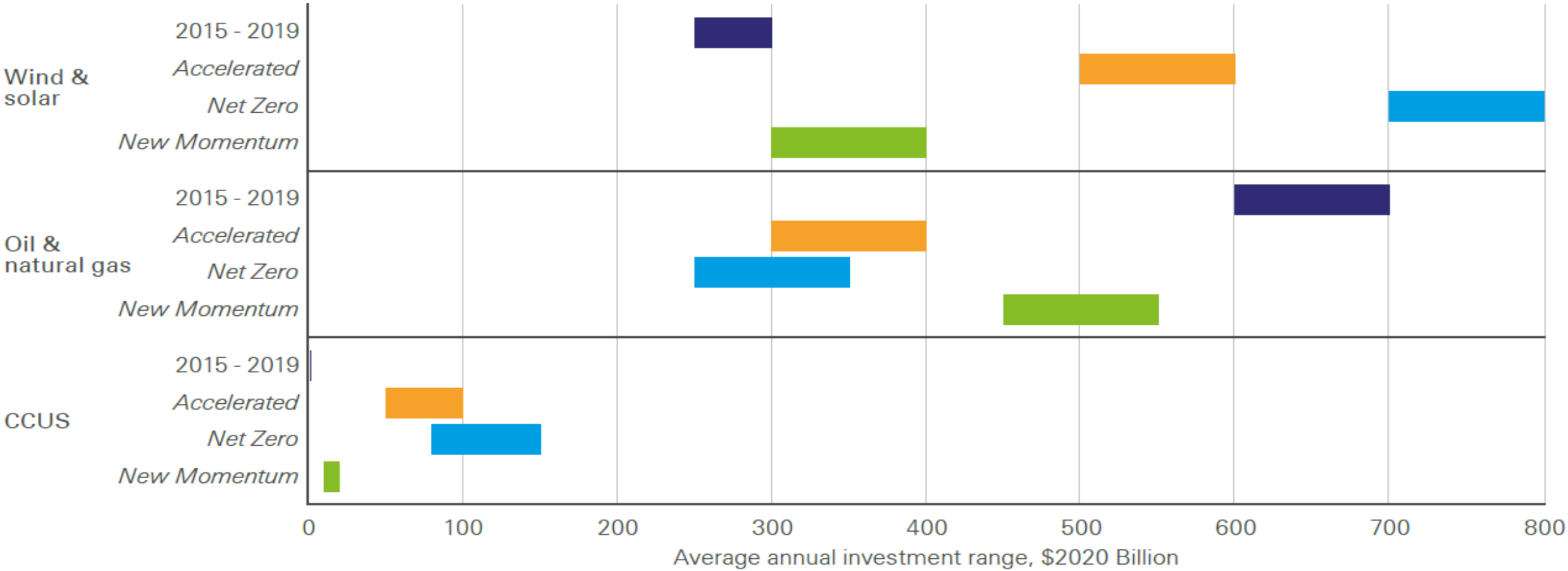
Average annual investment, history and 2020-2050



Source: "*BP Energy Outlook", 2022 Edition*

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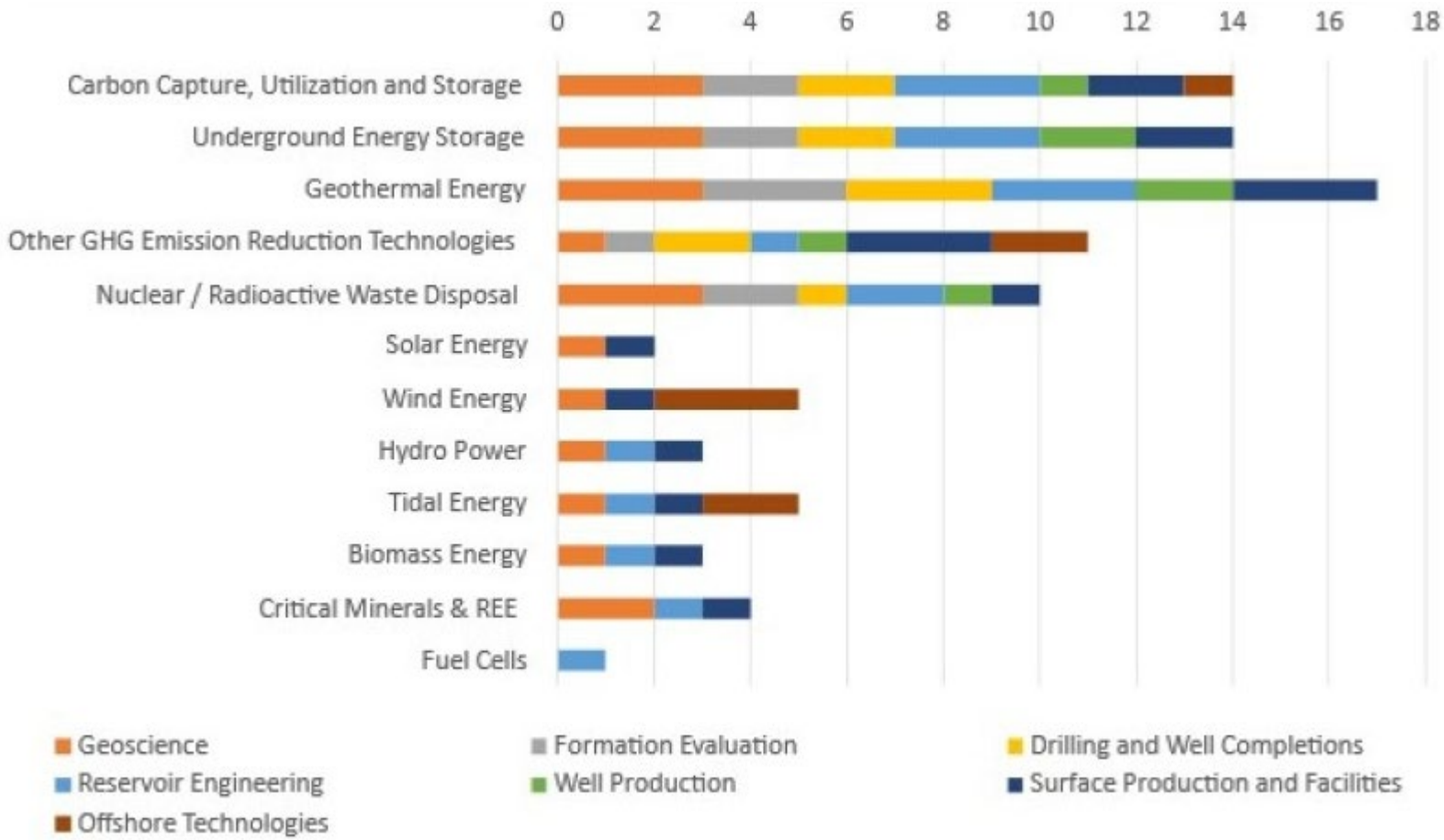

Source: *Okoroafor, E. R., Offor, C. P., and Ekeoma, I. P. (2022). Mapping Relevant Petroleum Engineering Skillsets for the Transition to Renewable Energy and Sustainable Energy. Accepted for presentation in SPE Nigeria Annual International Conference and Exhibition. Lagos, Nigeria, 1-3 August.*

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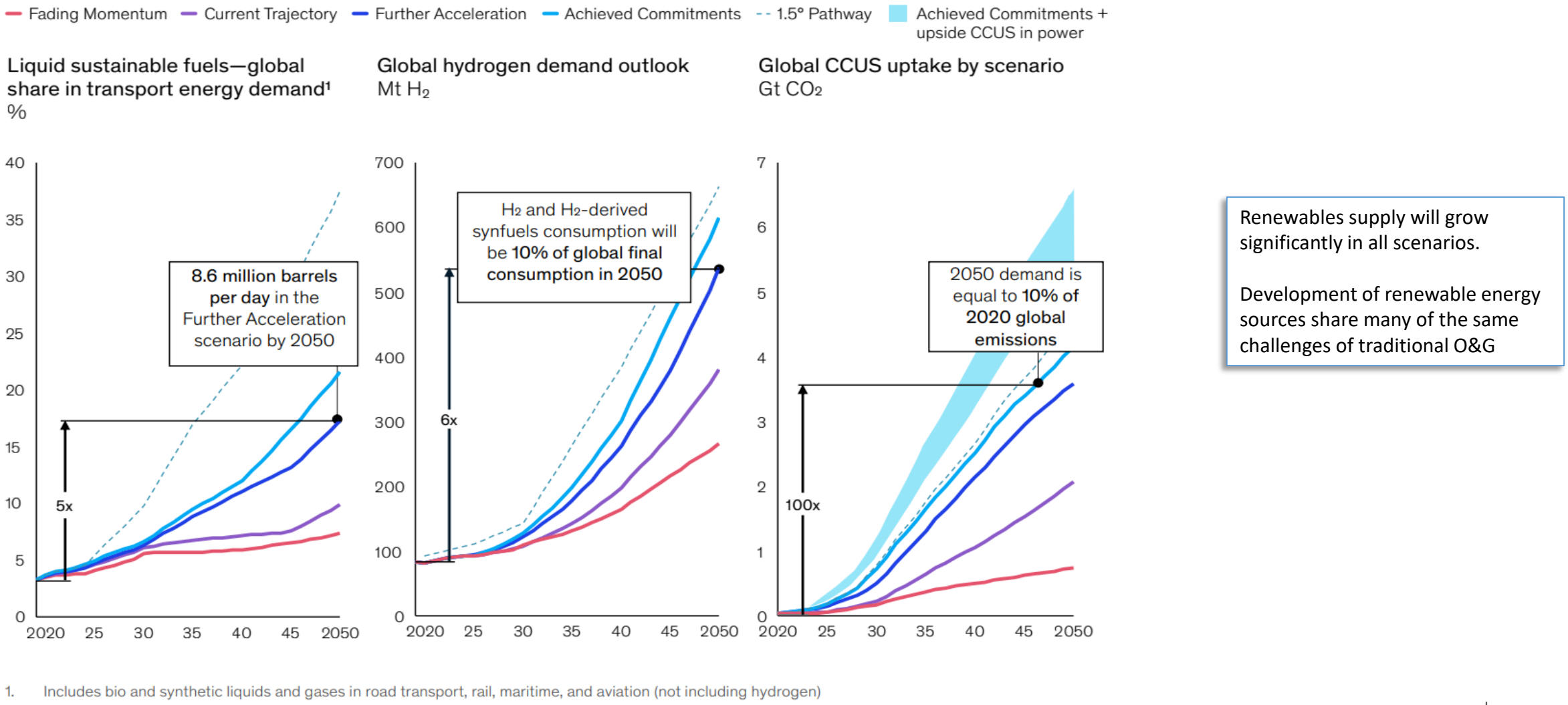

1. Includes bio and synthetic liquids and gases in road transport, rail, maritime, and aviation (not including hydrogen)

Renewables supply will grow significantly in all scenarios.

Development of renewable energy sources share many of the same challenges of traditional O&G

Source: *McKinsey & Company, "Global Energy Perspective 2022"*

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THANK YOU

for joining us

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Table 2. Selected Statistics for Five EV Battery Minerals

In metric tons, unless indicated otherwise

	Lithium	Cobalt	Manganese	Nickel	Graphite
NIR (%)	>25	76	100	48	100
U.S. Production	withheld	700	0	18,000	0
Global Production	100,000	170,000	20,000,000	2,700,000	1,000,000
Exports	1,900	4,800	1,000	25,000	8,400
Imports	2,500	9,900	460,000	110,024	53,000
U.S. Reserves	750,000	69,000	0	340,000	not indicated
Global Reserves	22,000,000	7,600,000	1,500,000,000	95,000,000	320,000,000

Source: USGS, *Mineral Commodity Summaries, 2022*, 2022, at https://doi.org/10.3133/mcs2022.

Source: *US Congressional Research Service, "Critical Minerals in Electric Vehicle Batteries" August 2022, https://crsreports.congress.gov*

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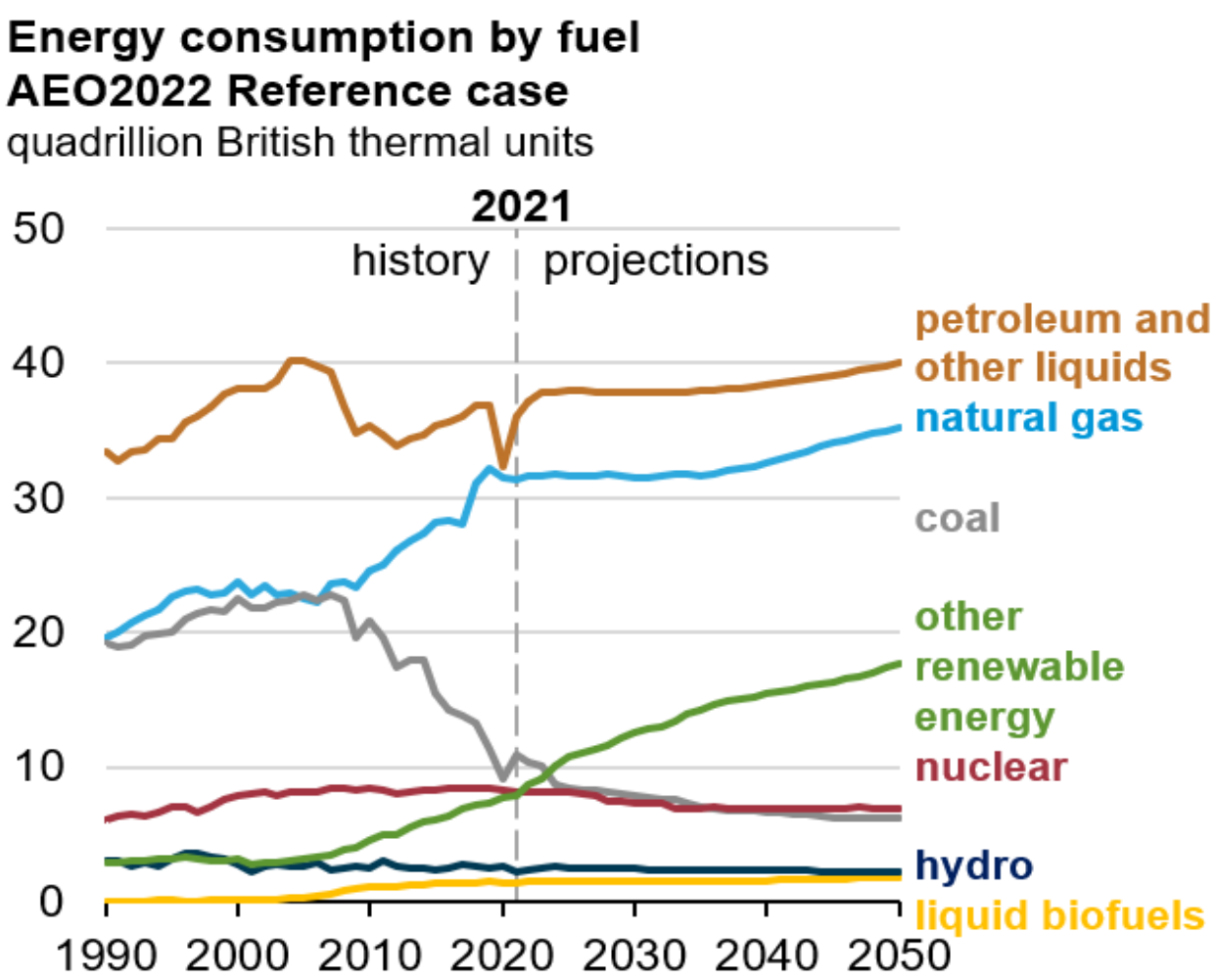

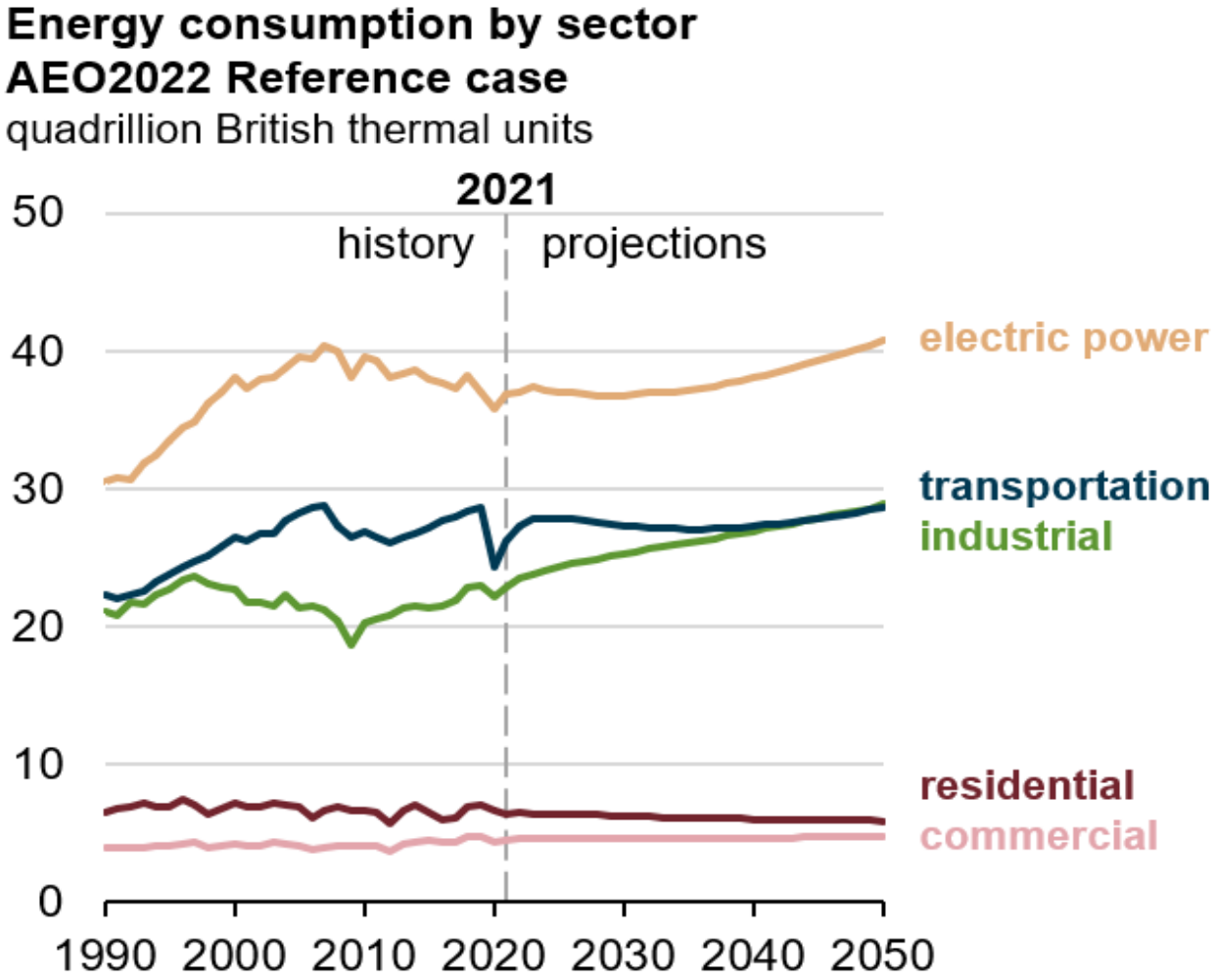

Note: Biofuels are shown separately and included in petroleum and other liquids.

Source: *US Energy Information Administration (EIA), Annual Energy Outlook 2022 – note, data above is for US only*

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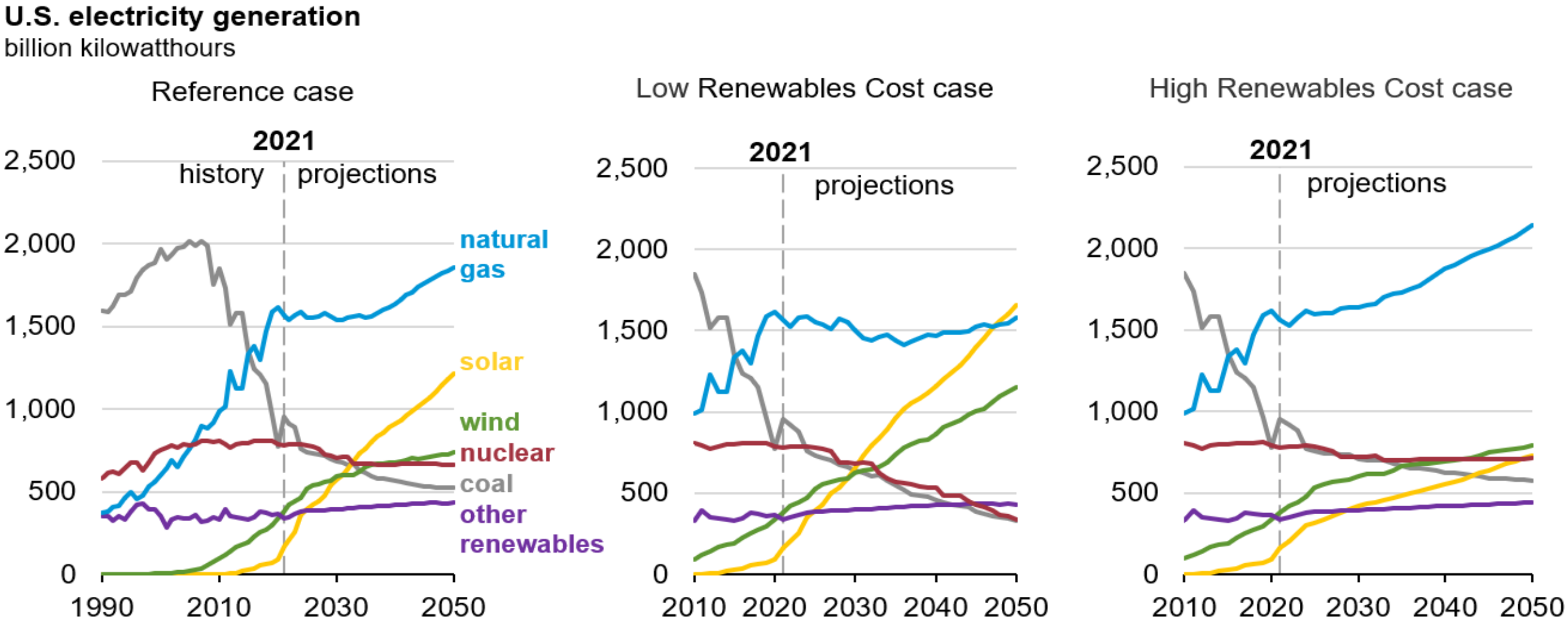

Note: Other renewables category includes electricity generation from hydroelectric, geothermal, wood, and other biomass sources.

Source: *US Energy Information Administration (EIA), Annual Energy Outlook 2022 – note, data above is for US only*

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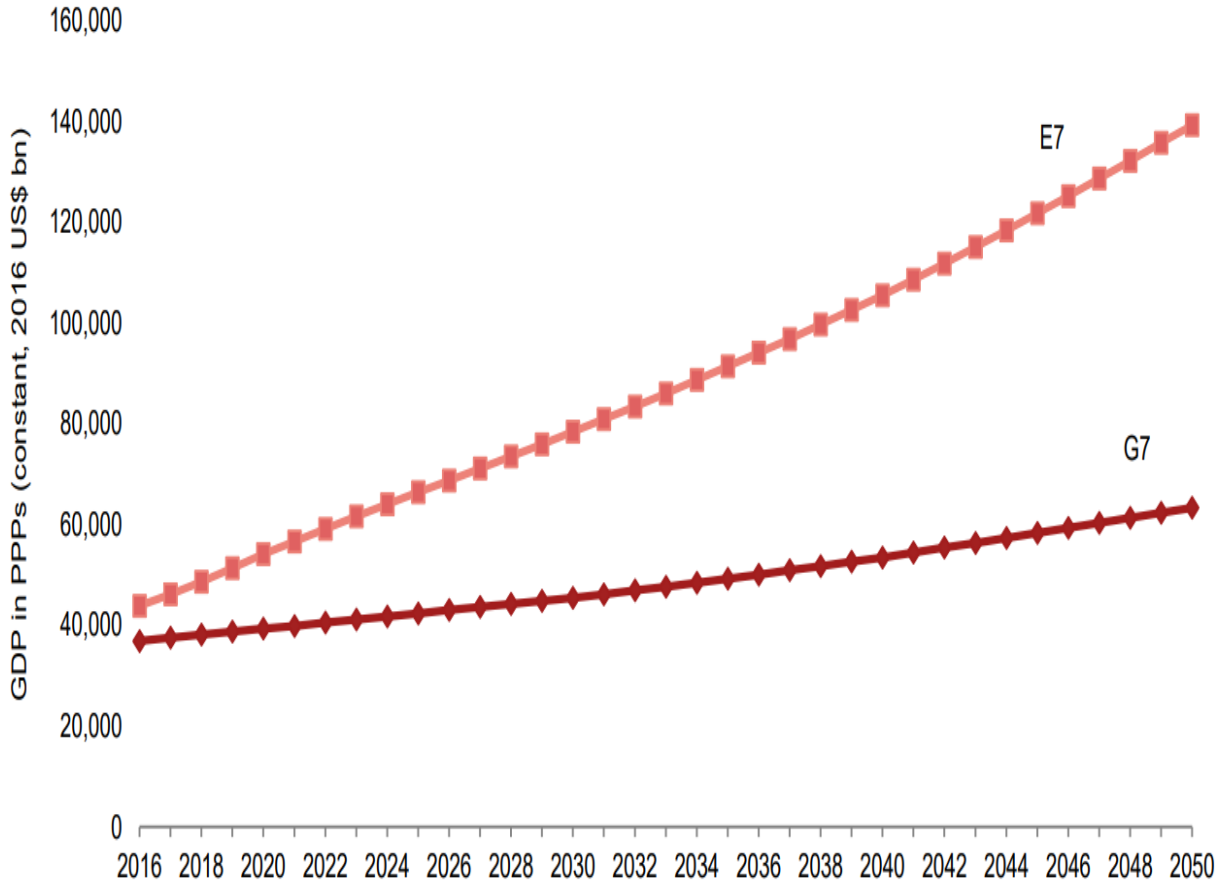
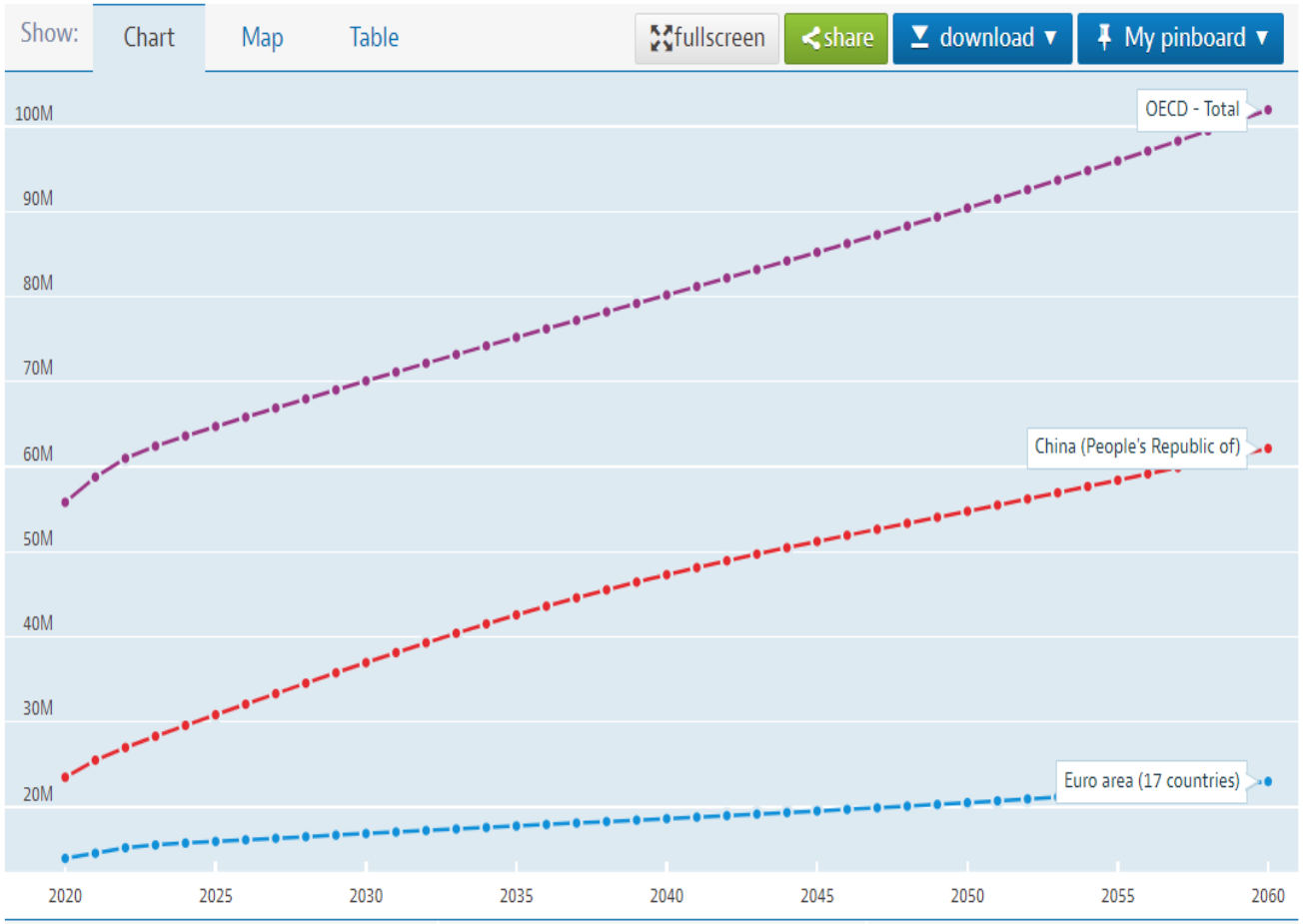
Figure 6: Growth paths of the E7 and G7 economies in PPP terms



Real GDP long-term forecast Total, Million US dollars, 2020 – 2060 Source: Long-term baseline projections, No. 109 (Edition 2021)



Source: *PWC, "The World in 2050" // OECD GDP Forecast report, 2019*

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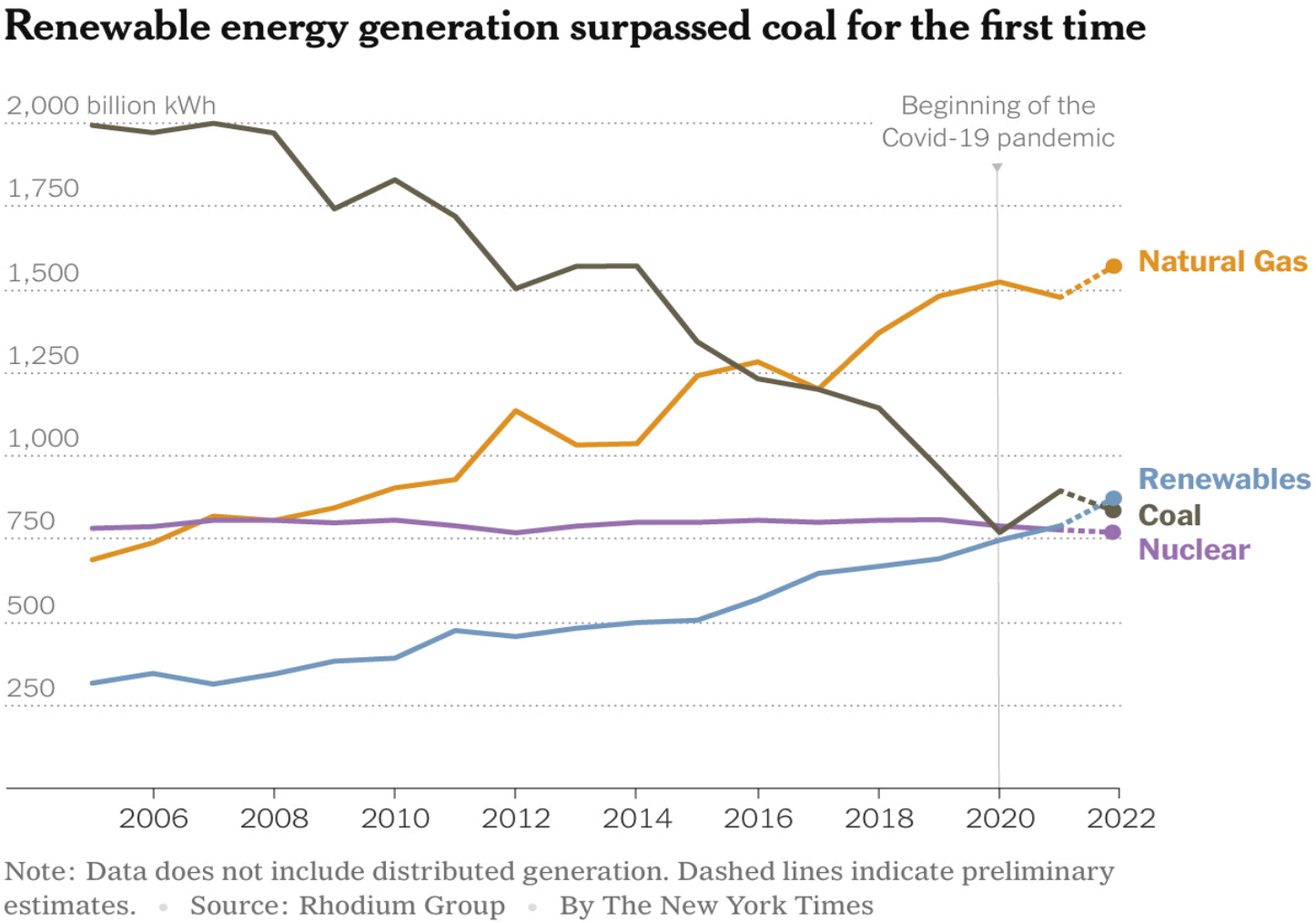

Two features to note:

Increase in coal consumption when oil

Traditional energy consumption decreases but far from zero

Source: *New York Times, Elena Shao, "US Carbon Emissions Grew in 2022" Jan 10, 2023*

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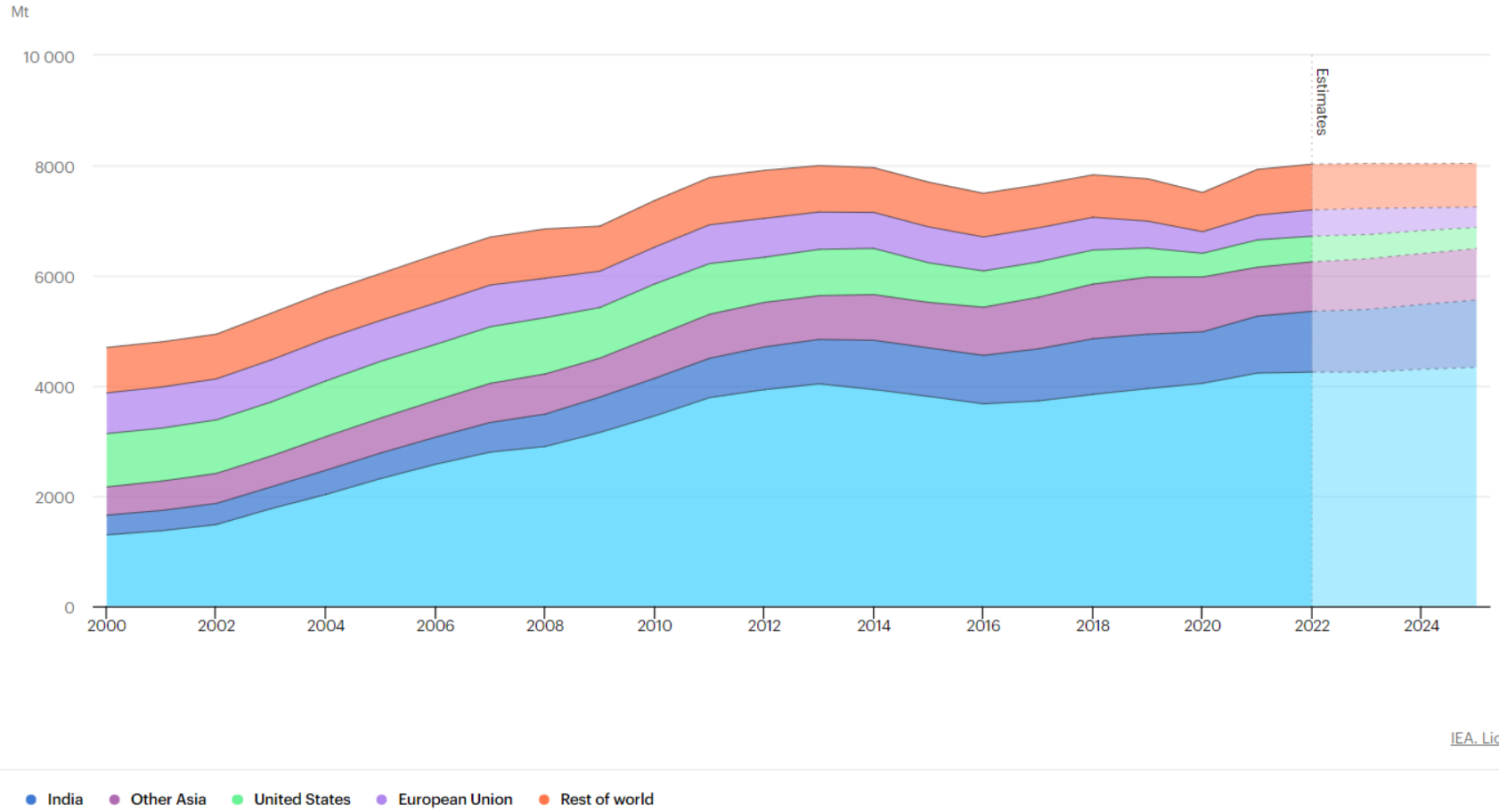
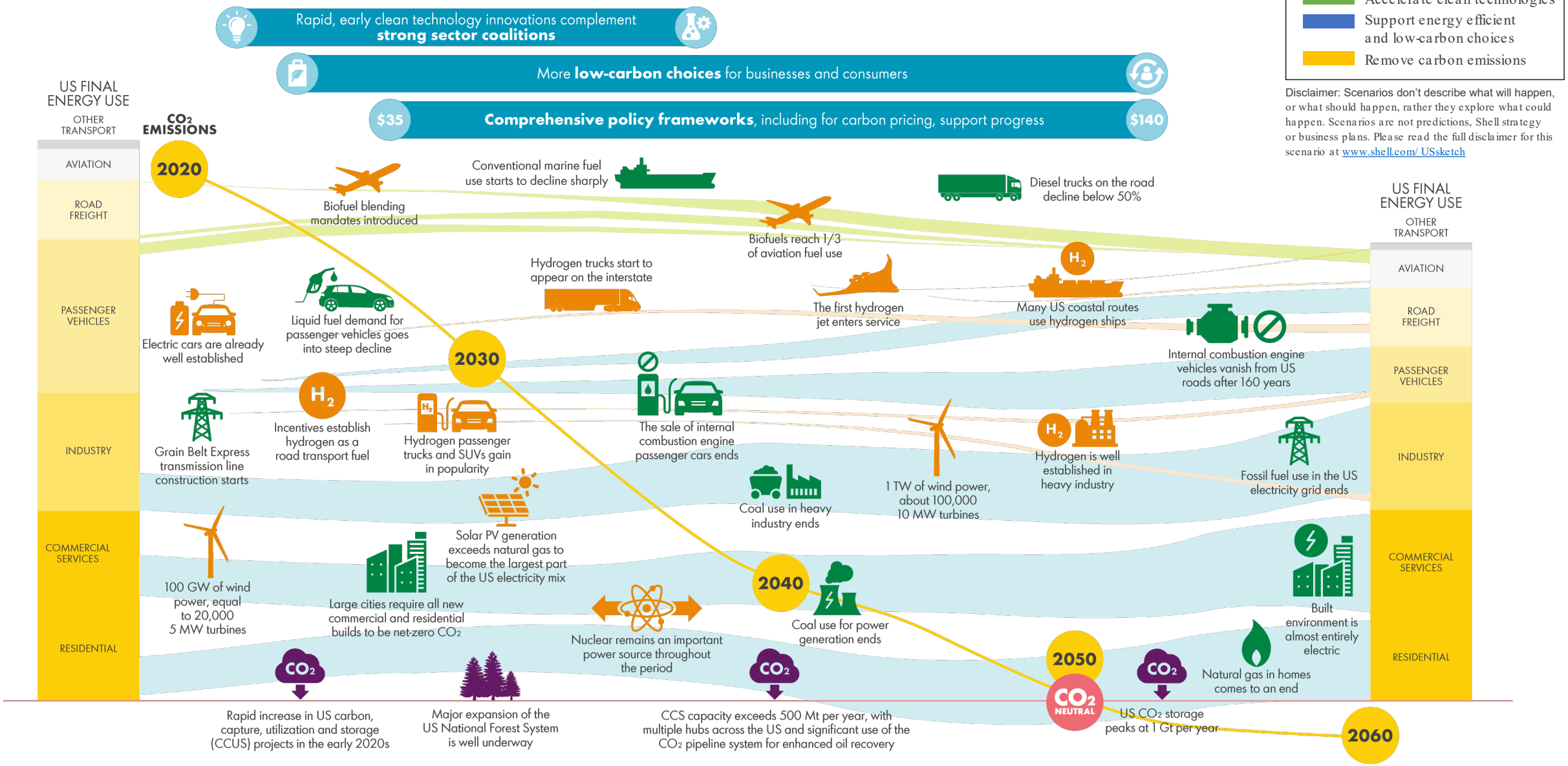
Global coal consumption, 2000-2025 (million tonnes)



Source: *IEA.org, "Coal 2022"*

Shell Scenarios sketch

A US net-zero CO_2 energy system by 2050



Disclaimer: Scenarios don't describe what will happen, or what should happen, rather they explore what could happen. Scenarios are not predictions, Shell strategy or business plans. Please read the full disclaimer for this scenario at www.shell.com/ USsketch