



Energy Strategy MasterClass

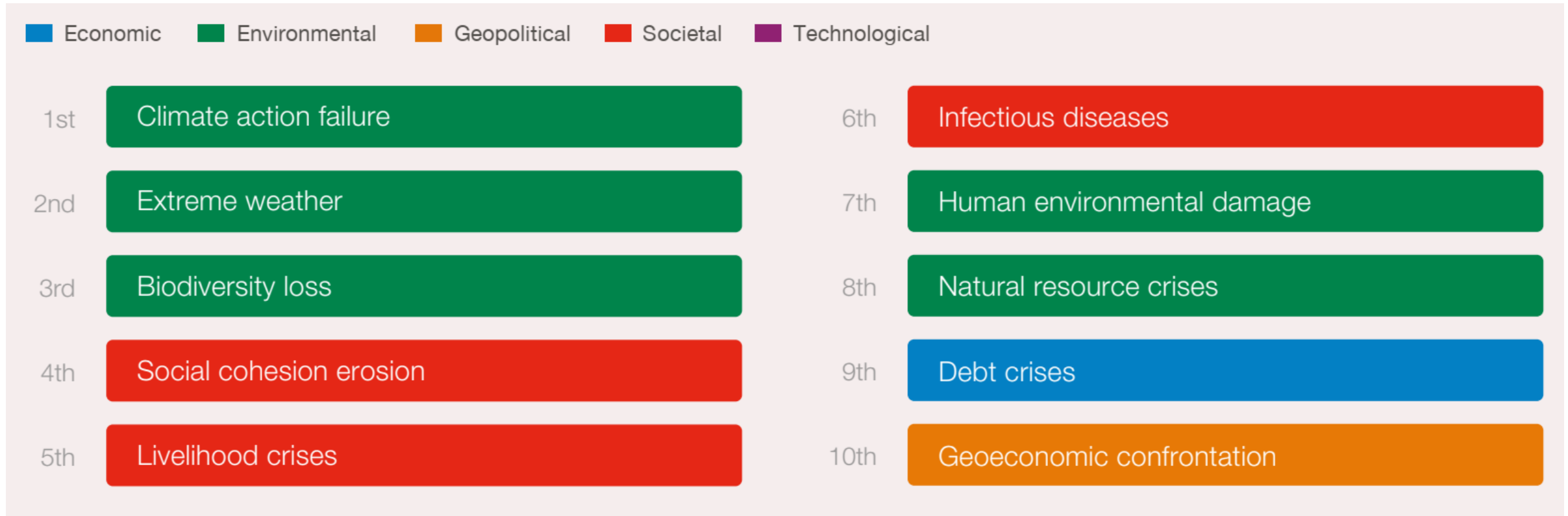
Ramin Forouzandeh | Aug 17-18, 2022



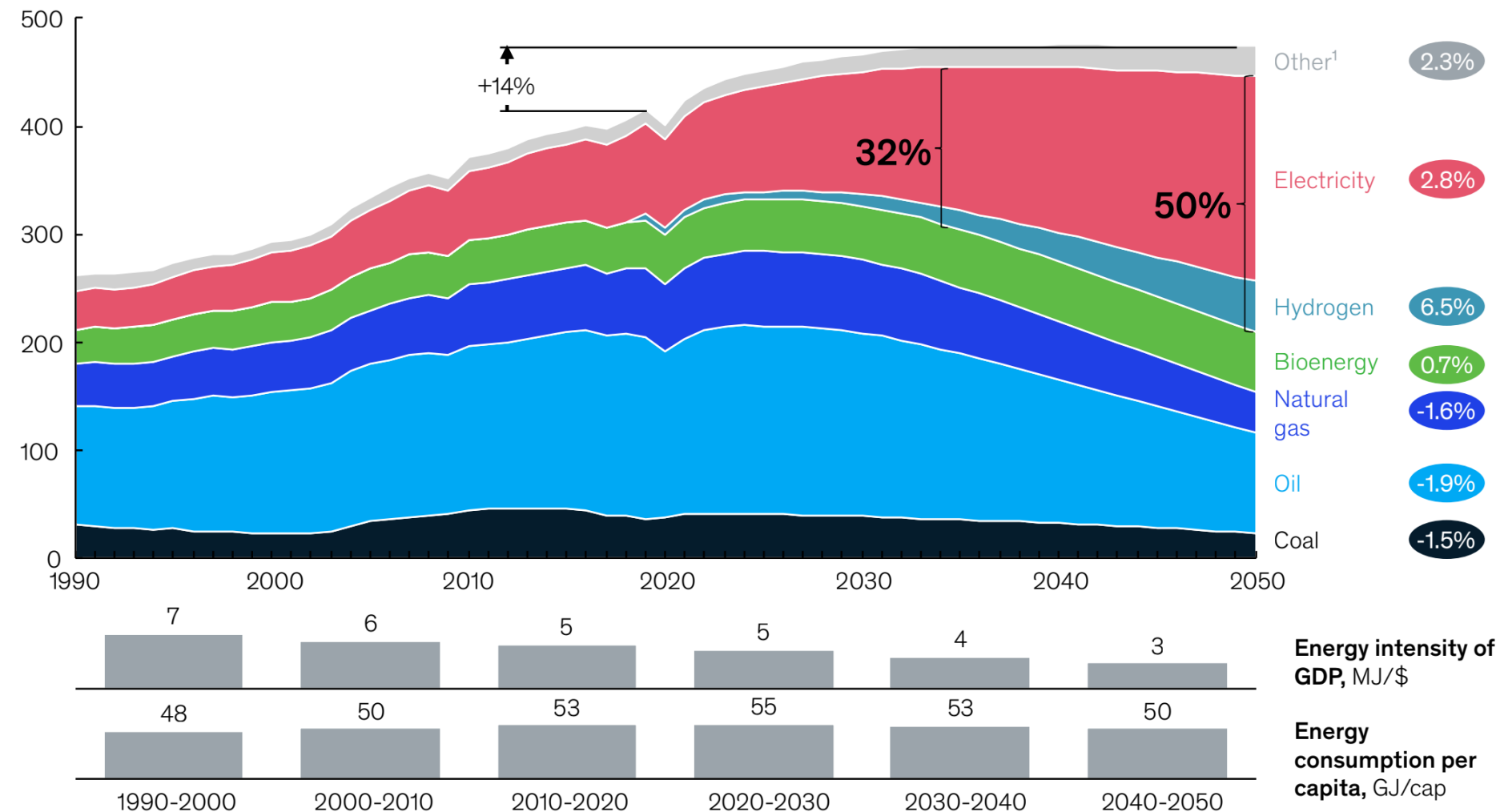
The Energy Cake

To provide an overview of key energy demand and supply figures by region and product

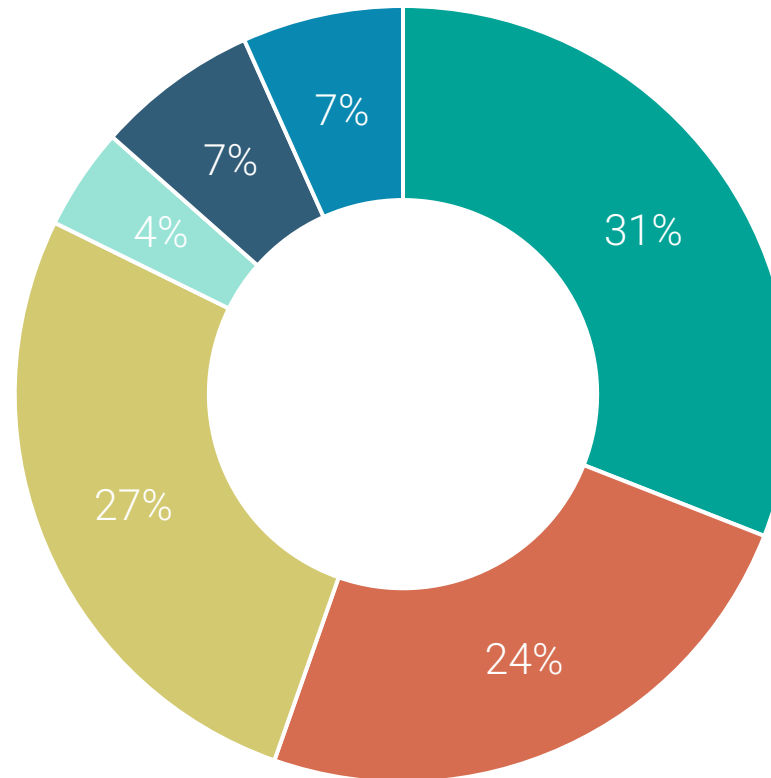
The Most Severe Risks On A Global Scale Over The Next 10 Years



Final Energy Consumption by Fuel Under Further Acceleration Scenario (Million TJ)

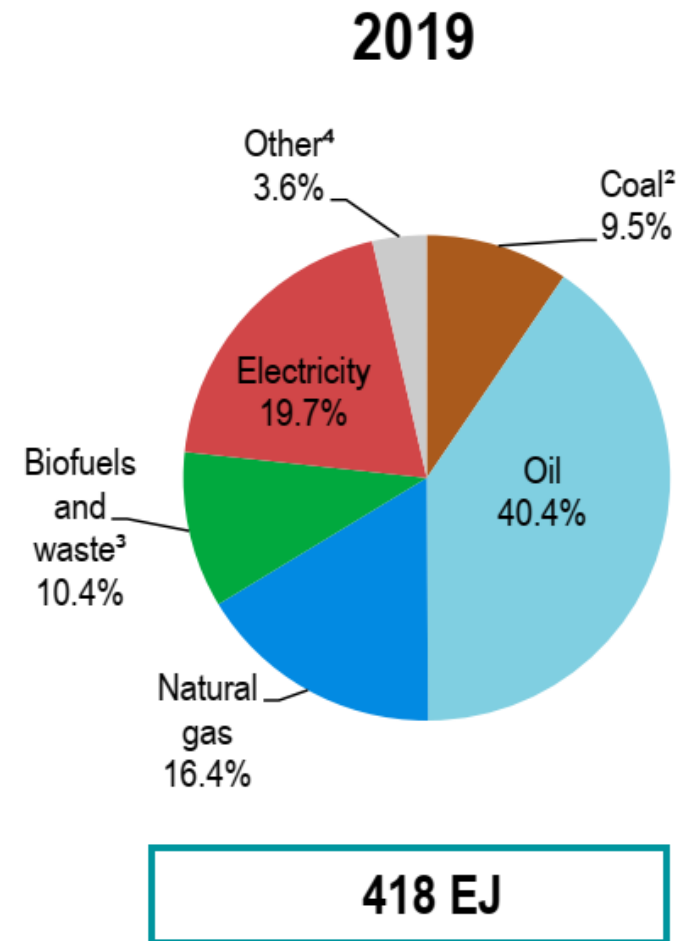
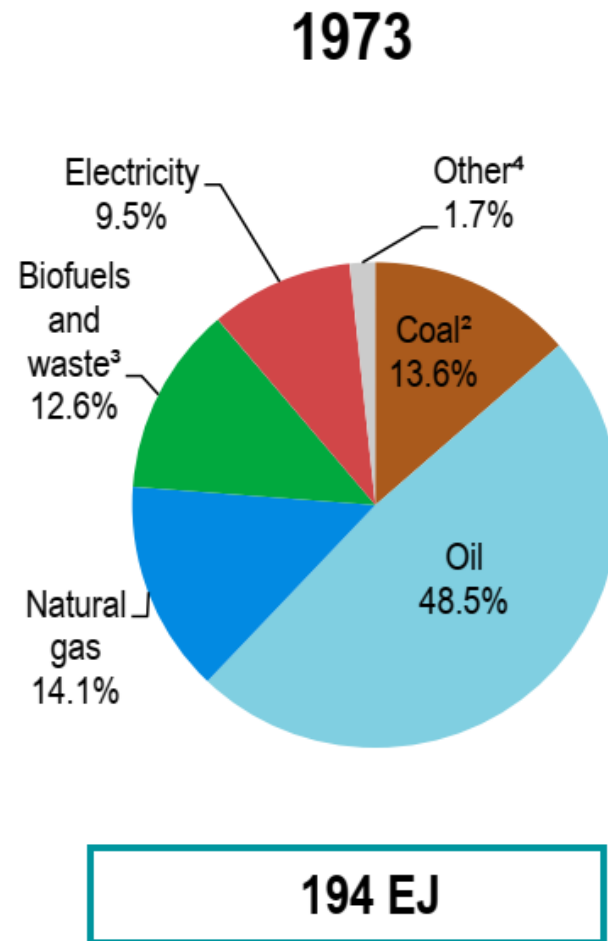


Primary Energy Consumption by Fuel (Exajoules)

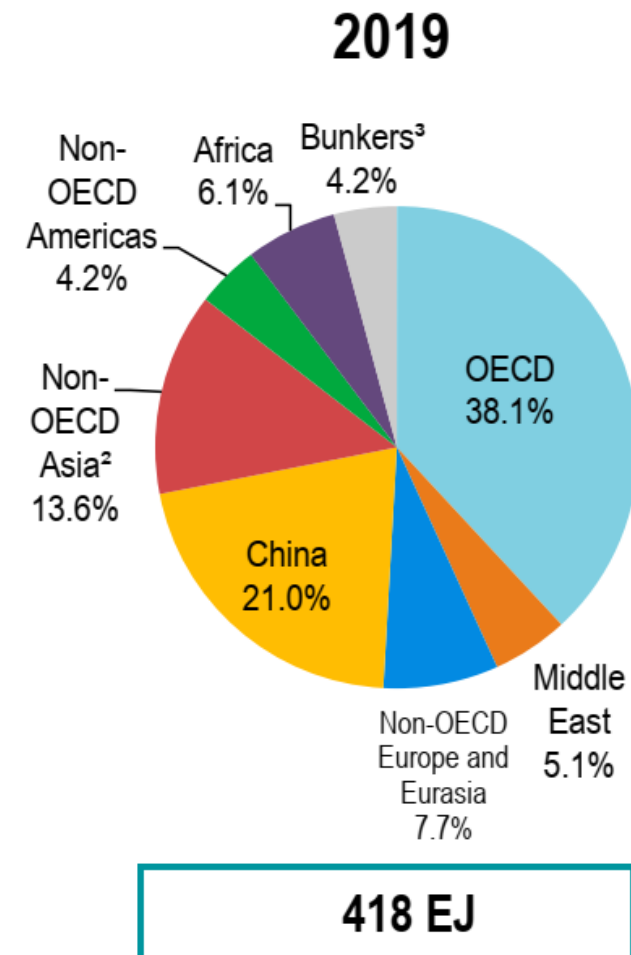
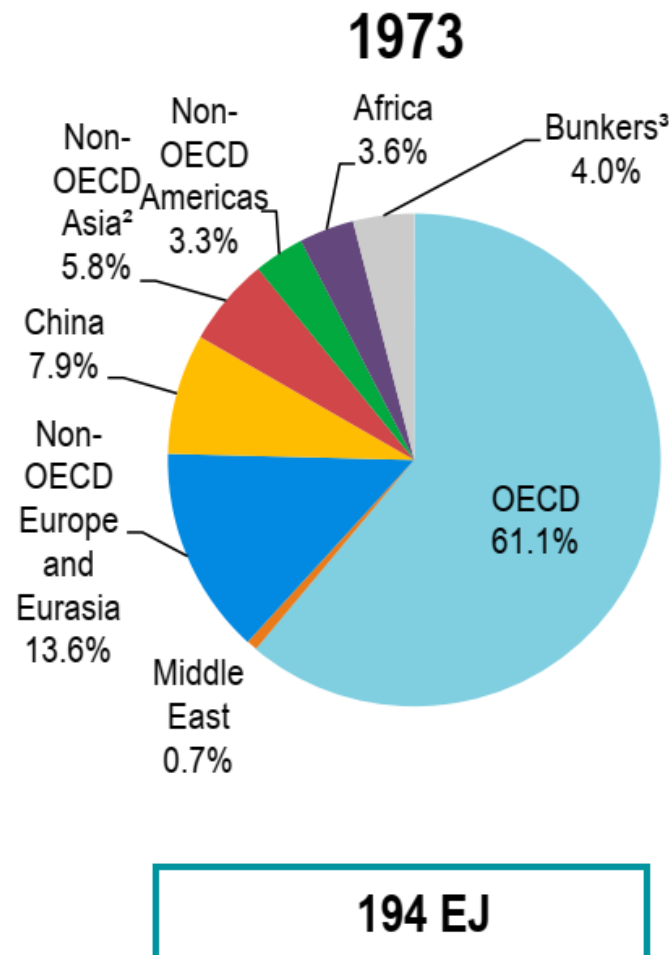


■ Oil ■ Natural gas ■ Coal ■ Nuclear energy ■ Hydro-electricity ■ Renewables

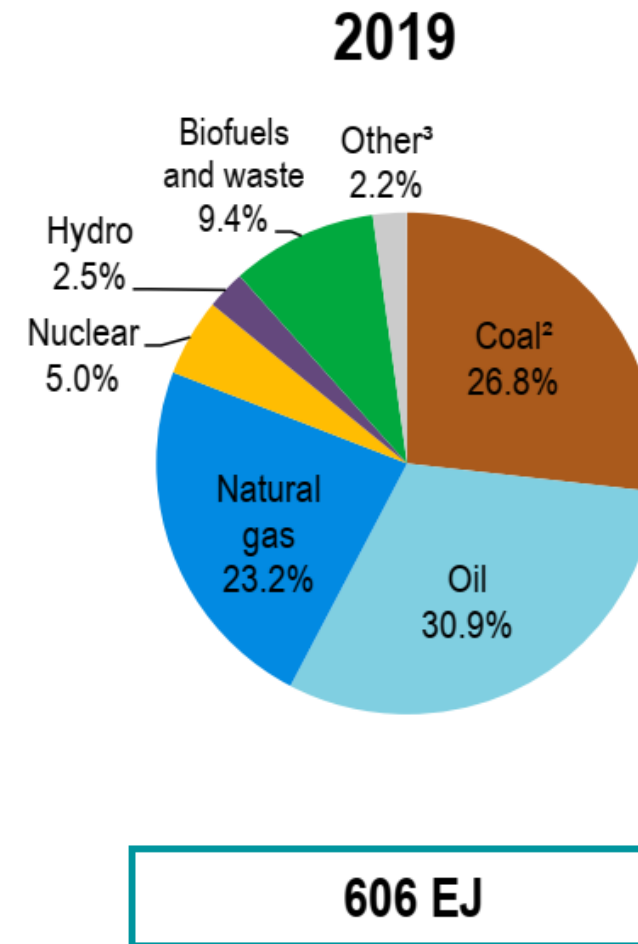
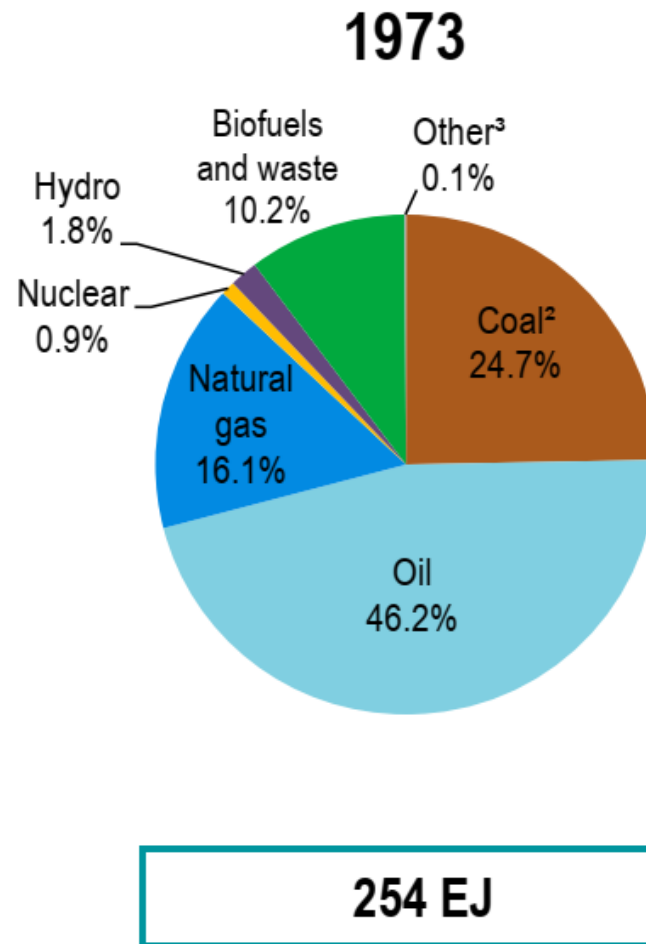
World Total Final Consumption by Source



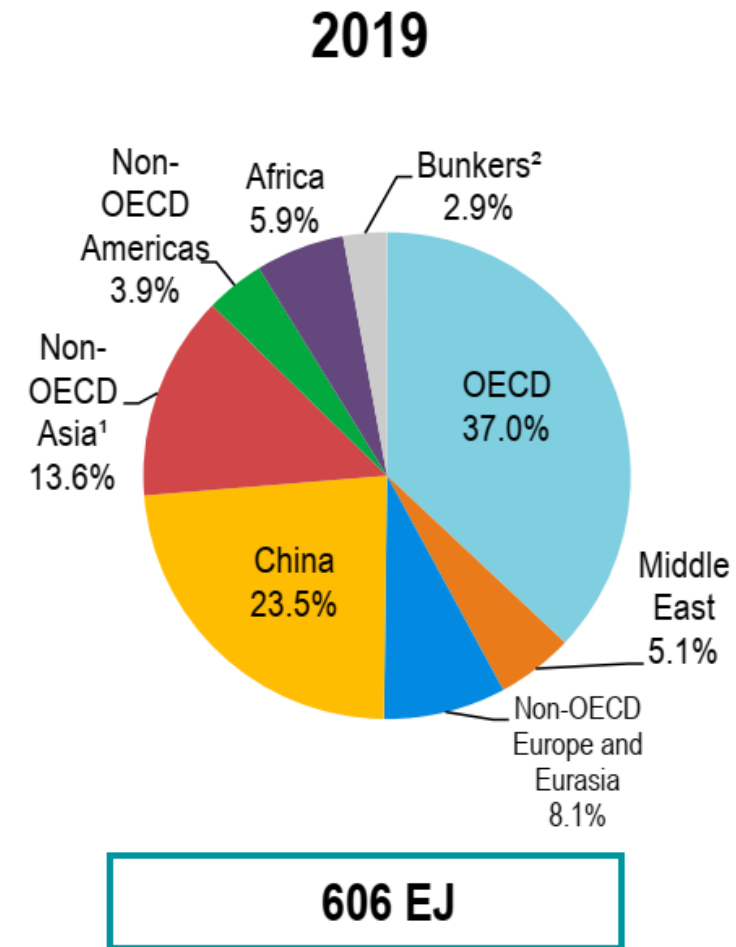
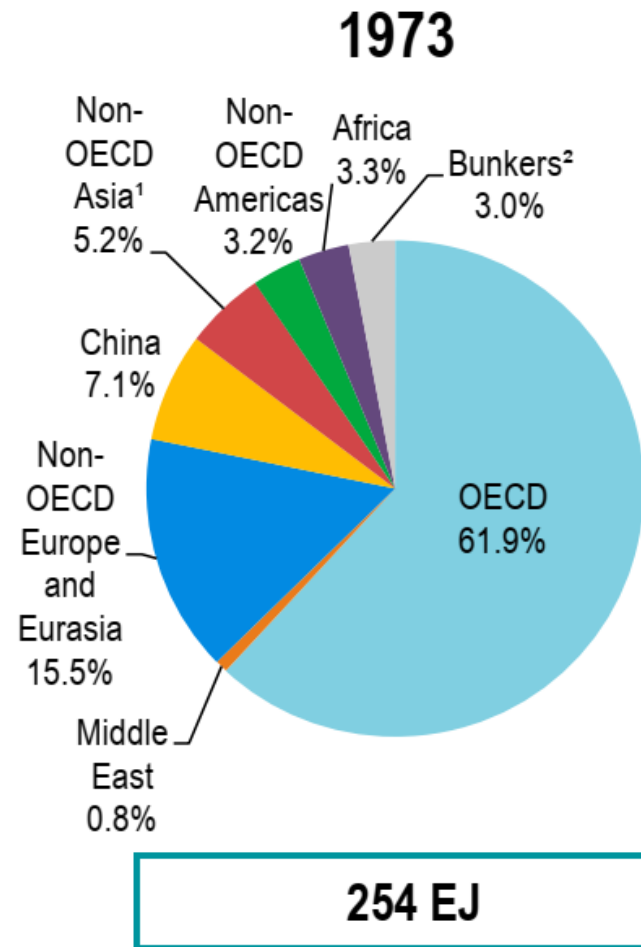
World Total Final Consumption by Region



World Total Energy Supply by Source



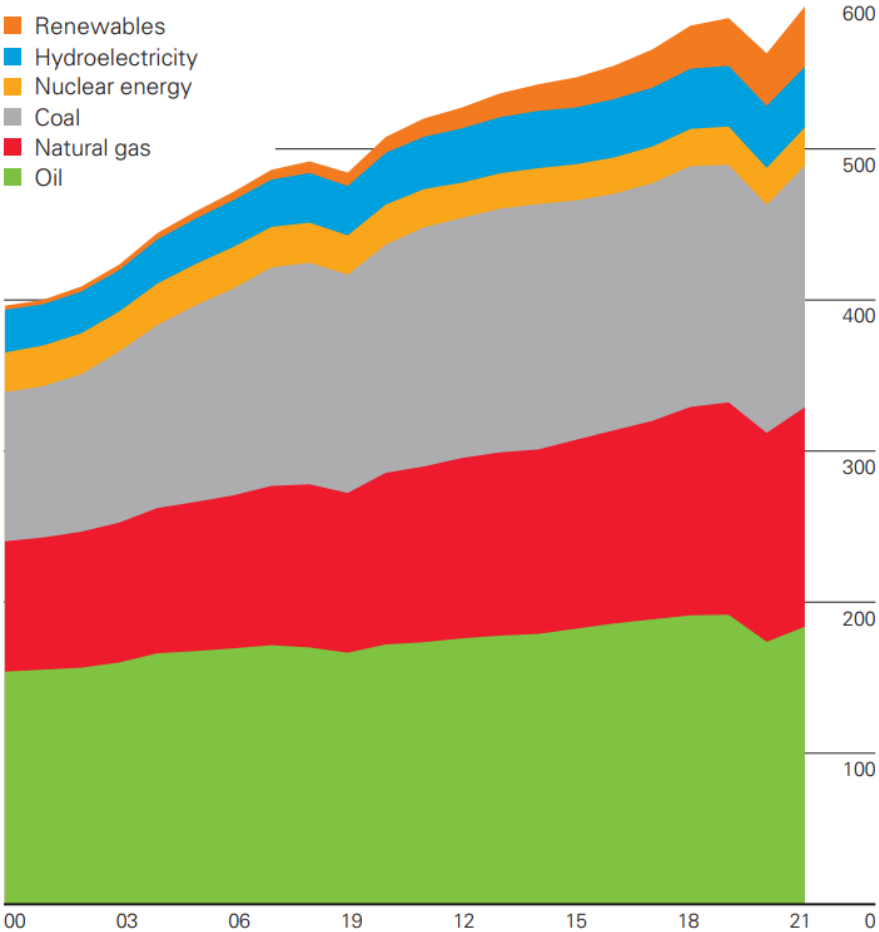
World Total Energy Supply by Region



World Energy Consumption

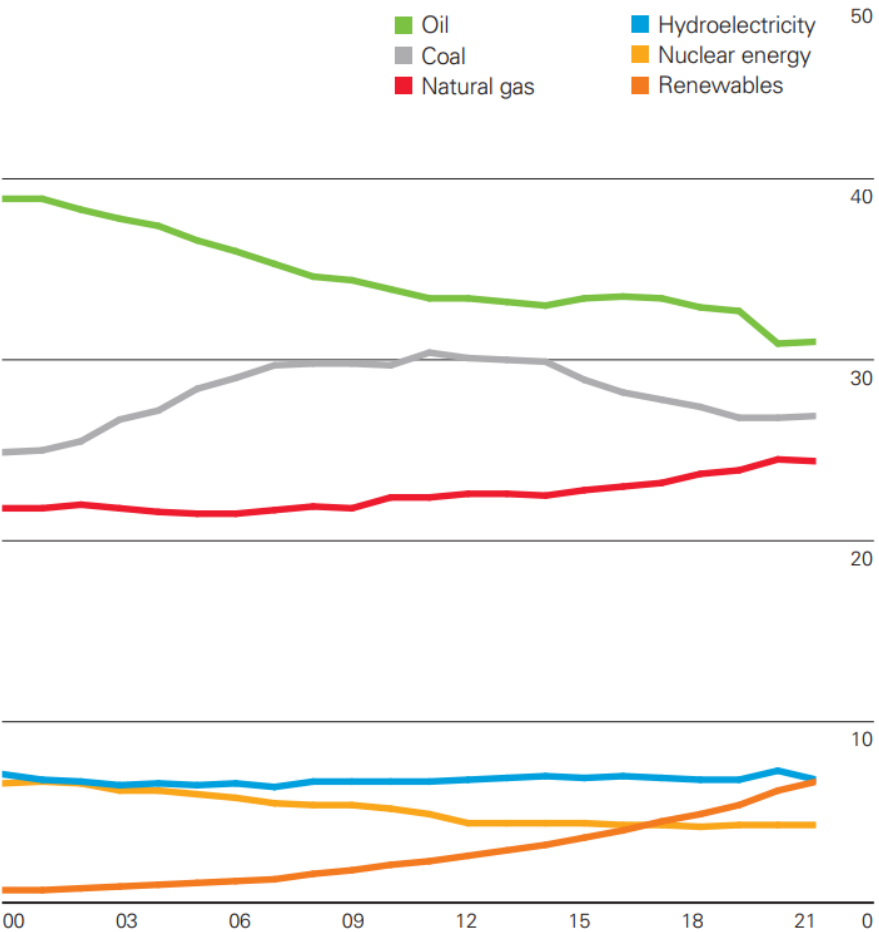
World consumption

Exajoules

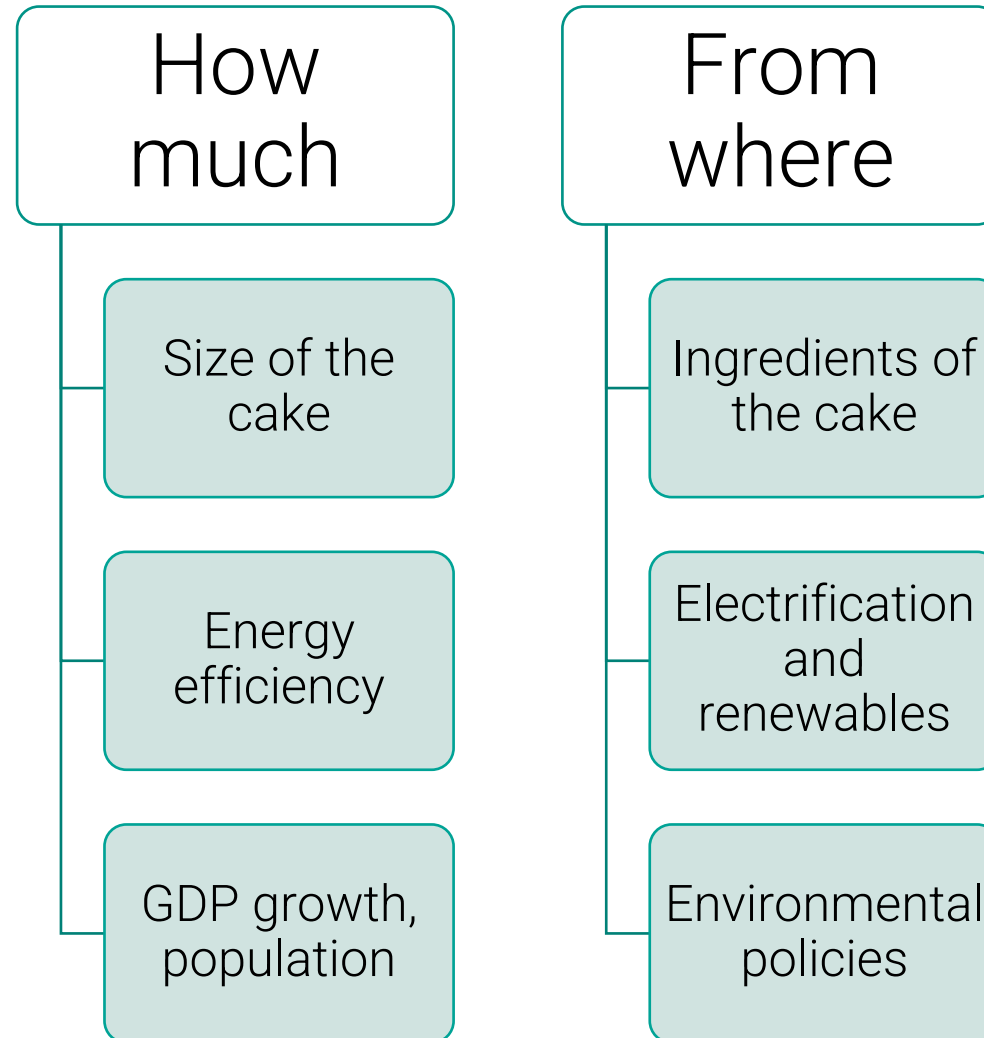


Shares of global primary energy

Percentage



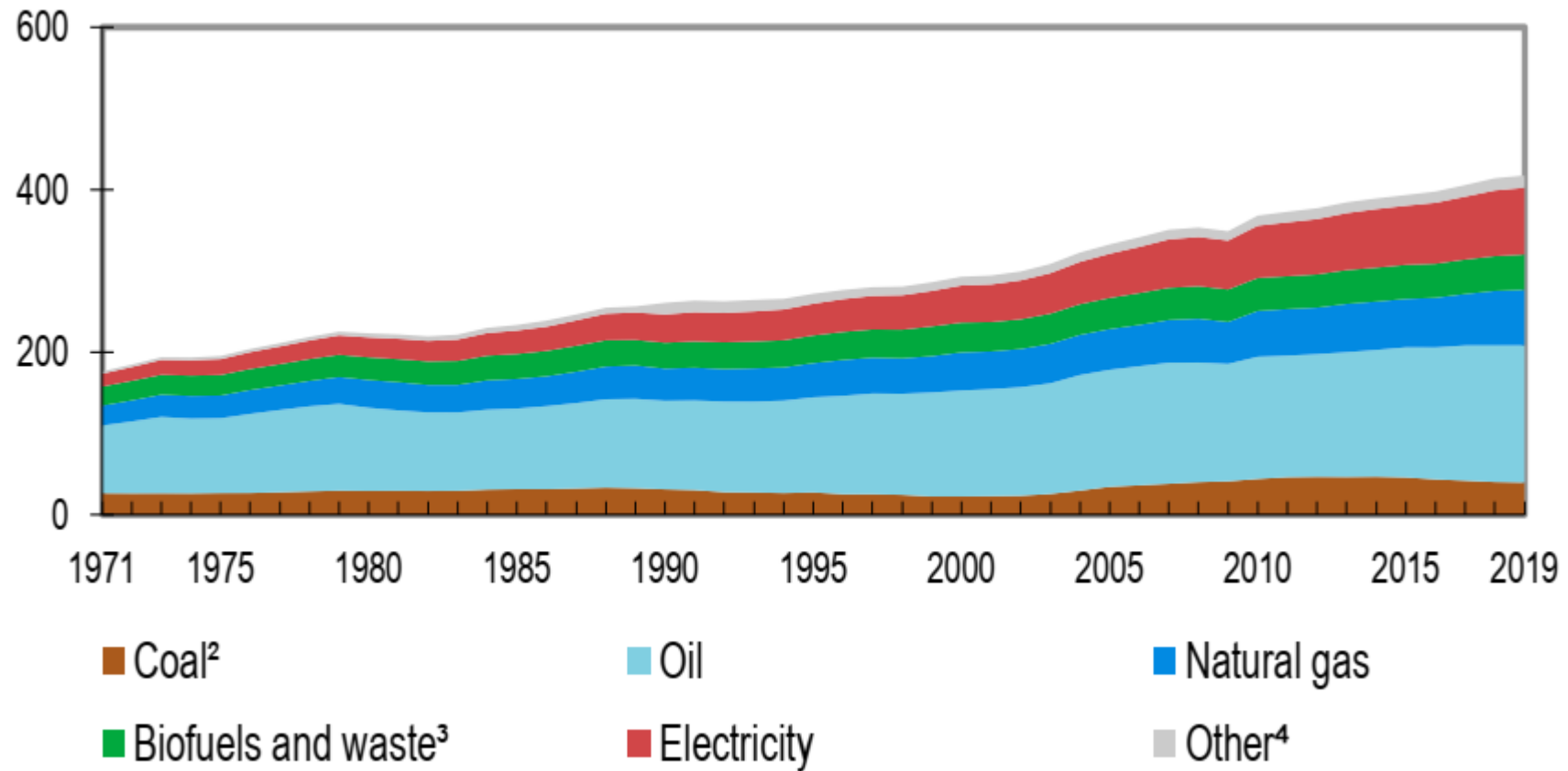
Two dimensions of the energy cake



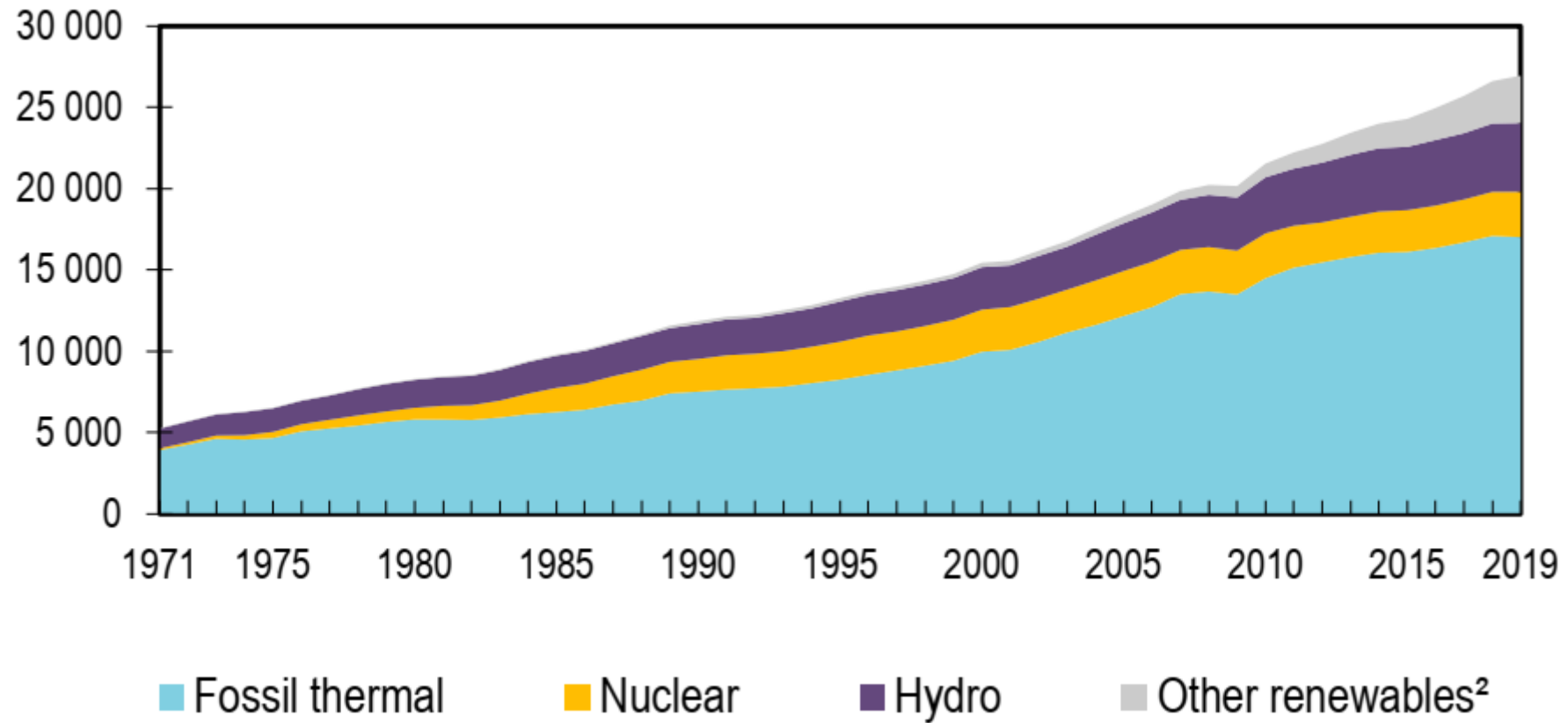
Electrification

To understand the role of renewable power and electric vehicles

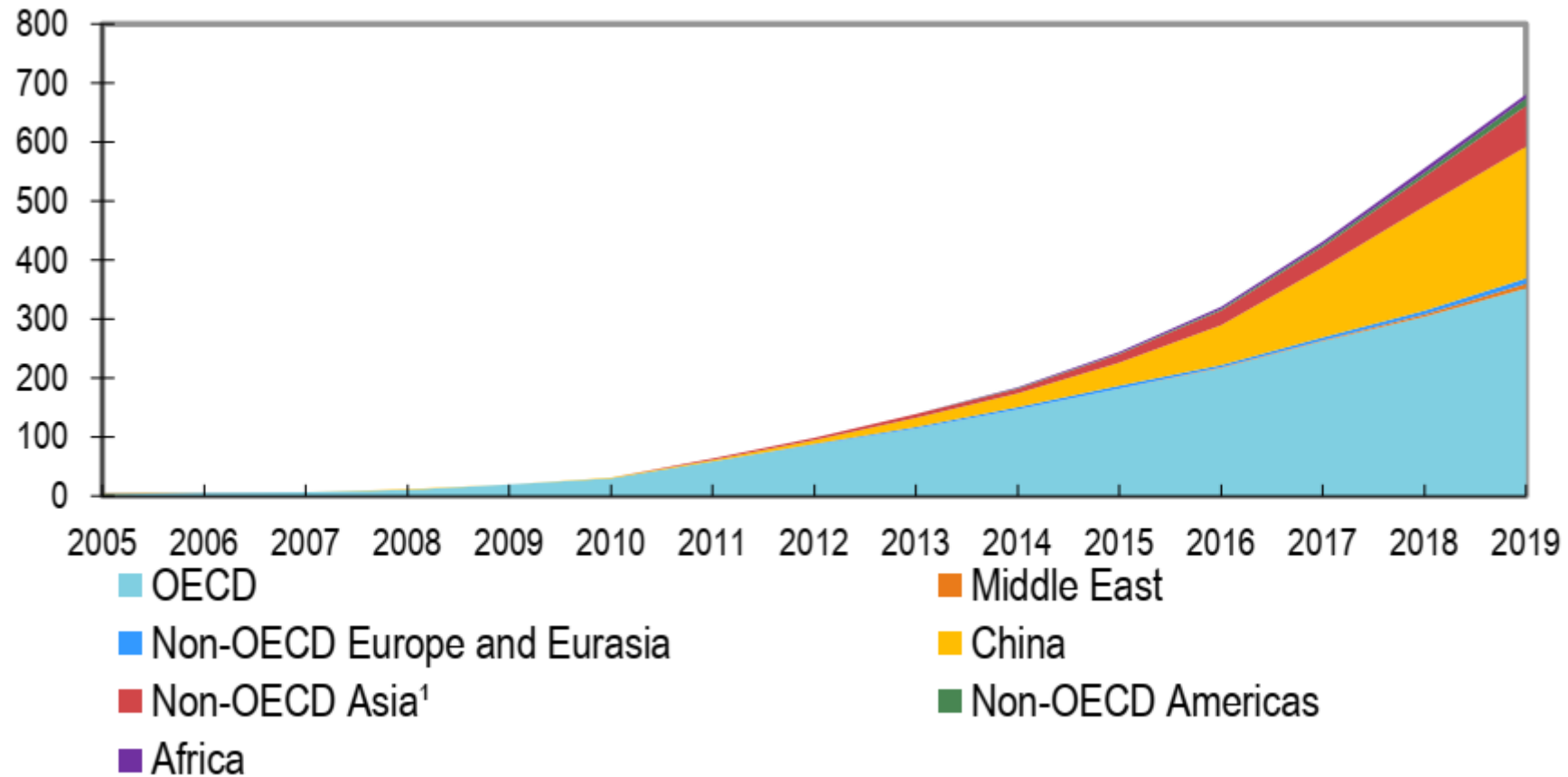
World Total Final Consumption by Source (EJ)



World Electricity Generation By Source (Twh)

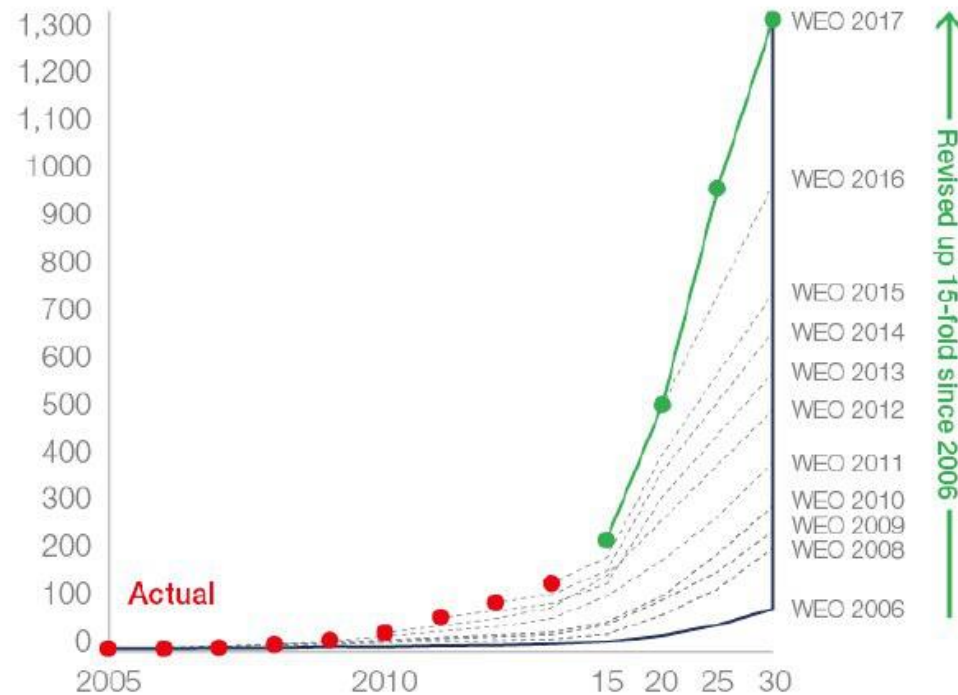


World Solar PV Electricity Production by Region (Twh)

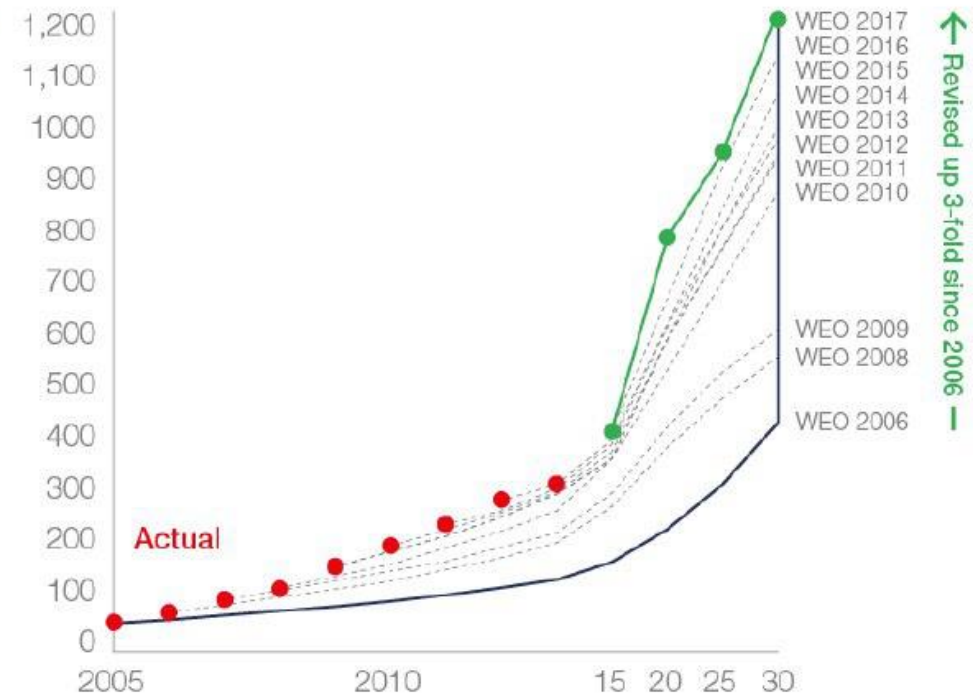


Underestimating Renewables

Solar: global forecast of cumulative installed capacity
GW

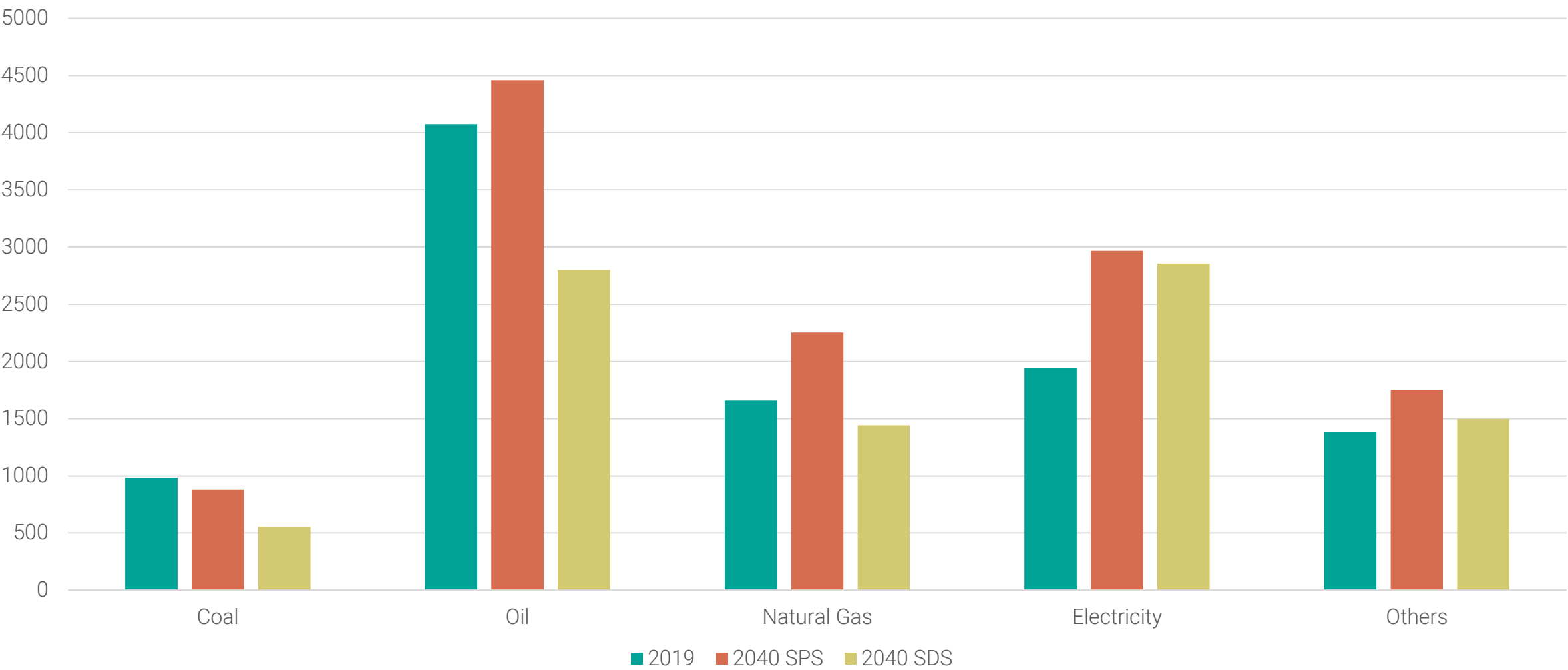


Wind: global forecast of cumulative installed capacity
GW

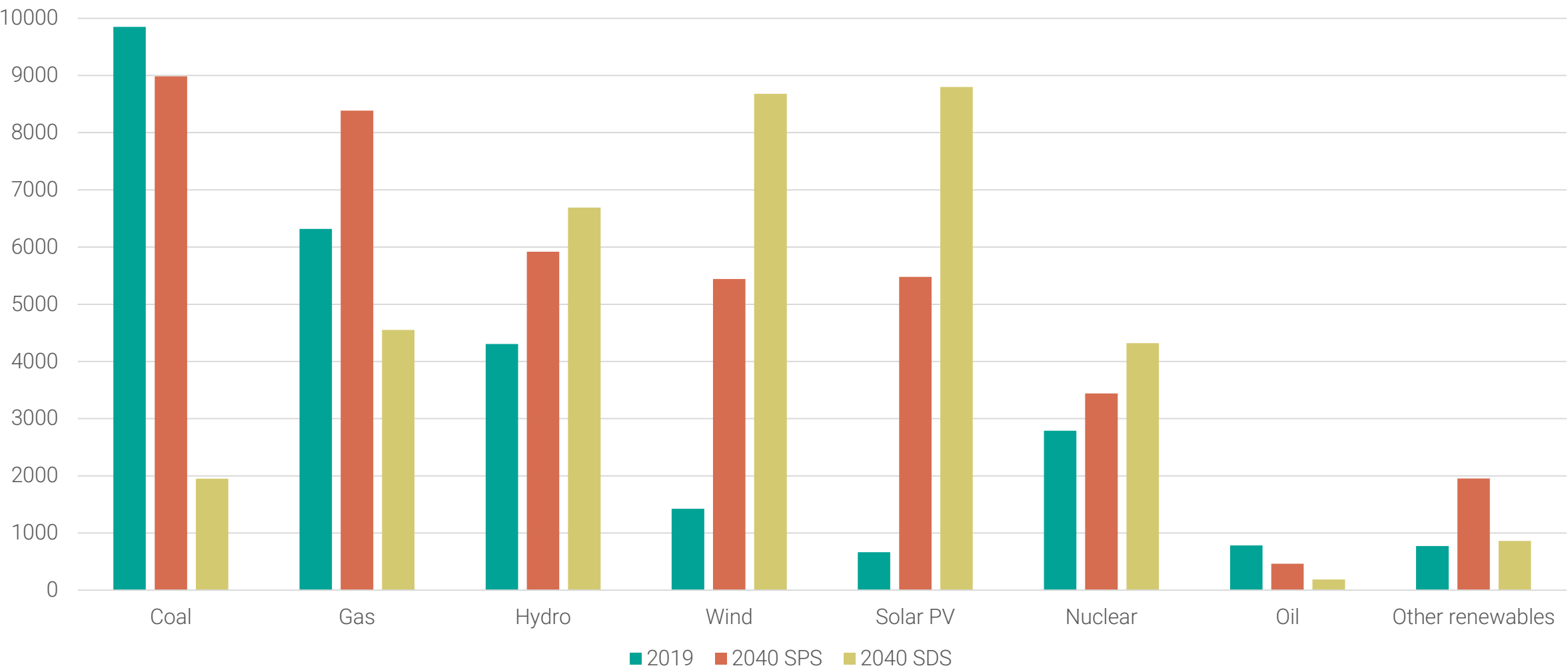


Source: IEA World Energy Outlook – New Policy Scenario

Total Final Consumption (Mtoe)



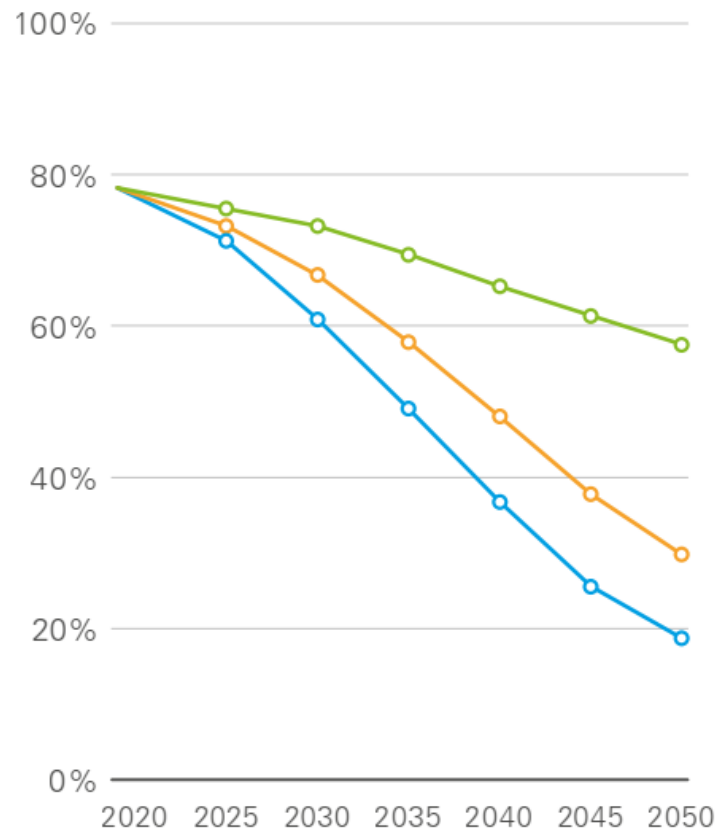
Electricity Generation (TWh)



Gradual Shift in Energy Demand

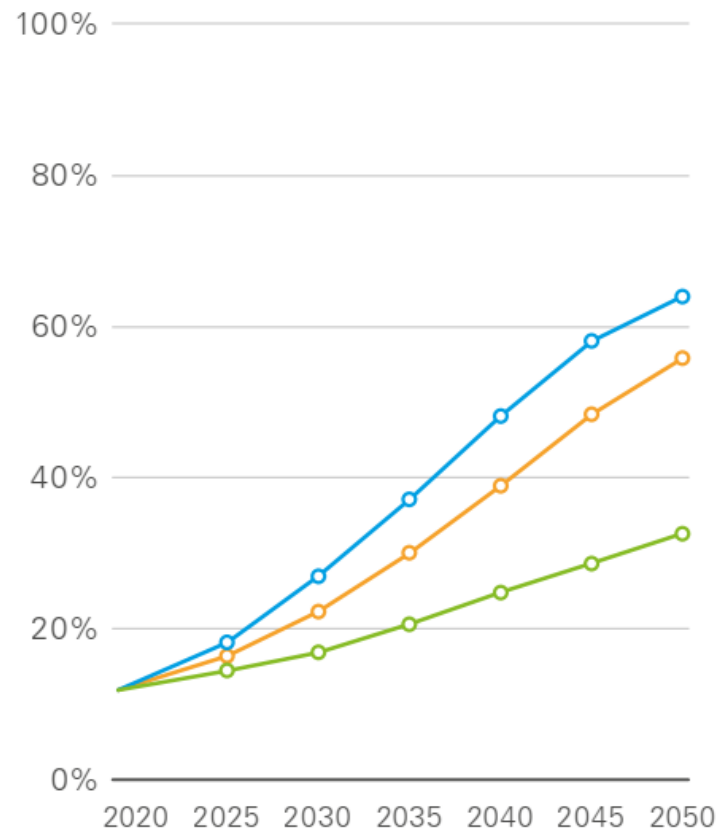
Fossil fuels

Share of primary energy



Renewables*

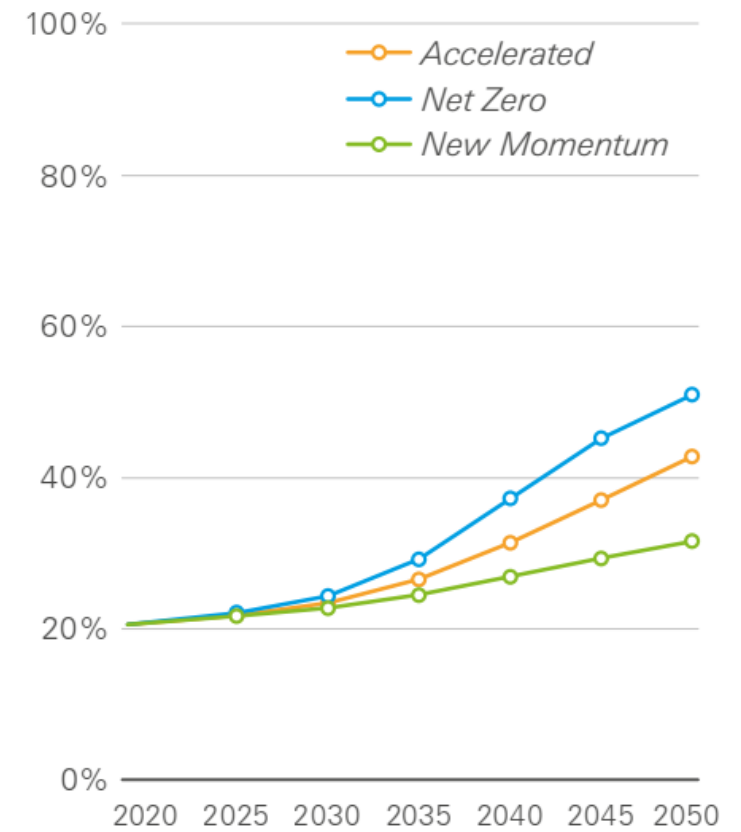
Share of primary energy



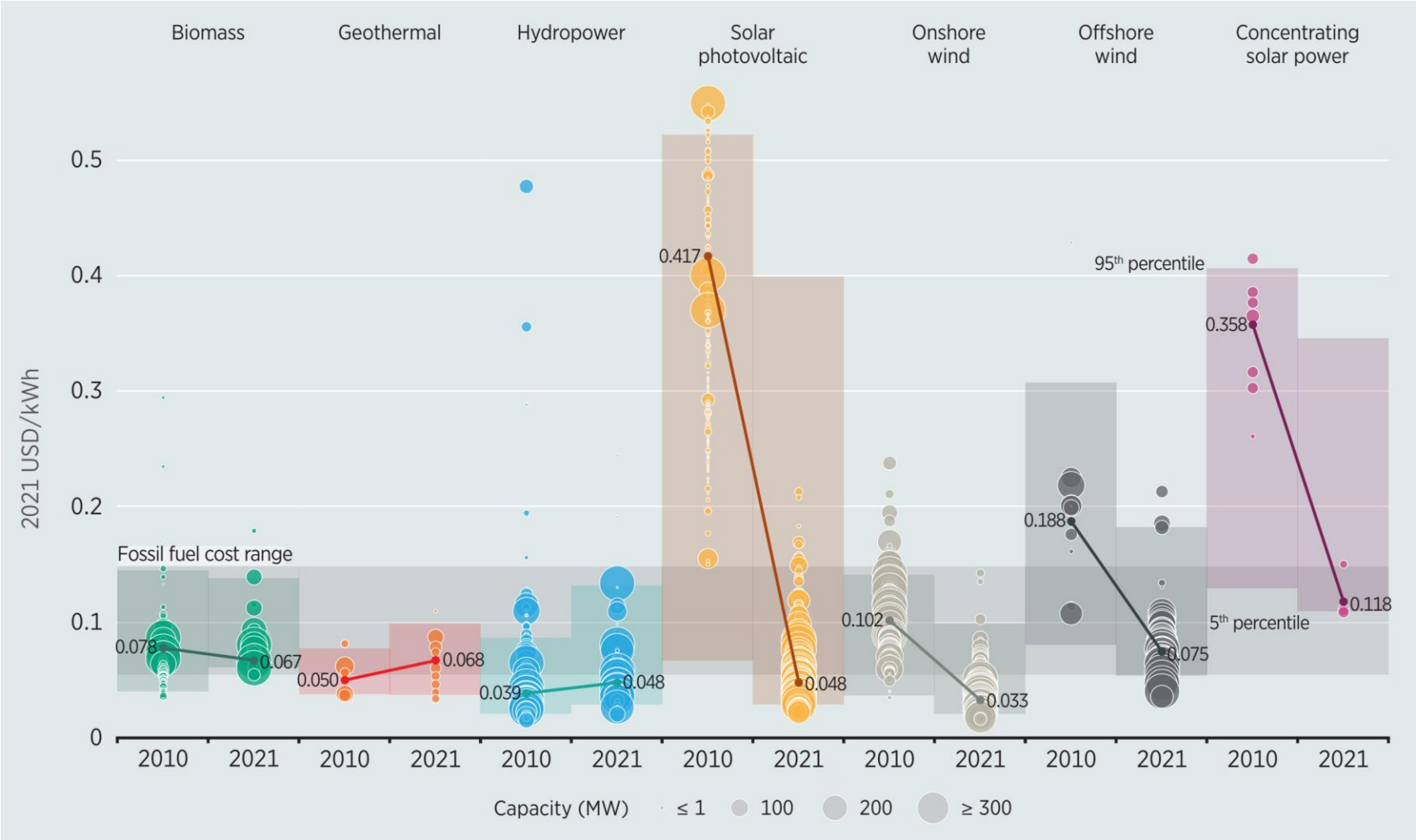
* Includes wind, solar, bioenergy and geothermal

Electricity

Share of total final consumption

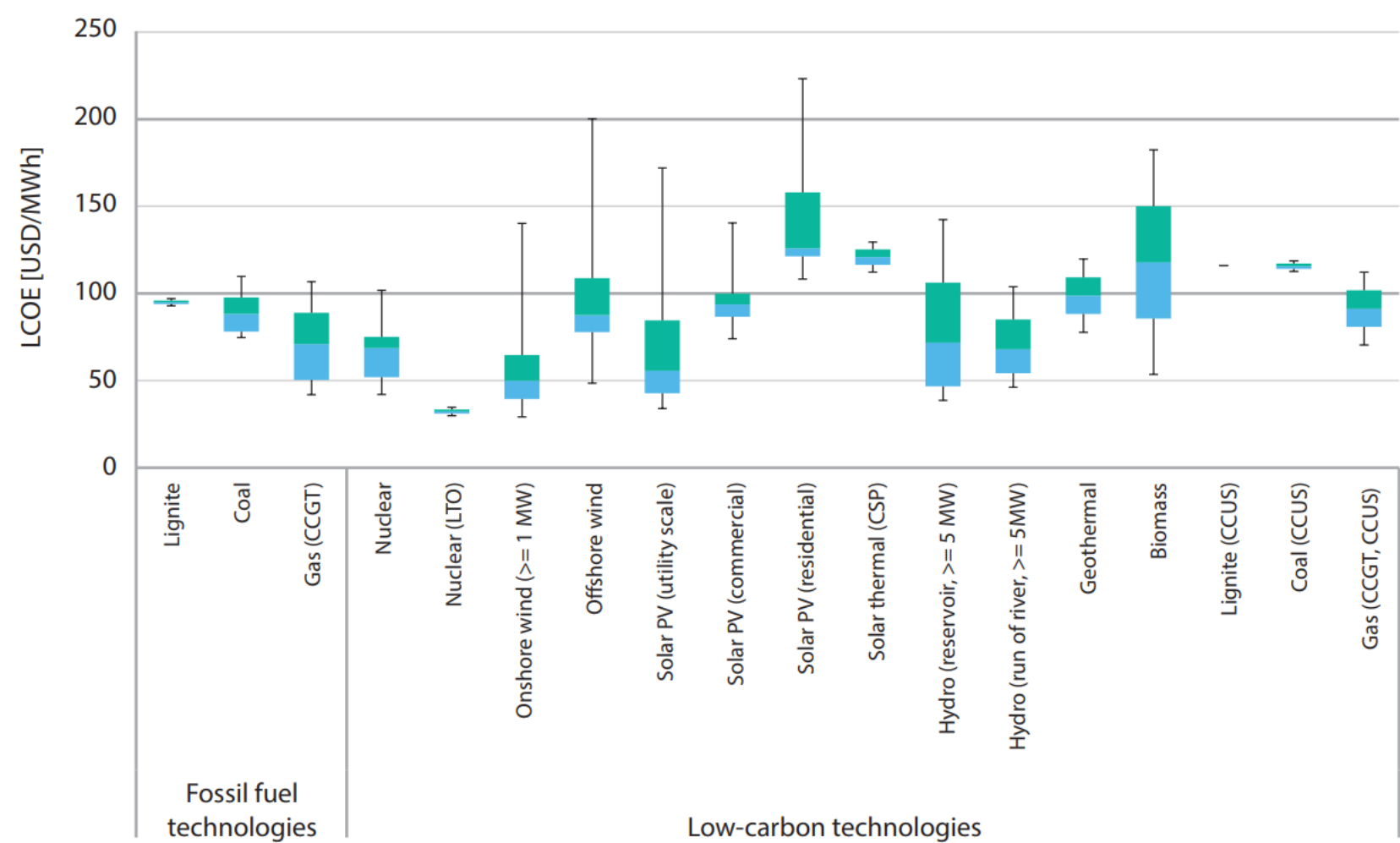


Global LCOEs from Utility-scale Power Generation Technologies



IRENA Renewable Power Generation Costs in 2021

LCOE by Technology

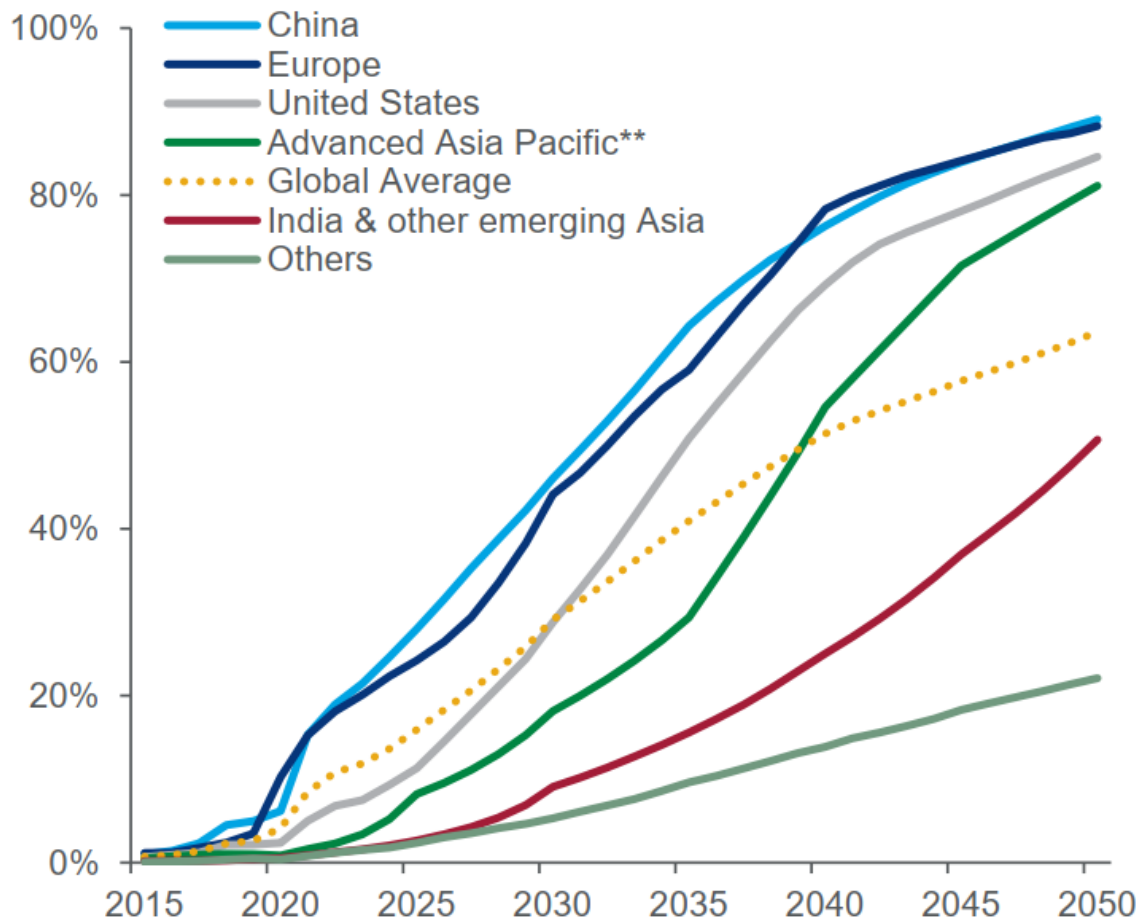


Key Metrics

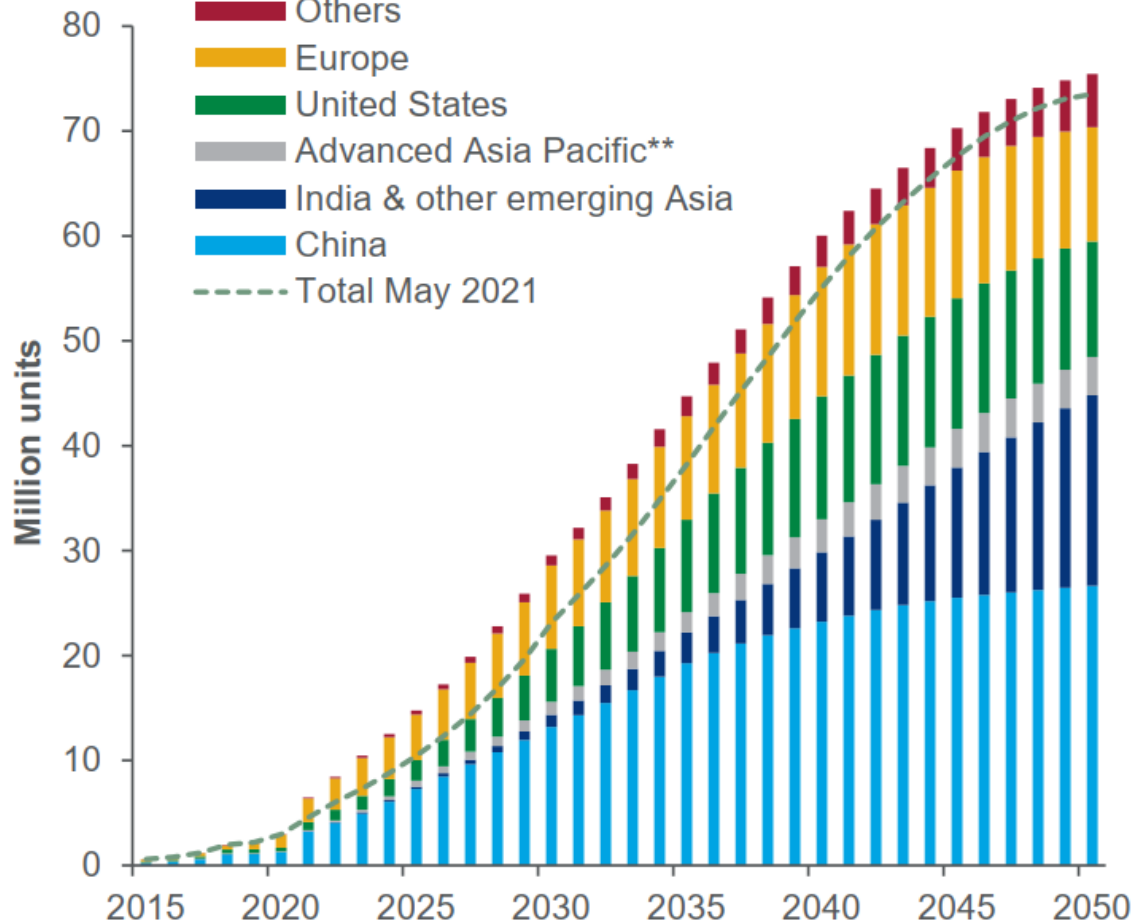


Global EV Sales

EV* share of light vehicles sales



Global EV* sales



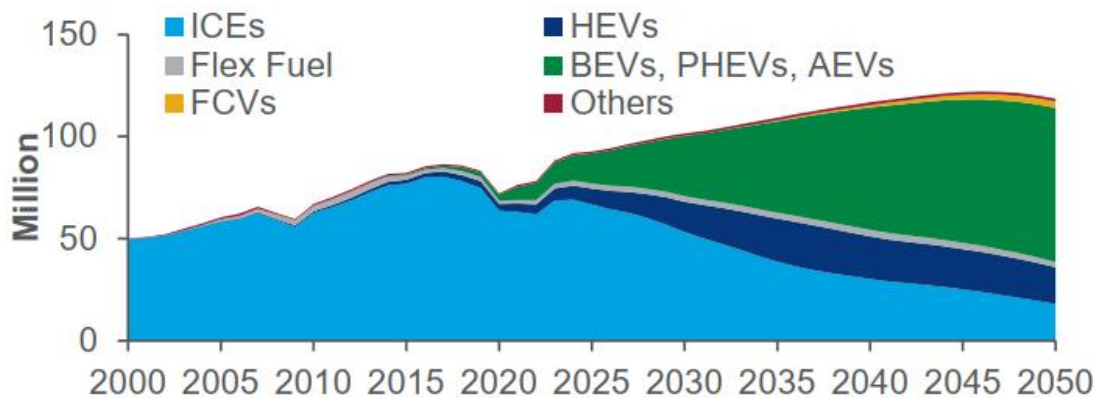
Wood Mackenzie Macro Oils long-term November 2021 outlook to 2050

The Key Differences Between Electric Cars

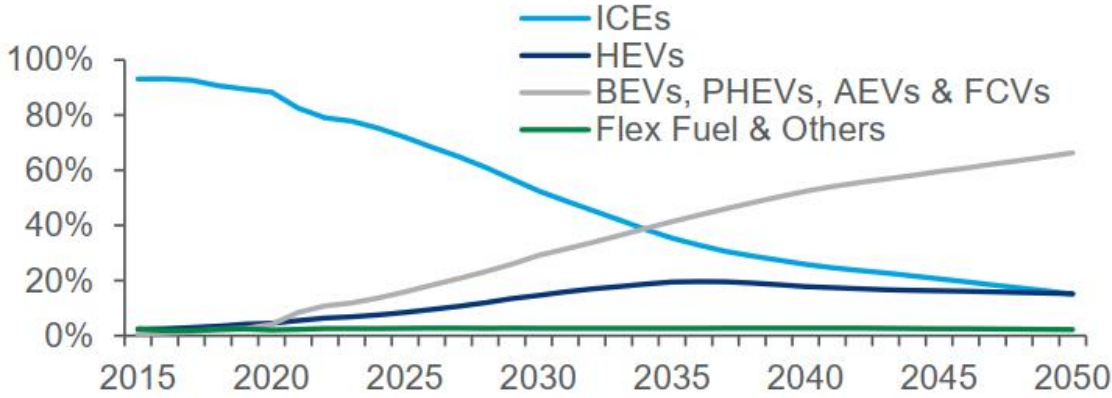
- AEV: All-Electric Vehicle. Run only on electricity, either from a battery (BEV) or a fuel cell (FCEV).
- BEV: Battery Electric Vehicle. A PEV that uses only a battery and electric motor to power the EV.
- EV: A generic term for a vehicle that gets some or all of its power from an electric motor. Sometimes used to mean PEV, BEV, AEV, FCEV, and occasionally HEV.
- FCEV: Fuel Cell Electric Vehicle. An AEV that is powered by a fuel cell rather than a battery. These are not covered in this resource kit, which addresses only PEVs.
- HEV: Hybrid Electric Vehicle. These vehicles do not plug in, but have a large battery on board that is charged by the vehicle's braking. The energy stored by this battery assists the ICE in moving the car, significantly improving the gas mileage.
- PEV: Plug-in Electric Vehicle. An EV that plugs in to an external source to charge an on-board battery that provides the electricity for the electric motor.
- PHEV: Plug-in Hybrid Electric Vehicle. PHEVs use both an ICE and an electric motor with a battery that recharges by plugging into an external source.

Light Vehicles Sales and Stock

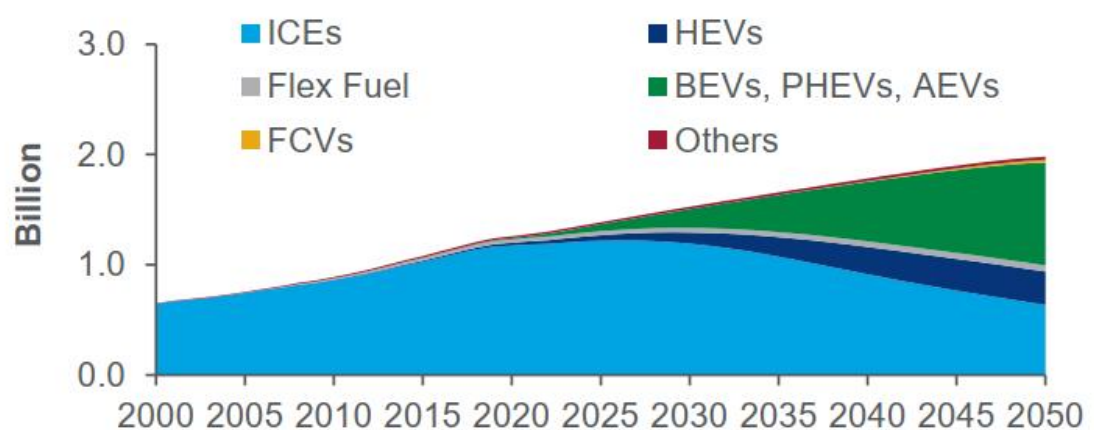
Global light vehicles sales



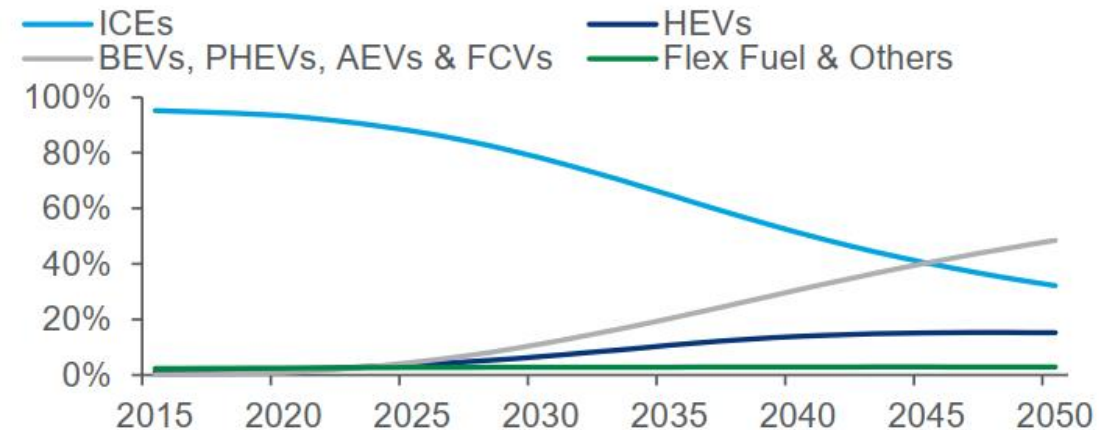
Share% in light vehicles sales



Global light vehicles stock

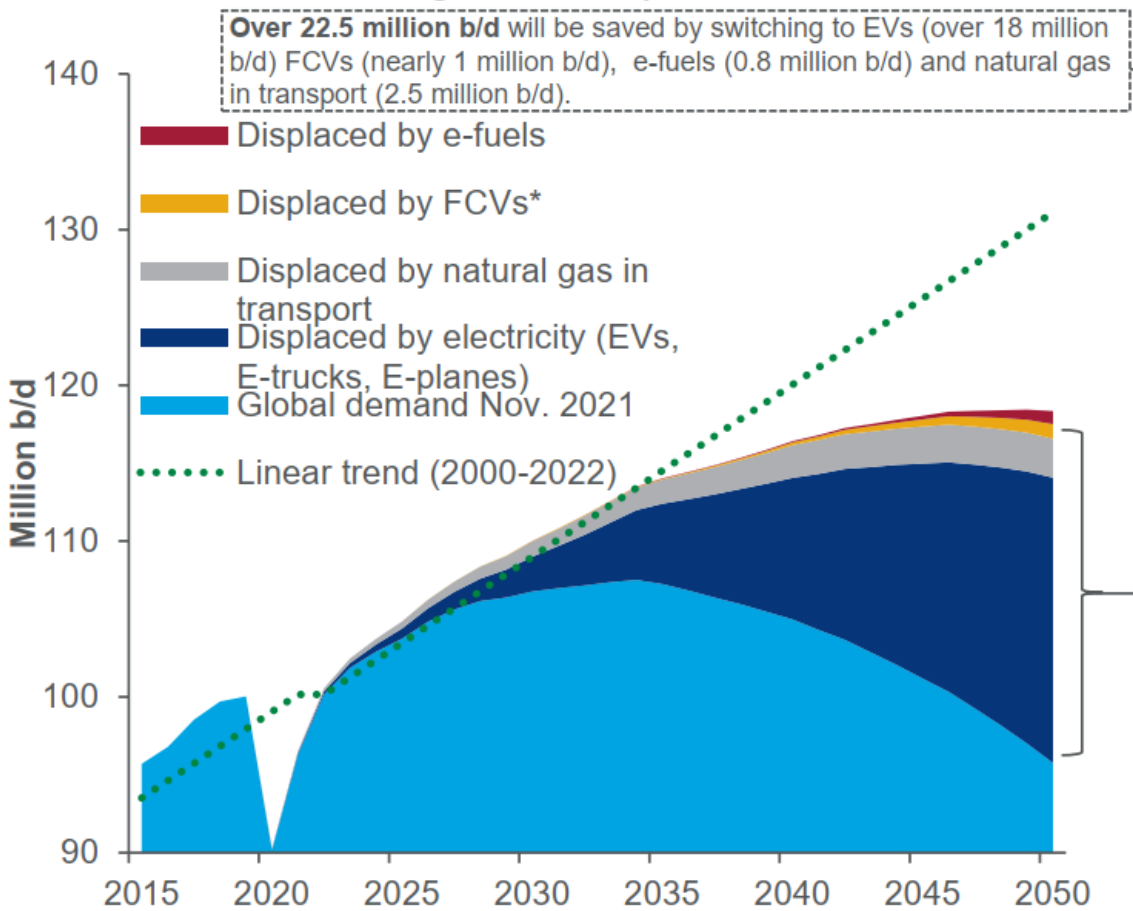


Share% in light vehicles stock

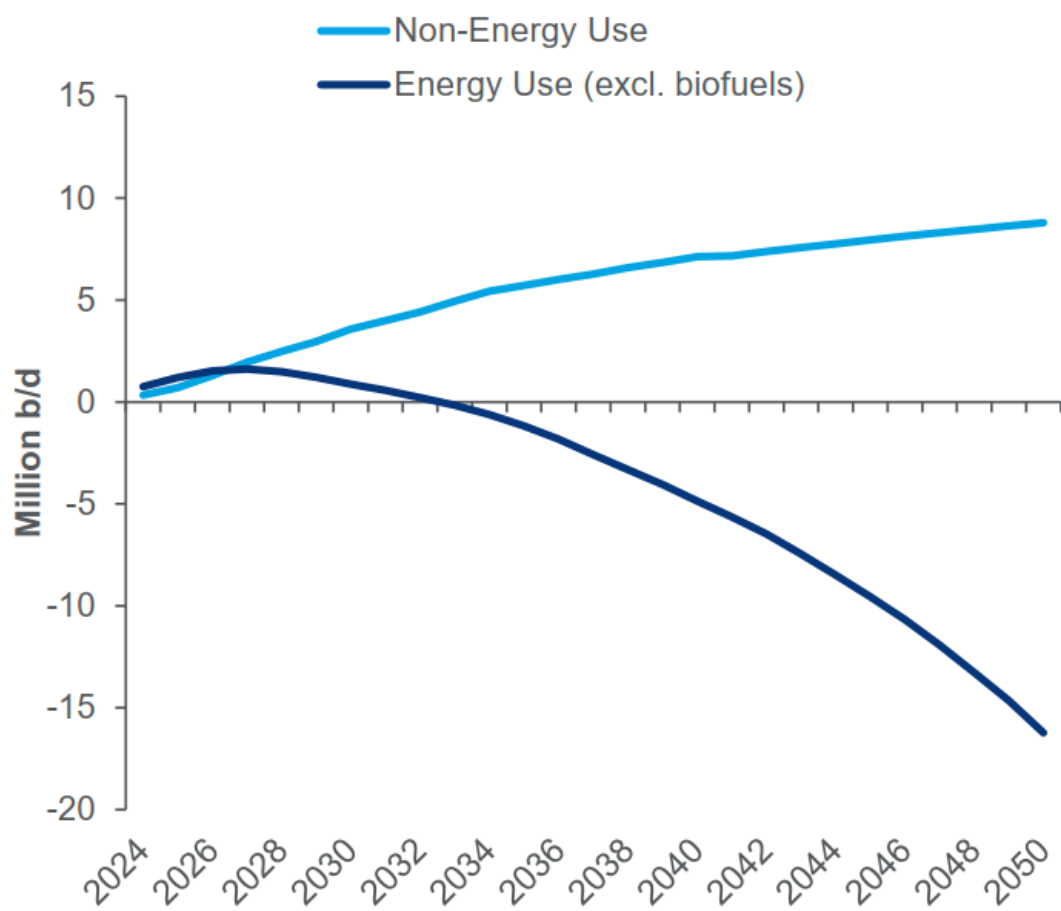


The Displacement Effects from EVs, FCVs and Natural Gas in Transport

Global liquids demand and the displacement effects from EVs, FCVs and natural gas in transport

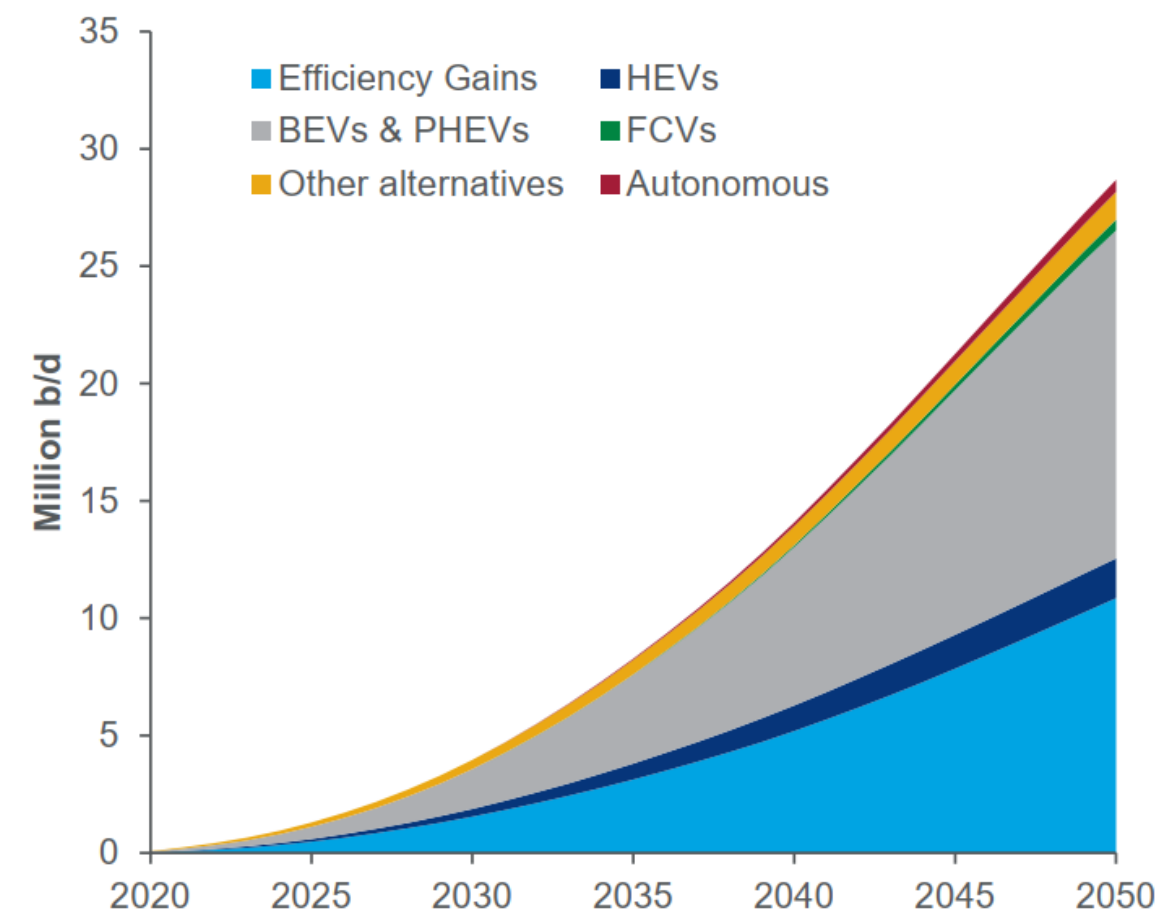


Accumulated change in global liquids demand after 2023

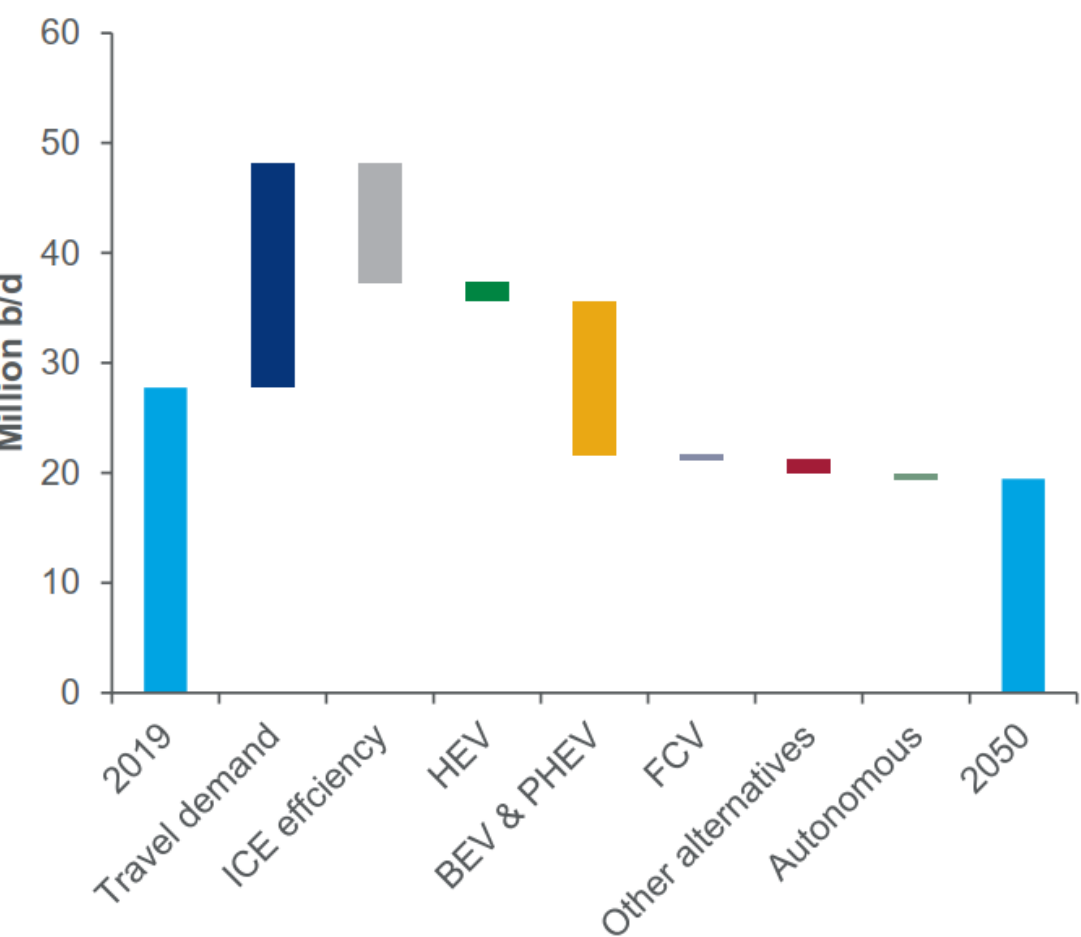


Changes in Liquids Demand from Light Vehicles

Oil saved in the global light vehicles sector



Global liquids demand for light vehicles

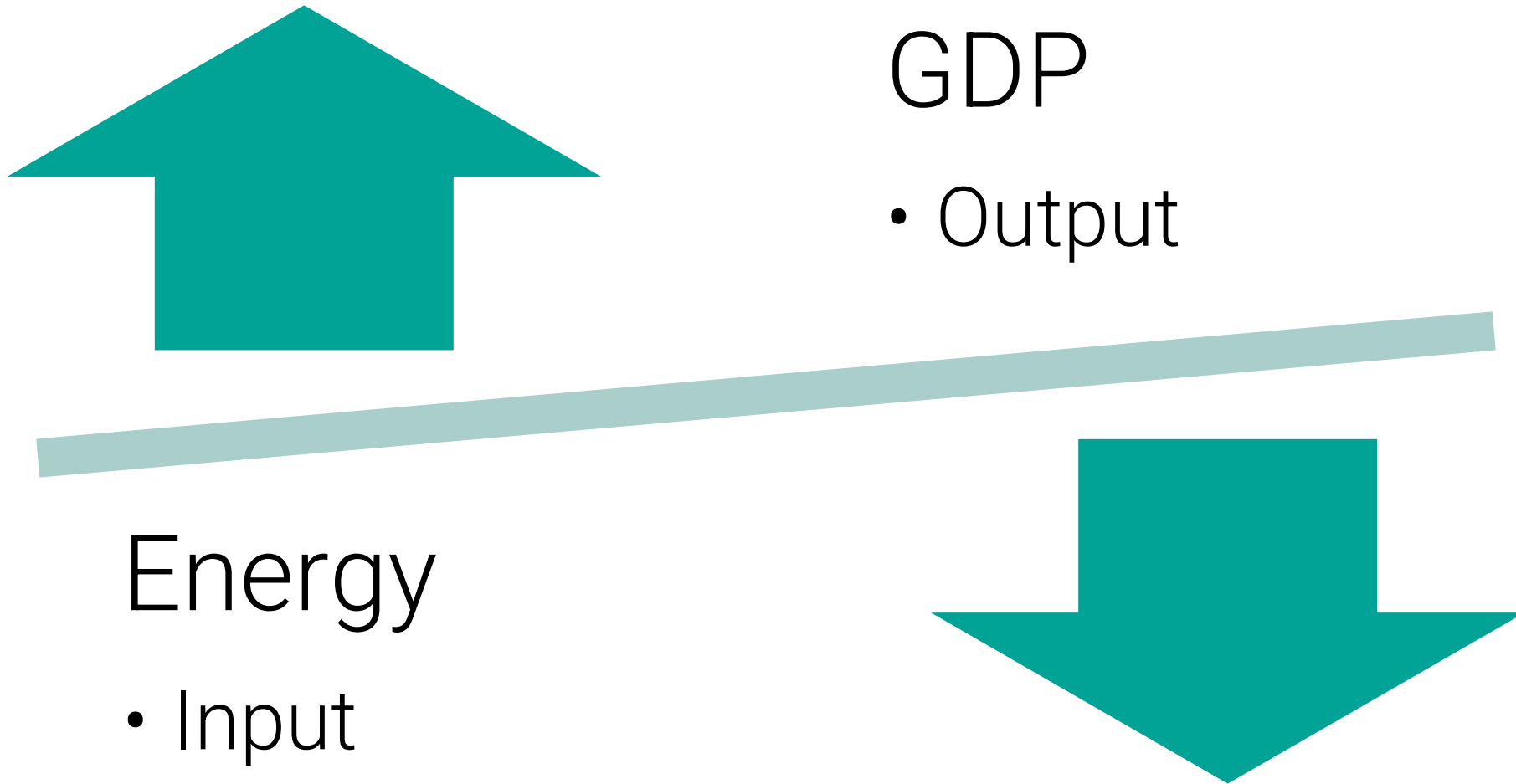


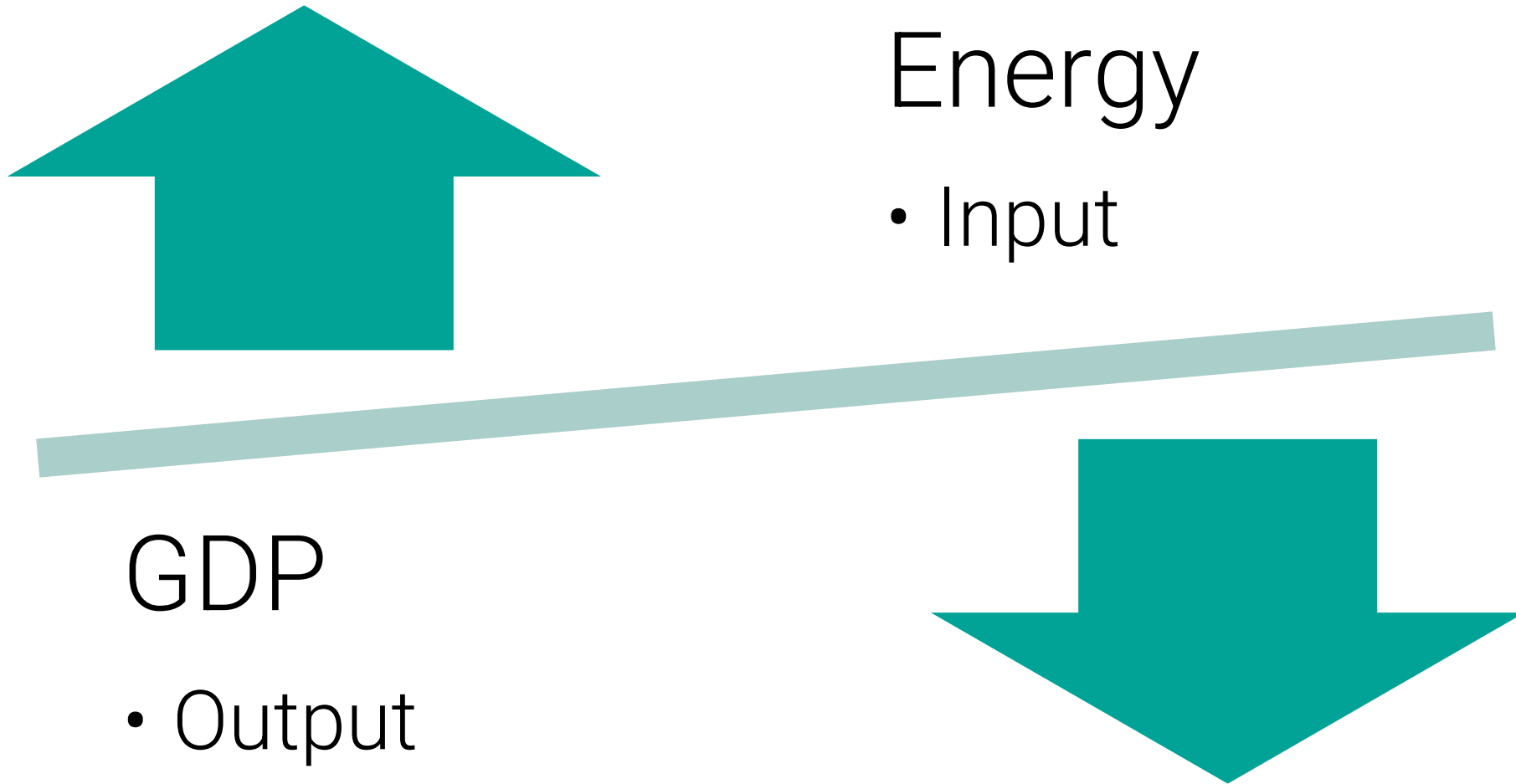
Wood Mackenzie Macro Oils long-term November 2021 outlook to 2050

Efficiency

To provide an overview of scale and importance of energy efficiency in energy transition

Productivity Increase

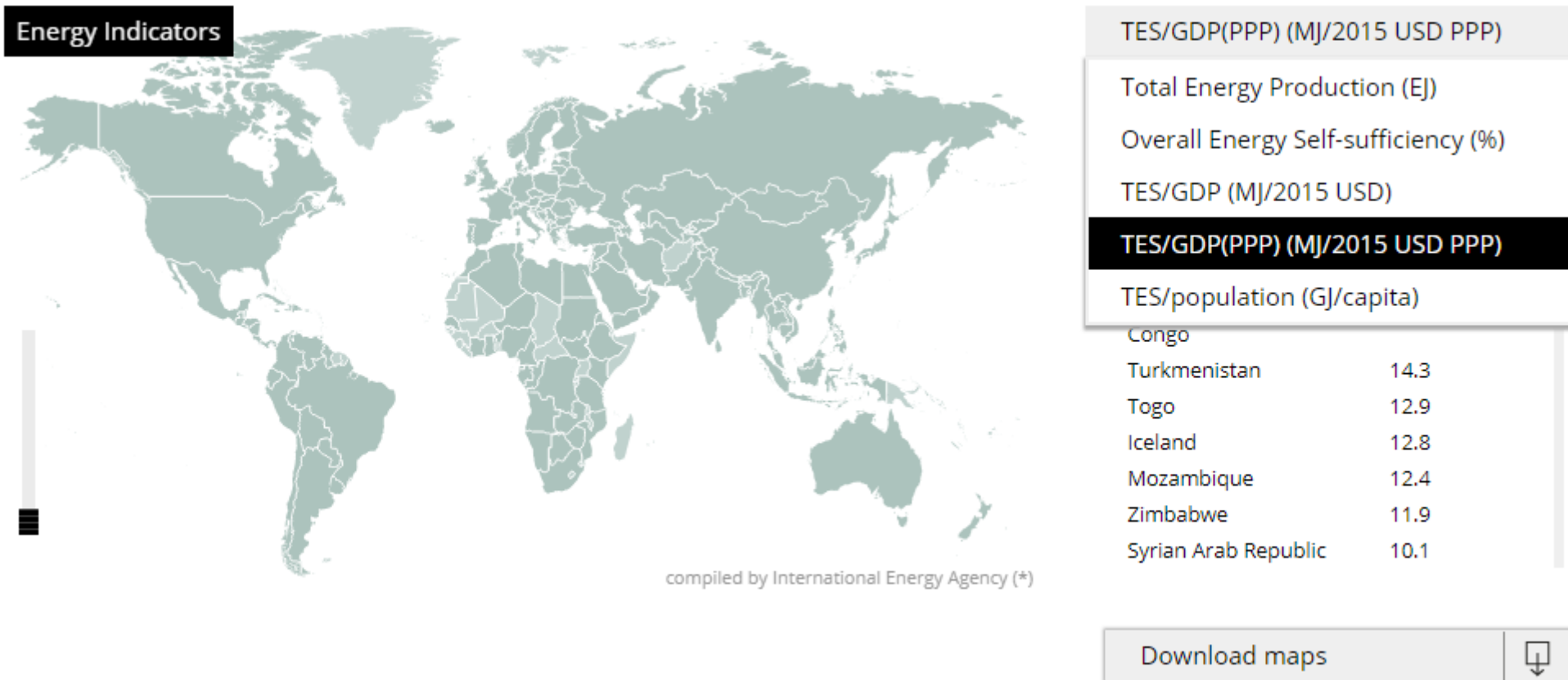




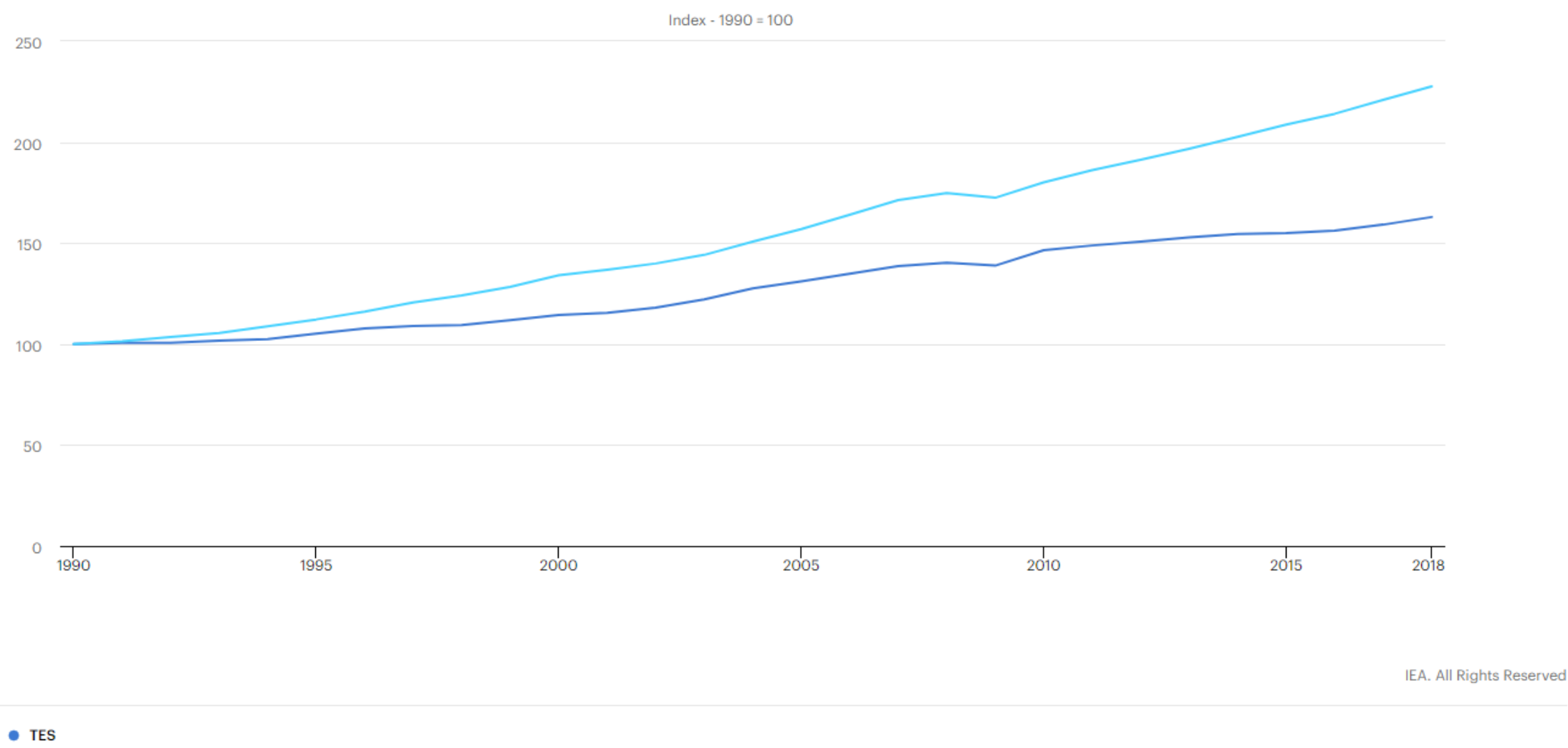
Energy Efficiency and Energy Intensity

- Energy Intensity is measured by the quantity of energy required per unit output or activity, so that using less energy to produce a product reduces the intensity.
- Energy Efficiency improves when a given level of service is provided with reduced amounts of energy inputs or services are enhanced for a given amount of energy input.
- Declines in energy intensity are a proxy for efficiency improvements, provided:
 - a) energy intensity is represented at an appropriate level of disaggregation to provide meaningful interpretation, and
 - b) other explanatory and behavioral factors are isolated and accounted for.

IEA Energy Atlas



World GDP and TES Trends, 1990-2018



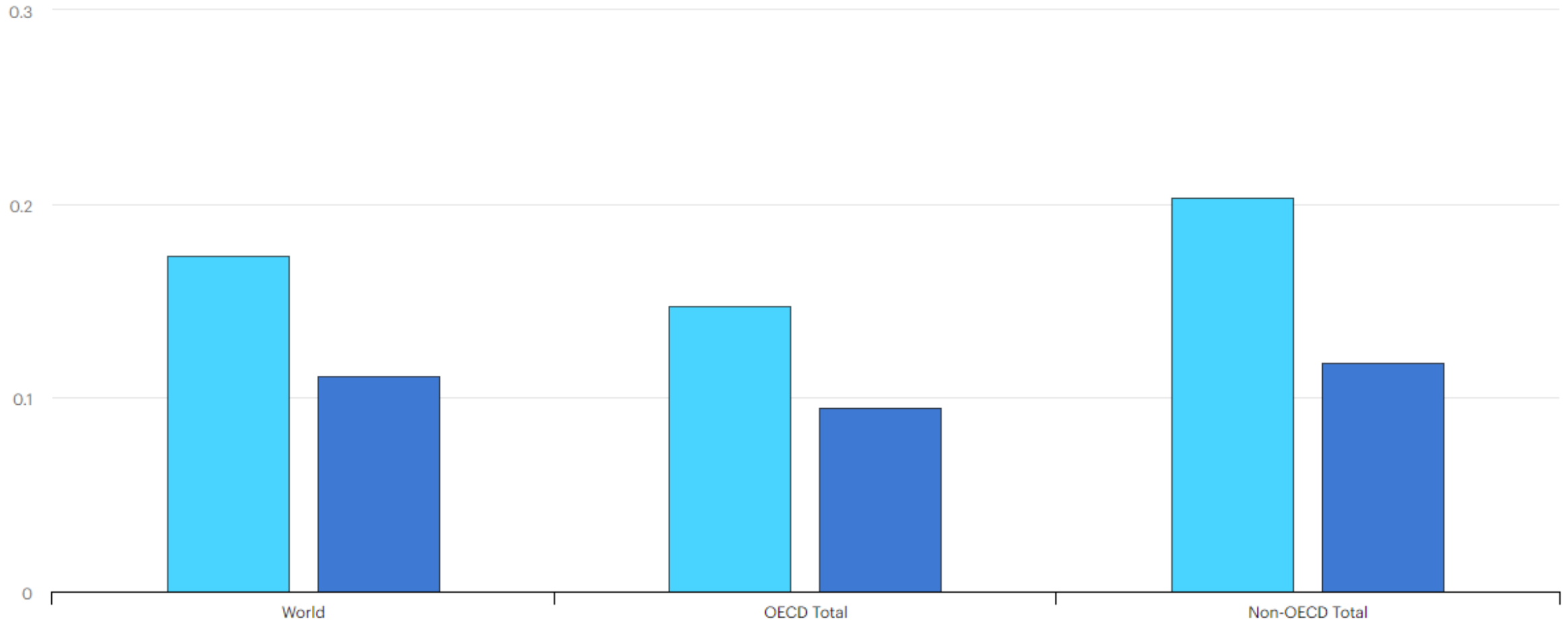
Energy Intensity

Energy intensity measured in terms of primary energy and GDP, 2000-2017



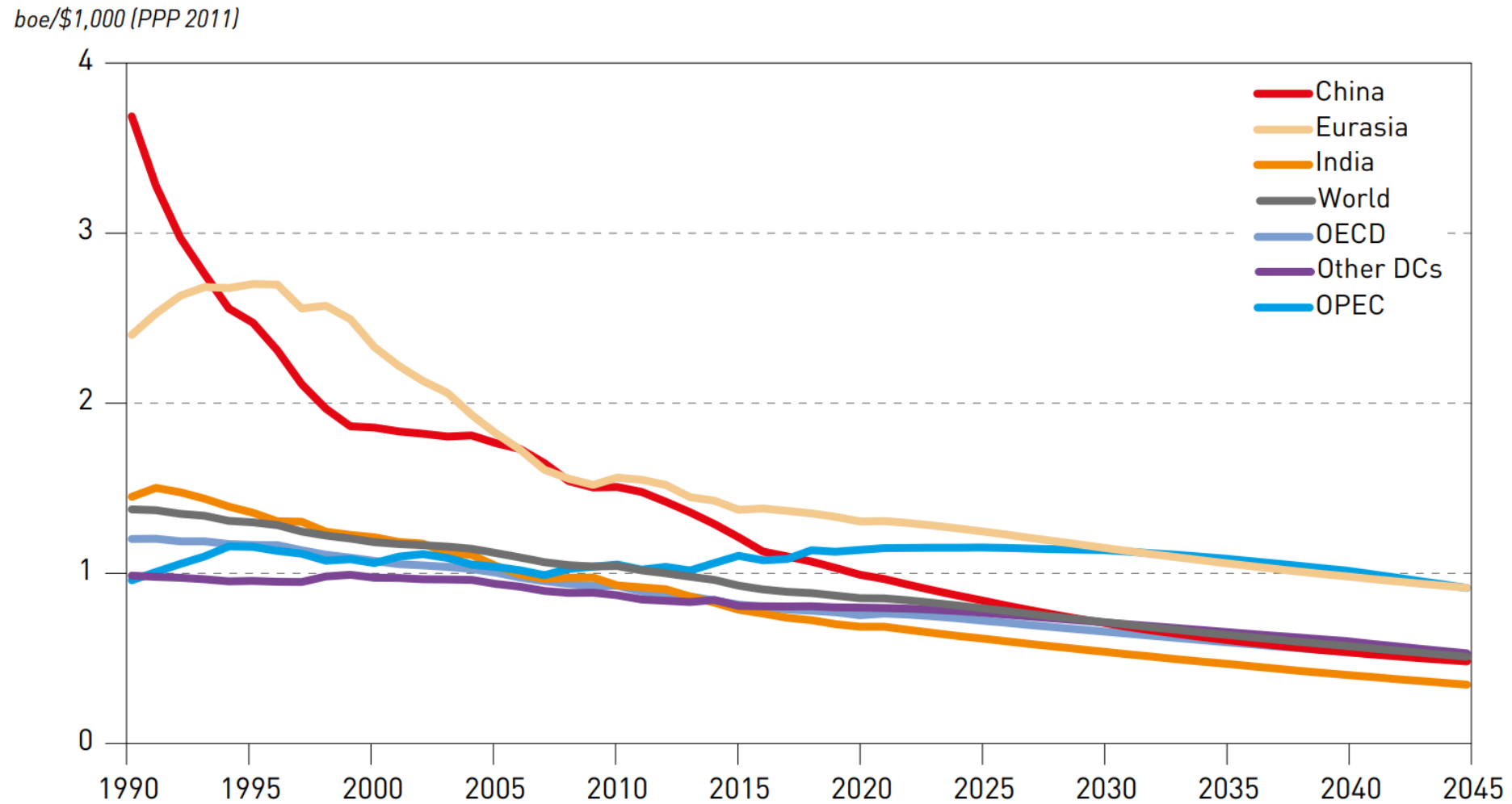
Global Energy Intensity, 1990 Compared to 2018

toe/thousand 2015 USD PPP

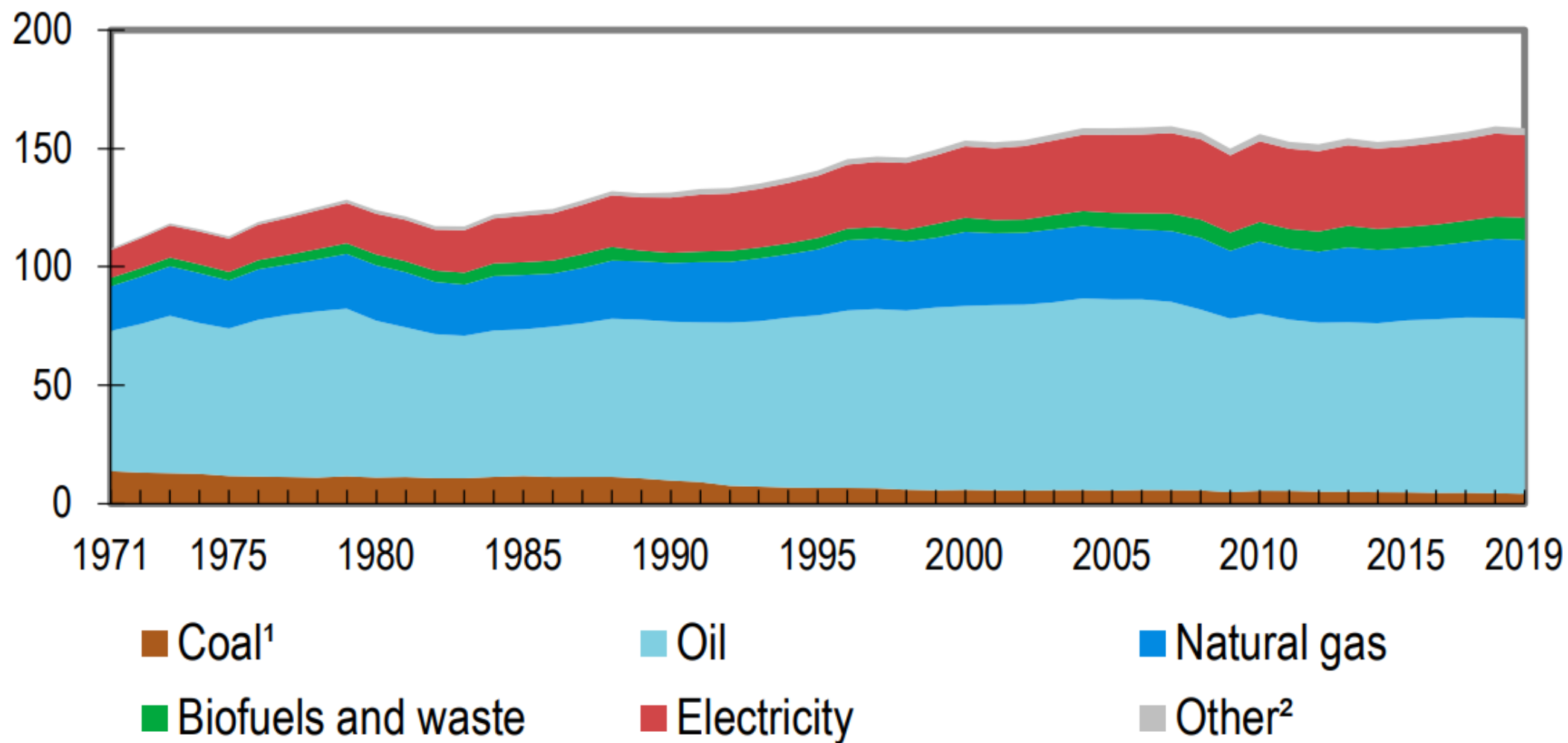


IEA Energy Efficiency Indicators

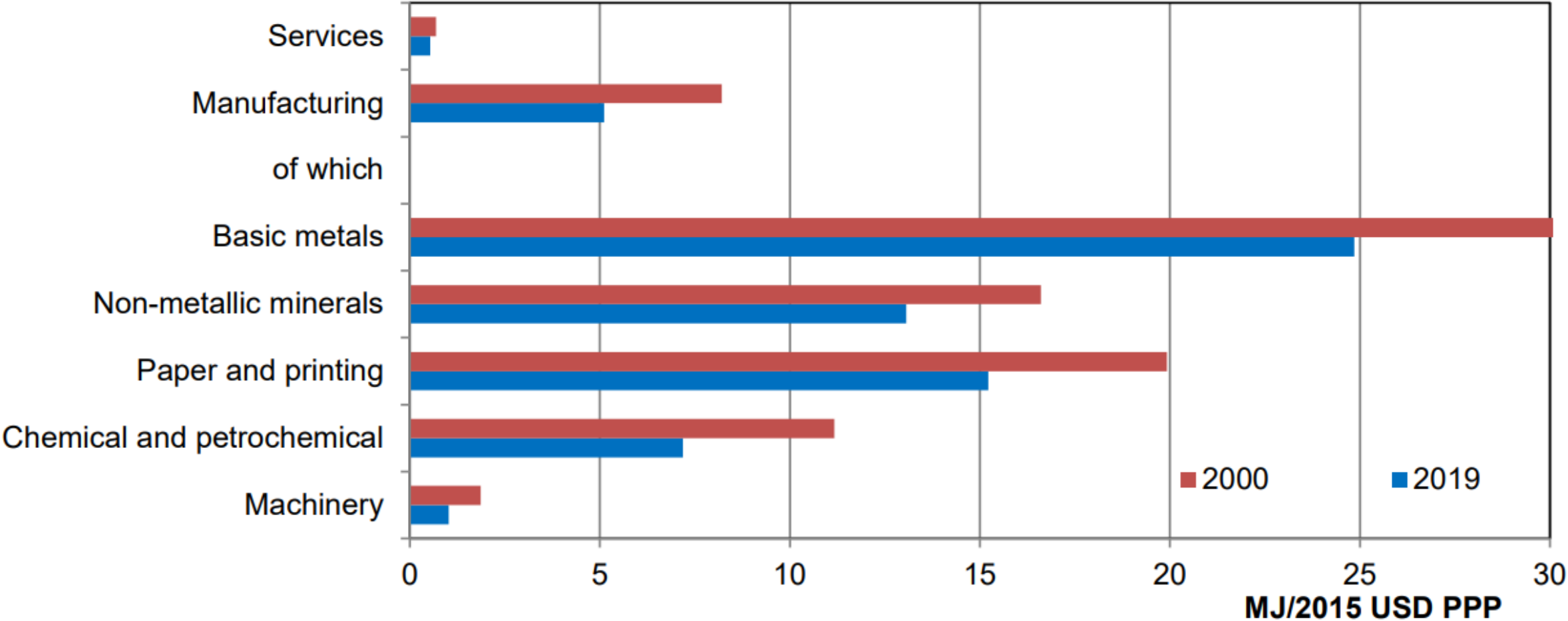
Energy Intensity



OECD Total Final Consumption by Source (EJ)



Services and Manufacturing in Selected IEA Countries: Energy Per Value Added



Peak Oil

To present two definitions of peak oil: the old and the new one

Peak Oil

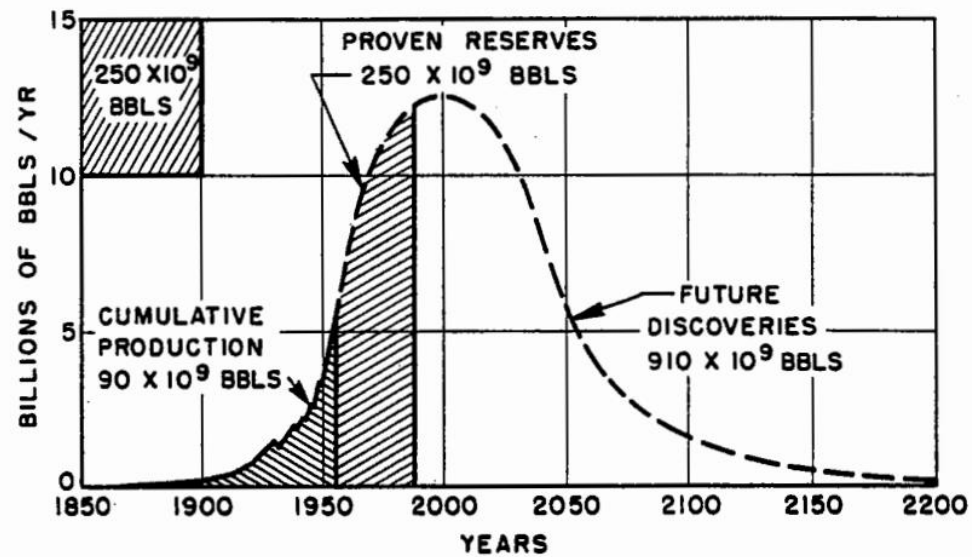


Figure 20 - Ultimate world crude-oil production based upon initial reserves of 1250 billion barrels.

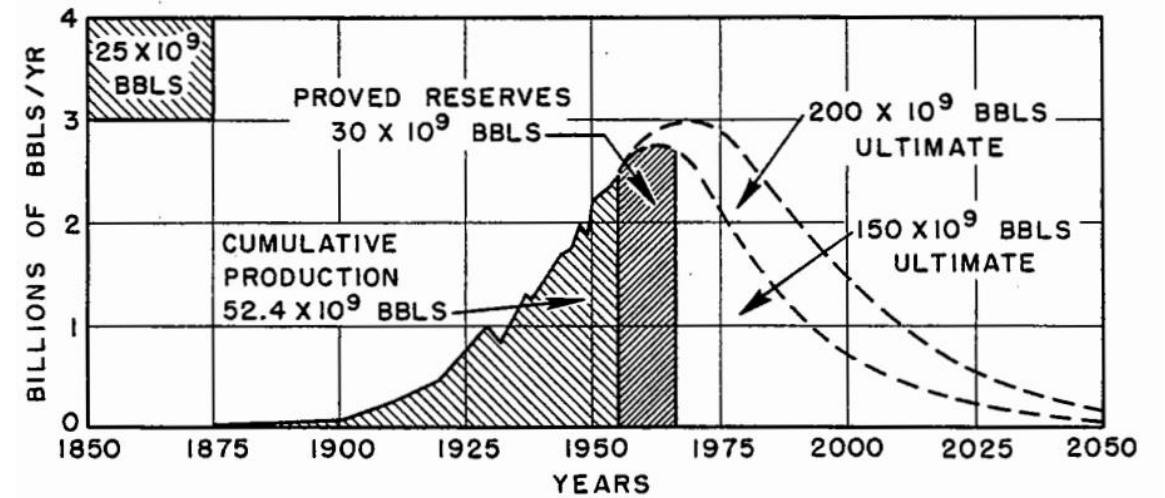
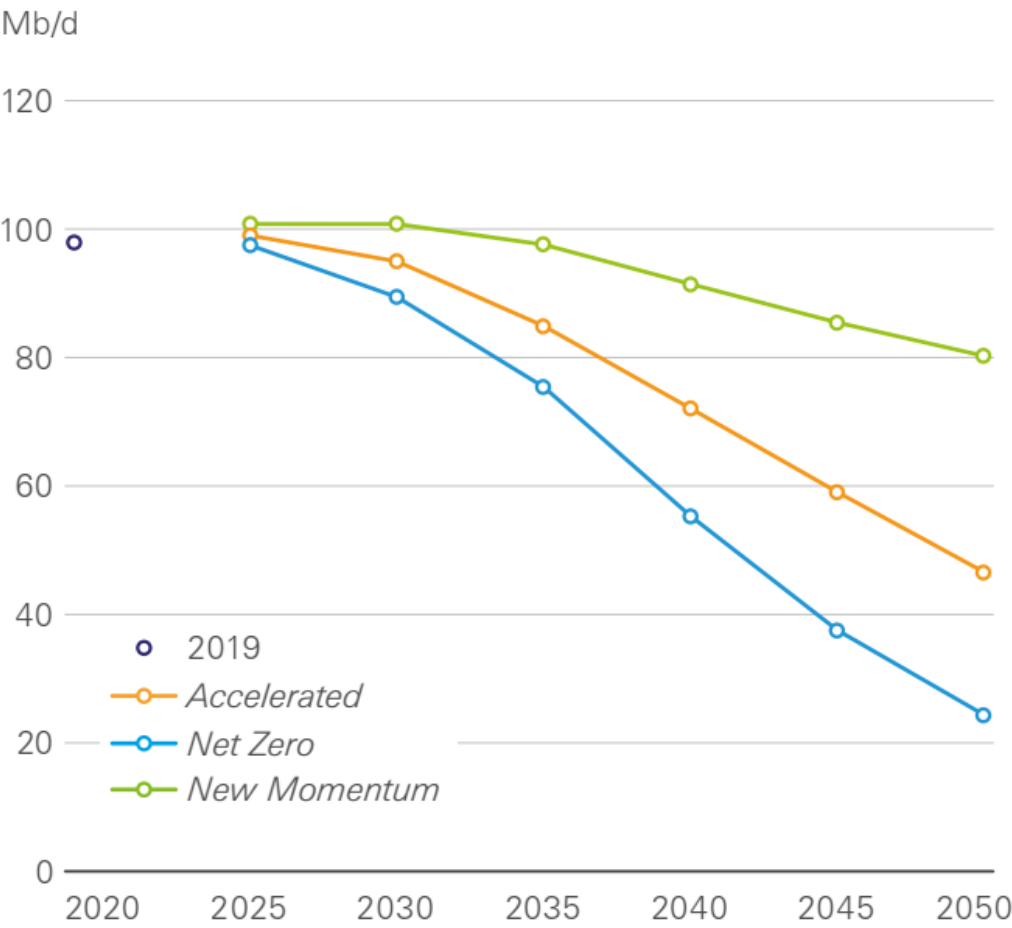


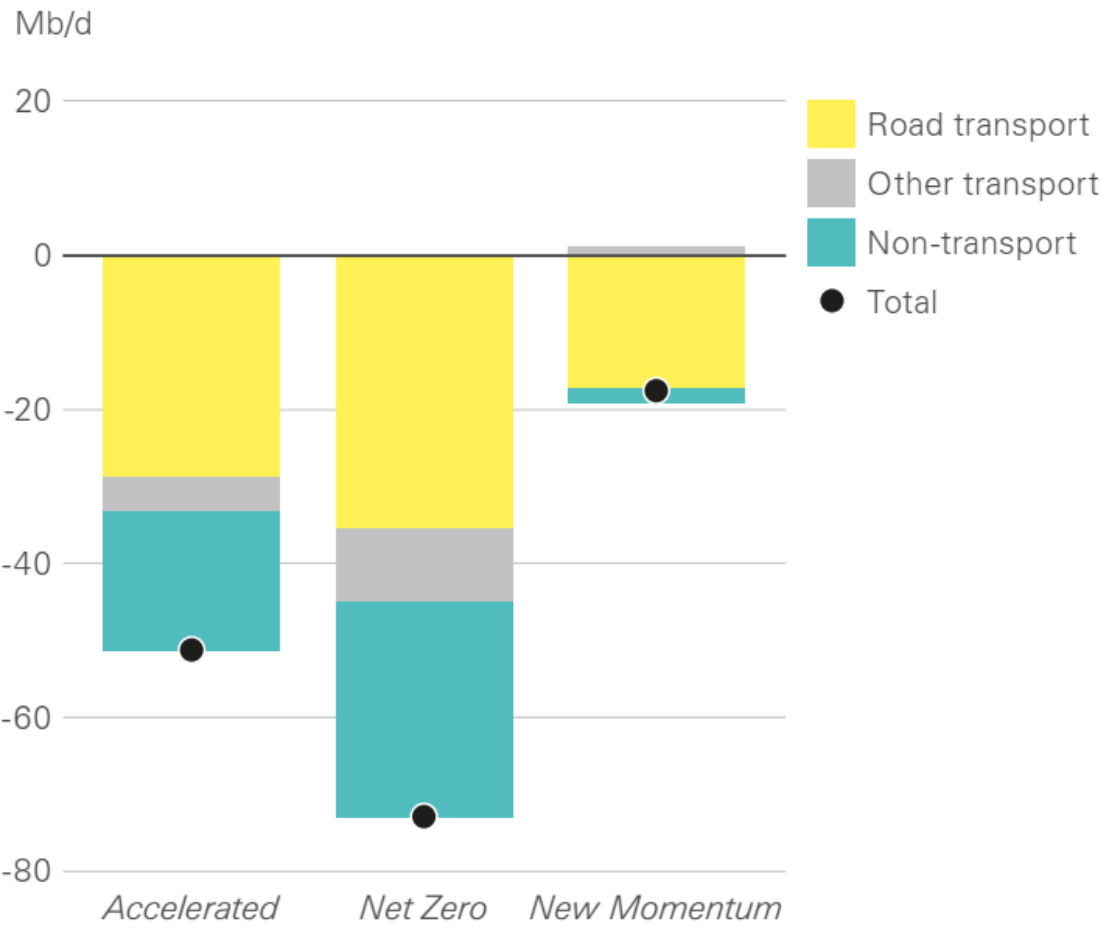
Figure 21 - Ultimate United States crude-oil production based on assumed initial reserves of 150 and 200 billion barrels.

Oil Demand in Three Scenarios

Oil demand



Change in oil demand (2019 - 2050)

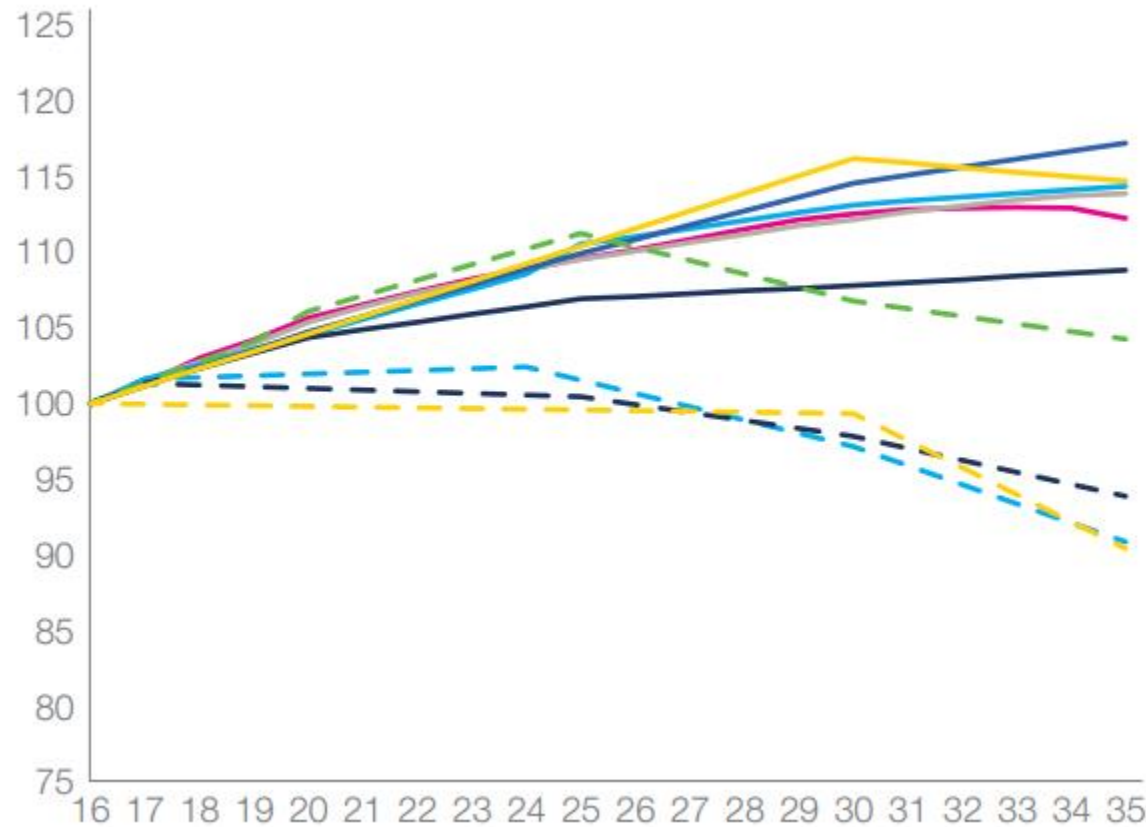


Peak Oil Scenarios

Global oil demand¹

Indexed to 100

— Reference case forecasts -- Sustainability cases



CAGR
2018-35

ExxonMobil

0.8%

Equinor Reform

0.7%

IEA New Policies

0.6%

Global Downstream Model 2018¹

0.6%

Global Downstream Model 2019¹

0.5%

BP Evolving Transition

0.4%

Shell – Sky

0.1%

BP Rapid Transition

-0.4%

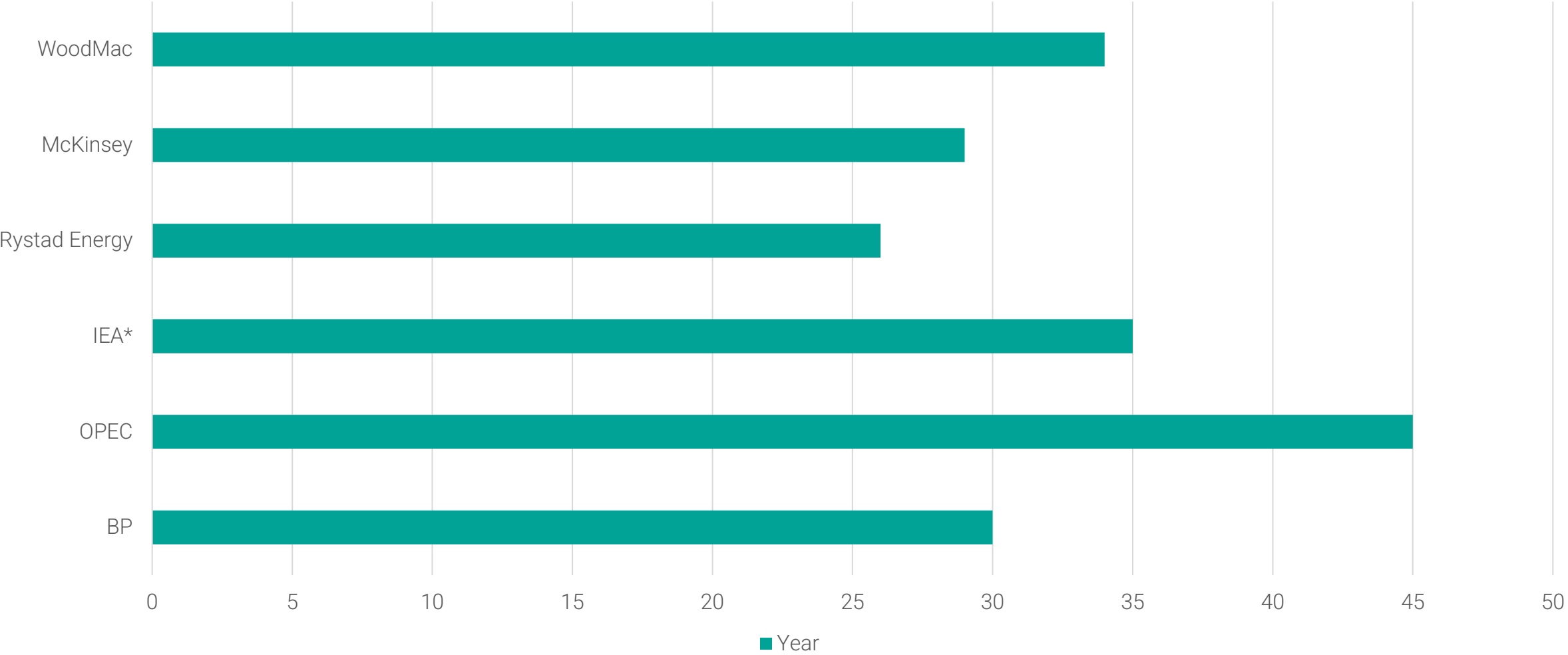
IEA Sustainable Development

-0.7%

Equinor Renewal

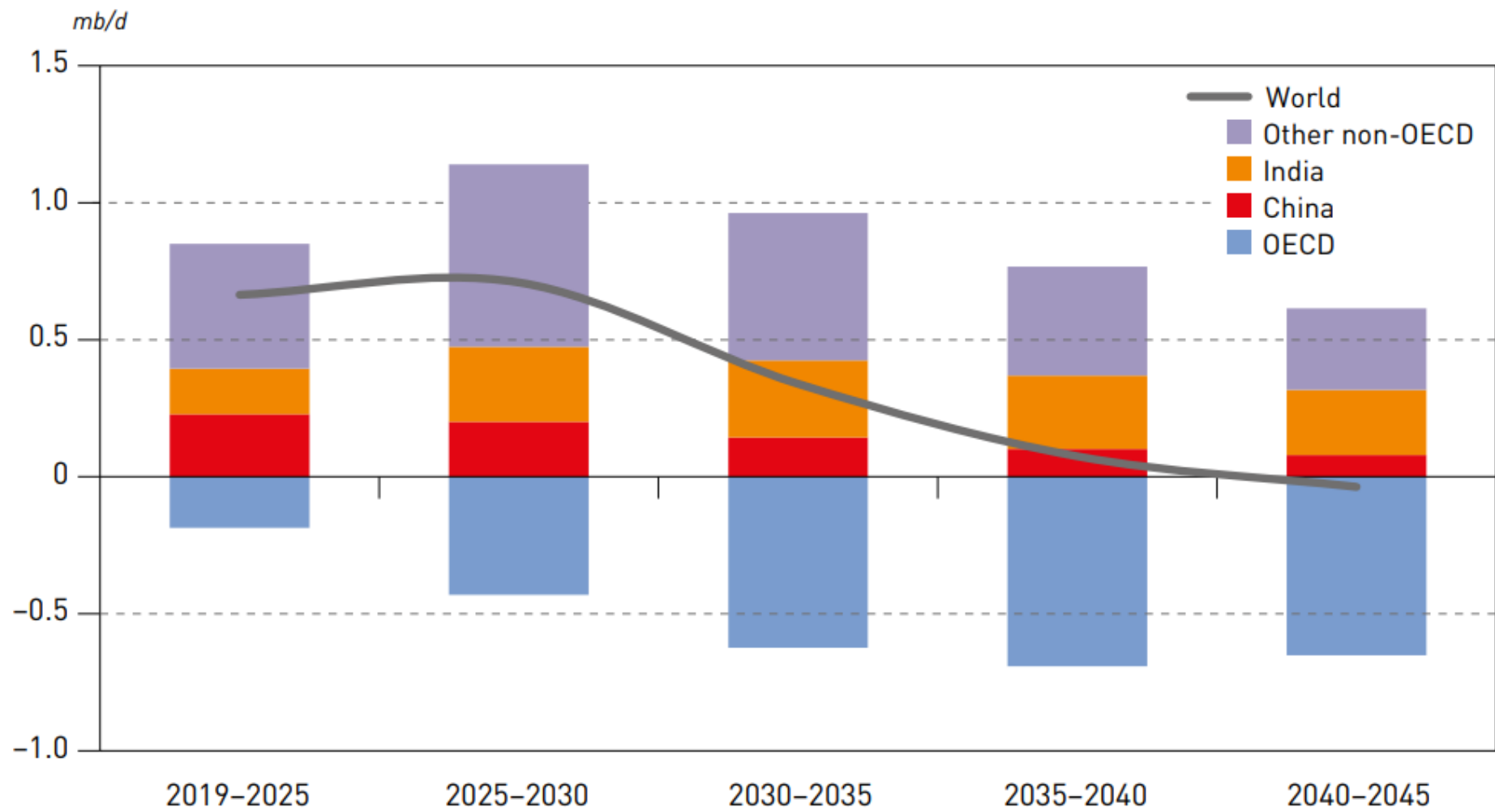
-0.6%

Peak Oil Demand Year (Base Case)

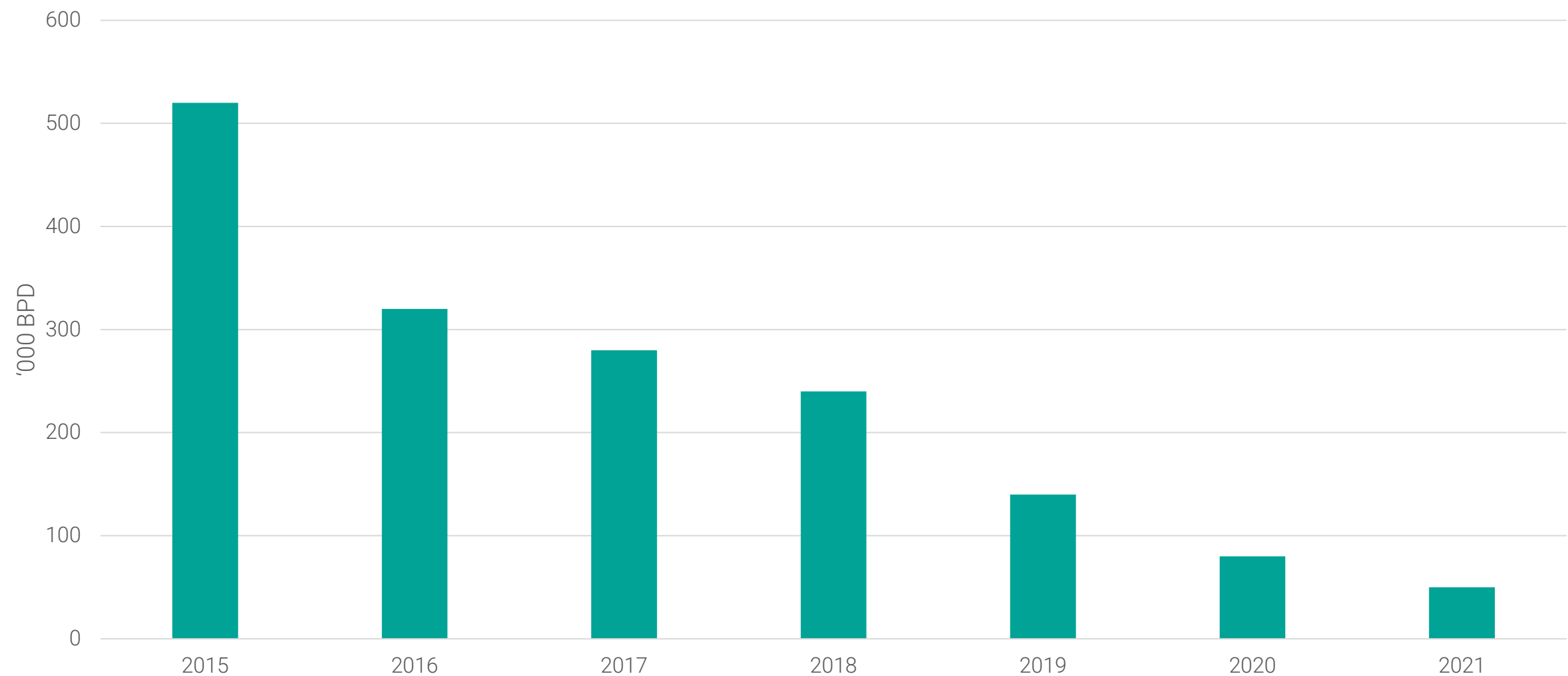


Companies' outlooks

Average Annual Oil Demand Growth



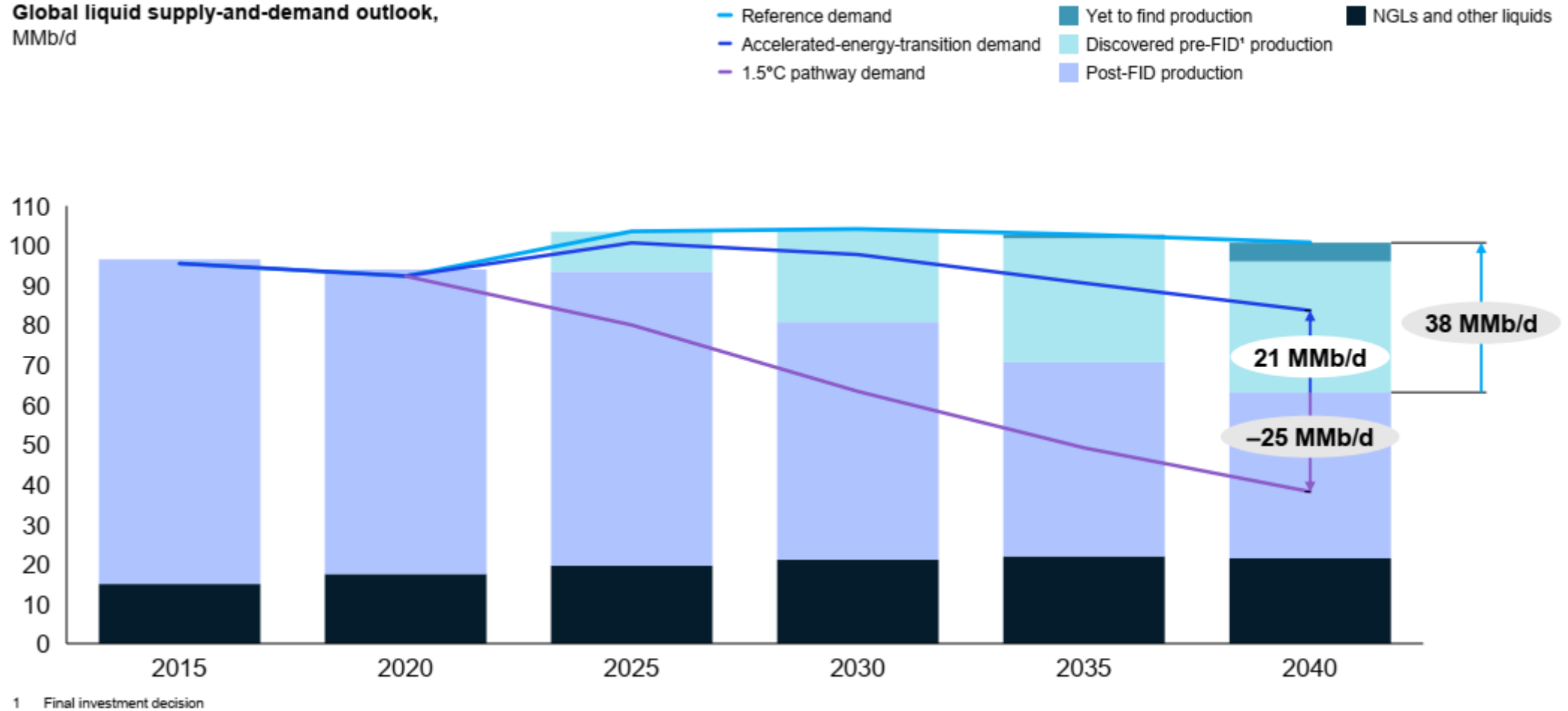
Average Annual Oil Demand Growth in OPEC WOO for Period 2035–2040



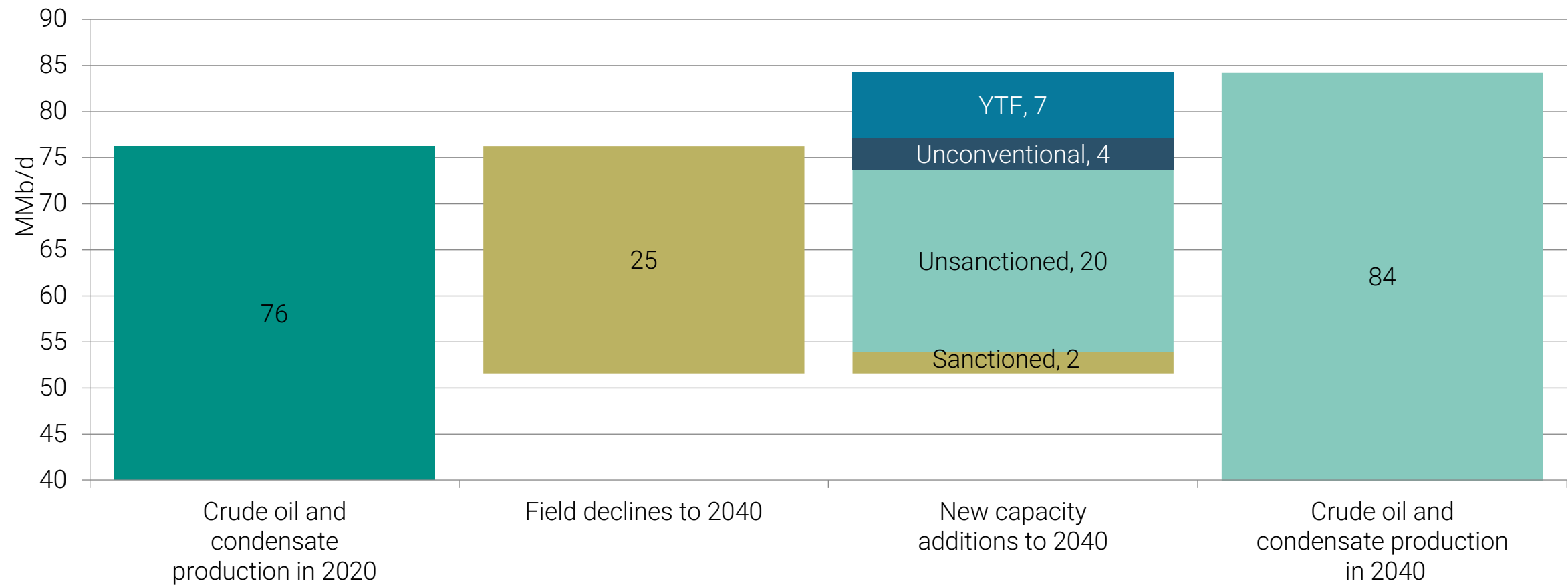
OPEC World Oil Outlook 2021

Required Investment

Global liquid supply-and-demand outlook,
MMb/d

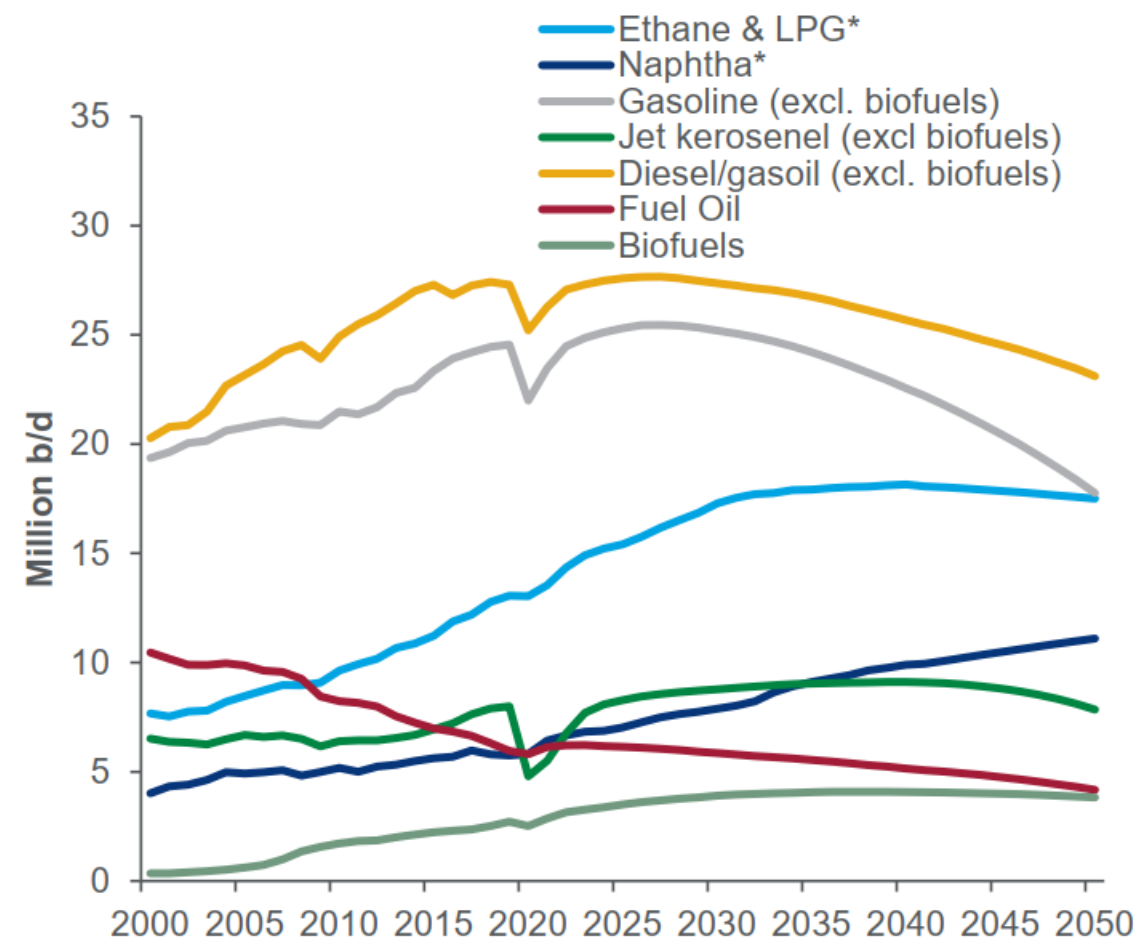


Global Crude Oil and Condensate Outlook Balance in 2040

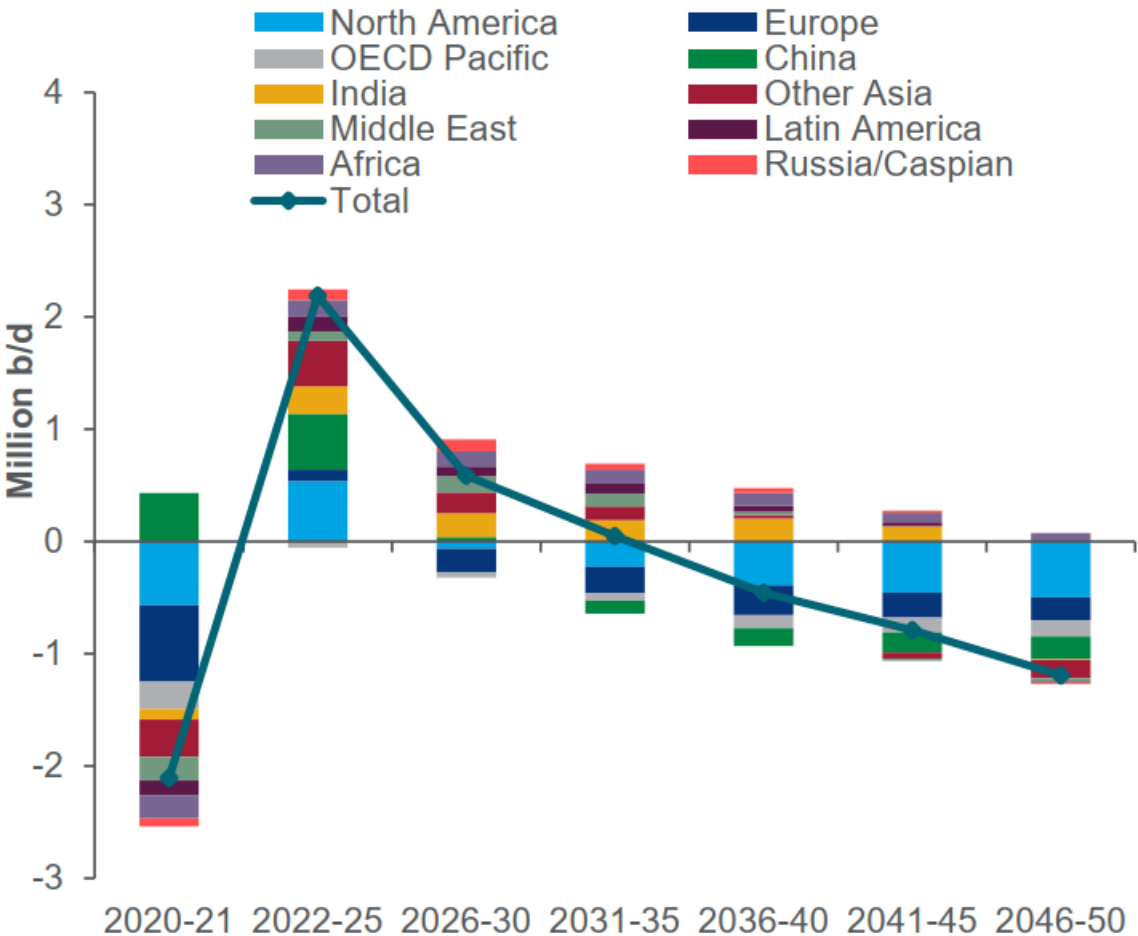


Demand Peak By Product And Region

Global products demand



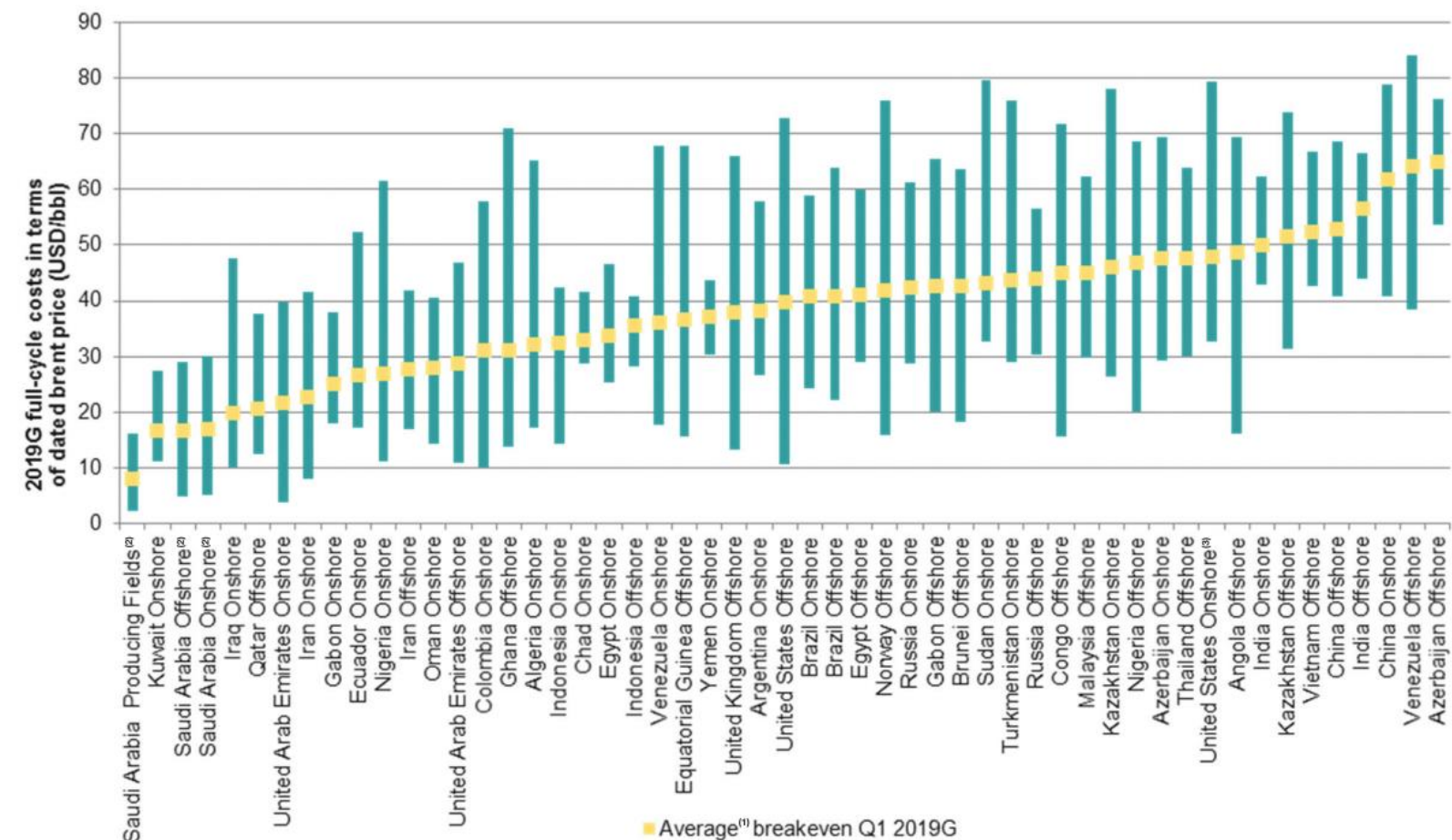
Average YoY change in total liquids demand by region



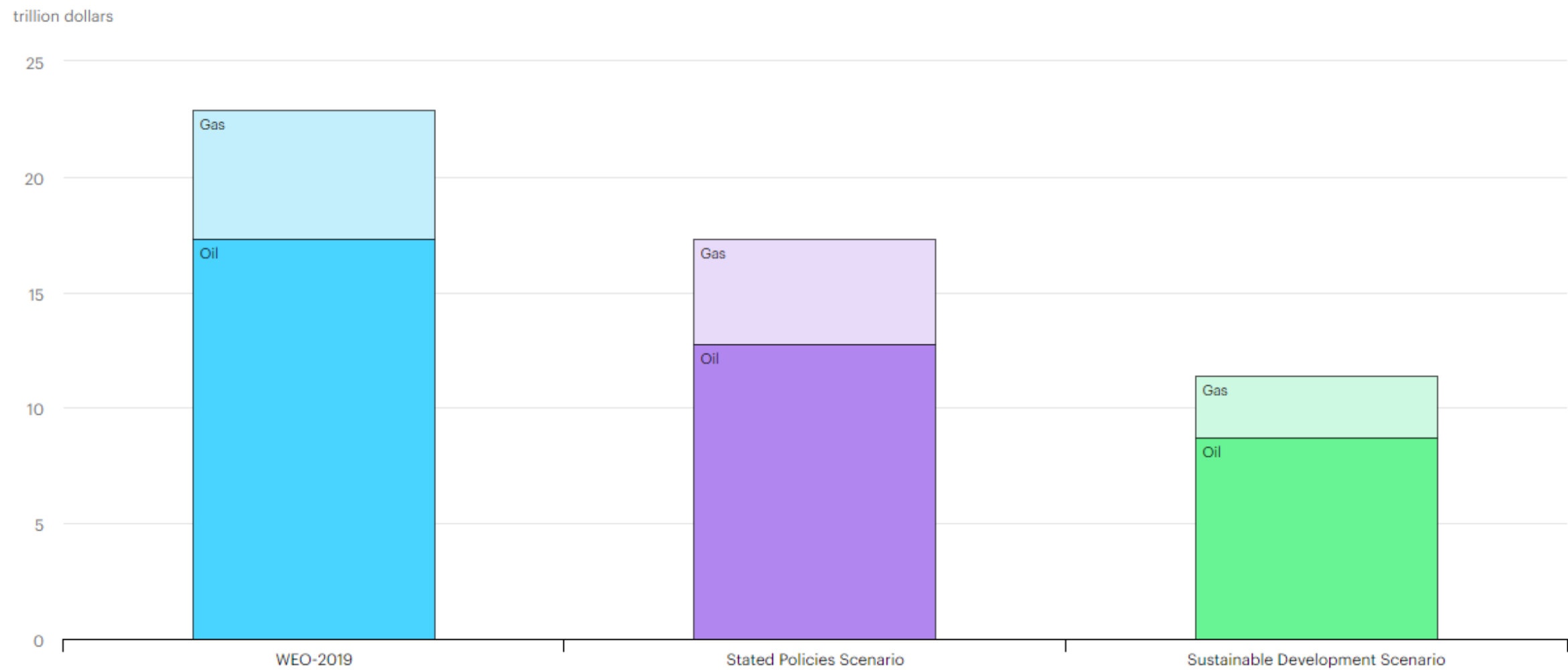
Wood Mackenzie Macro Oils long-term 2021 outlook to 2050 November 2021

Breakeven Cost for New Oil Projects

Exhibit 6: Post-tax breakeven costs for new oil projects at a 10% rate of return by country through 2030G



Estimated Present Value of Future Oil and Natural Gas Production to 2040



Unburnable Carbon

مجله ی 181 - آن که گفت آری، آن که گفت نه اخبار بین الملل (اقتصاد)

مرگ مدل قدیمی کسب و کار شرکتهای بینالمللی نفتی

تاریخ انتشار: هنبه ۲۹ خرداد ۱۳۹۵

پایان غول‌ها

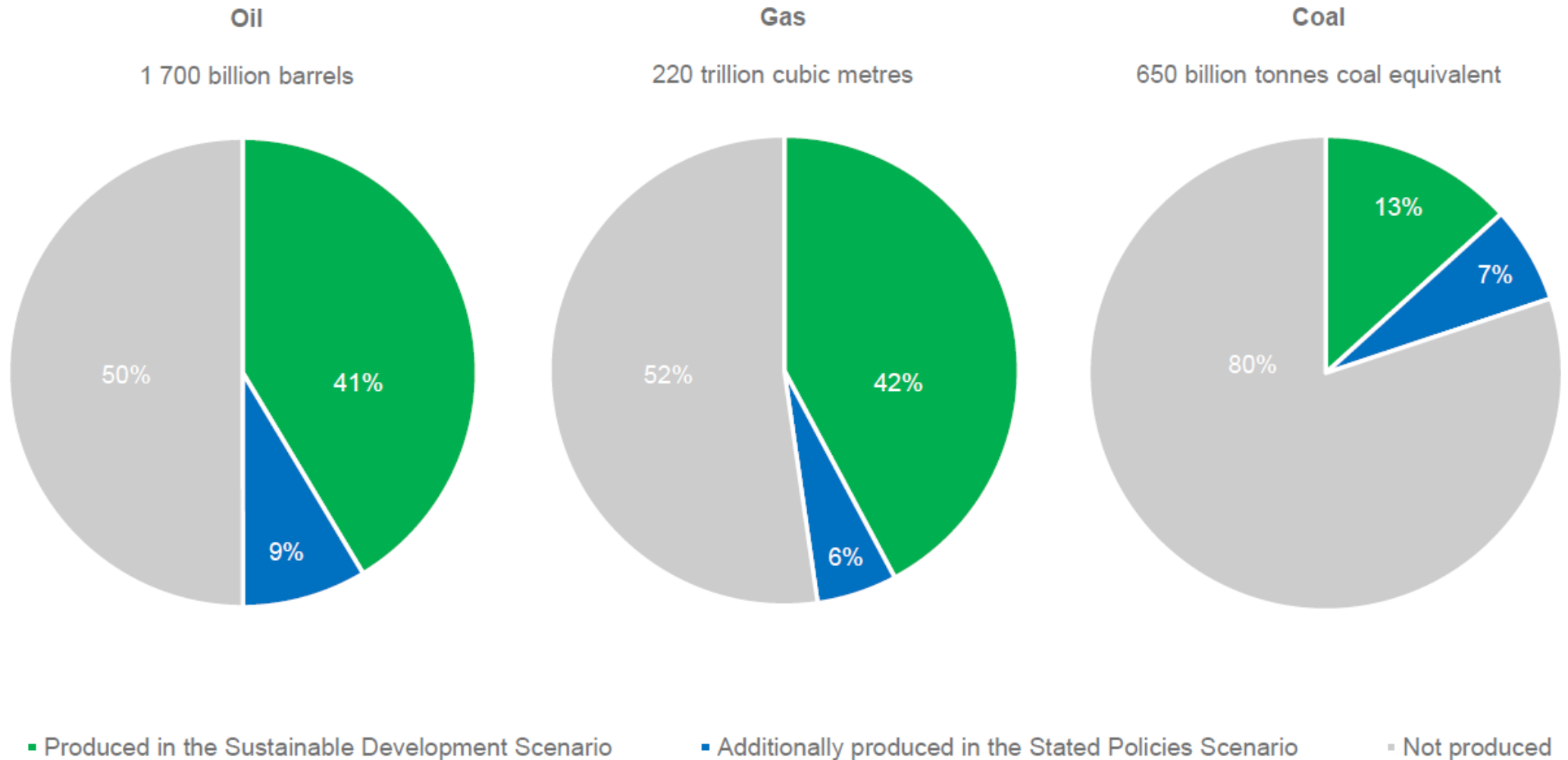
آینده شرکت‌های نفتی بزرگ بین‌المللی (IOCs)، شامل بی‌پی، شورو، اگزون موبیل، شل و توتال، در هاله‌ای از تردید قرار دارد. مدل کسب و کار که طی قرن بیستم موجب بقای آنها شد، اکنون دیگر برای دستیابی به اهداف مناسب به نظر نمی‌رسد. در نتیجه این شرکت‌ها با دو انتخاب مواجه هستند: مدیریت نزولی آرام از طریق کوچک‌سازی؛ یا ریسک سقوطی سریع با تلاش برای تداوم استفاده از مدل قبلی. اغلب تحلیلگران در زمینه مشکلات IOCها، بر سقوط اخیر قیمت نفت و تعهدهای رو به فزونی در سطح جهان برای مقابله با تغییرات اقلیمی متمرکز شده‌اند. این در حالی است که طالع آنها پیش از این دو مورد تاریک به نظر می‌رسید. آخرین تکرار مدل کسب و کار IOCها طی دهه ۱۹۹۰ ظهور کرد و بر سه ستون استوار بود: افزایش ارزش دارایی سهامداران، حداکثرسازی ذخایر قابل ثبت و حداقل کردن هزینه.



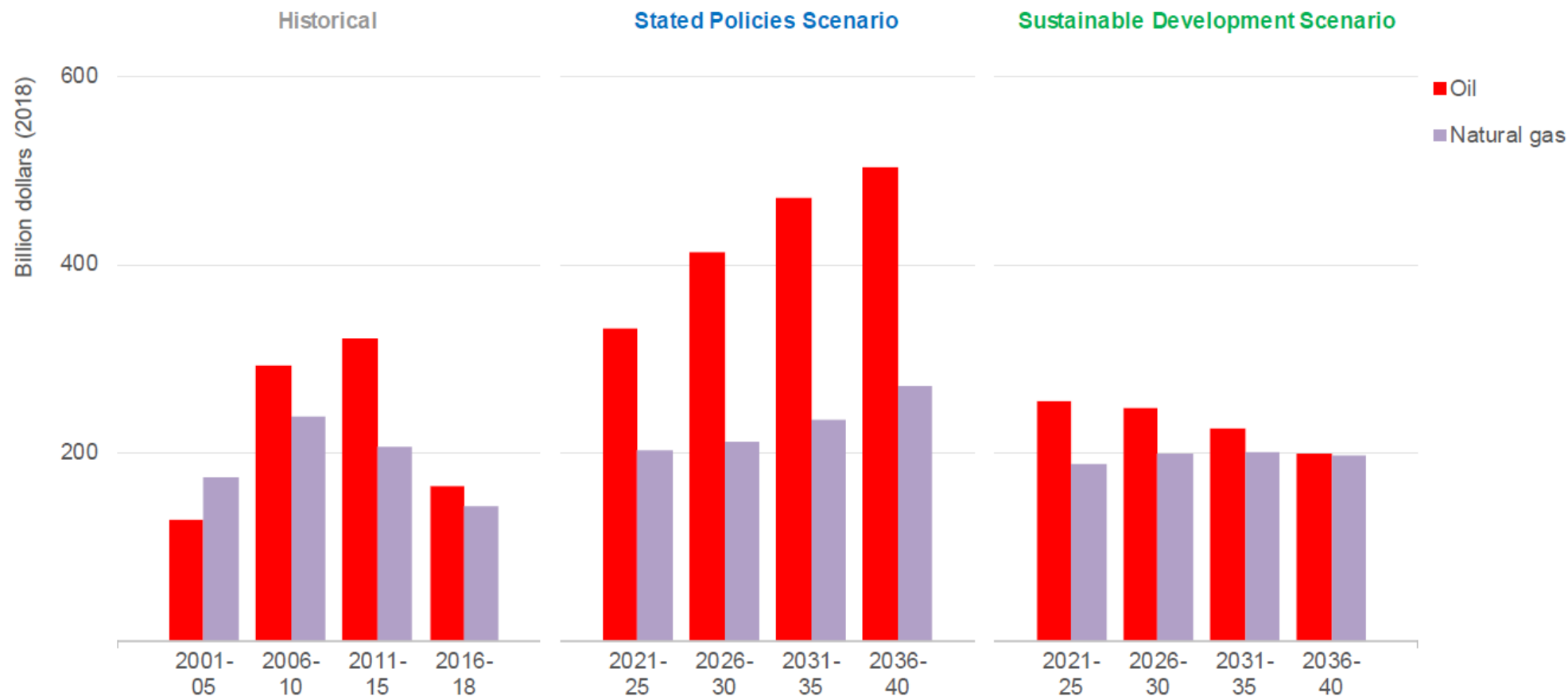
پل استیونس پژوهشگر چتم هاوس / ترجمه: رامین فروزنده

آینده شرکت‌های نفتی بزرگ بین‌المللی (IOCs)، شامل بی‌پی، شورو، اگزون موبیل، شل و توتال، در هاله‌ای از تردید قرار دارد. مدل کسب و کار که طی قرن بیستم موجب بقای آنها شد، اکنون دیگر برای دستیابی به اهداف مناسب به نظر نمی‌رسد. در نتیجه این شرکت‌ها با دو انتخاب مواجه هستند: مدیریت نزولی آرام از طریق کوچک‌سازی؛ یا ریسک سقوطی سریع با تلاش برای تداوم استفاده از مدل قبلی. اغلب تحلیلگران در زمینه مشکلات IOCها، بر سقوط اخیر قیمت نفت و تعهدهای رو به فزونی در سطح جهان برای مقابله با تغییرات اقلیمی متمرکز شده‌اند. این در حالی است که طالع آنها پیش از این دو مورد تاریک به نظر می‌رسید. آخرین تکرار مدل کسب و کار IOCها طی دهه 1990 ظهور کرد و بر سه ستون استوار بود: افزایش ارزش دارایی سهامداران، حداکثرسازی ذخایر قابل ثبت و حداقل کردن هزینه. با تغییر شرایط عملیاتی، این مدل با چالش‌های جدی روبه‌رو شد. شرکت‌های یادشده طی 25 سال پایانی قرن گذشته توانستند نجات یابند، اما نشانه‌هایی وجود دارد مبنی بر اینکه ضعف مدل کسب و کار آنها در حال نمایان شدن است.

Stranded Assets

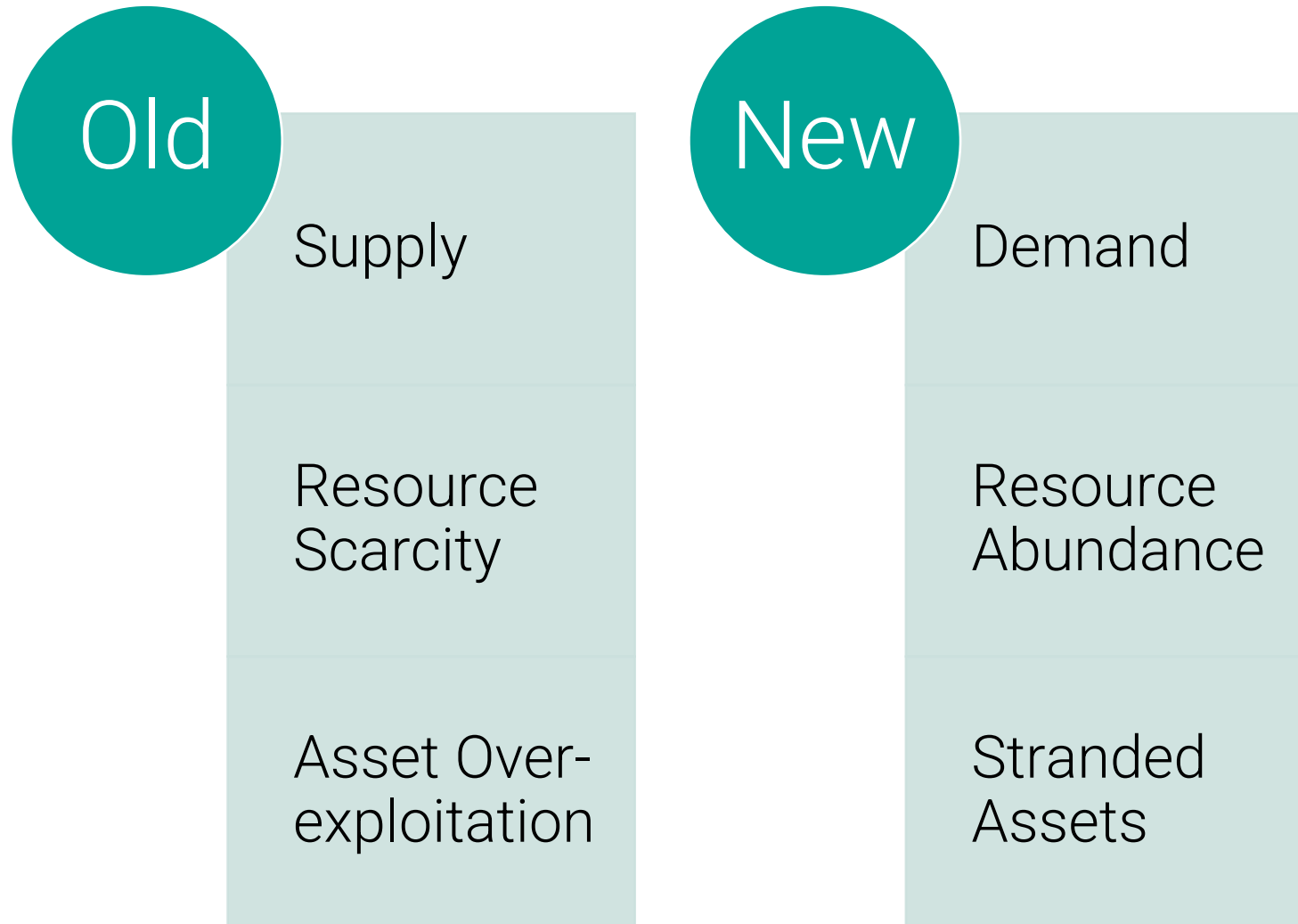


Average Annual Net Income for Private Companies



Notes: Net income is revenue minus finding and development costs, operating costs, and government taxes. Estimates are for all private oil and gas companies (Majors and Independents), and are derived from country-level data using a field-by-field database that classifies asset ownership by type of company along with assumptions about the ownership of future discoveries. Assumes no changes in fiscal terms.

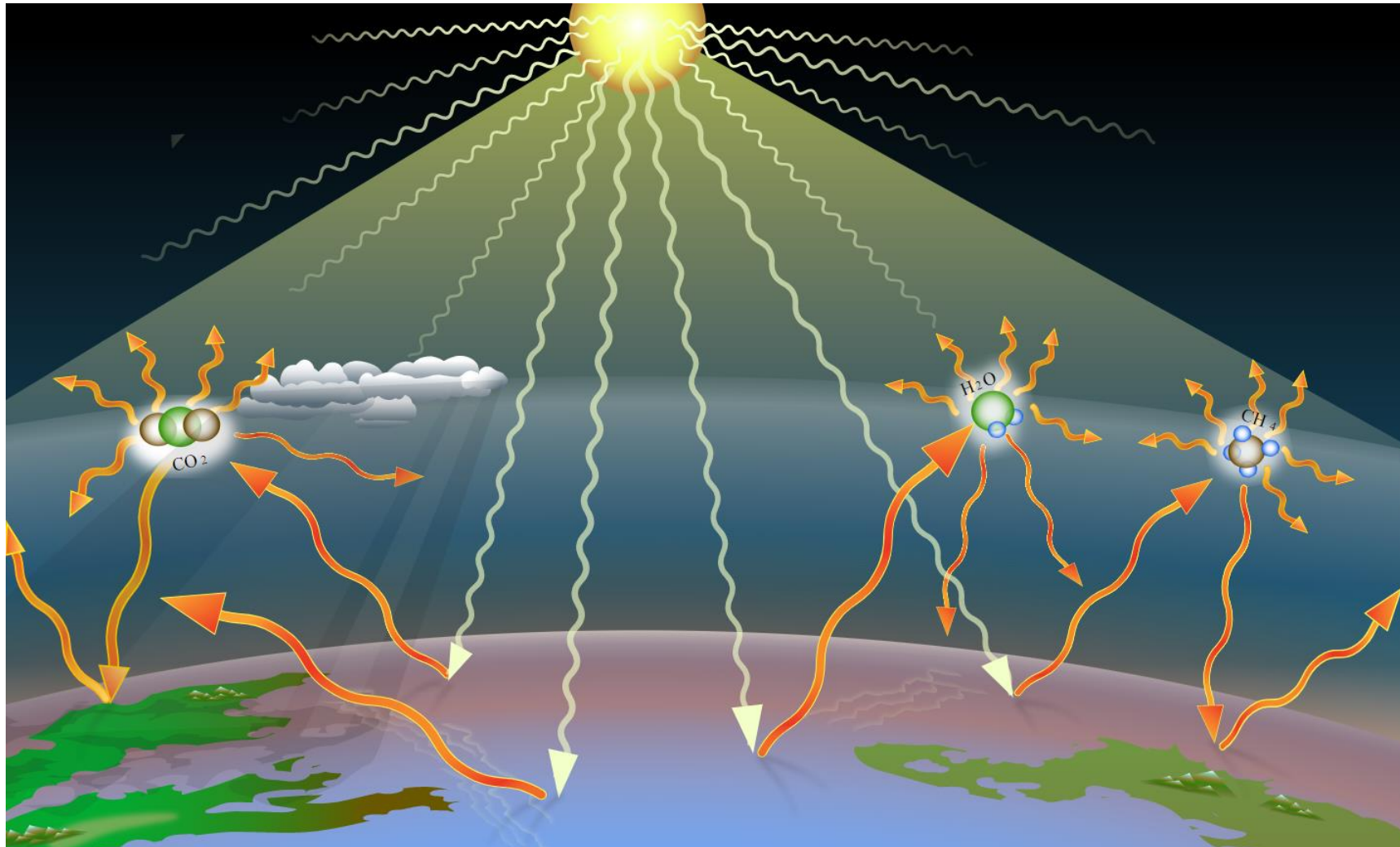
New Versus Old Peak Oil



Climate Change

To introduce climate change fundamentals

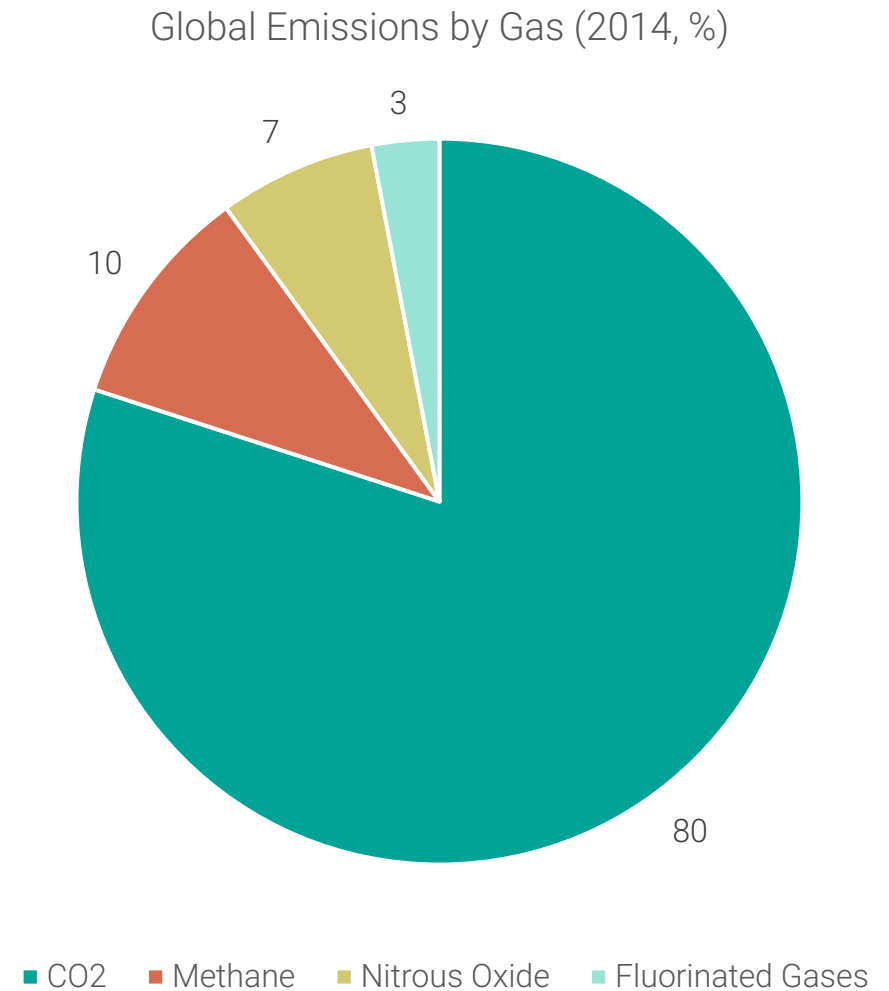
Greenhouse effect



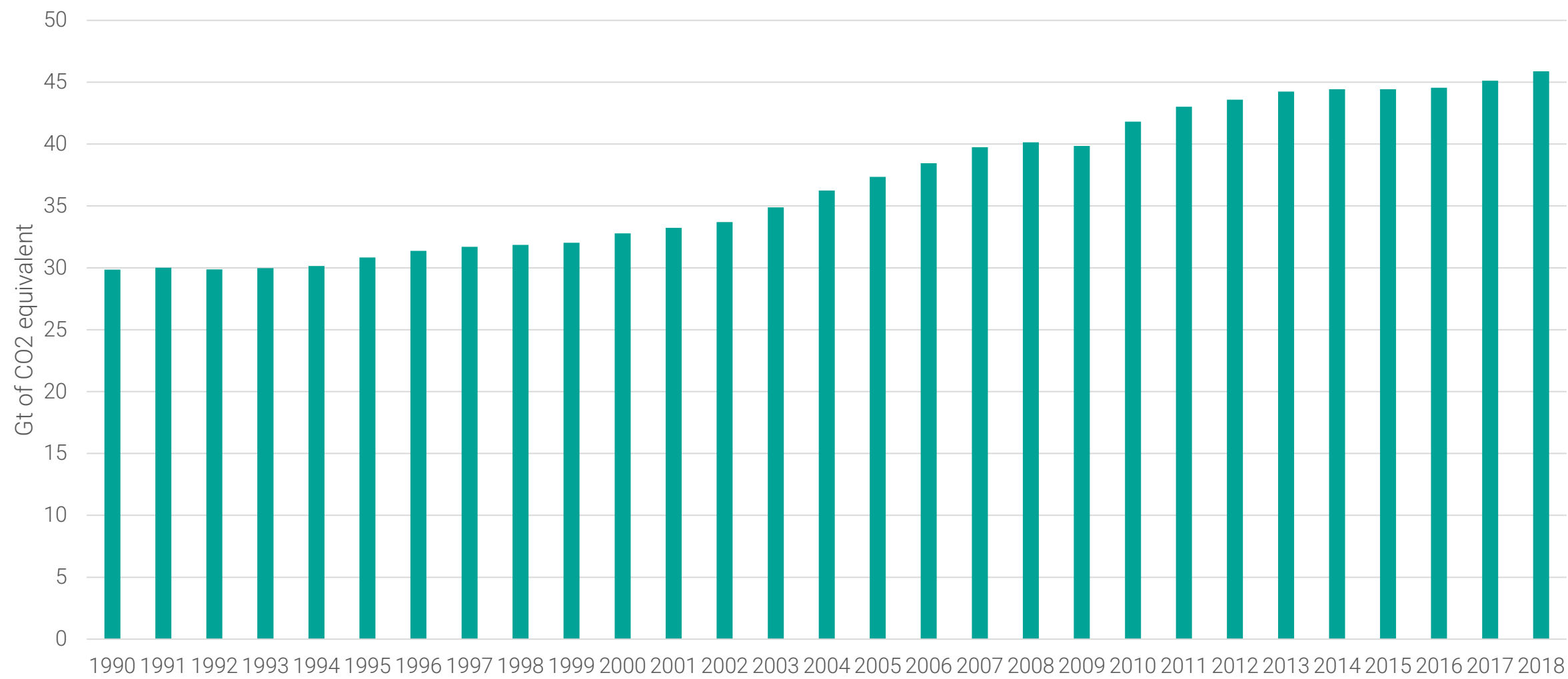
Wikipedia on Greenhouse gas

GHG

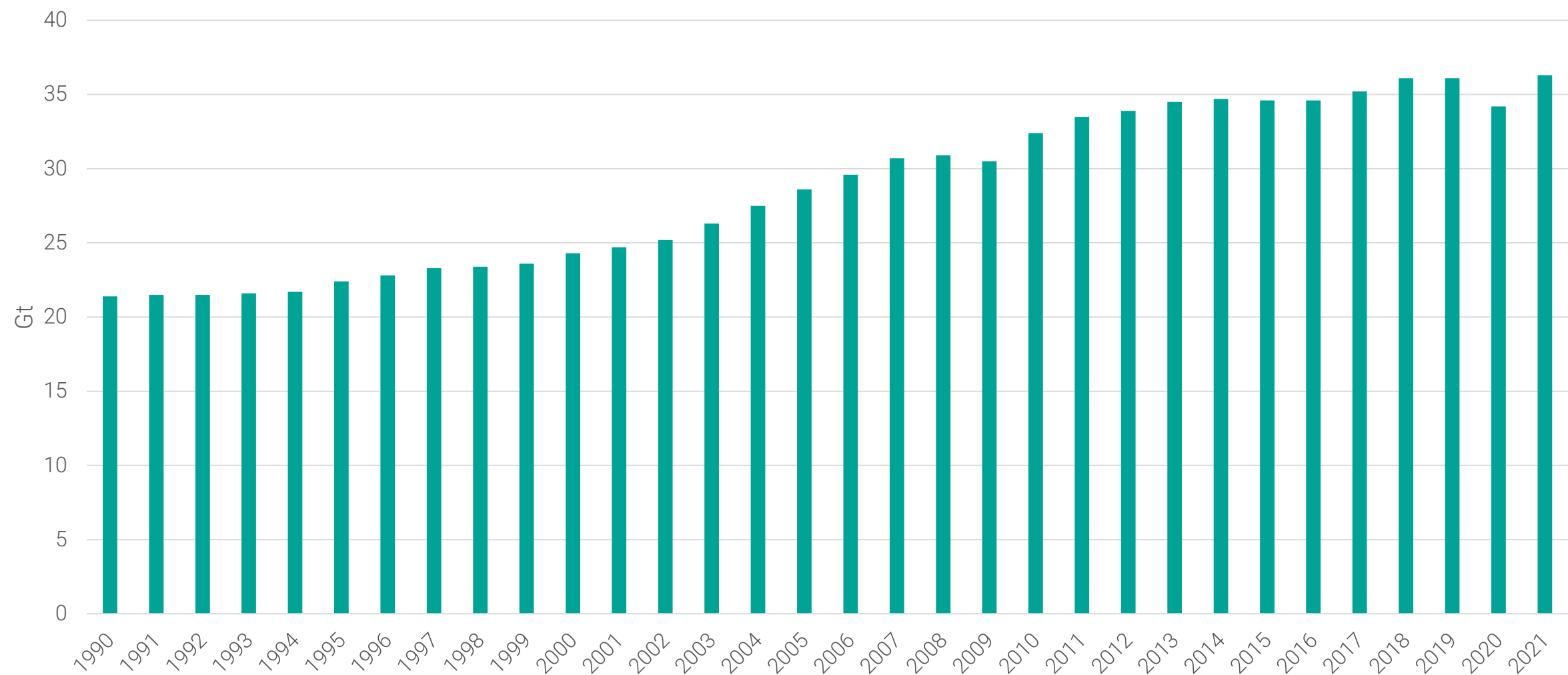
- Carbon Dioxide (CO₂)
- Methane
- Nitrous Oxide
- Fluorinated Gases (F-gases)
- Water Vapor!



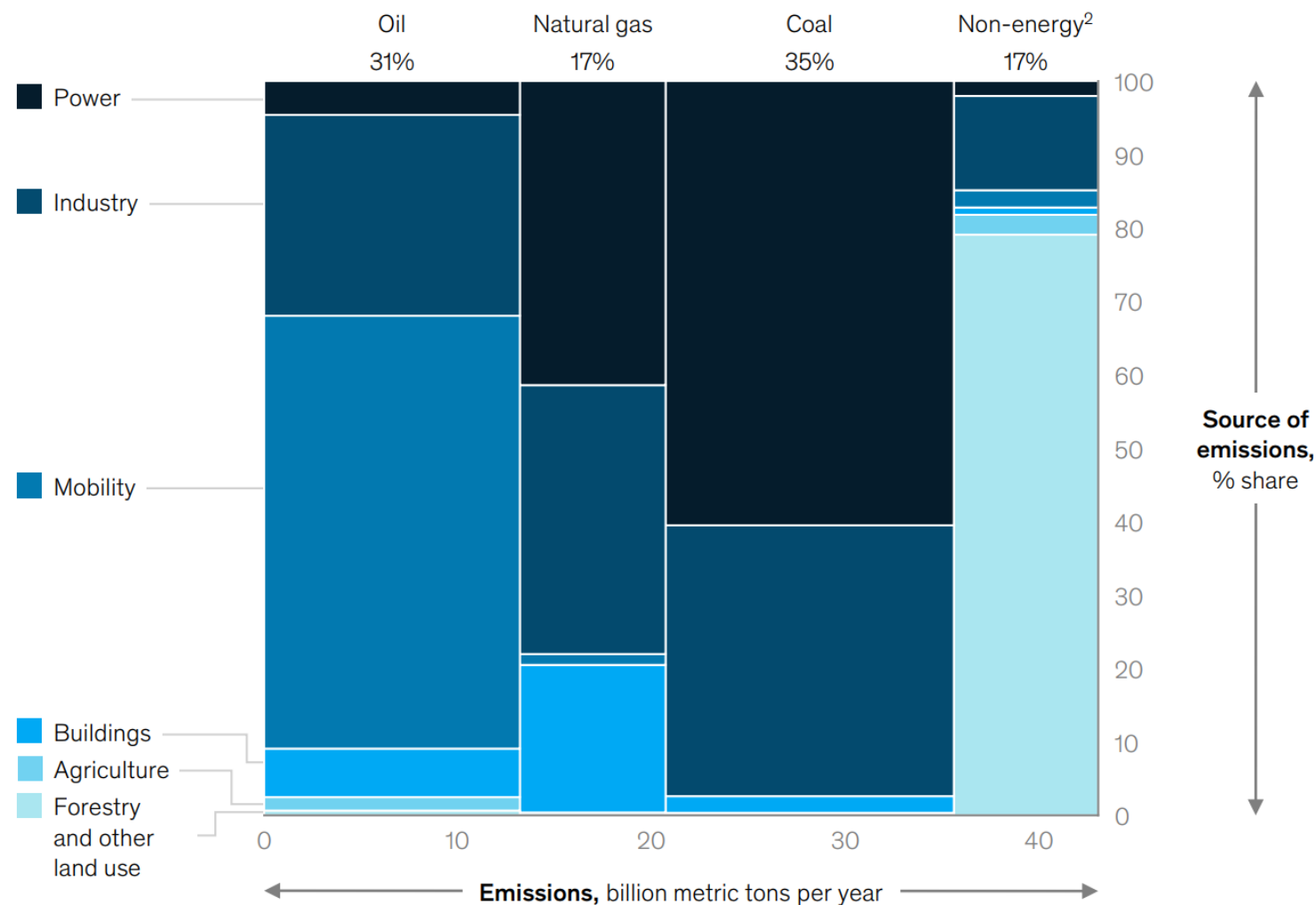
Global Greenhouse Gas Emissions



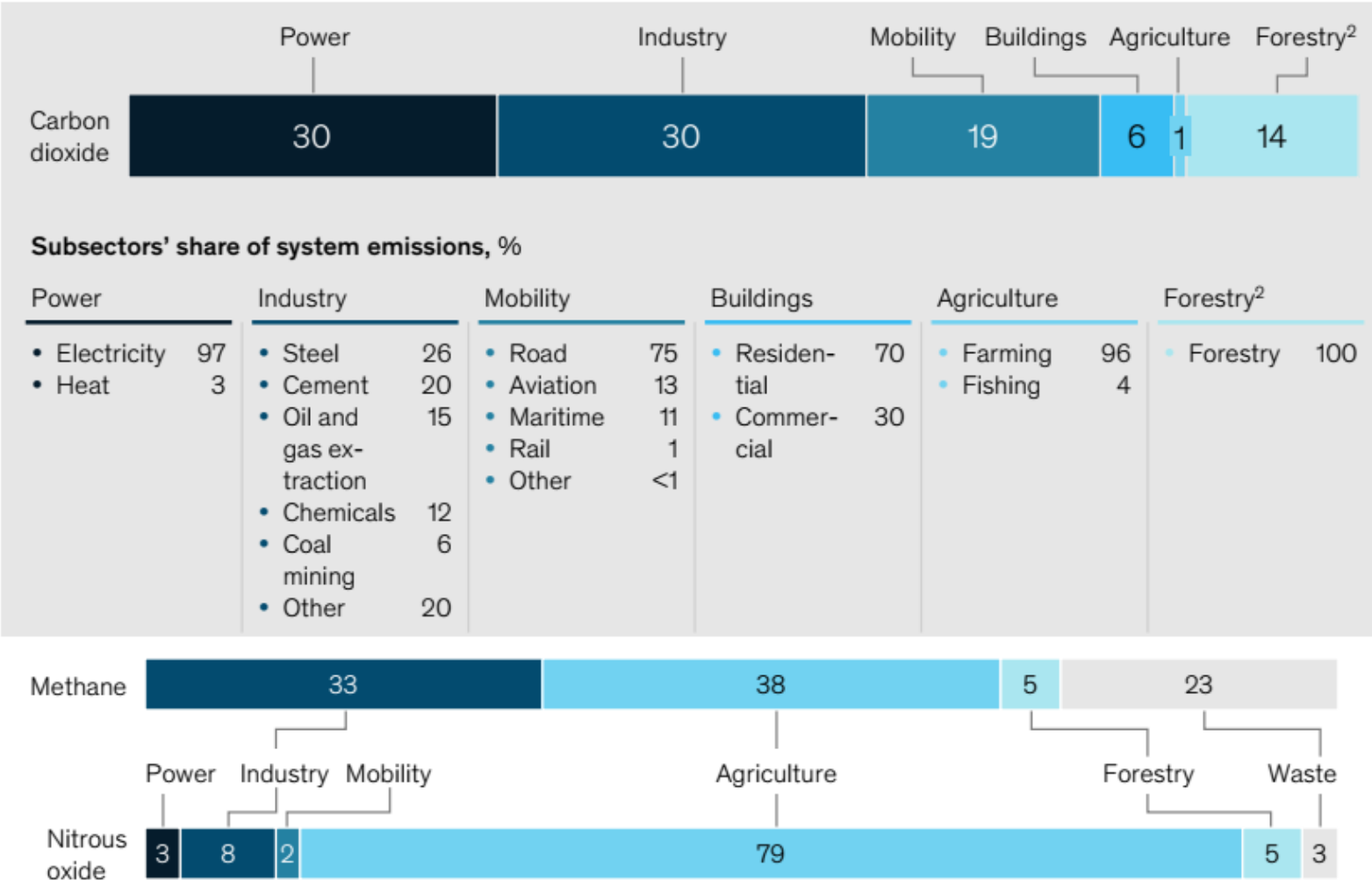
CO2 Emissions from Energy Combustion and Industrial Processes, 1900-2021



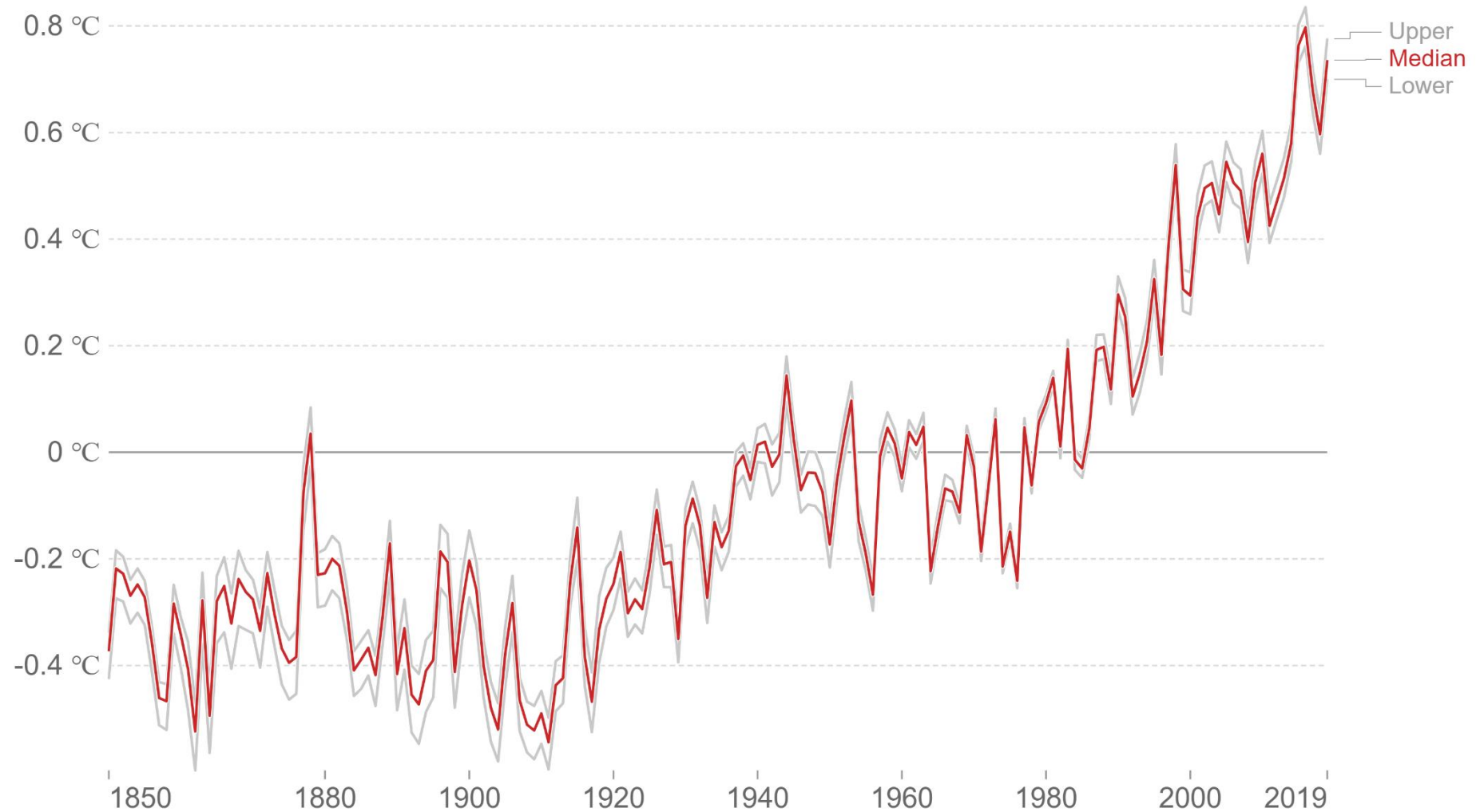
CO₂ Emissions Per Fuel And Energy And Land-use System, 2019, Share



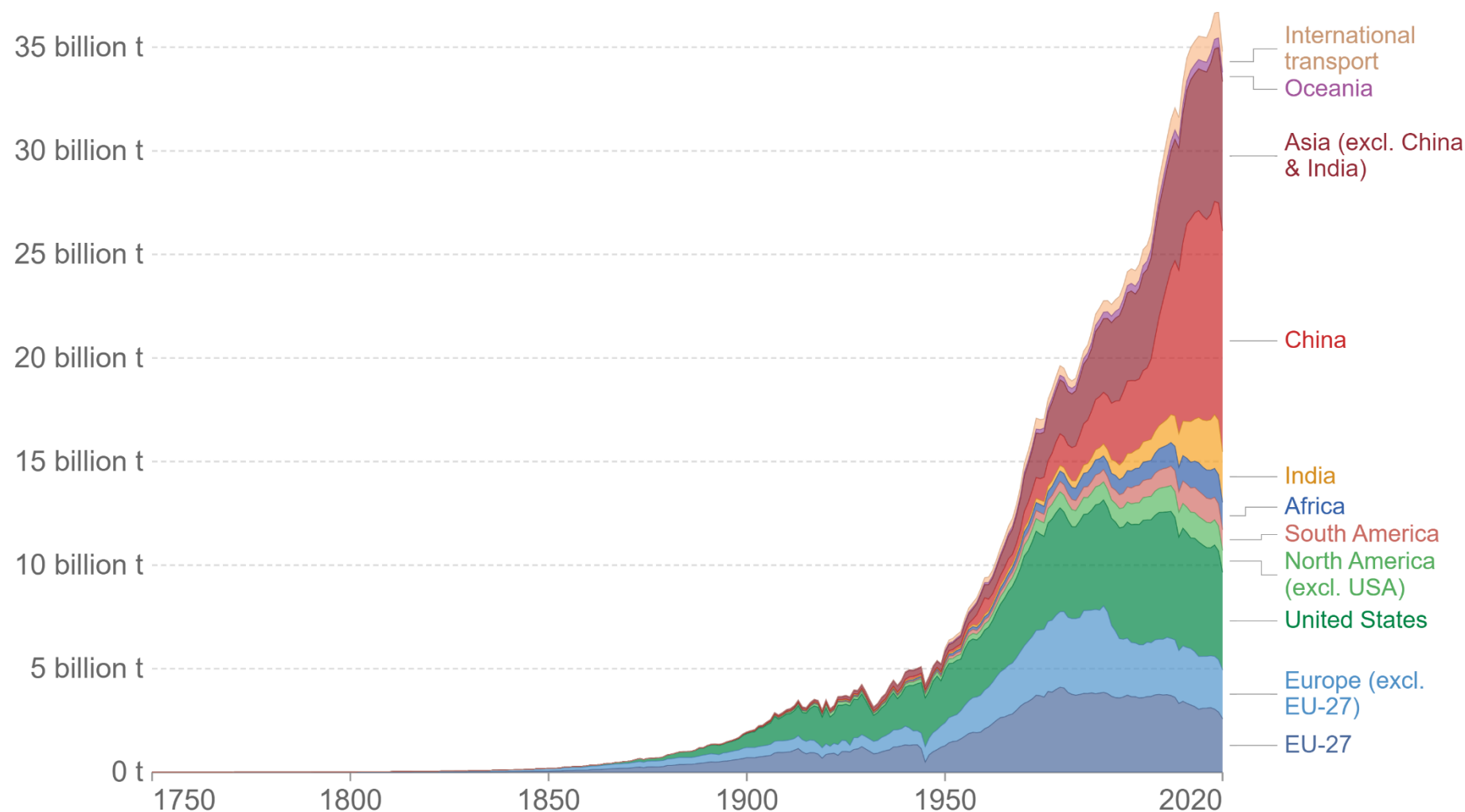
Share of Emissions per Energy and Land-use System (2019, %)



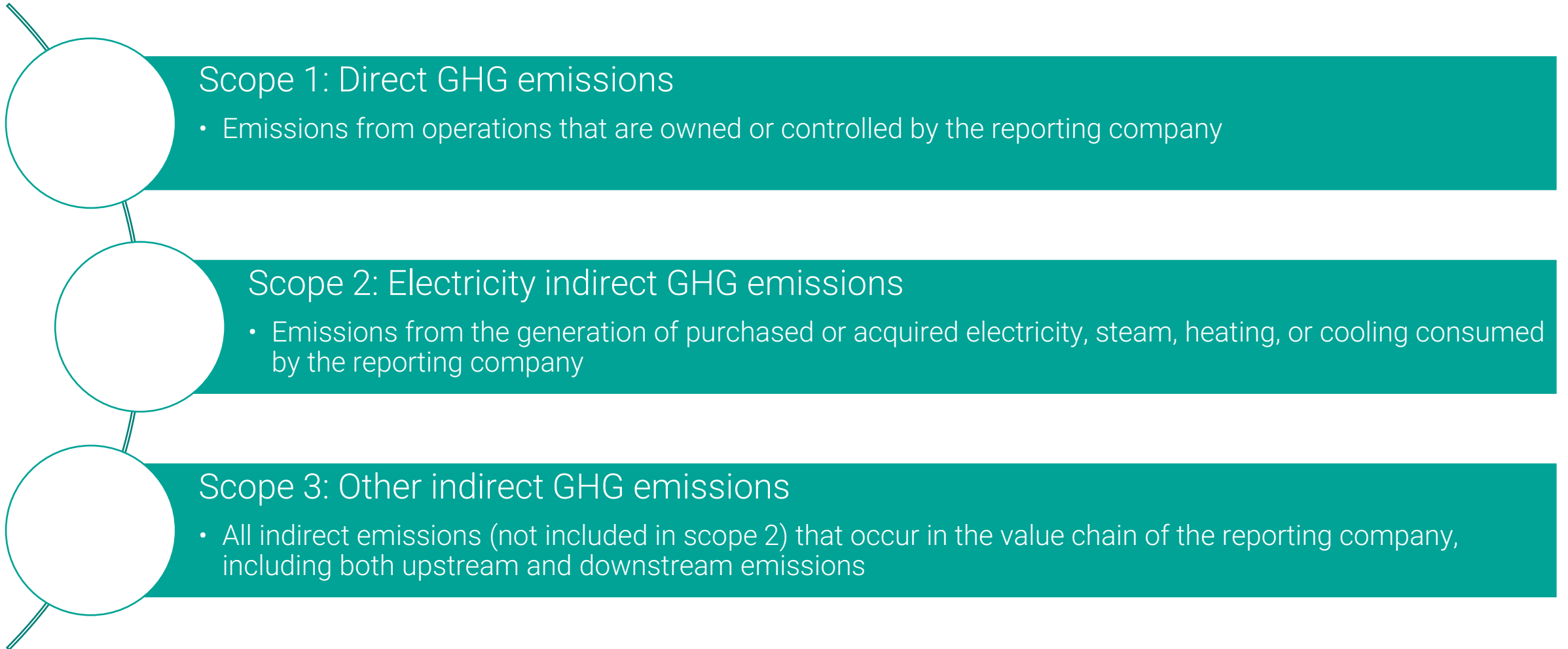
Average Temperature Anomaly (Global)



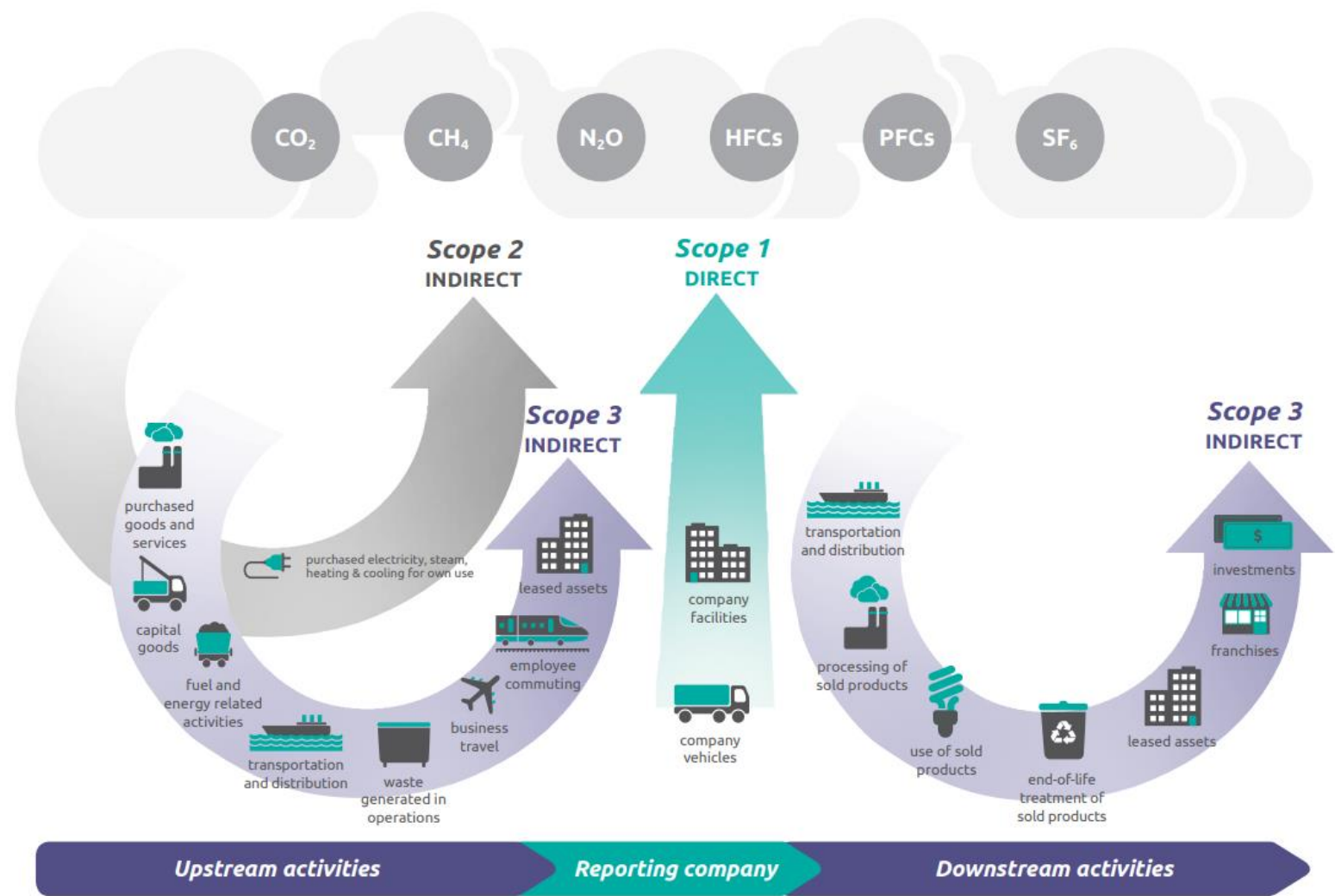
Annual CO₂ Emissions from Fossil Fuels by World Region



Emissions' Scopes

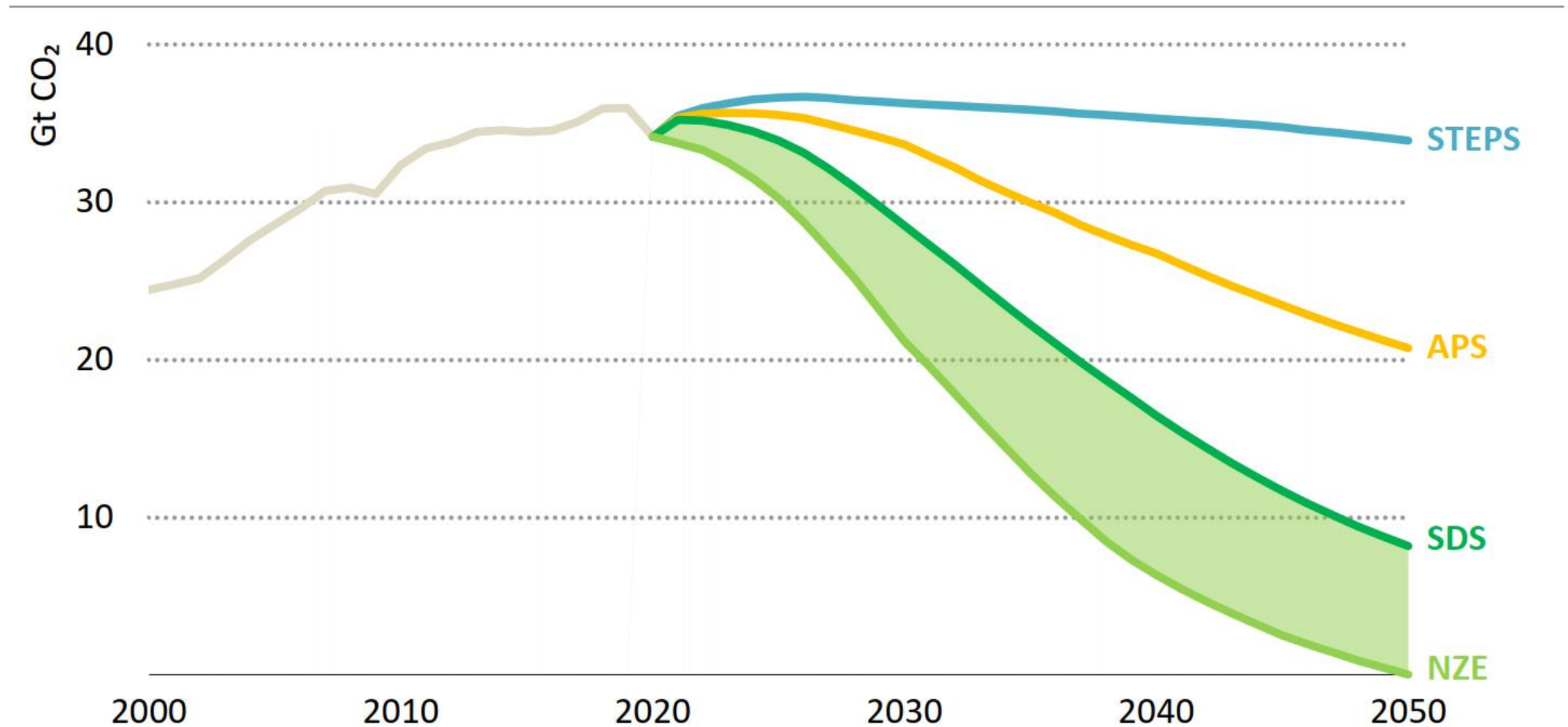


Overview of GHG Protocol Scopes and Emissions Across the Value Chain

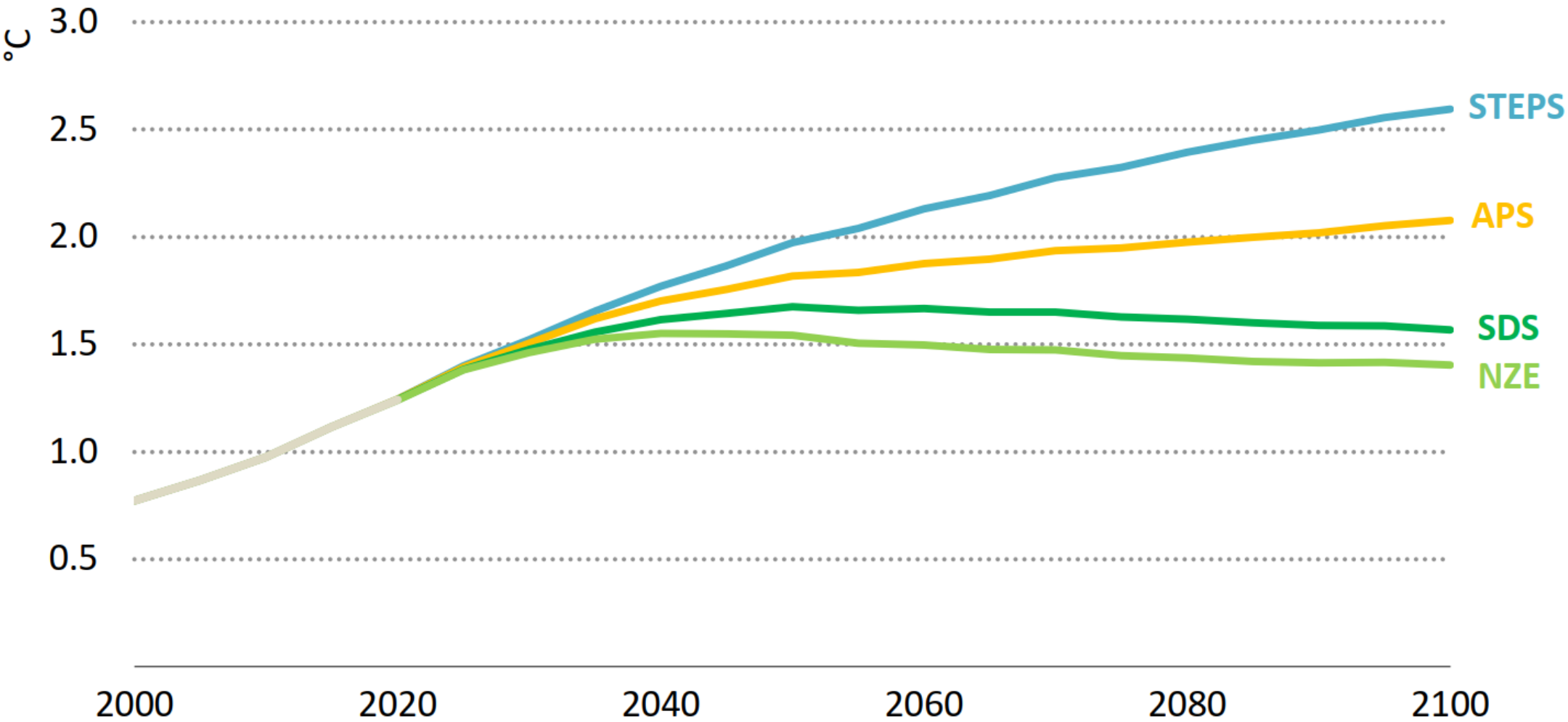


Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard 2011

CO2 Emissions In The WEO-2021 Scenarios Over Time



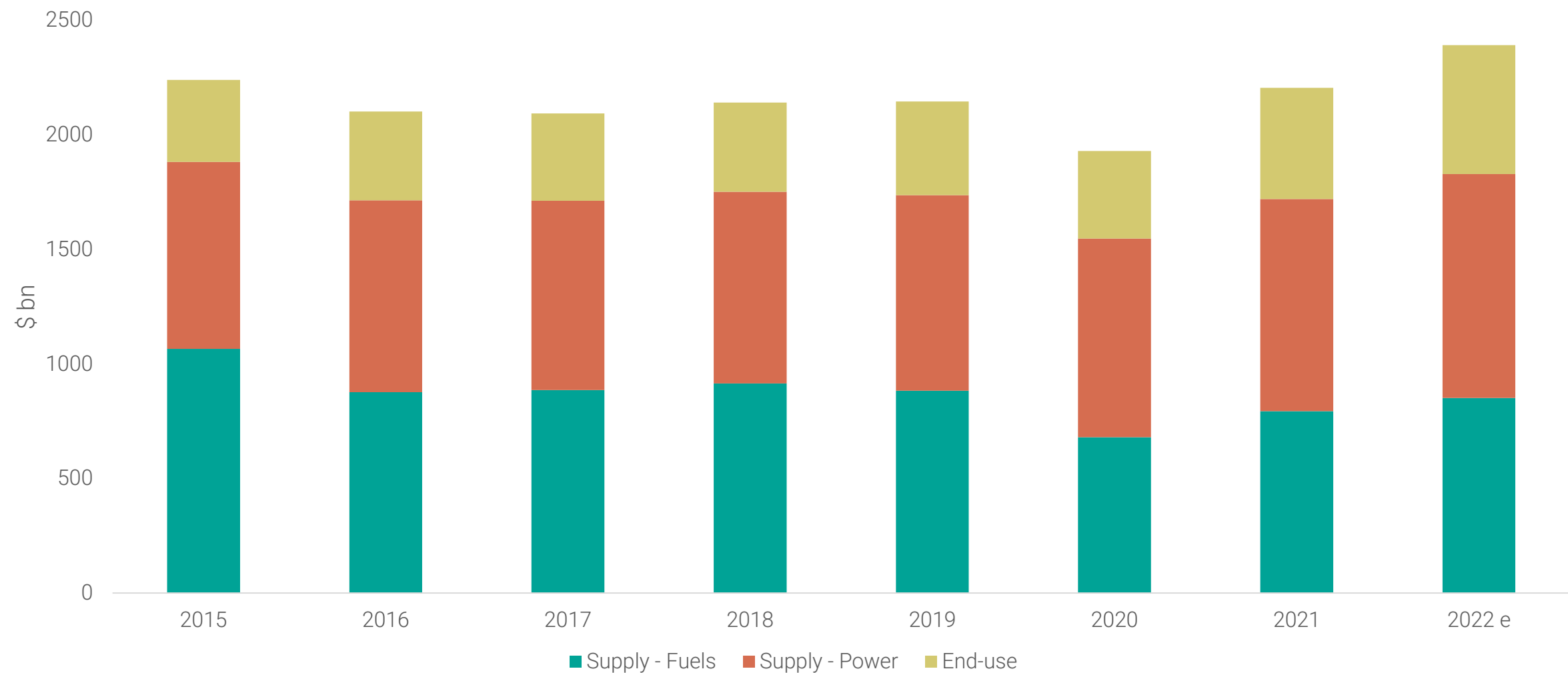
Global Median Surface Temperature Rise Over Time



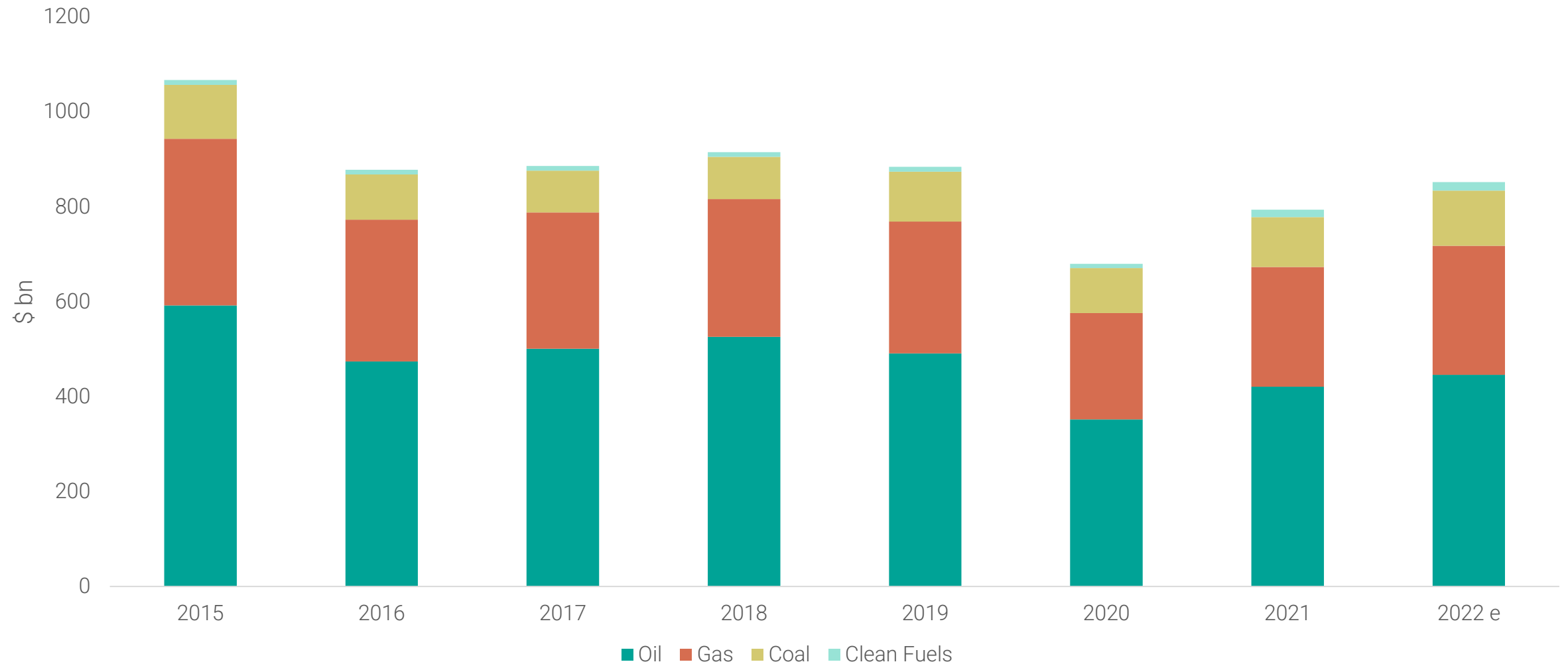
Investment

To understand key trends in global energy investment, with specific focus on upstream oil and gas industry

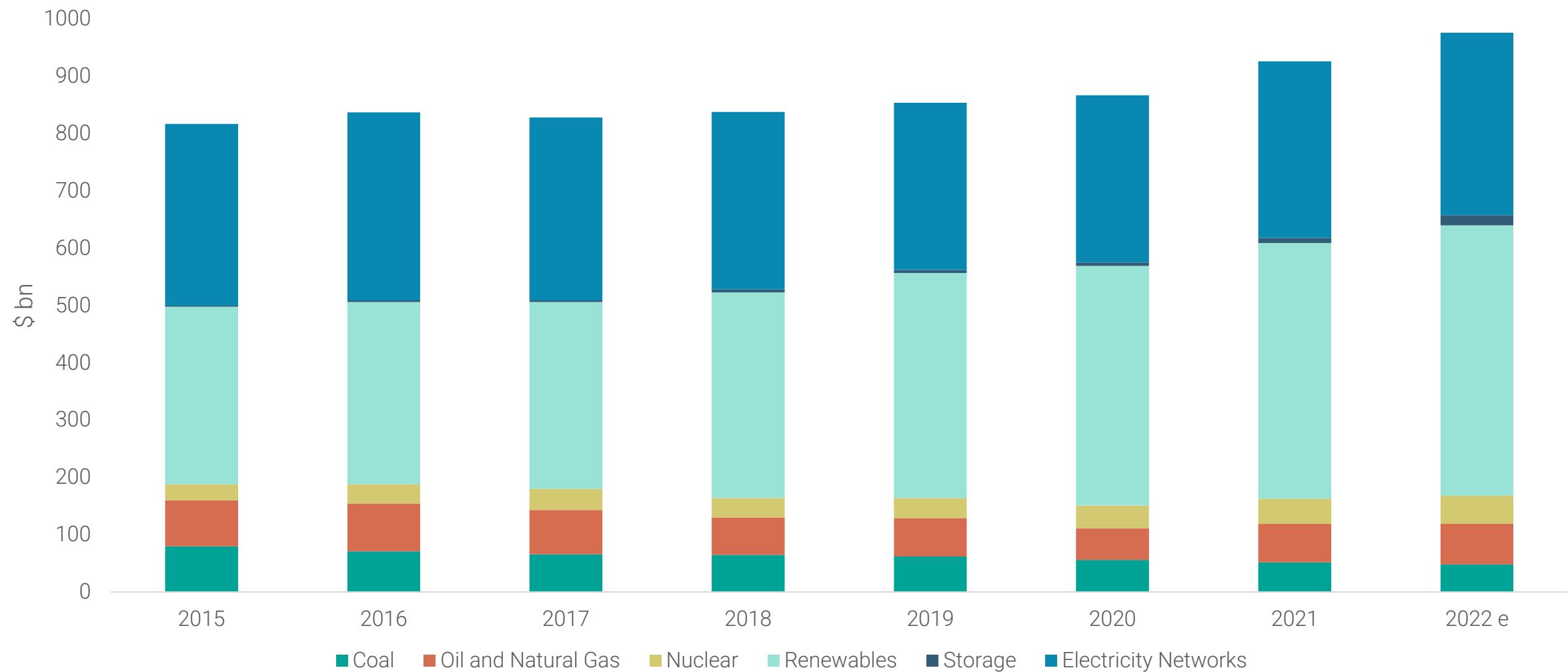
World Energy Investment Trend



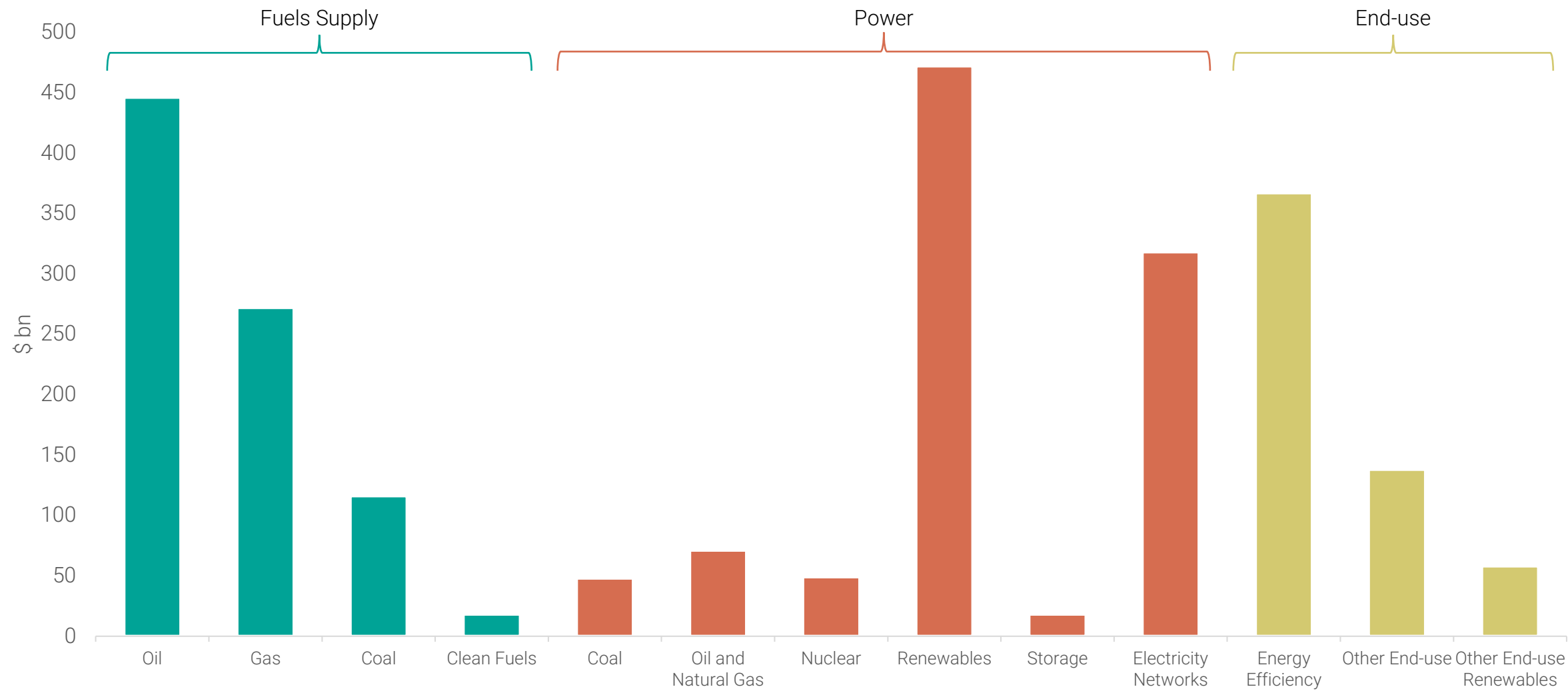
Investment in Fuels Supply



Investment in Power Supply

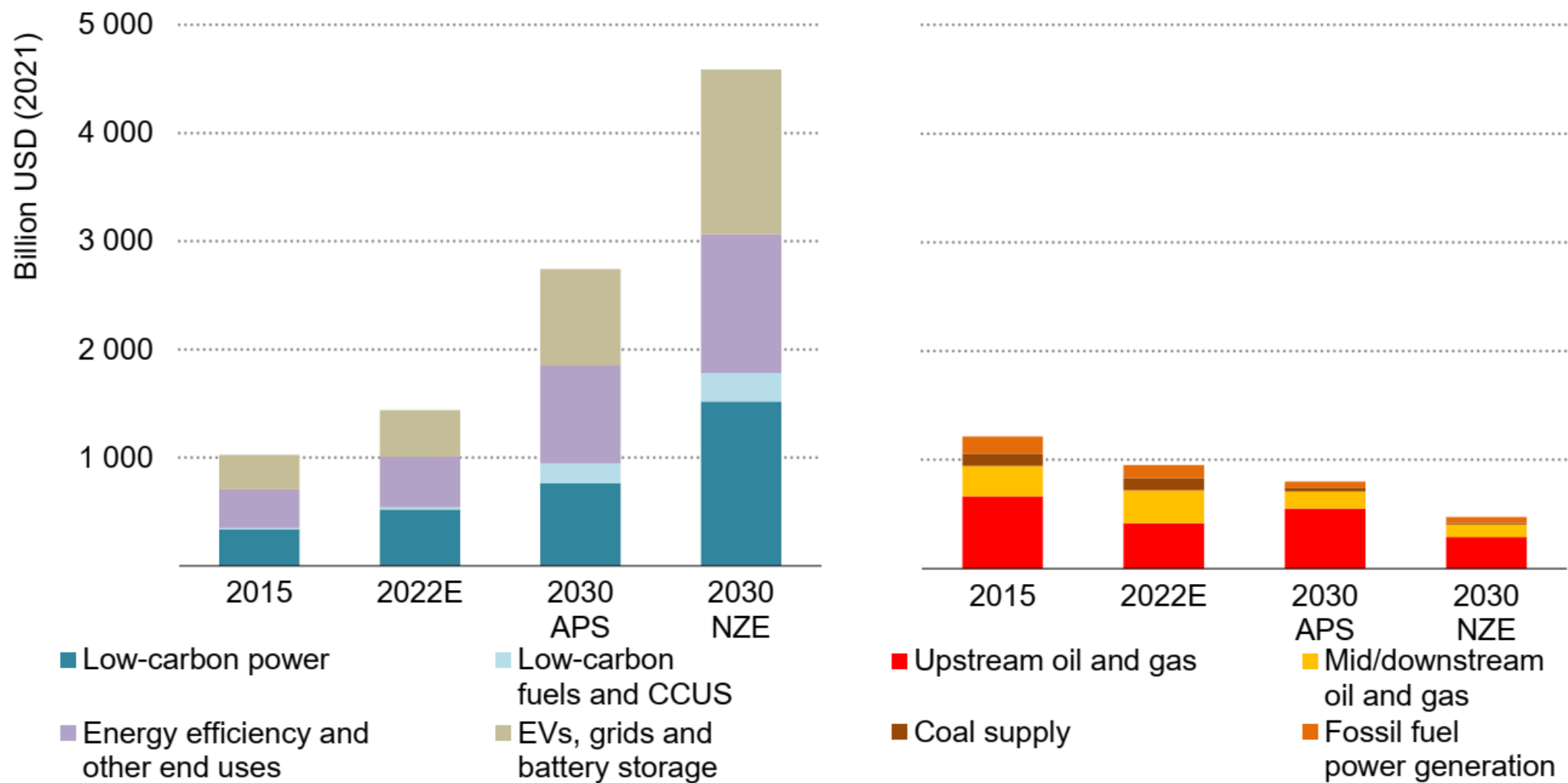


Overview of Energy Investment

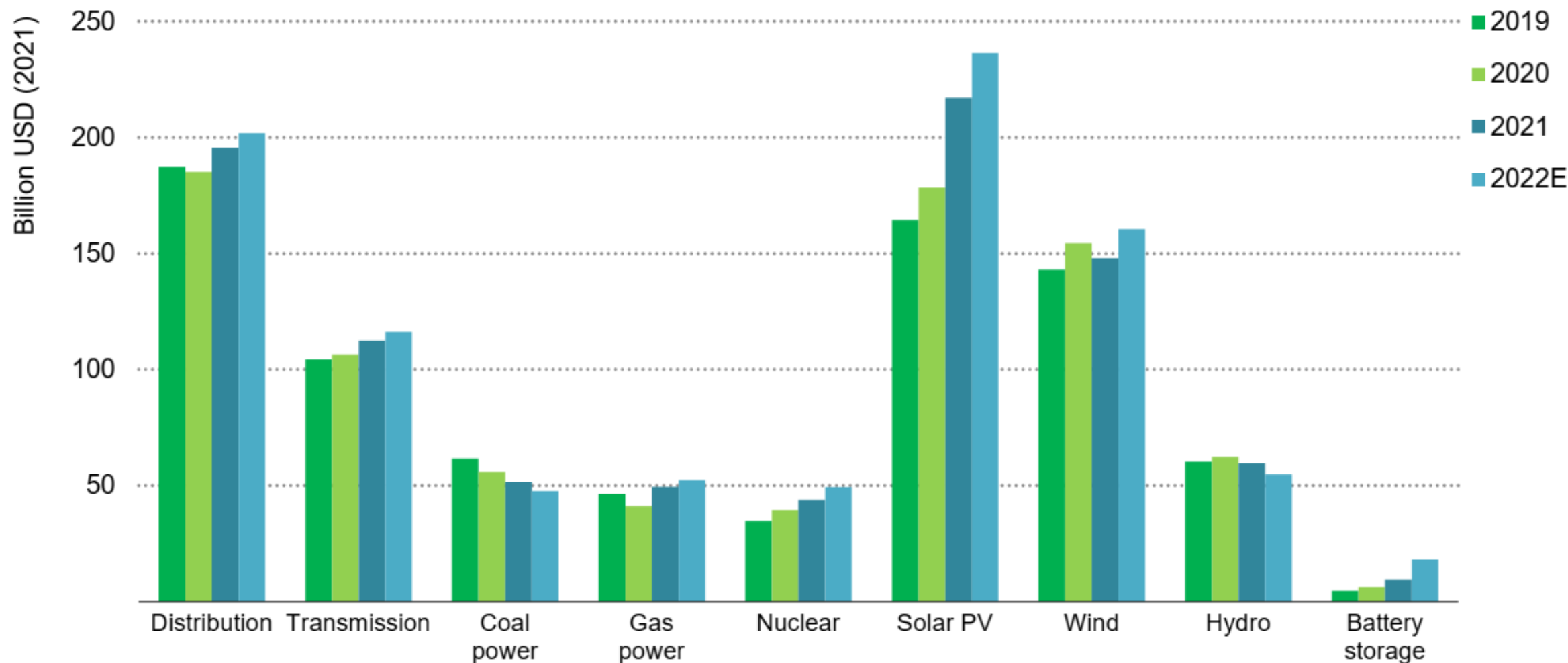


IEA World Energy Investment 2022

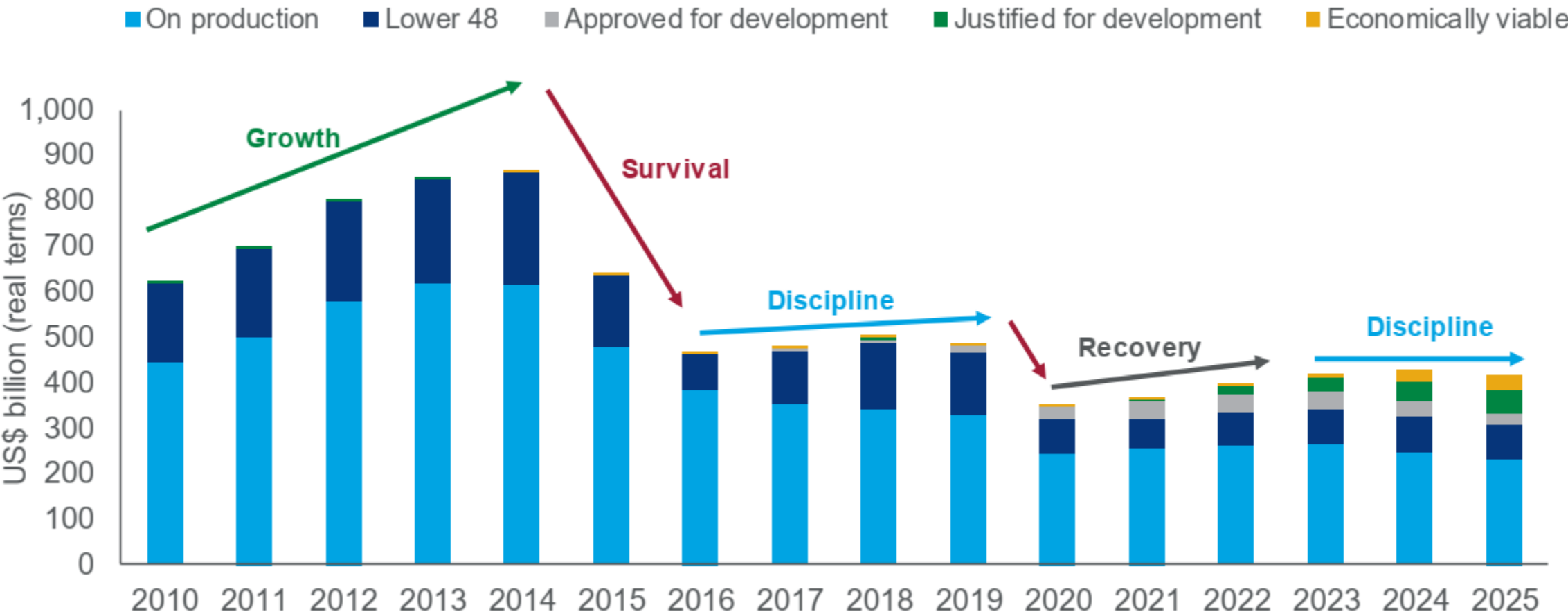
Annual Global Energy Investment Benchmarked Against The Needs



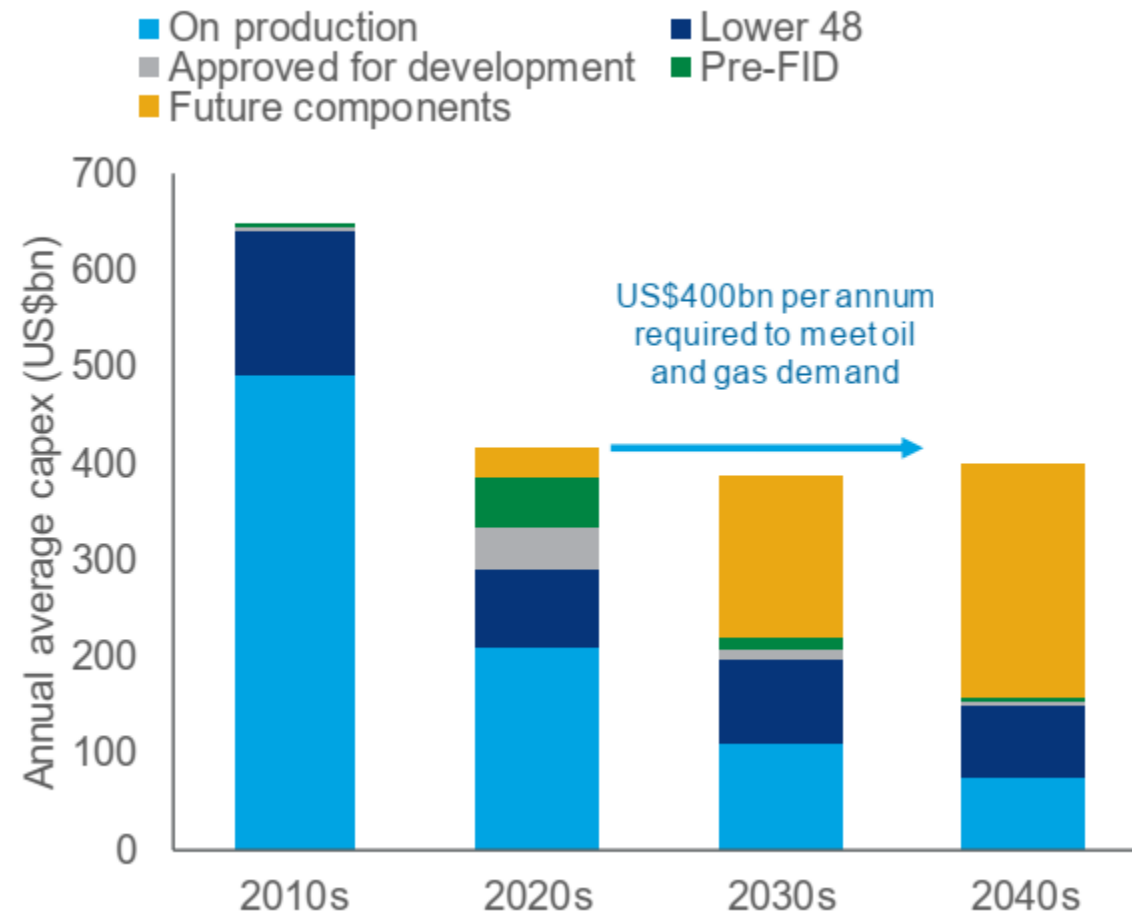
Global Annual Investment in the Power Sector By Technology



Upstream Development Capex



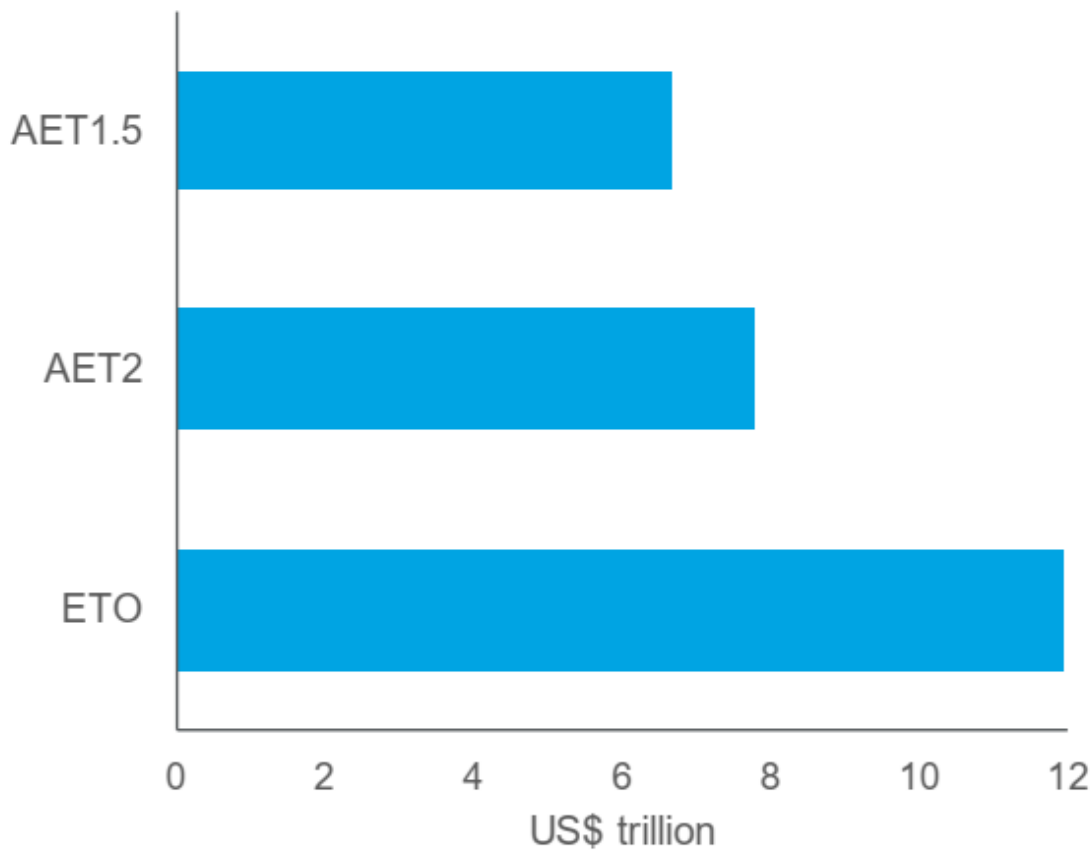
Upstream Capex by Development Status



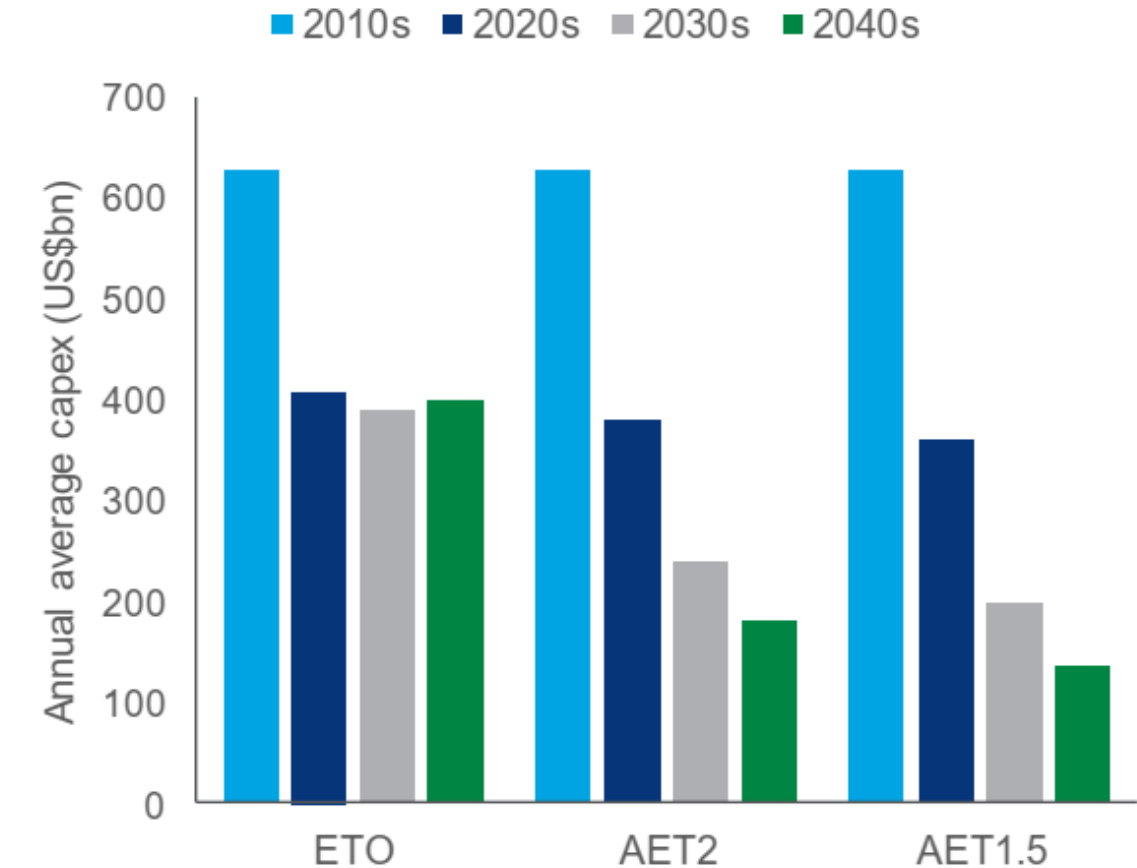
Wood Mackenzie How much does the oil and gas industry need to spend?

Upstream CAPEX by Scenario

Cumulative capex by scenario (2021 to 2050)

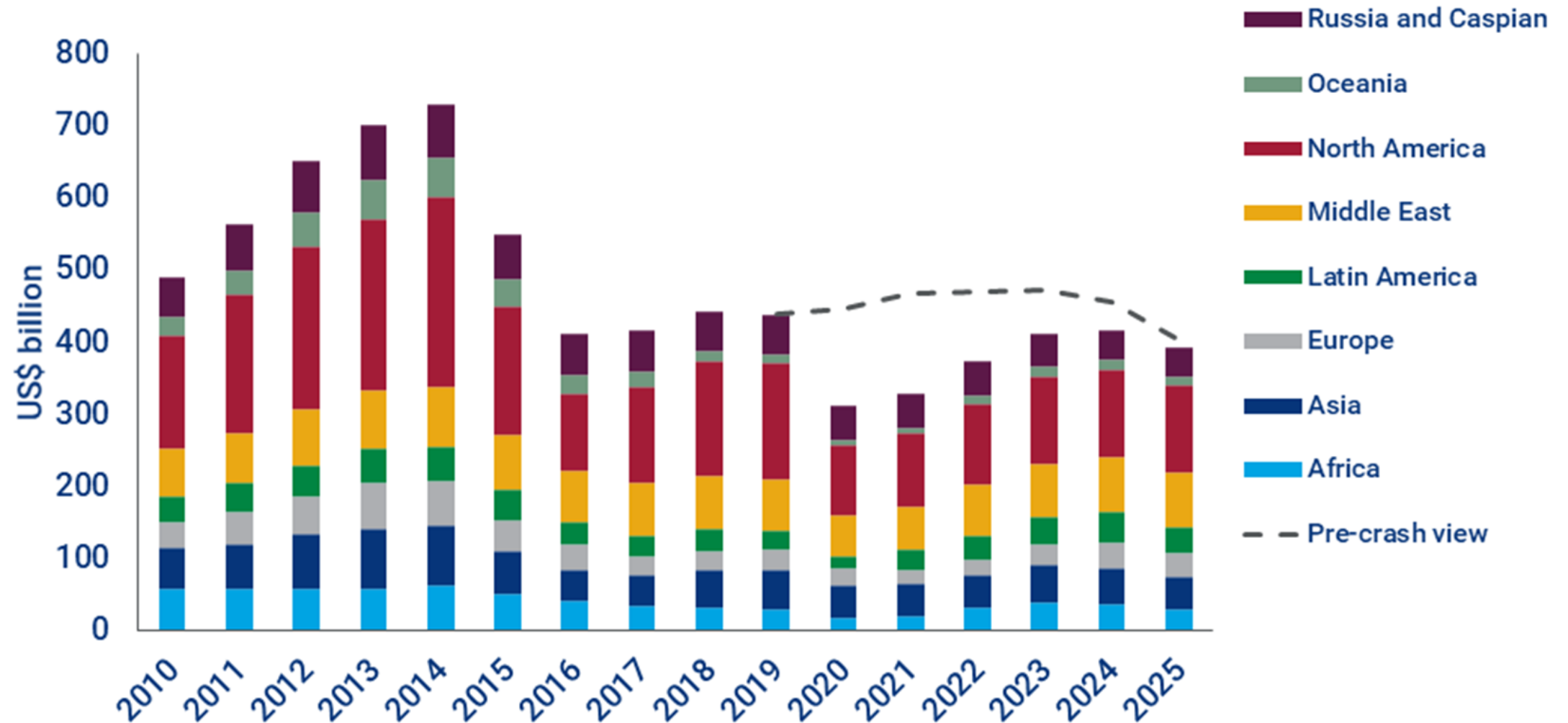


Upstream development capex (in real terms)



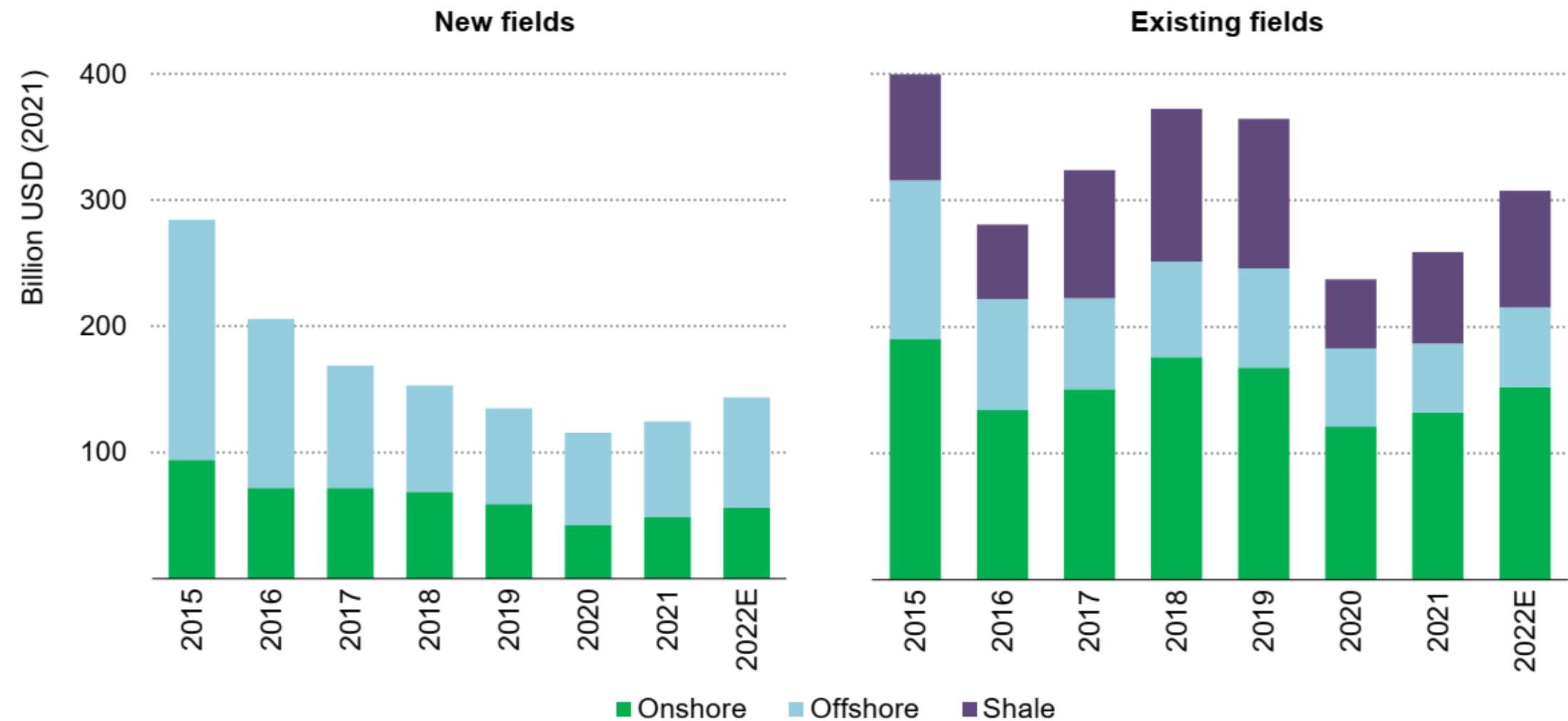
Wood Mackenzie How much does the oil and gas industry need to spend?

World Upstream Investment by Region

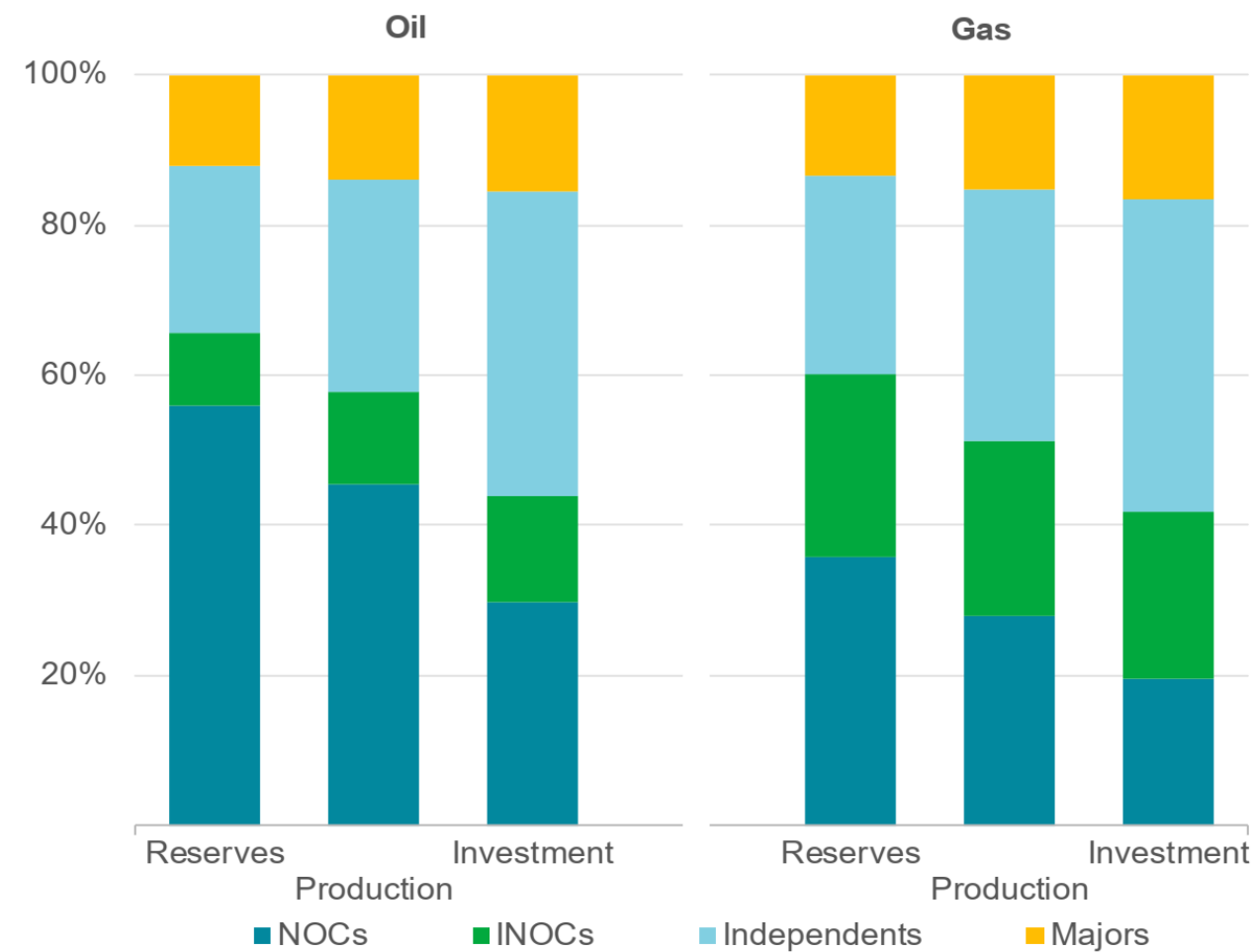


Wood Mackenzie Competing for capital in a downcycle

Upstream Investment in New and Existing Oil and Natural Gas Fields

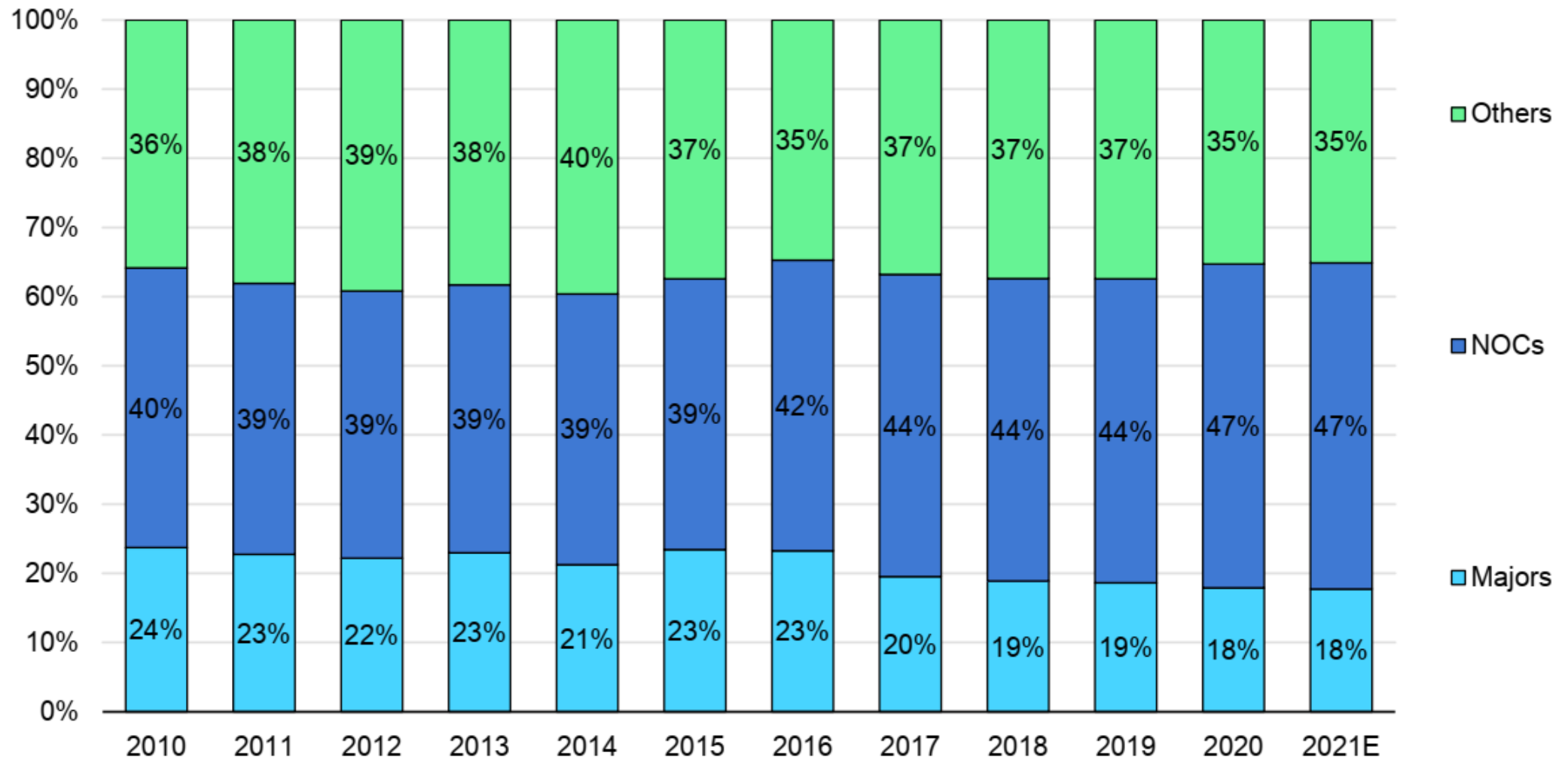


Ownership Of Oil And Gas Reserves, Production and Upstream Investment



Note: NOCs = national oil companies; INOCs = international national oil companies.

Share of Upstream Investment by Company Type



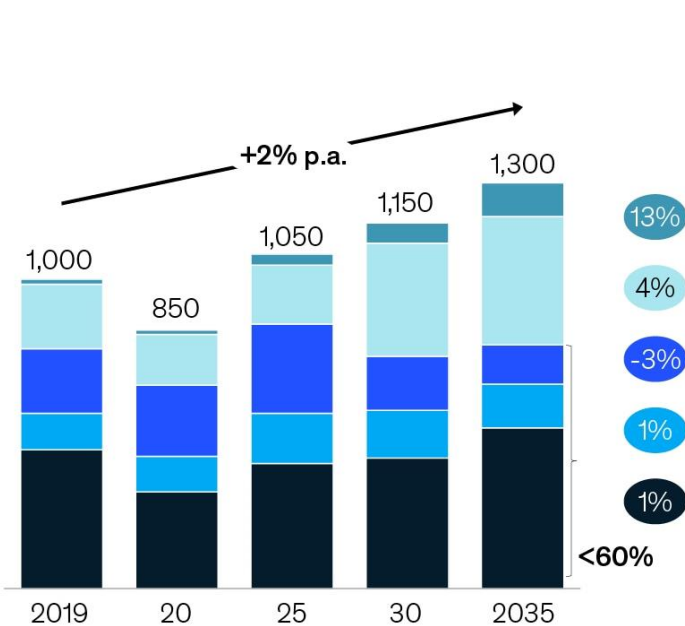
Energy Investments by Technology in Two Scenarios

Energy Investments, bn USD

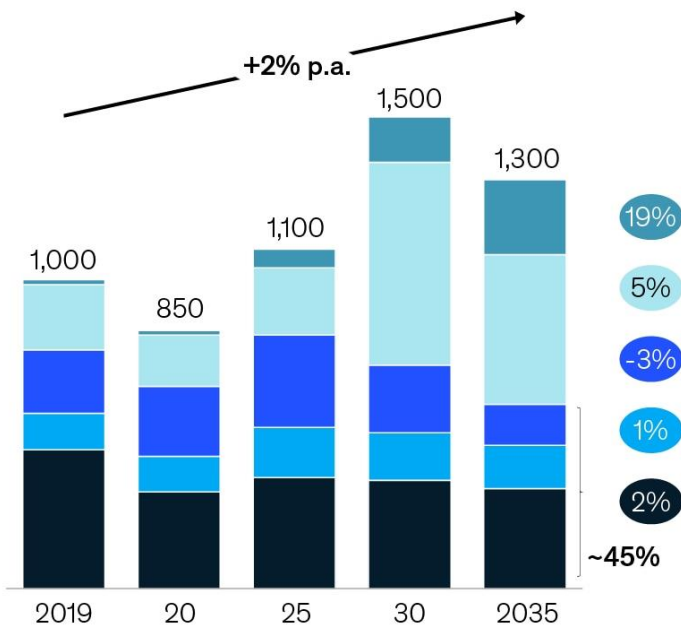
(x%) 2019-35 CAGR

- New Tech¹
- Renewable Power²
- Conventional Power³
- Natural Gas⁴
- Oil⁵

Reference Case



Accelerated Transition



¹Includes Biofuels, Hydrogen production, EV Charging, and NBS

²Includes Solar, Onshore Wind, and Offshore Wind

³Includes Coal, Gas, Nuclear, Hydro, Other

⁴Includes Upstream gas, and LNG

⁵Includes Upstream Oil, Oil Refining, Specialty Chemicals, PetChem (only for Reference Case), Lubricants (only for Reference Case), and Retail.

Source: McKinsey Energy Insights Energy Value Pools Model

McKinsey The global energy landscape is going through major shifts: What does this mean for value pools in energy?

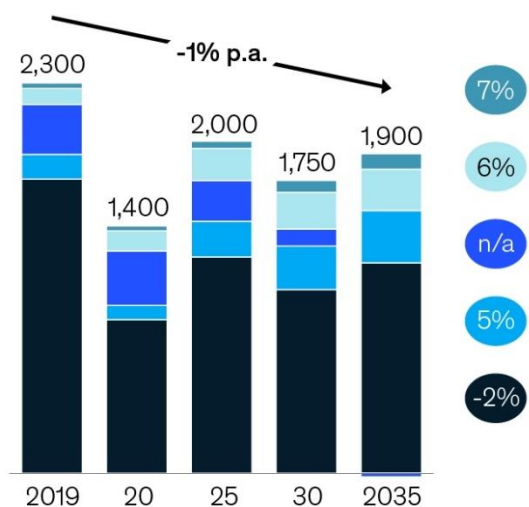
Energy Value Pool by Technology in Three Scenarios

Energy Value Pool (EBIT), bn USD

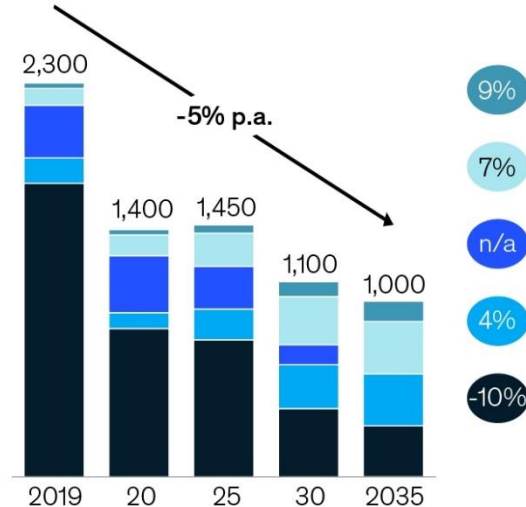
(x%) 2019-35 CAGR

- New Tech¹
- Conventional Power³
- Natural Gas⁴
- Renewable Power²
- Oil⁵

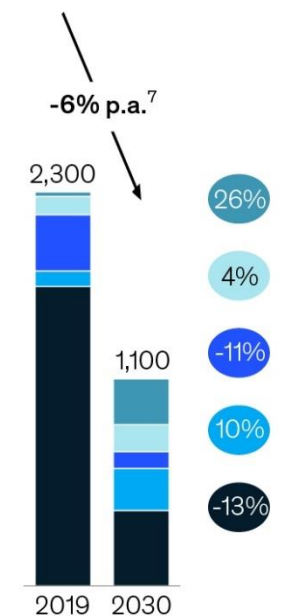
Reference Case



Accelerated Transition



1.5°C Pathway⁶



¹Includes Biofuels, Hydrogen production, CCUS, EV Charging, and NBS

²Includes Solar, Onshore Wind, and Offshore Wind

³Includes Coal, Gas, Nuclear, Hydro, Other

⁴Includes Upstream gas, and LNG

⁵Includes Upstream Oil, Oil Refining, Specialty Chemicals, PetChem (only for Reference Case), Lubricants (only for Reference Case), and Retail

⁶EV Charging, NBS, and Specialty Chemicals components based on Accelerated Scenario values

⁷CAGR values in 1.5C pathway are 2019-2030.

Source: McKinsey Energy Insights Energy Value Pools Model

McKinsey The global energy landscape is going through major shifts: What does this mean for value pools in energy?

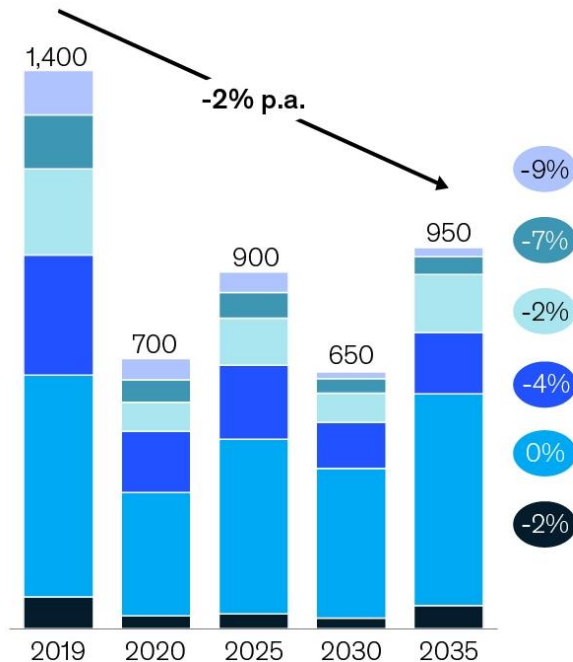
EBIT in Upstream Oil in Three Scenarios

EBIT in Upstream Oil¹, bn USD

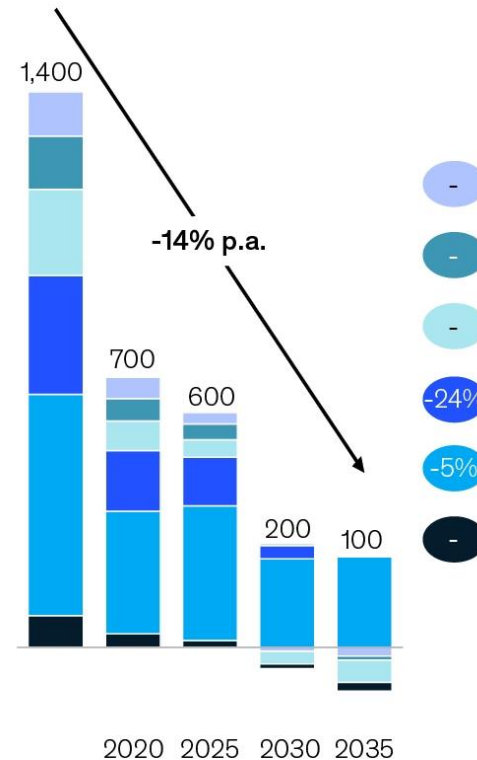
xx% 2019-35 CAGR

- Asia
- Africa
- North America
- Europe
- Middle East
- LATAM

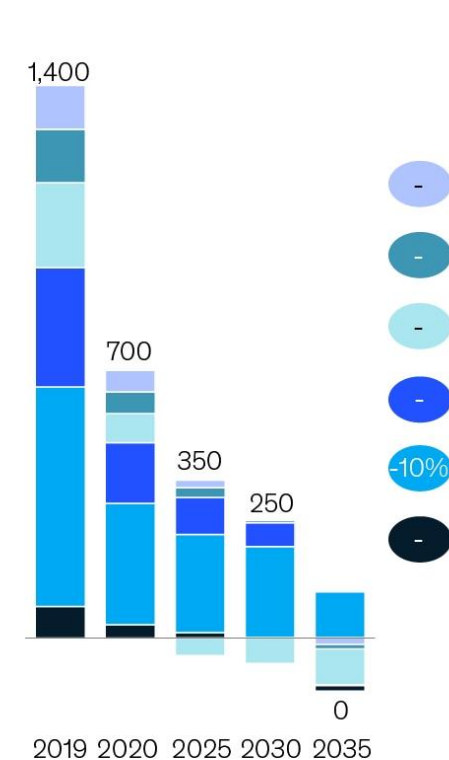
Reference Case



Accelerated Transition

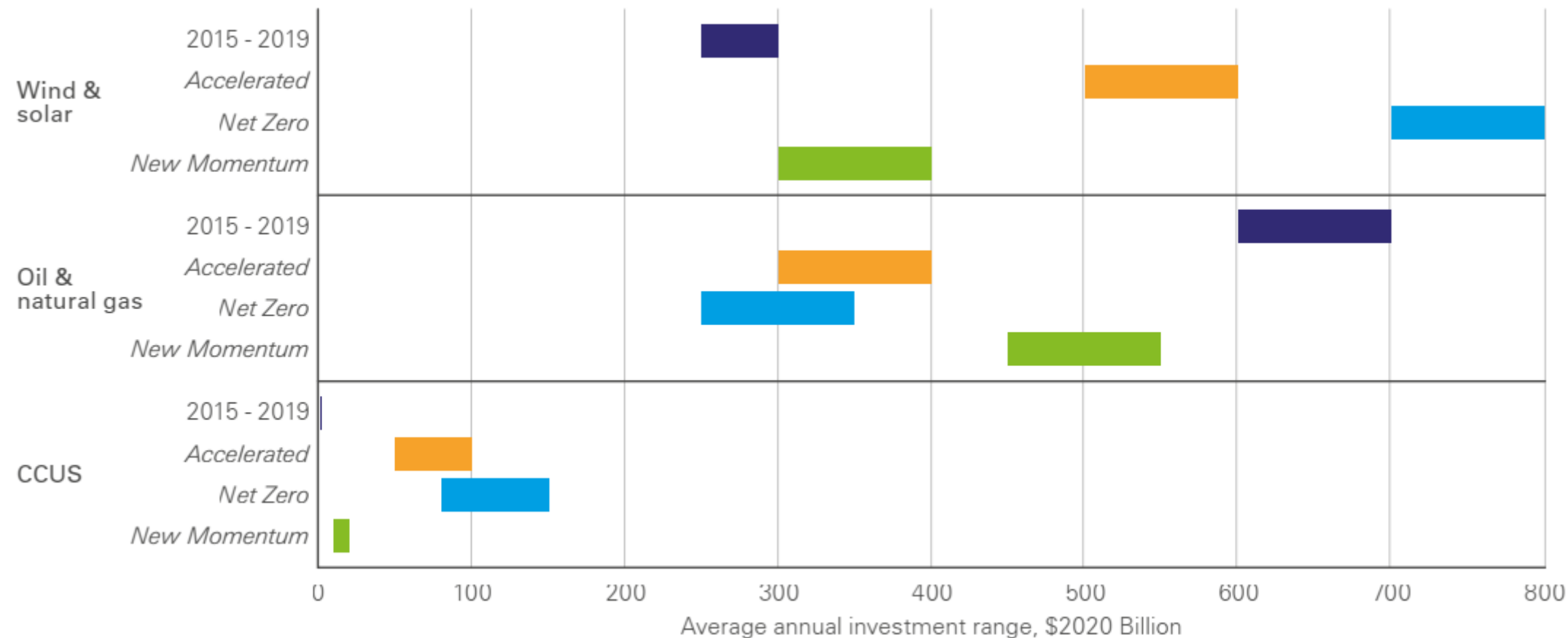


1.5°C Pathway



¹Includes government take

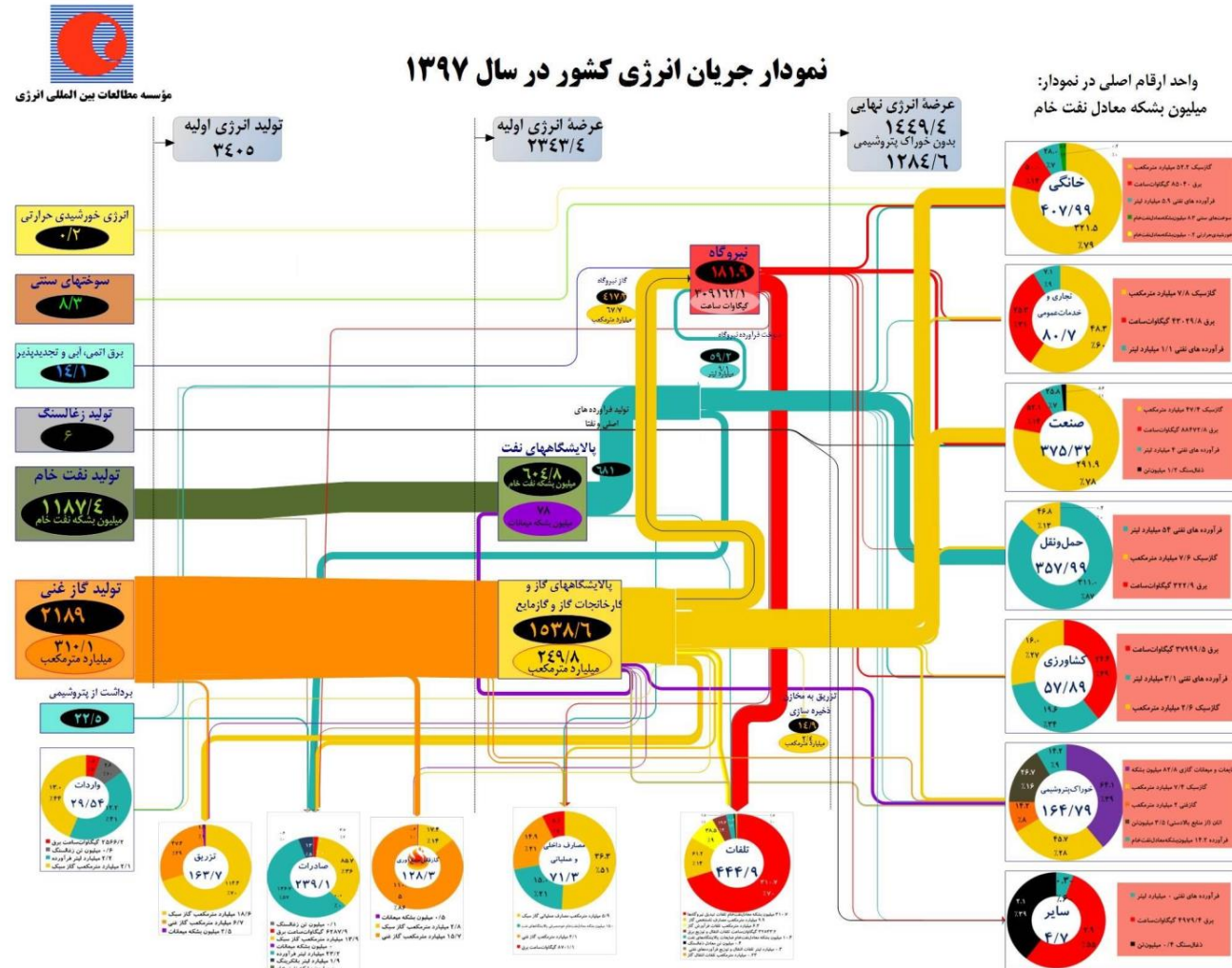
Average Annual Investment, History and 2020-2050



Iran Energy Profile

To provide an overview of Iran's energy basket, based on Iran's Hydrocarbon Balance 1397

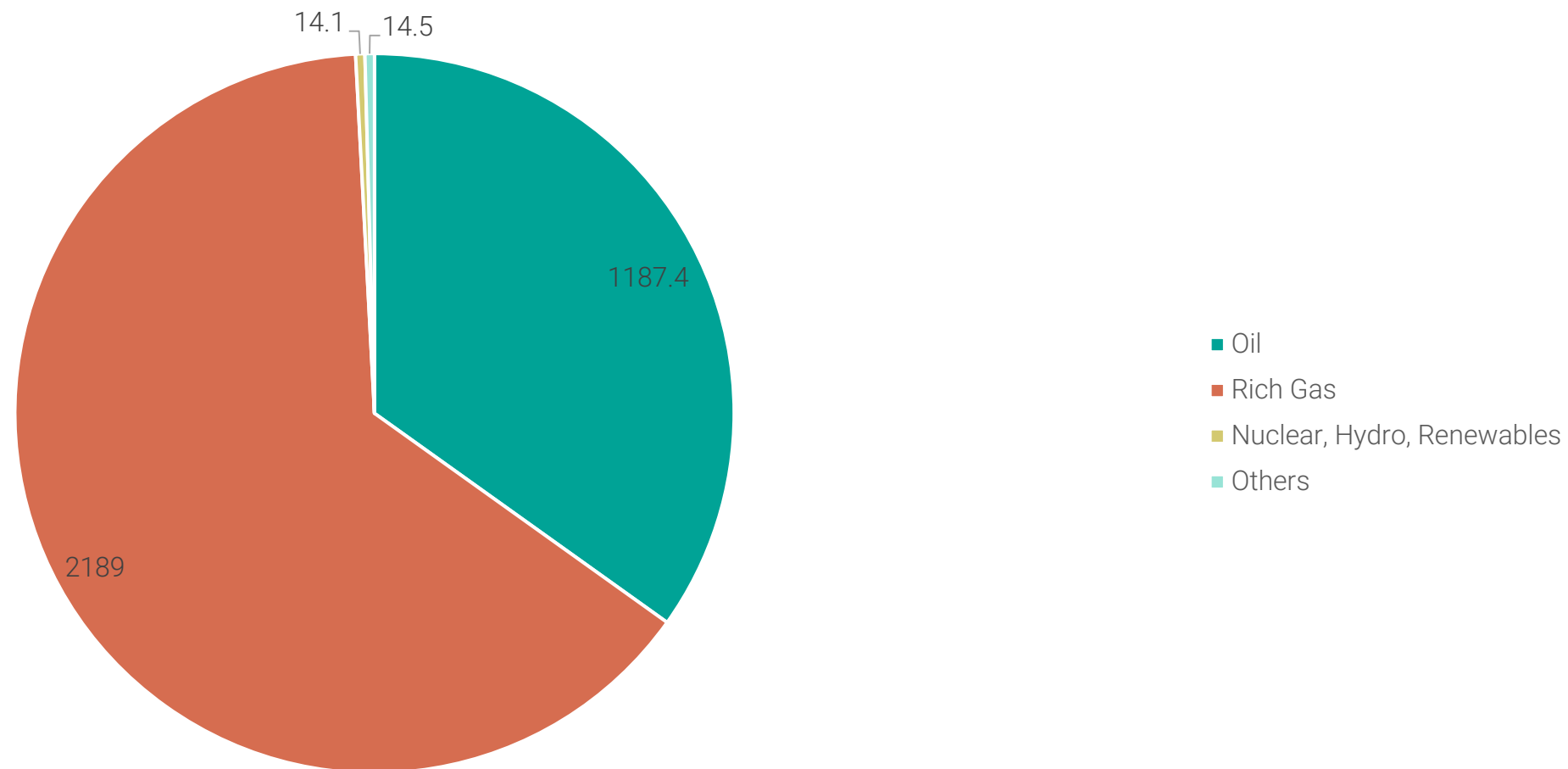
Energy Flow in 1397



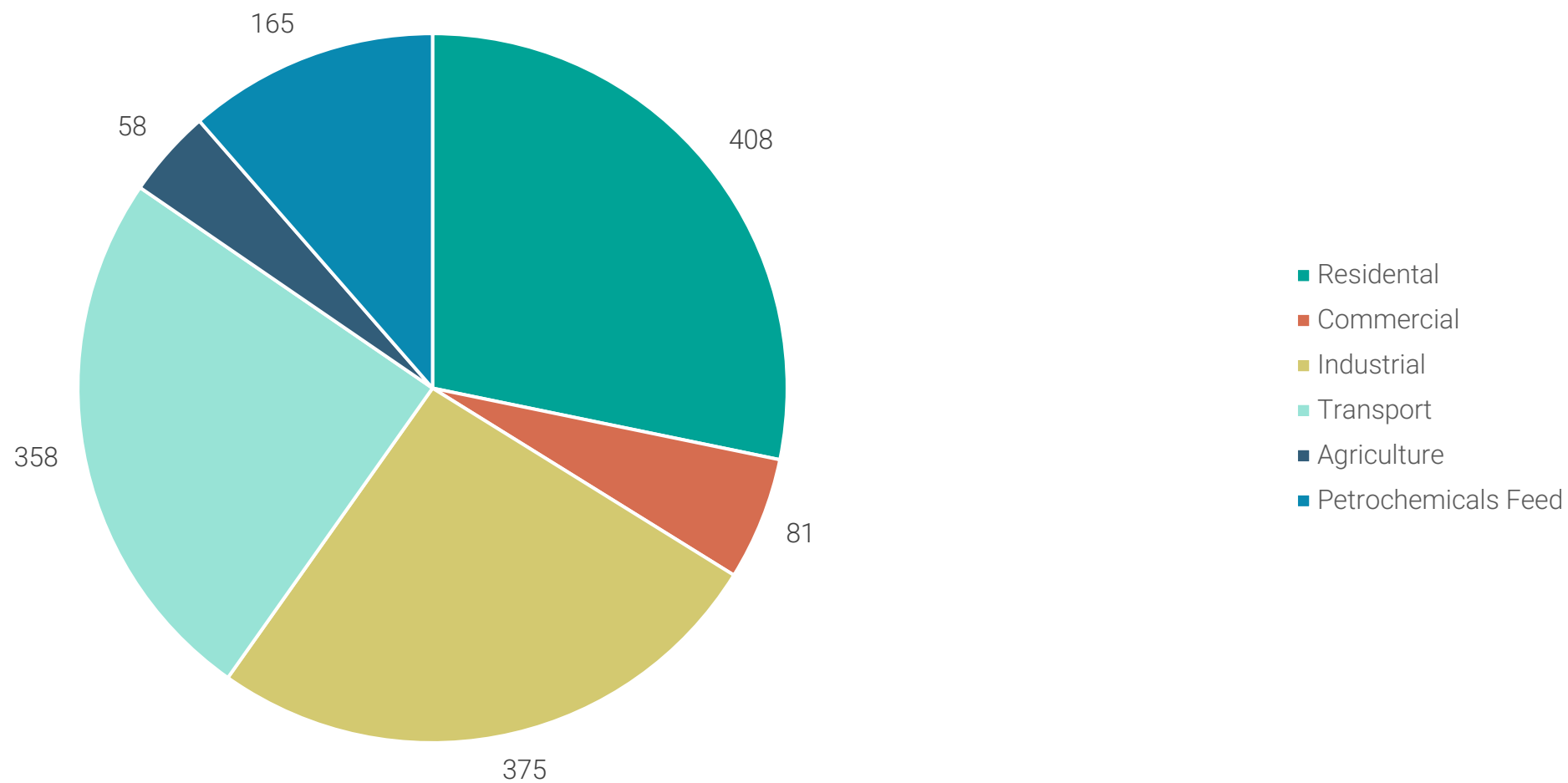
Energy Flow Summary



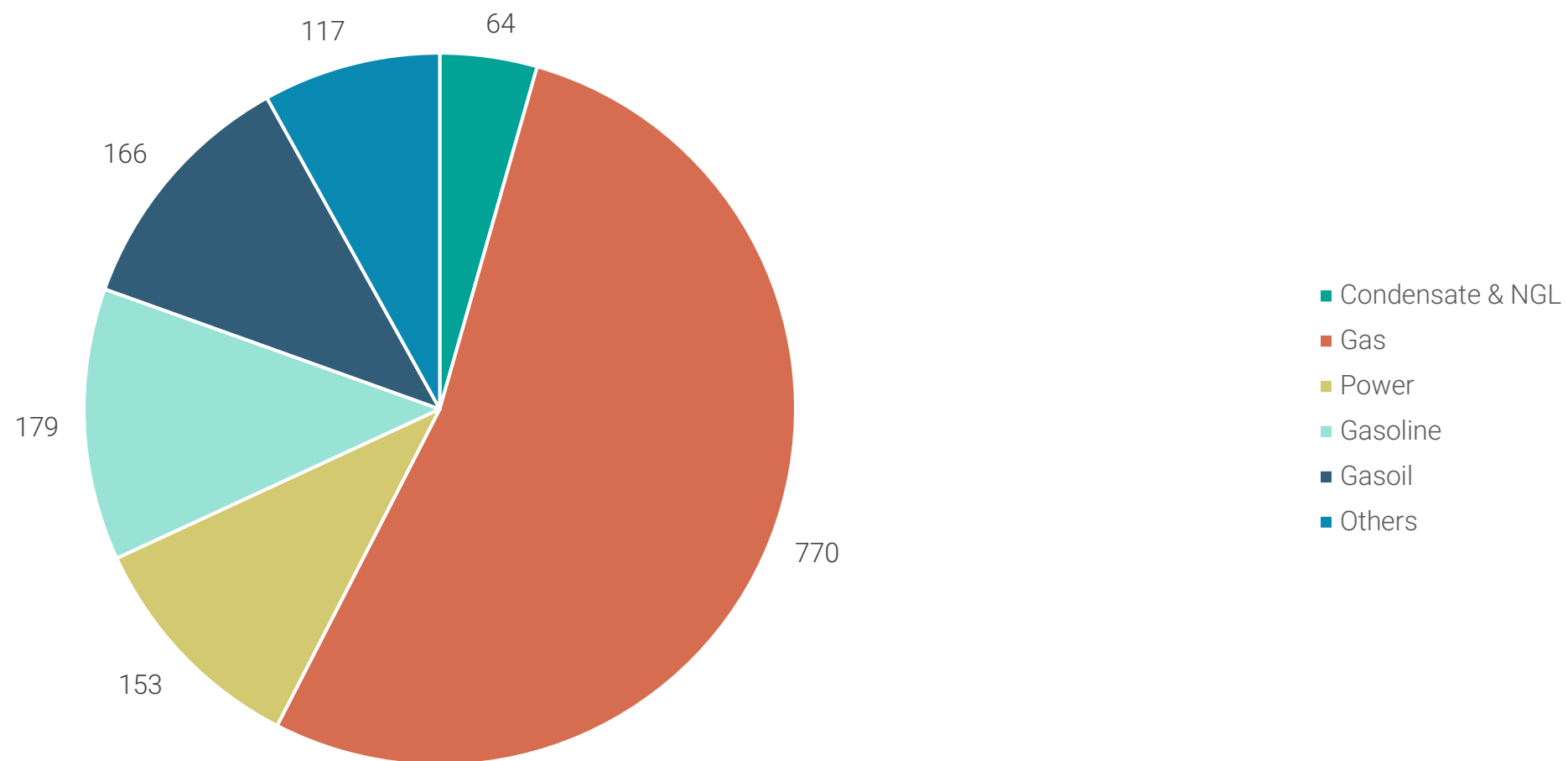
Primary Energy Production (MBOE)



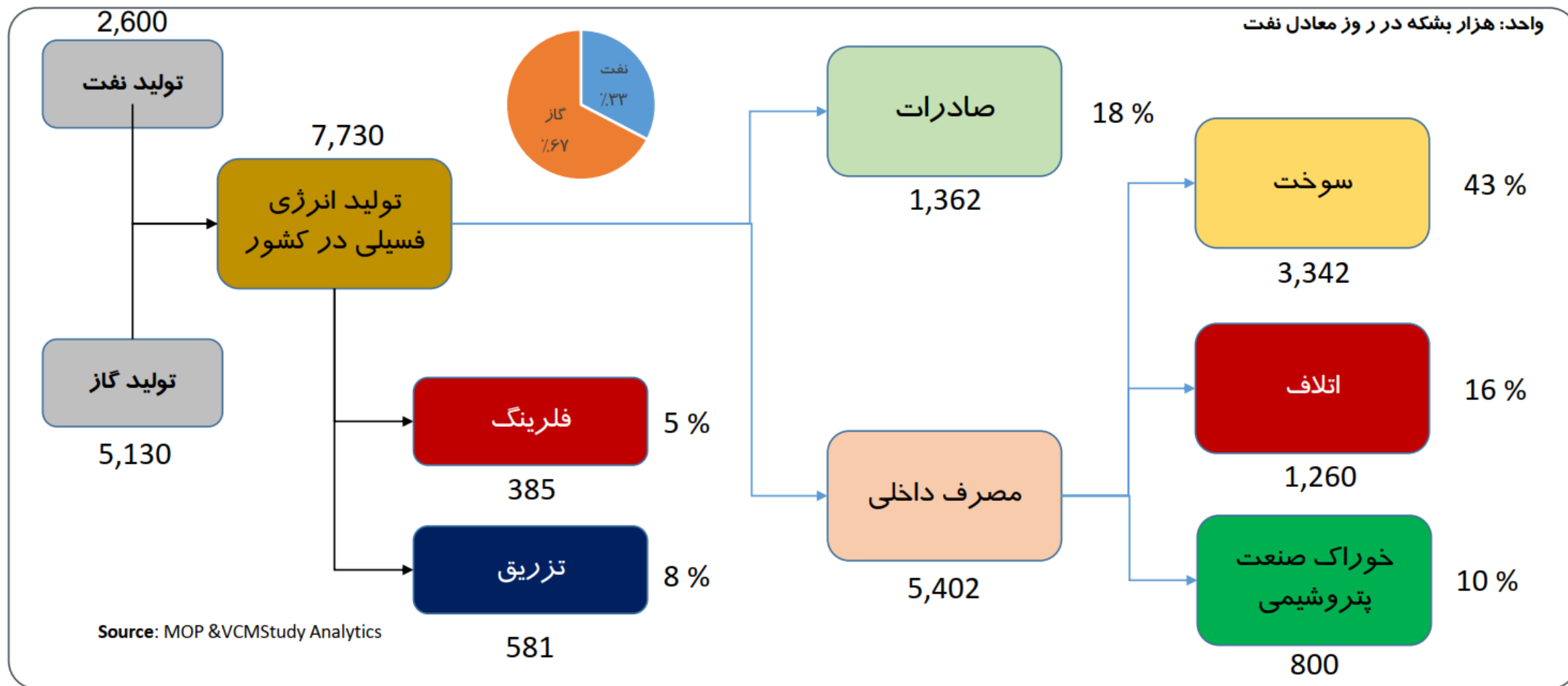
Final Energy Consumption by Sector (MBOE)



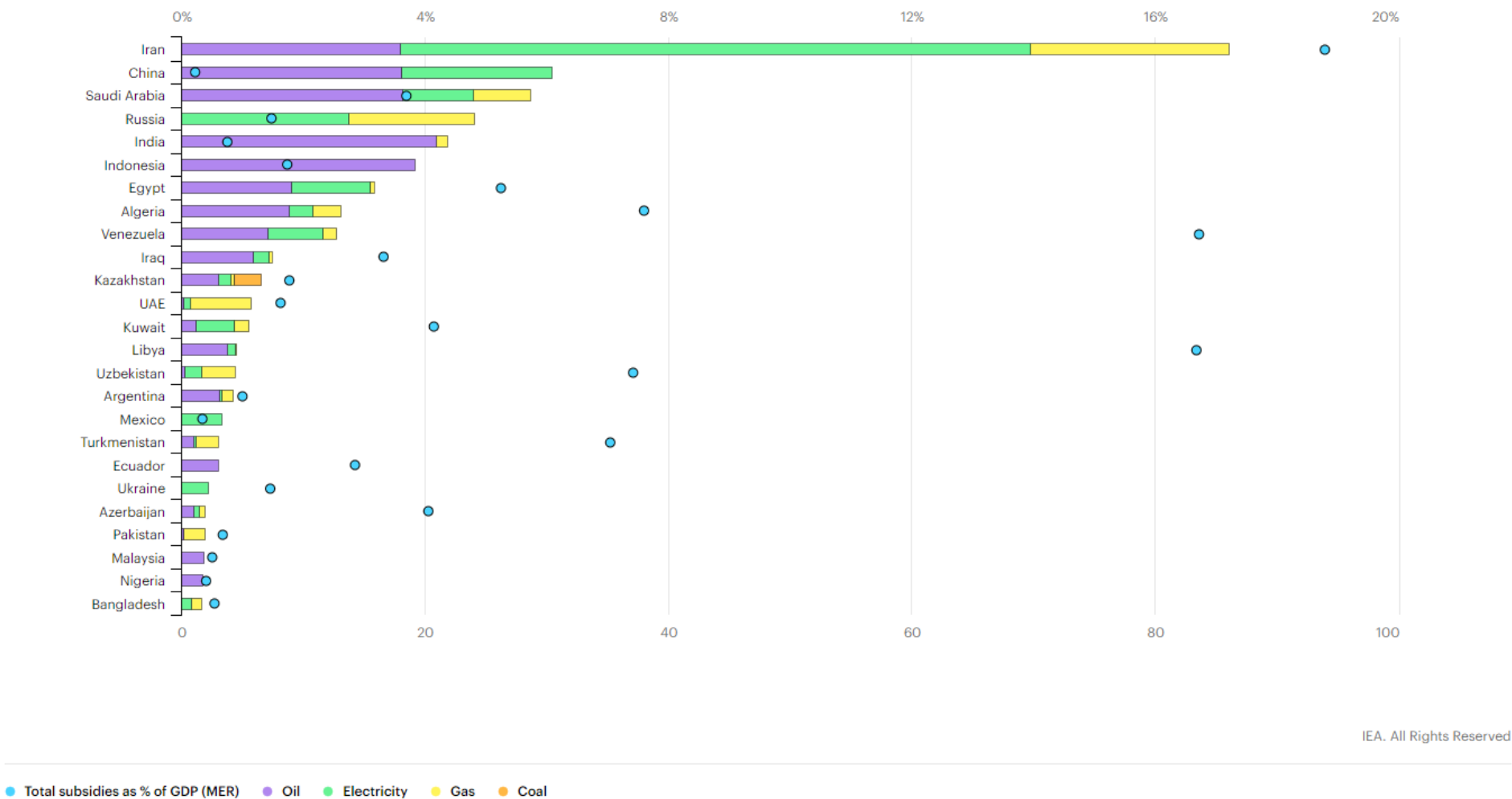
Final Energy Consumption by Fuel (MBOE)



Iran Energy Flow (1399)



Value of Fossil-fuel Subsidies by Fuel in the Top 25 Countries (2019)



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Key Issues



Energy

- Efficiency
- Subsidies
- Sustainability
- Emission

Oil & Gas

- Investment
- Fiscal Regime
- Governance
- Technology



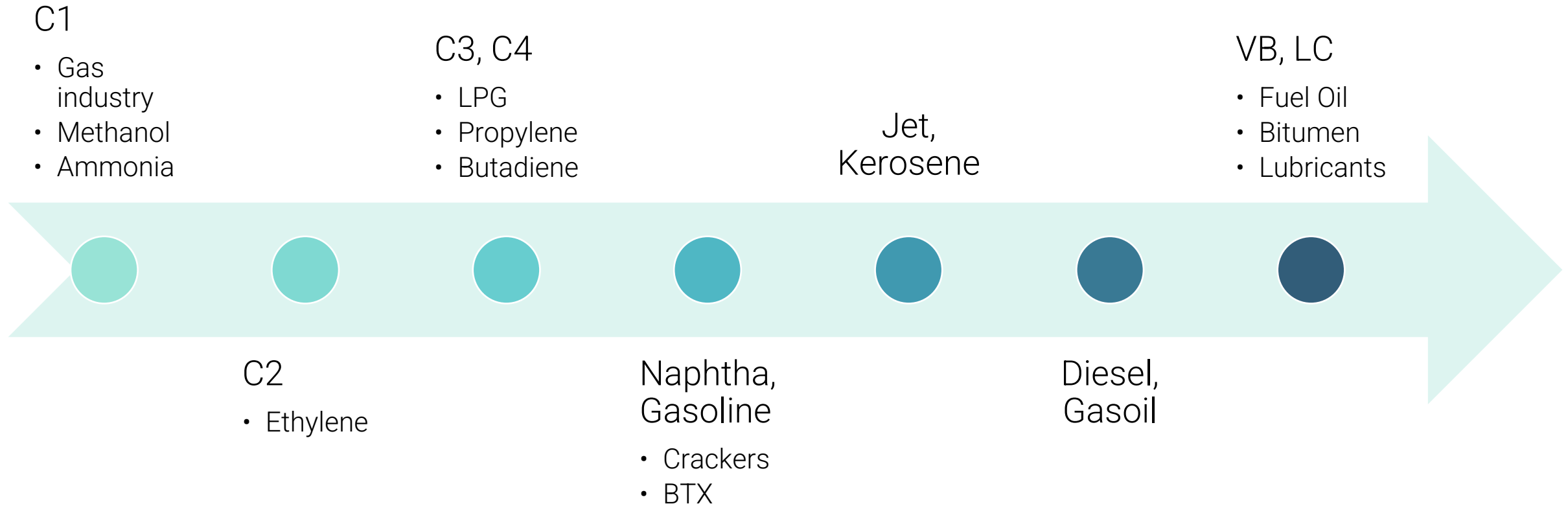
Power

- Efficiency
- Emission
- Pricing
- Investment

Carbon

To provide a high-level introduction of key elements within hydrocarbon value chain

A Simplified Overview



Gas-related Abbreviations

CNG

- Compressed Natural Gas (Cars in Iran)

LNG

- Liquefied Natural Gas (Power Sector)

NGL

- Natural Gas Liquid (C2+ for Olefin, ...)

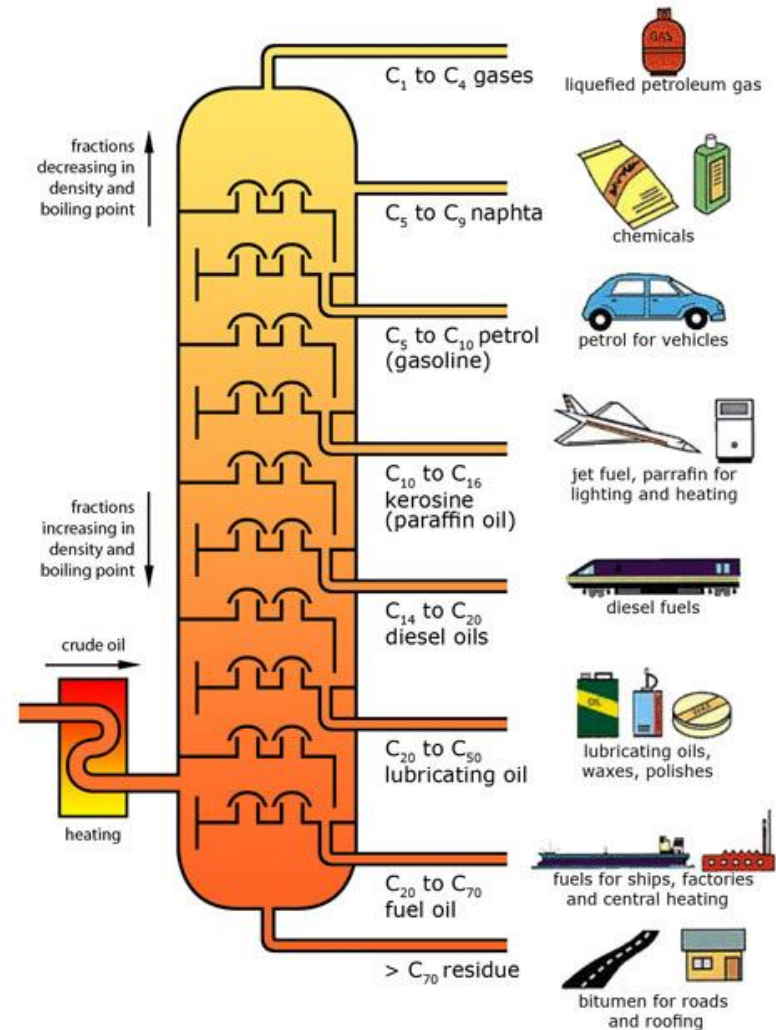
LPG

- Liquid Petroleum Gas (C3 & C4 for fuel, ...)

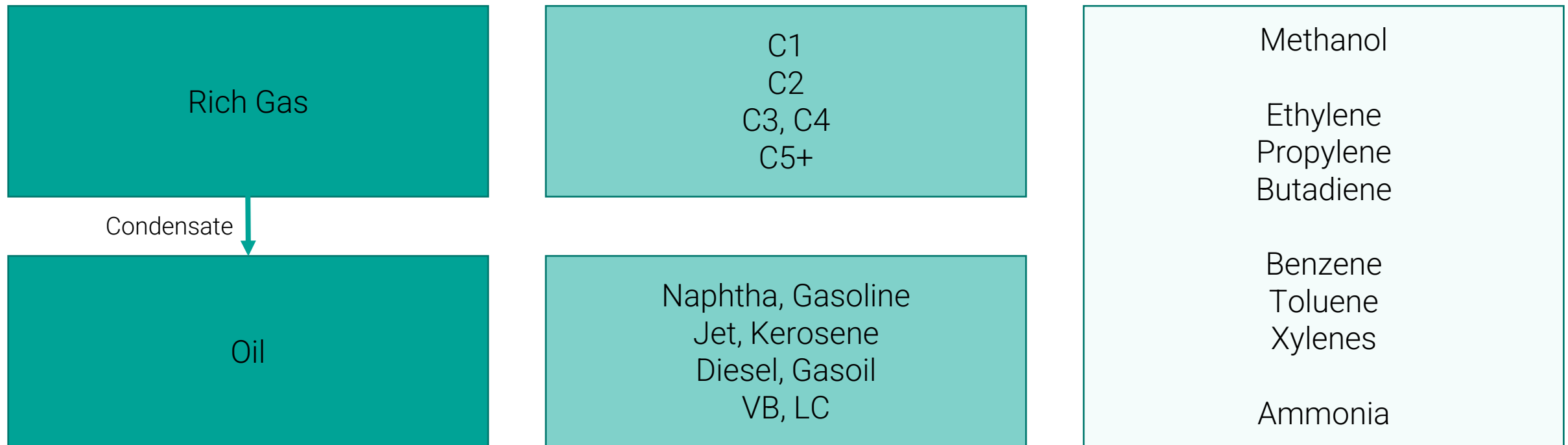
GTL

- Gas to Liquid (Convert C1 to Products)

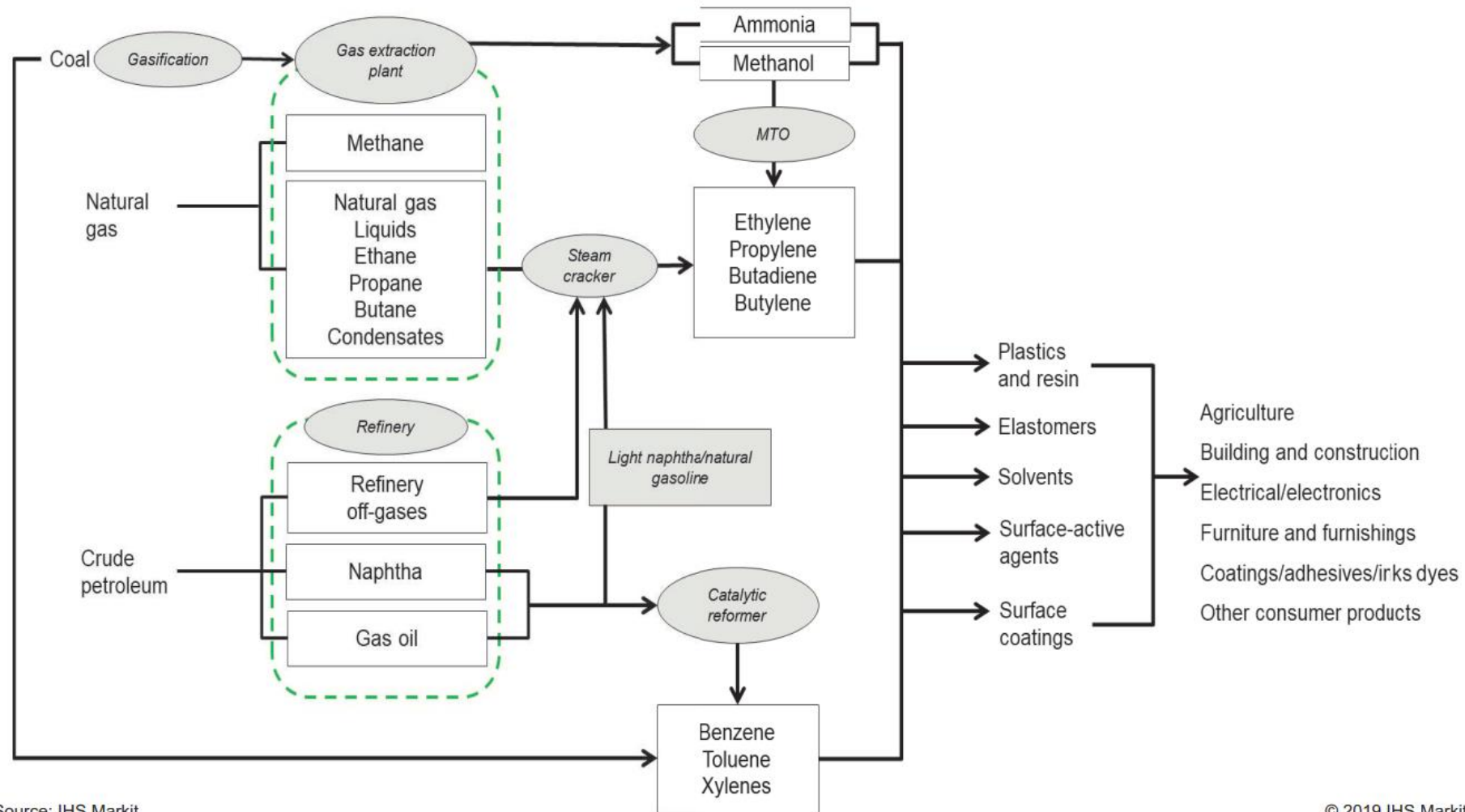
Distillation Tower



Industry Flow



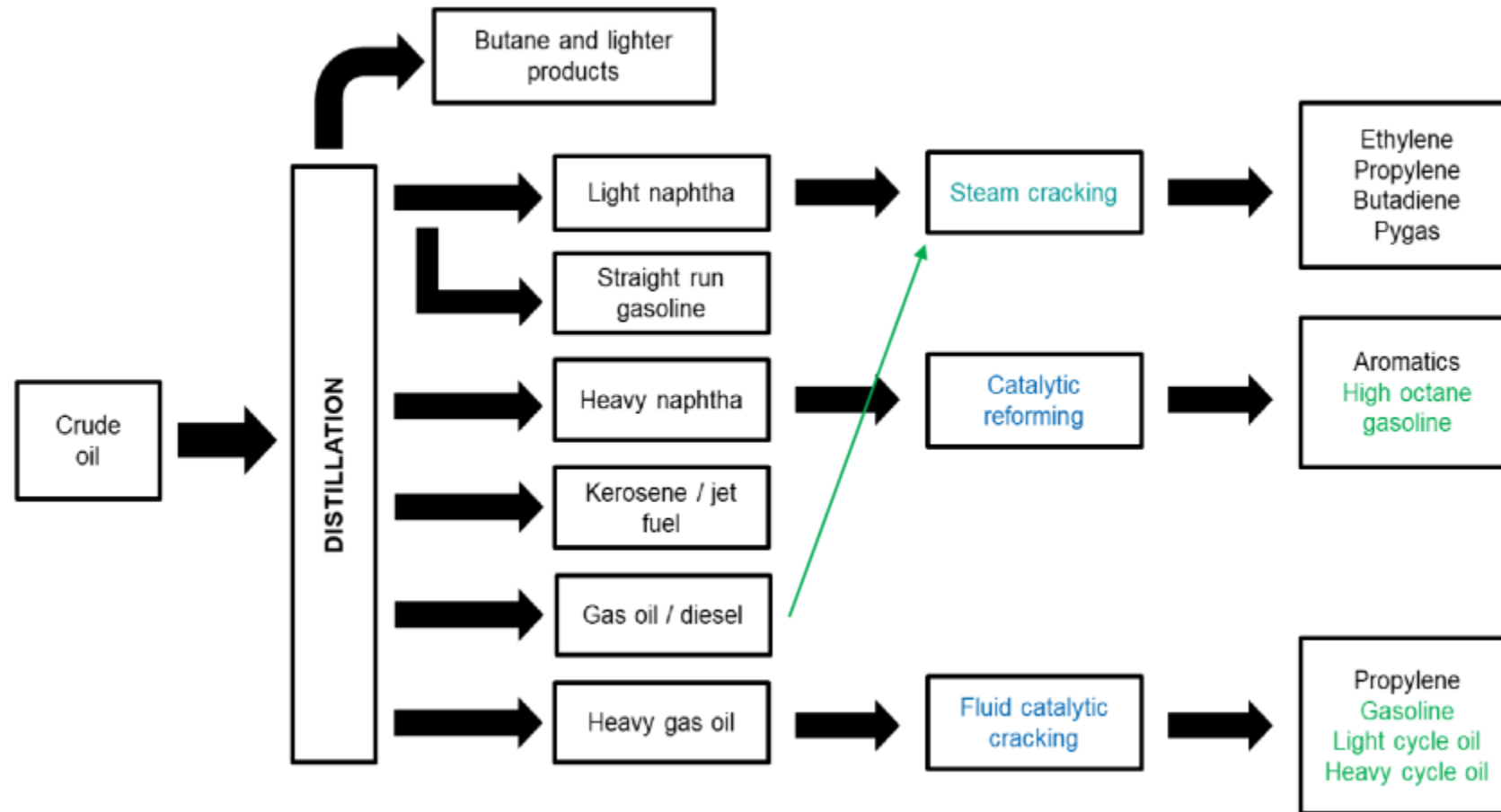
Petrochemical Feedstock and Derivatives



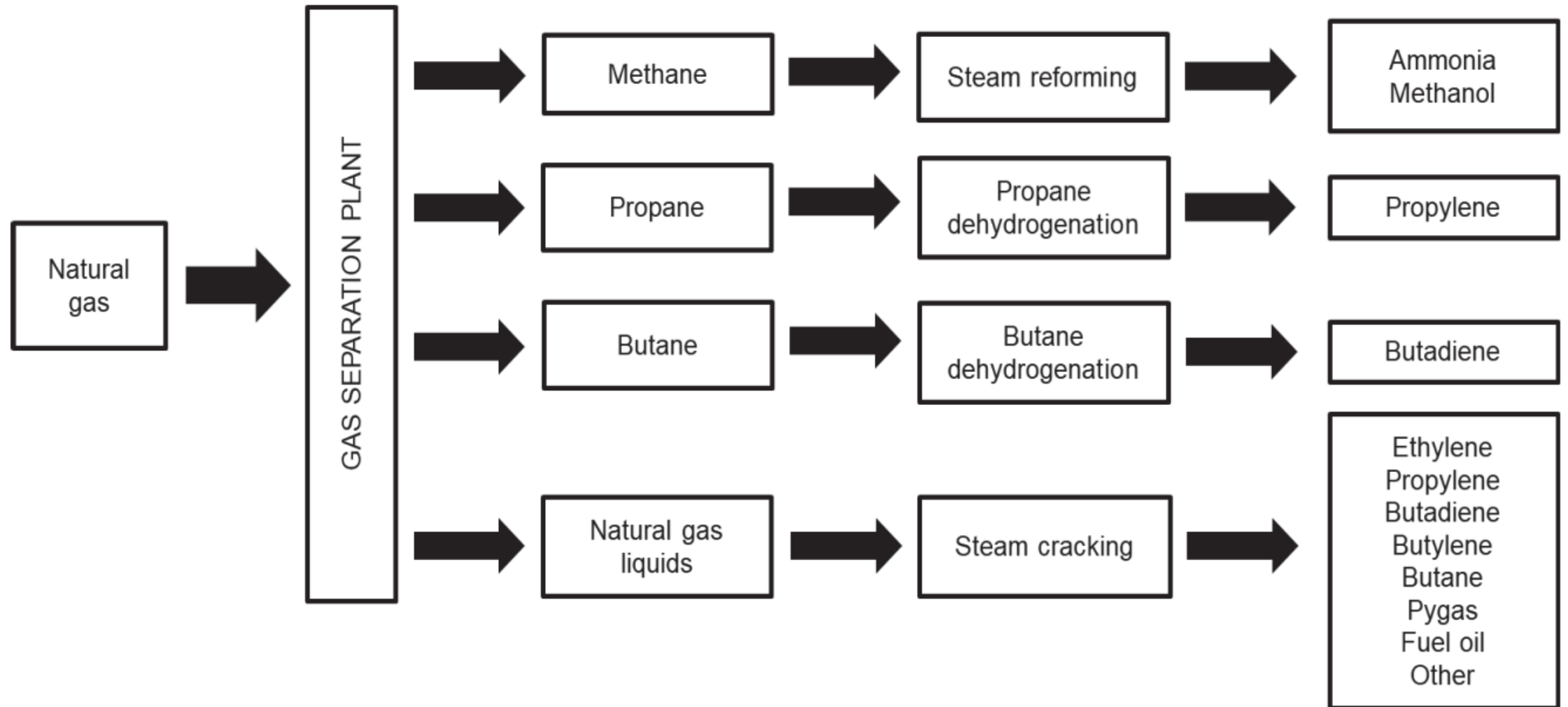
Source: IHS Markit

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From Crude Oil to Basic Petrochemicals



From Natural Gas to Basic Petrochemicals



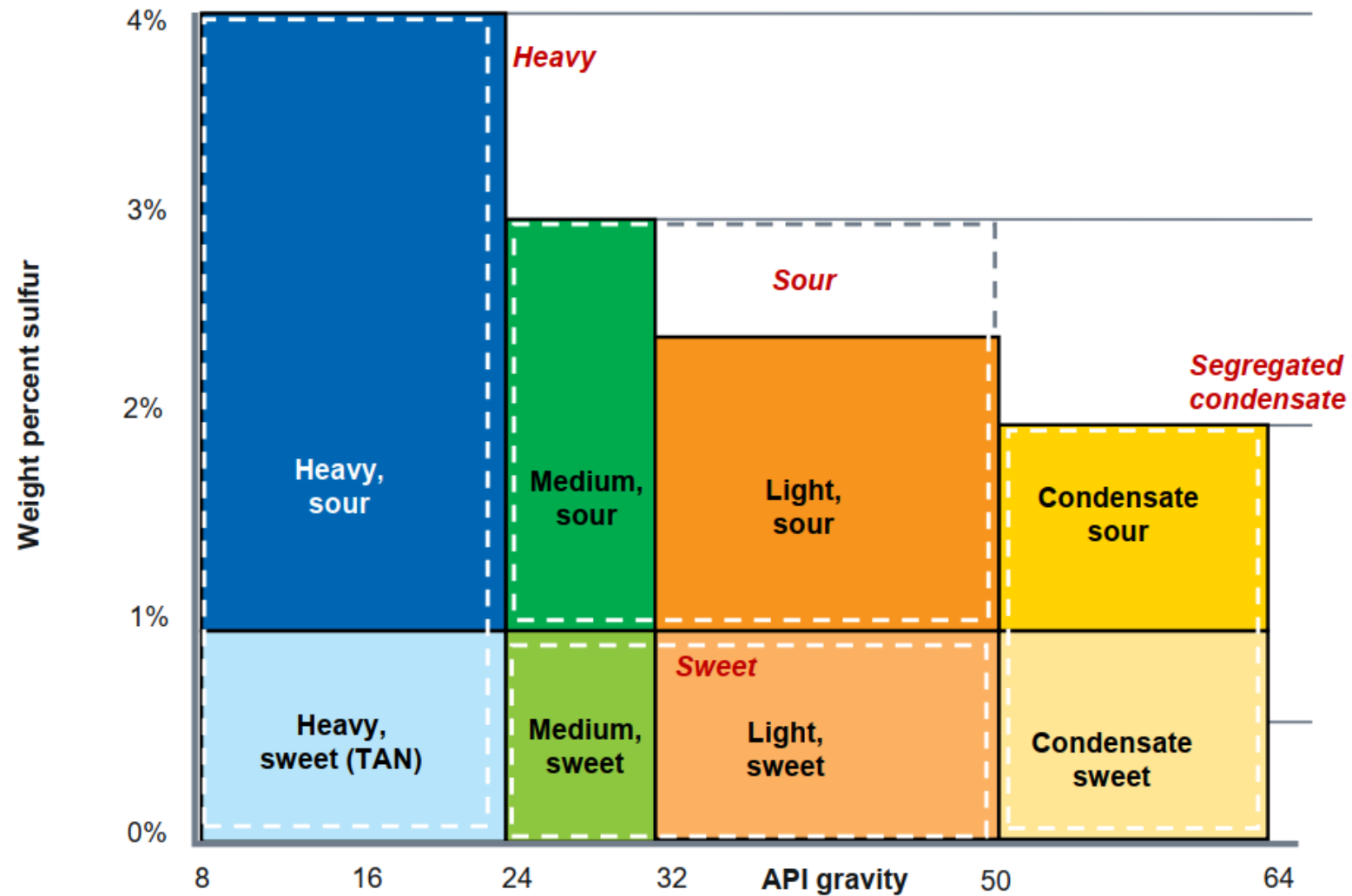
103



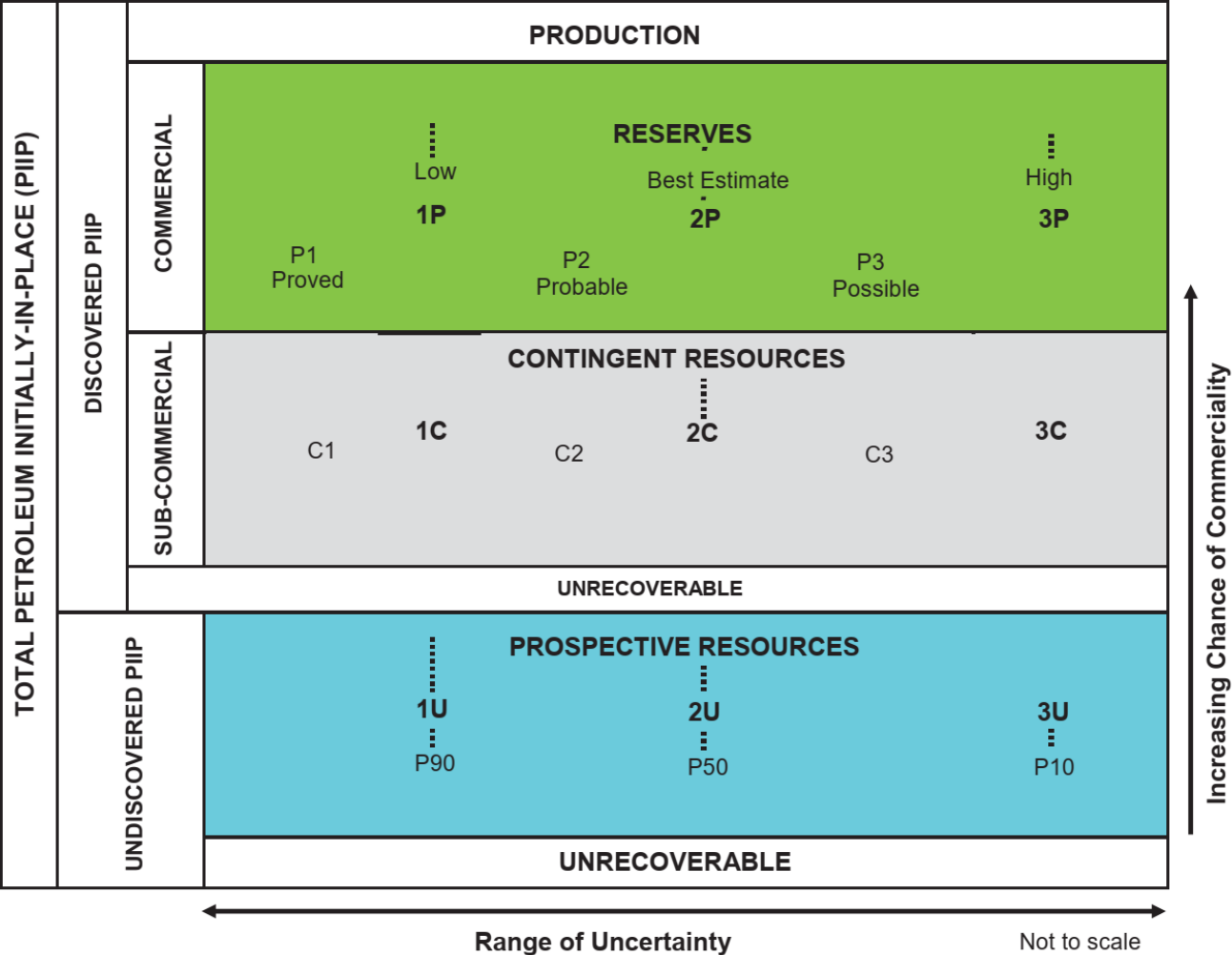
The Oil Market

To define a supply and demand framework for short-term and long-term analysis of oil market

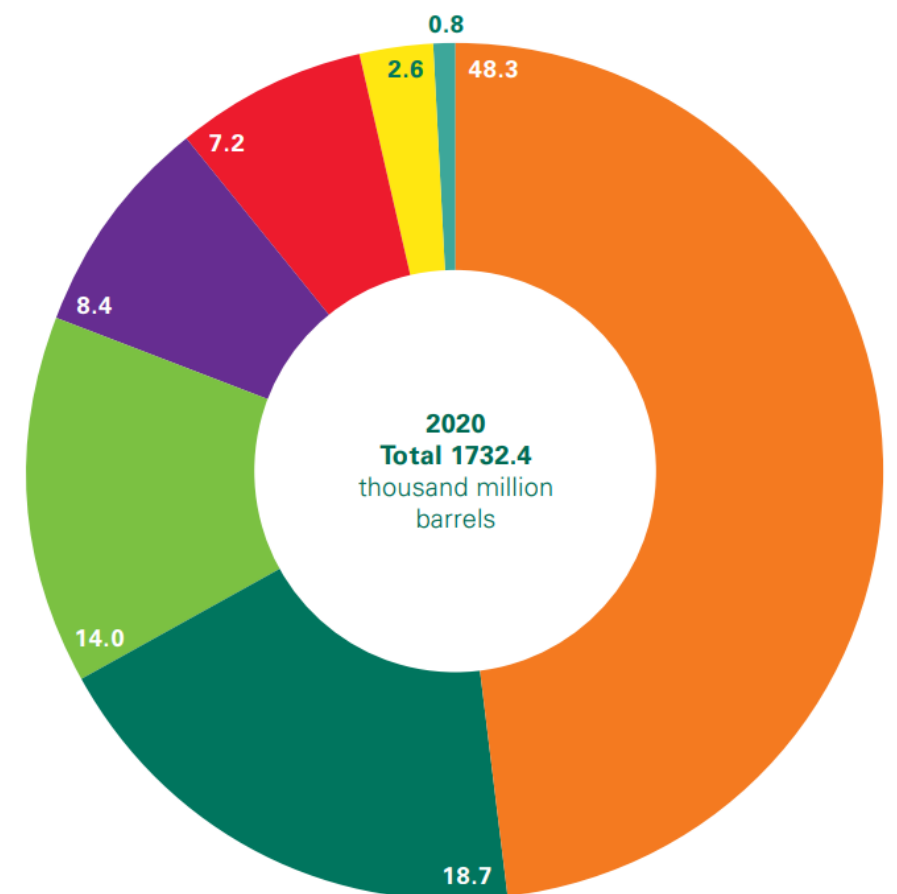
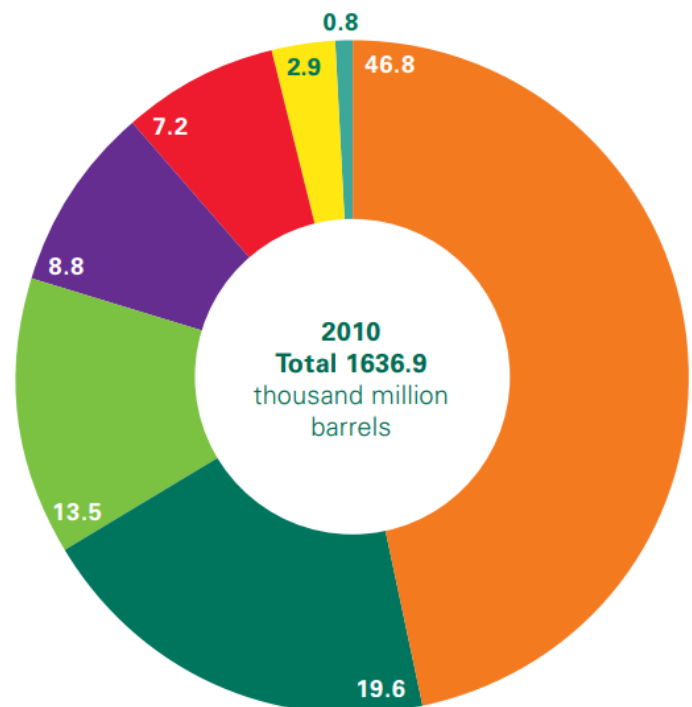
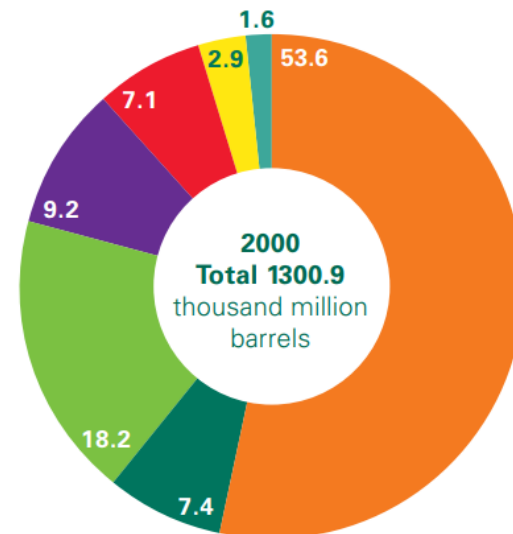
Oil Markets And Downstream Crude Oil Grade Map (General)



Resources Classification Framework



Distribution of Proved Reserves



Top Oil Producers, Net Exporters and Net Importers

Producers	Mt	% of world total
United States	706	17.0
Russian Federation	512	12.4
Saudi Arabia	511	12.3
Canada	255	6.2
Iraq	201	4.9
People's Rep. of China	195	4.7
United Arab Emirates	174	4.2
Brazil	153	3.7
Kuwait	131	3.2
Islamic Rep. of Iran	130	3.1
Rest of the world	1 173	28.3
World	4 141	100.0

2020 provisional data

Net exporters	Mt
Saudi Arabia	352
Russian Federation	269
Iraq	195
Canada	154
United Arab Emirates	148
Kuwait	102
Nigeria	99
Kazakhstan	70
Angola	63
Mexico	59
Others	531
Total	2 042

2019 data

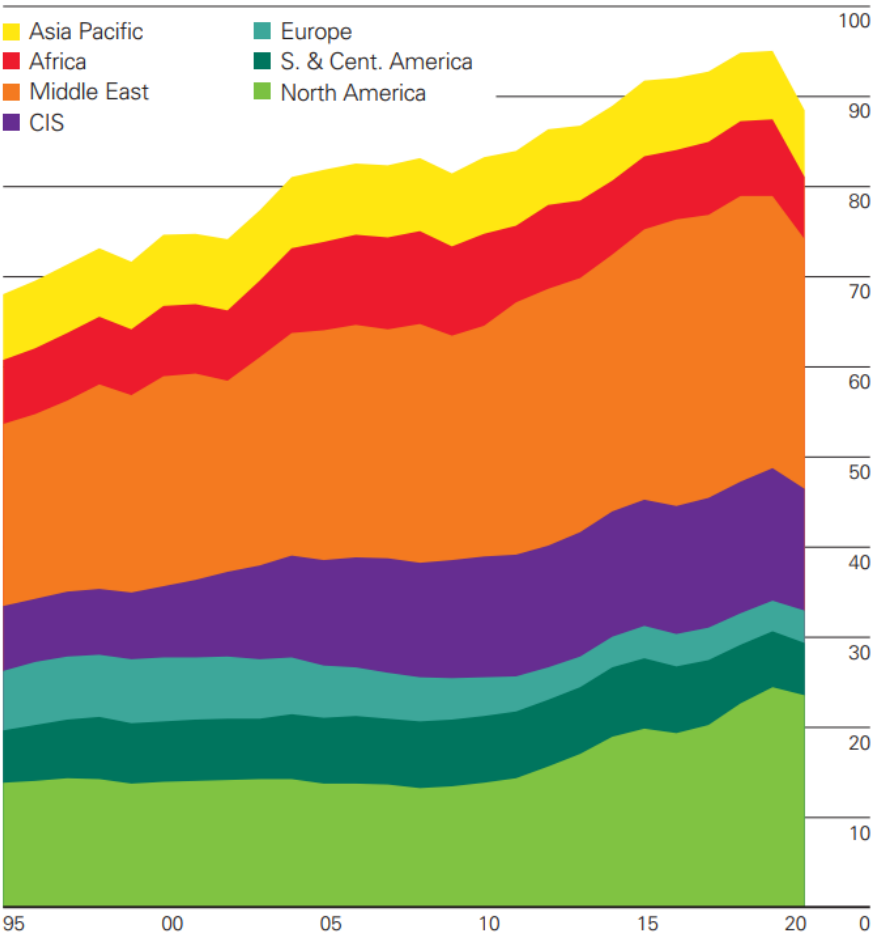
Net importers	Mt
People's Rep. of China	505
India	227
United States	202
Japan	149
Korea	145
Germany	86
Spain	66
Italy	65
Netherlands	62
Singapore	53
Others	509
Total	2 069

2019 data

Oil Production and Consumption by Region

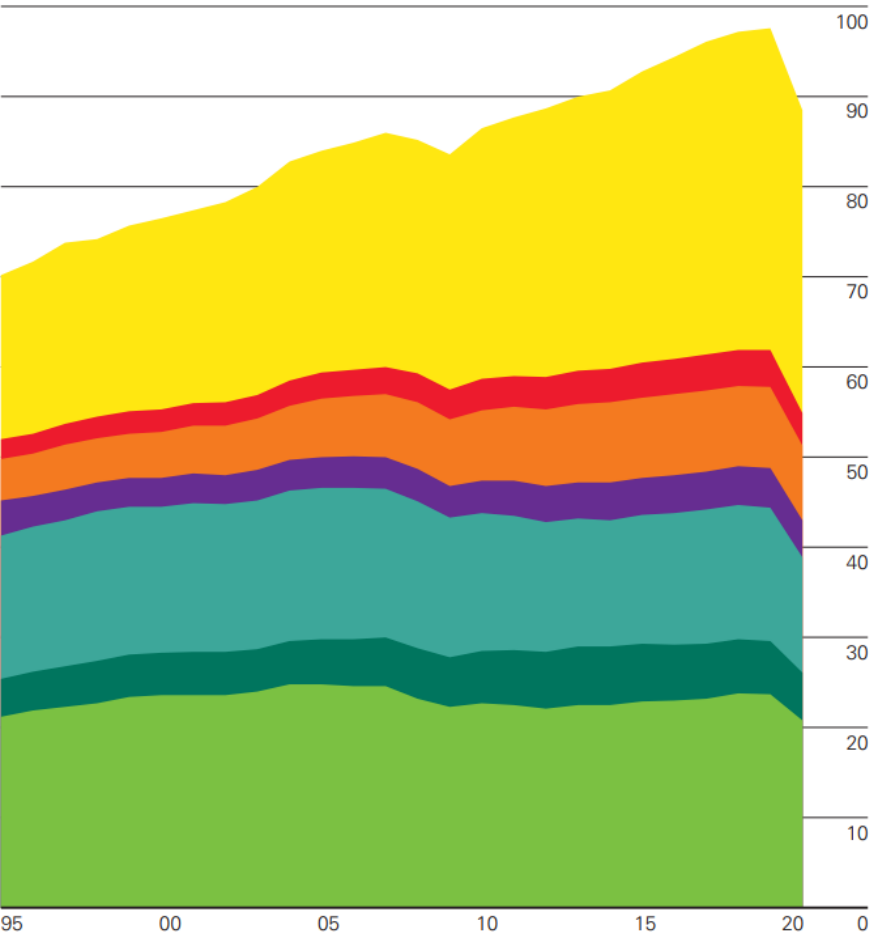
Oil: Production by region

Million barrels daily

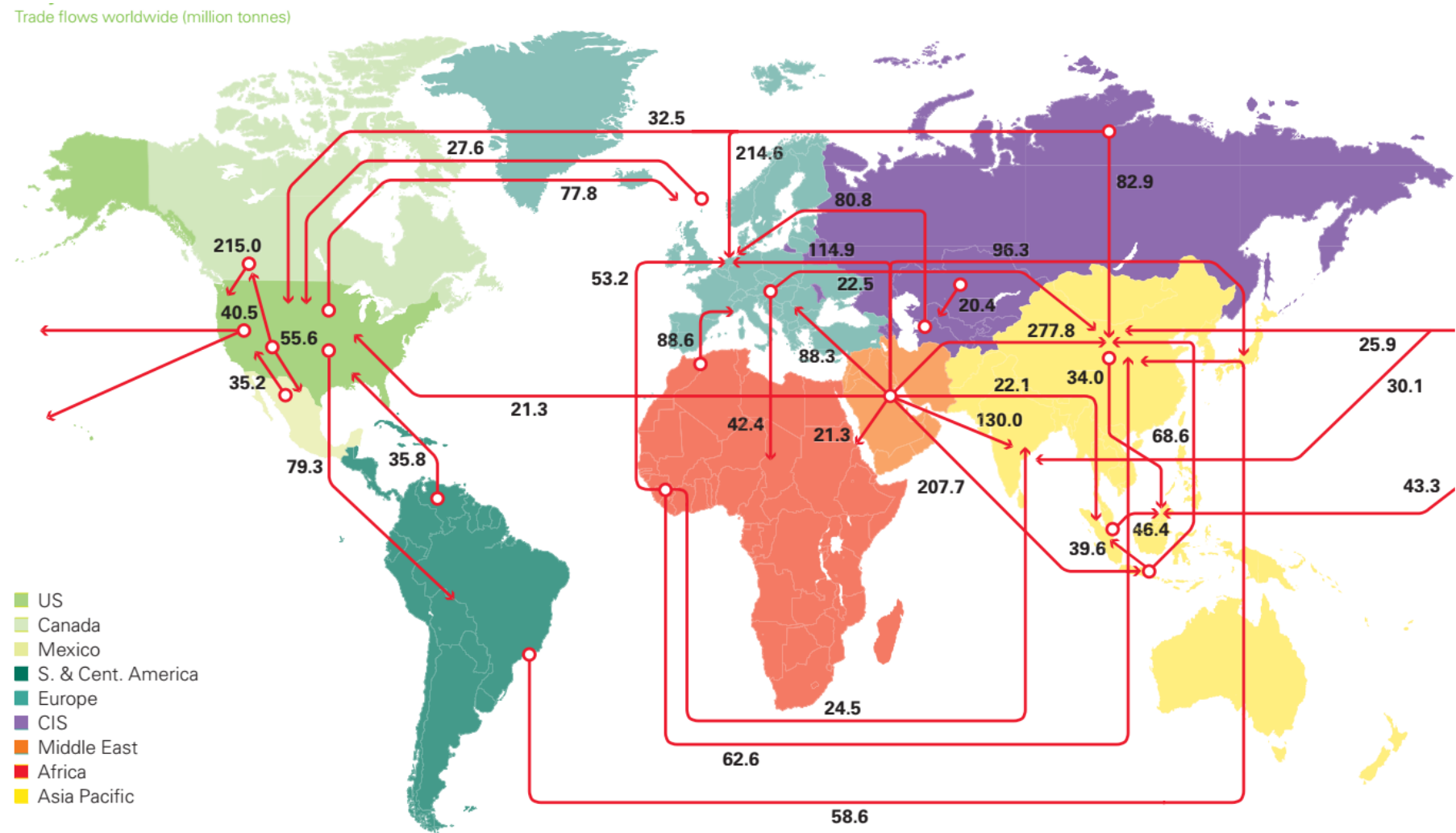


Oil: Consumption by region

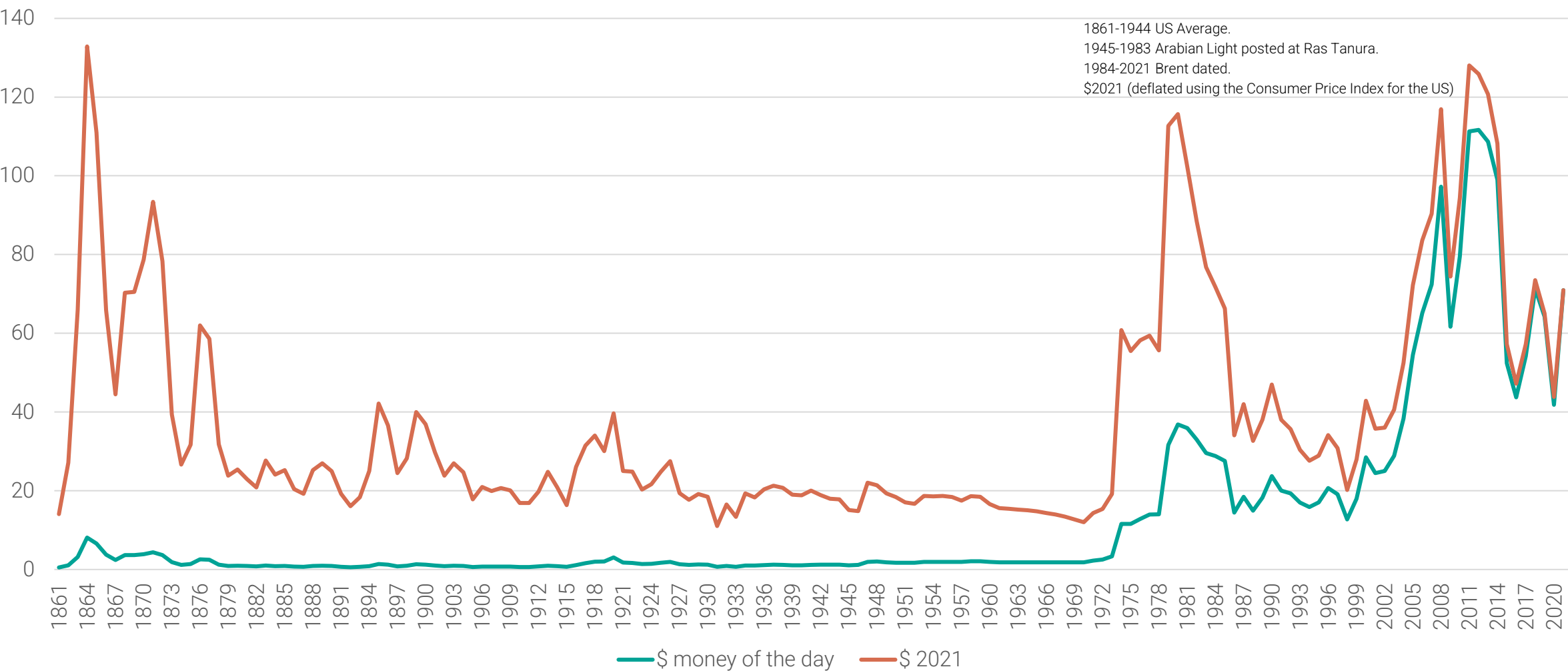
Million barrels daily



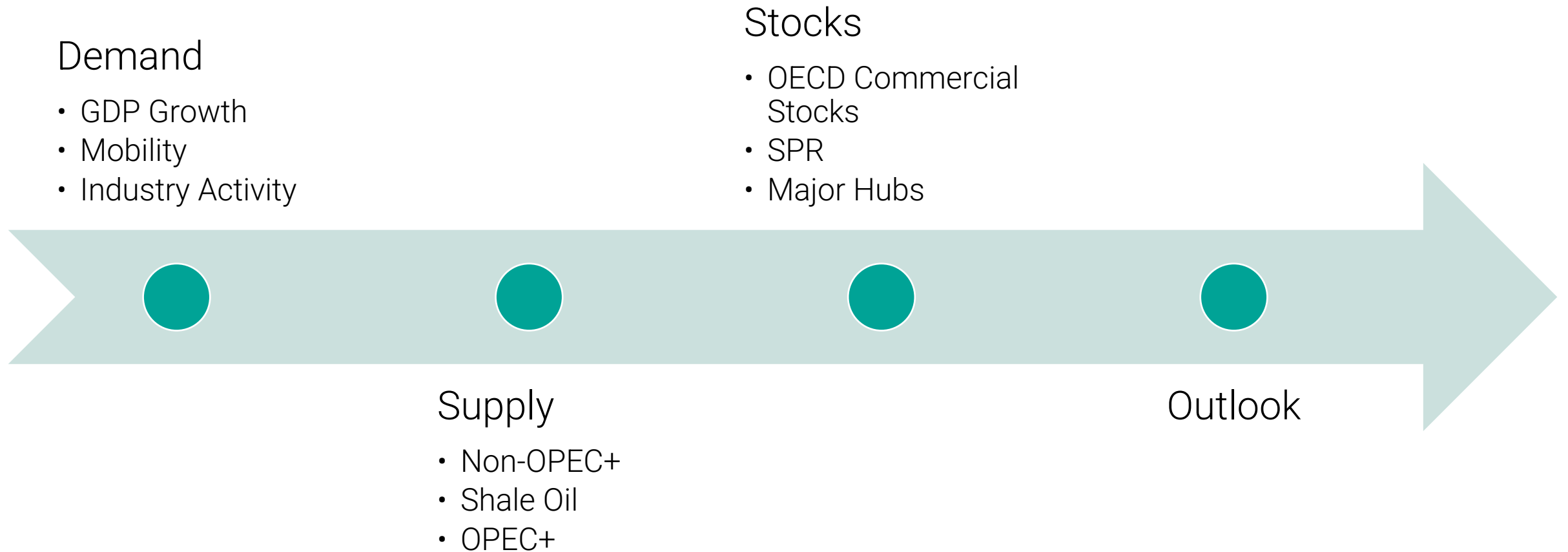
Major Oil Trade Movements (2021)



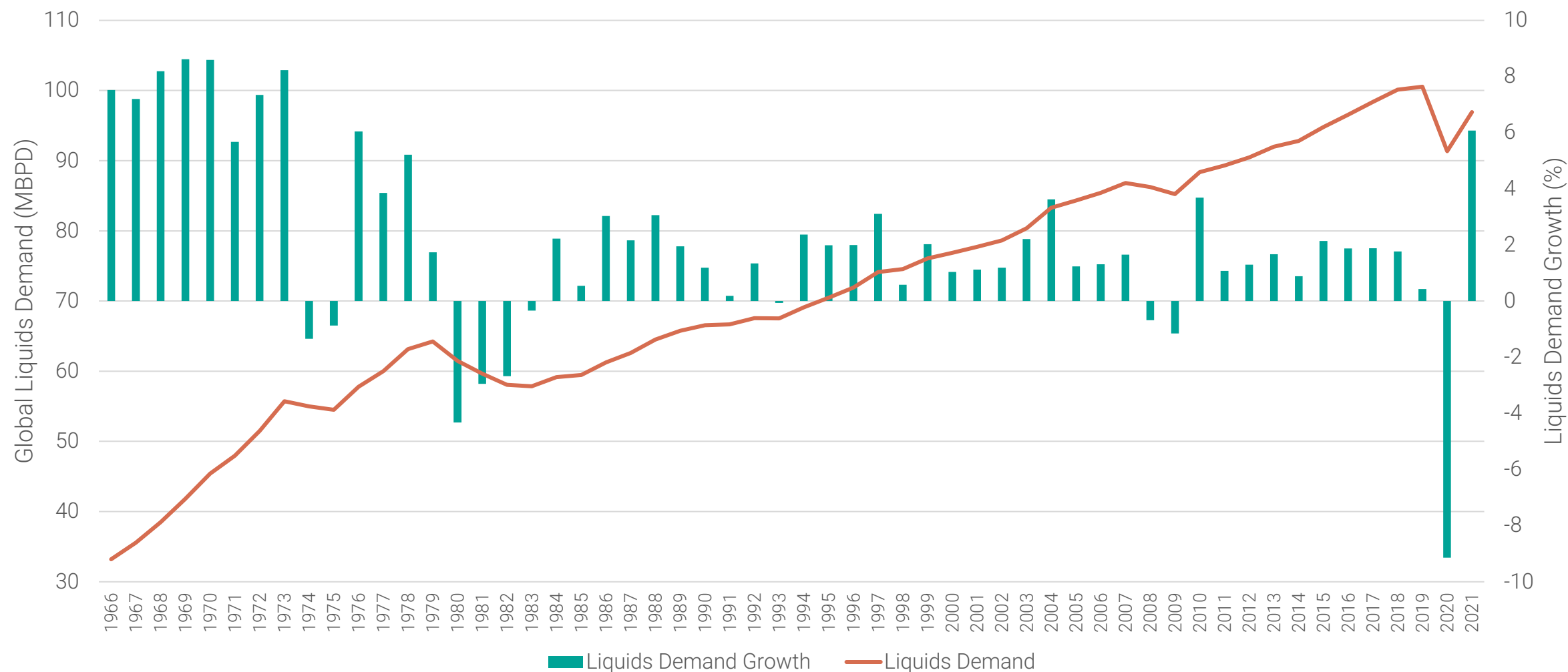
Crude Oil Prices (Nominal and Real)



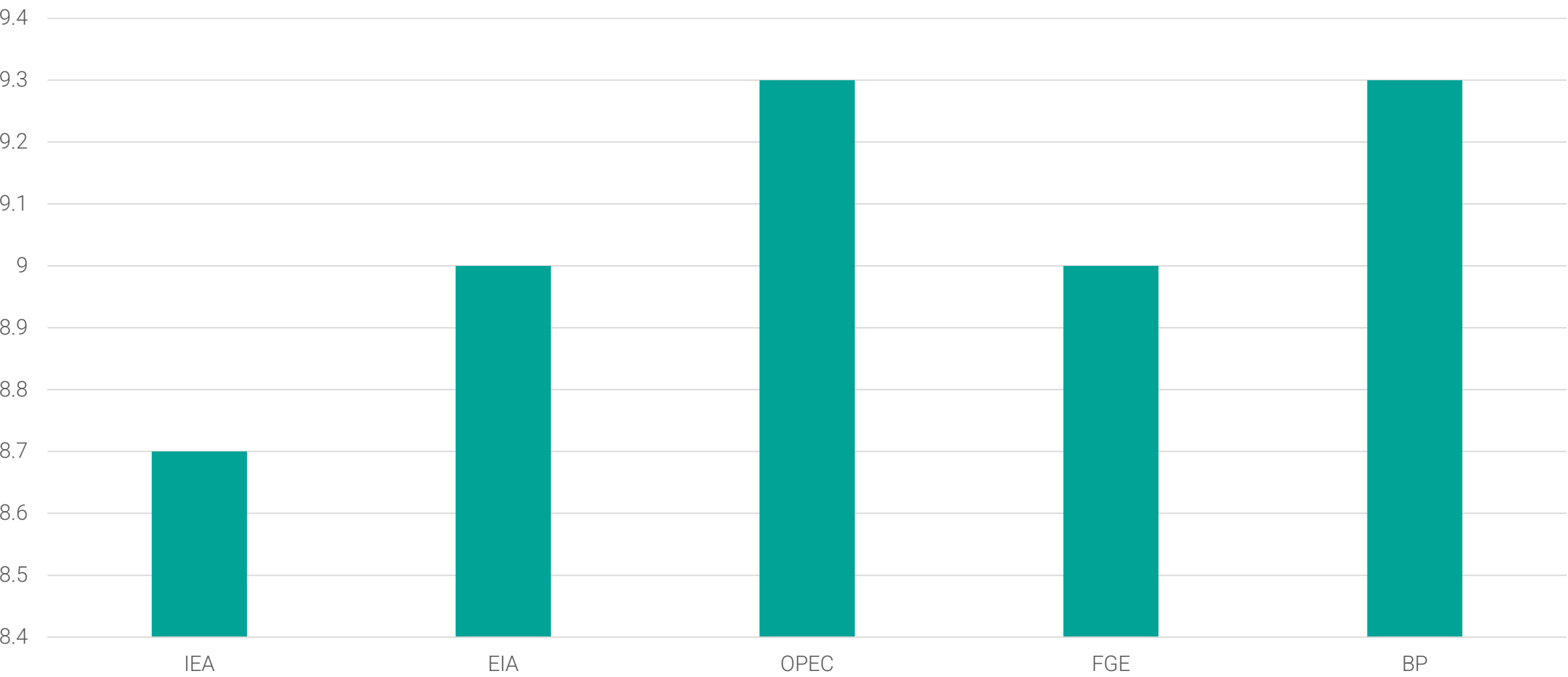
Short-to-medium Term Oil Price Forecast Methodology



Global Liquids Demand and Demand Growth



Demand Destruction in 2020 (MBPD)



World Oil Demand (MBPD)

World oil demand	2021	1Q22	2Q22	3Q22	4Q22	2022	Change 2022/21	
							Growth	%
Americas	24.28	24.84	24.99	25.49	25.76	25.27	1.00	4.11
<i>of which US</i>	19.93	20.38	20.57	20.99	21.21	20.79	0.86	4.34
Europe	13.08	13.09	13.31	14.29	14.15	13.71	0.63	4.81
Asia Pacific	7.41	7.91	7.19	7.25	7.93	7.57	0.16	2.16
Total OECD	44.77	45.83	45.49	47.03	47.84	46.55	1.79	3.99
China	14.94	14.67	14.96	15.42	15.97	15.26	0.32	2.14
India	4.77	5.18	4.95	5.01	5.39	5.13	0.36	7.53
Other Asia	8.63	9.09	9.54	8.93	8.95	9.12	0.50	5.77
Latin America	6.23	6.32	6.28	6.53	6.42	6.39	0.16	2.63
Middle East	7.79	8.06	7.82	8.32	8.09	8.07	0.28	3.59
Africa	4.22	4.51	4.15	4.23	4.54	4.36	0.14	3.23
Russia	3.61	3.67	3.28	3.45	3.54	3.48	-0.13	-3.58
Other Eurasia	1.21	1.22	1.15	1.01	1.24	1.15	-0.06	-4.71
Other Europe	0.75	0.79	0.71	0.73	0.80	0.76	0.01	1.01
Total Non-OECD	52.15	53.50	52.85	53.62	54.93	53.73	1.58	3.03
Total World	96.92	99.33	98.33	100.65	102.77	100.29	3.36	3.47
Previous Estimate	96.92	99.28	98.19	100.85	102.77	100.29	3.36	3.47
Revision	0.00	0.06	0.15	-0.20	0.00	0.00	0.00	0.00

Non-OPEC Liquids Production

Non-OPEC liquids production	2021	1Q22	2Q22	3Q22	4Q22	2022	Change 2022/21	
							Growth	%
Americas	25.16	25.86	26.35	26.95	27.46	26.66	1.50	5.97
<i>of which US</i>	17.75	18.26	18.94	19.27	19.67	19.04	1.28	7.23
Europe	3.76	3.73	3.58	3.79	4.12	3.81	0.05	1.27
Asia Pacific	0.51	0.49	0.52	0.56	0.54	0.53	0.01	2.80
Total OECD	29.43	30.08	30.45	31.30	32.12	30.99	1.56	5.31
China	4.31	4.49	4.49	4.42	4.43	4.46	0.15	3.49
India	0.77	0.77	0.78	0.80	0.83	0.79	0.02	2.72
Other Asia	2.41	2.37	2.36	2.36	2.35	2.36	-0.05	-1.90
Latin America	5.95	6.14	6.22	6.21	6.43	6.25	0.30	4.96
Middle East	3.24	3.29	3.31	3.38	3.38	3.34	0.10	3.14
Africa	1.35	1.33	1.29	1.31	1.32	1.31	-0.03	-2.55
Russia	10.80	11.33	10.63	10.29	10.29	10.63	-0.17	-1.57
Other Eurasia	2.93	3.06	2.91	3.17	3.22	3.09	0.16	5.38
Other Europe	0.11	0.11	0.11	0.10	0.10	0.11	-0.01	-6.36
Total Non-OECD	31.87	32.88	32.10	32.04	32.35	32.34	0.47	1.47
Total Non-OPEC production	61.30	62.96	62.54	63.34	64.48	63.33	2.03	3.32
Processing gains	2.29	2.40	2.40	2.40	2.40	2.40	0.11	4.90
Total Non-OPEC liquids production	63.59	65.36	64.94	65.74	66.88	65.73	2.15	3.37
Previous estimate	63.60	65.37	64.80	65.79	67.00	65.74	2.15	3.38
Revision	-0.01	-0.01	0.14	-0.05	-0.12	-0.01	0.00	0.00

OPEC Crude Oil Production (Secondary Sources)

Secondary sources	2020	2021	4Q21	1Q22	2Q22	Apr 22	May 22	Jun 22	Change Jun/May
Algeria	904	913	959	984	1,013	1,004	1,013	1,021	9
Angola	1,247	1,117	1,124	1,152	1,173	1,180	1,155	1,182	27
Congo	293	265	265	264	266	263	270	265	-5
Equatorial Guinea	114	98	87	92	94	96	93	92	-1
Gabon	191	182	185	199	187	199	173	189	16
IR Iran	1,991	2,392	2,472	2,528	2,560	2,565	2,543	2,574	31
Iraq	4,076	4,049	4,240	4,286	4,428	4,433	4,416	4,434	17
Kuwait	2,439	2,419	2,531	2,612	2,689	2,660	2,688	2,718	29
Libya	366	1,143	1,111	1,063	743	893	707	629	-78
Nigeria	1,575	1,372	1,321	1,376	1,252	1,285	1,233	1,238	5
Saudi Arabia	9,204	9,113	9,879	10,164	10,458	10,364	10,425	10,585	159
UAE	2,804	2,727	2,861	2,954	3,047	3,015	3,044	3,083	39
Venezuela	512	555	662	684	716	721	720	706	-14
Total OPEC	25,716	26,347	27,696	28,358	28,624	28,678	28,482	28,716	234

OPEC Crude Oil Production (Direct Communications)

Direct communication	2020	2021	4Q21	1Q22	2Q22	Apr 22	May 22	Jun 22	Change Jun/May
Algeria	899	911	958	984	1,016	1,006	1,015	1,027	12
Angola	1,271	1,124	1,123	1,161	1,173	1,183	1,162	1,175	13
Congo	300	267	260	267	..	261	261	..	..
Equatorial Guinea	114	93	79	95	91	95	89	91	2
Gabon	207	181	183	197	..	174	183	..	..
IR Iran	..	..	..	..	..	..	..	..	..
Iraq	3,997	3,971	4,167	4,188	4,472	4,430	4,470	4,515	45
Kuwait	2,438	2,415	2,528	2,612	2,694	2,664	2,694	2,724	30
Libya	389	1,207	1,182	1,151	..	..	..	..	..
Nigeria	1,493	1,323	1,260	1,299	1,133	1,219	1,024	1,158	134
Saudi Arabia	9,213	9,125	9,905	10,224	10,542	10,441	10,538	10,646	109
UAE	2,779	2,718	2,854	2,949	3,042	3,011	3,032	3,083	51
Venezuela	569	636	817	756	745	775	735	727	-8
Total OPEC	..	..	..	..	..	..	..	..	..

OPEC Secondary Sources

Platts

Argus

Energy
Intelligence

IHS Markit

IEA

EIA

Market Balance by OPEC

	2021	1Q22	2Q22	3Q22	4Q22	2022	Change 2022/21
(a) World oil demand	96.92	99.33	98.33	100.65	102.77	100.29	3.36
Non-OPEC liquids production	63.59	65.36	64.94	65.74	66.88	65.73	2.15
OPEC NGL and non-conventionals	5.28	5.35	5.38	5.41	5.43	5.39	0.11
(b) Total non-OPEC liquids production and OPEC NGLs	68.87	70.71	70.32	71.14	72.31	71.13	2.25
Difference (a-b)	28.05	28.63	28.01	29.50	30.46	29.16	1.11
OPEC crude oil production	26.35	28.36	28.62				
Balance	-1.70	-0.27	0.61				

Note: * 2022 = Forecast. Totals may not add up due to independent rounding. Source: OPEC.

	2022	1Q23	2Q23	3Q23	4Q23	2023	Change 2023/22
(a) World oil demand	100.29	101.72	101.12	103.64	105.40	102.99	2.70
Non-OPEC liquids production	65.73	67.28	67.15	67.37	67.96	67.44	1.71
OPEC NGL and non-conventionals	5.39	5.44	5.47	5.43	5.43	5.44	0.05
(b) Total non-OPEC liquids production and OPEC NGLs	71.13	72.71	72.63	72.80	73.38	72.88	1.76
Difference (a-b)	29.16	29.01	28.50	30.84	32.01	30.10	0.94

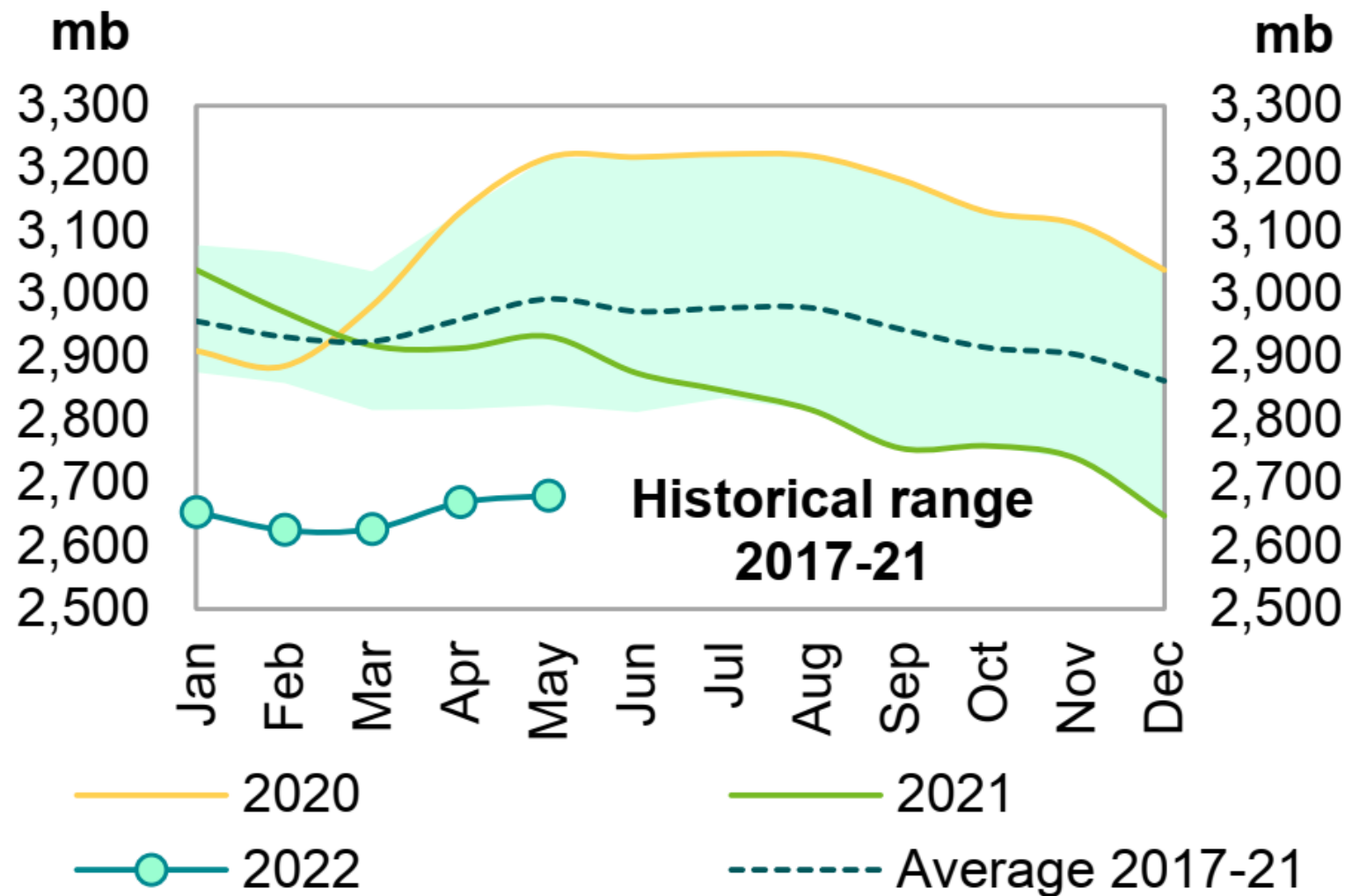
Note: * 2022-2023 = Forecast. Totals may not add up due to independent rounding. Source: OPEC.

Market Balance by IEA

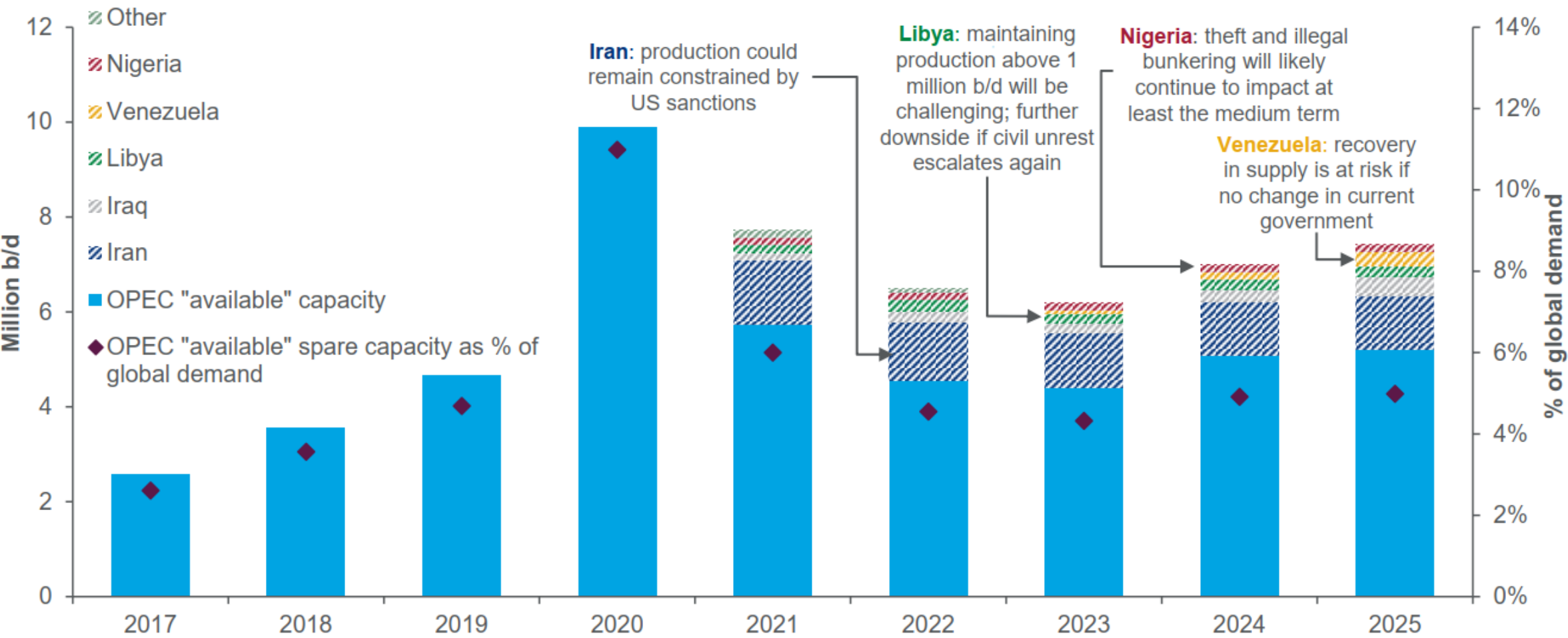
World oil demand and supply (mb/d)

	2019	1Q20	2Q20	3Q20	4Q20	2020	1Q21	2Q21	3Q21	4Q21	2021	2022	2023	2024	2025	2026
DEMAND																
Total OECD	47.7	45.4	37.6	42.3	43.1	42.1	43.3	43.8	45.4	46.5	44.7	45.8	46.2	46.2	46.0	45.8
Total Non-OECD	52.0	48.3	45.3	50.4	51.7	48.9	50.7	51.1	52.3	52.7	51.7	53.7	55.0	56.1	57.2	58.3
Total Demand ¹	99.7	93.8	82.9	92.7	94.7	91.0	93.9	94.9	97.7	99.2	96.5	99.4	101.2	102.3	103.2	104.1
SUPPLY																
Total OECD	28.5	29.9	26.9	27.1	27.8	27.9	27.8	28.1	28.3	28.7	28.2	29.0	29.6	29.9	29.9	29.7
Total Non-OECD	32.0	32.3	30.0	29.7	29.9	30.5	30.3	30.8	30.8	30.7	30.6	31.5	32.0	32.0	32.1	32.1
Processing Gains ²	2.4	2.3	2.0	2.1	2.1	2.1	2.1	2.2	2.3	2.3	2.2	2.4	2.4	2.4	2.5	2.5
Global Biofuels	2.8	2.2	2.5	3.1	2.6	2.6	2.3	2.9	3.2	2.9	2.8	3.0	3.1	3.2	3.3	3.3
Total Non-OPEC ³	65.6	66.7	61.3	61.9	62.4	63.1	62.5	63.9	64.5	64.6	63.9	66.0	67.1	67.5	67.7	67.6
OPEC																
Crude	29.5	28.2	25.6	24.1	24.9	25.7										
OPEC NGLs	5.4	5.4	5.2	5.1	5.2	5.2	5.2	5.3	5.3	5.3	5.3	5.5	5.5	5.6	5.6	5.7
Total OPEC ³	34.9	33.6	30.8	29.2	30.0	30.9										
Total Supply	100.5	100.2	92.1	91.1	92.4	93.9										
Memo items:																
Call on OPEC crude + Stock ch. ⁴	28.7	21.7	16.4	25.7	27.2	22.8	26.2	25.7	27.9	29.3	27.3	28.0	28.6	29.2	29.9	30.8

OECD Commercial Stocks



OPEC Spare Capacity



Wood Mackenzie Macro Oils long-term 2021 outlook to 2050 November 2021

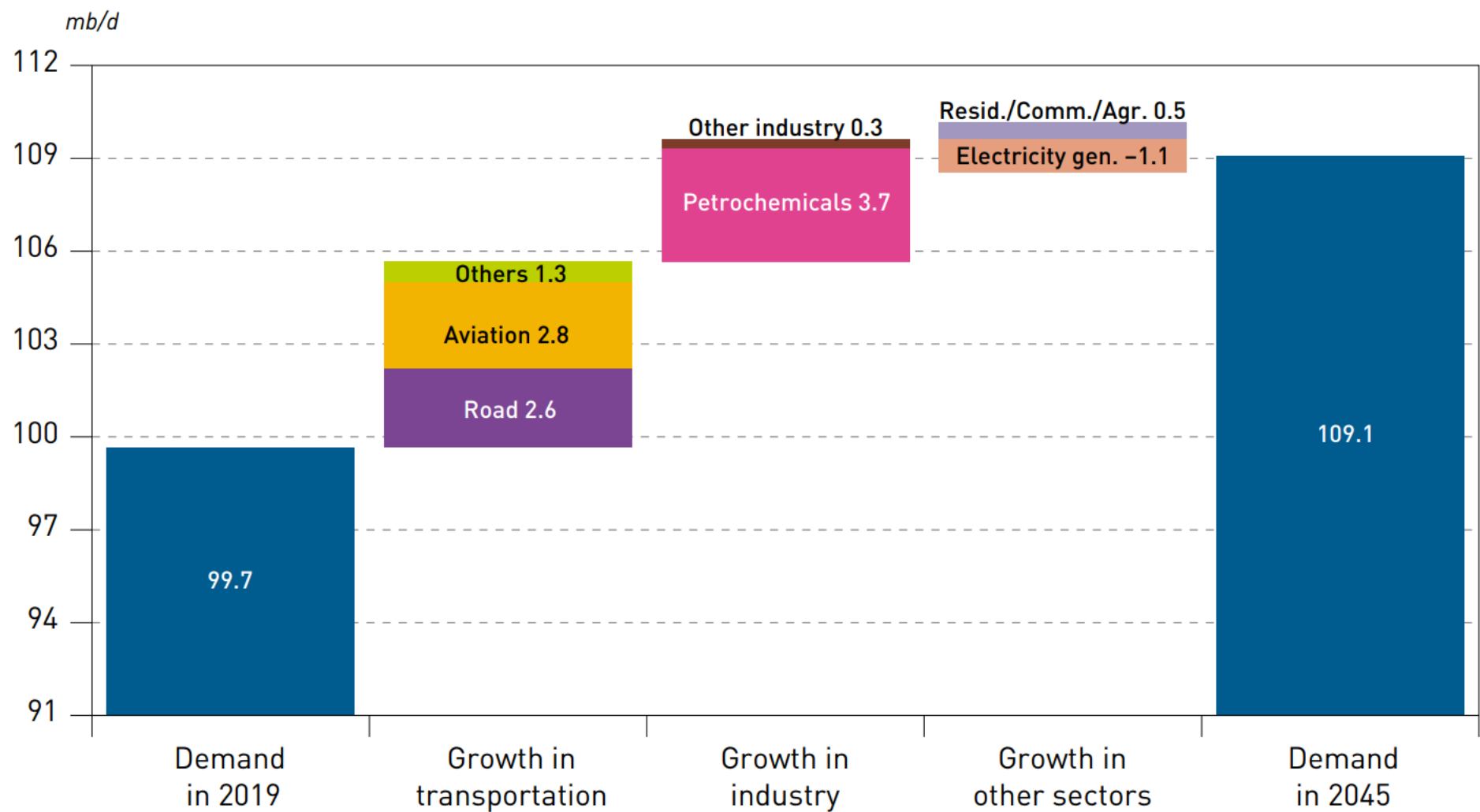
Long-term Oil Demand Outlook by Region

								Growth
	2019	2020	2025	2030	2035	2040	2045	2019–2045
OECD Americas	25.6	23.3	25.7	24.8	23.1	21.2	19.3	–6.3
OECD Europe	14.3	12.6	13.7	12.9	12.0	11.1	10.2	–4.1
OECD Asia Oceania	7.9	7.1	7.4	6.9	6.4	5.8	5.2	–2.7
OECD	47.9	43.0	46.8	44.6	41.5	38.0	34.8	–13.1
Latin America	6.2	5.8	6.6	7.1	7.4	7.6	7.9	1.6
Middle East & Africa	4.3	3.9	4.8	5.5	6.2	6.9	7.6	3.3
India	4.8	4.3	5.8	7.2	8.6	9.9	11.1	6.3
China	13.1	12.1	14.4	15.5	16.2	16.7	17.1	4.0
Other Asia	9.0	8.5	9.9	10.9	11.7	12.4	13.0	3.9
OPEC	8.7	8.2	9.5	10.5	11.3	11.7	11.7	3.0
Russia	3.6	3.2	3.7	3.8	3.8	3.8	3.7	0.1
Other Eurasia	2.0	1.8	2.1	2.2	2.3	2.3	2.3	0.2
Non-OECD	51.8	47.8	56.9	62.6	67.4	71.2	74.3	22.5
World	99.7	90.7	103.7	107.2	108.9	109.3	109.1	9.4

Long-term Oil Demand Outlook by Sector

	2019	2020	2025	2030	2035	2040	2045	Growth 2019–2045
Road	44.4	40.1	46.3	46.9	47.1	47.1	47.0	2.6
Aviation	6.7	3.5	7.1	7.7	8.4	8.9	9.4	2.8
Rail/waterways	1.9	1.8	1.9	2.0	2.1	2.1	2.0	0.2
Marine bunkers	4.2	4.0	4.4	4.6	4.7	4.7	4.6	0.5
Transportation	57.2	49.4	59.7	61.2	62.2	62.8	63.2	6.0
Petrochemicals	13.7	12.9	14.7	15.9	16.7	17.0	17.3	3.7
Other industry	12.8	12.7	13.0	13.5	13.5	13.3	13.1	0.3
Industry	26.5	25.6	27.8	29.4	30.2	30.3	30.4	4.0
Resid./Comm./Agric.	11.1	10.8	11.4	12.0	12.2	12.1	11.6	0.5
Electricity generation	4.9	4.9	4.8	4.6	4.3	4.1	3.9	–1.1
Other uses	16.0	15.7	16.1	16.6	16.5	16.1	15.5	–0.5
World	99.7	90.7	103.7	107.2	108.9	109.3	109.1	9.4

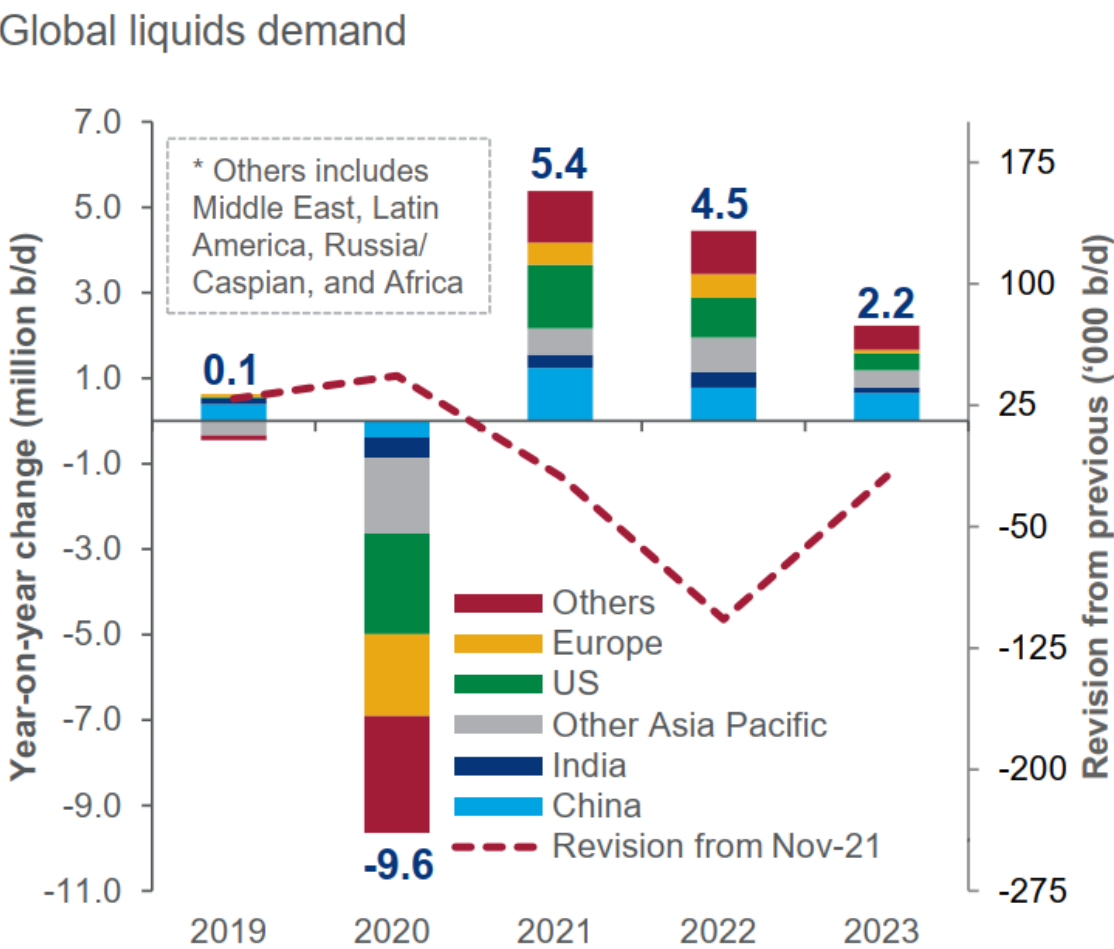
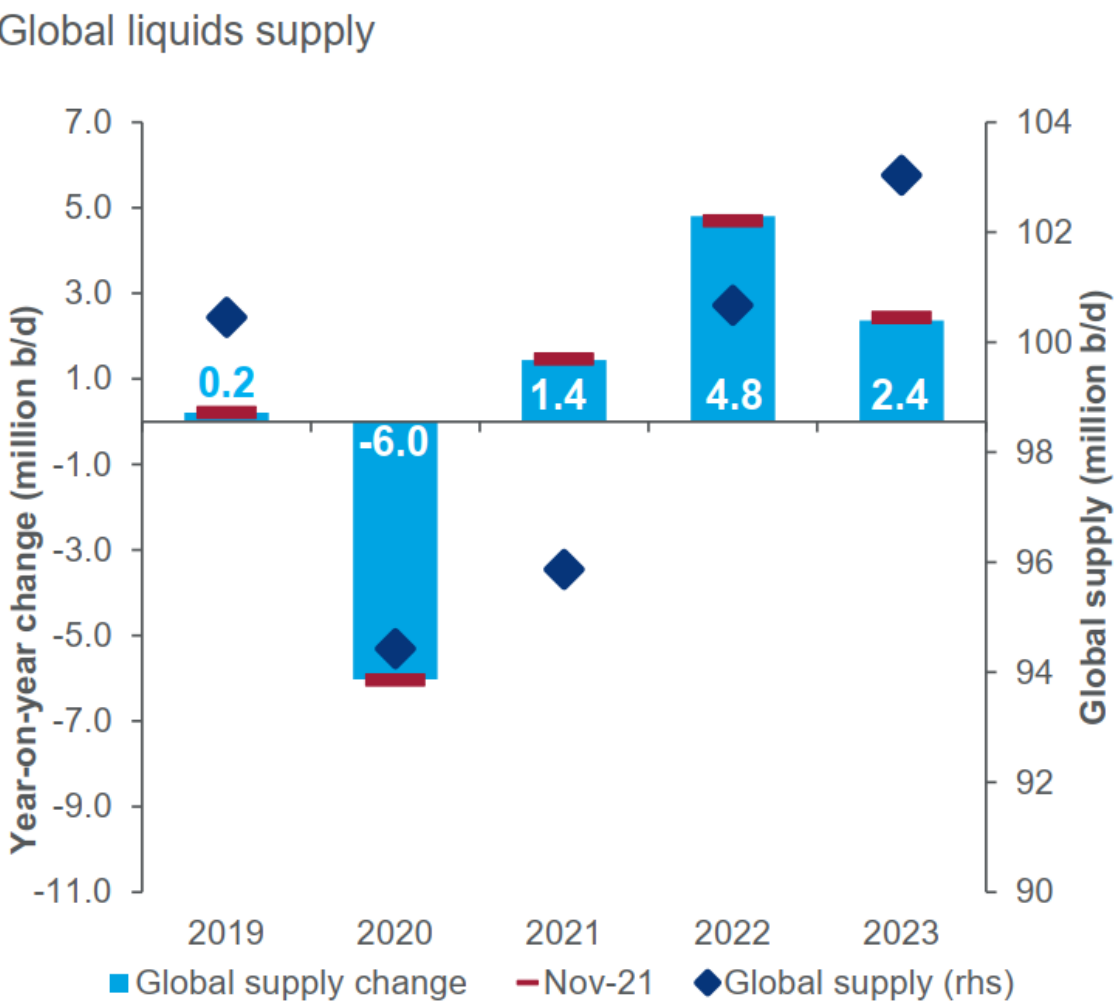
Oil Demand Growth By Sector



Long-term Global Liquids Supply Outlook

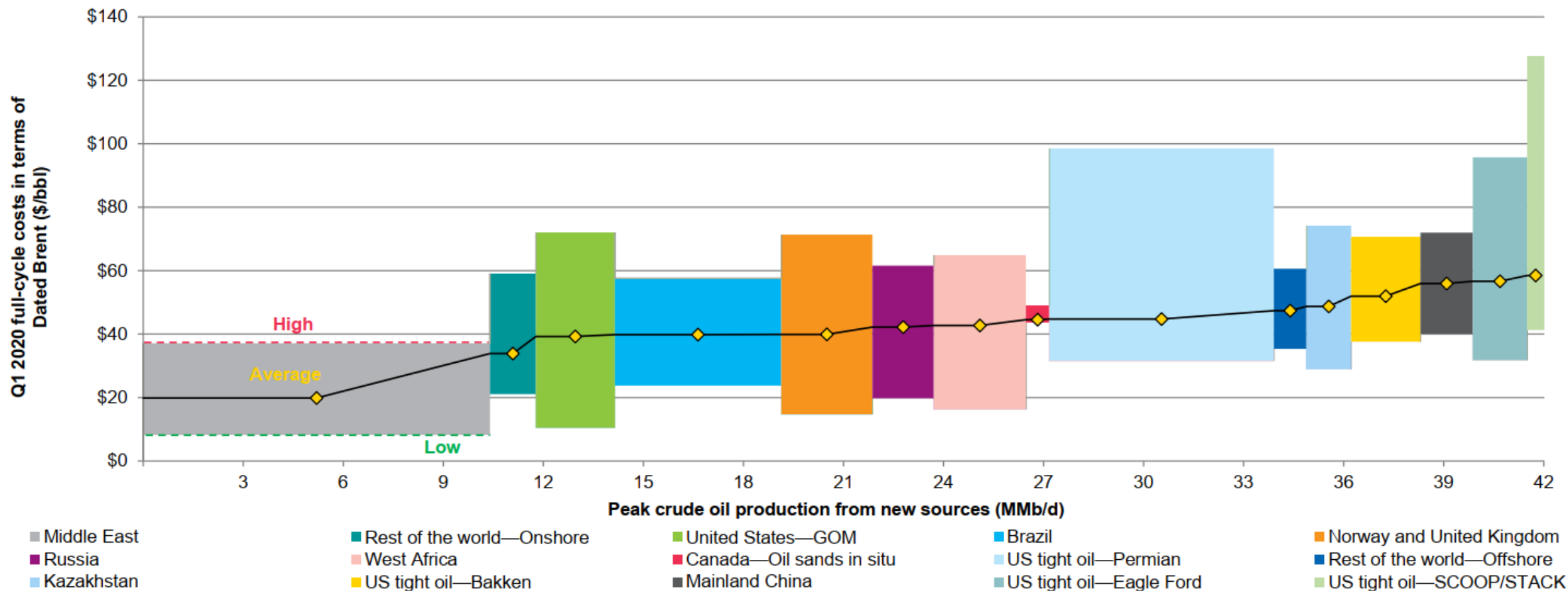
	2019	2020	2025	2030	2035	2040	2045	Change 2019–2045
OECD	30.0	28.5	32.5	32.3	30.8	29.1	27.7	–2.3
<i>of which: US</i>	18.4	17.0	19.8	20.3	19.1	17.7	16.6	–1.8
<i>of which: tight liquids</i>	11.7	10.9	14.5	15.8	15.4	14.3	13.3	1.6
Non-OECD	32.8	31.2	35.9	36.7	36.5	35.7	34.7	2.0
Processing gains	2.3	2.1	2.4	2.6	2.7	2.8	3.0	0.7
Non-OPEC	65.0	61.8	70.7	71.5	69.9	67.6	65.4	0.4
<i>of which*: crude</i>	45.9	43.5	50.0	48.9	46.0	43.0	40.3	–5.6
<i>NGLs</i>	10.5	10.3	11.3	12.5	13.0	13.2	13.2	2.7
<i>global biofuels</i>	2.5	2.3	2.8	3.1	3.3	3.5	3.6	1.0
<i>other liquids</i>	3.8	3.6	4.3	4.6	4.9	5.1	5.4	1.6
Total OPEC liquids	33.8	30.7	33.2	35.9	39.2	41.9	43.9	10.1
World	98.9	92.4	103.9	107.4	109.1	109.5	109.3	10.4

Demand and Supply Growth



Wood Mackenzie Macro Oils long-term 2021 outlook to 2050 November 2021

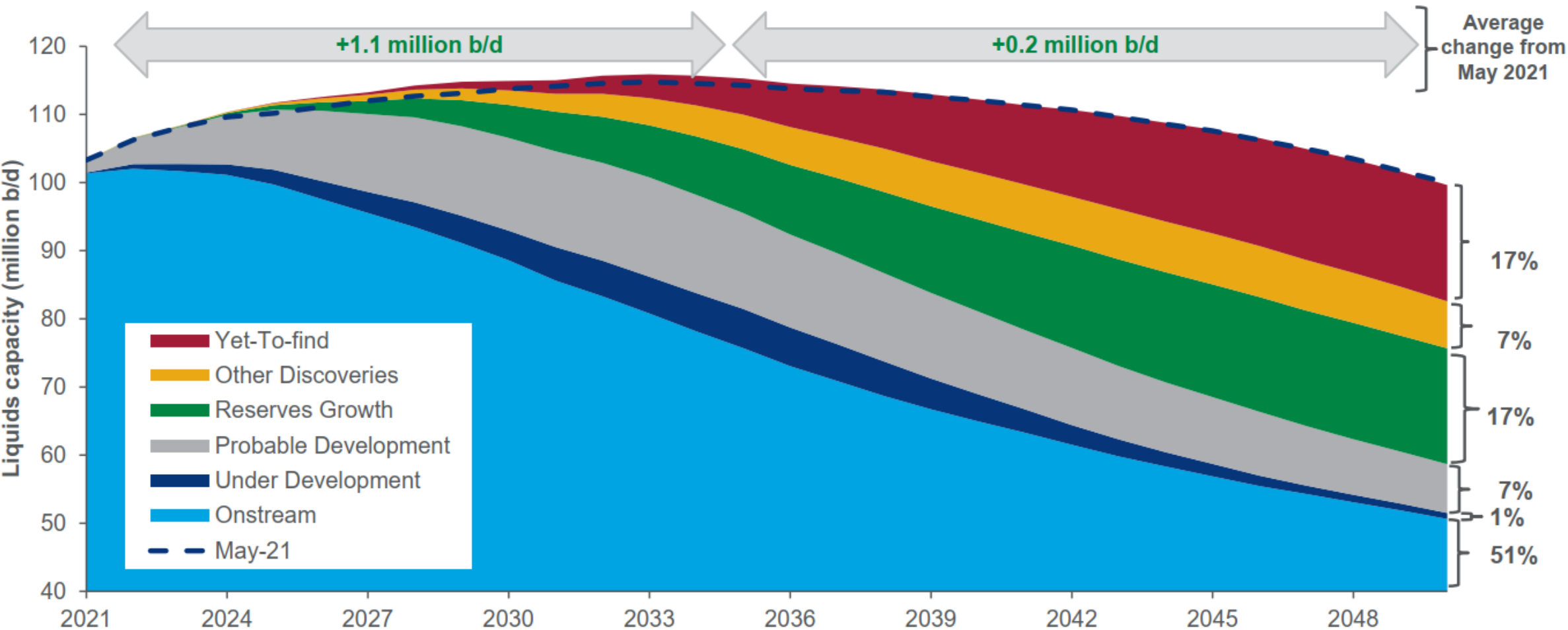
Cost Curve Of New Global Crude Oil Supply In Select Areas To 2040



Note: Details about the methodology behind the curve are provided in slides 84–85 in the Appendix in this slide deck.
Source: IHS Markit

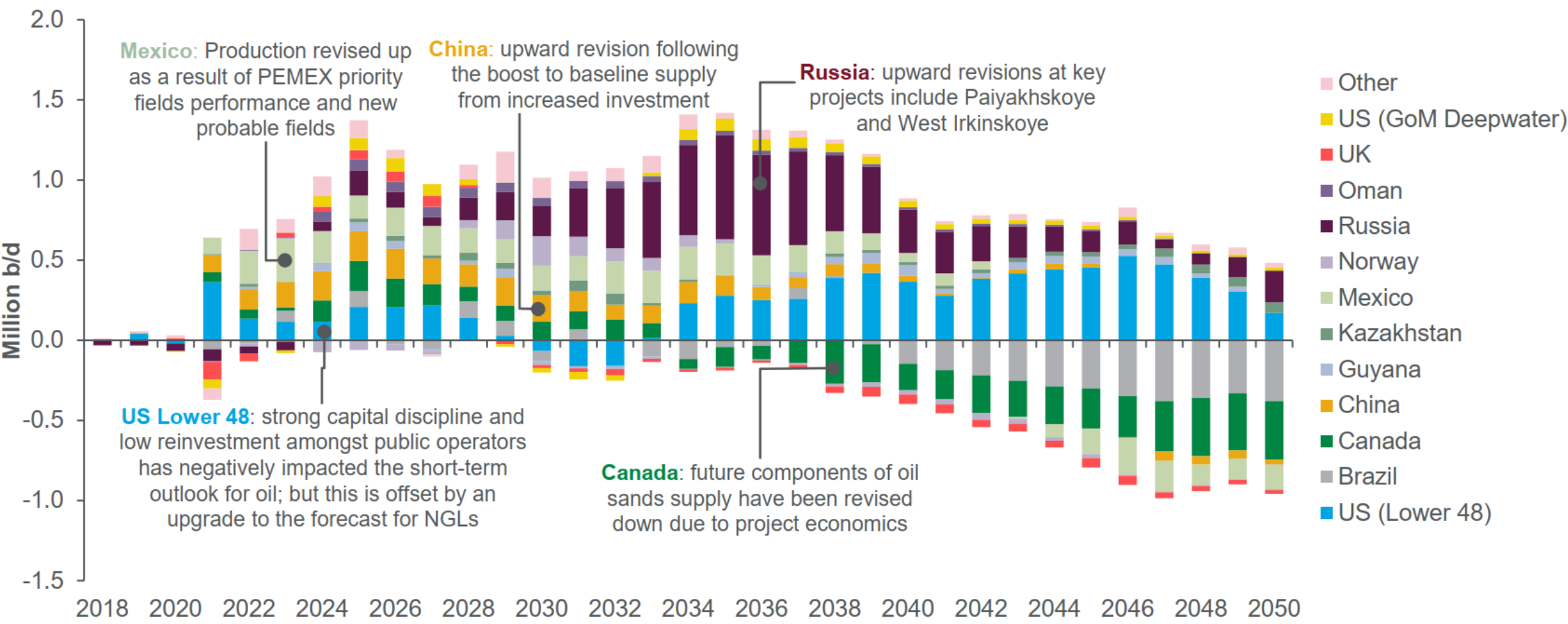
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Global Liquids Production Capacity

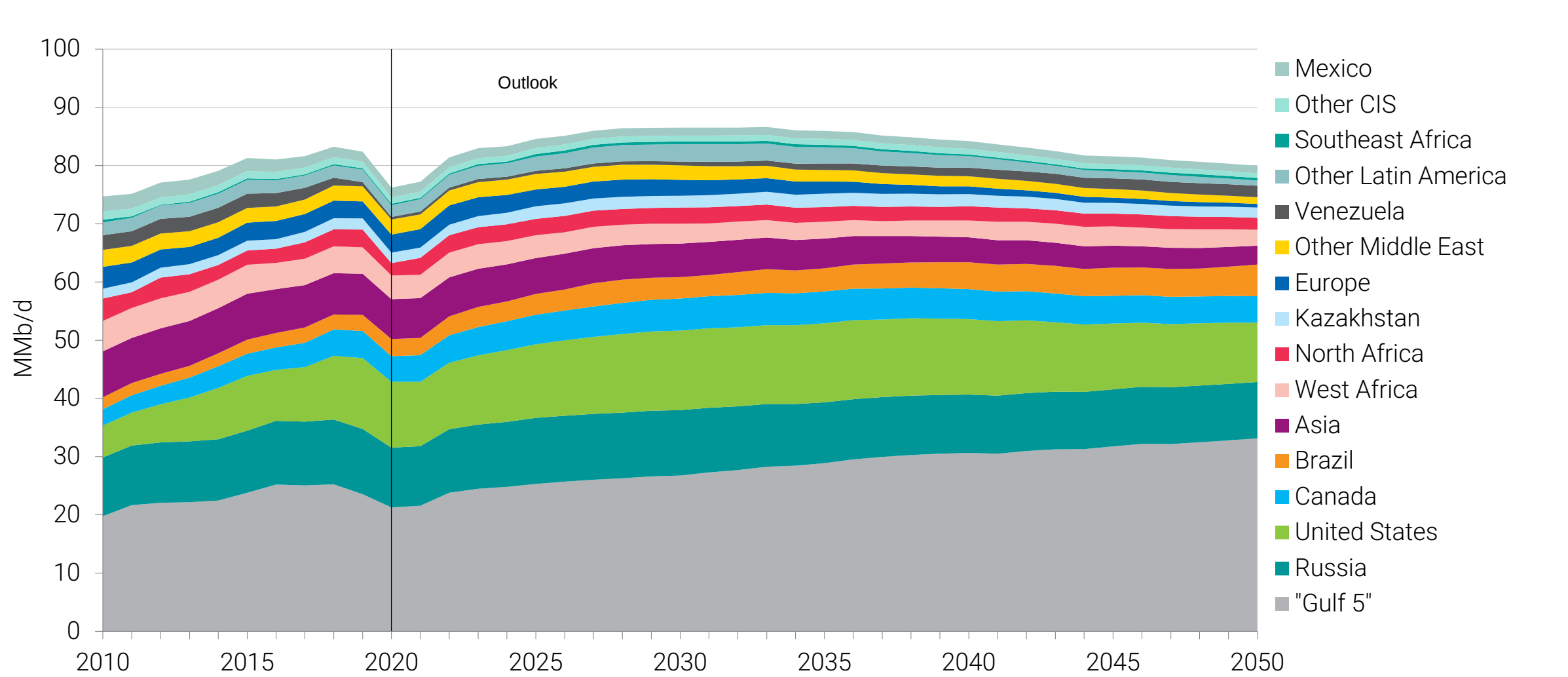


Wood Mackenzie Macro Oils long-term 2021 outlook to 2050 November 2021

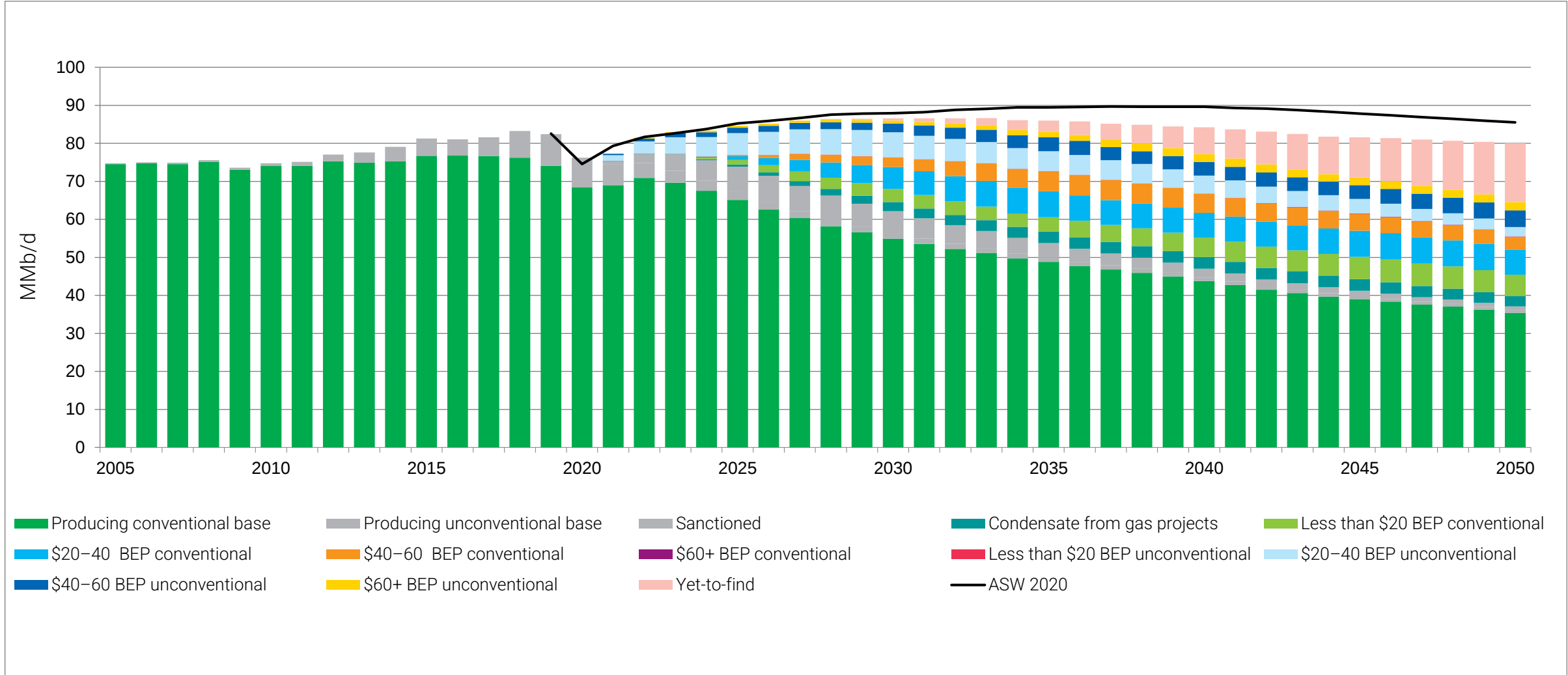
Non-OPEC Key Country Production Change from May 2021



World Crude and Condensate Production



Global Crude and Condensate Supply Outlook by Category and Breakeven Price



US Shale Oil

To provide an overview of US shale oil dynamics

مجله ی 29 - توصیه های پسران اخبار بین الملل (انرژی)

چگونه ذخایر نامتعارف، تولید انرژی در آمریکا را متحول کرده است؟

تاریخ انتشار: شنبه ۱۴ بهمن ۱۳۹۱

انقلاب رُسی

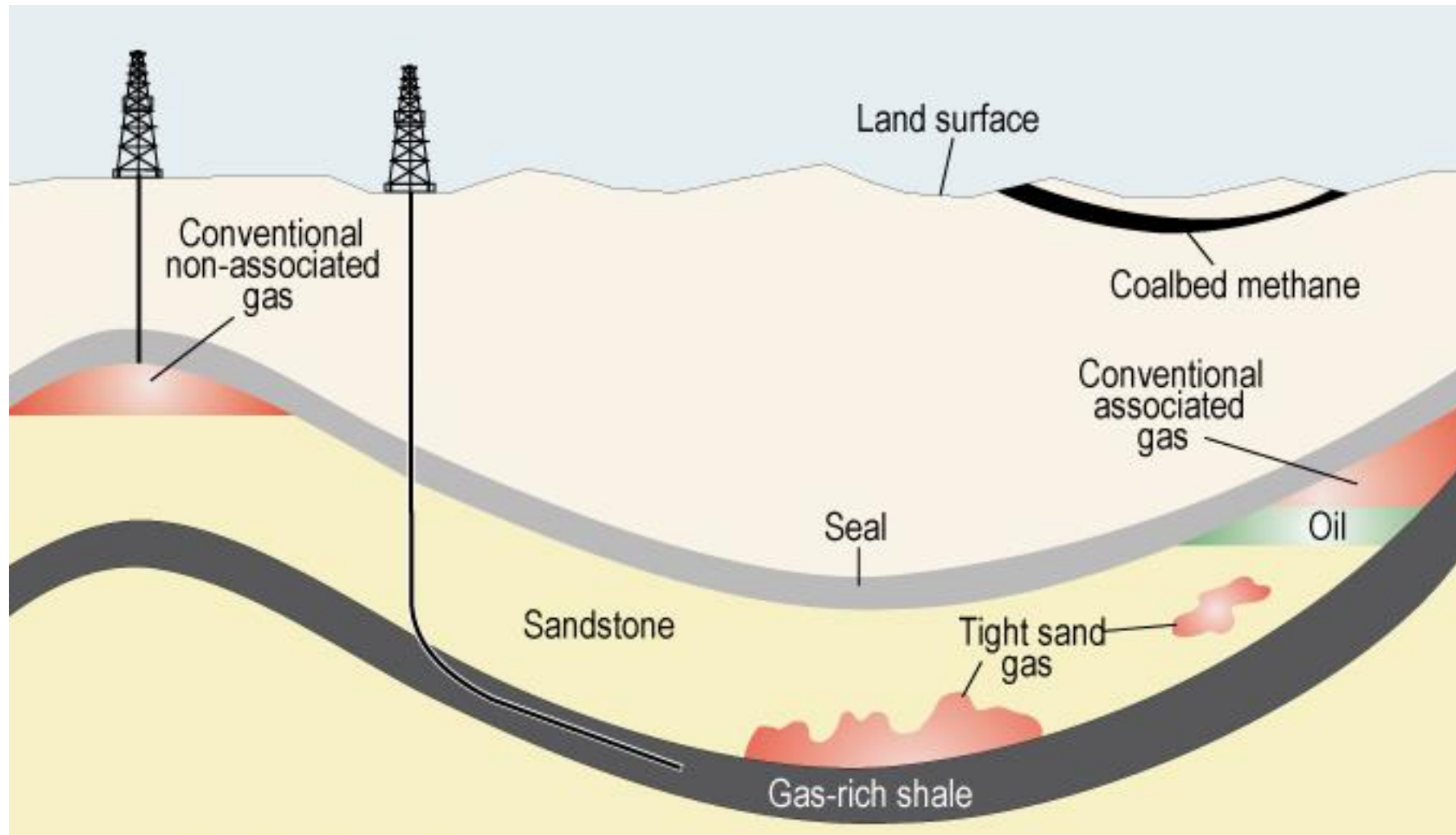
رامین فروزنده

«آمریکا احتمالاً در سال ۲۰۱۳ با پشت سر گذاشتن روسیه و عربستان، به بزرگ‌ترین تولیدکننده سوخت‌های مایع در جهان تبدیل خواهد شد.»

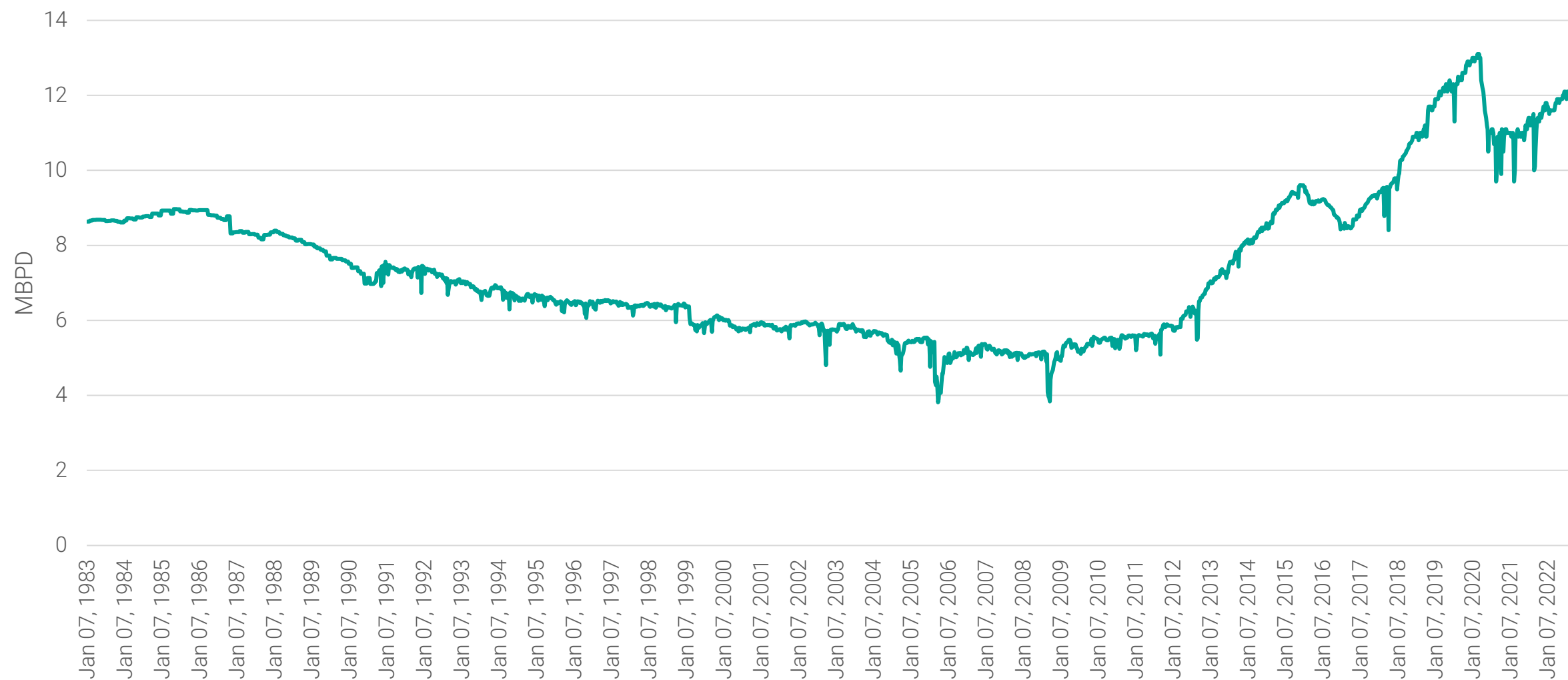


«آمریکا احتمالاً در سال 2013 با پشت سر گذاشتن روسیه و عربستان، به بزرگ‌ترین تولیدکننده سوخت‌های مایع در جهان تبدیل خواهد شد.» این جمله، شاید مهم‌ترین پیش‌بینی گزارش جدید شرکت بریتیش پترولیوم باشد؛ به خصوص اگر بدانیم سهم اصلی در افزایش تولید نفت و گاز را در آمریکا، ذخایر نامتعارف خواهند داشت. گزارش چشم‌انداز انرژی 2030 که در اواسط ژانویه سال جدید میلادی منتشر شد، نخستین گزارشی نیست که بر نقش تولید نفت و گاز از منابعی مثل شیل1 (سنگ حاوی ذخایر هیدروکربن که از رُس تشکیل شده است) متمرکز شده است. گفته می‌شود تولید از ذخایر نامتعارف که با افزایش قیمت‌های جهانی انرژی و بهبود فناوری‌های صنعت نفت اقتصادی همراه شده است، چشم‌انداز جدیدی را به روی صنعت نفت و گاز جهان گشوده است که می‌توان از آن به «انقلاب رُسی» یاد کرد.

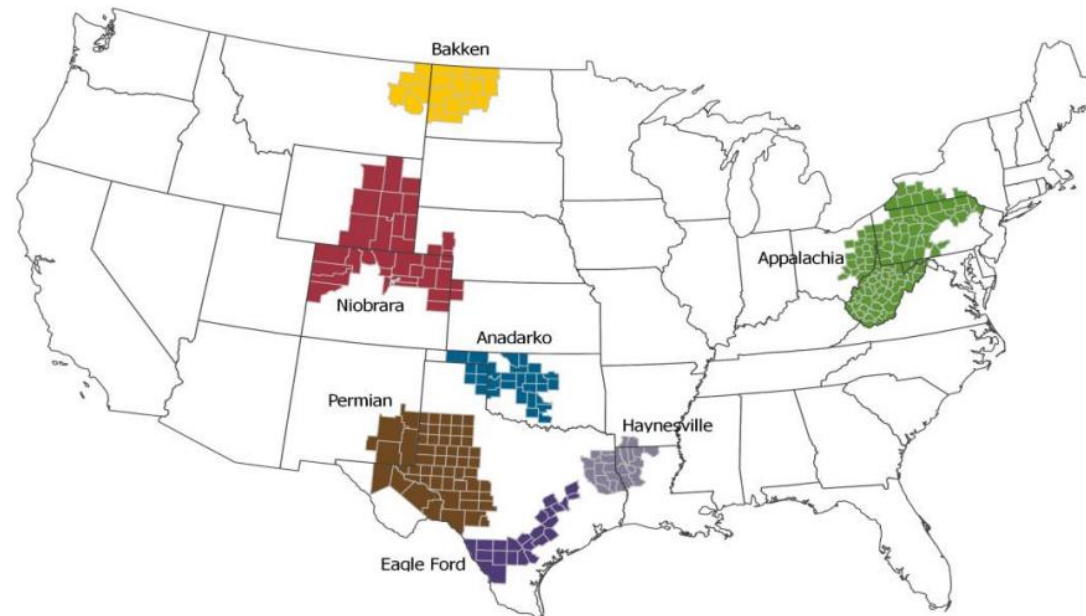
Definition



Weekly US Crude Oil Production



EIA Drilling Productivity Report

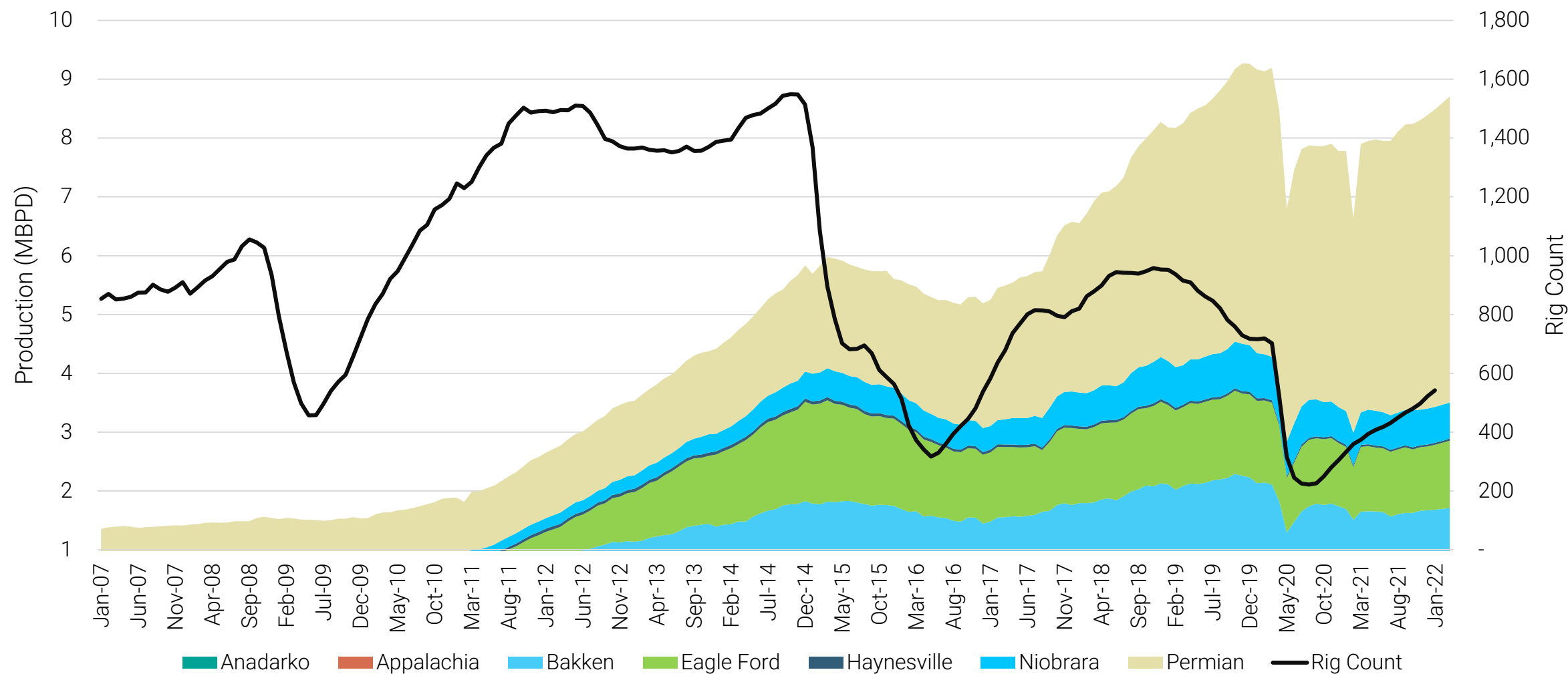


Note:

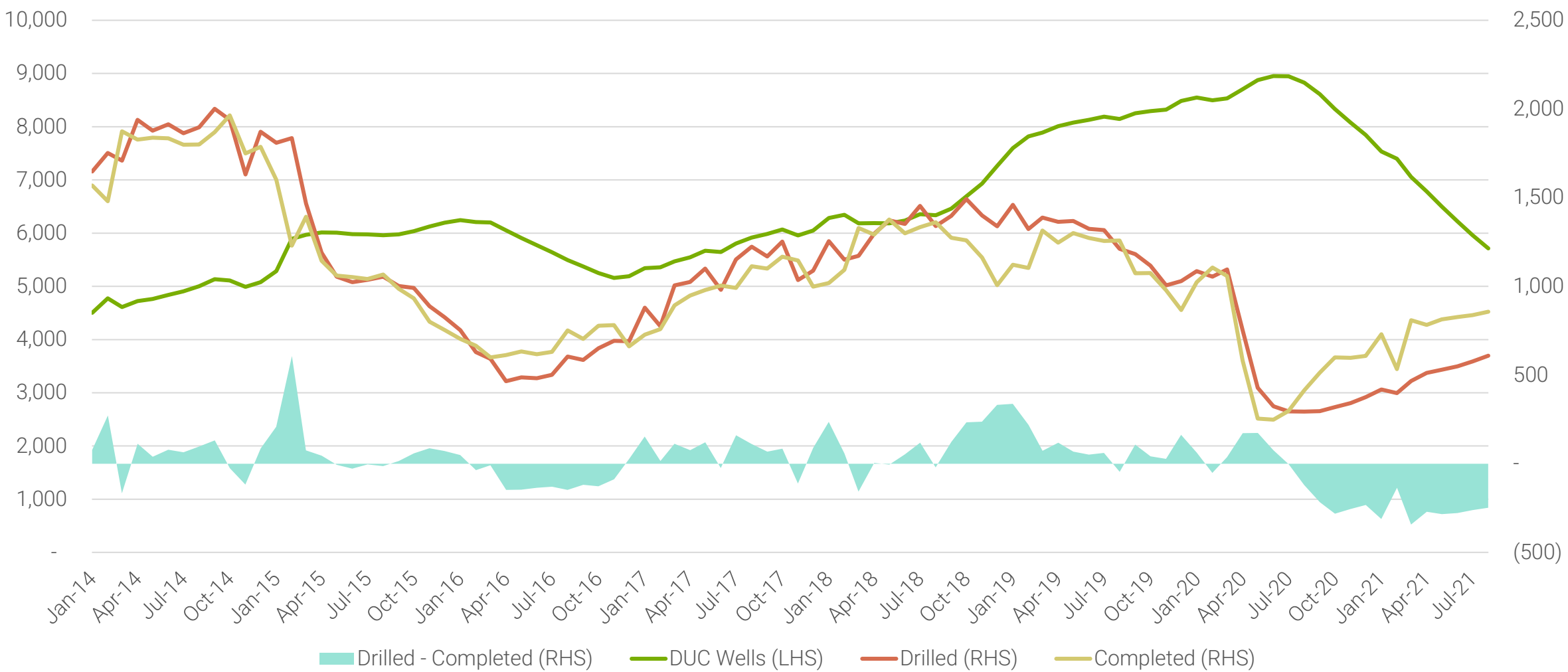
The DPR rig productivity metric *new-well oil/gas production per rig* can become unstable during periods of rapid decreases or increases in the number of active rigs and well completions. The metric uses a fixed ratio of estimated total production from new wells divided by the region's monthly rig count, lagged by two months. The metric does not represent new-well oil/natural gas production per newly completed well.

The DPR metric *legacy oil/gas production change* can become unstable during periods of rapid decreases or increases in the volume of well production curtailments or shut-ins. This effect has been observed during winter weather freeze-offs, extreme flooding events, and the 2020 global oil demand contraction. The DPR methodology involves applying smoothing techniques to most of the data series because of inherent noise in the data.

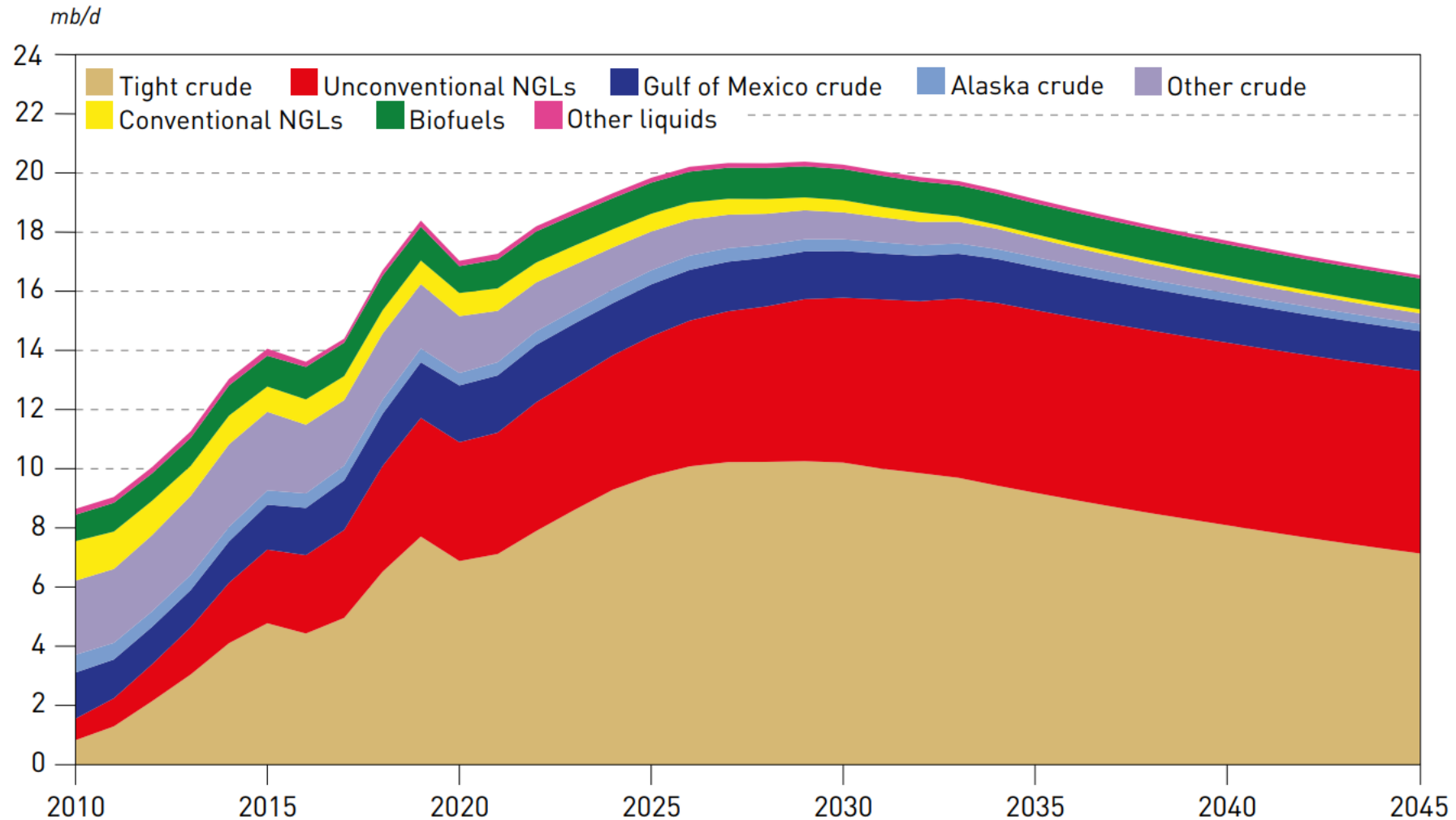
US Tight Oil Production & Total Rig Count



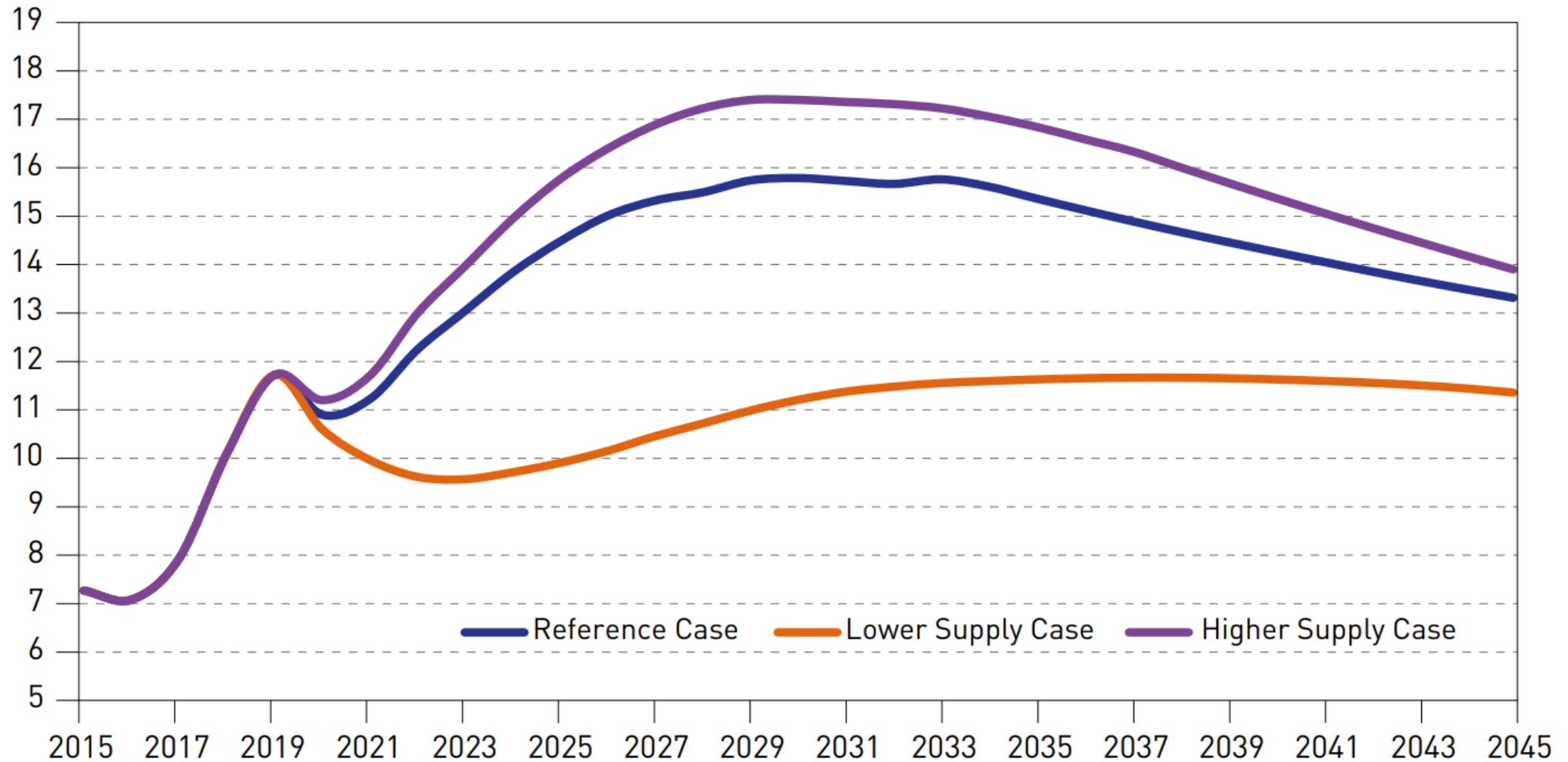
DUC Wells



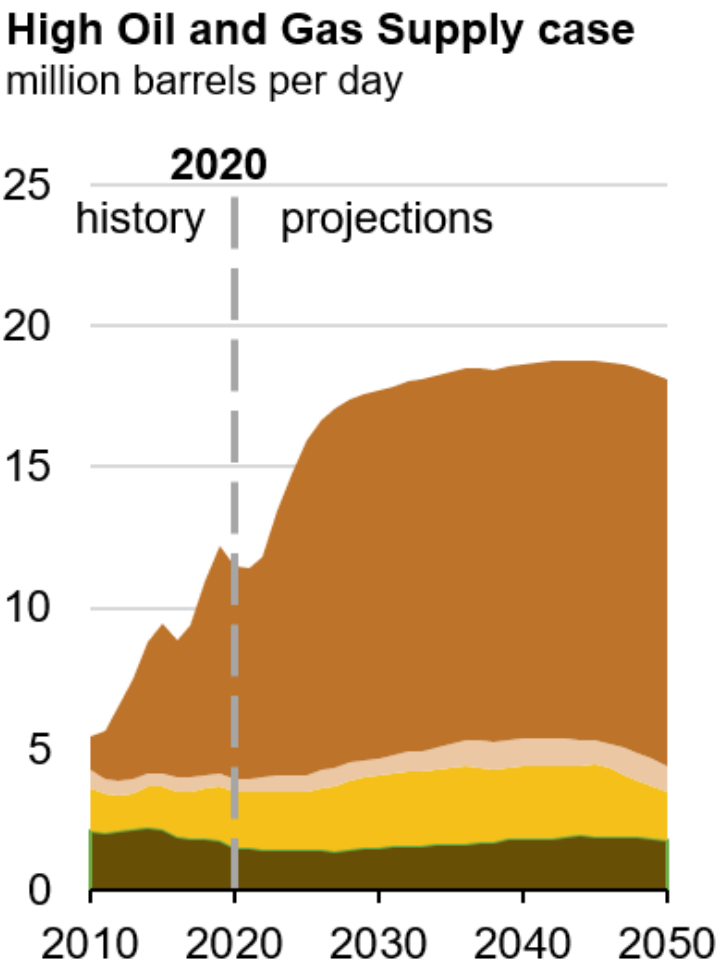
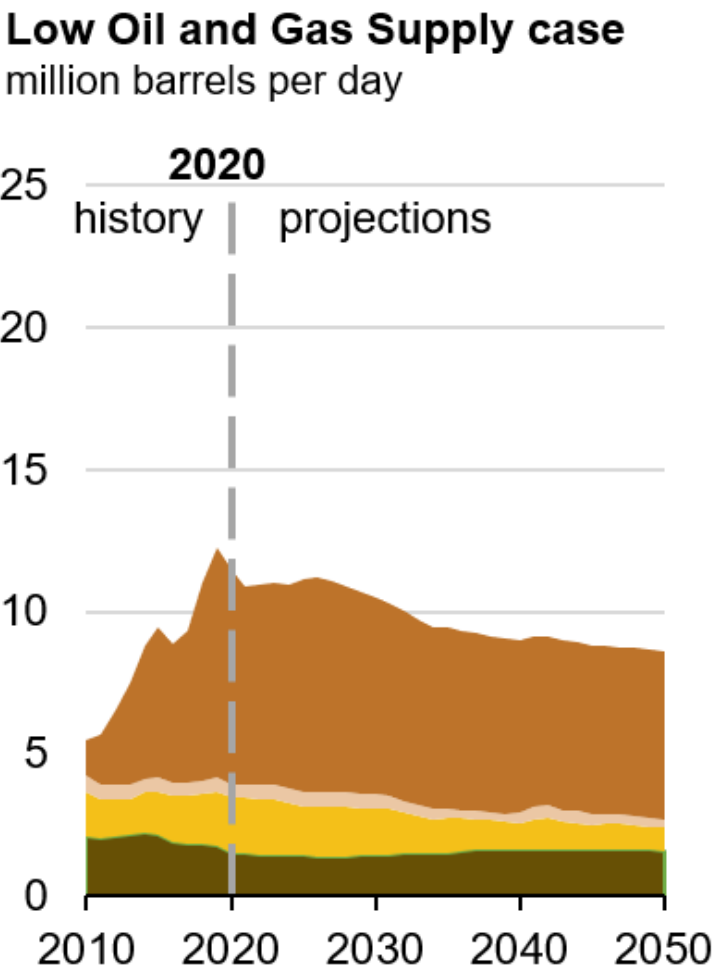
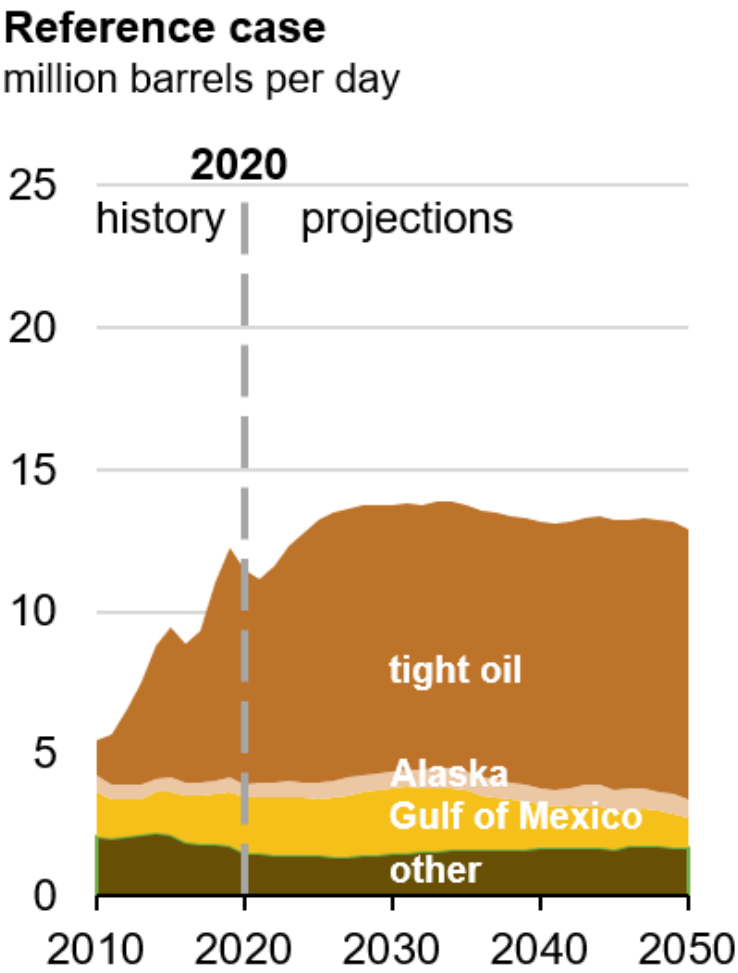
US Liquids Supply Outlook



Long-term US Tight Oil Sensitivities



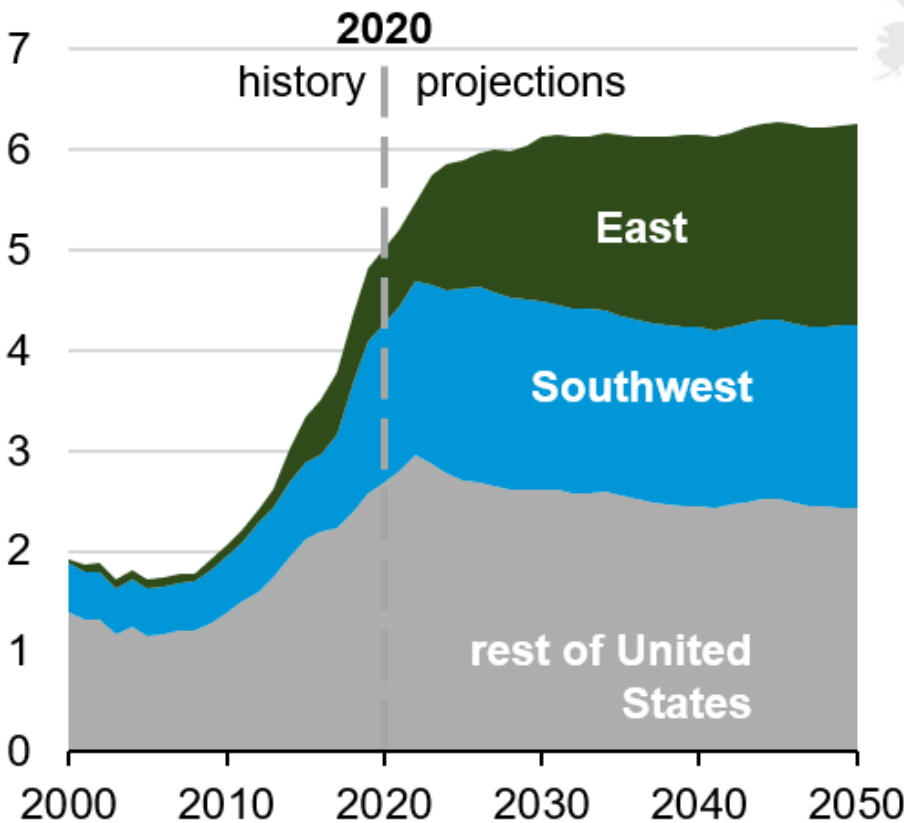
U.S. Crude Oil Production



Natural Gas Plant Liquids Production By Region And Type

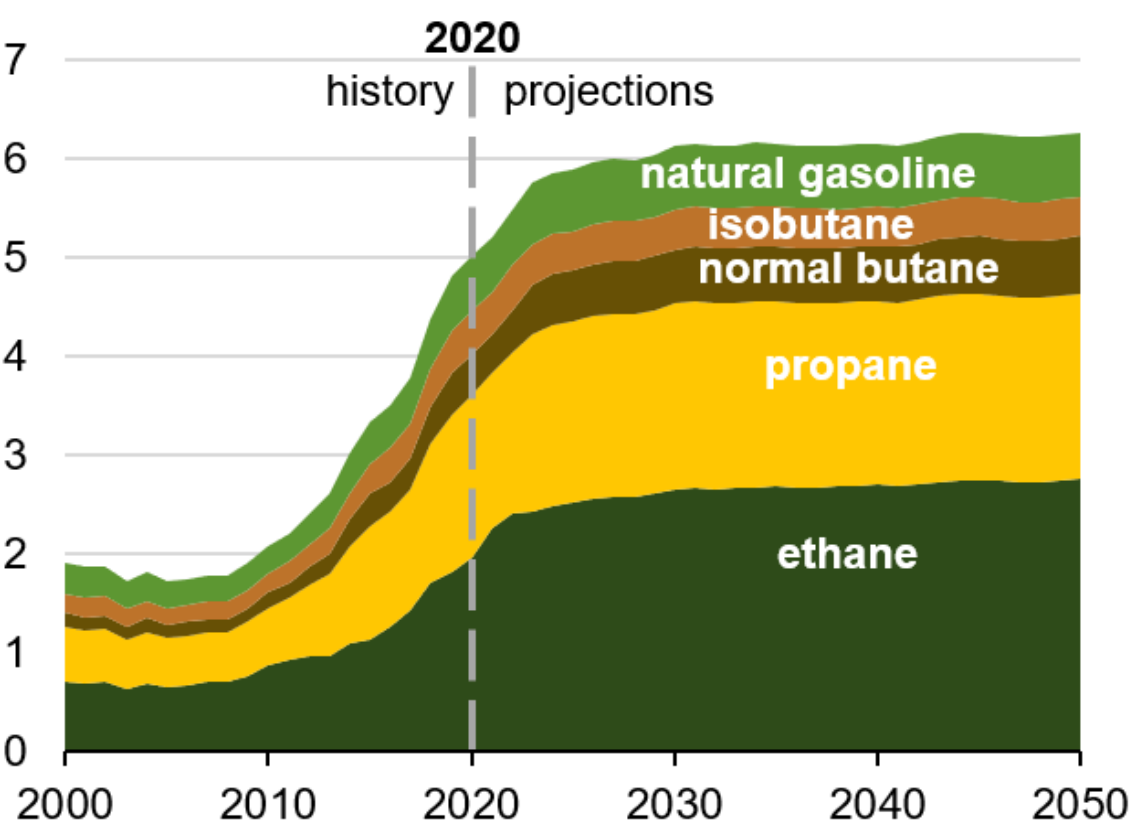
U.S. natural gas plant liquids production by region
AEO2021 Reference case

million barrels per day

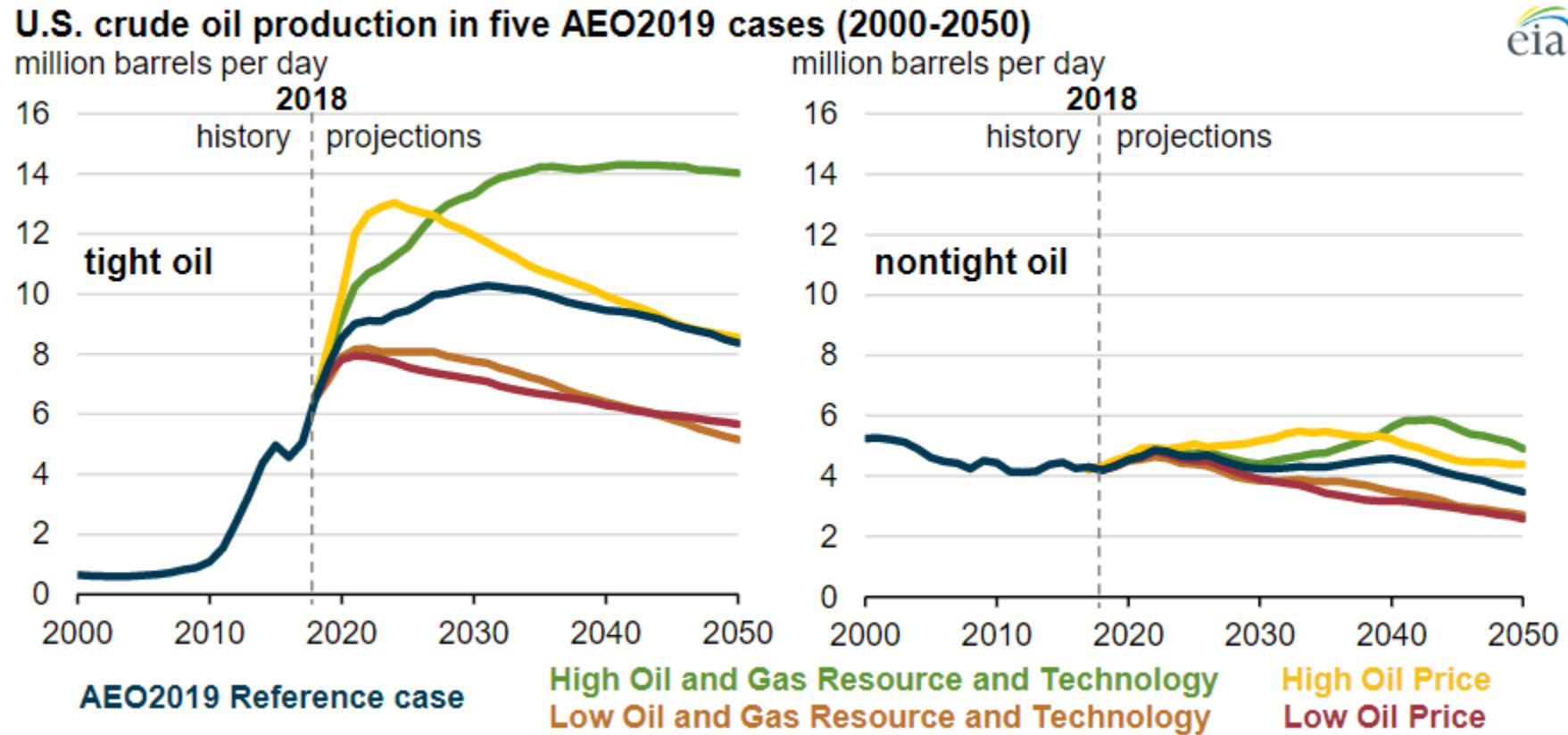


U.S. natural gas plant liquids production by type
AEO2021 Reference case

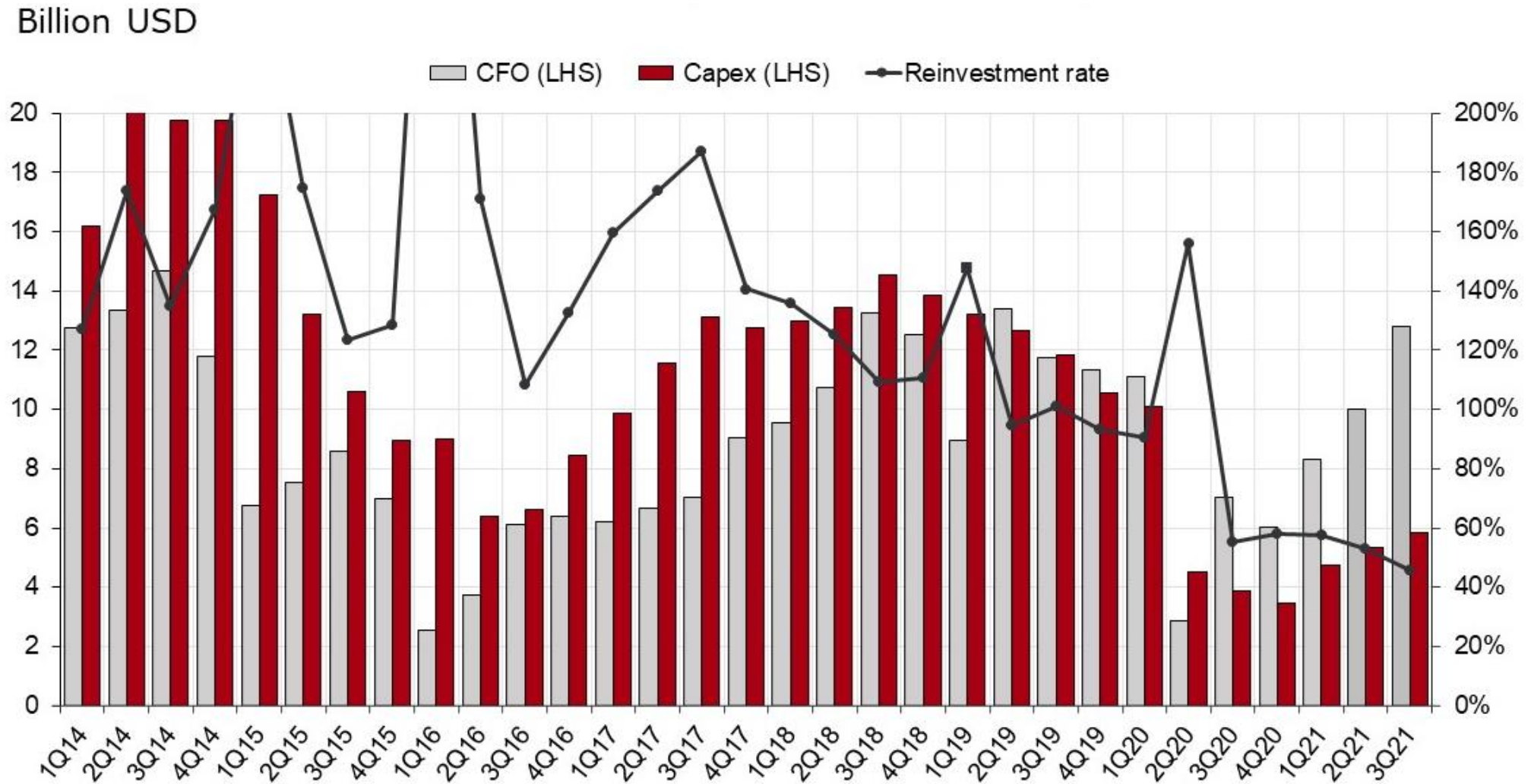
million barrels per day



Tight Oil Development



US Shale Oil CFO and Capex



Breakeven Reduction



Structural

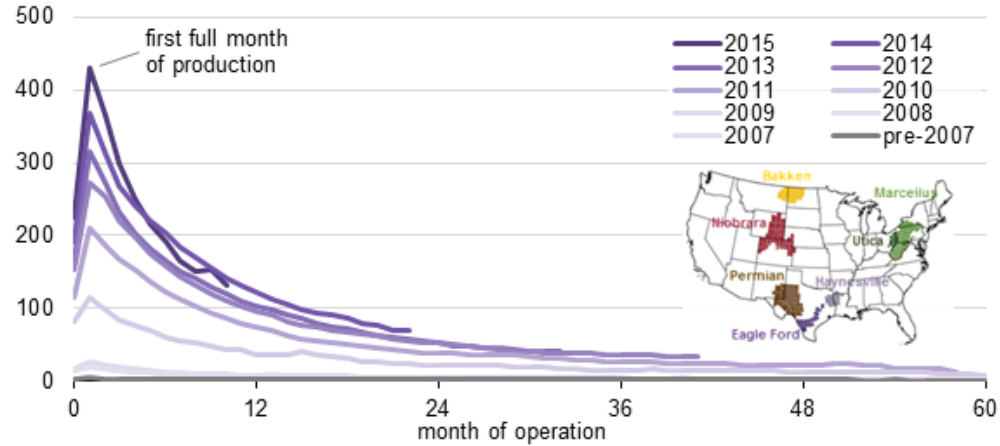
- Wells Productivity
- Drilling & Completion Efficiency

Cyclical

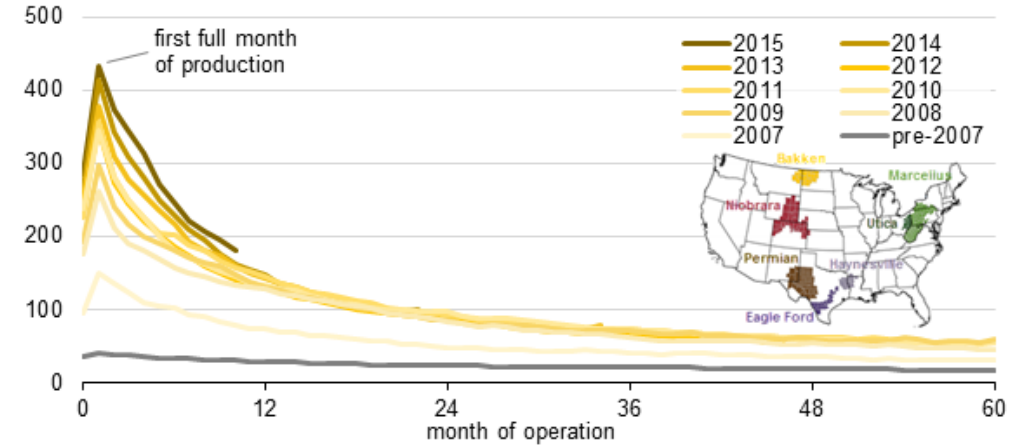
- Cost of Drilling & Operating
- High-grading

Initial Production Rates In Tight Oil Formations

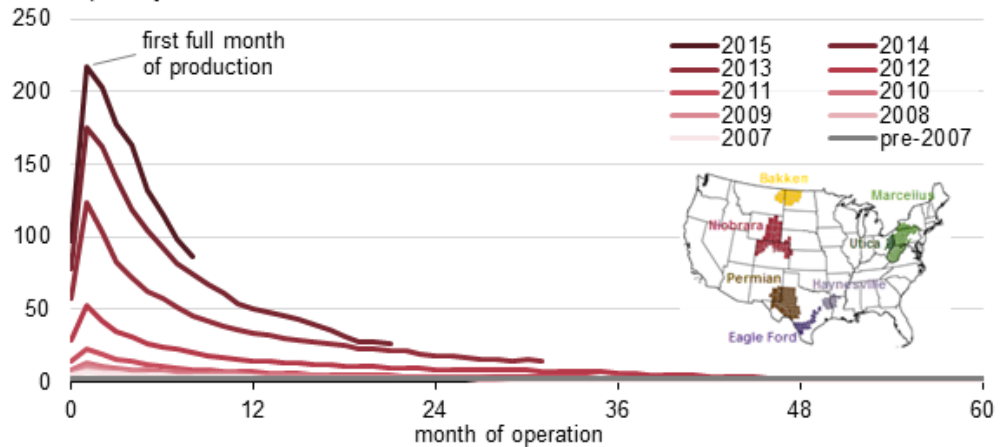
Average oil production per well in the Eagle Ford region
barrels per day



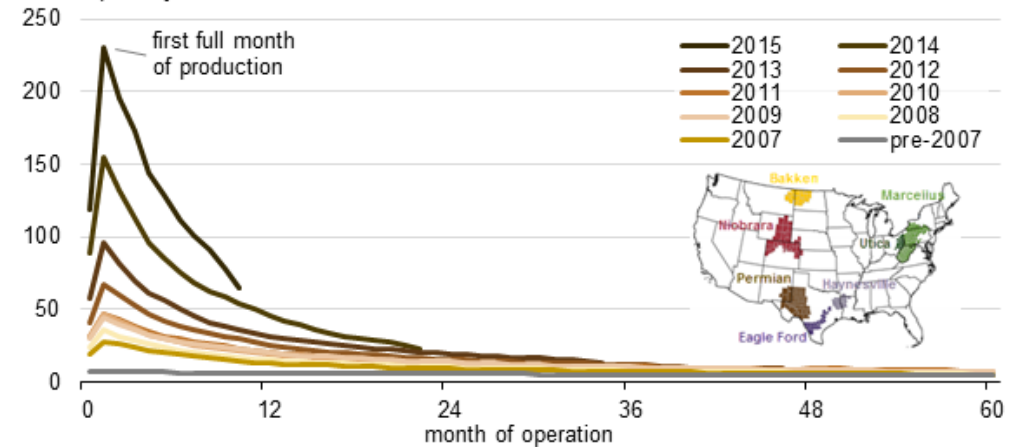
Average oil production per well in the Bakken region
barrels per day



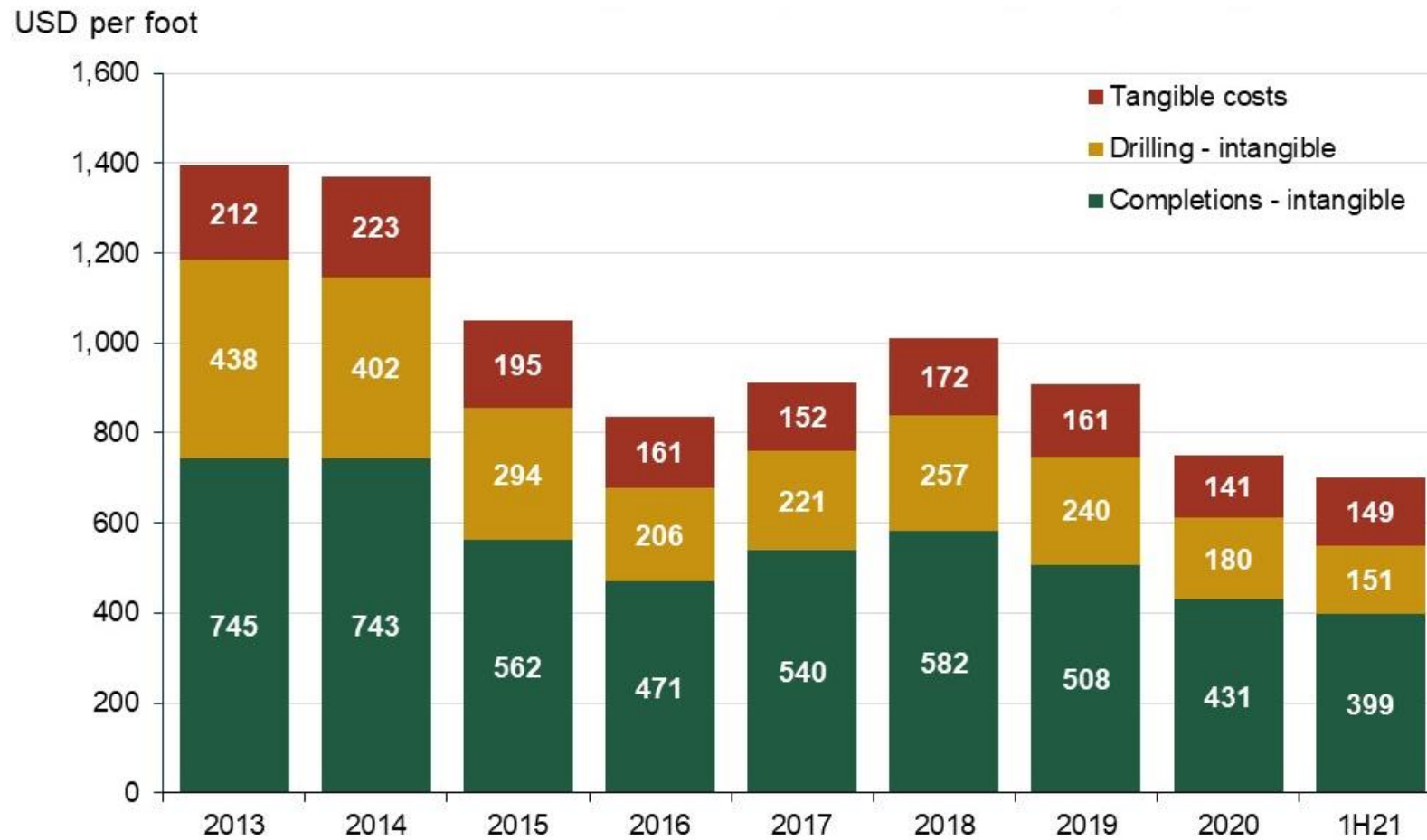
Average oil production per well in the Niobrara region
barrels per day



Average oil production per well in the Permian region
barrels per day



Permian Basin P50 Drilling and Completion Cost by Completion Year

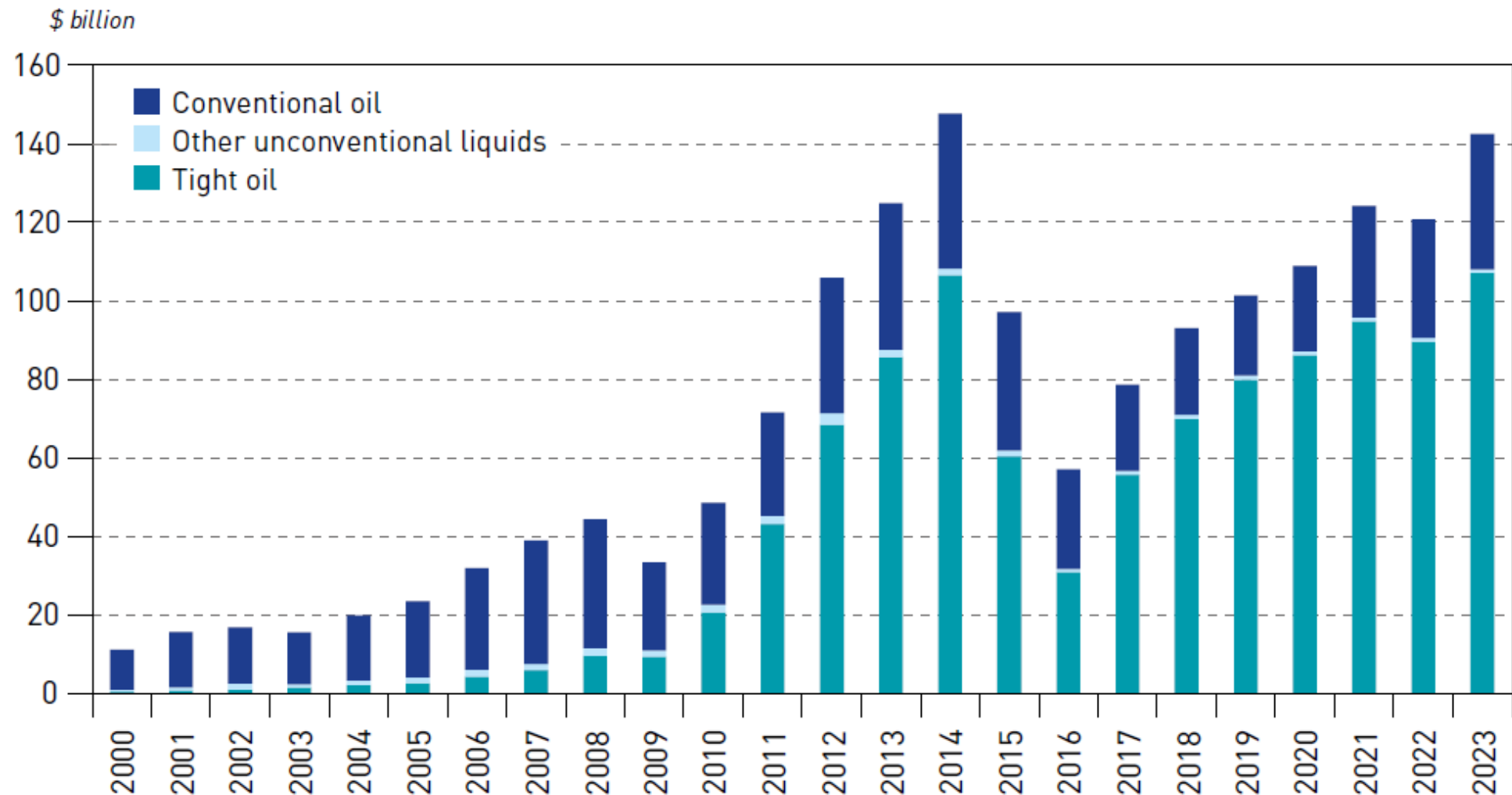


*Tangible cost consist primarily of OCTG and facilities

**The chart includes all horizontal wells with perforated length greater than 3,000'

Source: Rystad Energy ShaleWellCube, July 2021

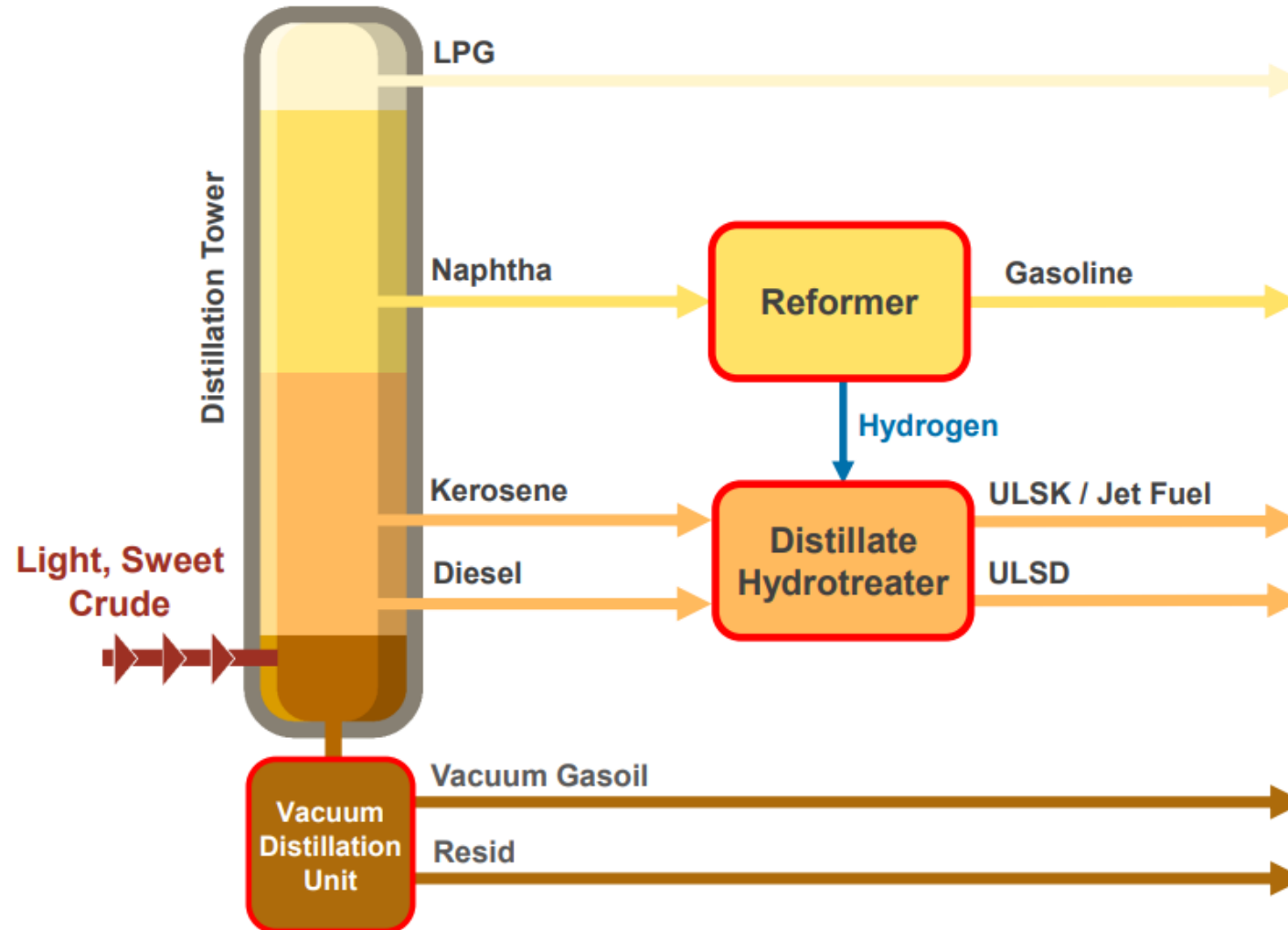
US Upstream Investment



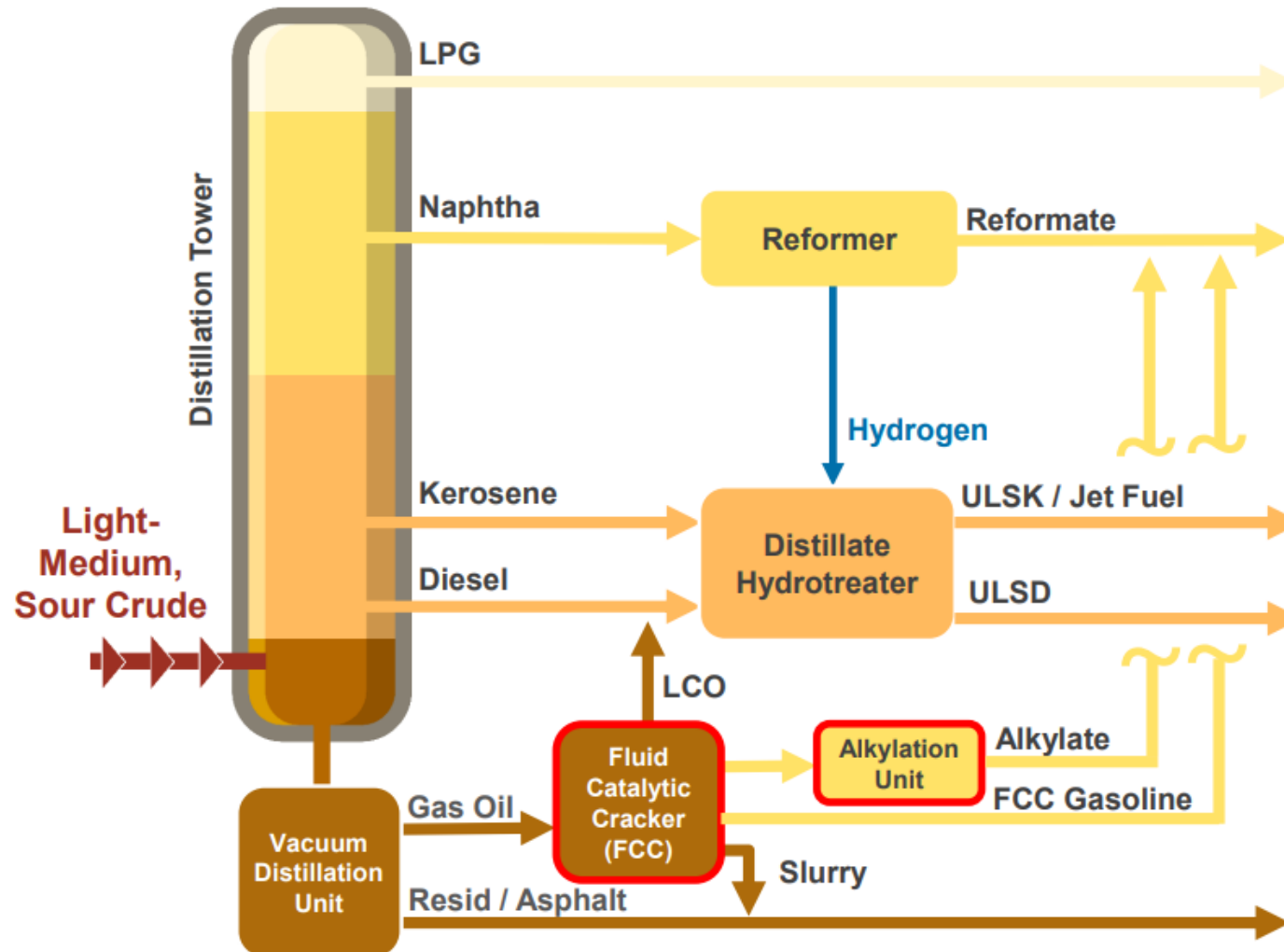
Refining & Chemicals

To draw a comprehensive picture of refining and chemicals sectors

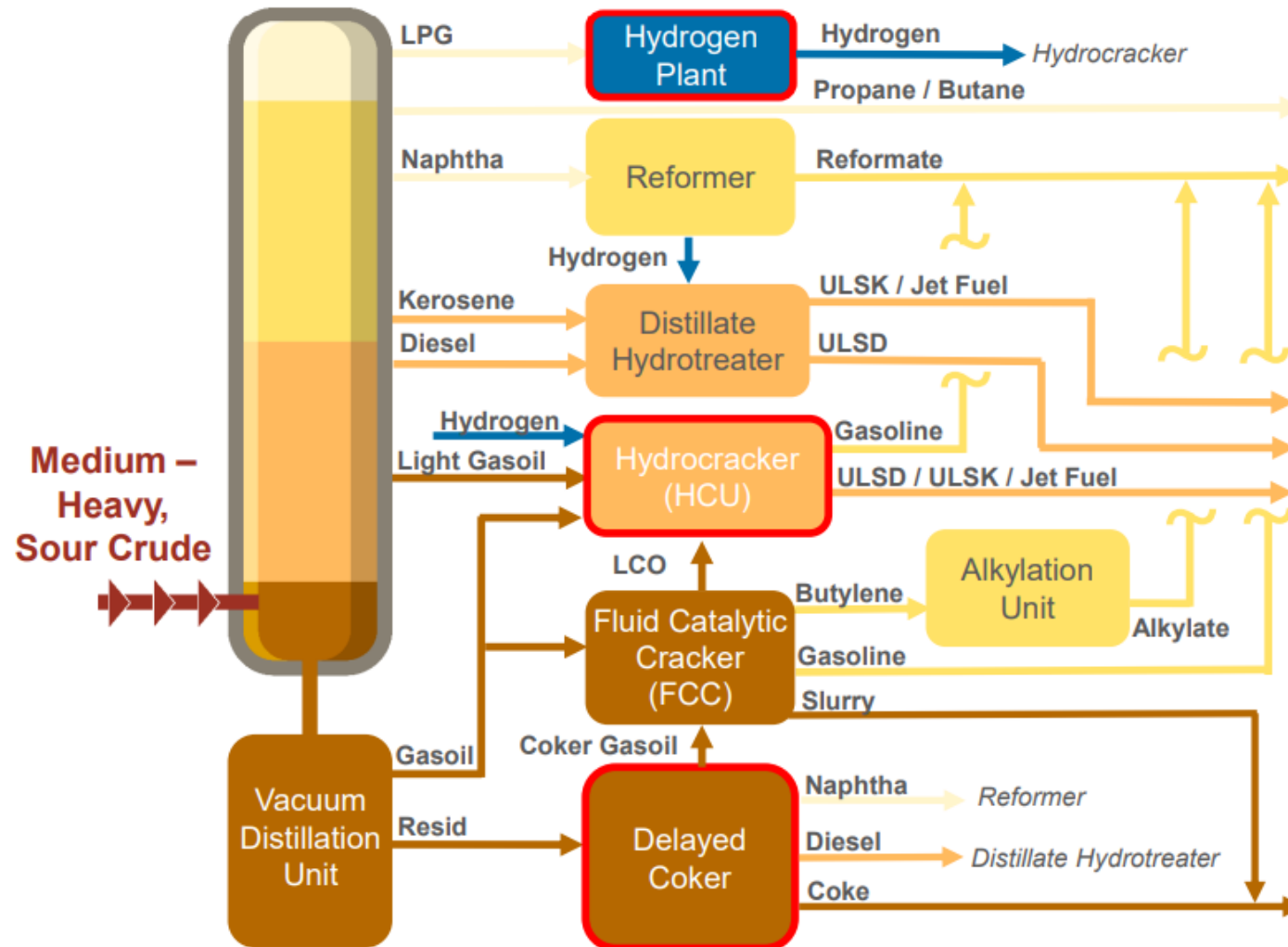
Low Complexity: Hydroskimming (Topping)



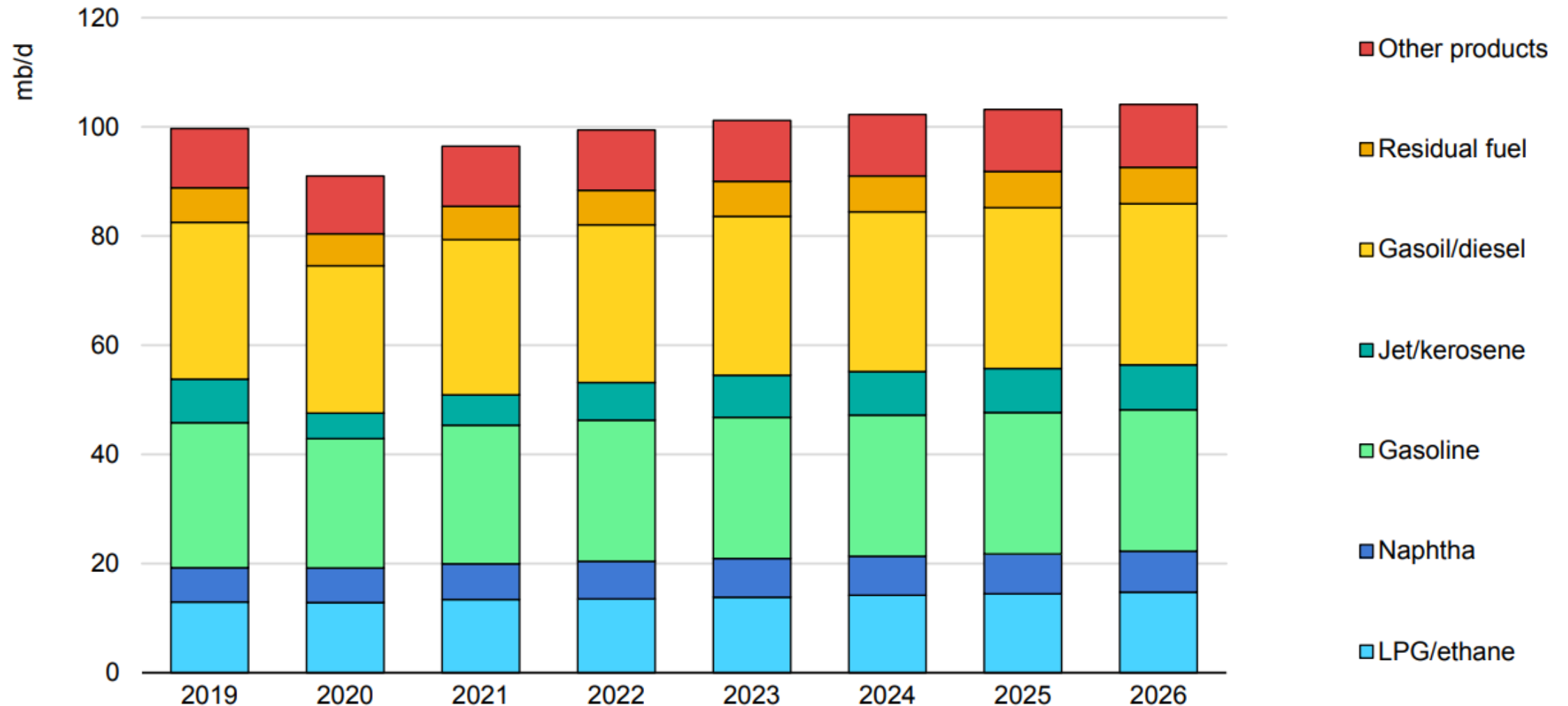
Medium Complexity: Catalytic Cracking



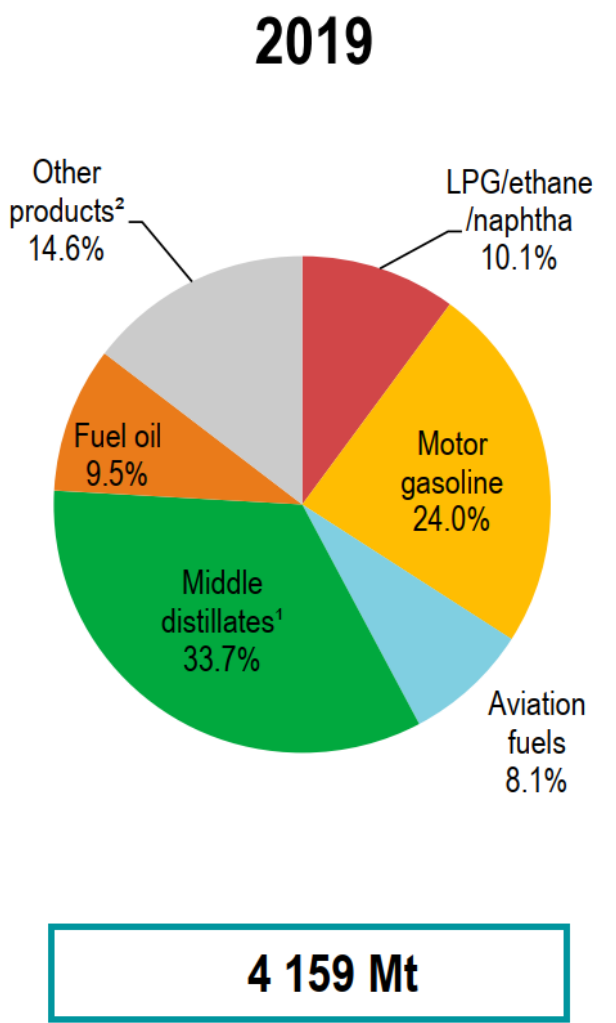
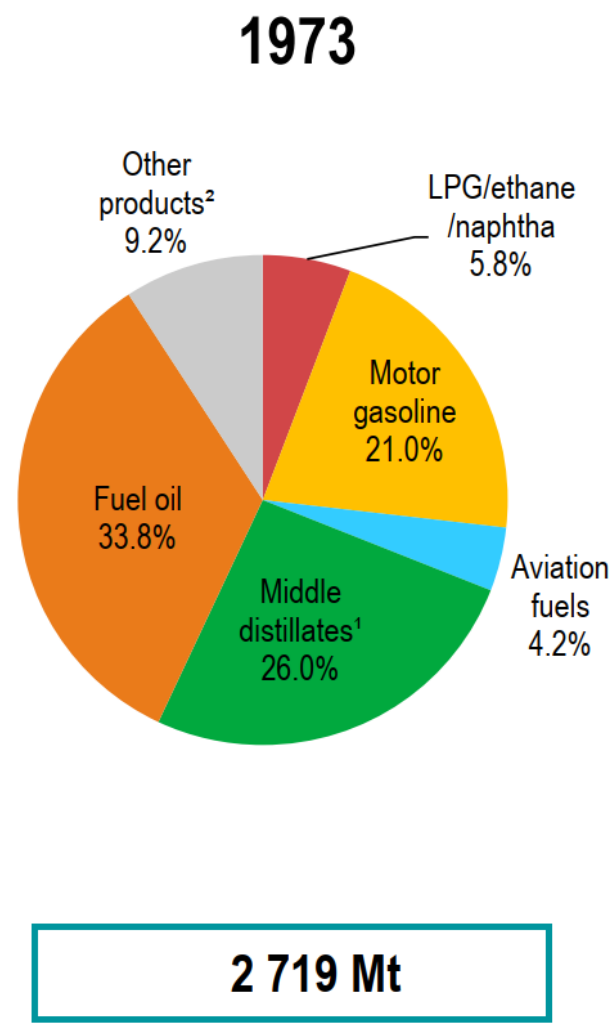
High Complexity: Coking / Reside Destruction



Global Oil Demand by Product

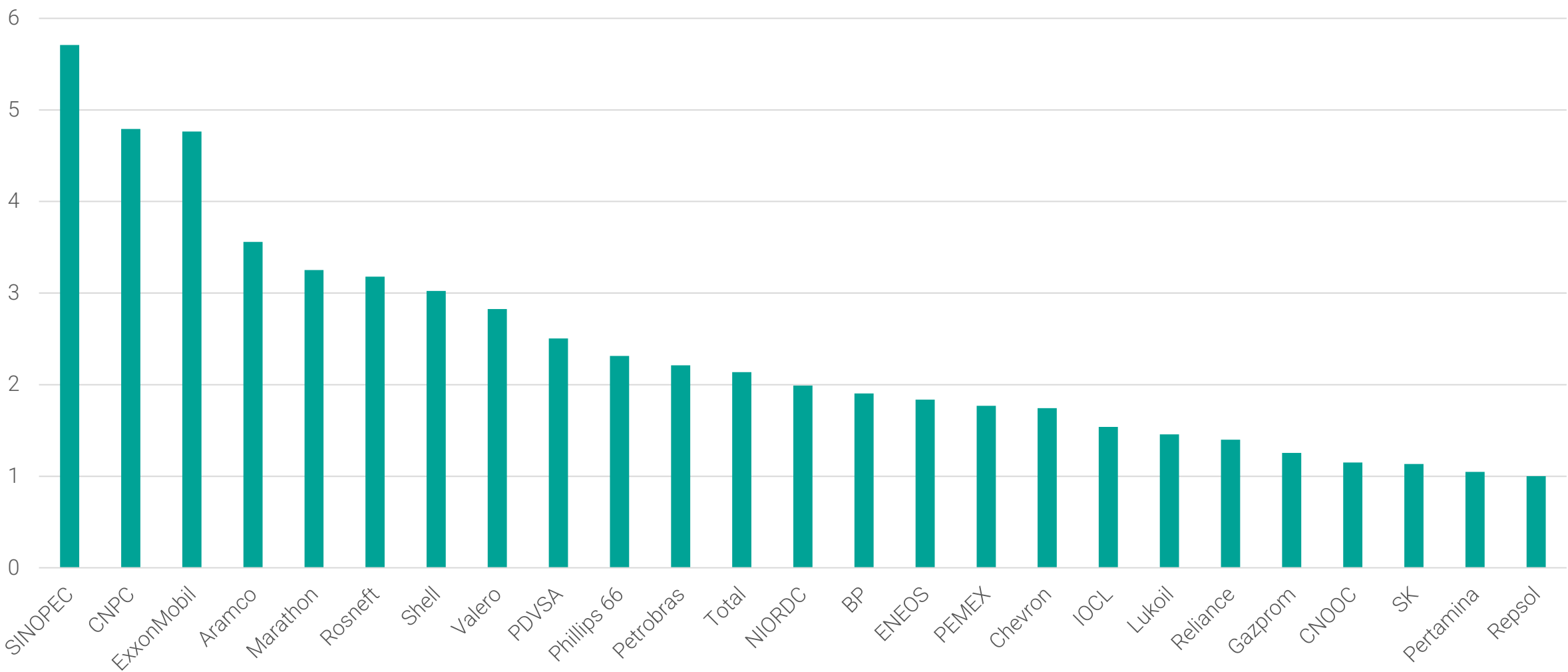


Refinery Output by Product

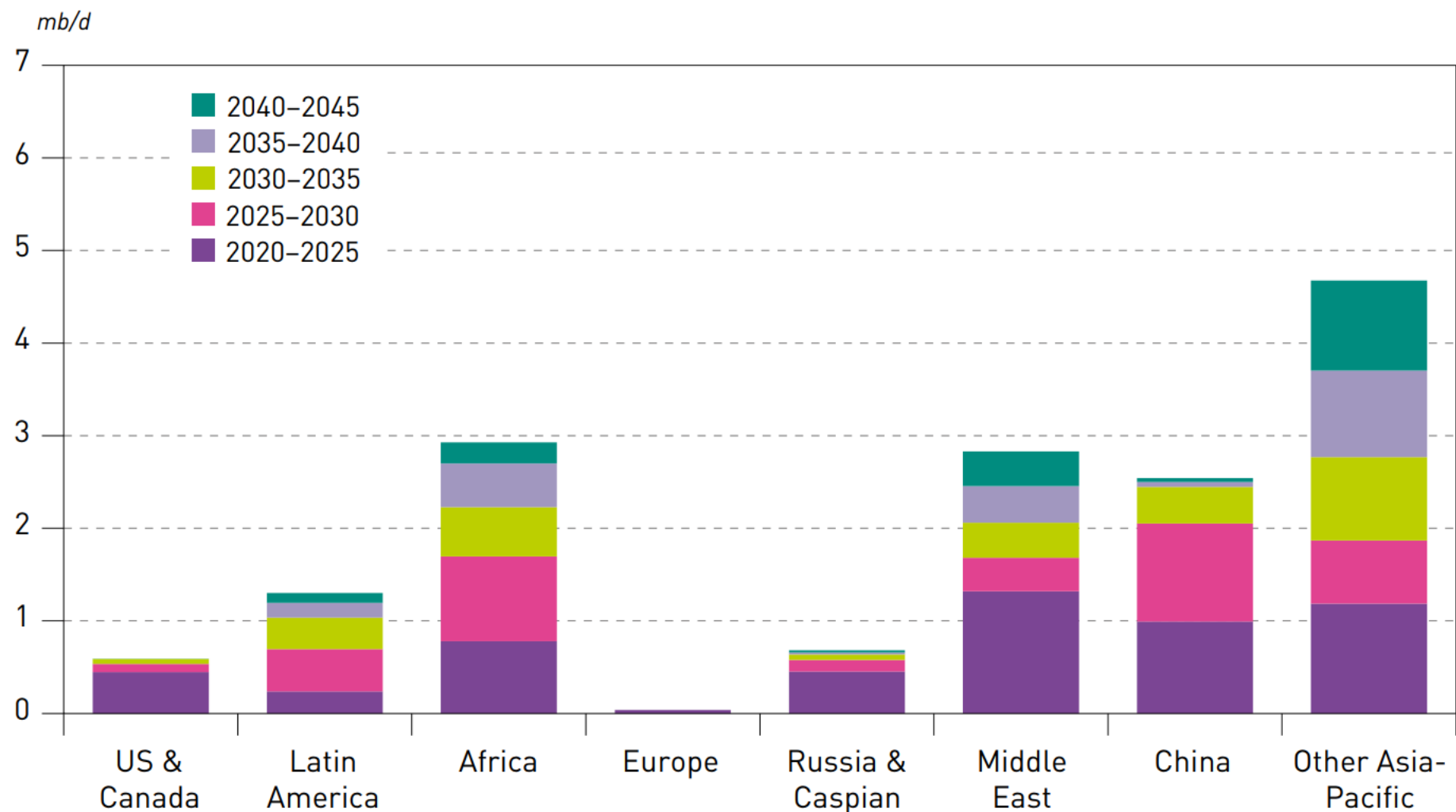


IEA Key World Energy Statistics 2021

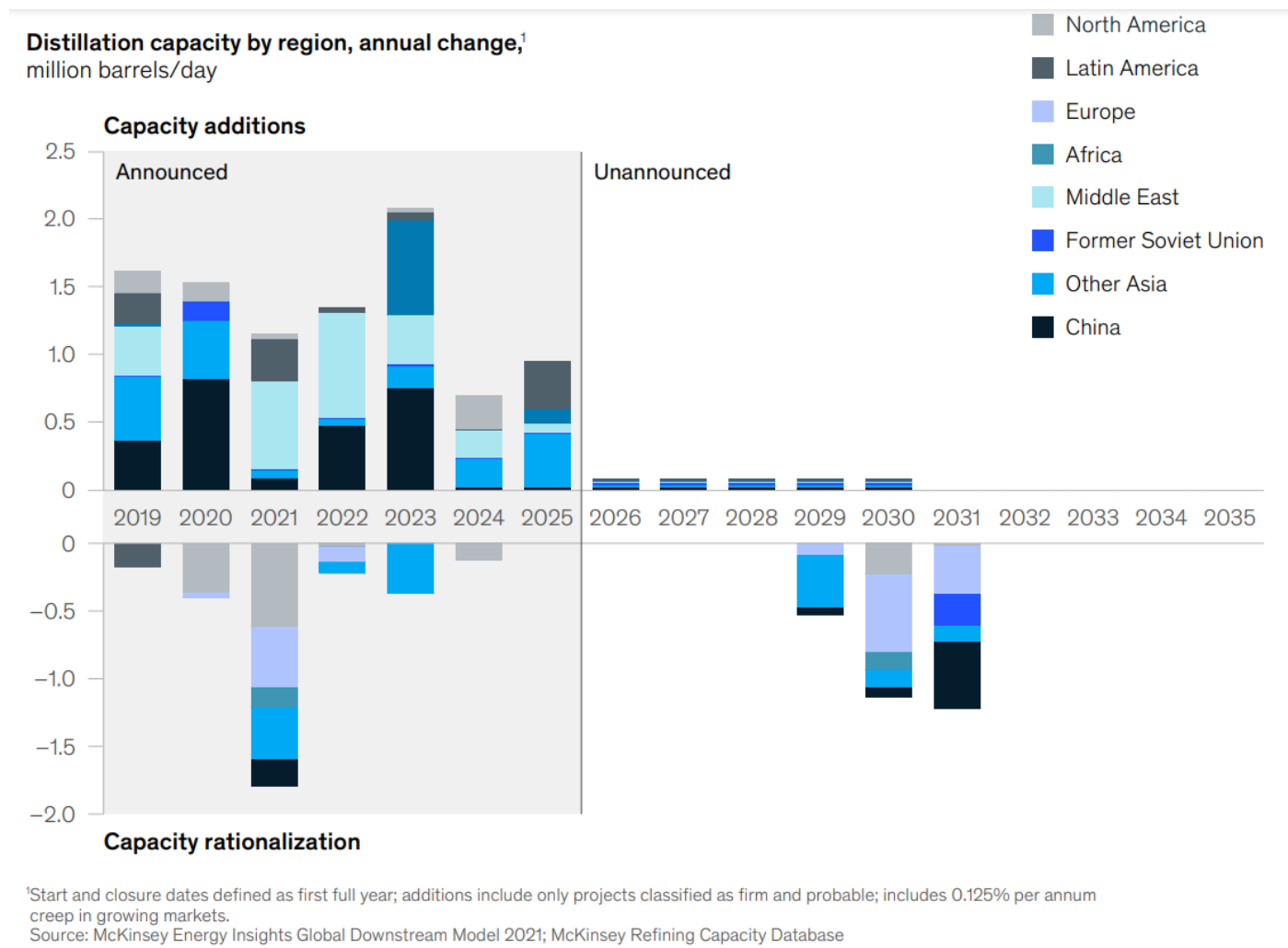
Top Refining Companies by Capacity (MBPD)



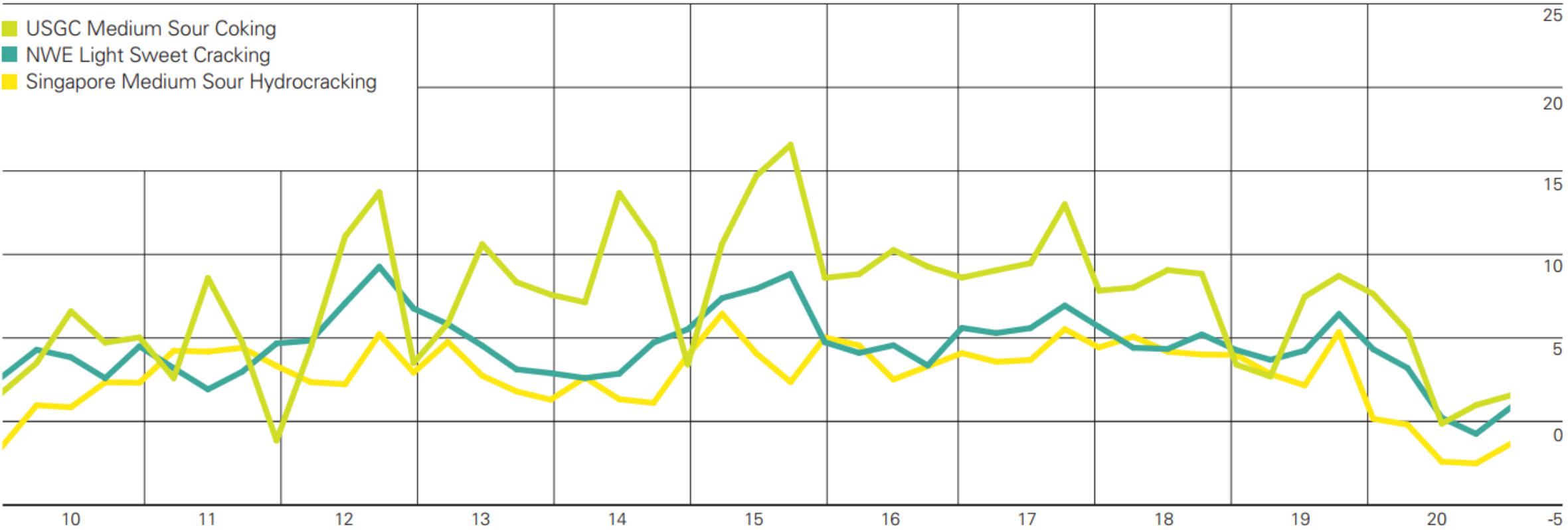
Distillation Capacity Additions (2019–2045)



Distillation Capacity by Region, Annual Change

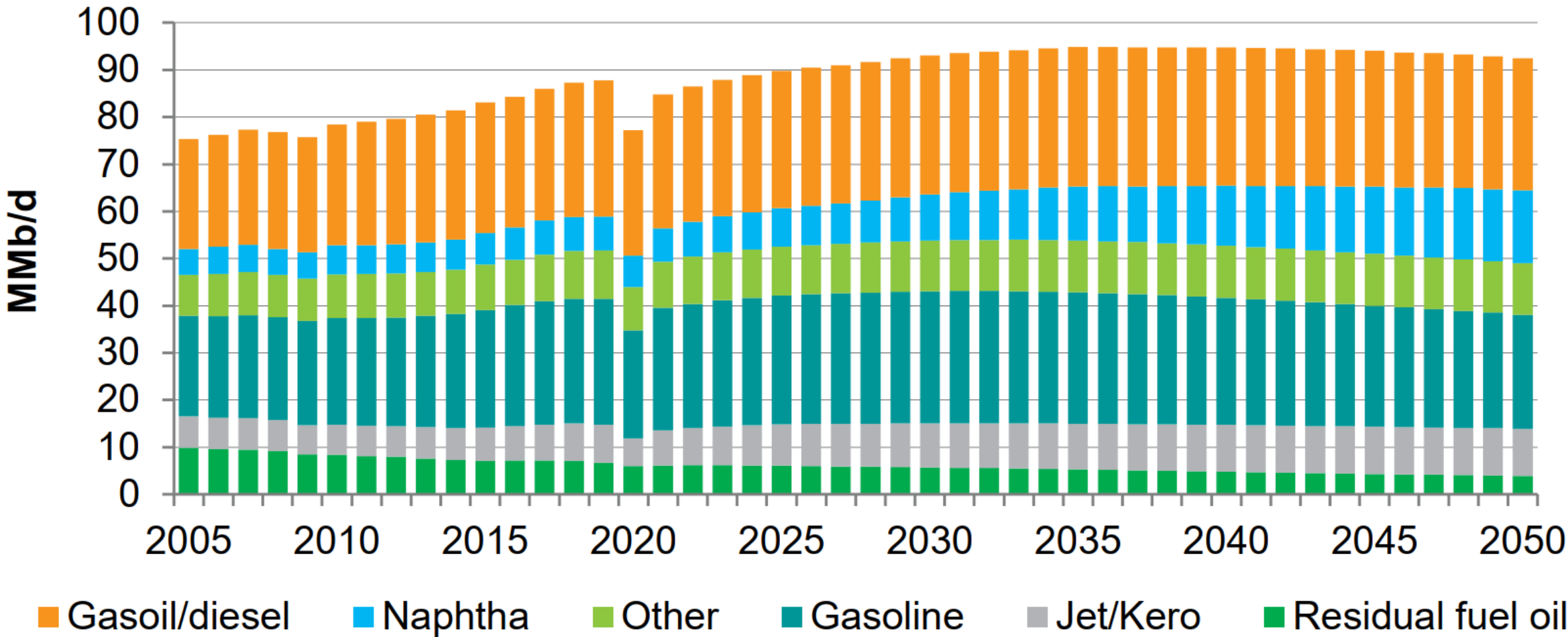


Refining Margins by Region

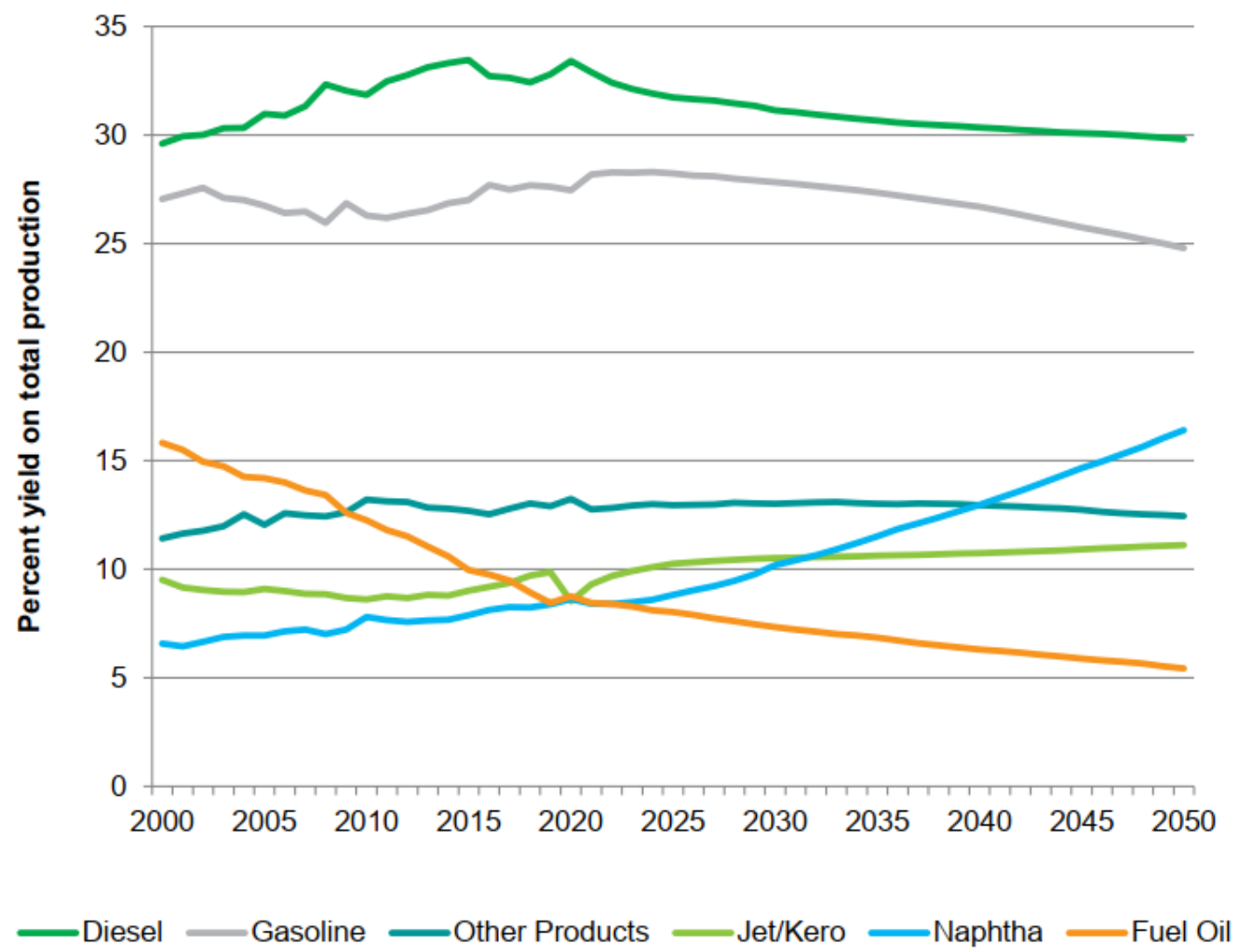


Note: The refining margins presented are benchmark margins for three major global refining centres. US Gulf Coast (USGC), North West Europe (NWE – Rotterdam) and Singapore. In each case they are based on a single crude oil appropriate for that region and have optimized product yields based on a generic refinery configuration (cracking, hydrocracking or coking), again appropriate for that region. The margins are on a semi-variable basis, i.e. the margin after all variable costs and fixed energy costs.

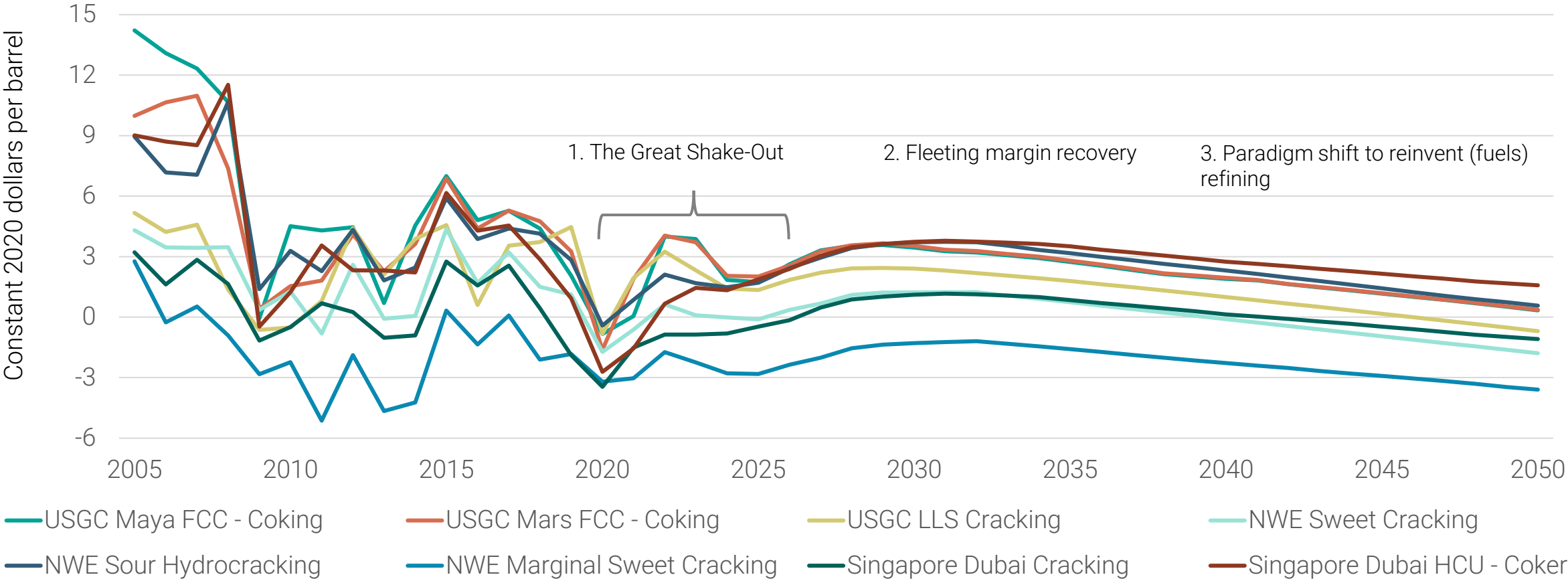
World Refined Product Demand



World Refinery Yields



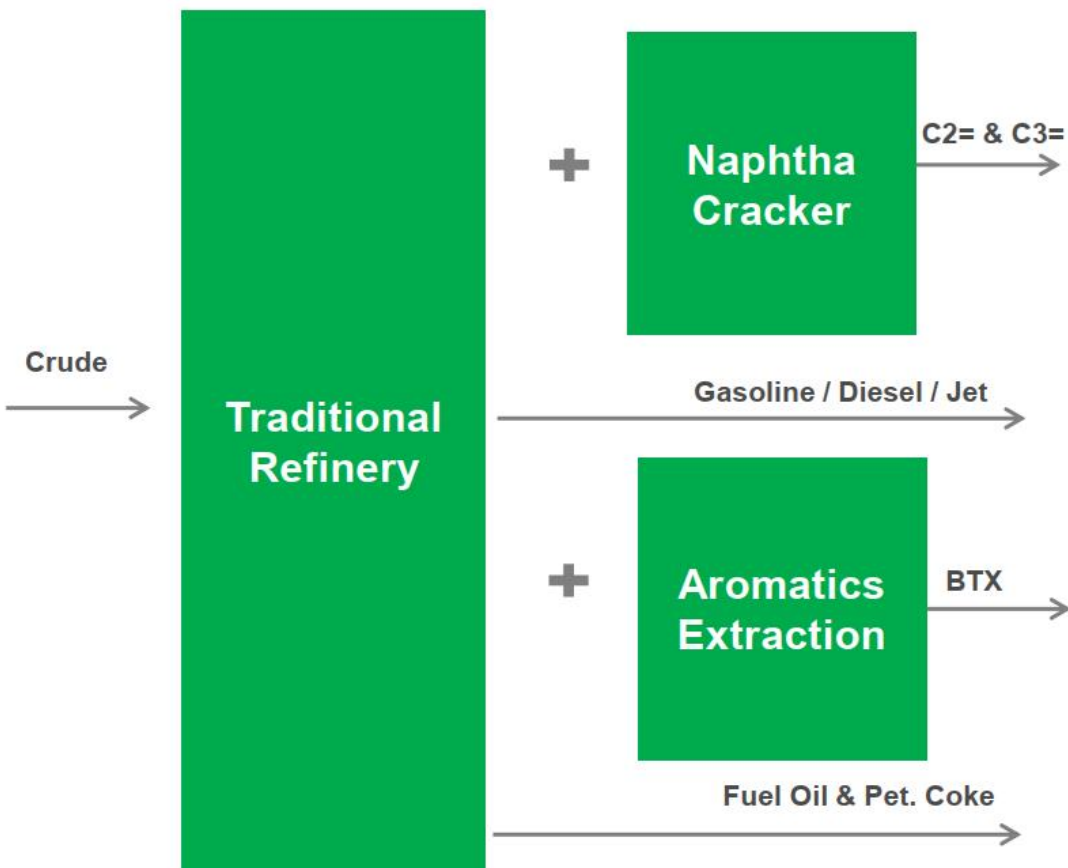
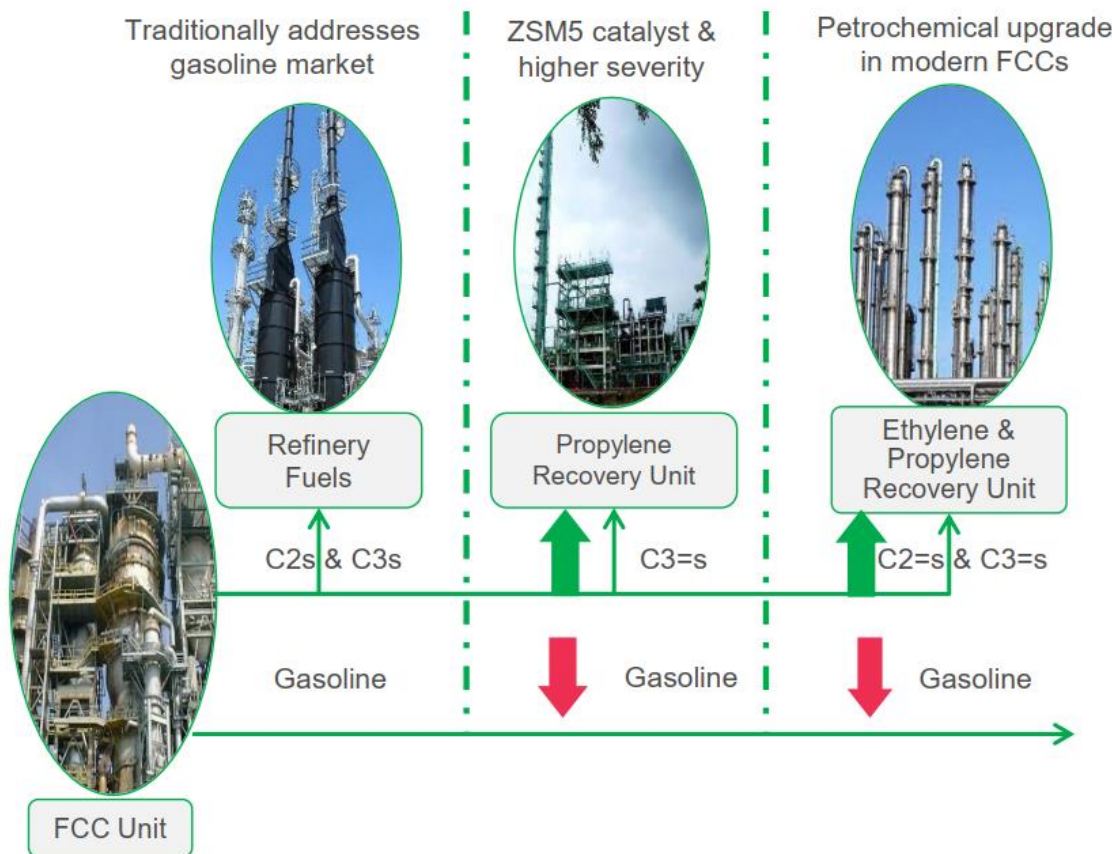
Long-term Benchmark Margin Outlook (USGC Margins Include RIN Costs)



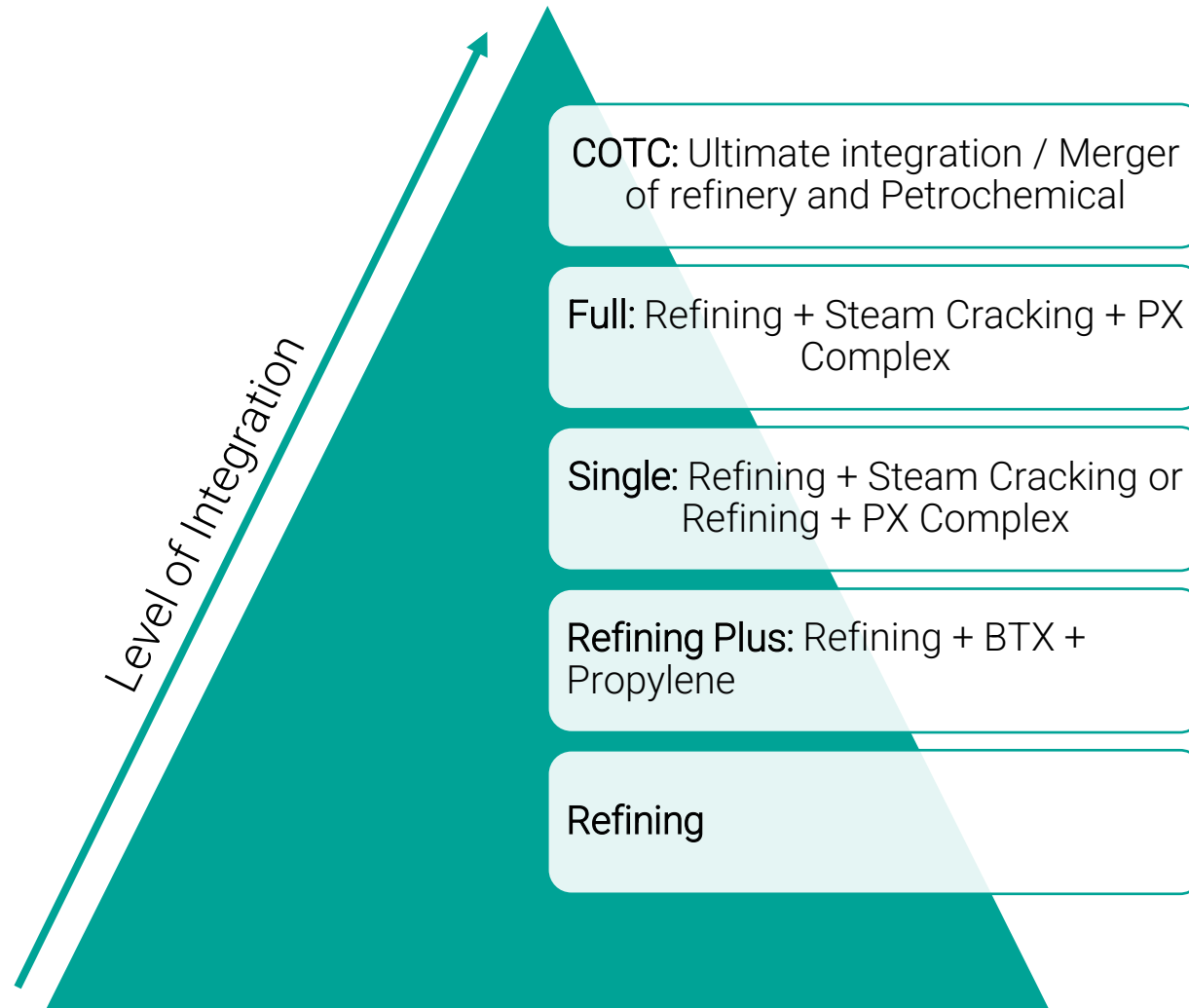
Refining Petrochemical Integration

“Re-inventing” the FCC can potentially be the first move

Long term plan to “bolt-on” petrochemical production



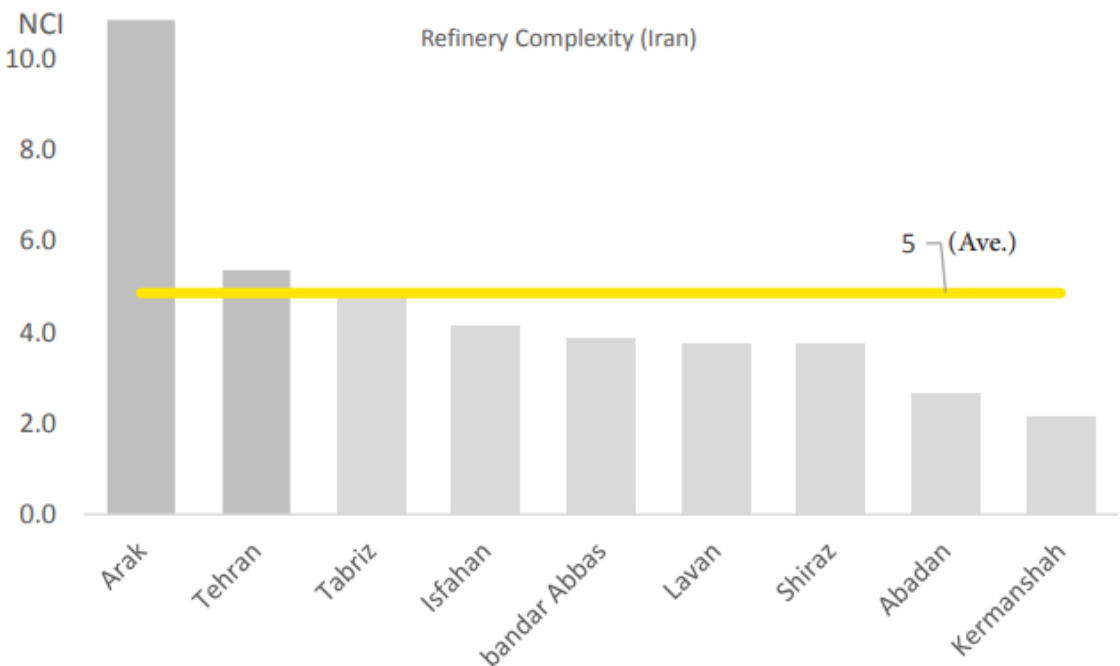
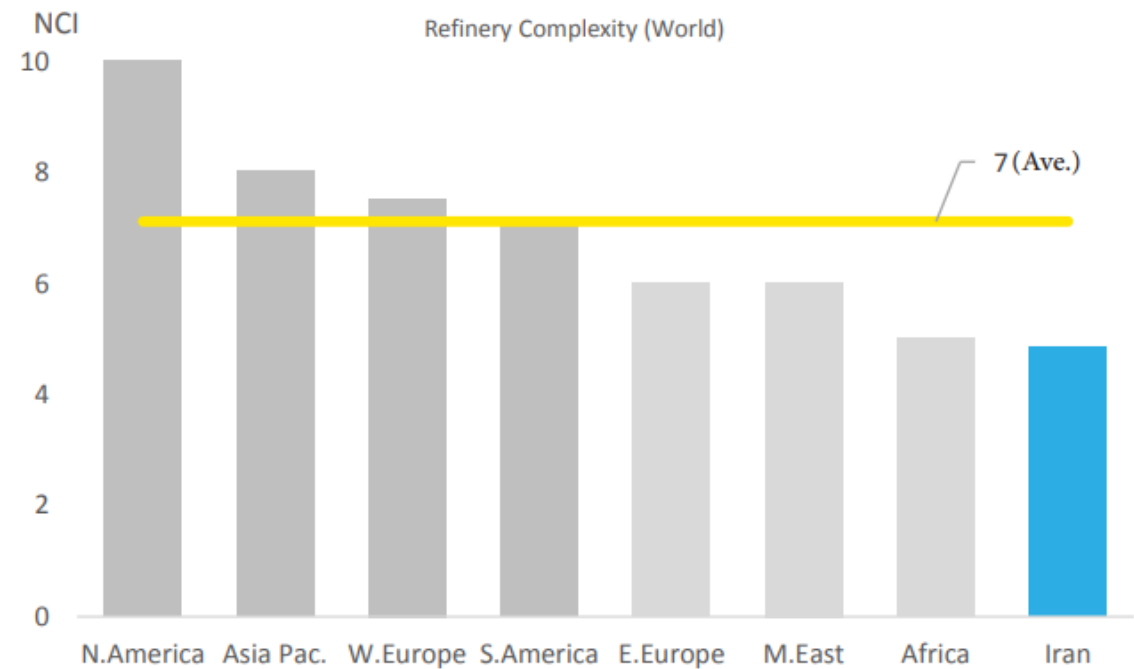
COTC Configures a Refinery to Produce Maximum Chemicals



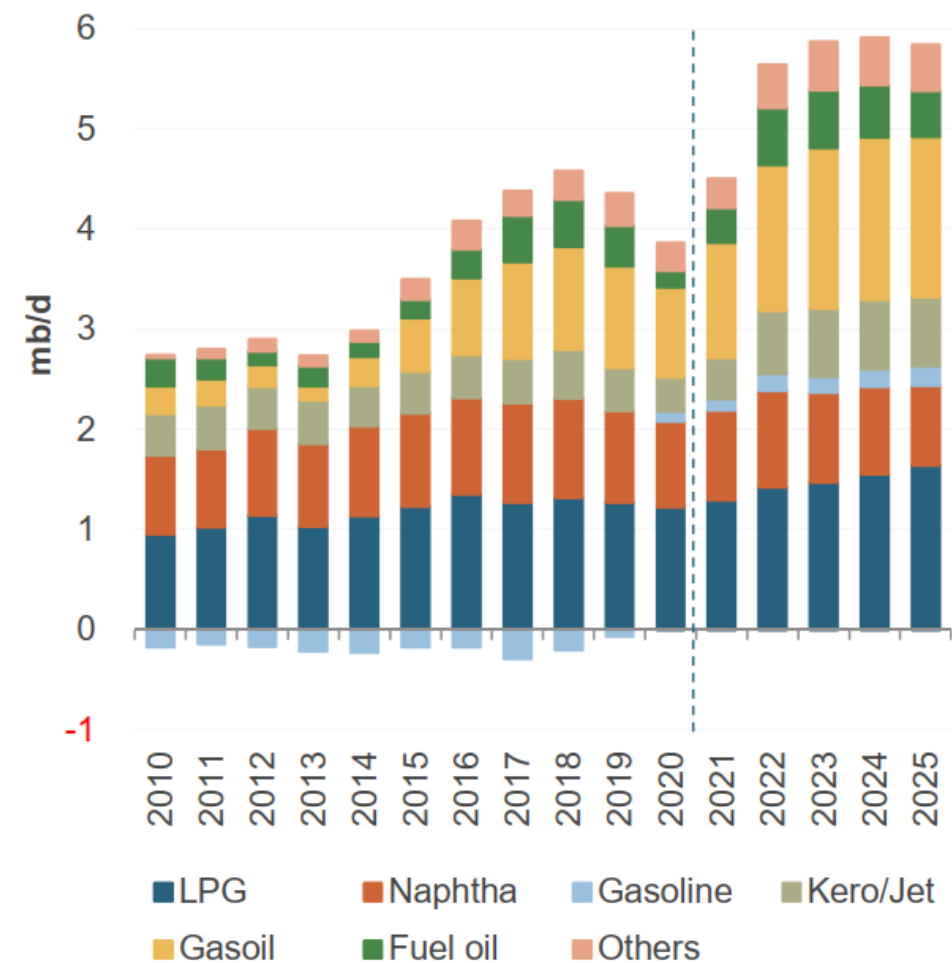
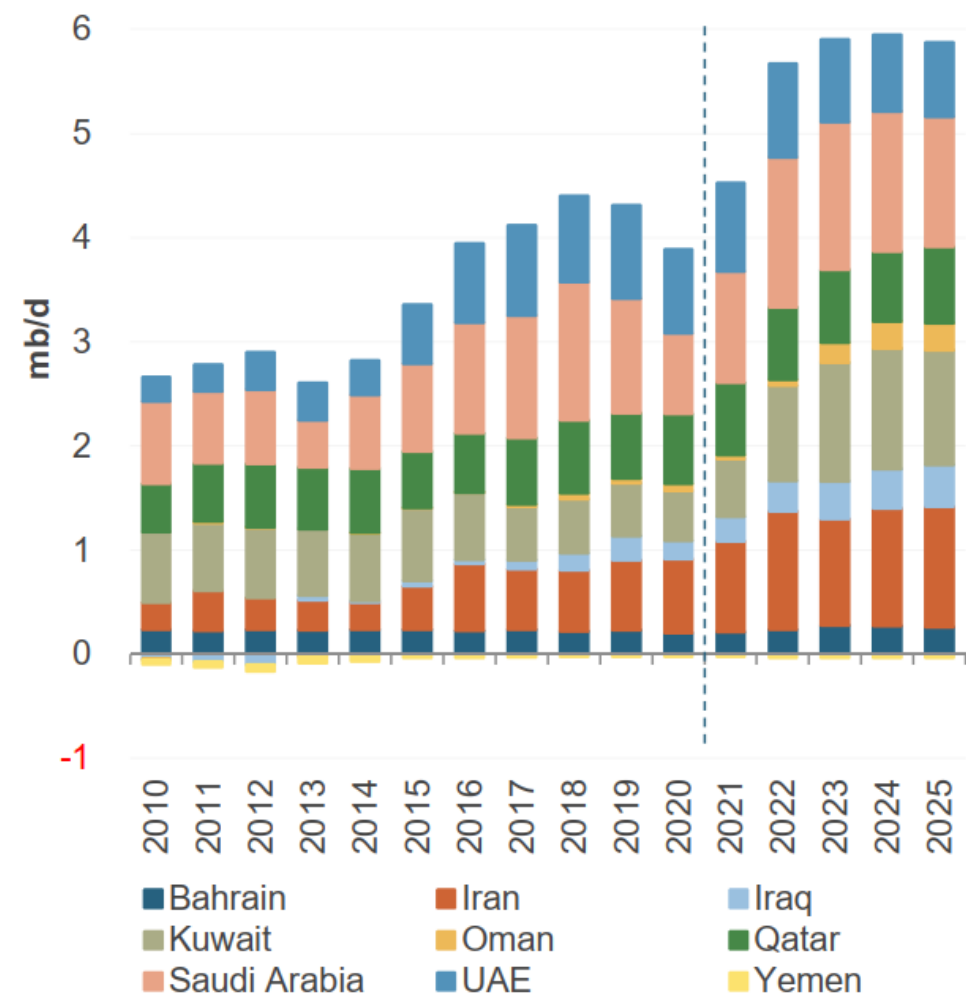
COTC Projects (2019)

Project	Refinery Capacity (MMTPA)	P-Xylene Capacity (MMTPA)	Olefin Capacity (MMTPA)	Est. Chemical conversion/ bbl of oil (%)	Investment (\$bn)	Start Trial Operation
Hengli Petrochemical	20	4.3	1.5	42	11.4	Dec 2018
Zhejiang Petroleum and Chemical (ZPC) Phase 1	20	4.0	1.4	45	12	Est. Q2 2019
Hengyi (Brunei) PMB Refinery-Petrochem	8	1.5	0.5	>40	3.45	Est. 2019
Zhejiang Petroleum and Chemical (ZPC) Phase 2	20	4.8*	1.2	50*	12	Est. 2021
Shenghong refinery and Integrated Petrochem	16	2.8	1.1	60**	11.0	H2** 2021
Aramco/SABIC JV	20	--	3.0	45	20	2025

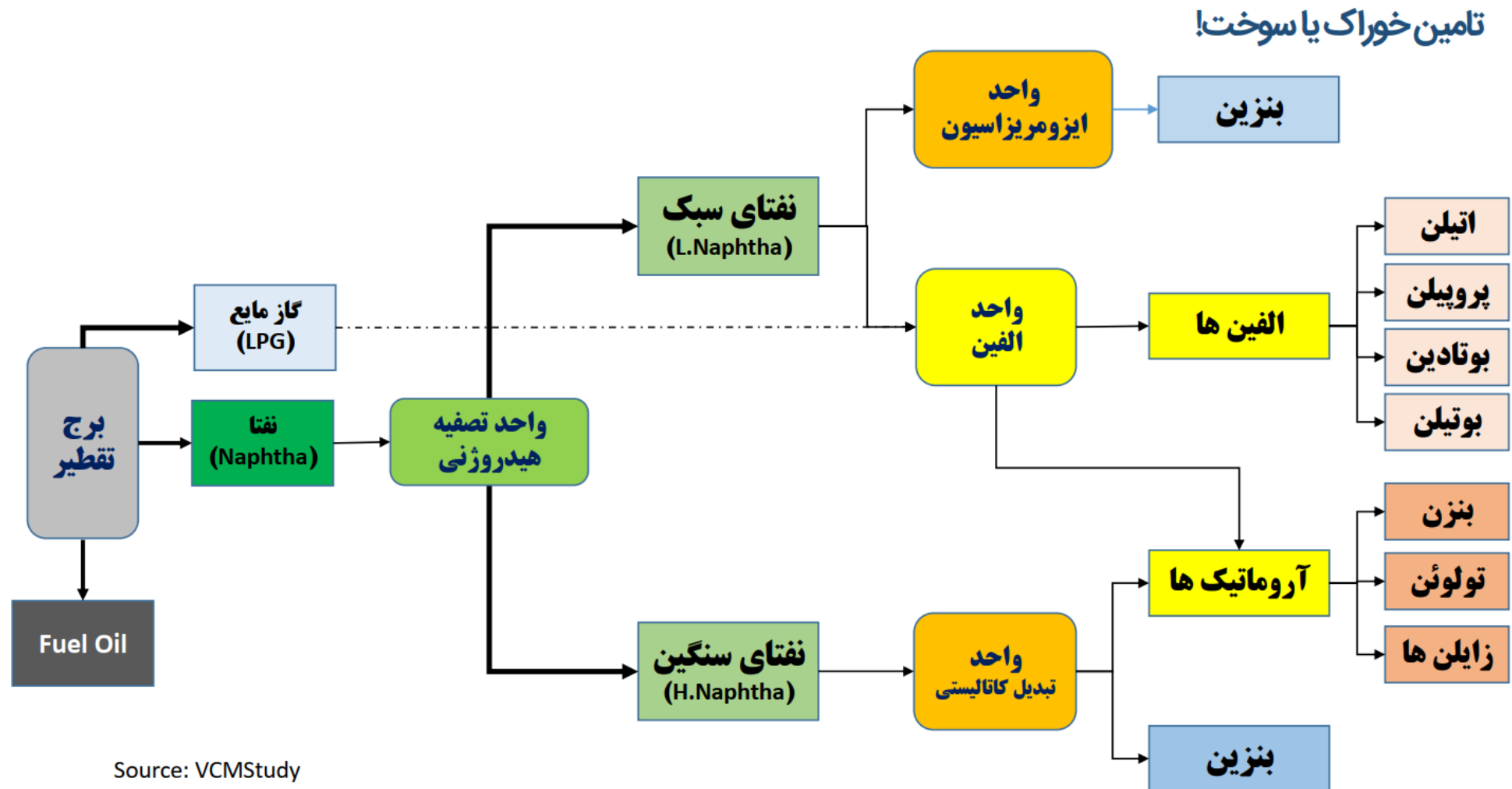
Nelson Complexity Index of Iran Refineries



Middle East Products Net Exports



Iran Refineries: Fuel or Feed

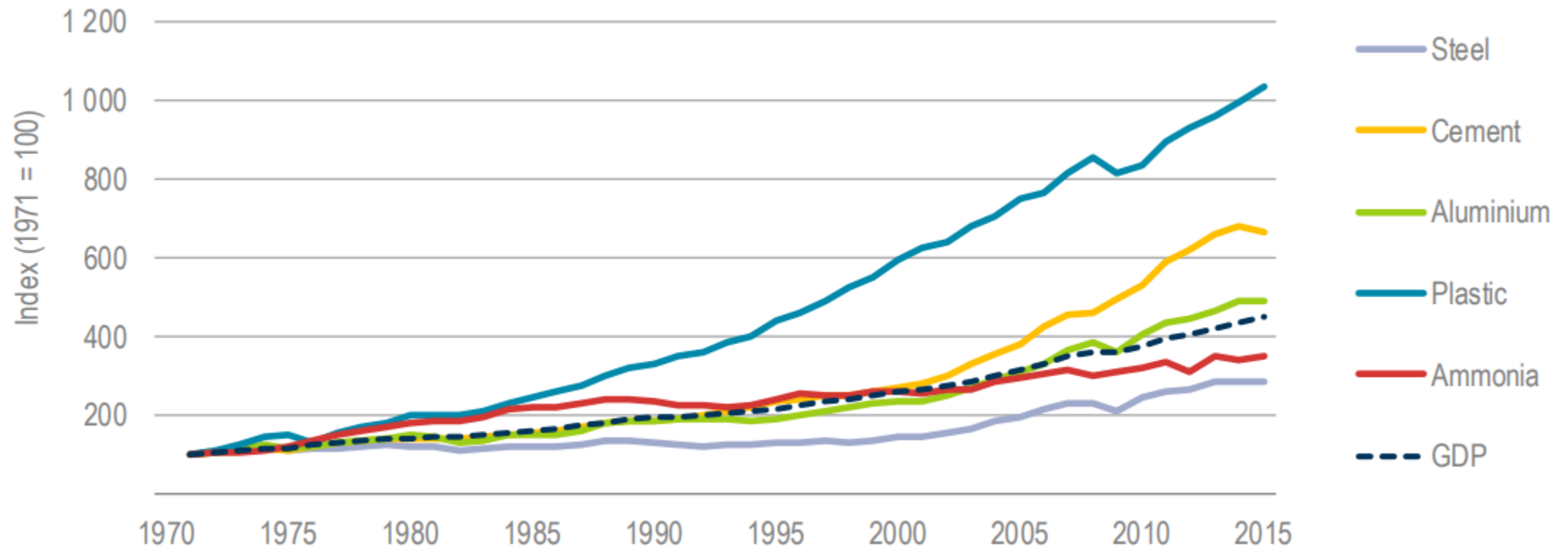


Source: VCMStudy

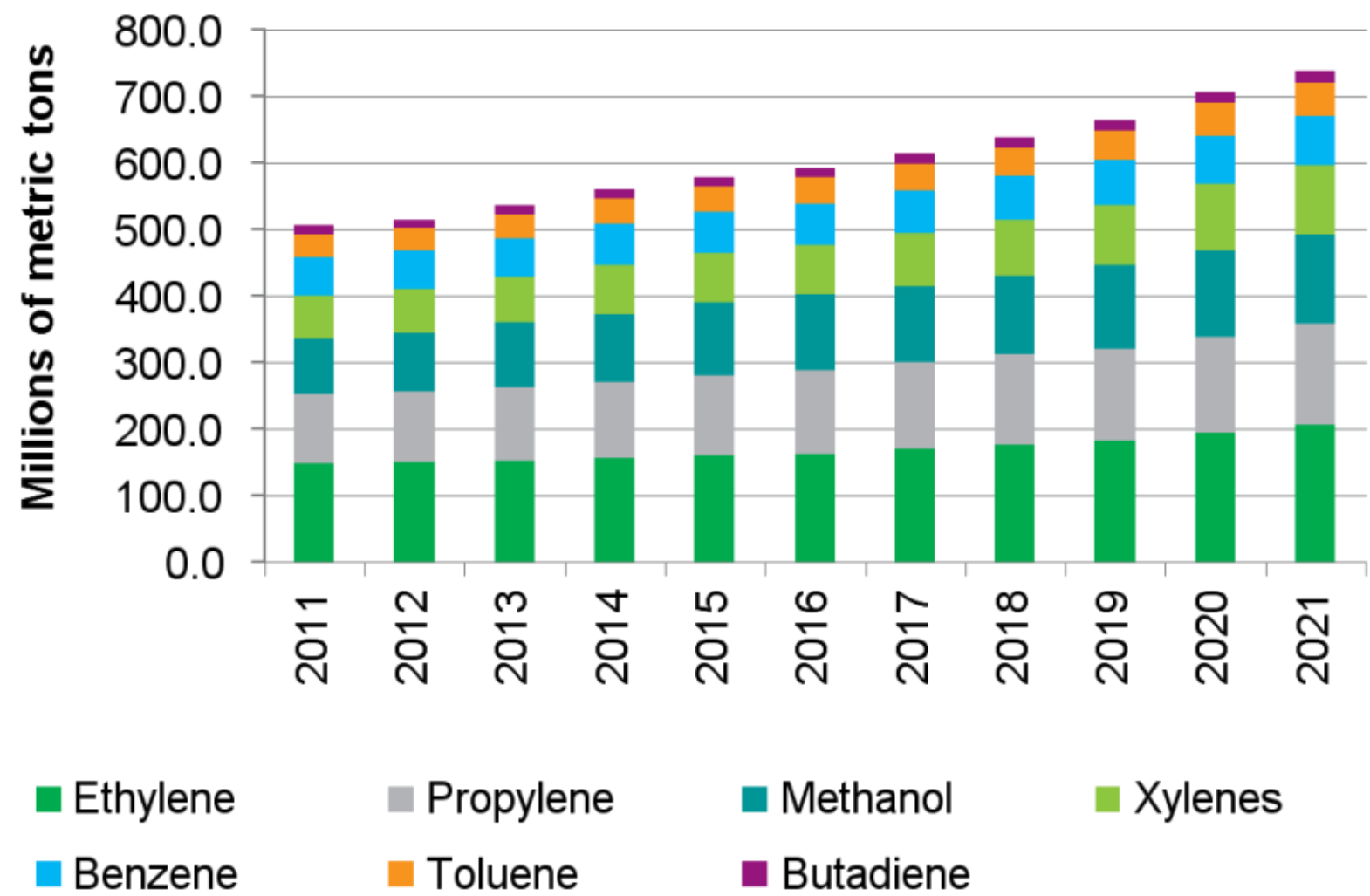
Oil Demand in the Petrochemical Sector

	2019	2020	2025	2030	2035	2040	2045	Growth 2019–2045
OECD Americas	3.5	3.2	3.8	4.1	3.9	3.7	3.5	0.1
OECD Europe	1.9	1.7	1.8	1.8	1.7	1.6	1.5	–0.4
OECD Asia Oceania	2.1	1.9	2.0	2.0	2.0	2.0	2.0	–0.1
OECD	7.4	6.9	7.6	8.0	7.7	7.4	7.0	–0.4
Latin America	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.1
Middle East & Africa	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
India	0.4	0.4	0.5	0.7	0.9	1.0	1.1	0.7
China	1.9	1.8	2.1	2.2	2.4	2.6	2.7	0.8
Other Asia	1.3	1.3	1.5	1.7	1.9	2.0	2.1	0.8
OPEC	1.2	1.2	1.4	1.7	2.2	2.5	2.7	1.5
Russia	0.9	0.9	1.1	1.1	1.1	1.1	1.1	0.1
Other Eurasia	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0
Non-OECD	6.2	6.0	7.1	8.0	9.0	9.7	10.3	4.1
World	13.7	12.9	14.7	15.9	16.7	17.0	17.3	3.7

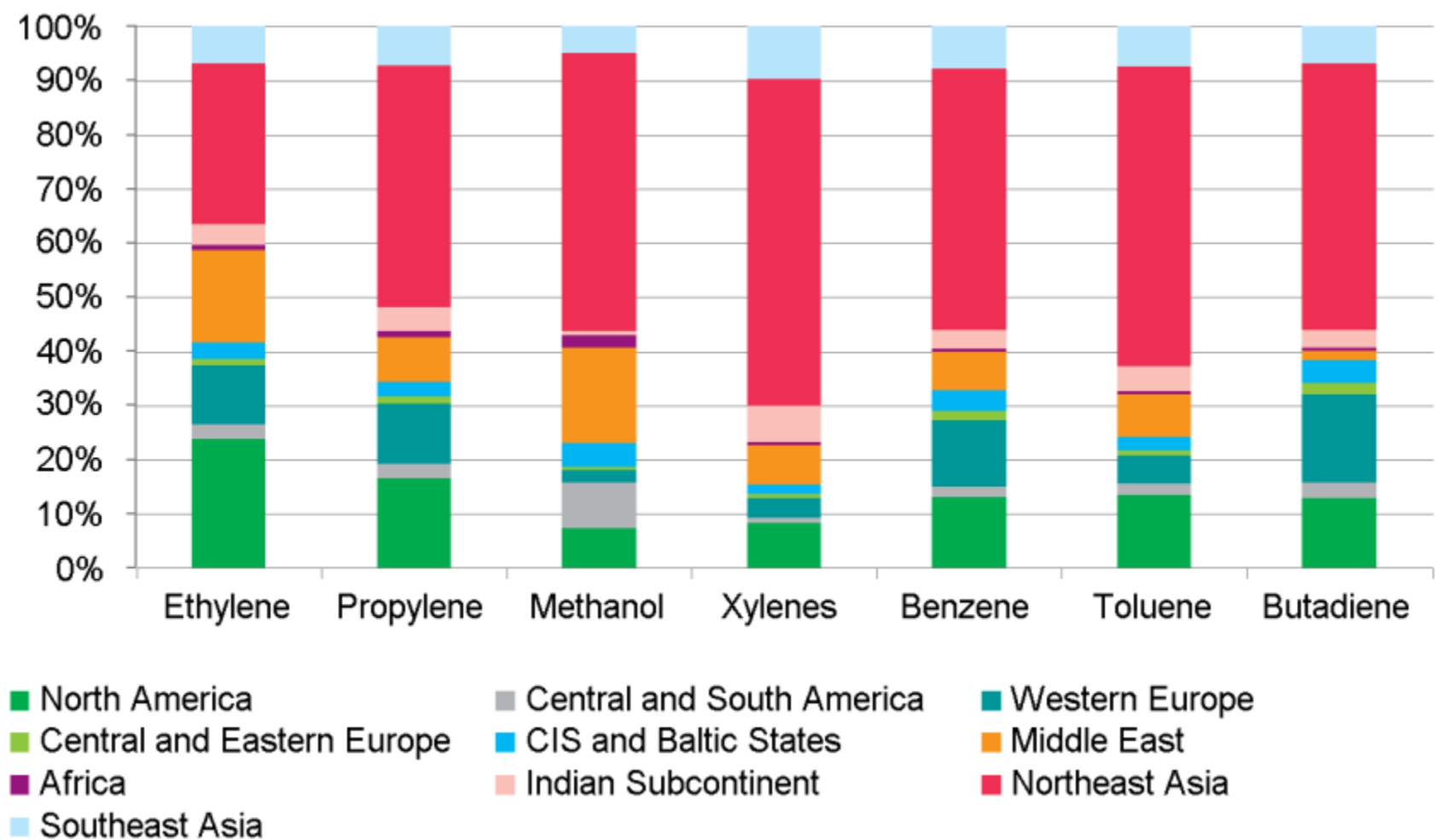
Production Growth for Selected Bulk Materials and GDP



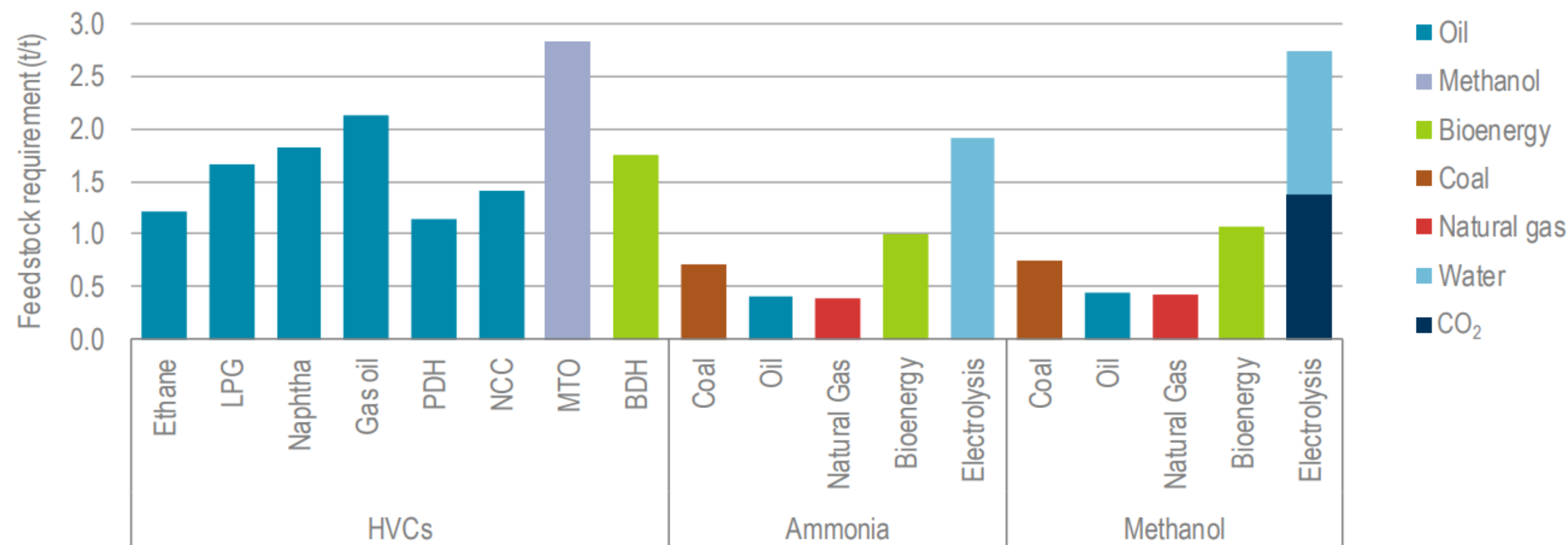
World Capacity for Primary Petrochemicals



Regional Share of Capacity for Primary Petrochemicals

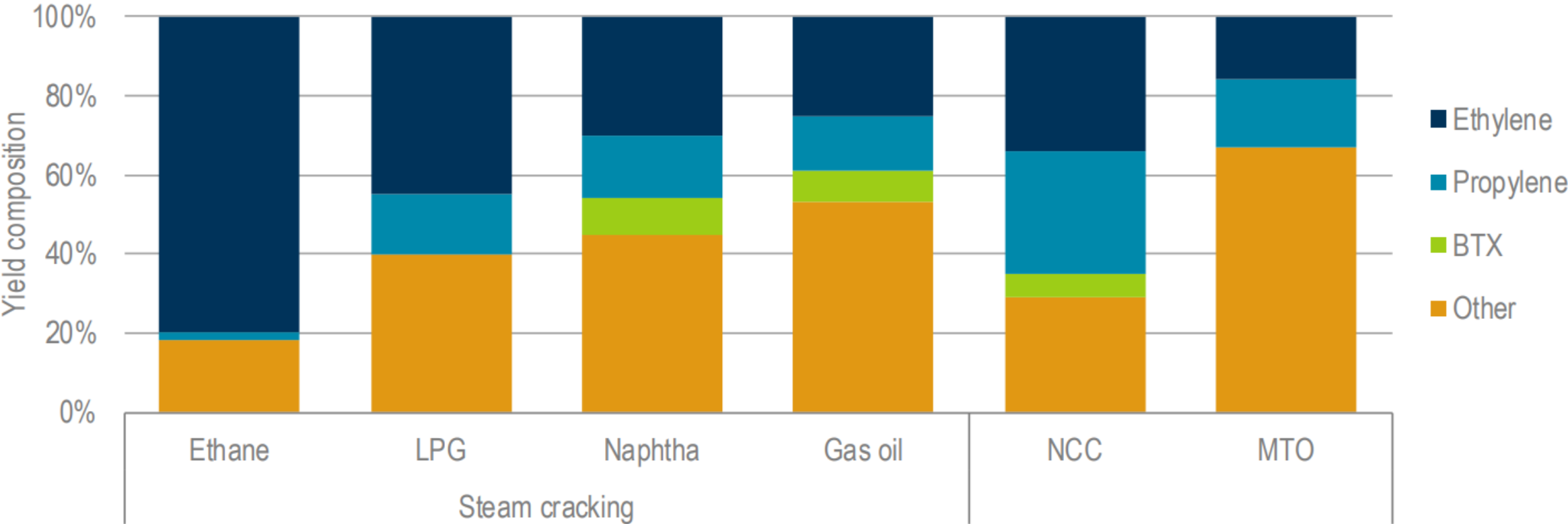


Feedstock Options by Chemical Product

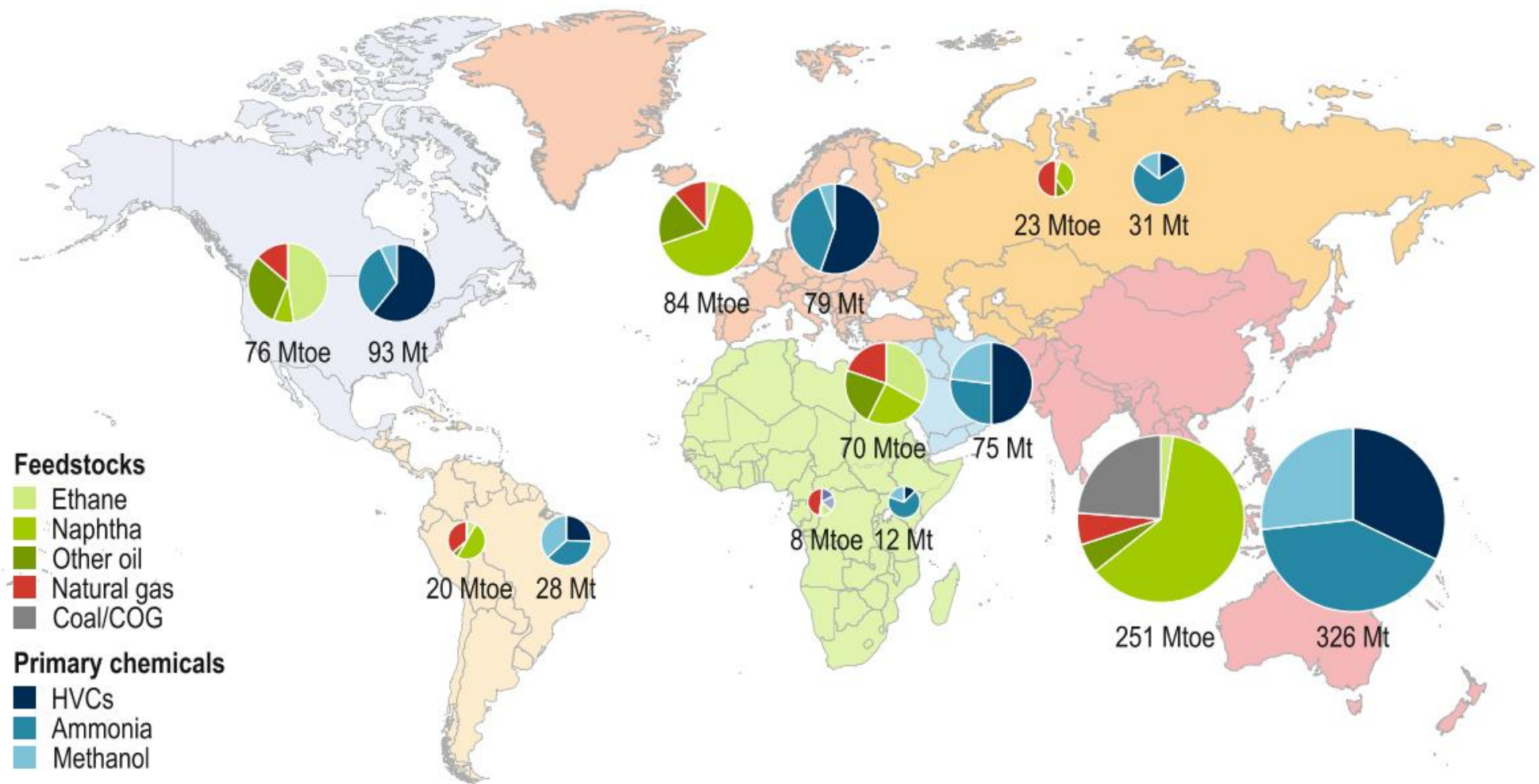


Notes: BDH = bioethanol dehydration; LPG = liquefied petroleum gas; NCC = naphtha catalytic cracking. The quantity pertaining to BDH is in terms of bioethanol.

Yield of Individual HVCs in Multi-product Processes

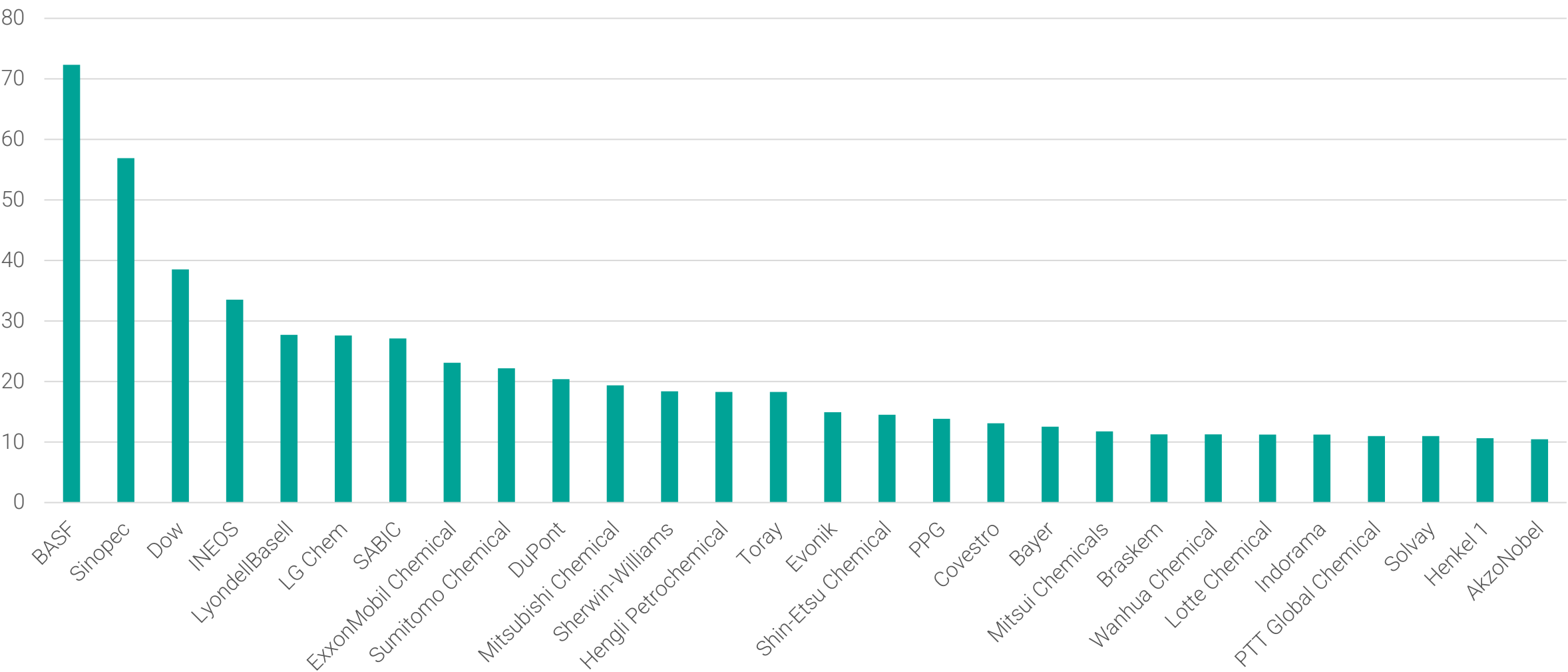


Primary Feedstock Use and Chemical Production by Region



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

The ICIS Top 100 Chemical Companies 2020 (\$B)



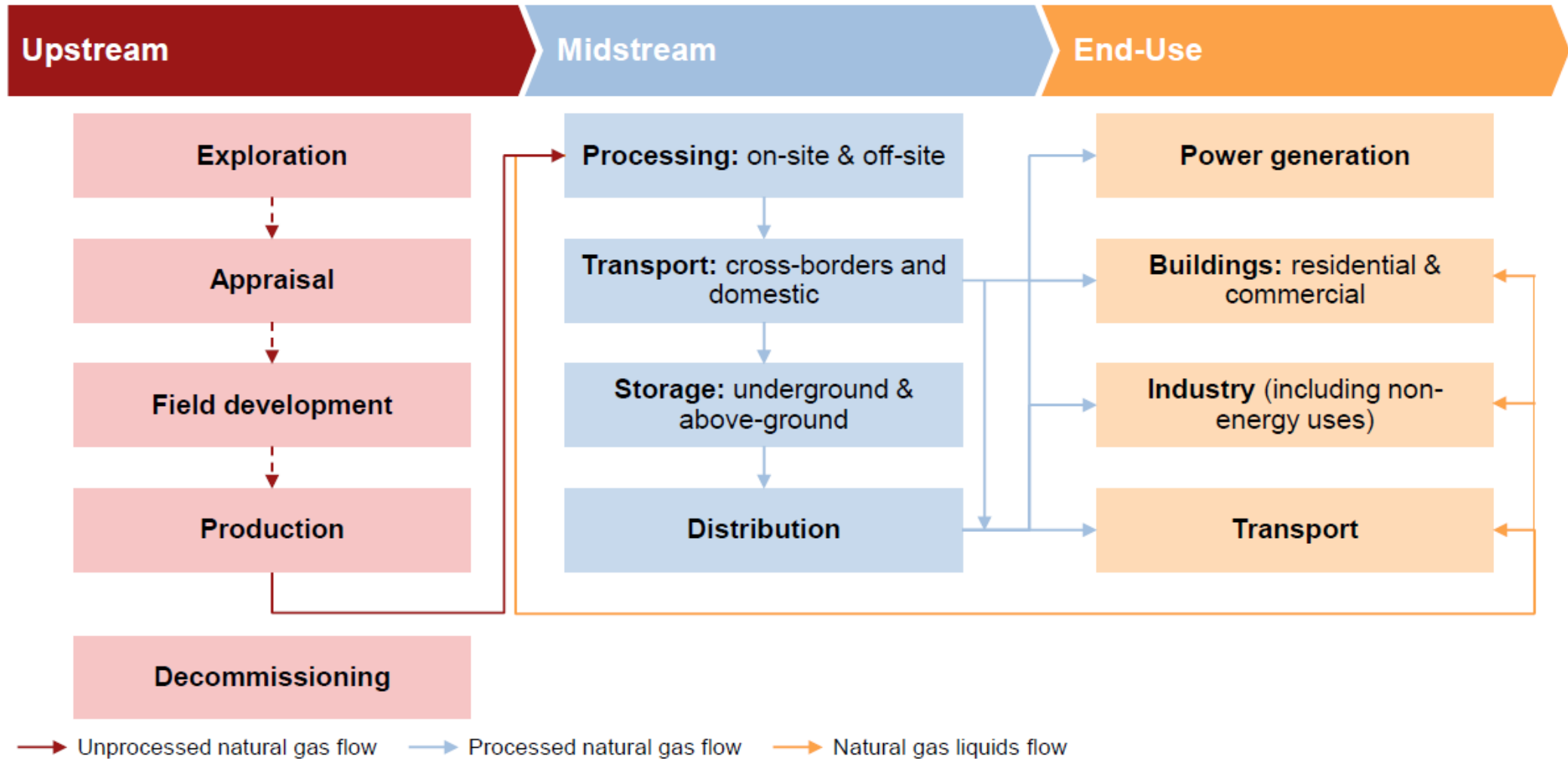
The ICIS Top 100 Chemical Companies 2020

Rank 2019	Company	Sales 2019% change		Operating profit 2019% change		Net income 2019% change		Total Assets 2019% change		R&D 2019% change		Capex 2019% change		Employees 2019% change	
\$m, change in reporting currencies															
1	BASF	66,594	-1.5	4,549	-32.2	9,454	78.9	97,619	0.5	2,423	8.2	4,310	6.2	132,061	-3.9
2	Sinopec ²	63,244	-6.9	2,463	-36.5	-	-	-	-	-	-	-	-	-	-
3	Dow ¹	42,951	-13.4	-395	-	-1,272	-	60,524	-27.7	765	-4.4	1,961	-6.2	36,500	-32.4
4	LyondellBasell	34,727	-11.0	4,116	-21.3	3,397	-27.6	30,435	7.6	111	-3.5	2,694	28.0	19,100	-1.8
5	SABIC ²	32,488	-19.0	3,680	-59.1	-	-	74,933	-3.2	-	-	-	-	-	-
6	INEOS ²	32,103	-8.6	2,485	-39.0	-	-	-	-	-	-	-	-	23,015	13.9
7	ExxonMobil ²	27,416	-15.5	-	-	592	-82.3	-	-	-	-	1,933	29.4	-	-
8	LG Chem	24,793	1.6	776	-60.1	326	-75.2	29,470	17.6	949	8.7	1,793	1.4	-	-
9	DuPont ¹	21,512	-4.8	194	-70.4	498	-87.0	69,396	-63.1	955	-10.7	1,492	19.9	35,000	-
10	Sumitomo Chemical ³	20,480	-4.0	1,265	-24.8	501	-64.3	33,588	15.1	-	-	1,108	-31.1	-	-

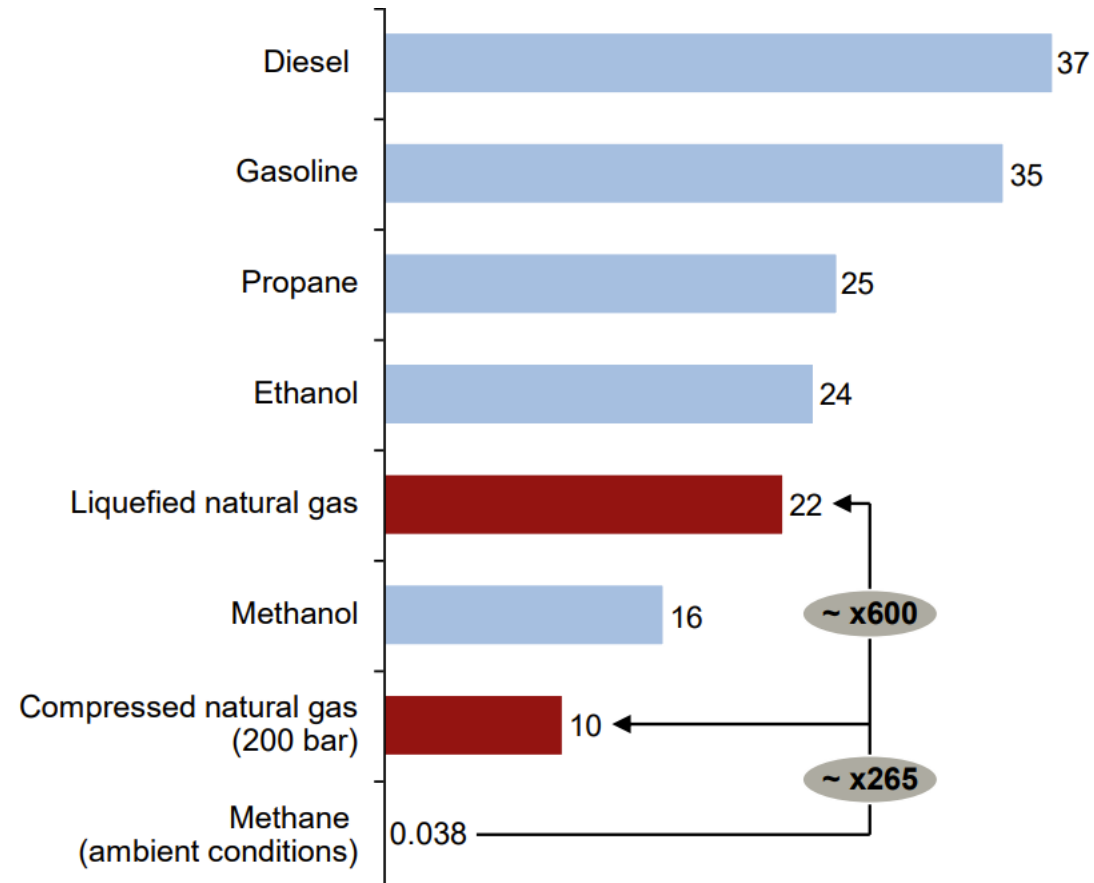
Gas and LNG

To Provide a comprehensive review of gas and LNG markets

Natural Gas Value Chain

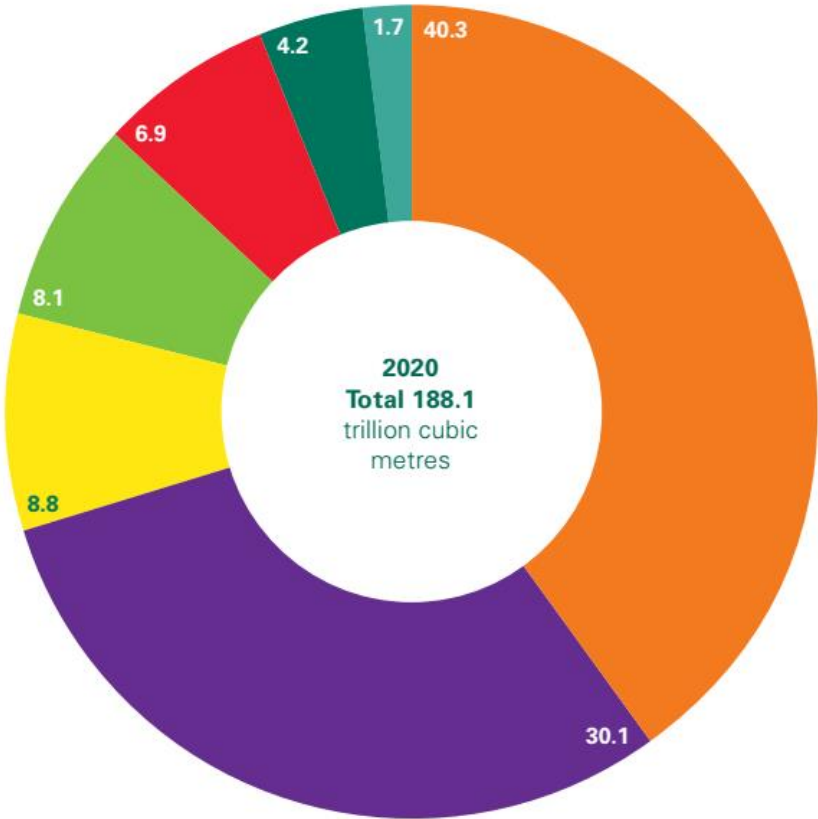
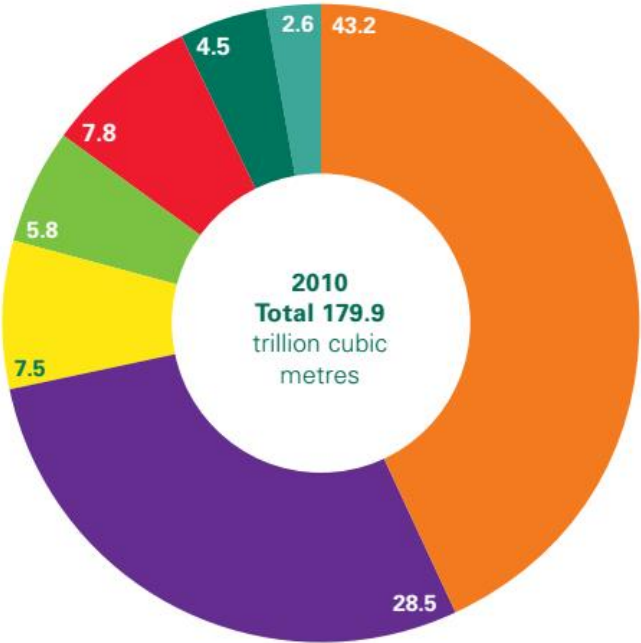
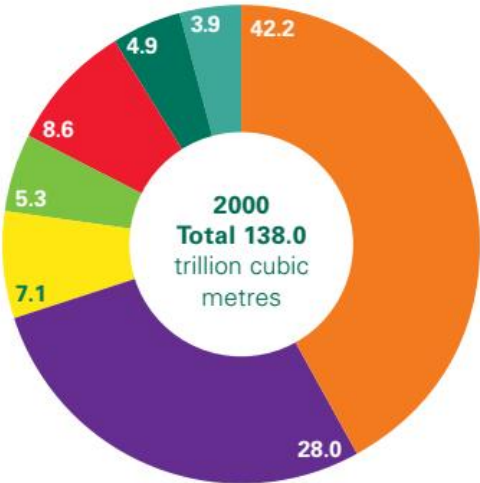


Volumetric energy density of chemical fuels (MJ/liter)



Distribution of Proved Reserves

- Middle East
- CIS
- Asia Pacific
- North America
- Africa
- S. & Cent. America
- Europe

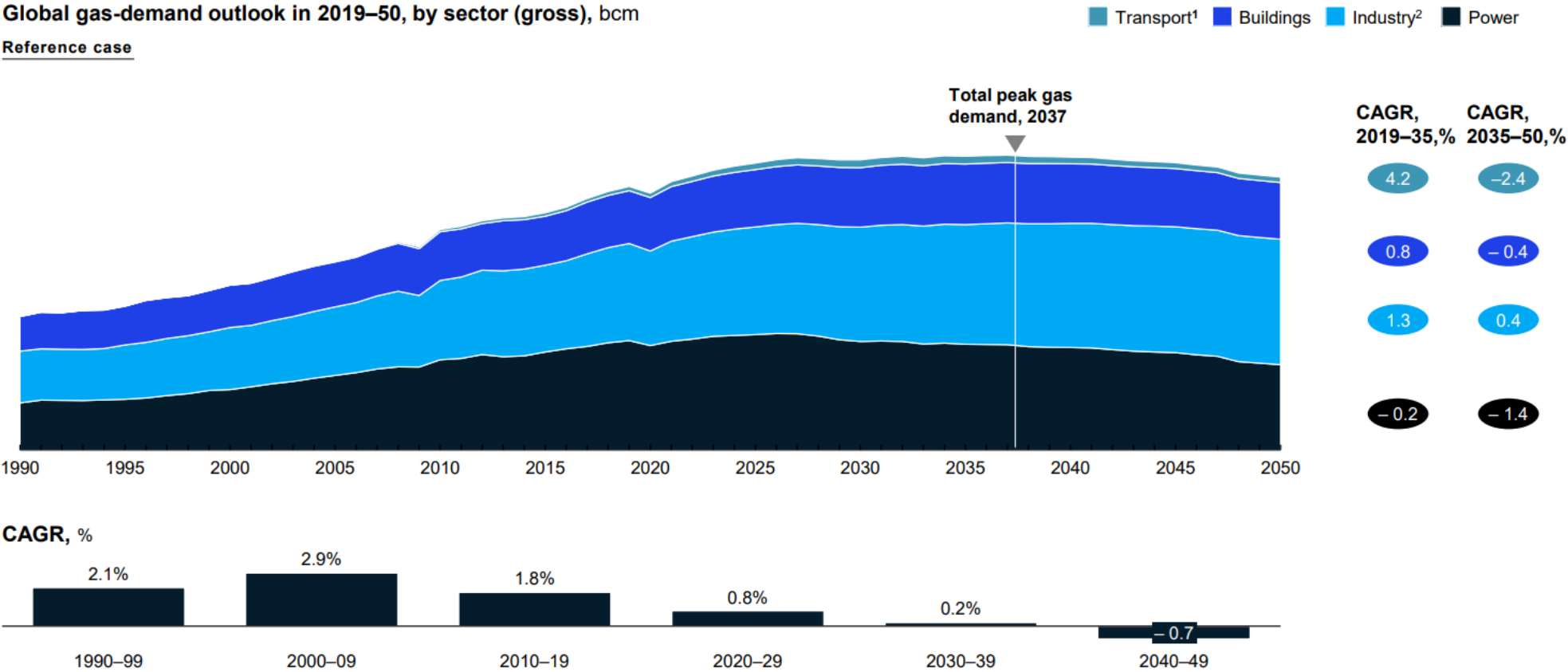


Global Gas-demand Outlook by Sector

In the 2021 Global Energy Perspective reference case, gas demand peaks in 2037 but will decline slowly afterward.

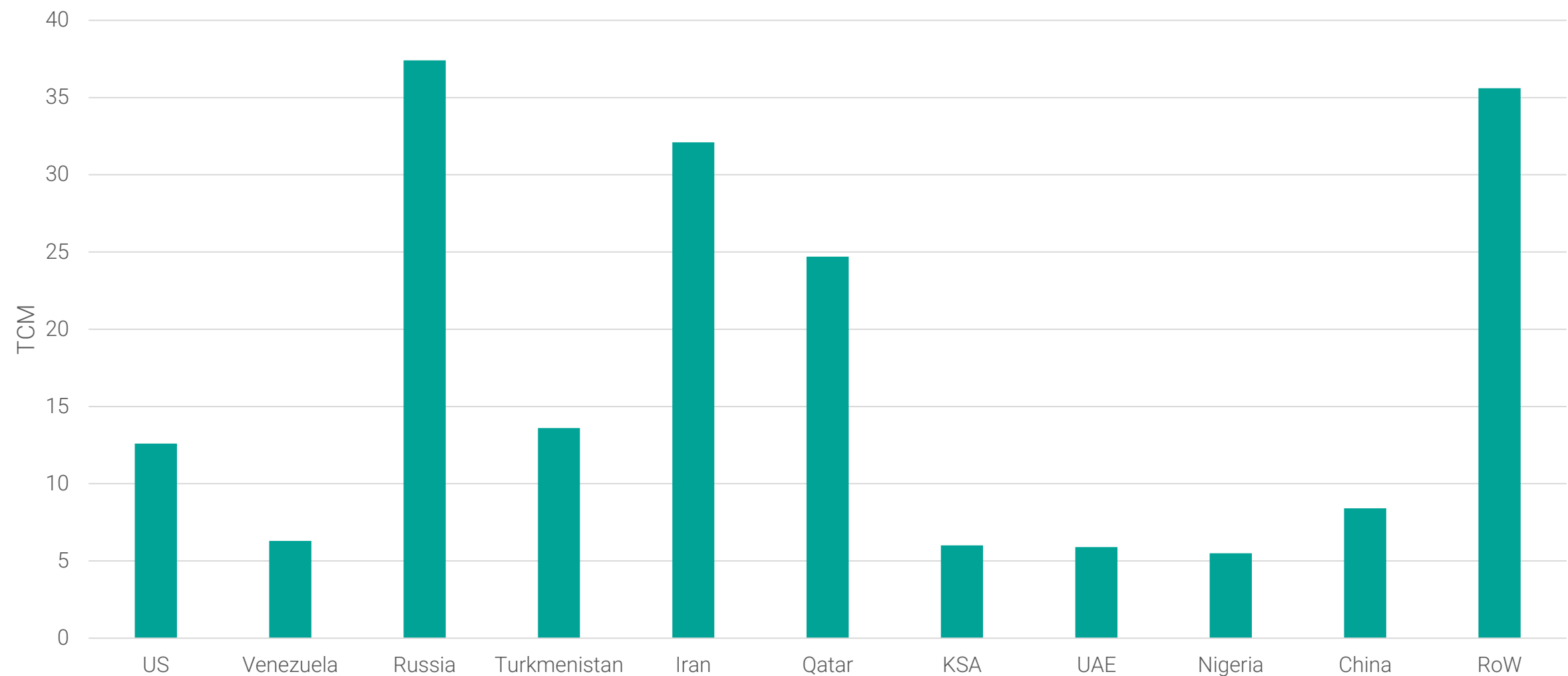
Global gas-demand outlook in 2019–50, by sector (gross), bcm

Reference case



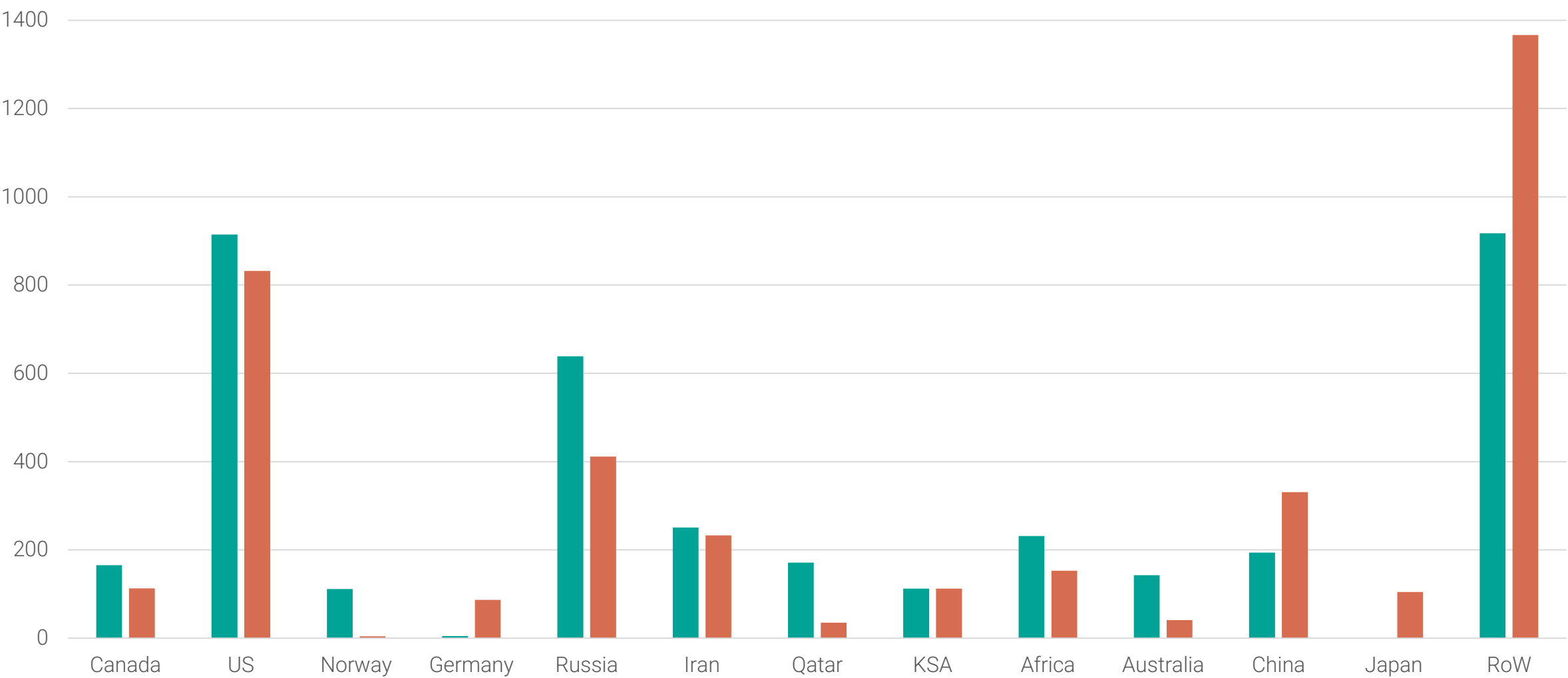
1. Does not include gas use for pipeline transport (approximately 75 bcm in 2019).
2. Includes "other" energy sector.

Top Countries by Reserves



BP Statistical Review of World Energy 2021

Top Countries by Production and Consumption (BCM)



BP Statistical Review of World Energy 2021

Producers, Net Exporters and Net Importers of Natural Gas

Producers	bcm	% of world total
United States	949	23.6
Russian Federation	722	18.0
Islamic Rep. of Iran	235	5.9
People's Rep. of China	191	4.8
Canada	184	4.6
Qatar	167	4.2
Australia	148	3.7
Norway	116	2.9
Saudi Arabia	99	2.5
Algeria	92	2.3
Rest of the world	1 111	27.5
World	4 014	100.0

2020 provisional data

Net exporters	bcm
Russian Federation	230
Qatar	127
Norway	111
Australia	103
United States	77
Turkmenistan	56
Canada	47
Algeria	41
Nigeria	27
Malaysia	22
Others	176
Total	1 017

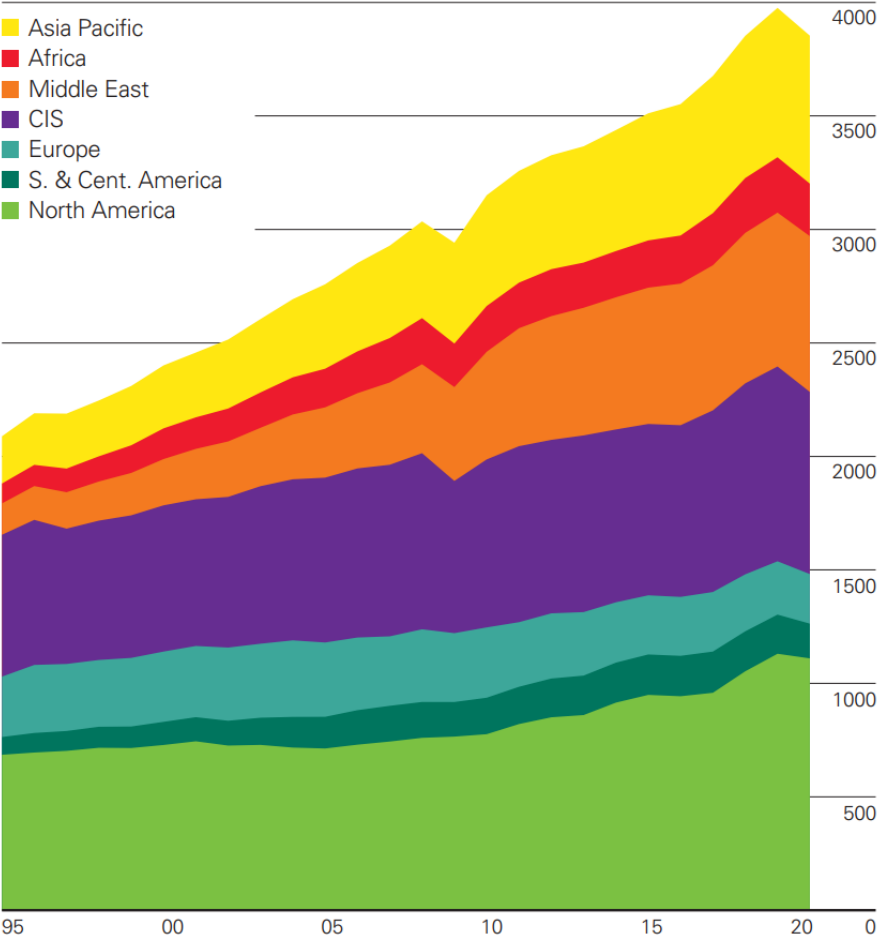
2020 provisional data

Net importers	bcm
People's Rep. of China	125
Japan	105
Germany	83
Italy	66
Mexico	64
Korea	54
Turkey	47
France	37
United Kingdom	34
India	34
Others	324
Total	973

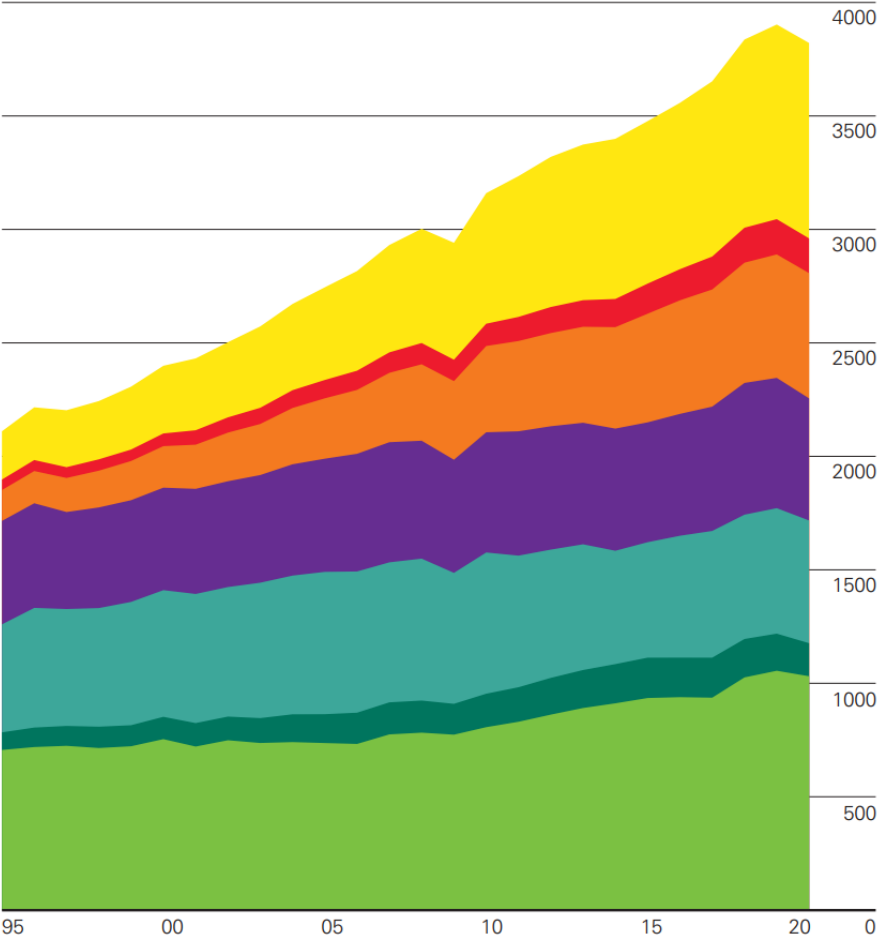
2020 provisional data

The Geopolitics of Gas

Natural gas: Production by region
Billion cubic metres



Natural gas: Consumption by region
Billion cubic metres



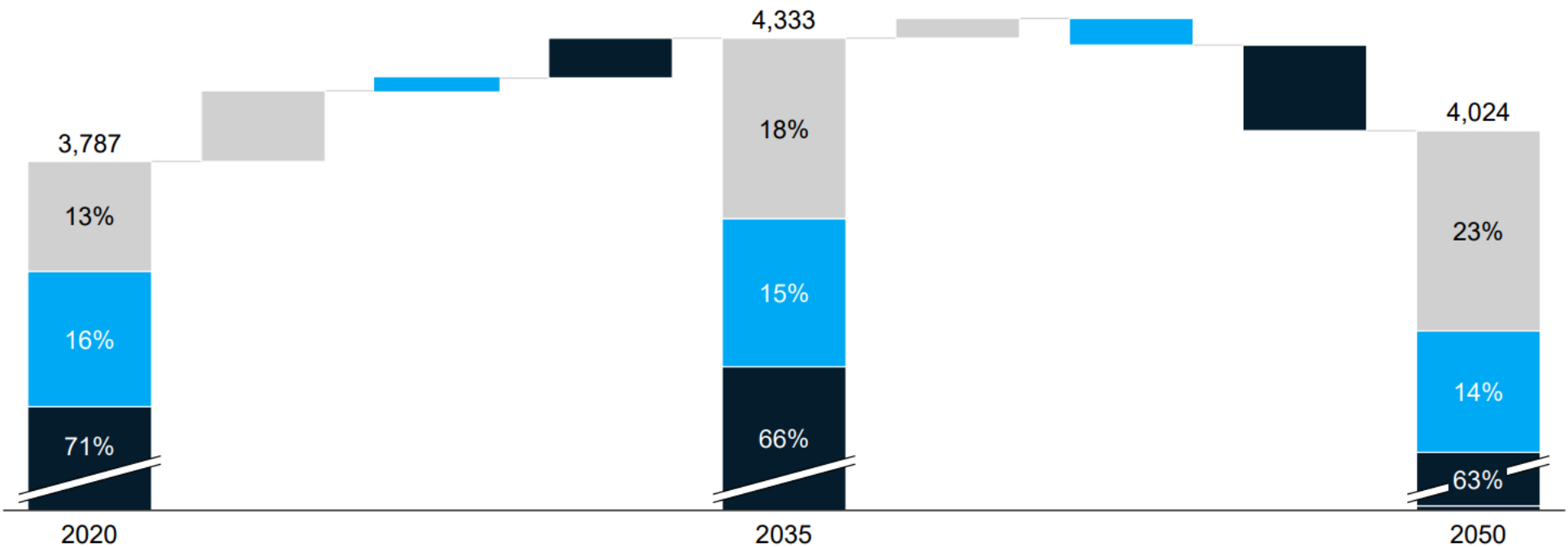
Global Domestic Consumption (BCM)

The share of LNG in the global gas supply will increase consistently, as it meets demand growth and replaces declining pipeline and domestic gas.

Global domestic consumption (piped and LNG gas and import projections), bcm

Reference case

LNG¹ Pipeline-import flows Domestic gas



1. Including LNG flows within country for Indonesia and Malaysia.

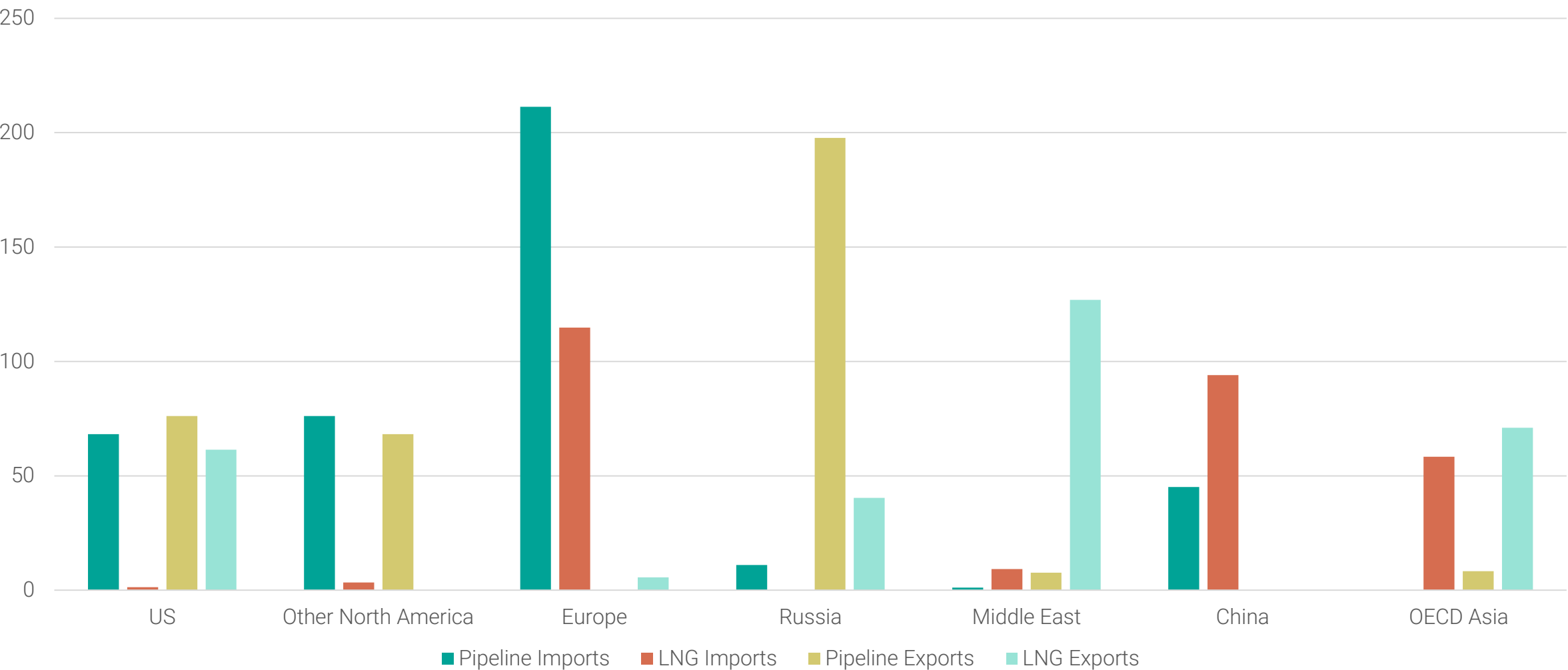
Natural Gas Inter-regional Trade (BCM)

Inter-regional
Trade
940.1

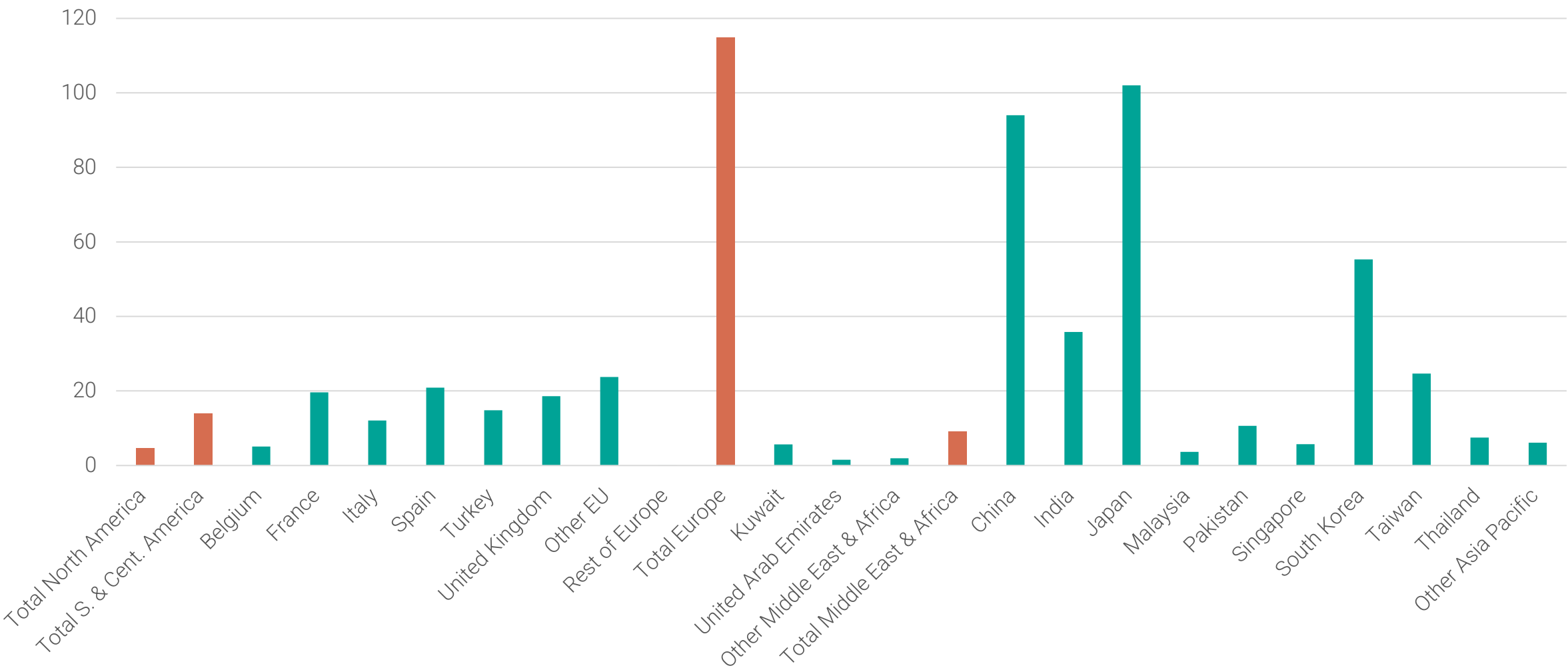
Inter-regional
Pipeline Trade
452.2

LNG Trade
487.9

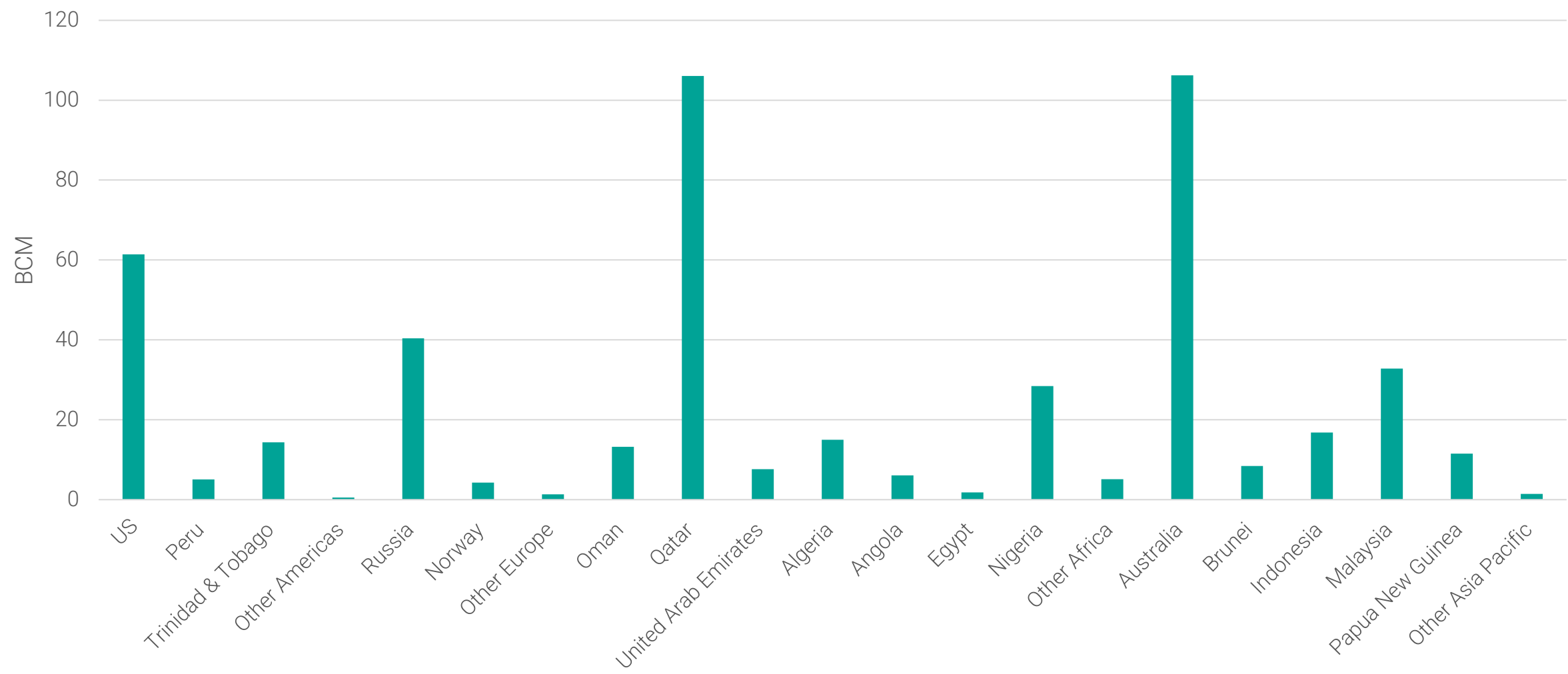
Natural Gas Major Inter-regional Trade Movements (BCM)



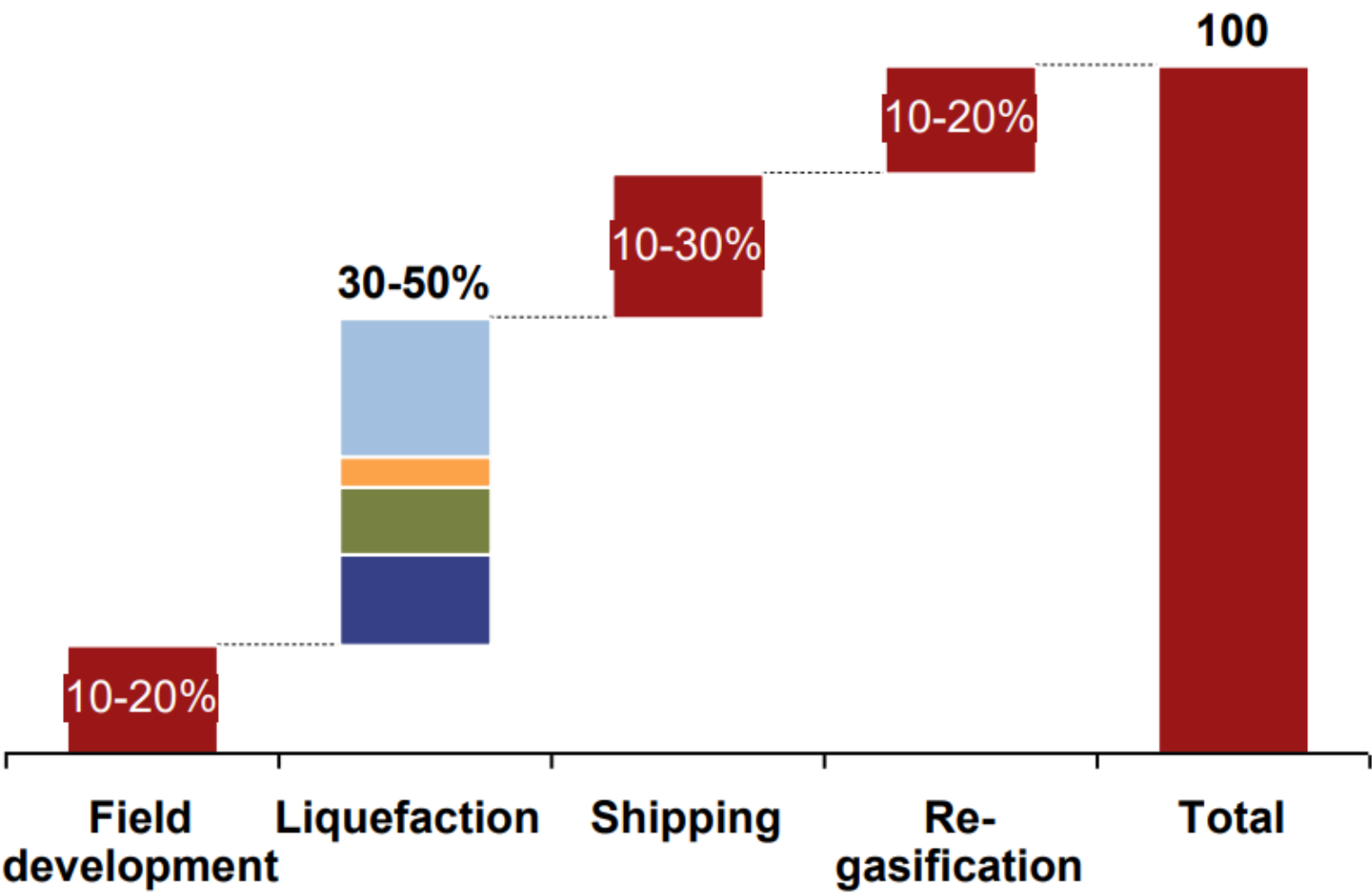
Key LNG Importers (BCM)



Key LNG Exporters

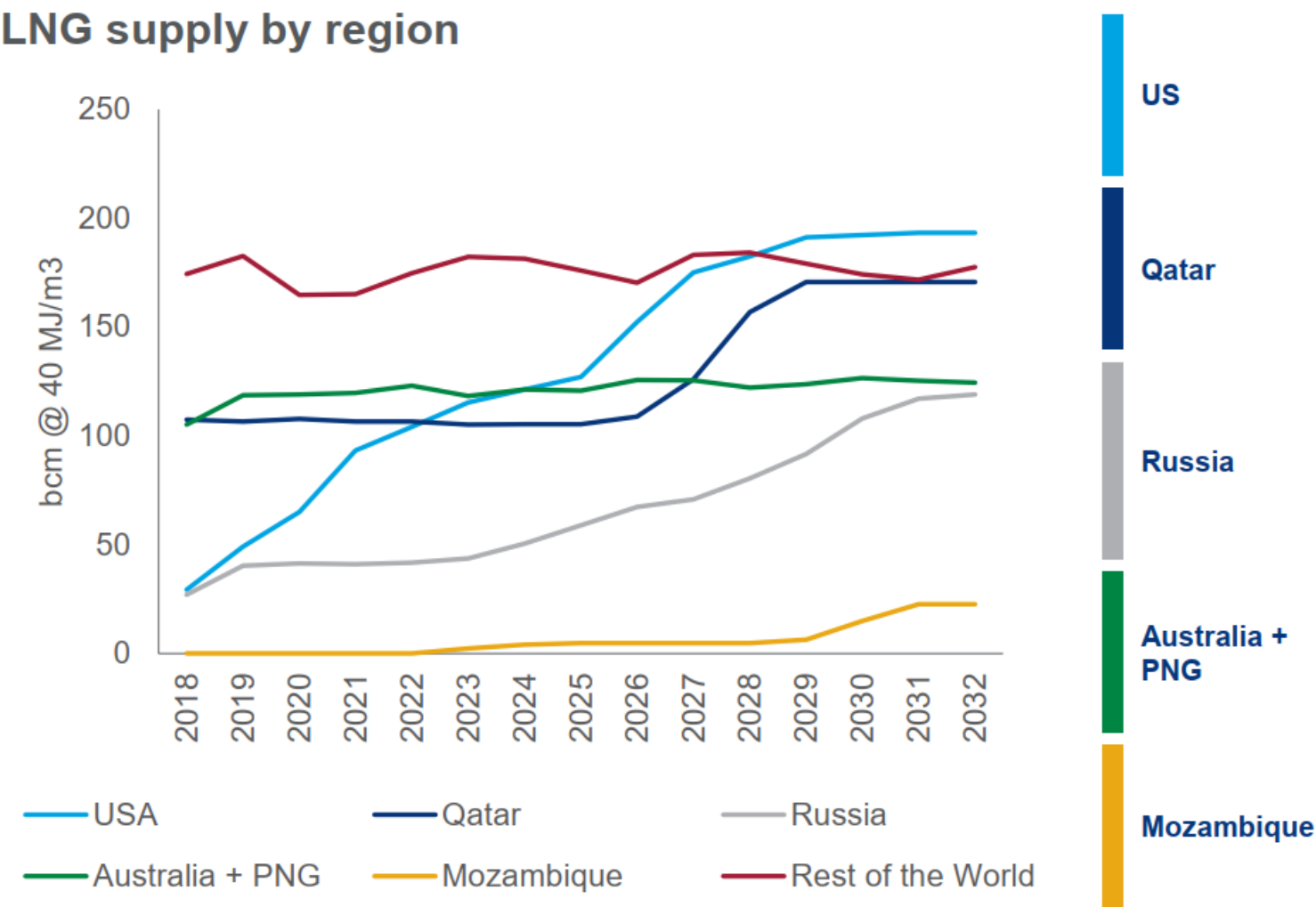


Typical Cost Breakdown Of LNG Value Chain

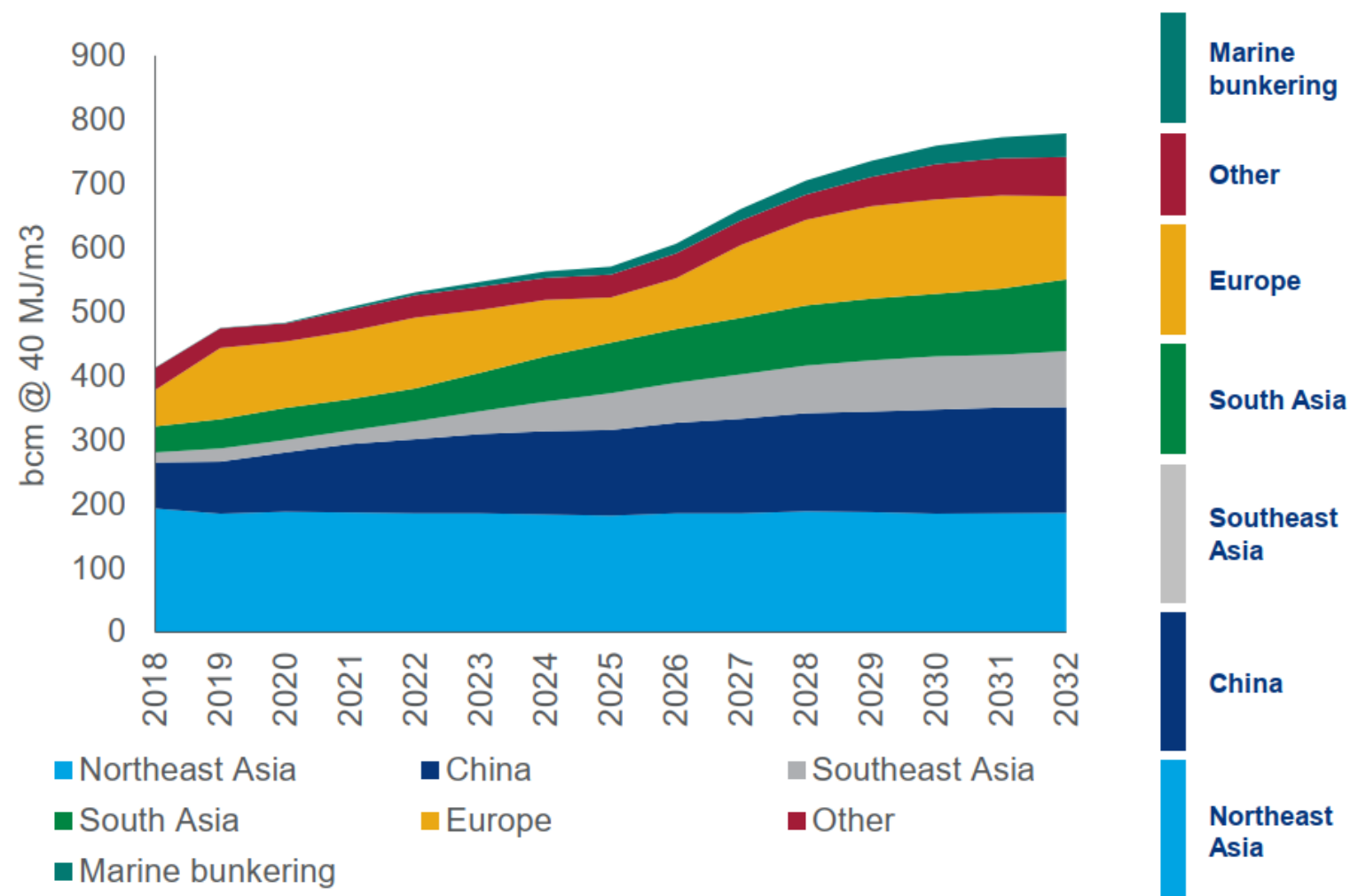


Kearney Introduction to Natural Gas 2014

LNG Supply by Region



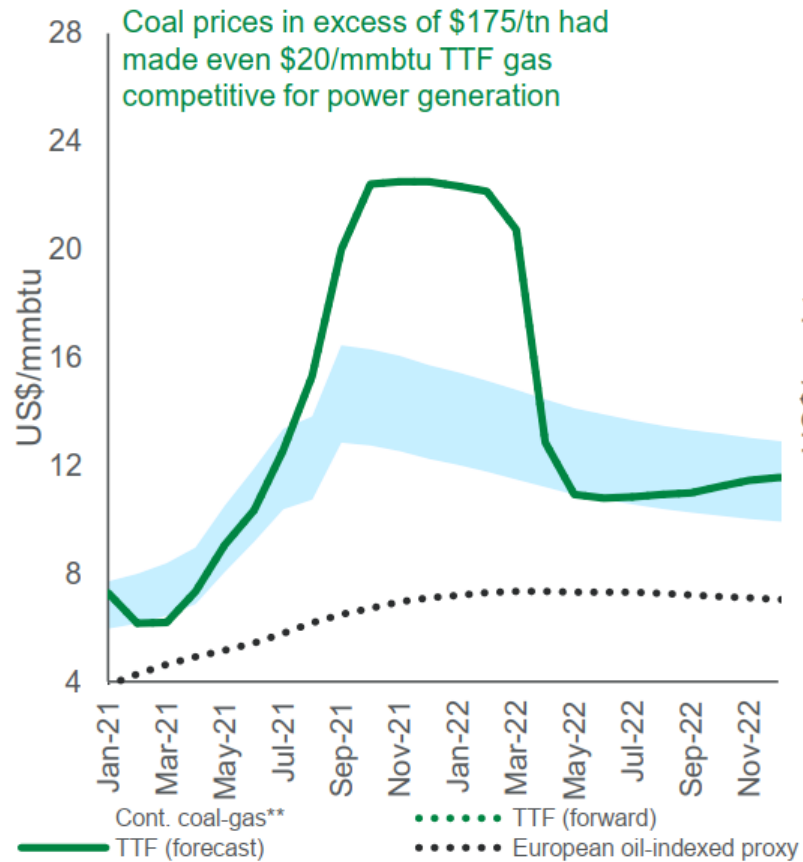
Global LNG Demand



Wood Mackenzie Global Gas investment horizon outlook to 2032 November 2021

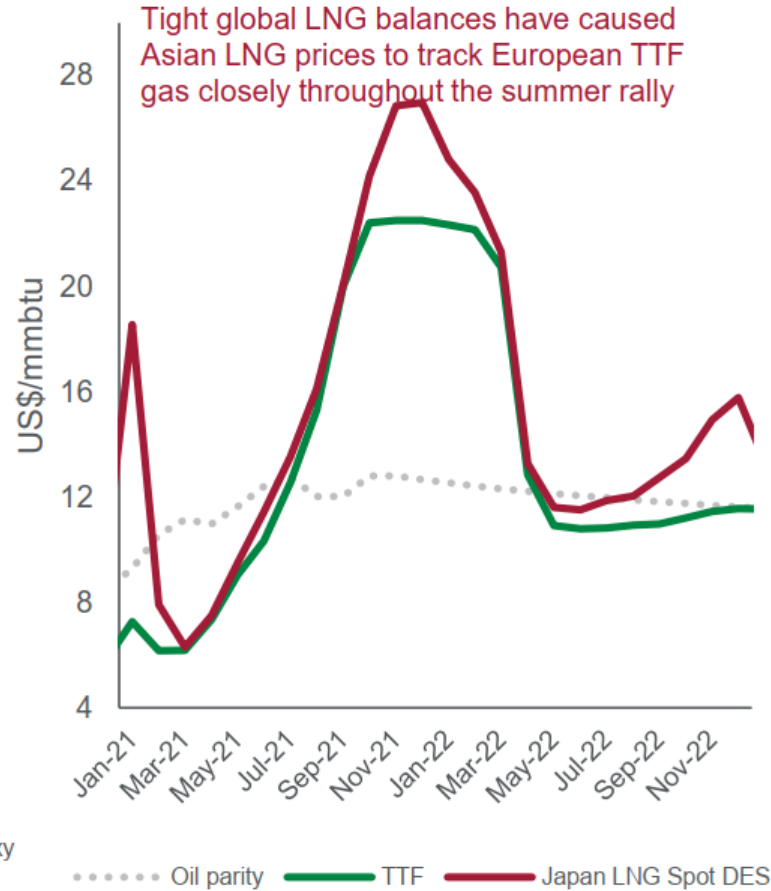
Domino Effect: High Coal Prices, Tight LNG Markets, Lift Fuel-oil Cracks

1. Tight coal and gas market

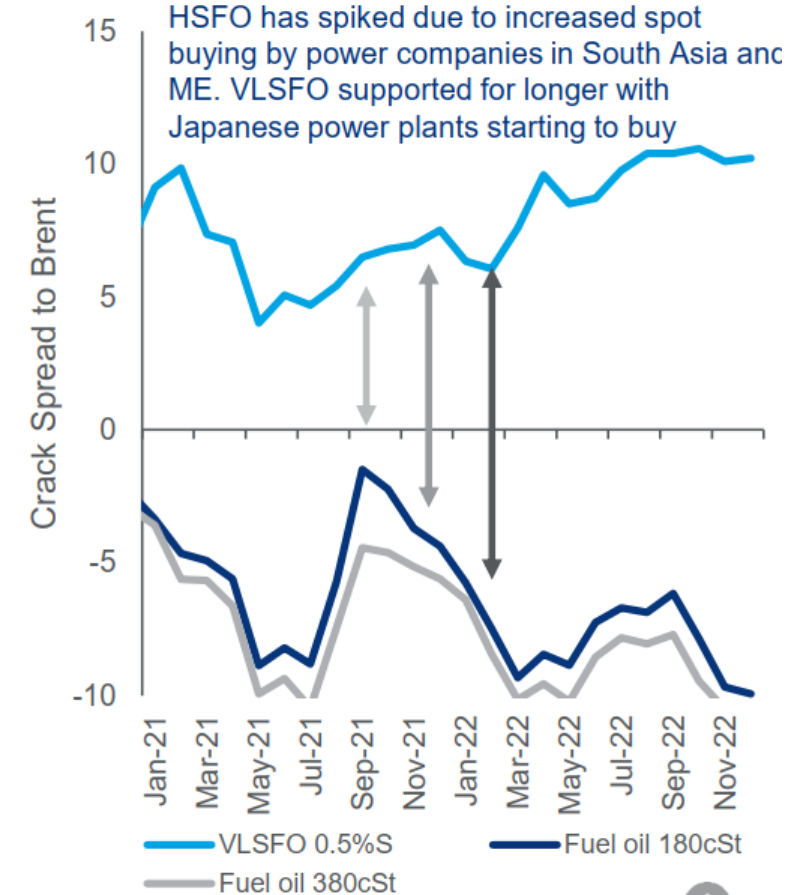


Source: Wood Mackenzie, the Argus Media group, GIE (AGSI)

2. Competition for LNG

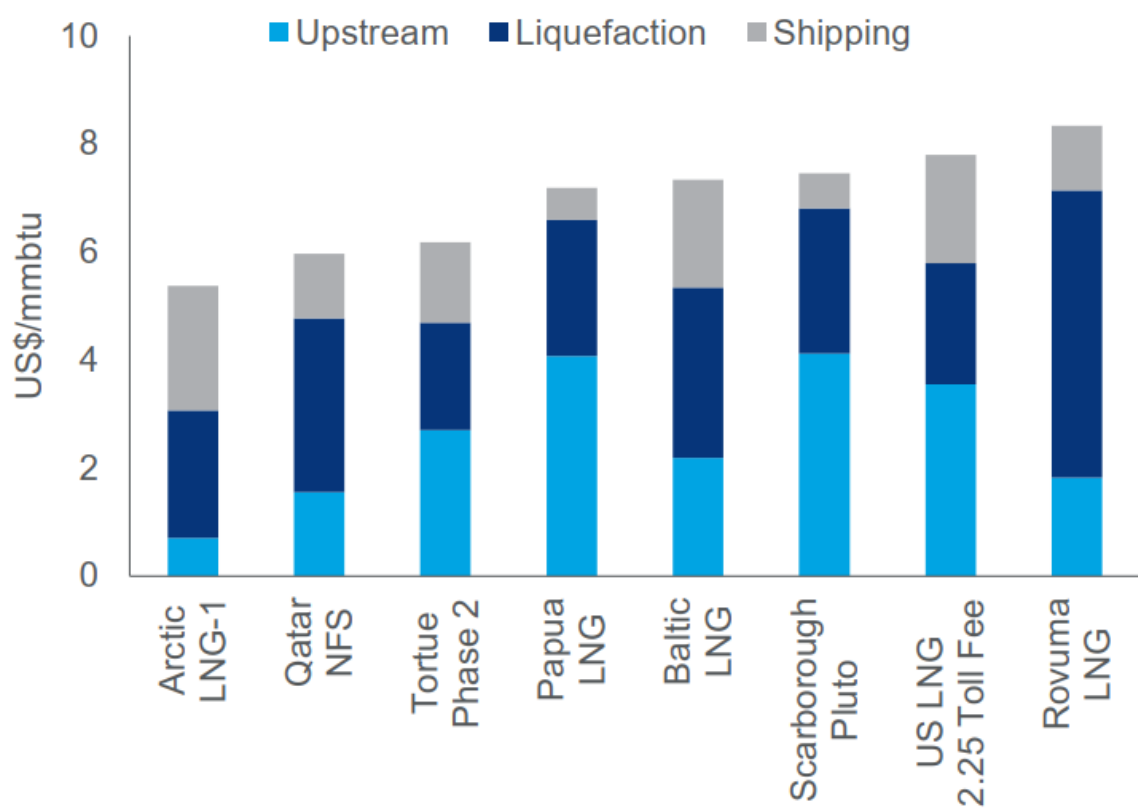


3. Pressure on Fuel Oil cracks

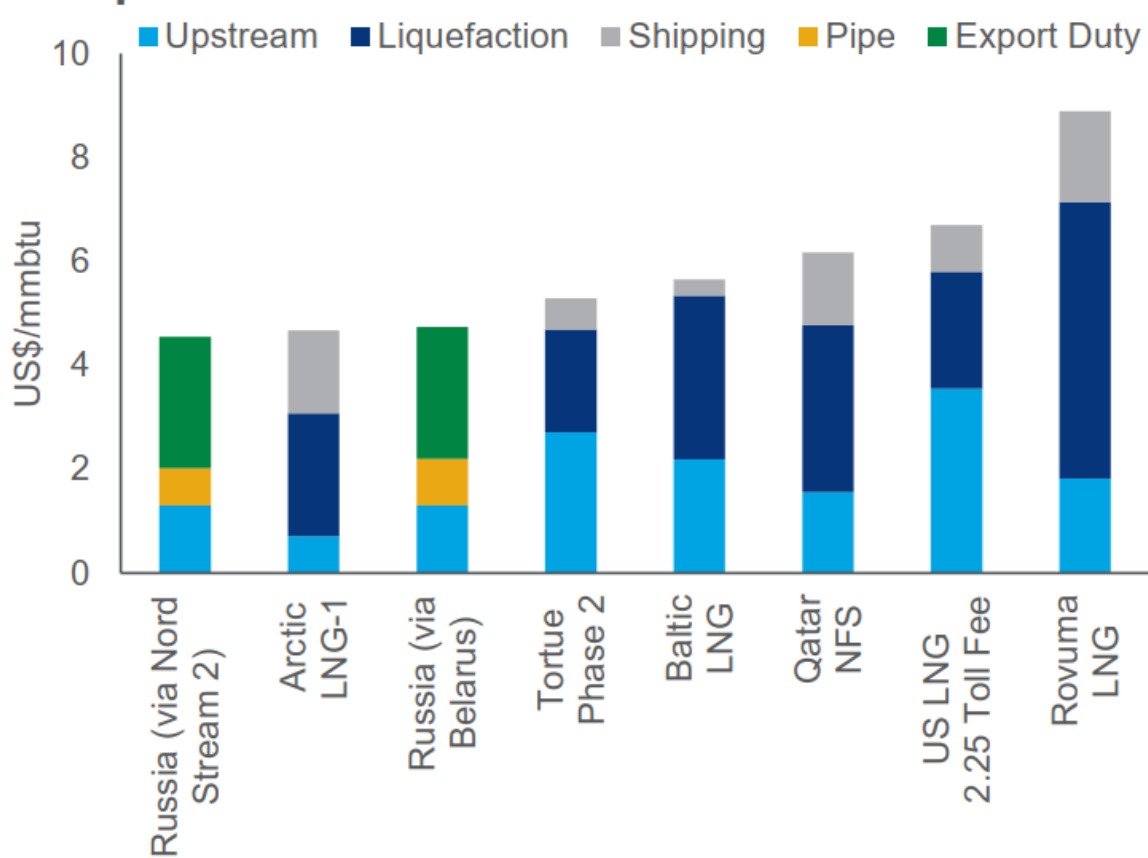


The Breakeven Prices of Gas Projects

LNG breakeven cost stack DES Northern Asia

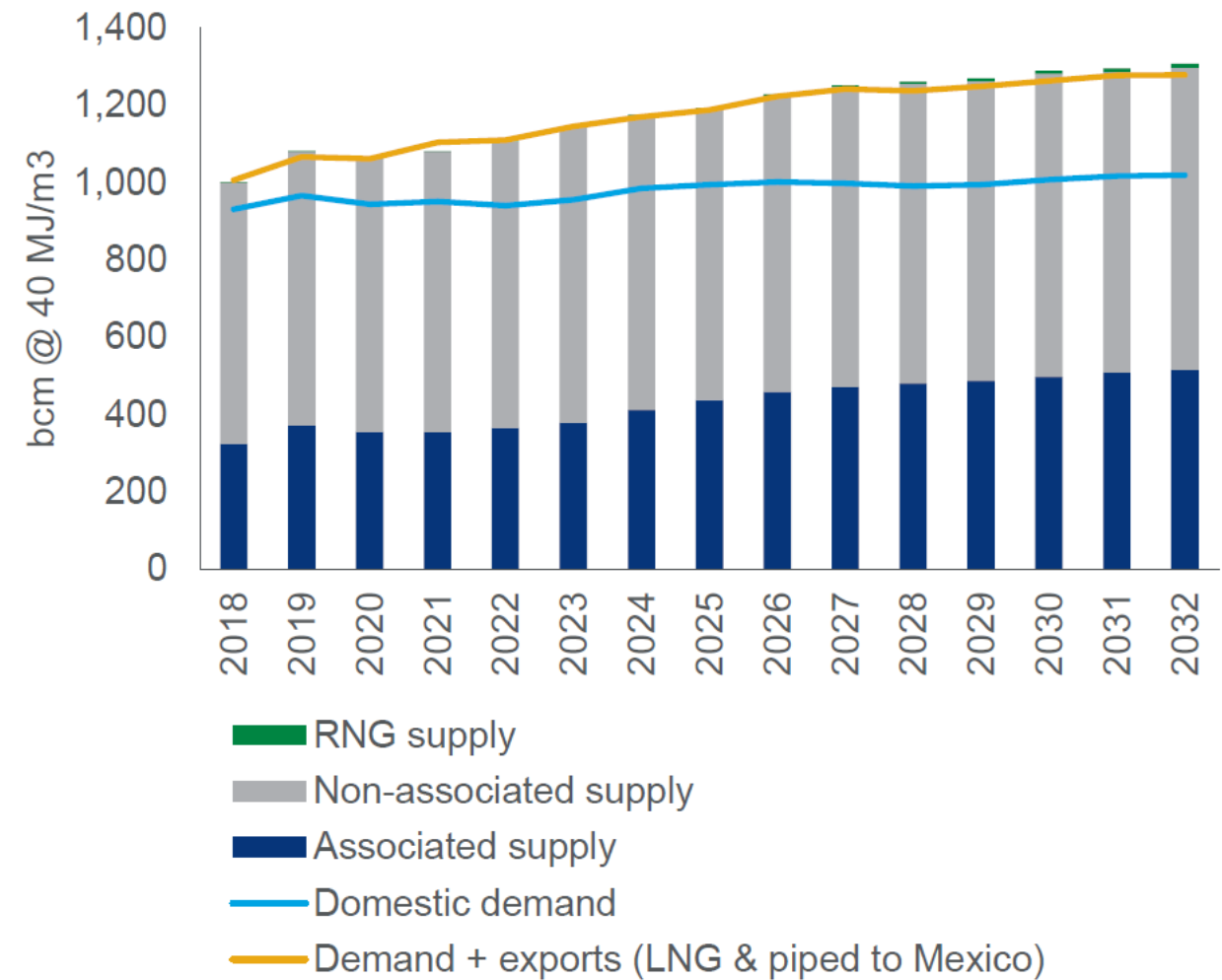


LNG and pipe breakeven cost stack DES NW Europe

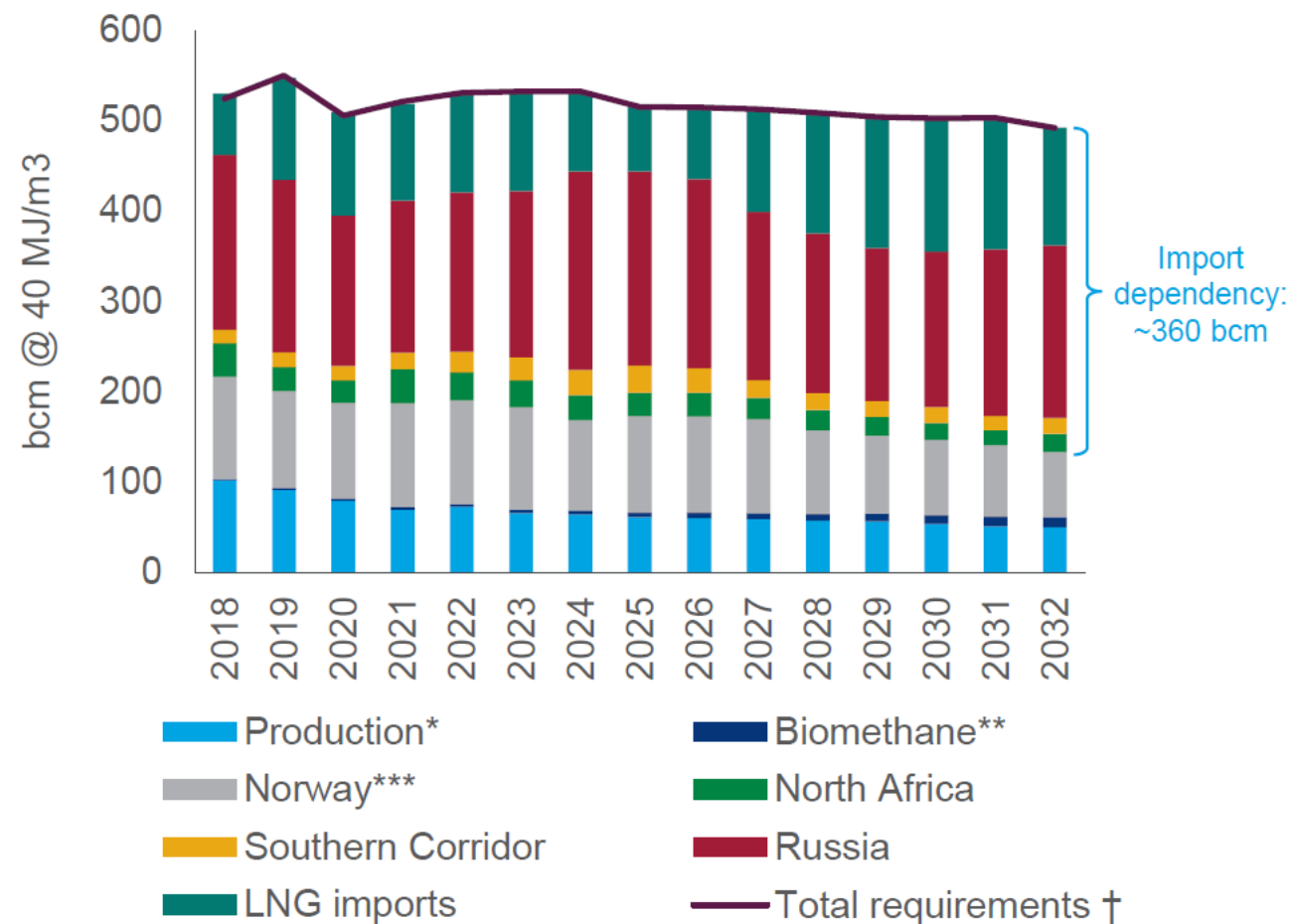


Source: Wood Mackenzie LNG Tool Q4 2021

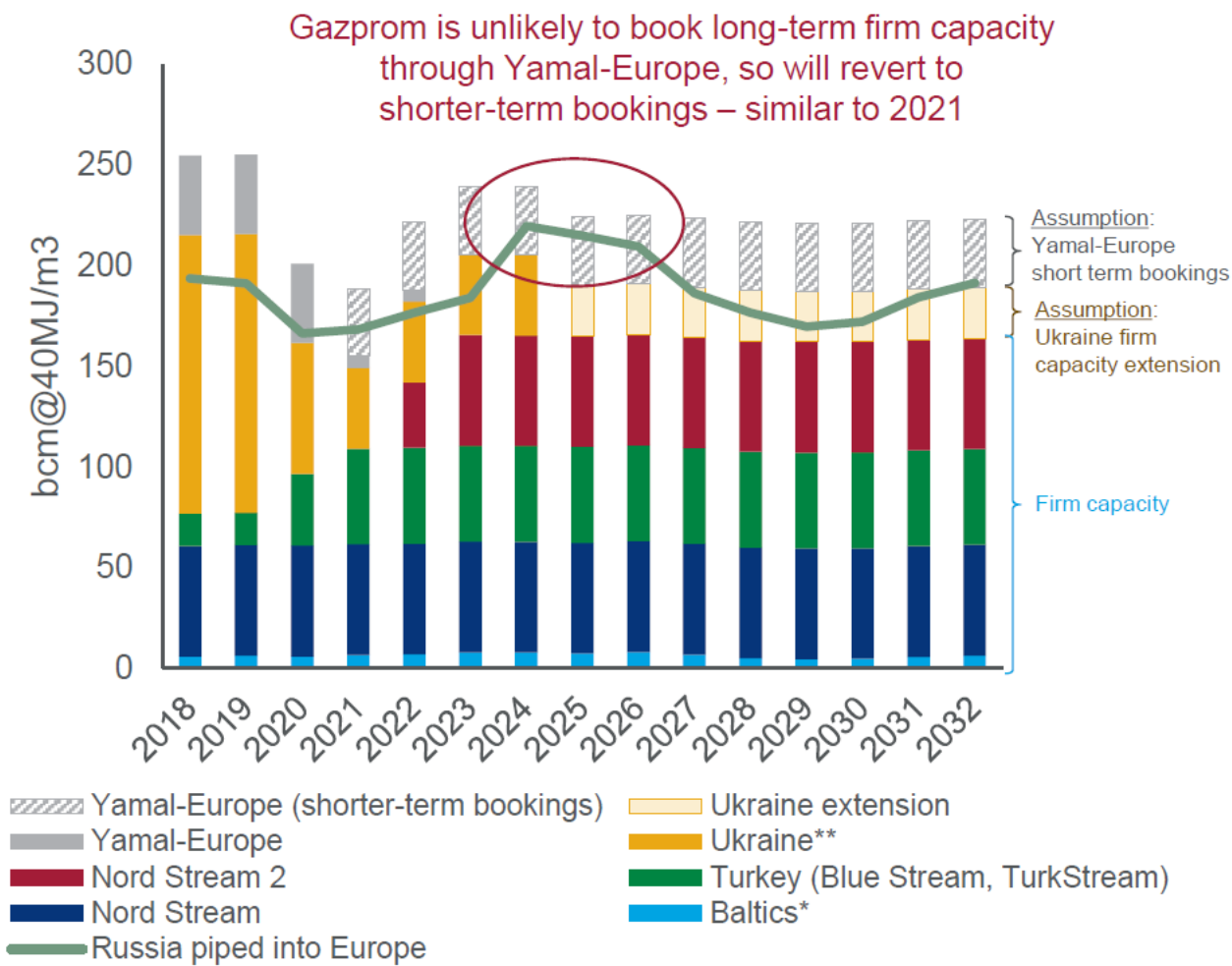
North America Gas Balance



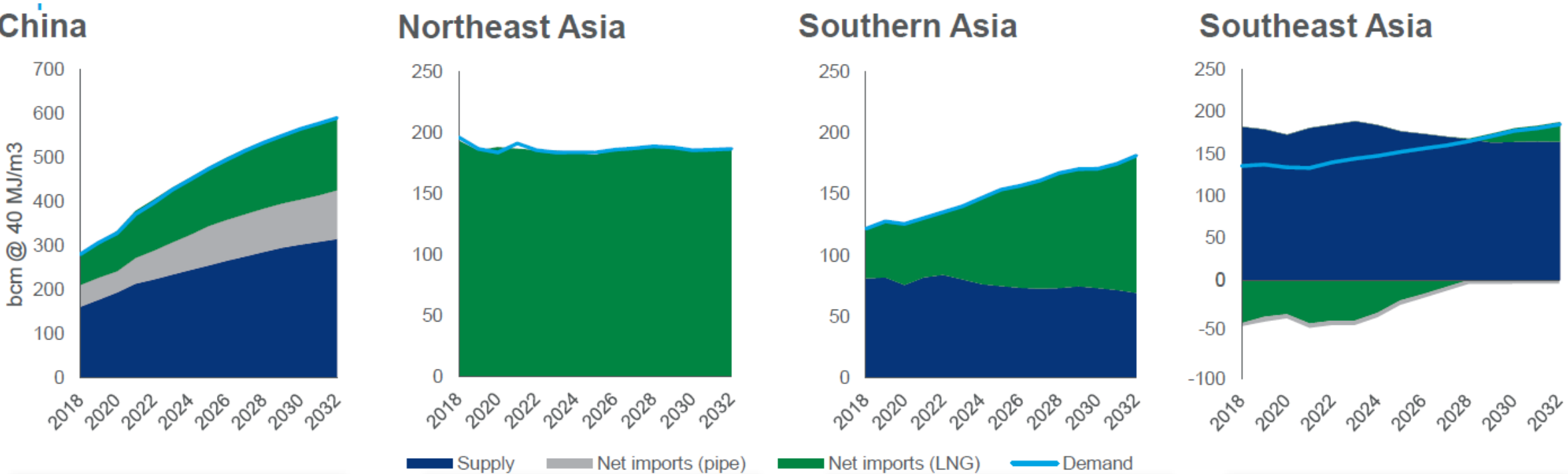
Europe Gas Balance



Russia Piped Capacity and Flows to Europe

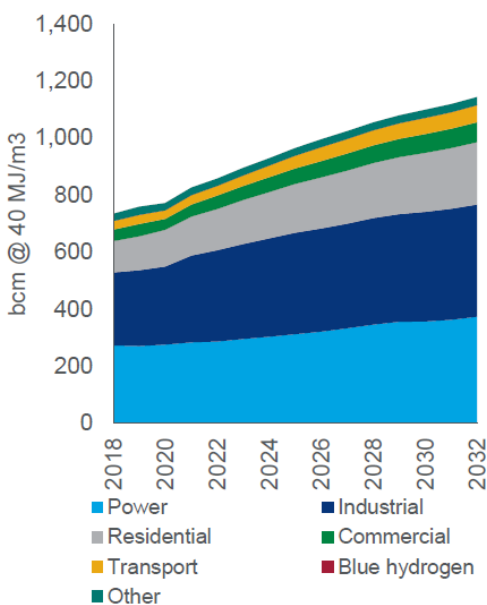


Asia Gas Balance

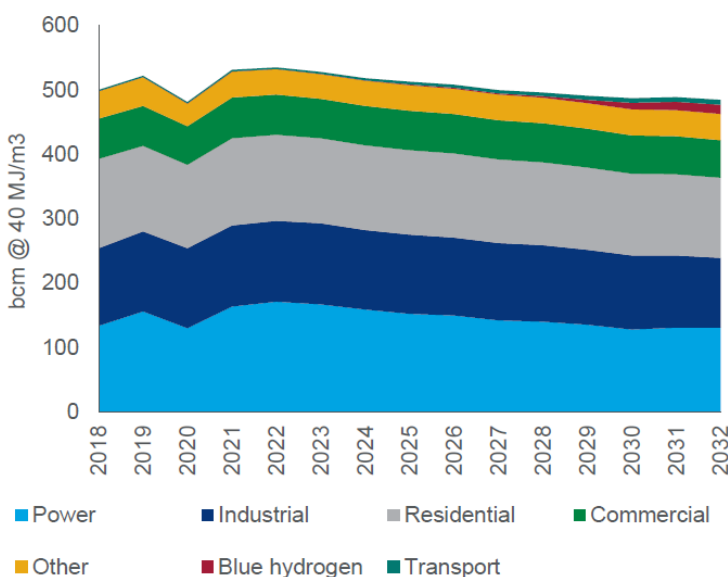


Regional Gas Demand by Sector

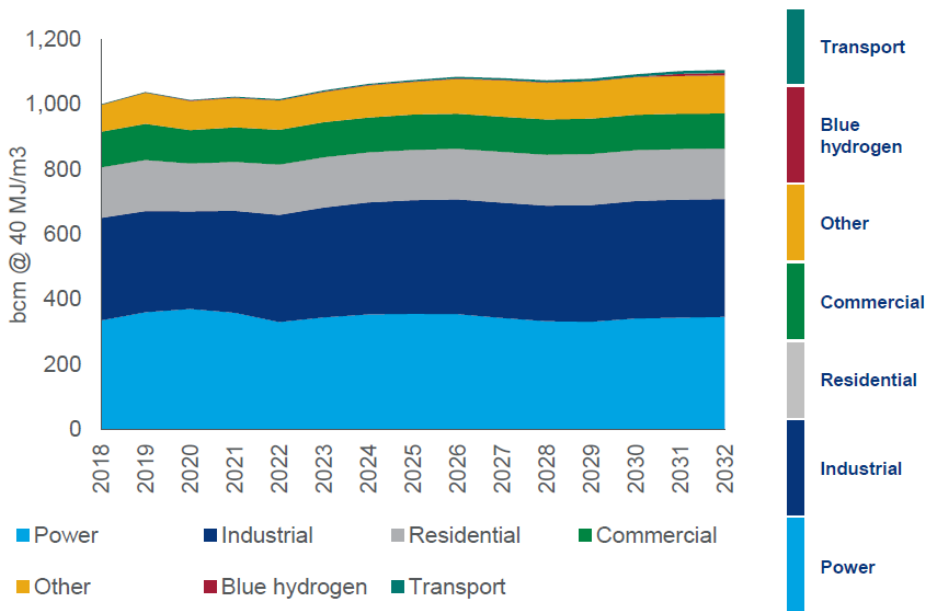
Asia gas demand by sector



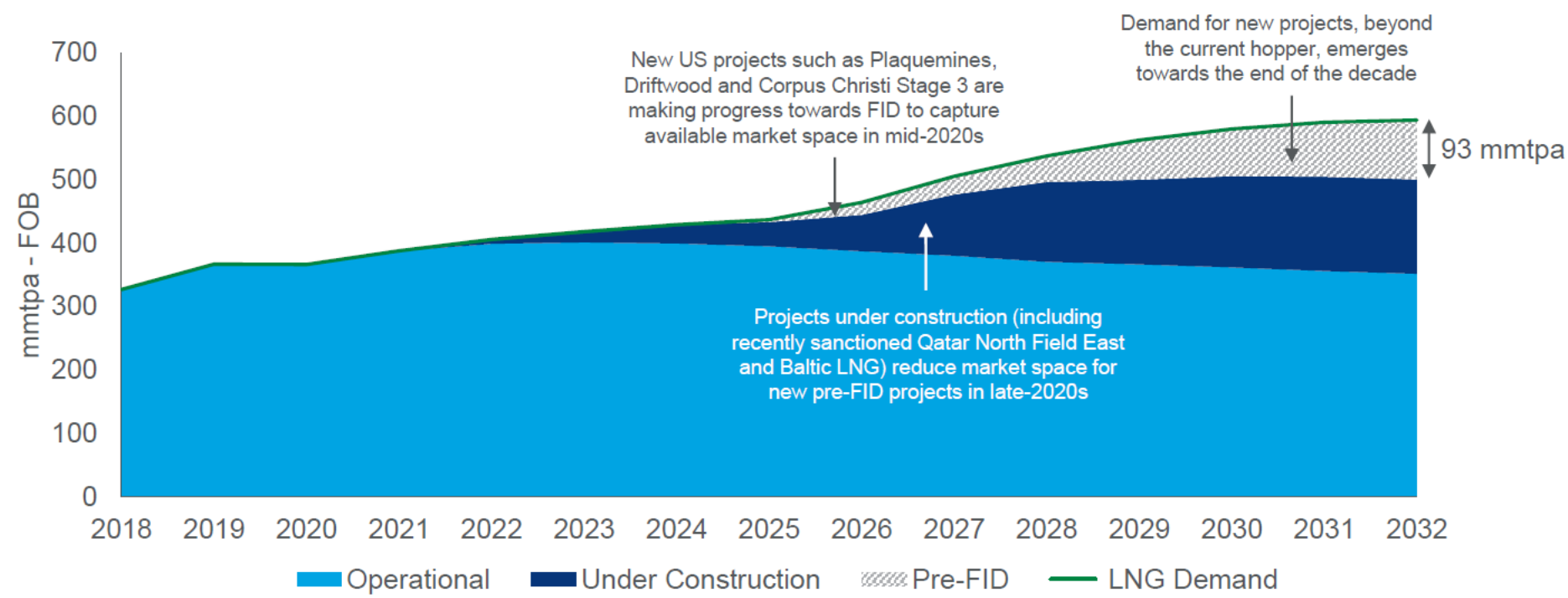
Europe gas demand by sector



North America gas demand by sector



LNG Supply and Demand by Project Development Status



Gas and LNG Investment Requirements to 2032

	Upstream	Liquefaction	Shipping	New pipeline developments*	Regas	Value of uncontracted LNG demand
	US\$ billion capex	US\$ billion capex	US\$ billion capex	Bcm/yr capacity	US\$ billion capex	US\$ billion
Global	1,510	175	120	490	48	620
Asia	● 150		● 120	● 90	• 38	● 490
Europe	• 60			• 16	4	● 130
North America	● 630**	• 50		● 315	0.5	
Middle East	● 210	• 30			0.5	
Russia and the Caspian	● 170	• 25			0	
RoW	● 290	• 70		• 70	5	

Wood Mackenzie Global Gas investment horizon outlook to 2032 November 2021

Global Gas Markets

Gas-on-gas markets



 US

Indexed to energy prices



 EU

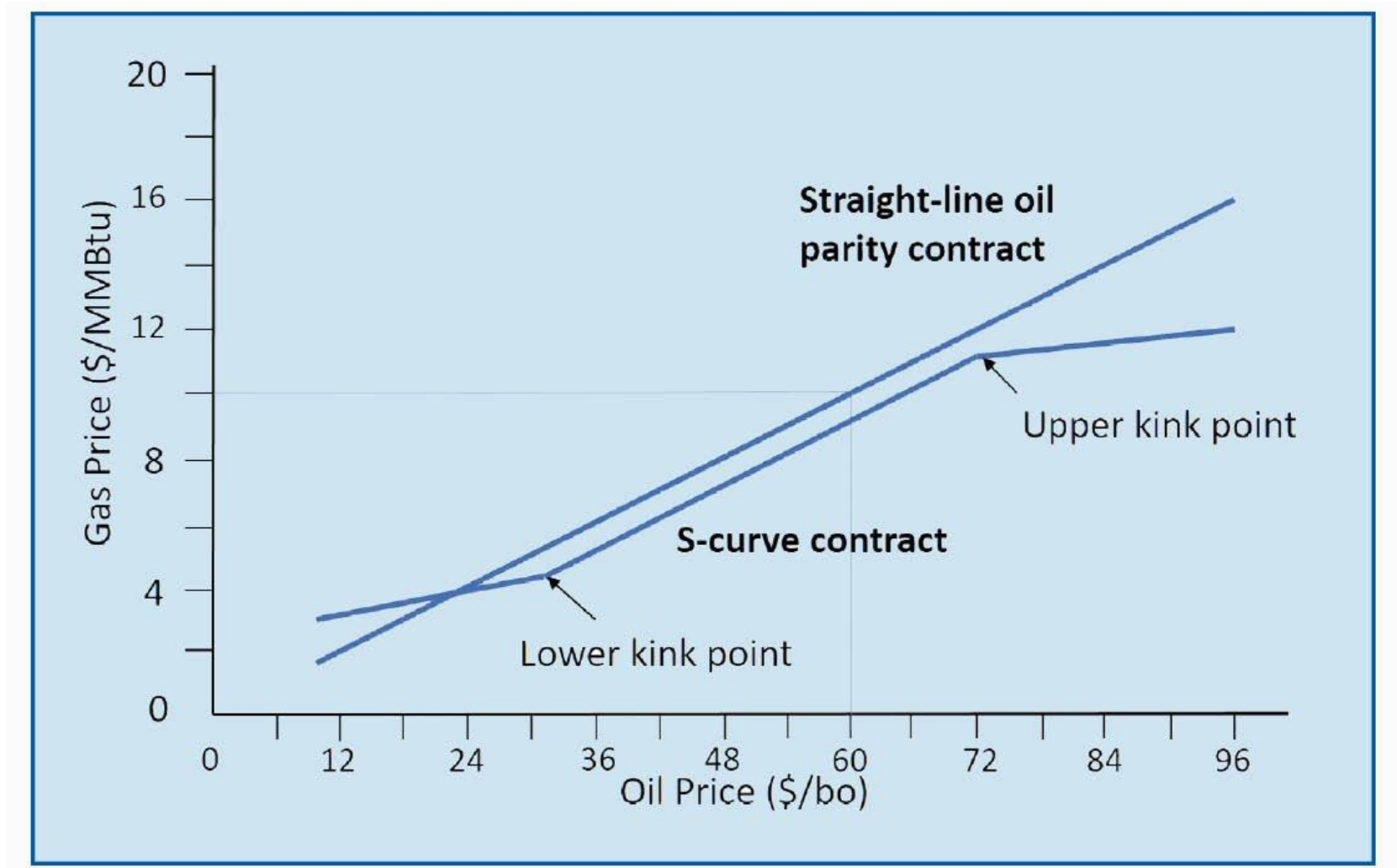
 Asia

Regulated

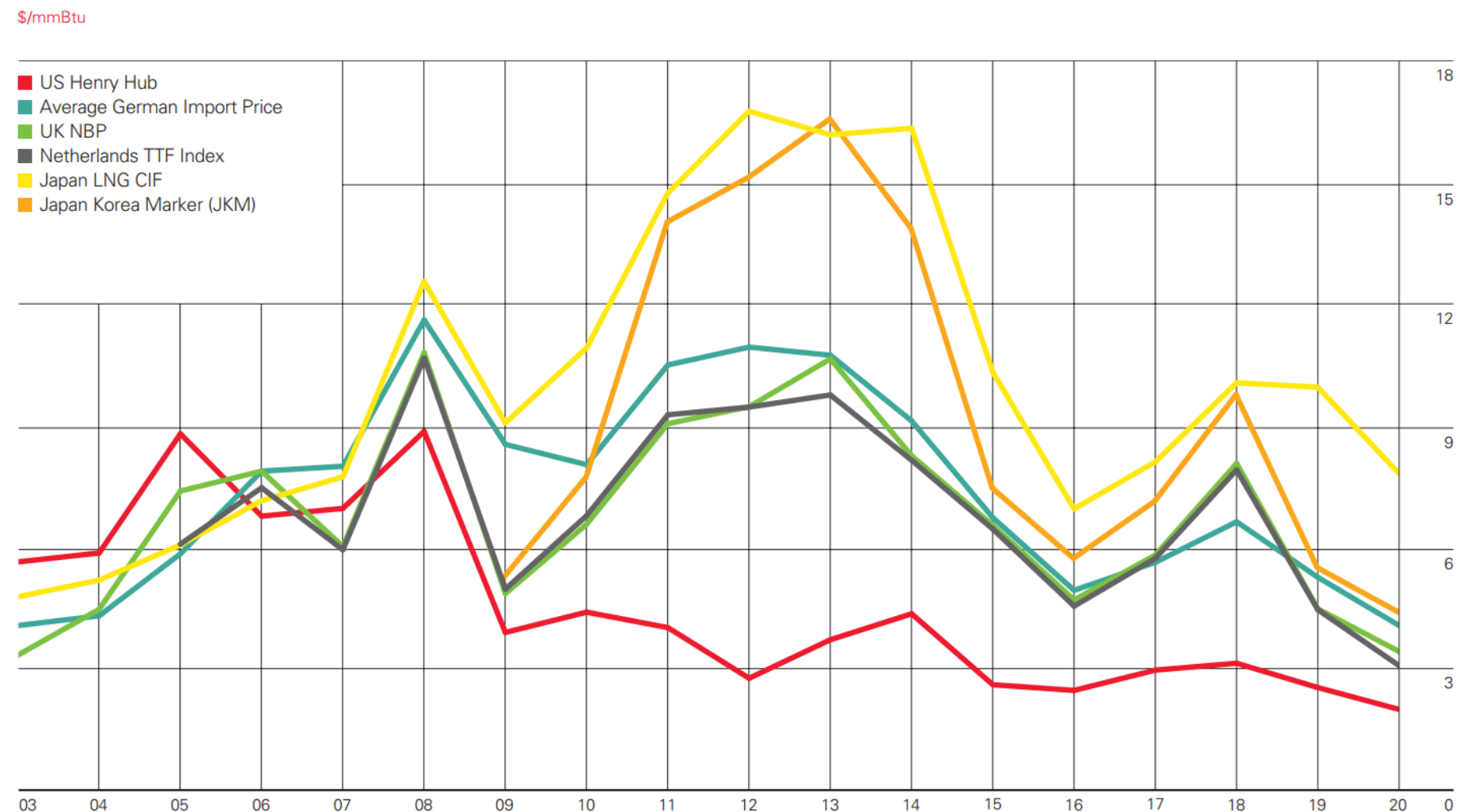


 Middle East

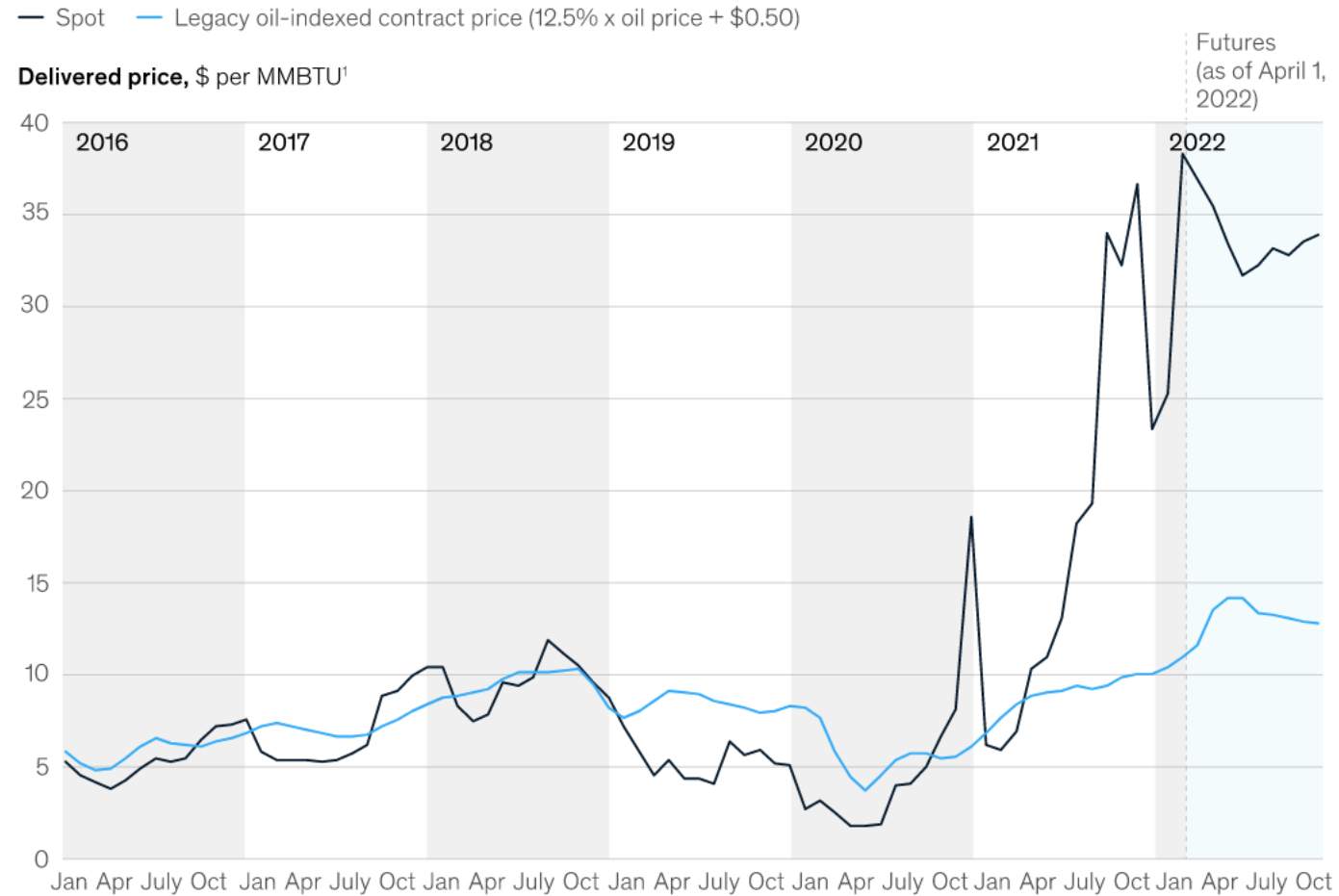
Oil Parity



Gas Prices



LNG Prices in Asia



¹Metric million British thermal units.

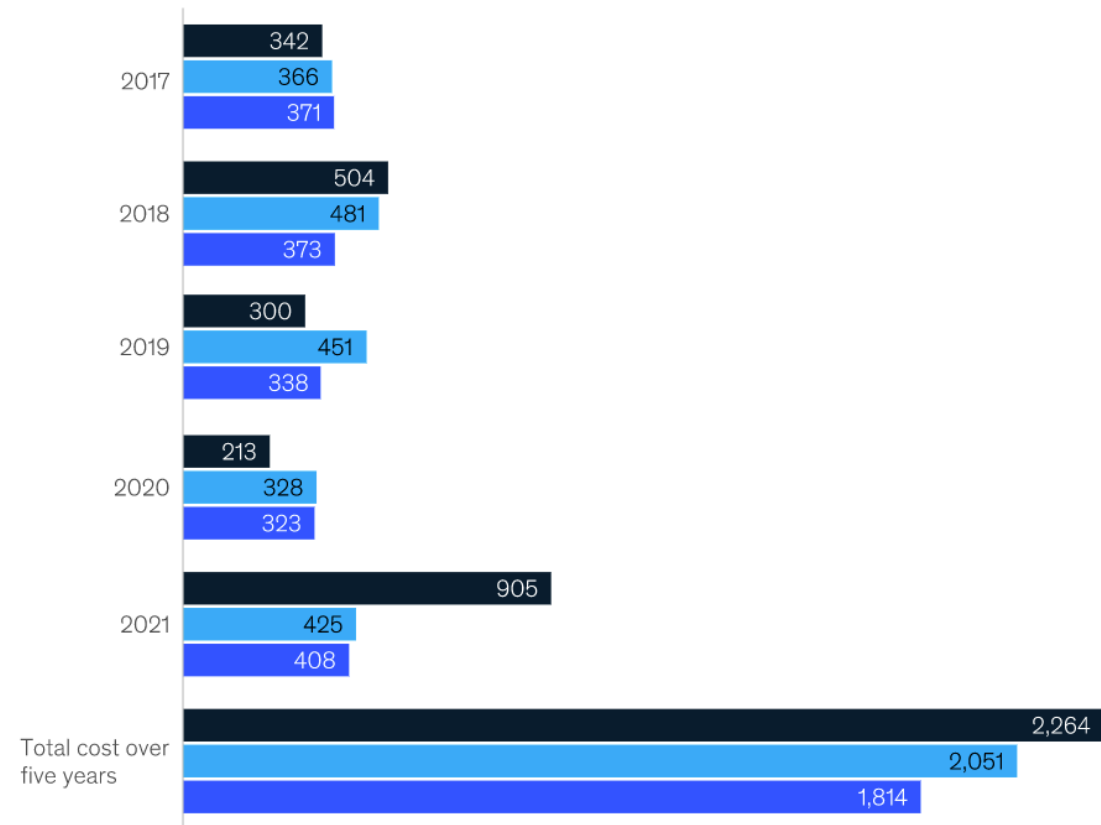
Source: Bloomberg

McKinsey Reflecting on 2021 global LNG and European pipeline flows 2021

LNG Cost Comparisons

■ Japan Korea Marker ■ Legacy oil-indexed contract price (12.5% × Brent Crude price + \$0.50) ■ 115% HH + \$2.5 + shipping¹

Cost comparison for 1 MMTPA² of LNG, \$ millions



¹Assumes \$1.2 for shipping from Gulf Coast to Japan through Panama Canal.

²Million metric tons per annum; 51.8 metric million British thermal units (MMBTU) per ton of LNG.

Source: Bloomberg

Price Economics Logic (\$/MMBTU)

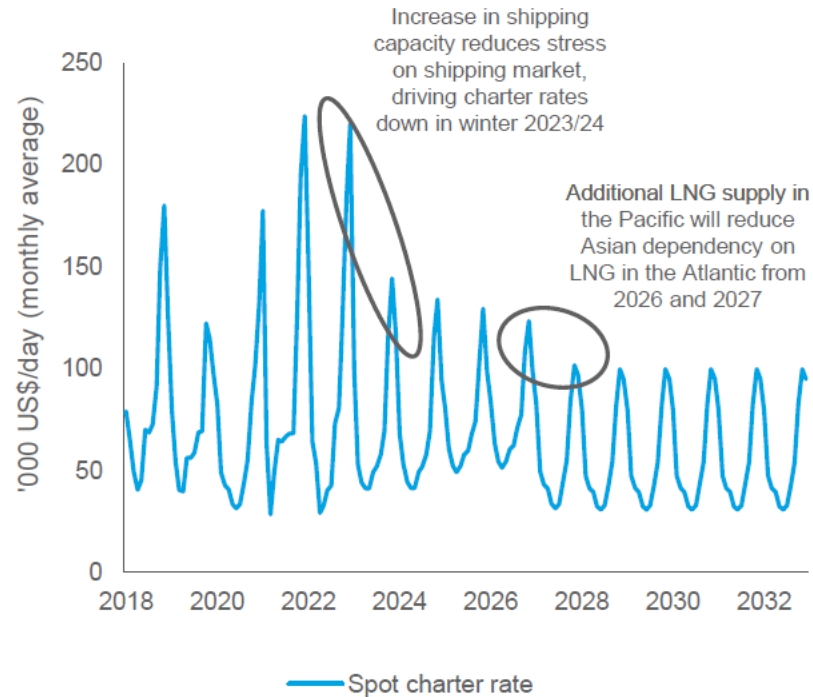
	Residual cash costs ²		Cash cost		Full cost	
Henry Hub (price setter)	Base		Base		Base	Abundant supply drives gas towards coal competition pricing
+						
Liquefaction cost	0.4–0.5	Tolling ToP fixed fee	+0.8	LNG cash cost in short-term oversupplied market (opex)	+2.2–2.7	LNG full costs in a balanced market (opex and capex)
Shipping cost	+0.5	Bunker fuel/boil off only	+1.7	Short-term charter rates	+1.8–2.2	Full cost shipping (opex and capex) to Tokyo Bay
Delivered LNG to Asia	Base +0.9-1.0	Near-term cash costs	Base +2.5	Short-term cash costs	Base + 4–5	Full cost

LNG Price Asia vs TTF

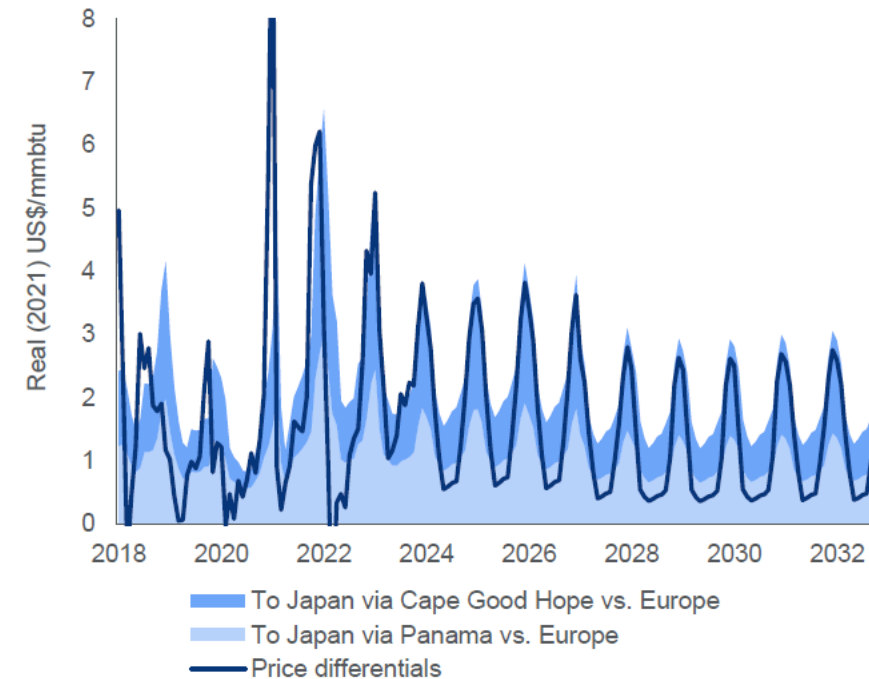
Japan LNG Spot DES (Asia) – price differentials vs TTF will soften from 2024 as increasing shipping capacity drives down spot charter rates

However, price differentials will remain relatively high as the “marginal cargo” will need to go through the Cape of Good Hope as requirements of US LNG to Asia remains sustained

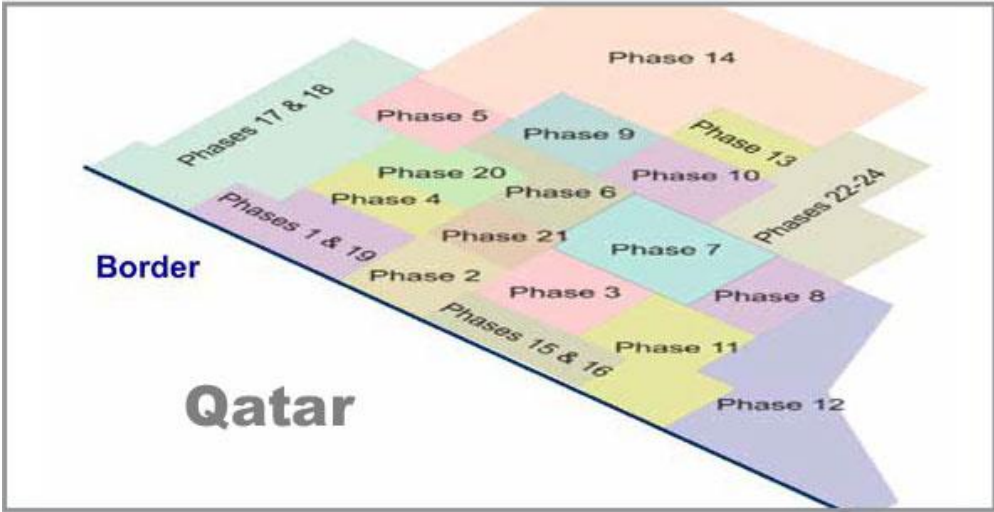
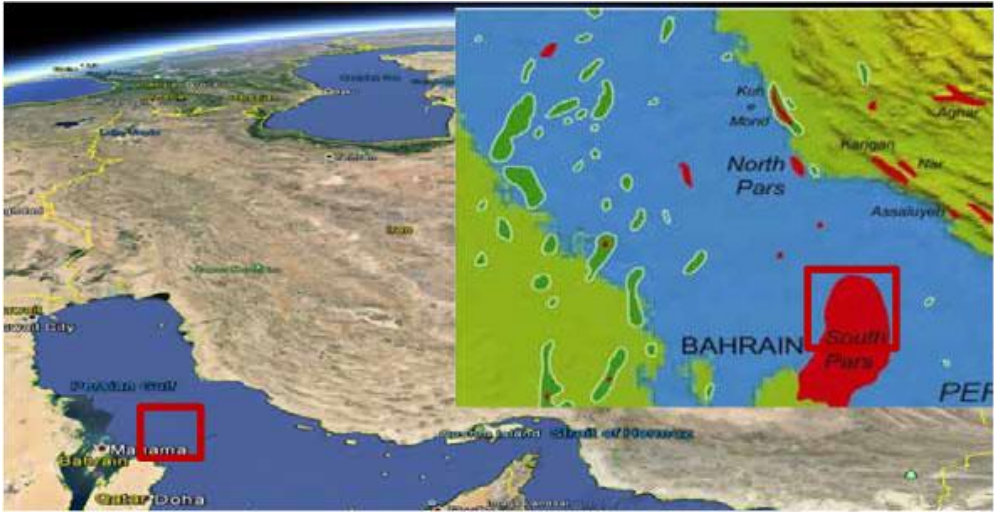
LNG shipping spot charter rates



Price differentials (Japan spot DES – TTF) vs shipping differentials (from the US)



South Pars



Major LNG Projects

Pars LNG

Phase 11

Total, PETRONAS, and NIGEC

10 mmtpa

Cancelled

Iran LNG

Phase 12

NIOC and OPIC

10.5 mmtpa

Delayed

Persian LNG

Phases 13 and 14

Shell, Repsol, and NIOC

16 mmtpa

Cancelled

14. Players

To provide a framework for understanding types and categories of oil and energy companies

BP Business Model



Key Players Classification by IEA

NOC

INOC

Majors

Independents

OFS Co.

Pure
Downstream
Co.

Trading Co.

National Oil Companies

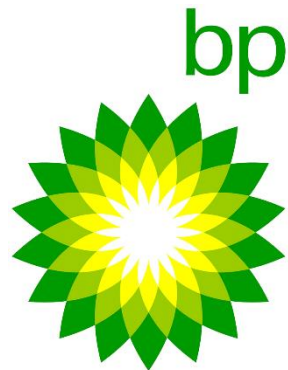
أرامكو السعودية
saudi aramco



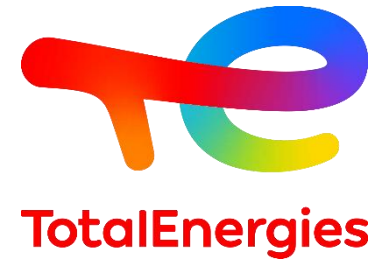
International National Oil Companies



Majors



ExxonMobil



Independents



Oilfield Services Companies

Schlumberger



COSL

HALLIBURTON



Pure Downstream Companies



Trading Companies



GLENCORE



The Old and New Seven Sisters

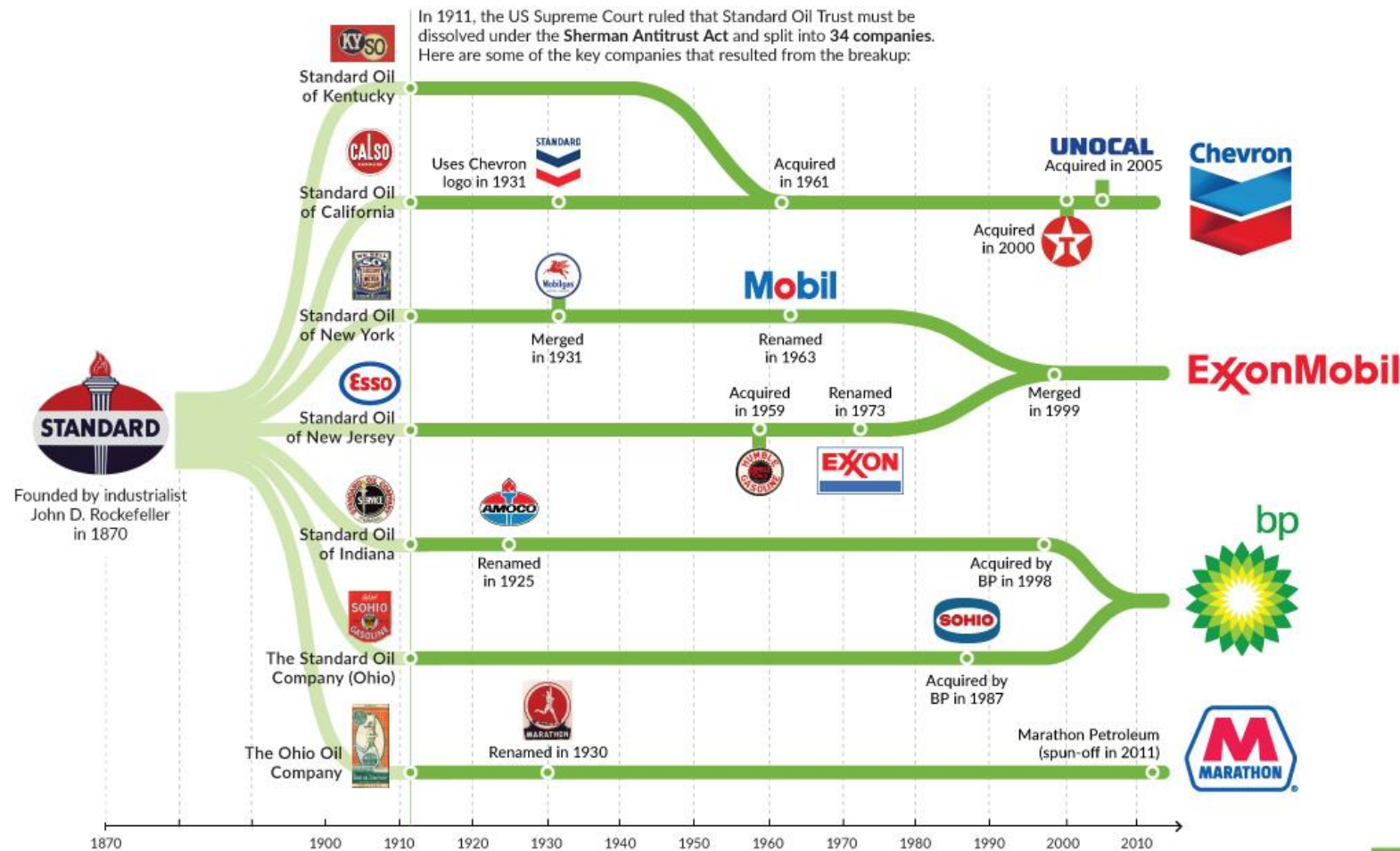
- The Old Seven Sisters



- The New Seven Sisters?!



The Evolution of Standard Oil



SOURCE: Wikipedia

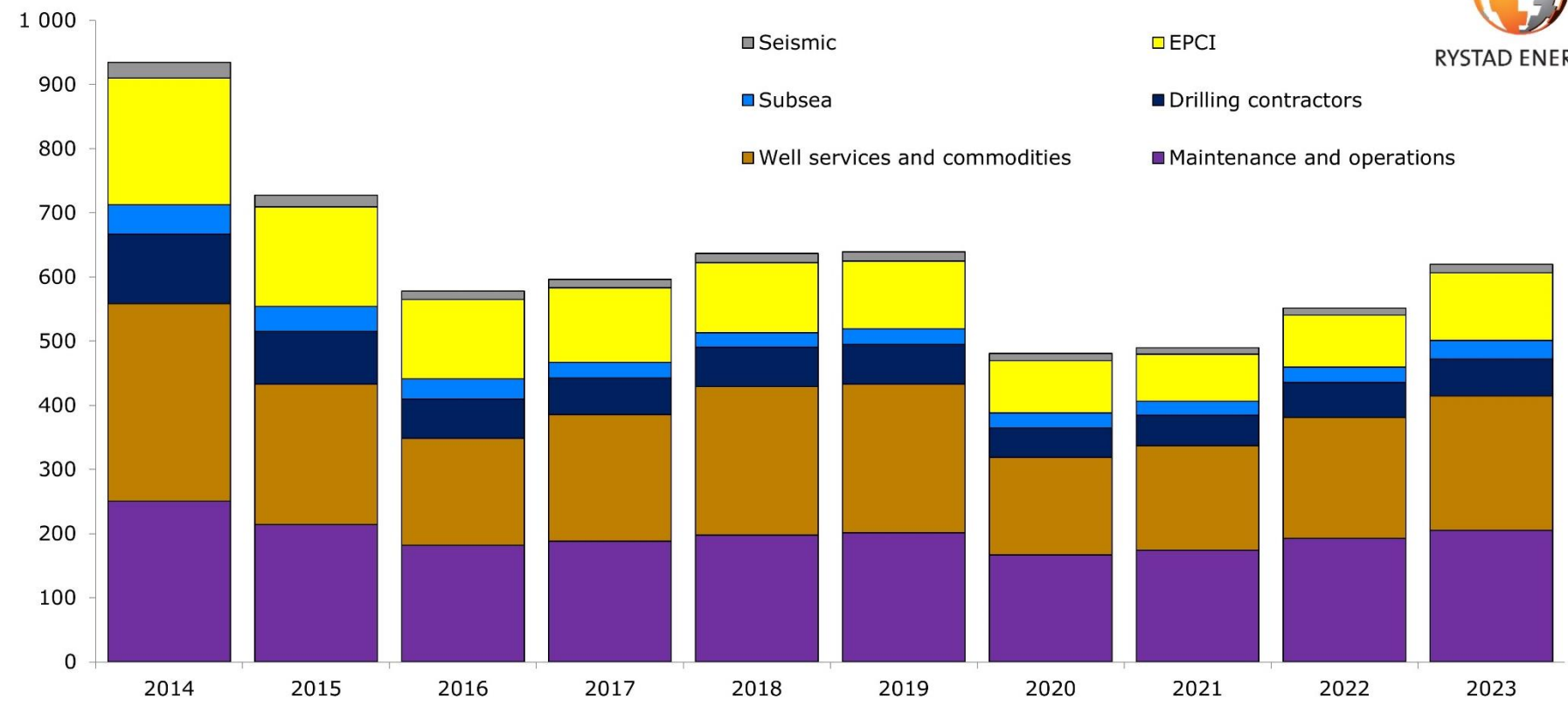
visualcapitalist.com



Global Oilfield Services Market

Oilfield Service yearly demand forecast by segment

Billion USD



RYSTAD ENERGY

The Portfolio of Oilfield Services Companies

Advantage of Scale — Breadth of Technology Portfolio

Market segments	SLB	HAL	BHI	WFT	NOV	FMC	TEC	AKSO	GE	H&P	NBR	PTEN
Wireline Logging												
Production Testing												
Geophysical Equipment & Services												
Software												
Directional Drilling												
Logging While Drilling												
Drilling & Completions Fluids												
Solid Controls												
Surface Data Logging												
Drill Bits												
Rental & Fishing												
OCTG												
Downhole Drilling Tools												
Casing & Tubing Services												
Land Contract Drilling												
Hydraulic Fracturing												
Cementing												
Artificial Lift												
Completion Equipment & Services												
Coiled Tubing												
Specialty Chemicals												
Inspection & Coating												
Subsea Equipment												
Rig Equipment												
Surface Equipment												
Unit Manufacturing												
Offshore Construction Services												
Offshore Contract Drilling												

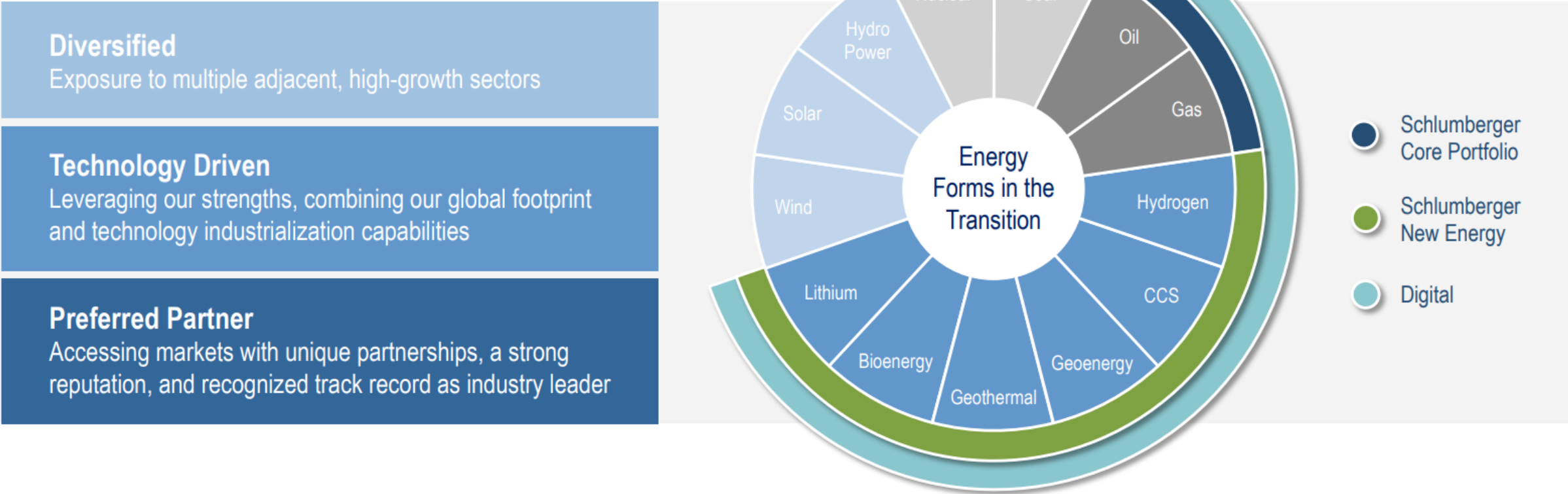
Market leadership

Presence in the category

Schlumberger

Source: Spears Oilfield Market Report April 2016; SLB Analysis

Long-term Growth in Schlumberger New Energy



Schlumberger New Energy Sectors

HYDROGEN

Genvia

Commercializing reversible solid oxide electrolyzer technology to produce clean hydrogen

CARBON

CCS

Providing carbon capture and storage solutions to partners with concentrated emission streams

GEO-ENERGY

Celsius Energy

Using geo-energy sources to provide digitally controlled heating and cooling

GEO THERMAL

GeoFrame Energy

Leveraging our subsurface and drilling expertise to develop geothermal power projects

LITHIUM / BATTERIES

New Ventures

Creating a pipeline of ventures such as developing advanced lithium extraction process technology

Rigs Market



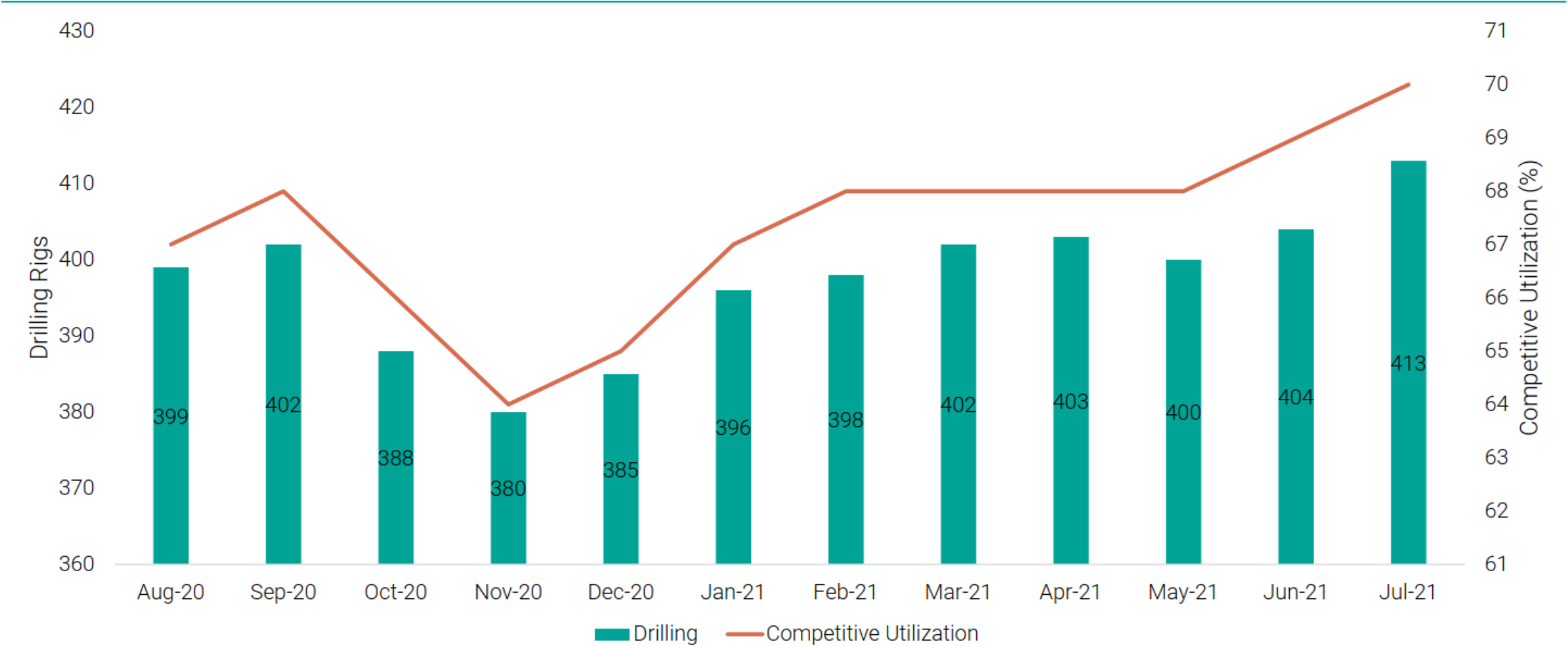
Land

- Drilling
- Workover

Offshore

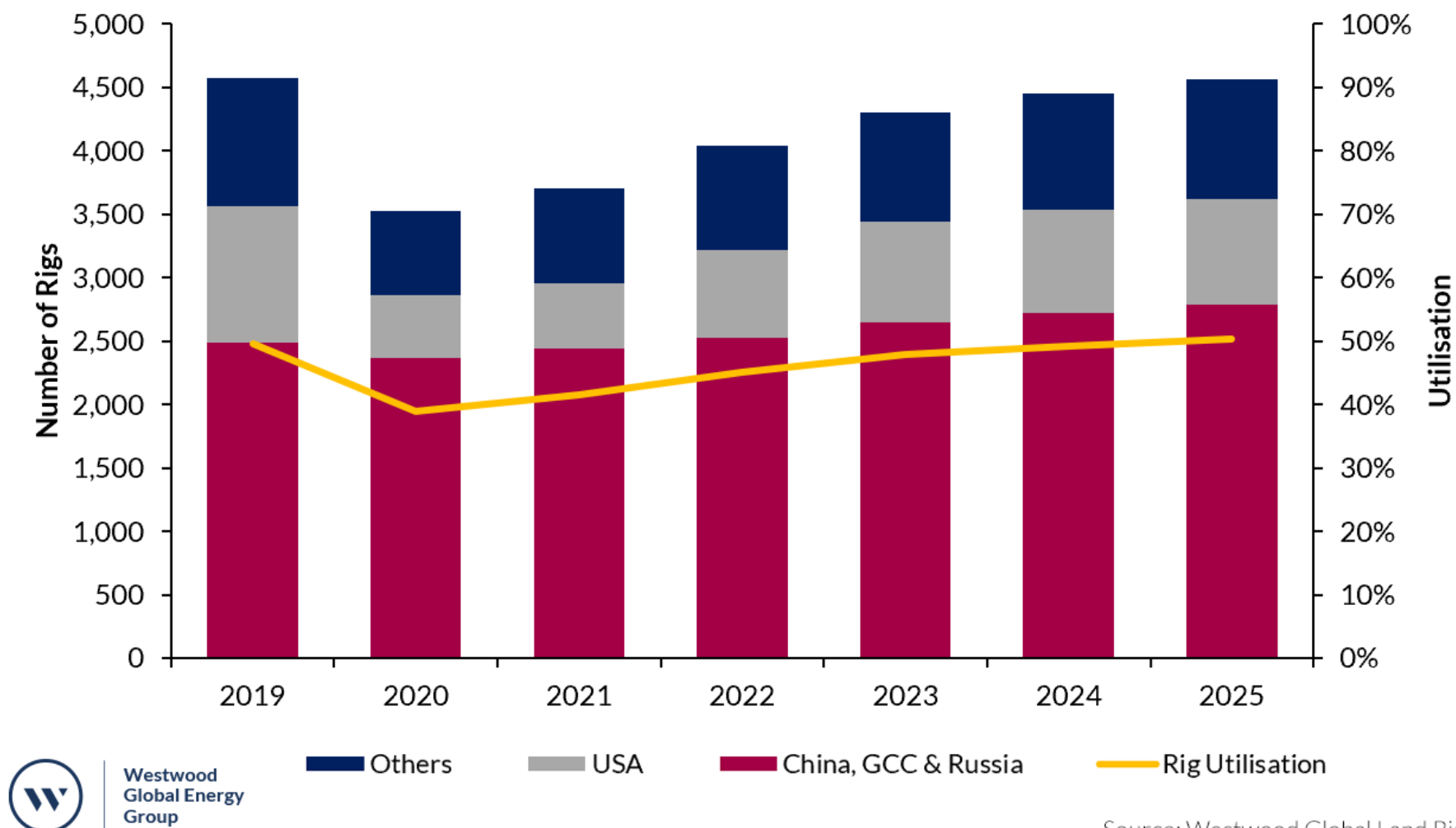
- Jackup
- Semisubmersible
- Drillship

Offshore Rig Market

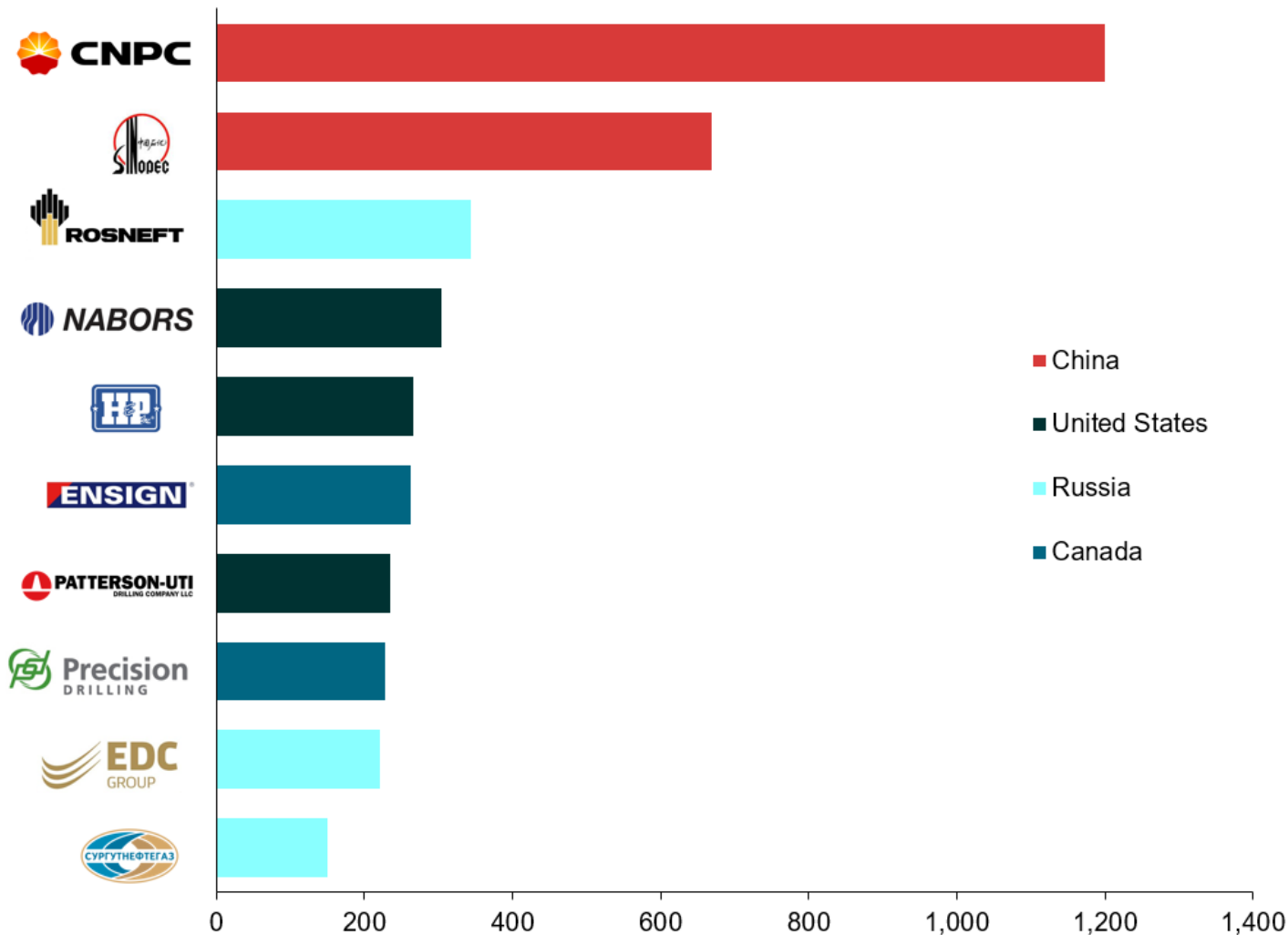


Source: Bassoe Analytics

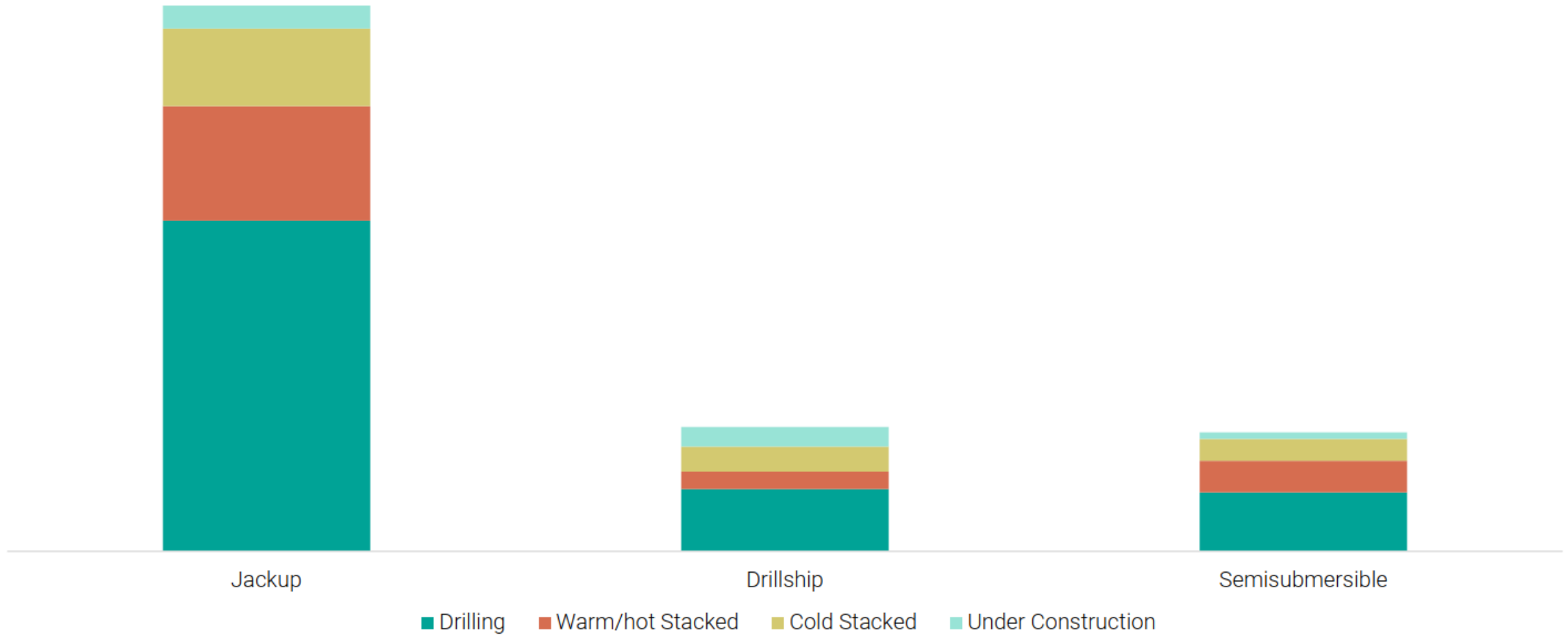
Average Number of Rigs Operational and Global Rig Utilization



Top 10 Land Drilling Contractors

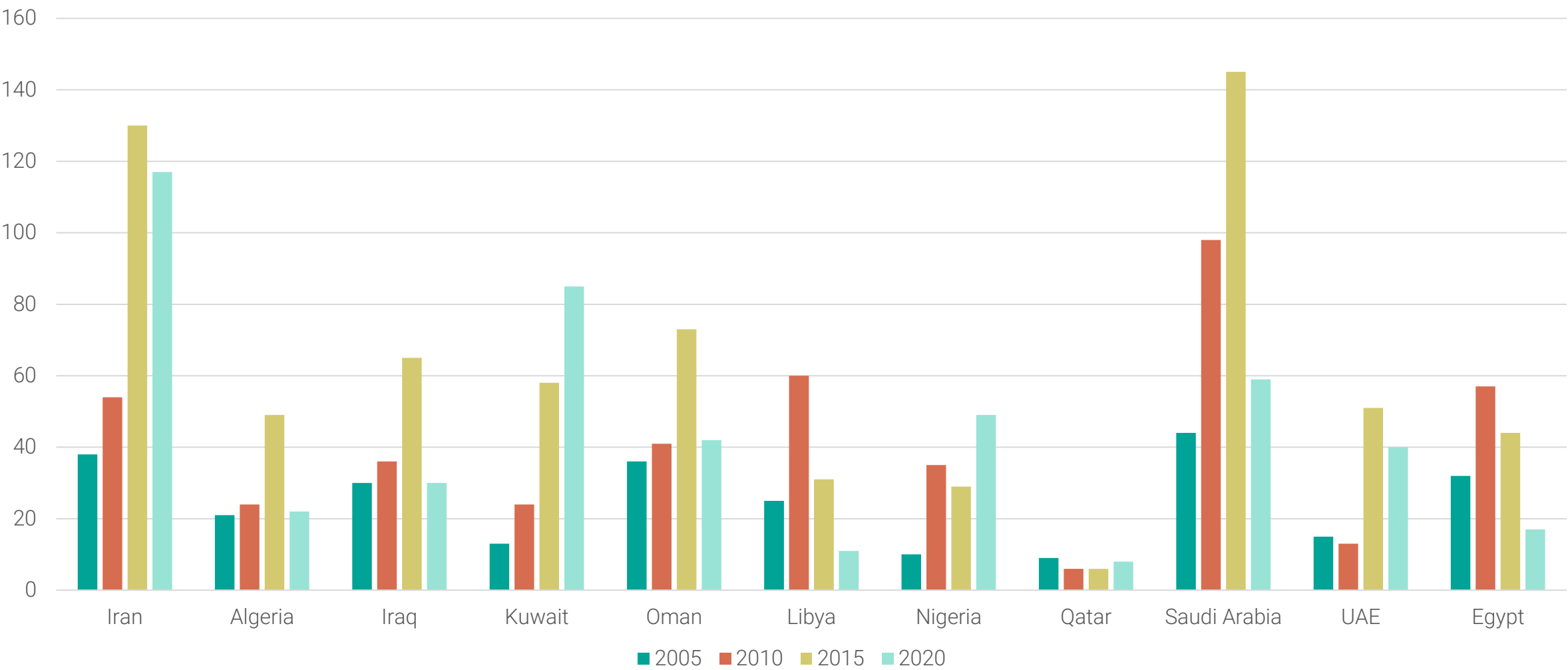


Rigs Status by Type

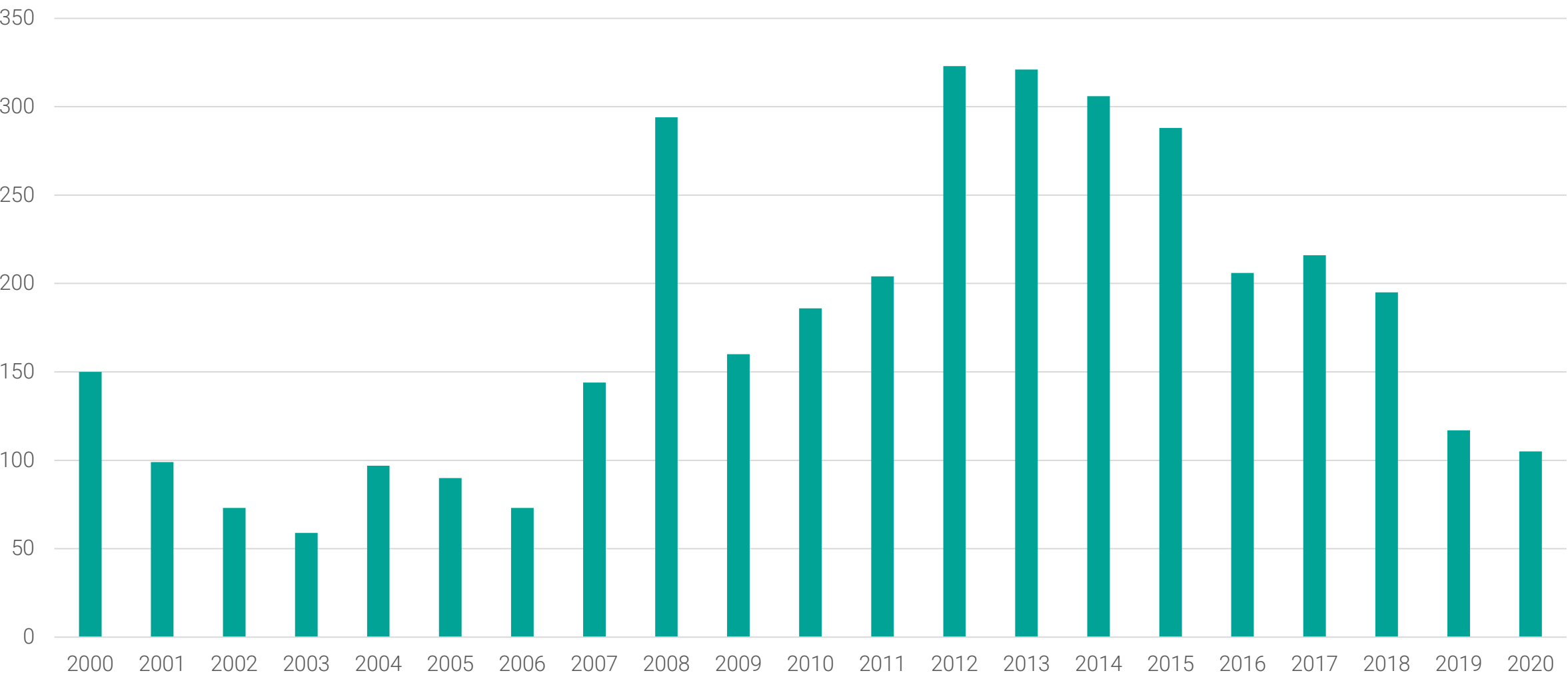


Source: Bassoe Analytics

Active Rigs in MENA



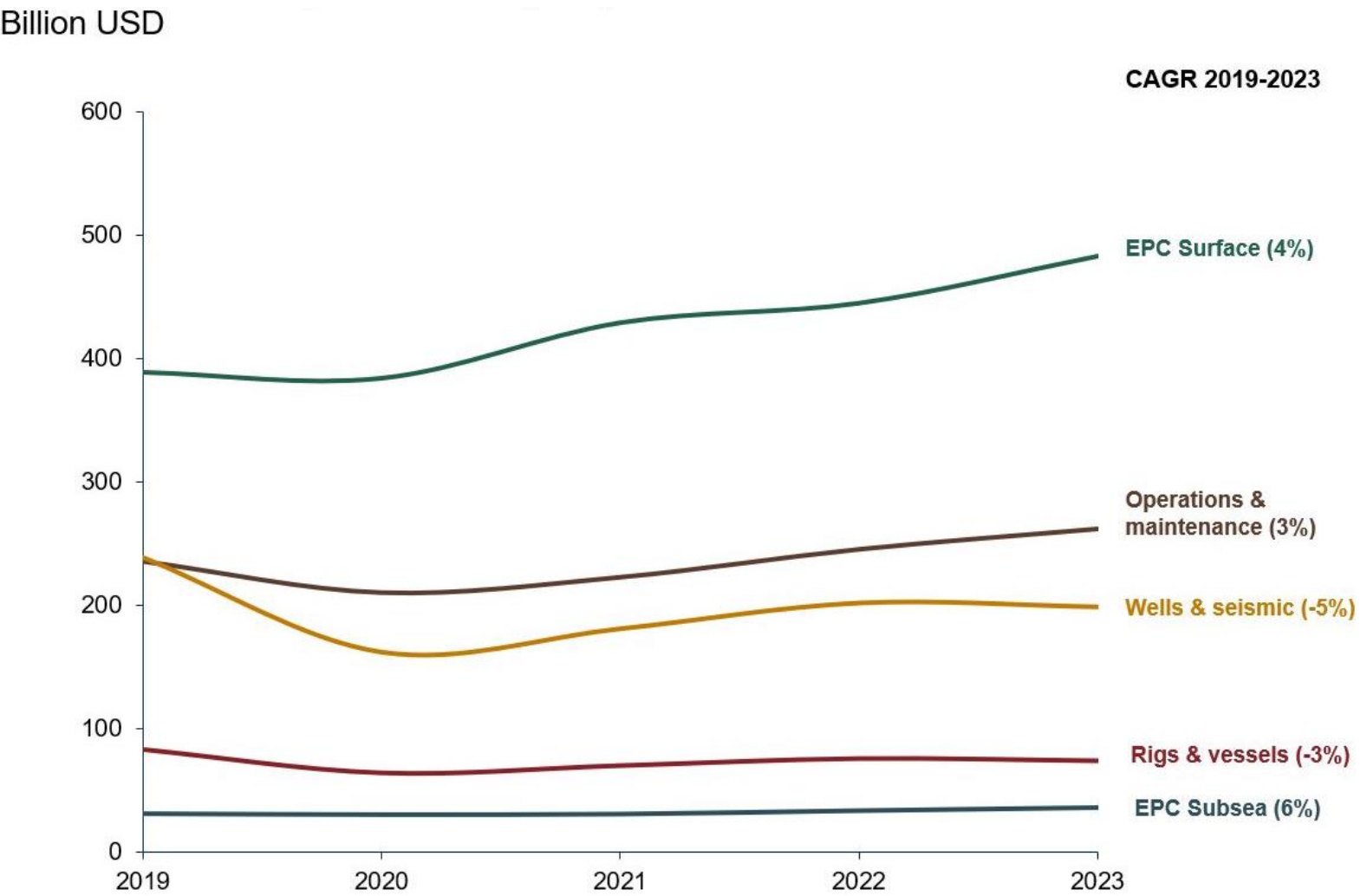
Completed Wells in Iran



Ranking of 11 OFS Segments Based on Resilience to Energy Transition



Services Purchase by Segment



16. Middle East Update

To provide an update of recent evolutions in selected Middle East countries

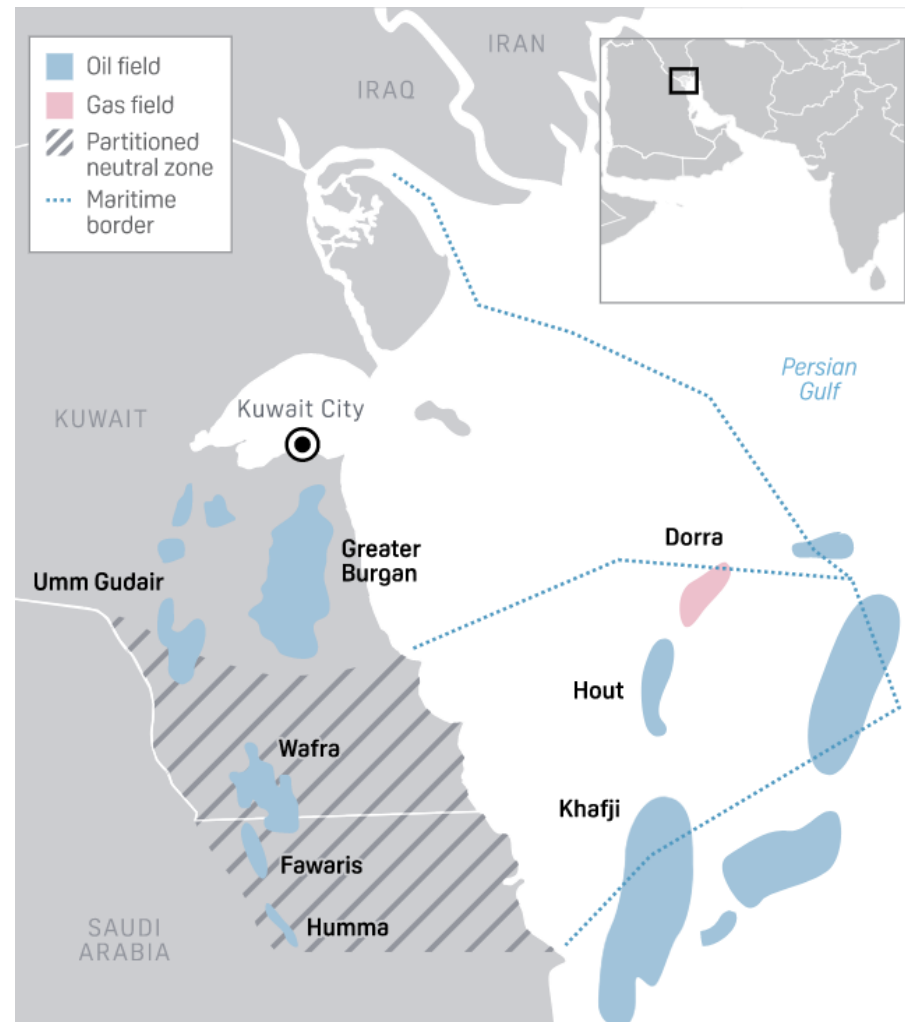
Saudi Arabia General Information (2020)

Population (million inhabitants)	35.01
GDP per capita (\$)	19,996
GDP at market prices (million \$)	700,118
Proven crude oil reserves (million barrels)	261,600
Proven natural gas reserves (billion cu. m.)	8,438
Crude oil production *(1,000 b/d)	9,213.2
Marketed production of natural gas (million cu. m.)	119,000.0
Refinery capacity (1,000 b/cd)	2,927.0

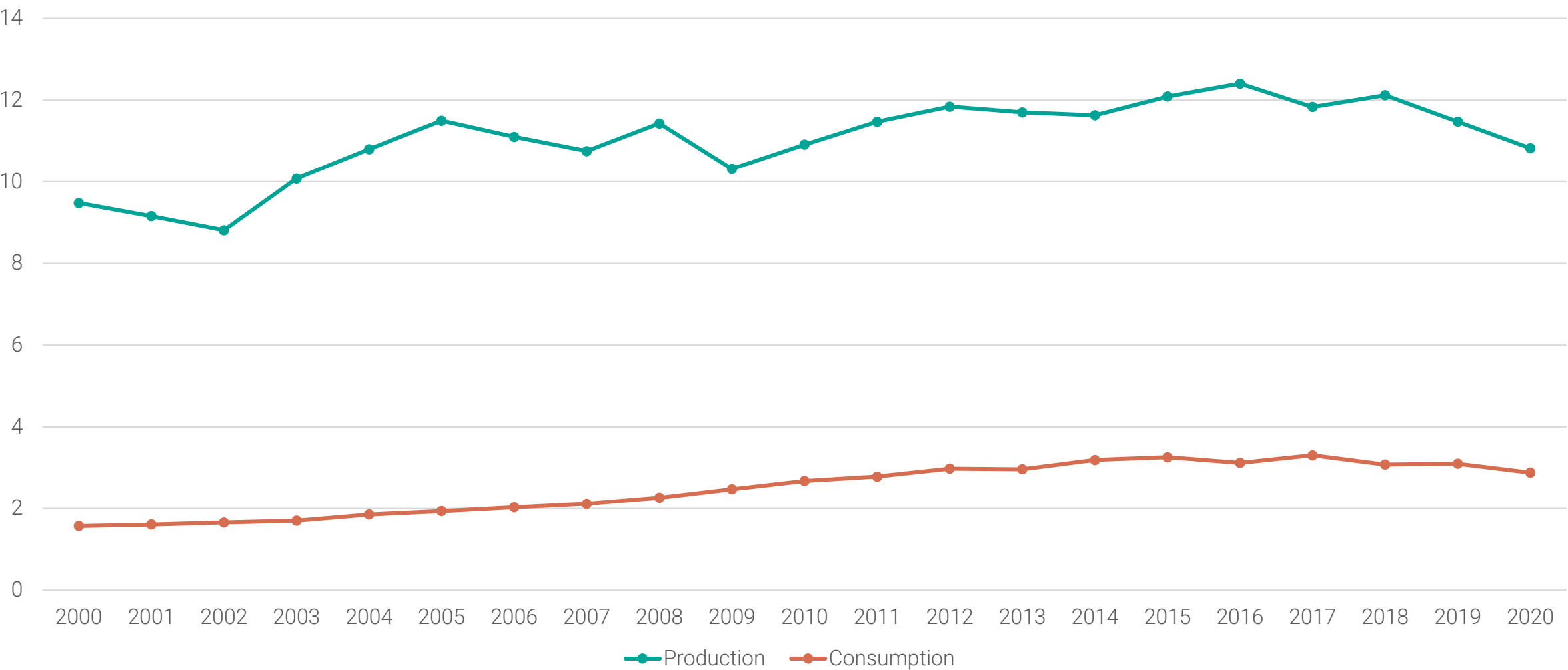
Key Issues

- World's largest oil exporter and OPEC's most influential member
- Oil production comes mostly from onshore fields and is dominated by the Ghawar field – the world's largest
- National oil company Saudi Aramco is responsible for nearly all oil and gas production
- Chevron holds a unique position as operator of the oil fields in the onshore portion of the Neutral Zone
- Saudi exports 7-8 million barrels per day with the remainder going to local refineries and power stations
- During the hotter summer months, demand for power generation increases, which increases crude burn

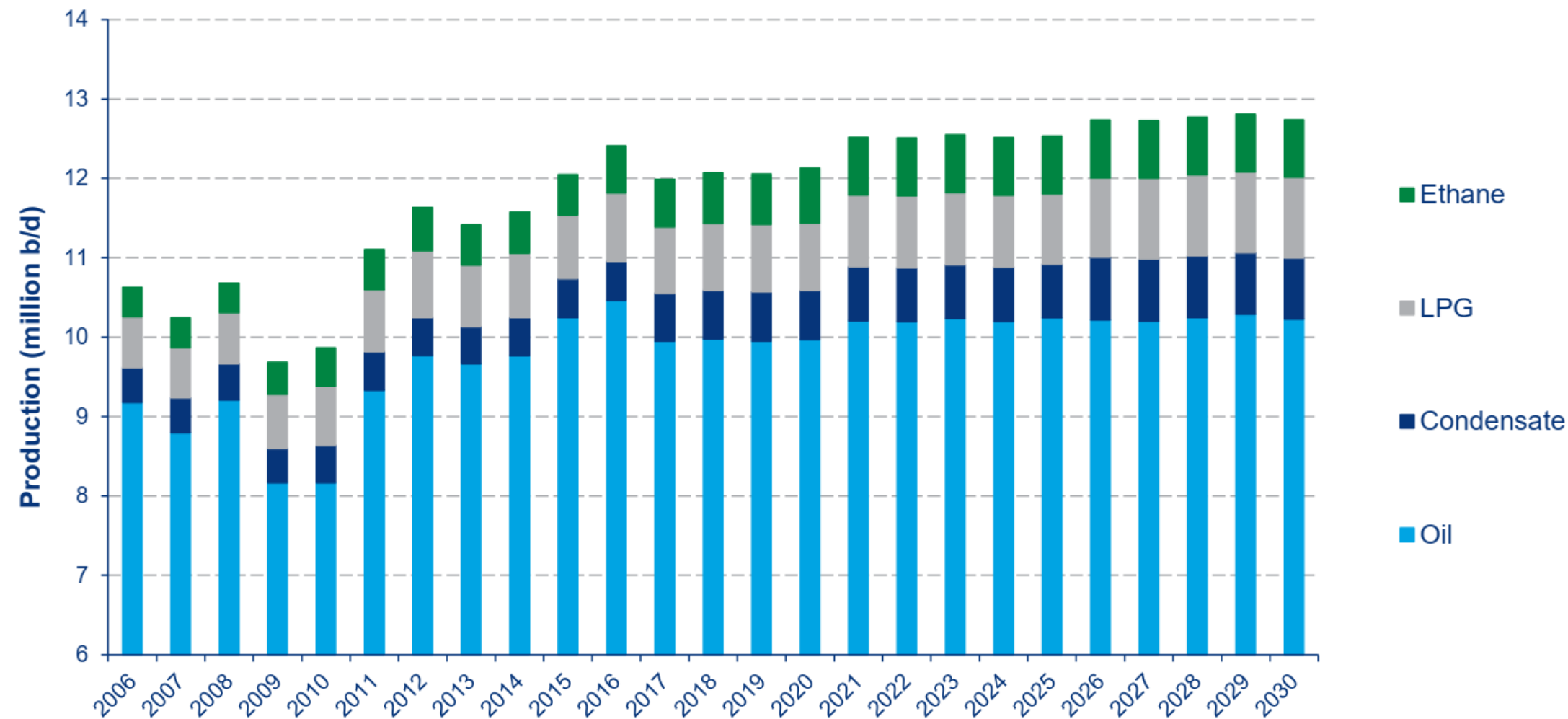
Neutral Zone



Petroleum and Other Liquids Production and Consumption (MBPD)

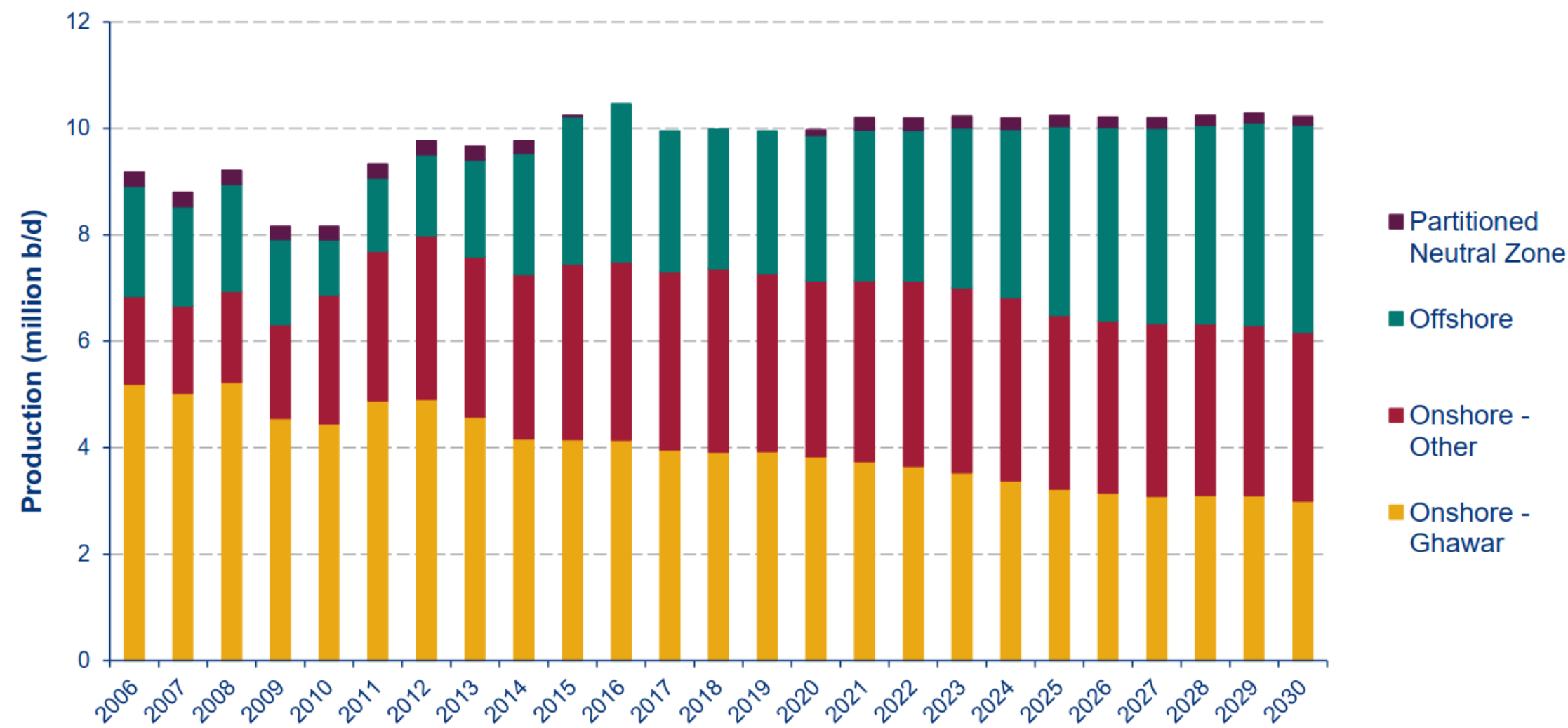


Liquids Production by Hydrocarbon Type (data: 2018)



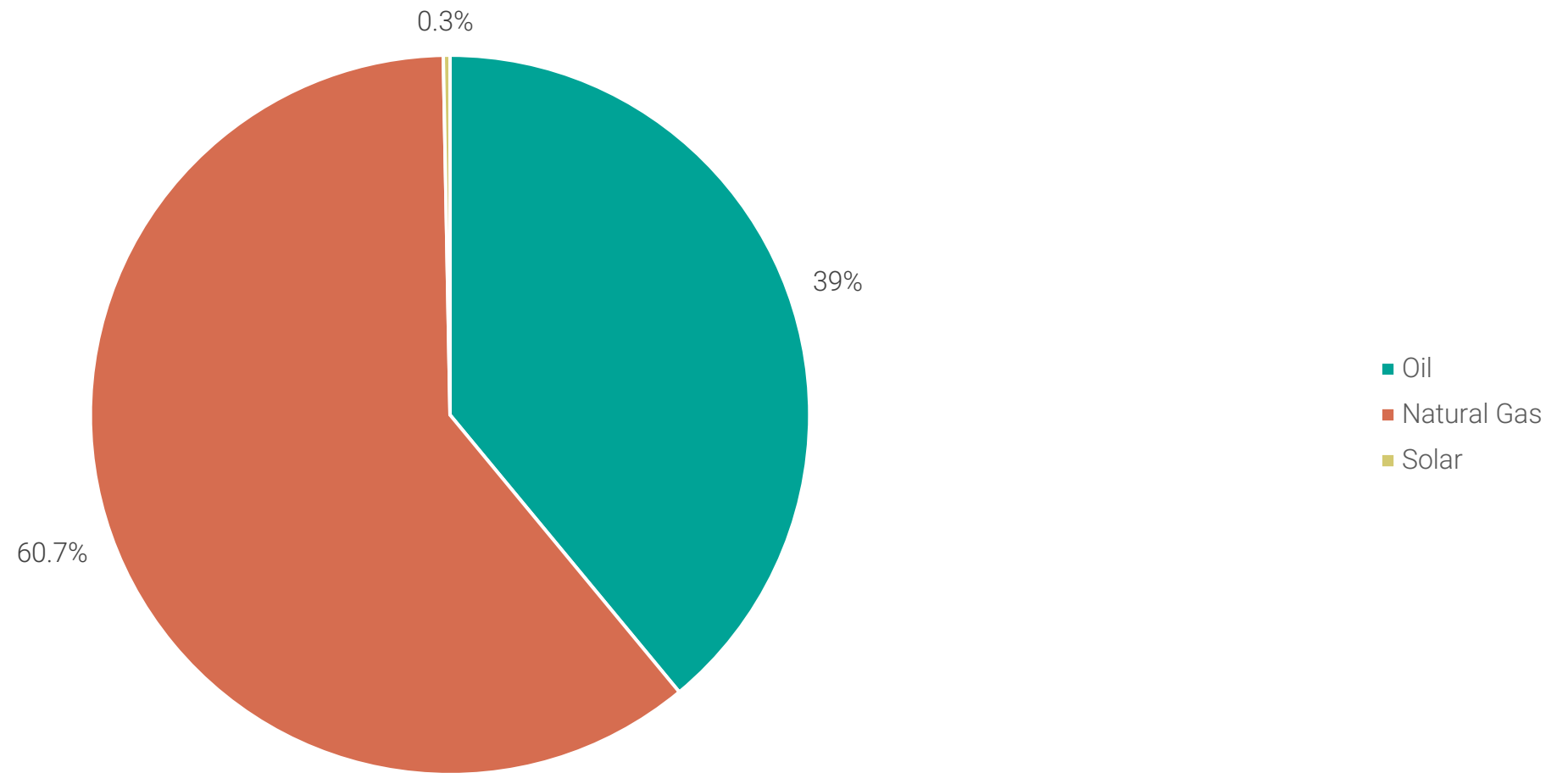
Wood Mackenzie Saudi Arabia Upstream Summary 2018

Oil production by Location (2018)

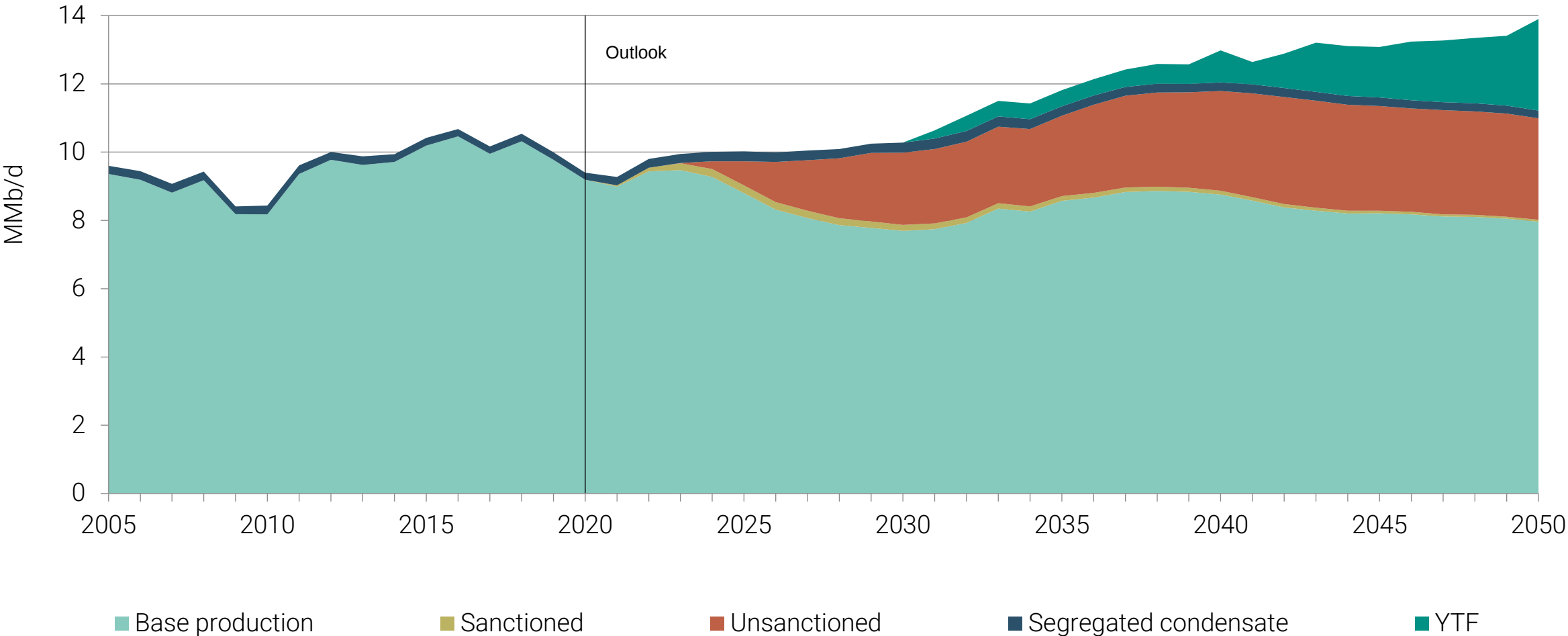


Wood Mackenzie Saudi Arabia Upstream Summary 2018

Electric Power Generation by Fuel



Crude and Condensate Production by Development



IHS Markit Asia Pacific and Middle East crude and condensate production outlook 2021

Aramco's Consolidated Statement of Income

	Note	SAR		USD*	
		Year ended December 31		Year ended December 31	
		2020	2019	2020	2019
Revenue	25	768,109	1,105,696	204,829	294,852
Other income related to sales		93,982	131,089	25,062	34,957
Revenue and other income related to sales		862,091	1,236,785	229,891	329,809
Royalties and other taxes		(89,964)	(182,141)	(23,991)	(48,571)
Purchases	26	(181,116)	(225,170)	(48,297)	(60,045)
Producing and manufacturing		(74,350)	(58,249)	(19,827)	(15,533)
Selling, administrative and general		(46,970)	(36,647)	(12,525)	(9,773)
Exploration		(7,293)	(7,291)	(1,945)	(1,944)
Research and development		(2,830)	(2,150)	(755)	(573)
Depreciation and amortization	6,7	(76,208)	(50,266)	(20,322)	(13,404)
Operating costs		(478,731)	(561,914)	(127,662)	(149,843)
Operating income		383,360	674,871	102,229	179,966
Share of results of joint ventures and associates	8	(3,554)	(9,455)	(948)	(2,521)
Finance and other income	28	3,182	7,351	849	1,960
Finance costs	21	(10,564)	(6,026)	(2,817)	(1,607)
Income before income taxes and zakat		372,424	666,741	99,313	177,798
Income taxes and zakat	9	(188,661)	(336,048)	(50,310)	(89,613)
Net income		183,763	330,693	49,003	88,185
Net income (loss) attributable to					
Shareholders' equity		184,926	330,816	49,313	88,218
Non-controlling interests		(1,163)	(123)	(310)	(33)
		183,763	330,693	49,003	88,185
Earnings per share (basic and diluted)	37	0.93	1.65	0.25	0.44

* Supplementary information is converted at a fixed rate of U.S. dollar 1.00 = SAR 3.75 for convenience only.

Aramco Operational Highlights

MSC (mmbpd) 12.0 (2019: 12.0)	Hydrocarbon production (mmboed) 12.4 (2019: 13.2)	Crude oil production¹ (mmbpd) 9.2 (2019: 9.9)	Reliability² (%) 99.9 (2019: 99.2)
Gross refining capacity (mmbpd) 6.4 (2019: 6.4)	Net chemicals production capacity (million tonnes per year) 53.1 (2019: 21.7)	Upstream carbon intensity (kg of CO ₂ e/boe) 10.5 (2019: 10.4)	Flaring intensity³ (scf/boe) 5.95 (2019: 5.88)

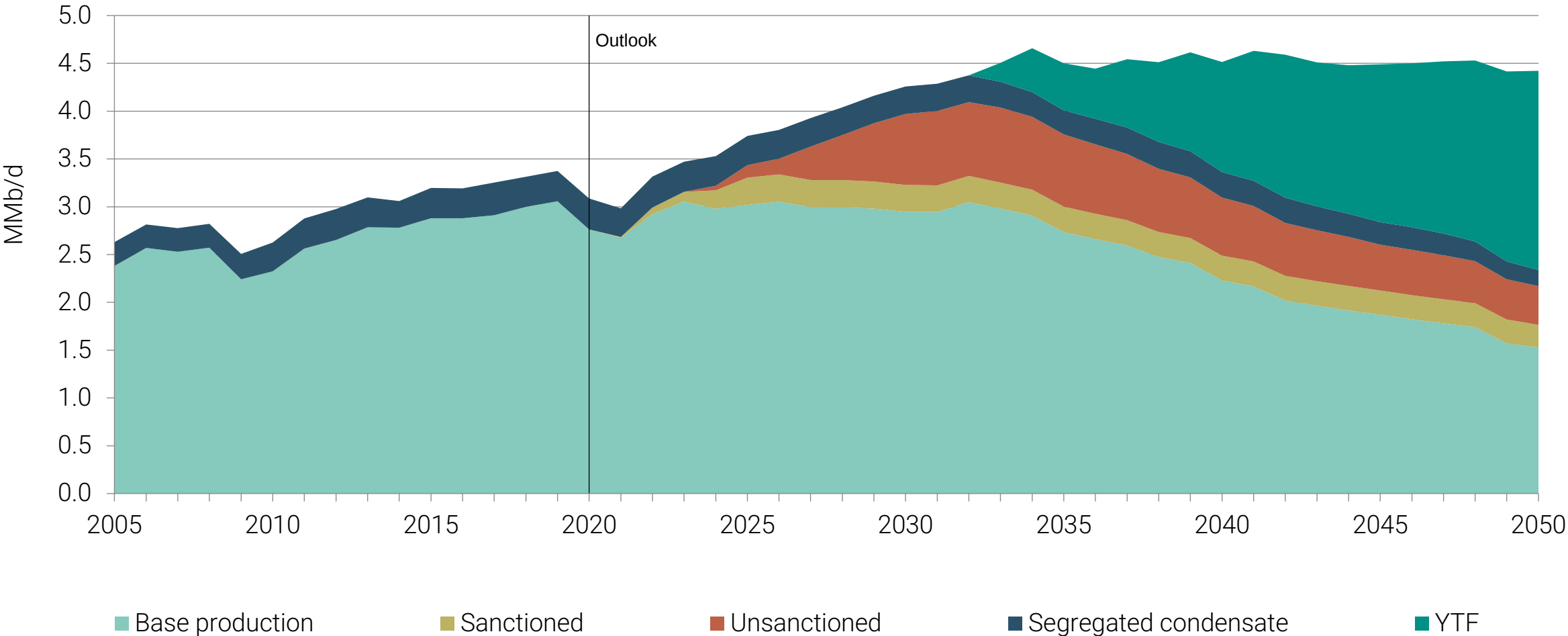
United Arab Emirates General Information (2020)

Population (million inhabitants)	9.28
GDP per capita (\$)	38,661
GDP at market prices (million \$)	358,869
Proven crude oil reserves (million barrels)	107,000
Proven natural gas reserves (billion cu. m.)	7,726
Crude oil production (1,000 b/d)	2,778.6
Marketed production of natural gas (million cu. m.)	55,064.5
Refinery capacity (1,000 b/cd)	1,272.0

Key Issues

- Most of the UAE's oil and gas production (>95%) is in Abu Dhabi
- Five fields (Asab, Bab, Bu Hasa, Umm Shaif and Zakum) account for more than 85% of the total oil production
- Pipeline gas imports from Qatar started in 2007. Dubai was the first emirate to begin LNG imports in 2010, followed by Abu Dhabi in 2016
- The volumes of sales gas available for the domestic market will be significantly lower, because of the continued reliance on gas re-injection for oil recovery
- Most contracts in the UAE are in the form of concession agreements and contractors are liable to pay royalty and income tax

Crude and Condensate Production by Development



IHS Markit Asia Pacific and Middle East crude and condensate production outlook 2021

Iraq General Information (2020)

Population (million inhabitants)	40.15
GDP per capita (\$)	4,160
GDP at market prices (million \$)	167,037
Proven crude oil reserves (million barrels)	145,019
Proven natural gas reserves (billion cu. m.)	3,714
Crude oil production (1,000 b/d)	3,996.6
Marketed production of natural gas (million cu. m.)	7,374.1
Refinery capacity (1,000 b/cd)	828.5

Key Issues

- Iraq has enormous oil resources. The ministry of oil estimate is over 150 billion barrels, with over 10 billion barrels in Kurdistan
- Production has grown from 2.4 million b/d in 2010 to 5 million b/d capacity in 2019, with Kurdistan contributing around 10%
- It has 110 tcf of gas resources, mostly associated with oil production, but domestic demand is not being met
- Iraq has the potential to be a substantial contributor to OPEC supply for many decades
- Kurdistan opened to foreign investors through license awards in 2002 and 2004, but the main influx started in 2006 with the award of the first Production Sharing Contract (PSC) in the region

The Summary of Four Bid Rounds

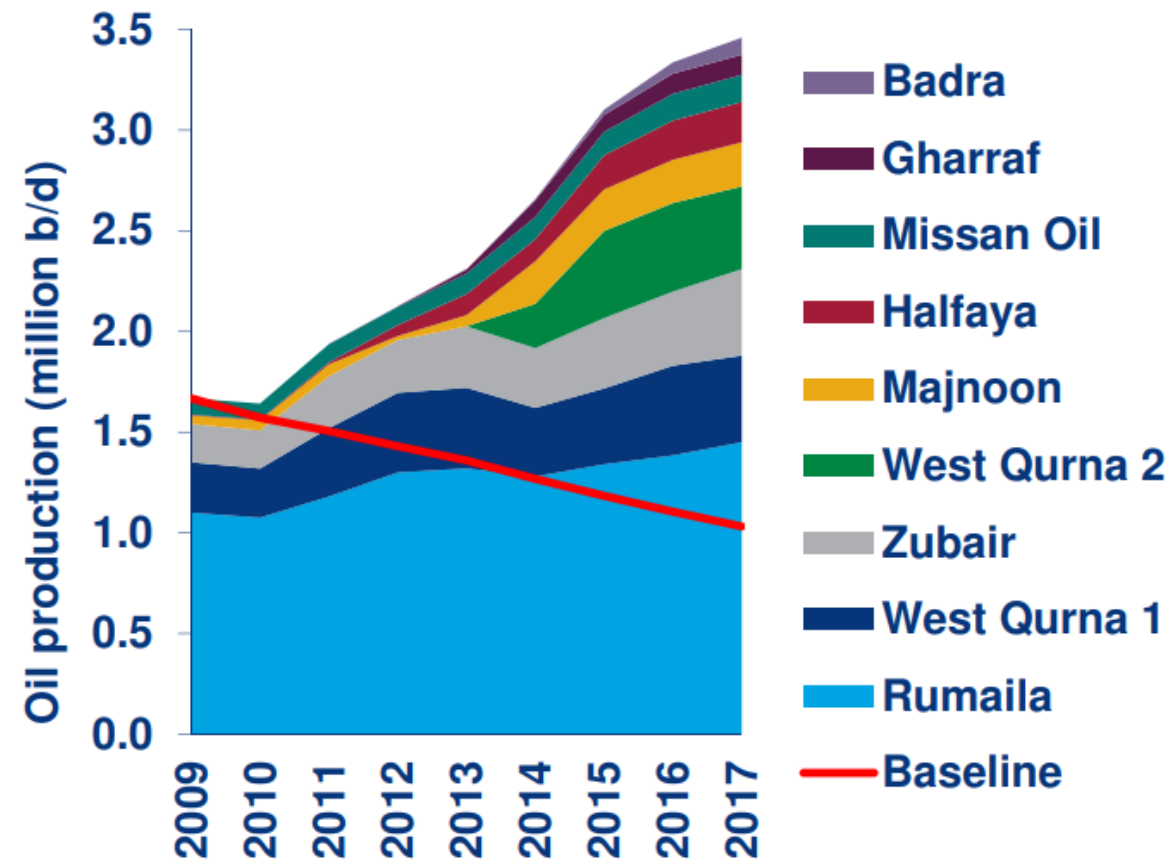
Bid round	Project or licensing block	Operator	Type	Production*			Max. fee**
				Initial Target	June 2012	Plateau target	
2008	Ahdab	Petrochina	Oil	25	129	140	6.00
One (2009)	Rumaila	BP	Oil	1 173	1 279	2 850	2.00
	West Qurna (I)	ExxonMobil	Oil	268	417	2 825	1.90
	Zubair	Eni	Oil	201	225	1 200	2.00
	Missan Group	CNOOC	Oil	97	91	450	2.30
	West Qurna (II)	Lukoil	Oil	120	-	1 800	1.15
Two (2009)	Majnoon	Shell	Oil	175	21	1 800	1.39
	Halfaya	Petrochina	Oil	70	34	535	1.40
	Gharraf	Petronas	Oil	35	-	230	1.49
	Badra	GazpromNeft	Oil	15	-	170	5.50
	Qairayah	Sonangol	Heavy oil	30	2	120	5.00
	Najmah	Sonangol	Heavy oil	20	-	110	6.00
	Akkas	KOGAS	Gas	1.03	-	4.1	5.50
Three (2010)	Mansuriyah	TPAO	Gas	0.78	-	3.1	7.00
	Siba	Kuwait Energy	Gas	0.26	-	1.0	7.50
Four (2012)	Block 8	Pakistan Petroleum	Gas-prone	n/a	-	n/a	5.38
	Block 9	Kuwait Energy	Oil-prone	n/a	-	n/a	6.24
	Block 10	Lukoil	Oil-prone	n/a	-	n/a	5.99
	Block 12	Bashneft	Oil-prone	n/a	-	n/a	5.00

Renegotiated Contract Terms

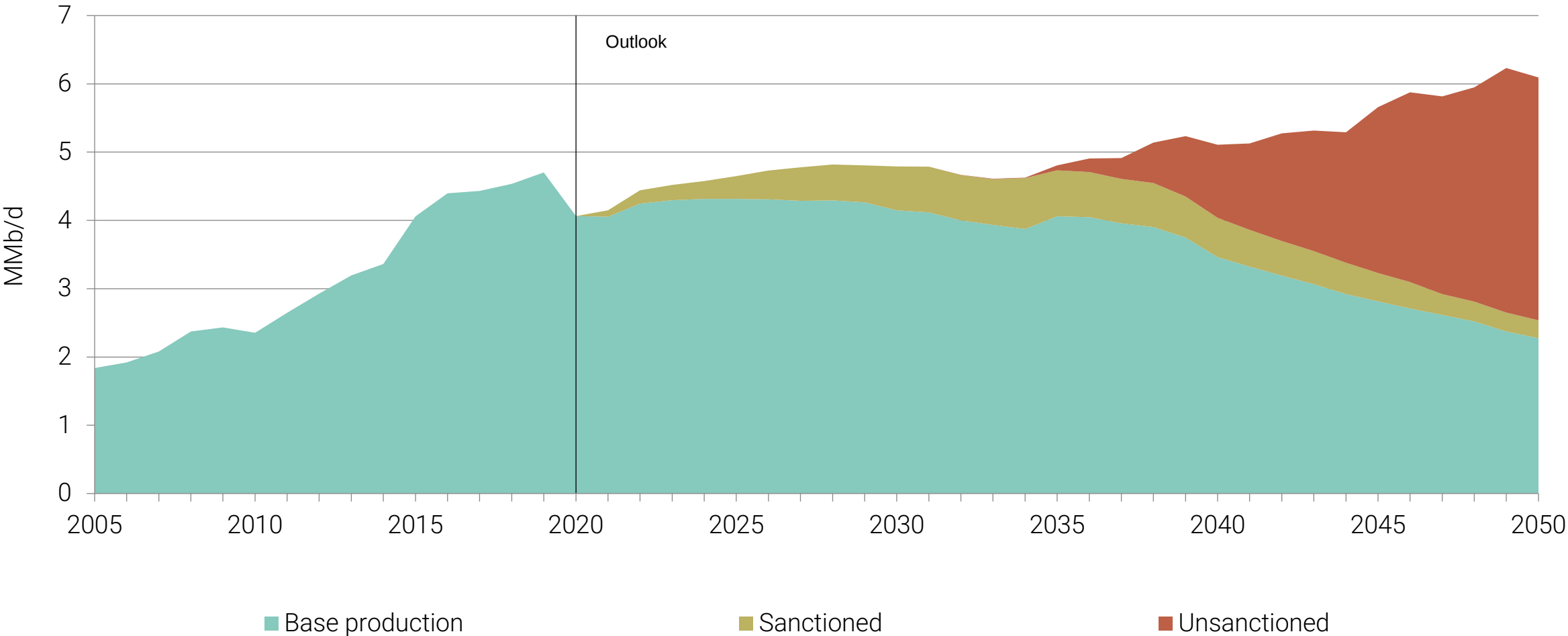
Project	Revised Plateau Production Target ('000 b/d)	Licence extension (Years)	Revised state equity (%)	Comments
Halfaya	400	10	10	-
Rumaila	2,100	5	6	R-factor removed
West Qurna 1	1,600	Unconfirmed	9.6	-
West Qurna 2	1,200	5	No change	Amendment includes construction of pipeline from Tuba to Fao
Zubair	850	5	No change	R-factor removed

Technical Service Contracts Performance

TSCs have more than doubled oil production



Crude and Condensate Production by Development



IHS Markit Asia Pacific and Middle East crude and condensate production outlook 2021

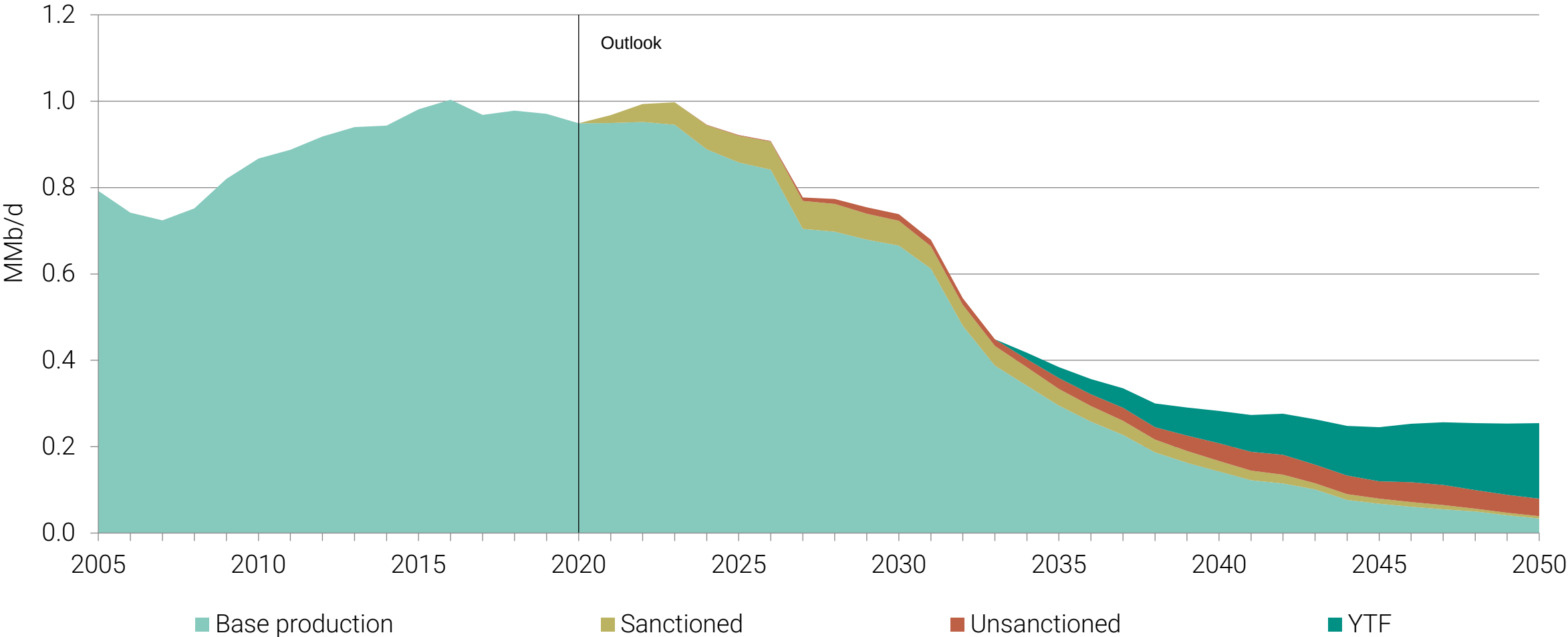
Oman General Information (2020)

Population (million inhabitants)	5.1
GDP per capita (\$)	14,255
GDP at market prices (million \$)	76,330
Proven crude oil reserves (million barrels)	5,400
Proven natural gas reserves (billion cu. m.)	700
Crude oil production (1,000 b/d)	951
Marketed production of natural gas (million cu. m.)	36,900

Key Issues

- Oman is the largest non-OPEC producer in the Middle East, dominated by state participated PDO
- Stable operating environment has drawn a multitude of international investors but considerable value remains locked up in PDO's Block 6, with less appetite and lower prospectivity in remaining acreage
- Challenging geology and requirement for EOR technology has resulted in relatively high cost developments
- Oman is a leading proponent of EOR developments in the Middle East, with steam flood, miscible gas and polymer injection projects common
- Oman offers Exploration and Production Sharing Agreements (EPSA) for new contracts. PDO Block 6 remains under concession terms

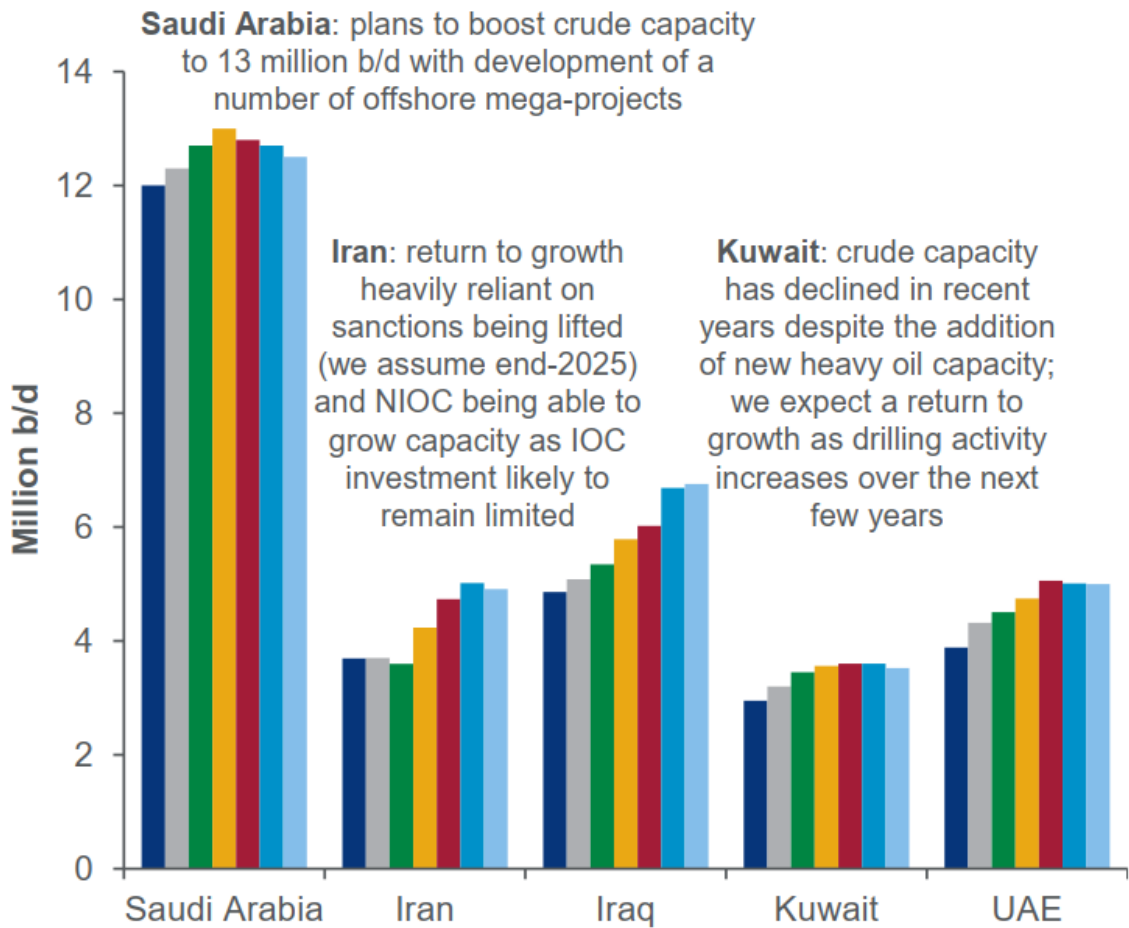
Crude and Condensate Production by Development



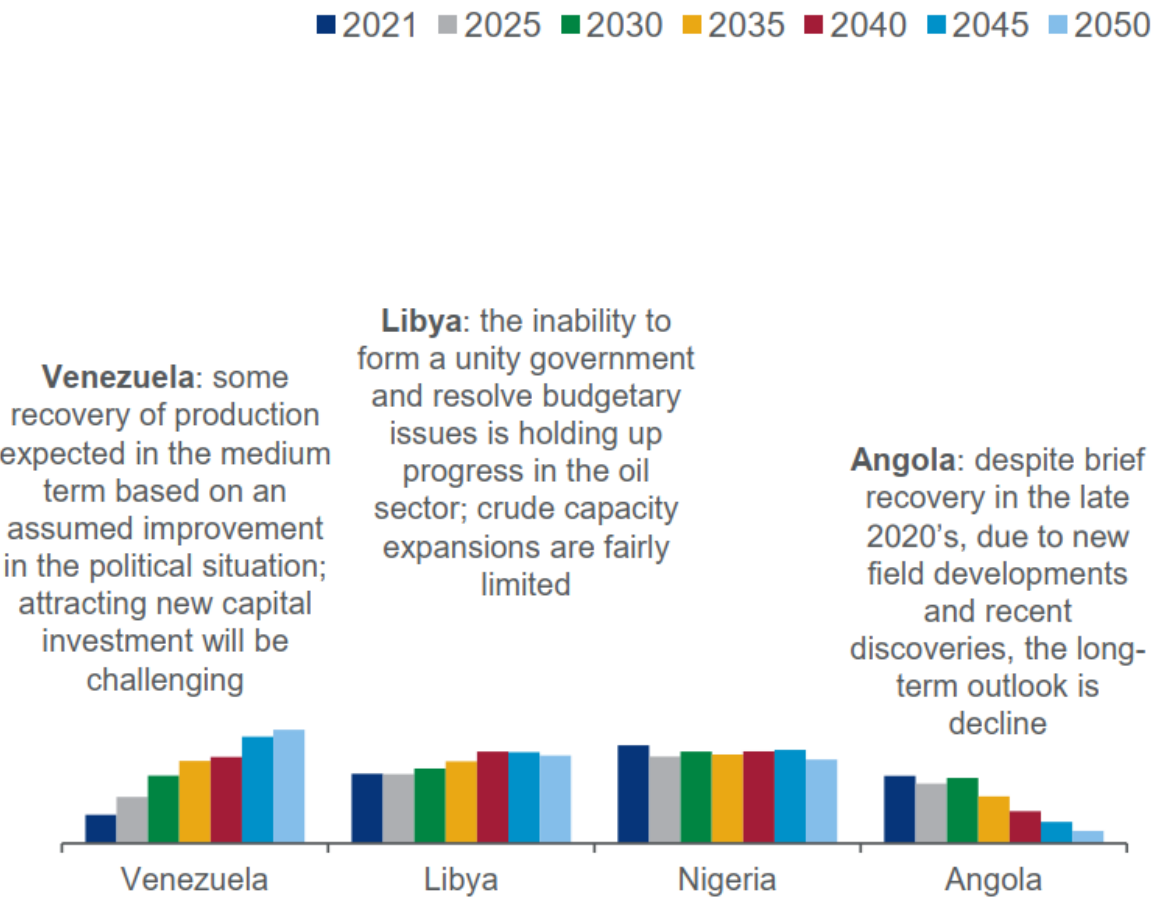
IHS Markit Asia Pacific and Middle East crude and condensate production outlook 2021

OPEC Crude Capacity

Middle East OPEC crude capacity

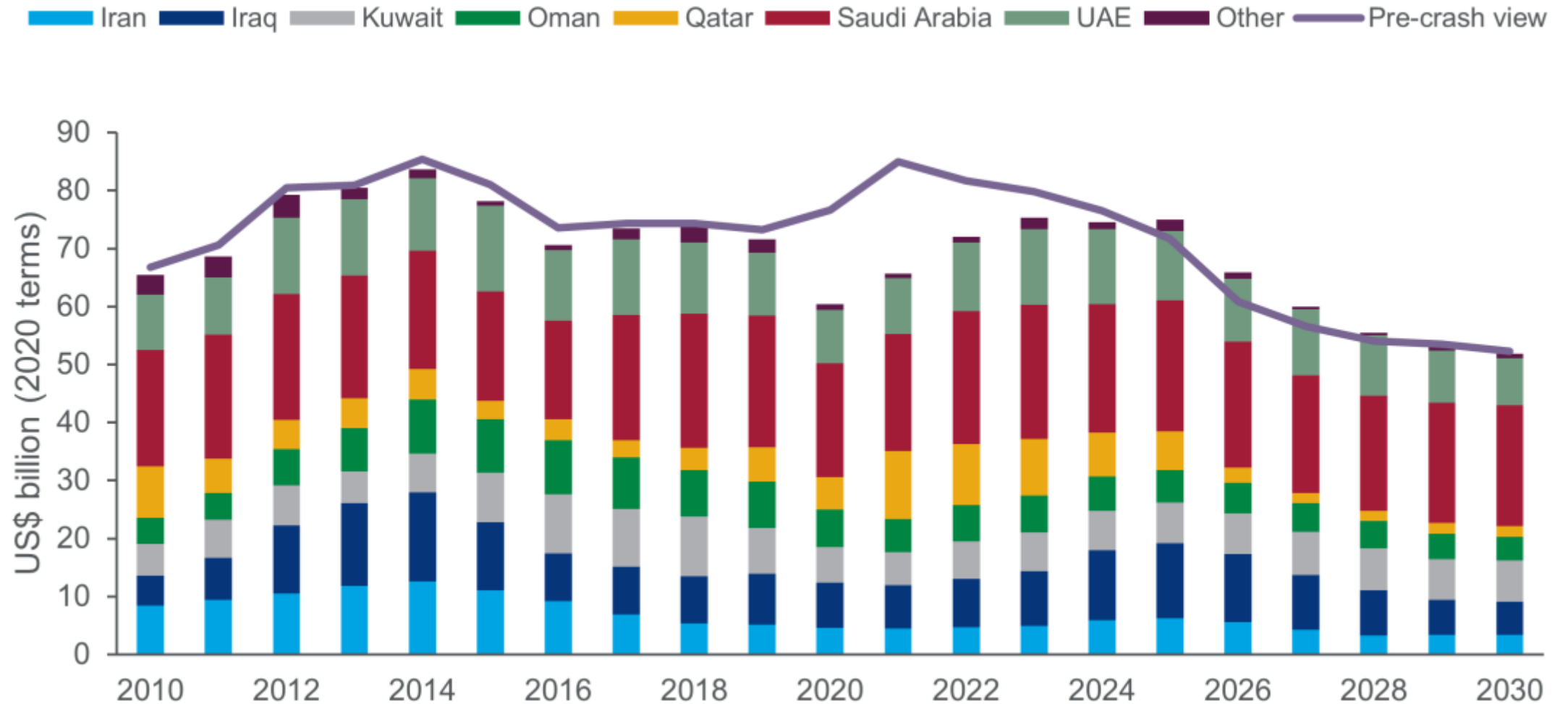


Other key OPEC crude capacity



Wood Mackenzie Macro Oils long-term 2021 outlook to 2050 November 2021

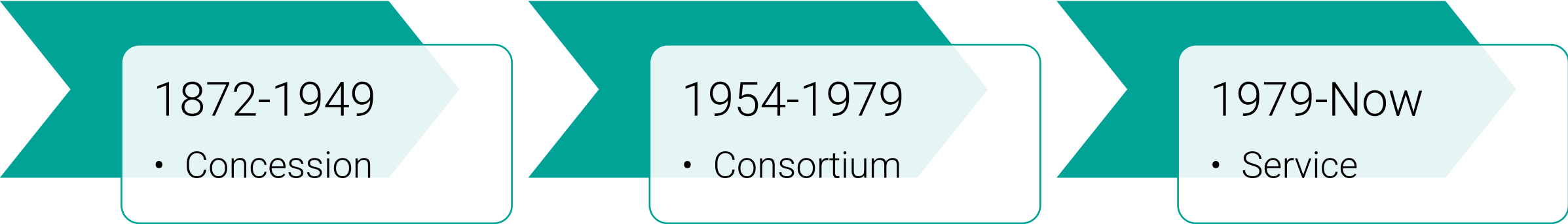
Middle East Upstream Investment



17. Oil in Iran

To present a briefing about Iran's oil history and recent evolutions

Periods of History



1872-1949

- Concession

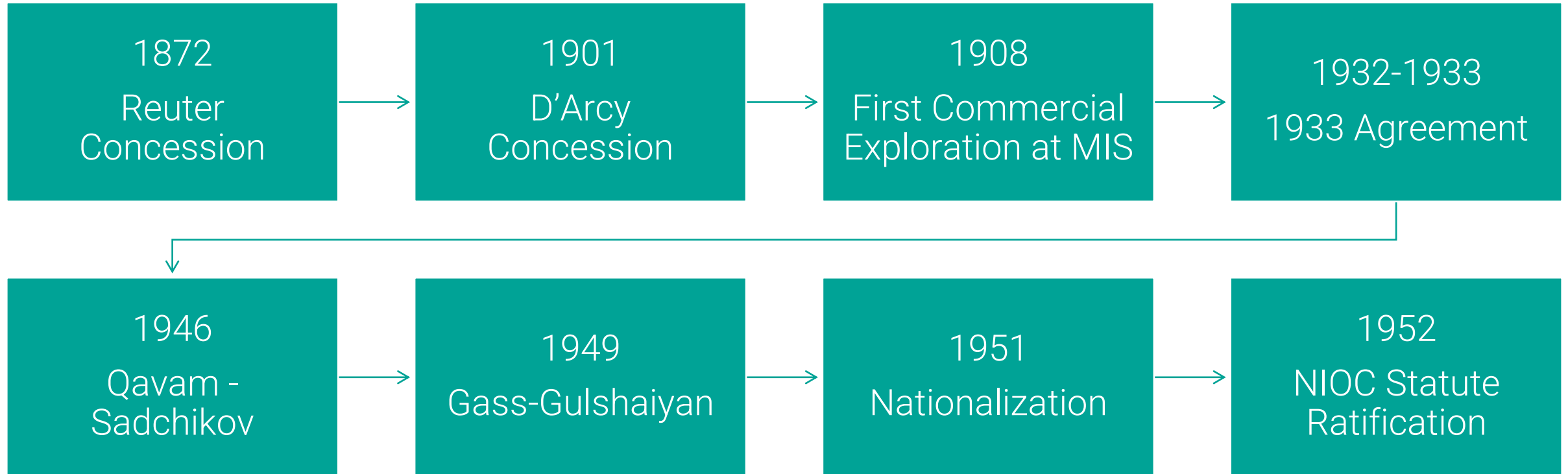
1954-1979

- Consortium

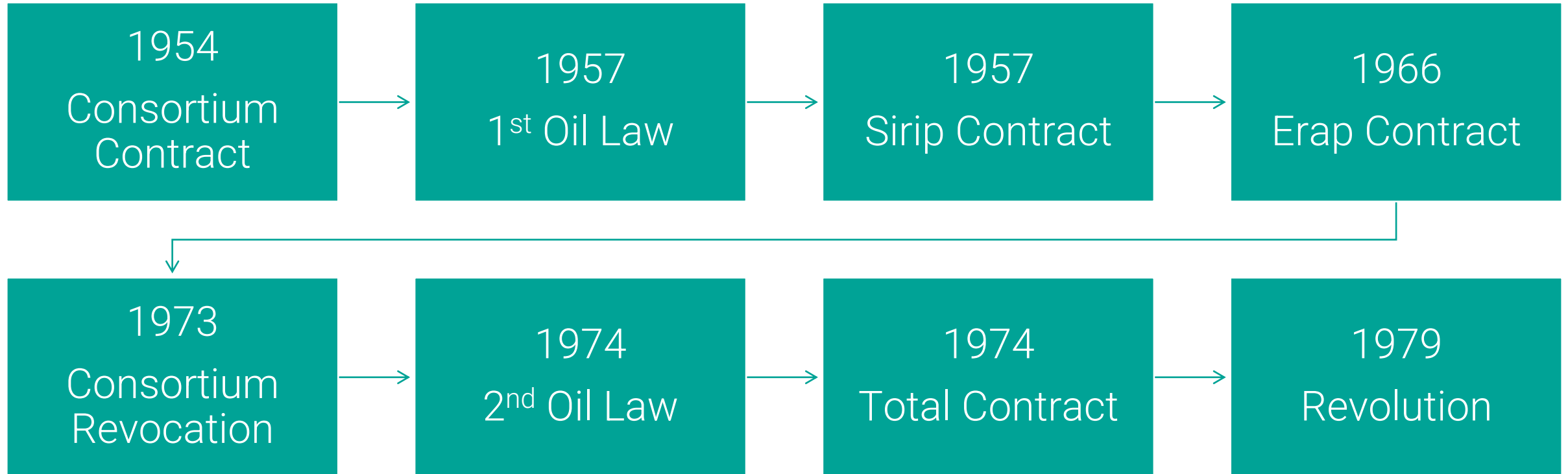
1979-Now

- Service

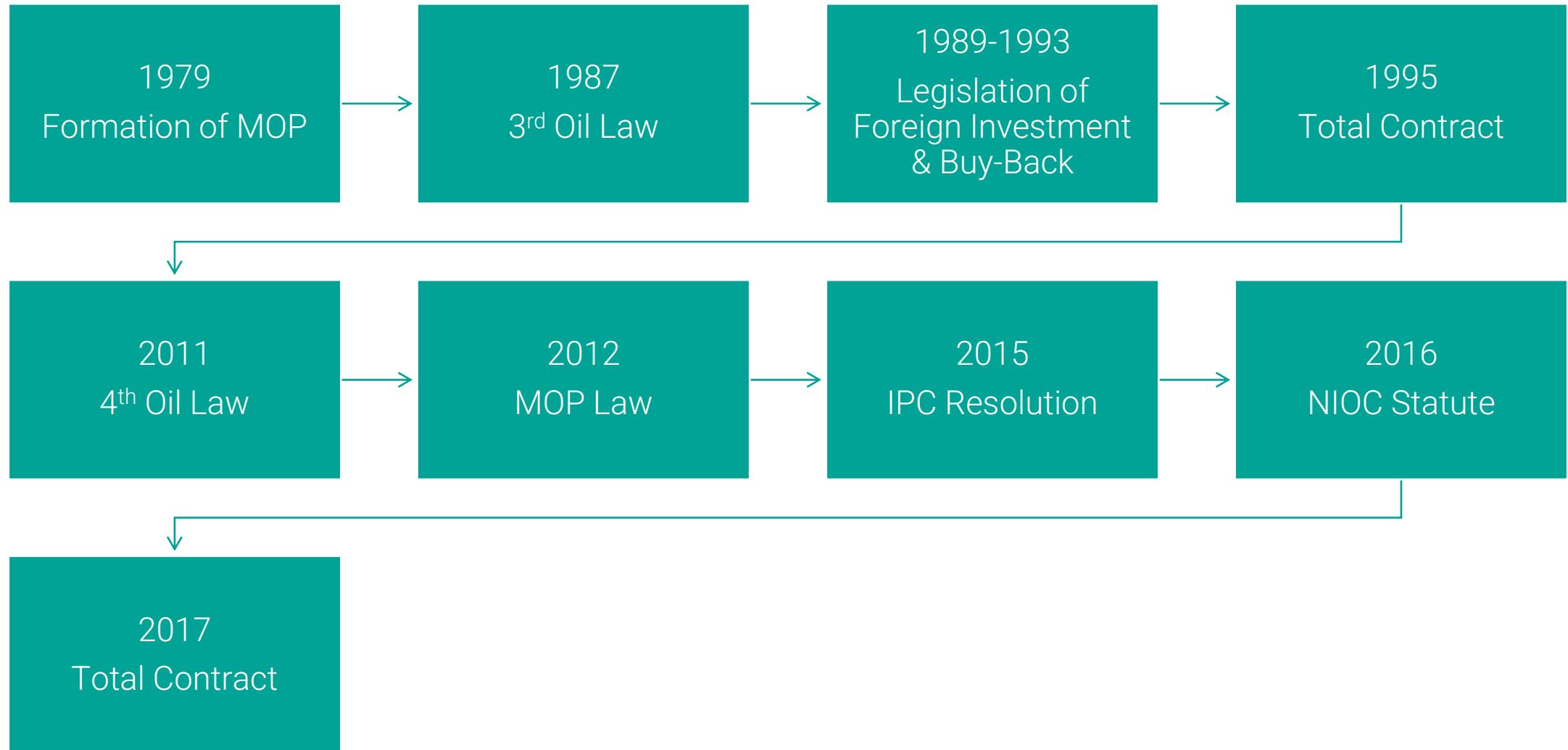
Concessions



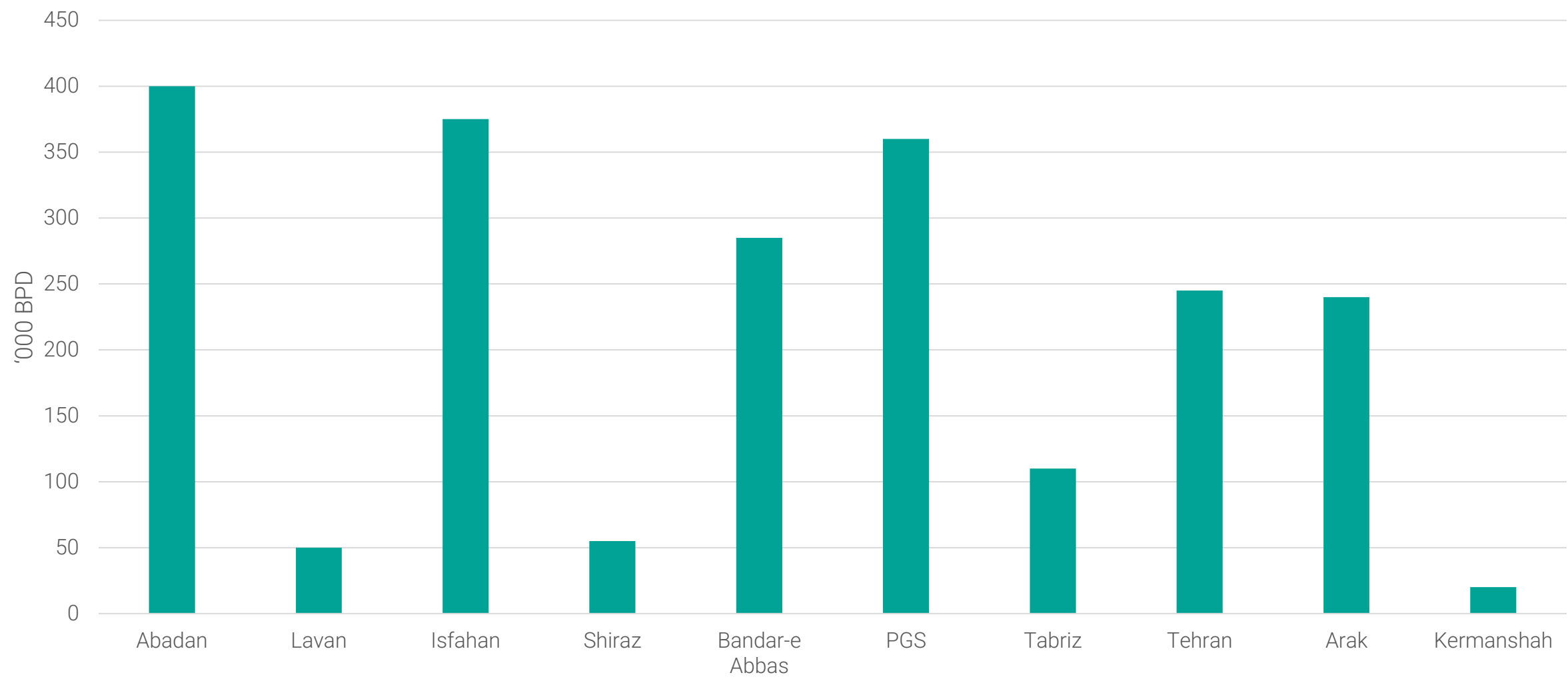
Consortium



Service Contracts



Iran Oil Refineries



Iran Petrochemical Plants (Examples)

Methanol

Zagros

Fanavaran

Urea

Pardis

Khorasan

Olefin

Arya Sasol

Arak

BTX

Nouri

Bu Ali

Post JCPOA E&P Players in Iran

European majors	Favoured by NIOC for their technology and know-how    
European mid-caps	Specific expertise can be a plus for specific mid-size projects     
Asians	Political relations and Iran's will to secure market share will help, but technical reputation can disserve some           
Russians	Political relations and part of Moscow's strategy to increase its influence in MENA oil and gas    

Iranian E&Ps

Name	Major shareholder	Name	Major shareholder
Petro Pars	Government	PEDC	Private *
OIEC	Public	PGFK	Public
Dana Energy	Private	IOEC	Public
PEDCO	Government	Kayson	Private
MAPNA	Public	Iran Ofogh	Private
Khatam-ol-Anbia	Public	Pars Petro Zagros	Private
IDRO	Government	Global Petro Tech	Private *
Persia	Public	NDCO	Public
Ghadir	Public		

Classification of Iranian Energy Players

Investment

E&P

- NIOC
- Dana Energy

Chemicals

- Arya Sasol
- Jam

Refining

- Tehran
- Abadan

Power & Utilities

- Mahtab Gostar
- Mapna

Supply Chain

EPC

- Jahan Pars
- Kayson

OFS

- NIDC
- NDCO

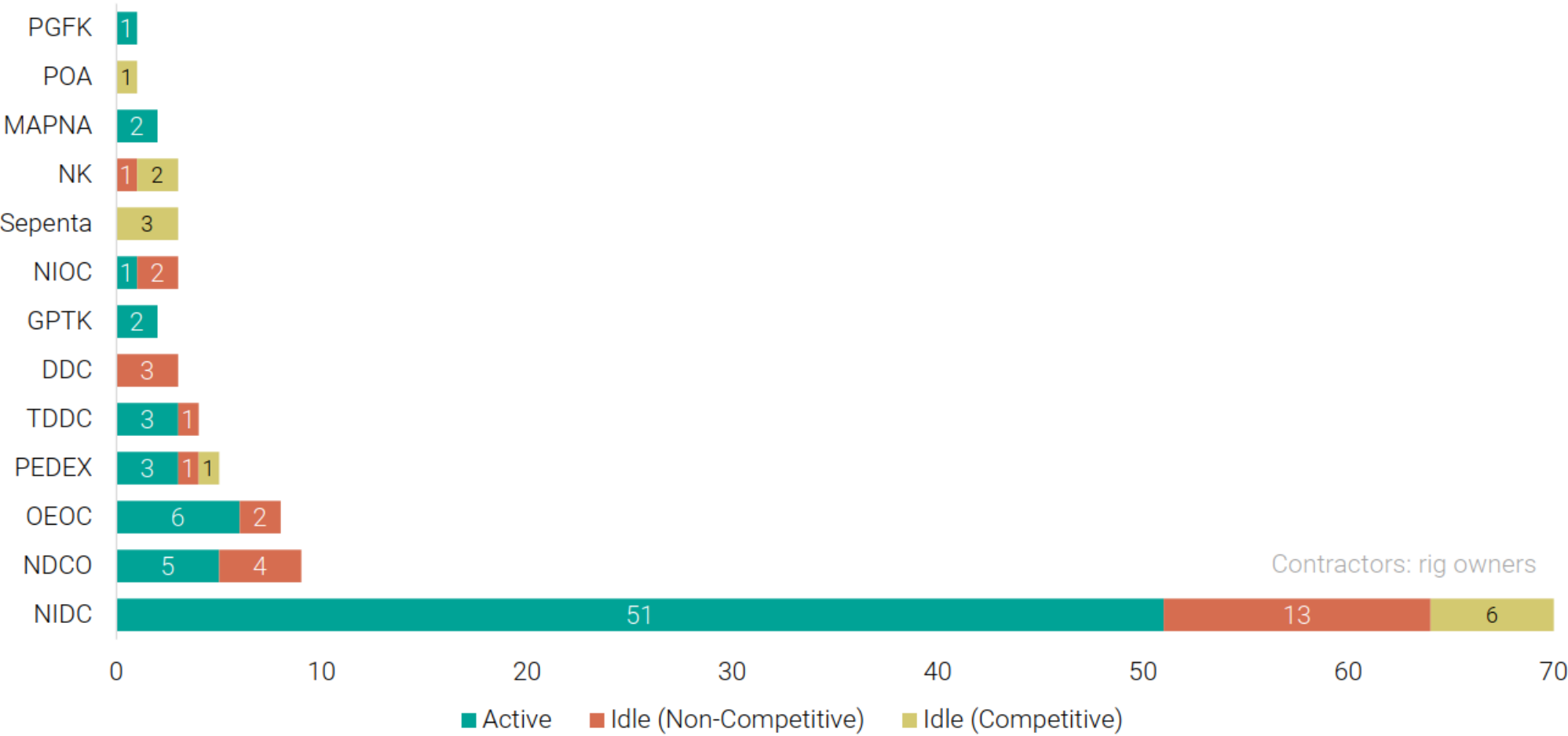
Manufacturing

- OTCC
- LulehGostar

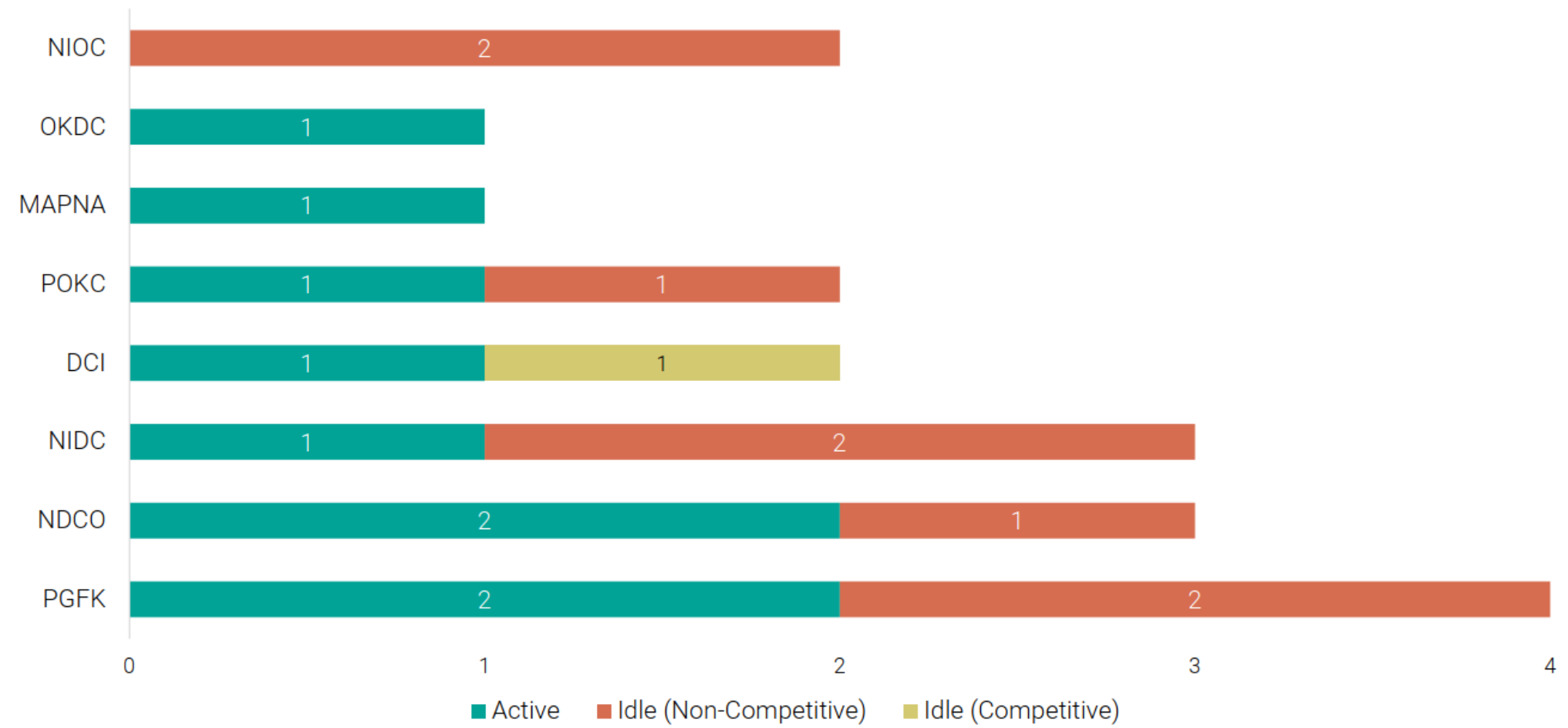
Consultants

- Monenco
- TEC

Iran Land Drilling Players (August 2021)



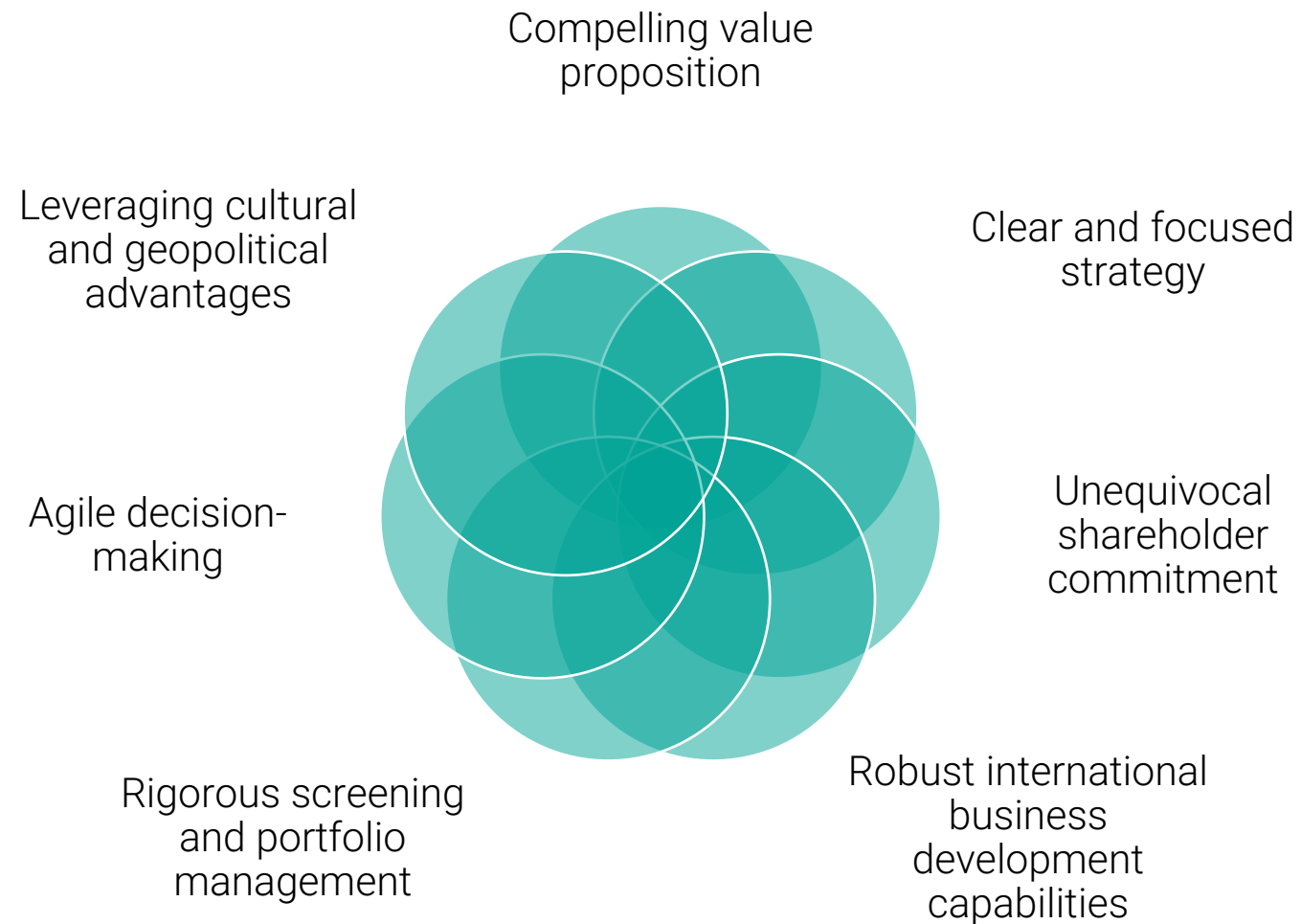
Iran Offshore Drilling Players (August 2021)



18. Business Strategies

To provide examples of some emerging business strategies developed by oil and energy companies

Key Success Factors for Internationalization of NOCs



Main Decisions

Business model

- What do we want to be known for in the future?

Growth objectives & portfolio structure

- How big do we want to be?

Operatorship targets

- What is our target balance between operatorship and non-operatorship of portfolio assets?

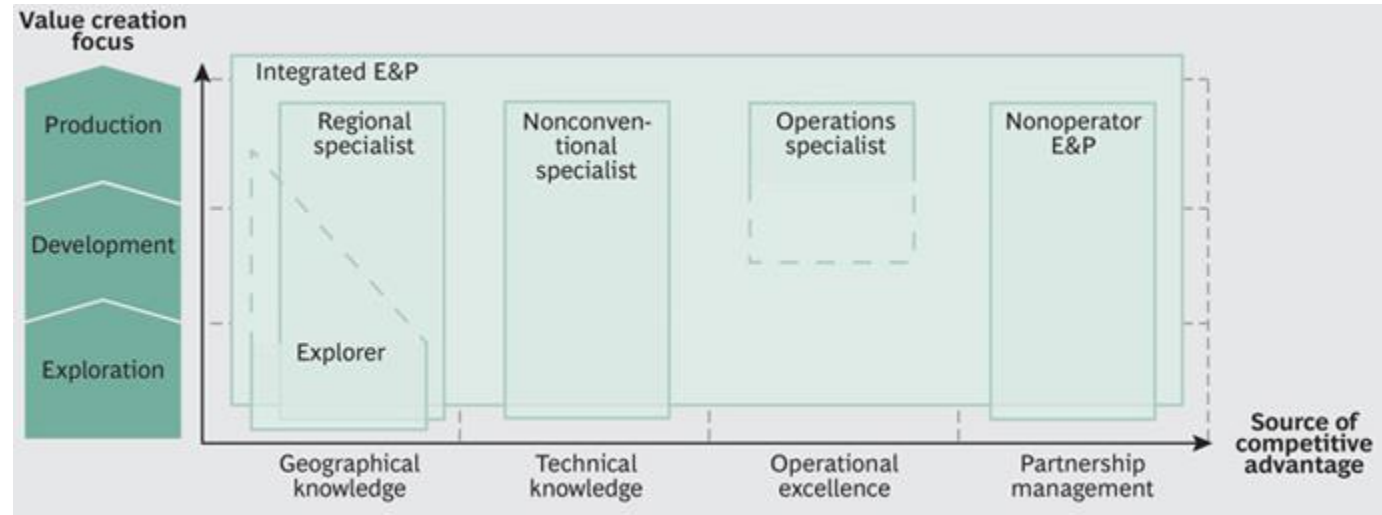
Risk appetite

- What is our appetite for risk?

Financing approach

- What financing approach is needed to support our growth strategy?

6 business models



6 E&P Business Models

Integrated E&P players (Anadarko, Premier Oil, & Apache):

- Balanced portfolio across technologies, geographies, and phases life cycle.

Explorers (Cairn Energy, Kosmos Energy, & Cove Energy)

- Concentrate on exploration of frontier areas and early monetization of discoveries.

Regional specialists (Pacific Rubiales Energy, Afren, & Pluspetrol):

- Specific countries with established presence & high degree of familiarity.

Nonconventional specialists (Chesapeake Energy, Canadian Oil Sands, & Husky Energy):

- Such as heavy oil, shale oil, and oil sands.

Operations specialists (including Perenco, Black Elk Energy, & Occidental Petroleum):

- Efficient extraction from existing fields.

Non-operator E&P players (Mitsui & Co. & Galp Energia)

- Use their relationships with NOC's and governments to gain access to high-quality assets & manage those assets but do not act as operators.

Deloitte Upstream Diversification Index

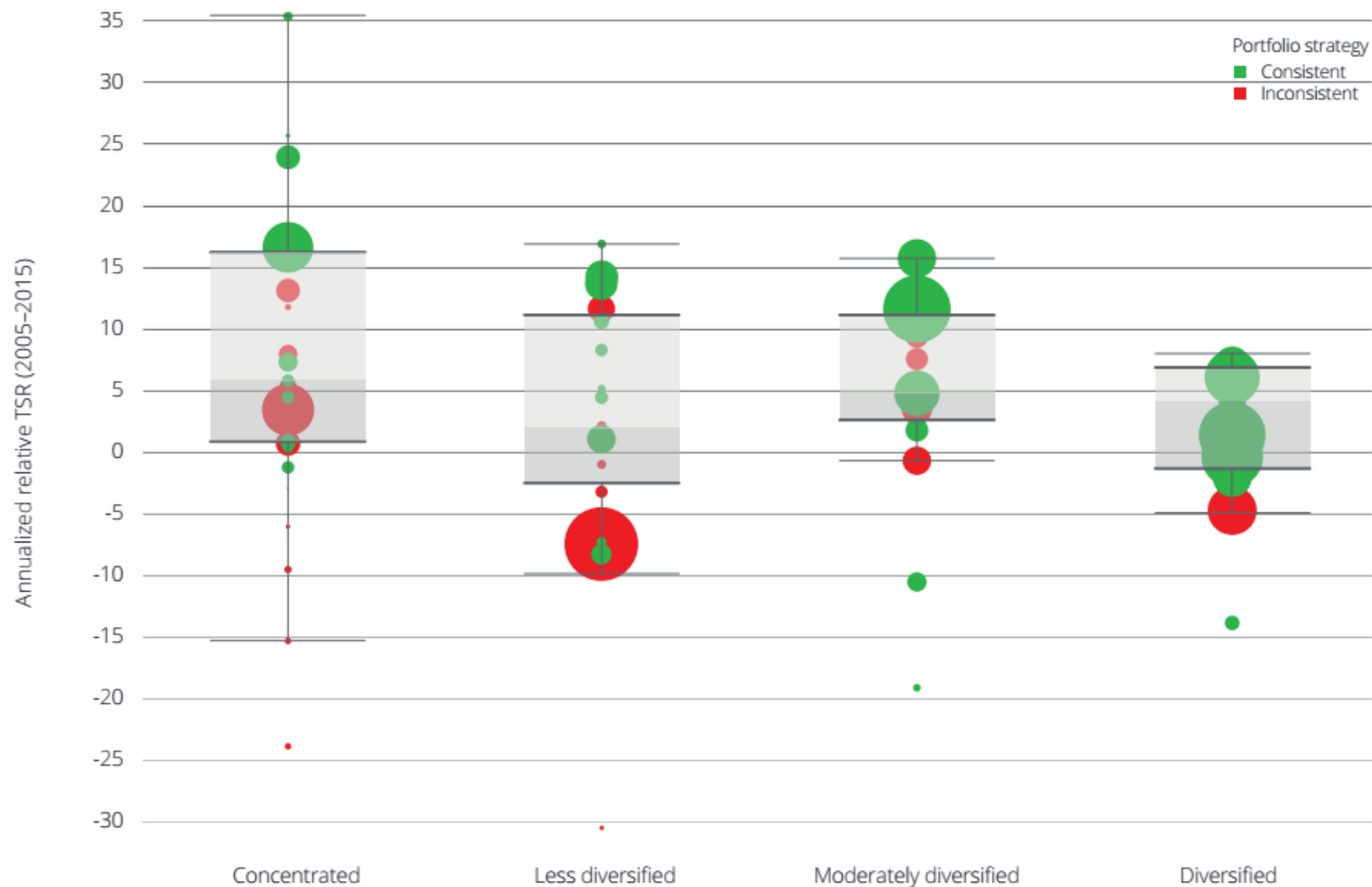
Production Mix

Region

Resource

Basin

Investment Cycle



Oil and Gas Capability Areas

Capability Area	Description	Example
E&P value chain	Capabilities with respect to a particular part of the E&P value chain	Occidental Enhanced oil recovery
Core region	Capabilities with respect to operating in a particular geographic area	Lundin Norwegian North Sea
Play types	Capabilities regarding exploration in particular geological play types	Tullow Oil Rift basins, stratigraphic traps
Technology	Capabilities in application of a particular specific technology	Statoil Harsh environments
Operational	Capabilities to combine various technologies and operating practices	EOG U.S. shale plays
Product	Capabilities relating primarily to one particular product	BG Gas value chain
Partnerships	Capabilities in establishing and leveraging partnerships	Wintershall Gazprom partnership
Political situation	Capabilities to operate under particular political circumstances	BP Russia
Commercial situation	Capabilities to secure assets in particular commercial situations	Apache Bilateral negotiations

Portfolio Management Components

E&P
corporate
strategy

Portfolio
management
model

Portfolio
strategy

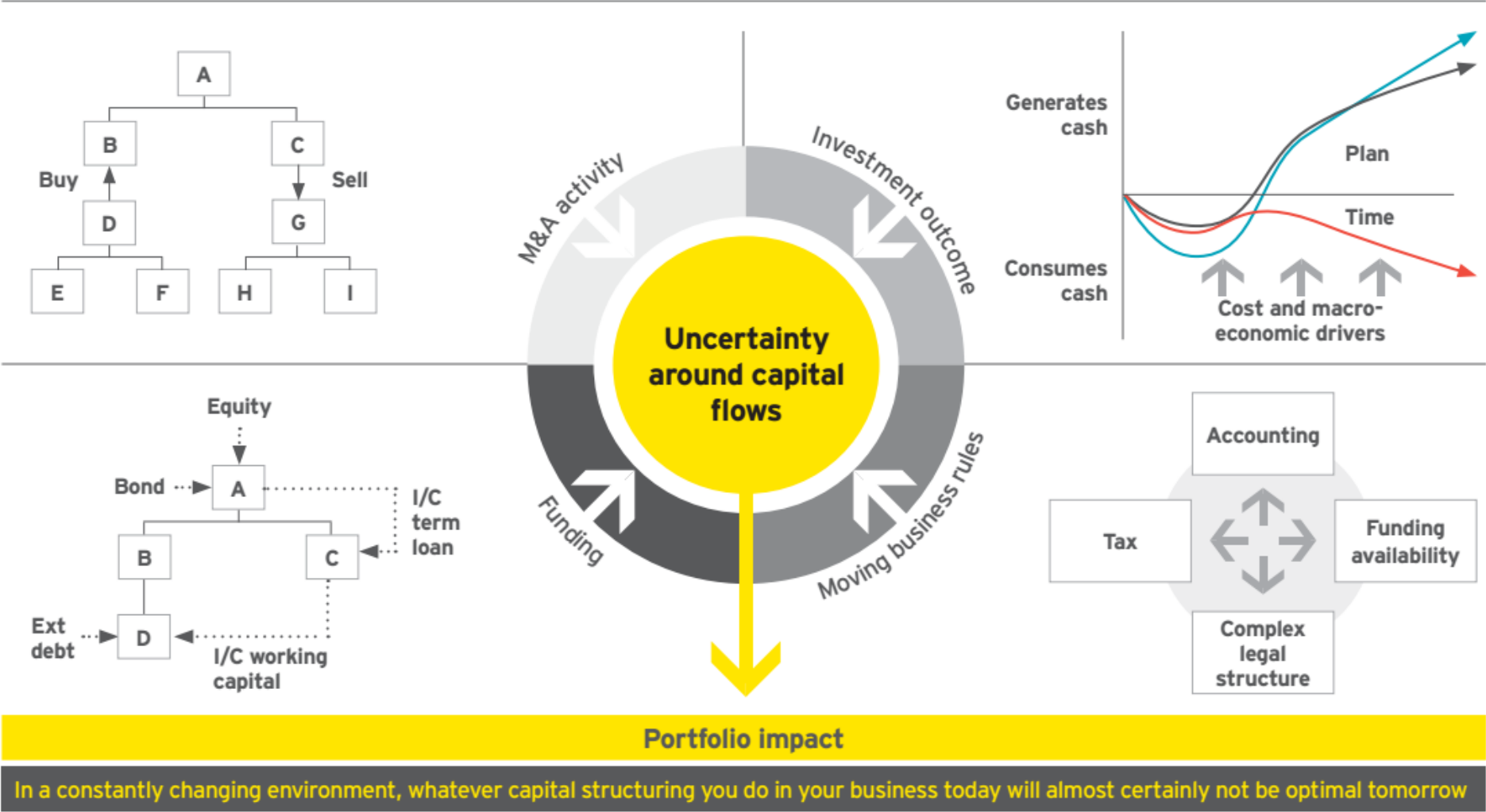
Portfolio
optimization

Performance
management

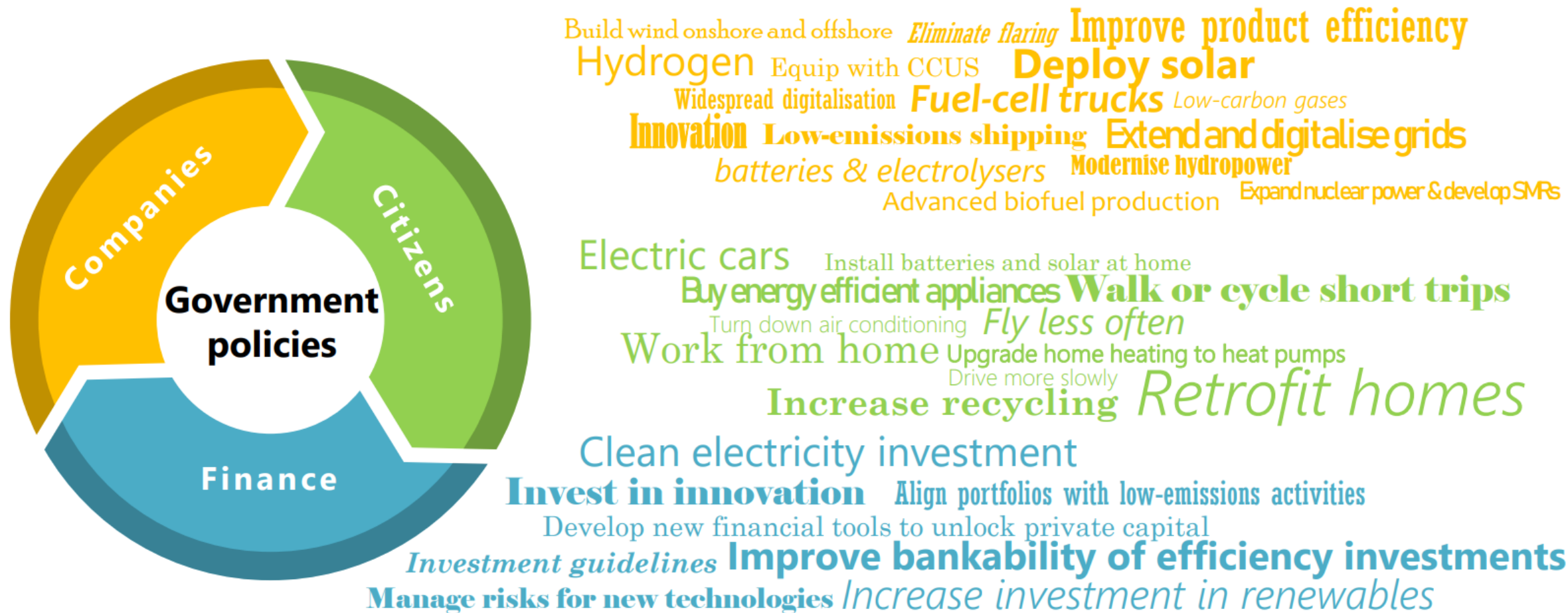
Optionality

- A company has optionality if it can quickly, effectively & efficiently shift its focus from underperforming businesses, assets & projects to better-performing ones that fit with its current strategy and enhance the overall value of the portfolio.
- A company will best leverage its optionality if it can:
 - Proactively identify potential changes in its operating environment and review the impact of these changes on its project and portfolio
 - Rapidly decide on a suitable course of action that would at the very least preserve, but ideally enhance, the value of its portfolio
 - Act in a timely, cost-efficient and effective manner

Optionality at the Corporate Level



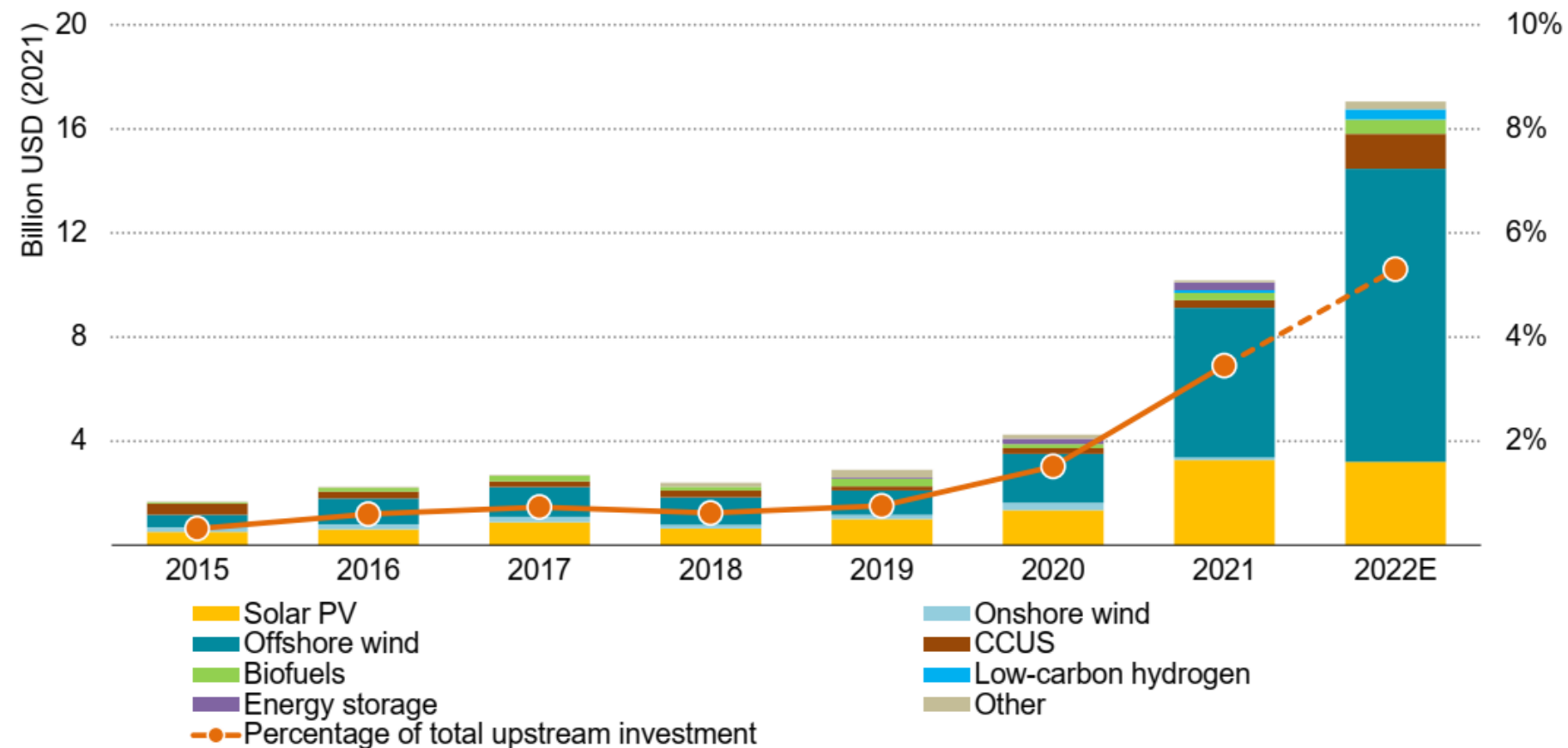
Net-Zero by 2050 Demands Unprecedented Efforts



Current Diversification Options by Selected International Oil Companies and NOCs

Company	Activity and investment in selected alternative businesses						
	Solar PV and wind generation	Geothermal	Electricity services	Bioenergy	CCUS	Low-carbon hydrogen	Nature-based solutions
BP	●	●	●	●	●	●	●
Eni	●		●	●	●	●	●
Shell	●	●	●	●	●	●	●
TotalEnergies	●		●	●	●	●	●
Chevron		●		●	●	●	
ExxonMobil				●	●	●	
ConocoPhillips					●		
Saudi Aramco	●				●	●	
ADNOC	●				●	●	
CNPC	●	●		●	●	●	●
Sinopec	●	●			●	●	
CNOOC	●				●	●	

Capex by Selected Oil and Gas Companies on Clean Energy Technologies



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Notes: Includes the majors, ADNOC, CNPC, CNOOC, Equinor, Gazprom, Kuwait Petroleum Corporation, Lukoil, Petrobras, Repsol, Rosneft, Saudi Aramco, Sinopec and Sonatrach. The estimated clean capex in 2022 is based on investment spending announced to 31 March 2022 and assumes that this pace of investment is maintained throughout the year.

Changes to Follow

Resource Abundance and Importance of Customer Preference



More Competitive and Productive Landscape For The Industry



Major Changes in Global Economy Shape and Living Standards



Lower for Longer Prices and Peak Demand for Liquid Fuels



Digitalization of the World Economy with Effects on the Industry



Increasing Pressure From Regulators and Society to Lower Emissions



Strategic Decisions

Focus on Core Competencies

Deploy key internal capabilities and divesting non-core assets through bold M&A actions (DNO, BP, Perenco)

Diversification and Internationalization

Expand into other geographical areas to investment in new opportunities (QE, Petronas)

Low-carbon Investment

Investment in low-carbon energy (gas and renewables), and in carbon capture and hydrogen (BP)

Integration and Consolidation

Mergers of upstream and downstream assets to build an integrated energy company (Aramco, OQ, ADNOC)

Partnership

Leverage technical and financial capabilities to be present through whole energy value chain (ADNOC)

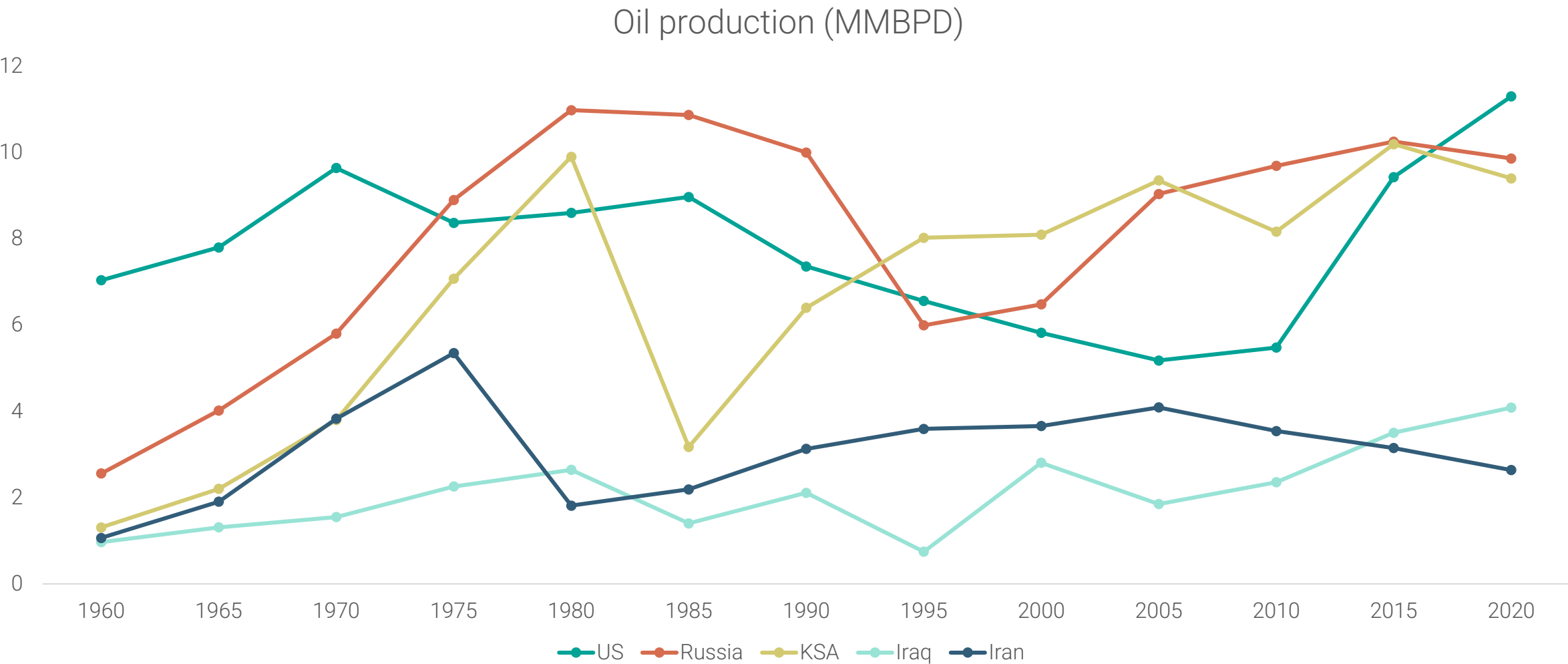
19. Iran's Oil Potential

To provide a basis for understanding Iran's oil production potential

Iran's Oil Production Potential

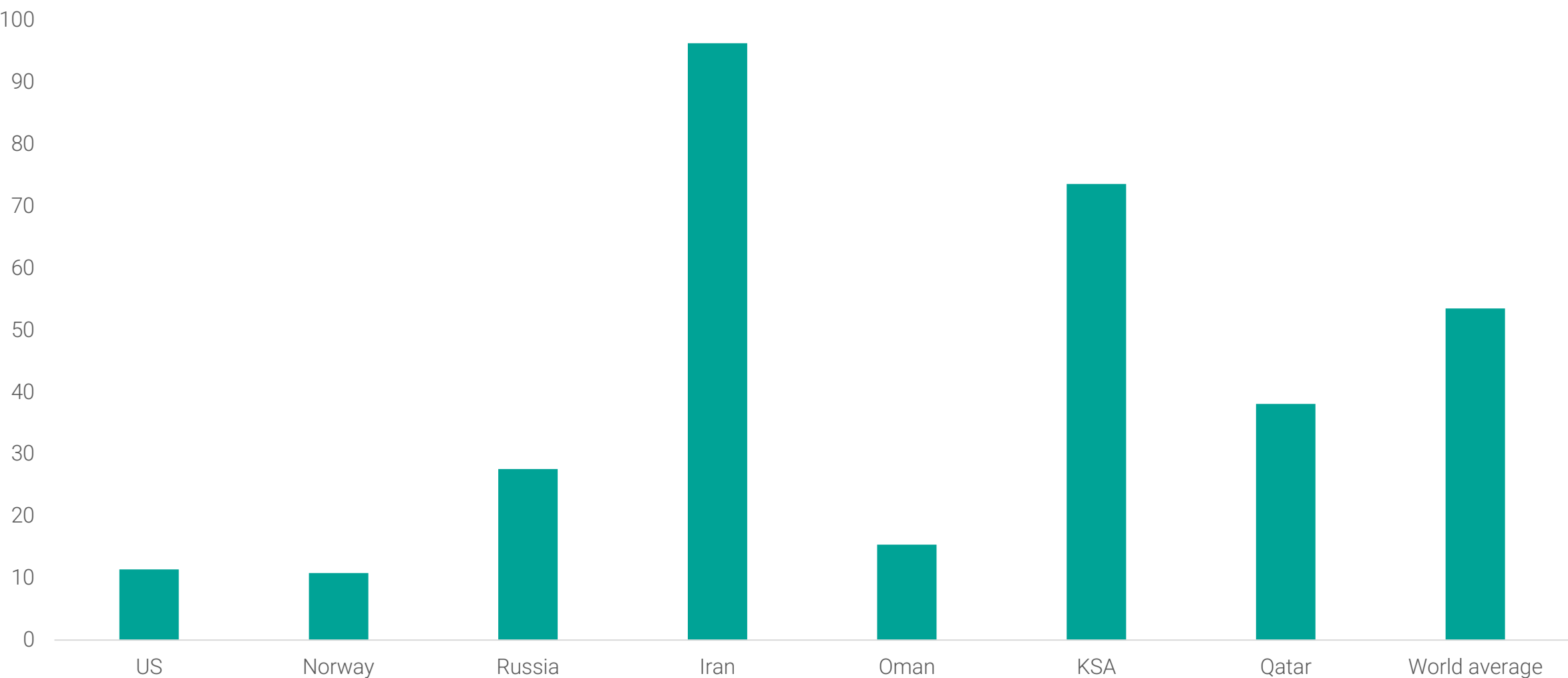


Oil Production: Iran Versus Competitors



EIA, OPEC, Brookings

Reserve to Production Ratio (Years)



BP Statistical Review of Worle Energy 2021

Iran Upstream Asset Lifecycle Issues

Exploration and Appraisal

- New Exploration Opportunities
- Shale Exploration
- Appraisal of Opportunities

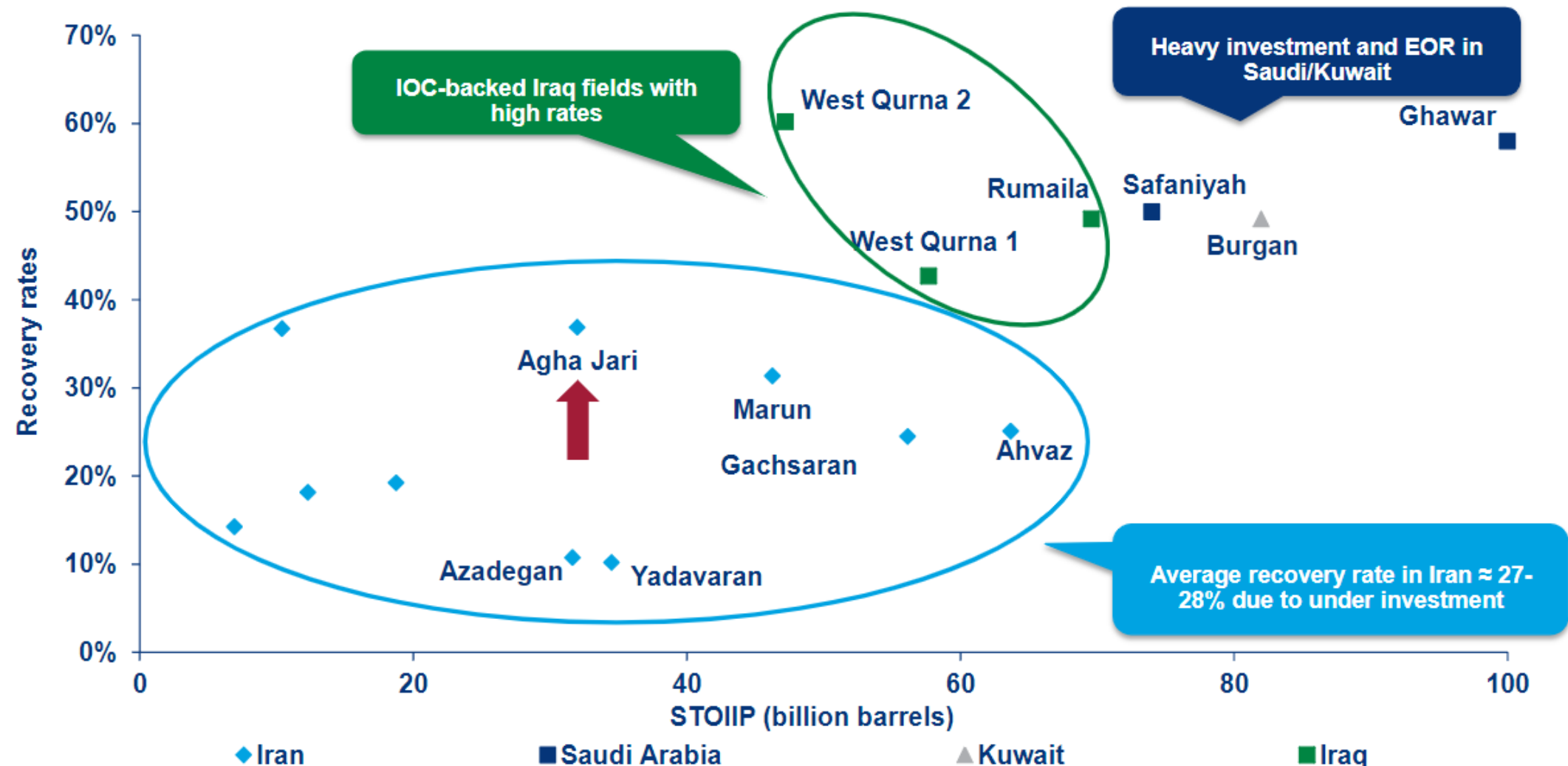
Development and Production

- 200+ Undeveloped Assets
- Limited Production
- Low OPEX in Brownfields

IOR / EOR

- Recovery Factor Around 25%
- Focus on IOR/EOR
- Limited access to Technology

Recovery Factor in Selected MENA Countries' Assets



Wood Mackenzie Opportunities in Middle East, Iraq & Iran 2018

“The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil.”

Sheikh Zaki Yamani

