

BOOK 4

Oil Industry Fundamentals

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Professor TPA

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TPA

Sharing Experience

Building bridges between the oil industry and academic circles by delivering technical or business-related presentations by professors or experts.



OIL & GAS and ENERGY GLOBAL ISSUES

A Toolbox to understand the World of Energy in the Global Economy

The Toolbox is updated twice a year and benefits from the contributions of TPA Professors:

Coordination: GUÉRITTE Christian

LUC Benoît, PERSILLON Philippe, CORDIER Jean-Pierre, PAPÉE Jean, MULLER Isabelle, DEUTSCH Denis, FOURCADE Bernard, MICHAUD Olivier, SAINCRY Daniel, FOURNIÉ François, CHOUX Jean-Claude, BERA Jean, GUYS Philippe, DE MERVILLE Eric, DUMAY Jean-Michel, VALDELIÈVRE Michel, FONTAINE Jean-Marc, FERRIER Jérôme, BITEAU Jean-Jacques, PETTEAU Pascal, NOSJEAN Nicolas



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Oil



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10. Oil prices: yesterday & today
11. The drivers for a long term oil price
12. Oil prices: various scenarios for the future
13. Oil industry stakeholders: governments, NOCs and IOCs



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Oil industry: general considerations

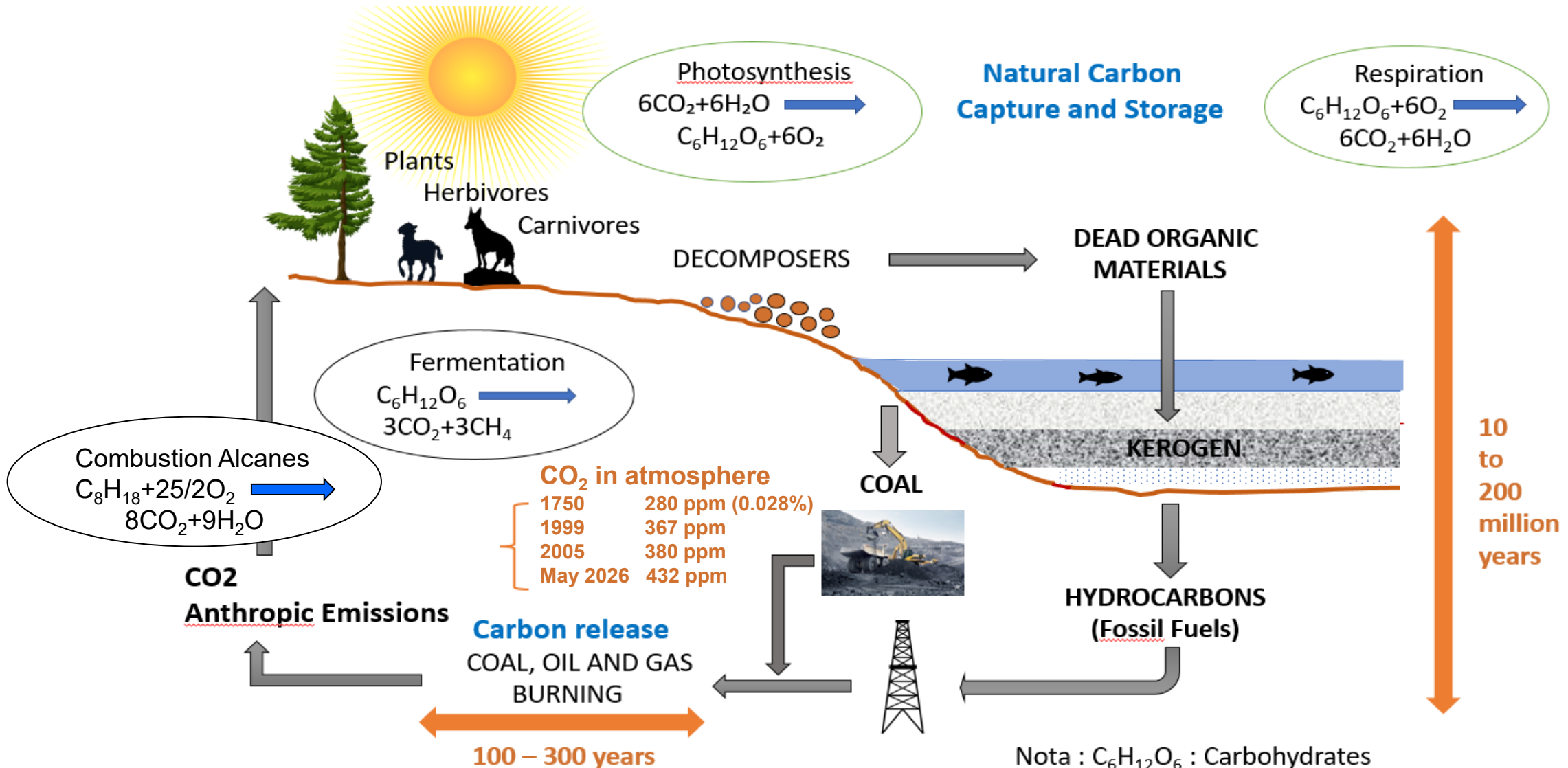


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Energy and Life: Carbon is a Vital Element for the day to day Life. It also creates nuisance in relation with the Climate change



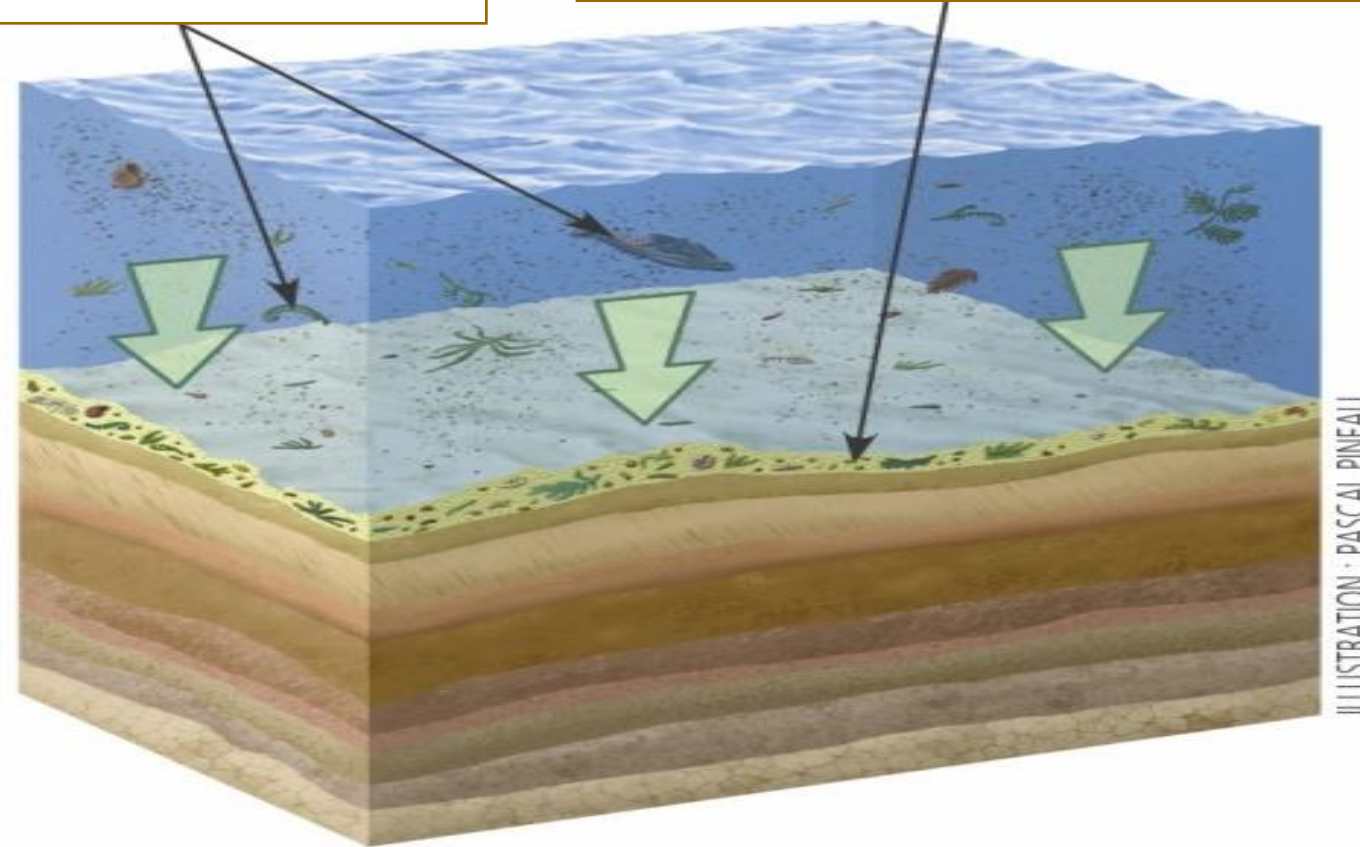
The Formation of Hydrocarbons



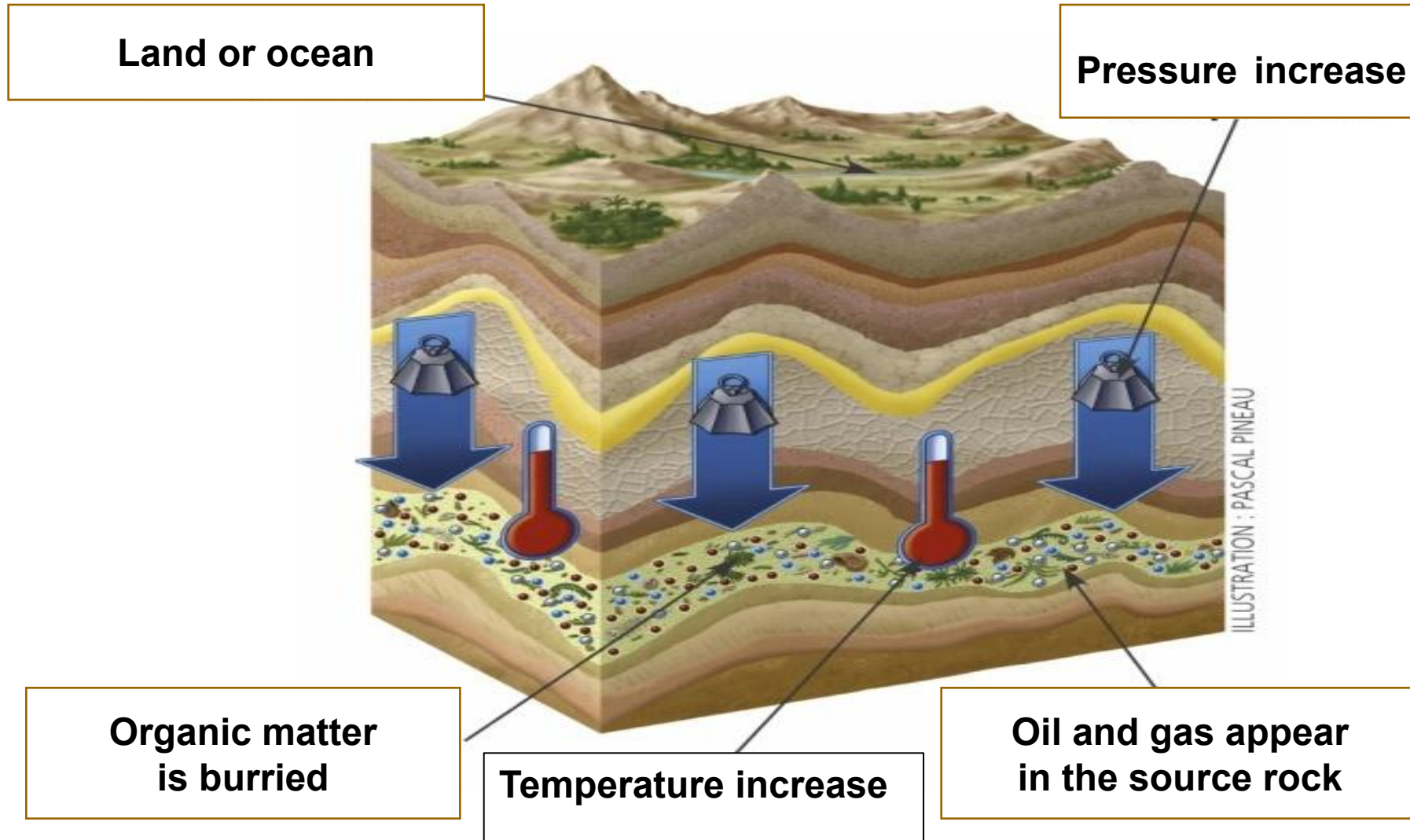
Source Rock

Organic matter falls

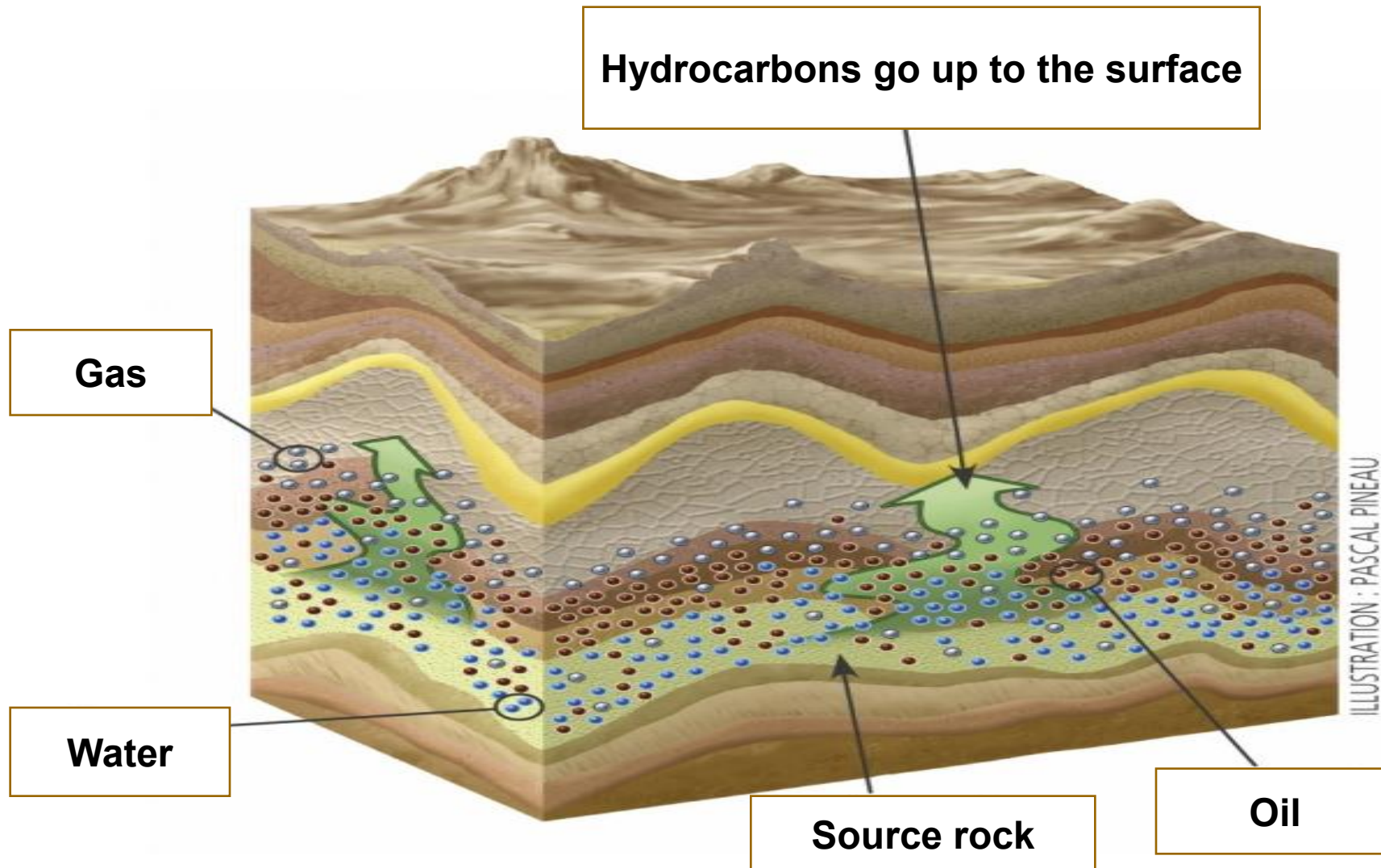
Sediments and organic matter at the sea bottom



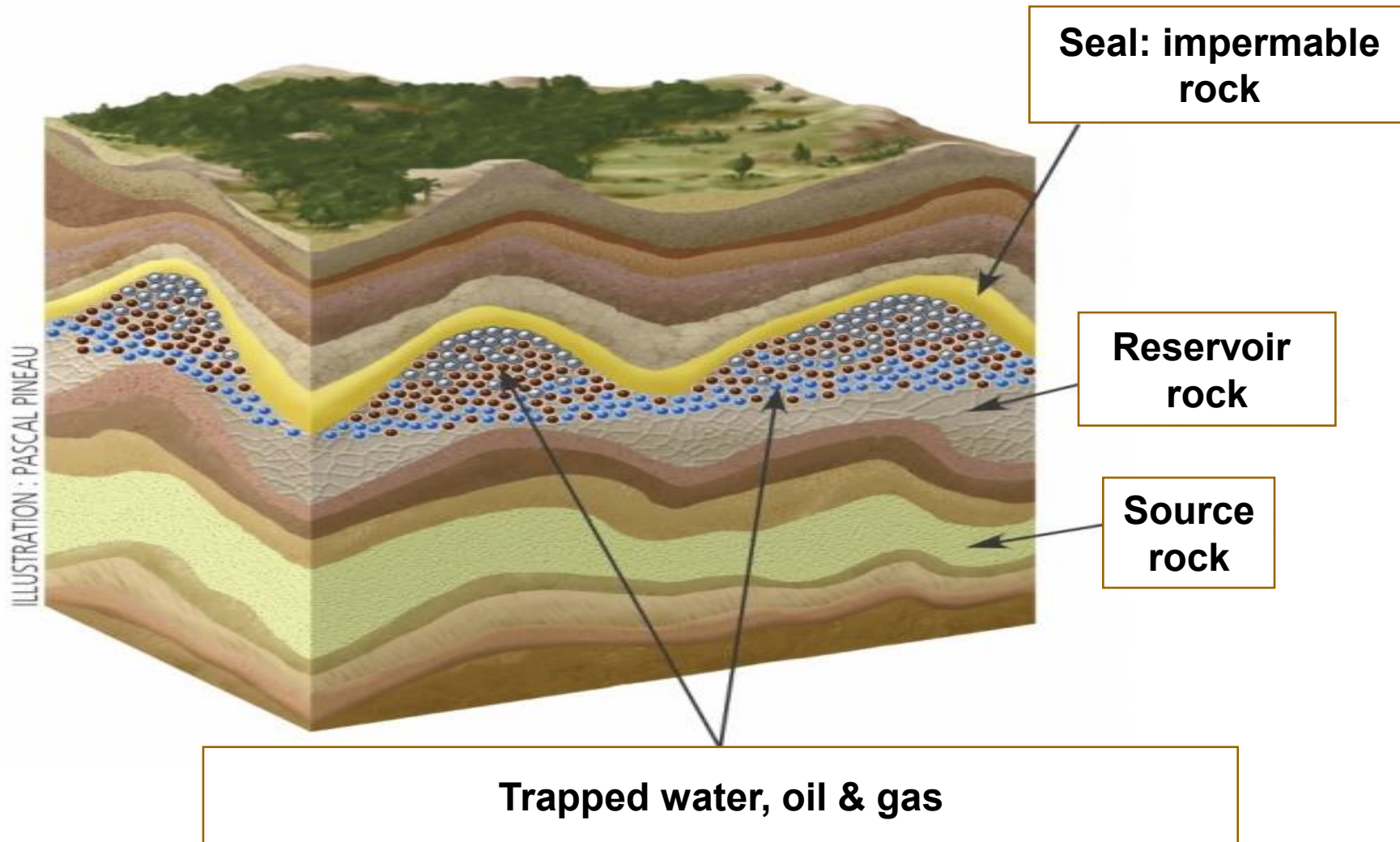
Maturation



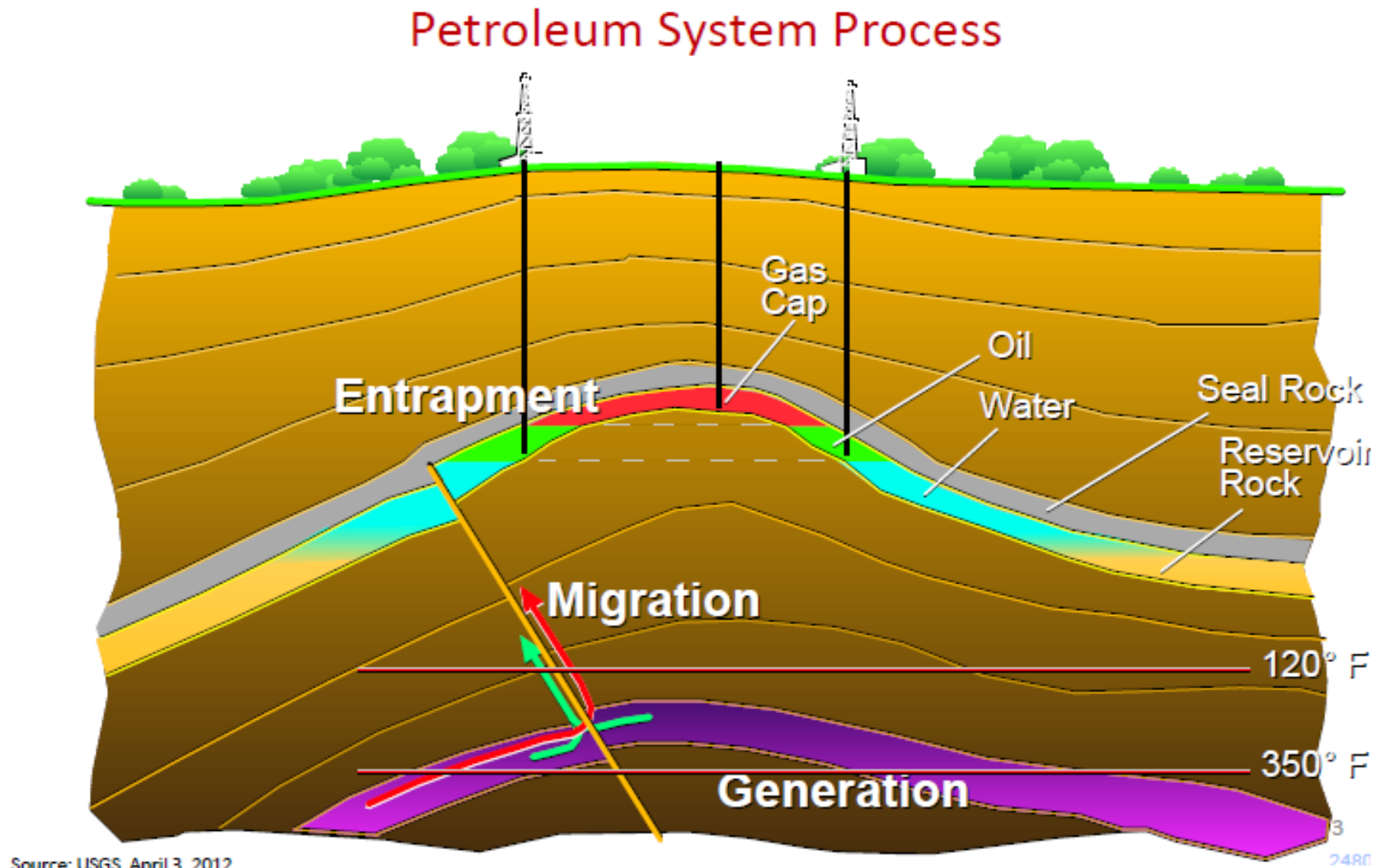
Migration



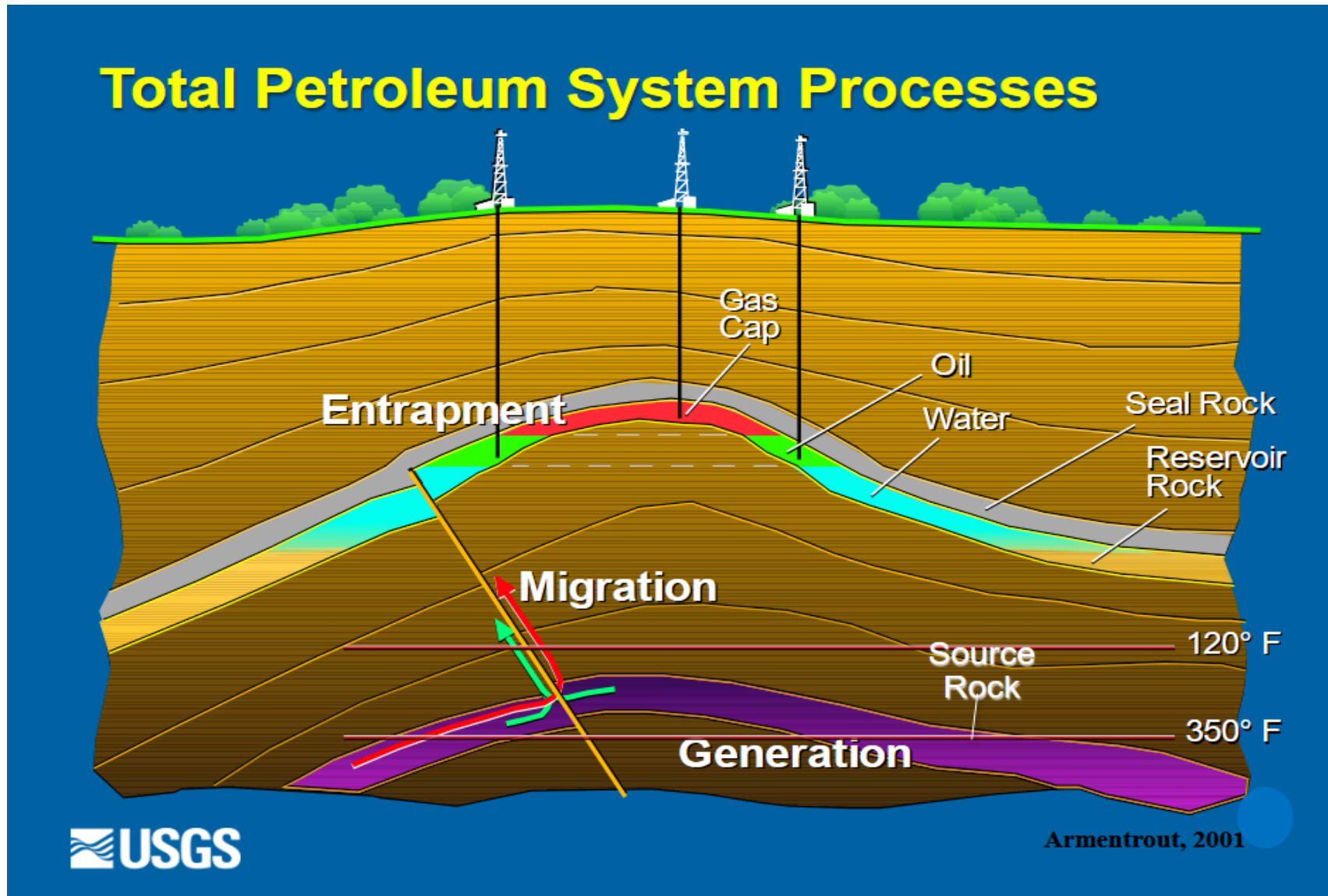
Entrapment



The Petroleum System Process



The Petroleum System Processes

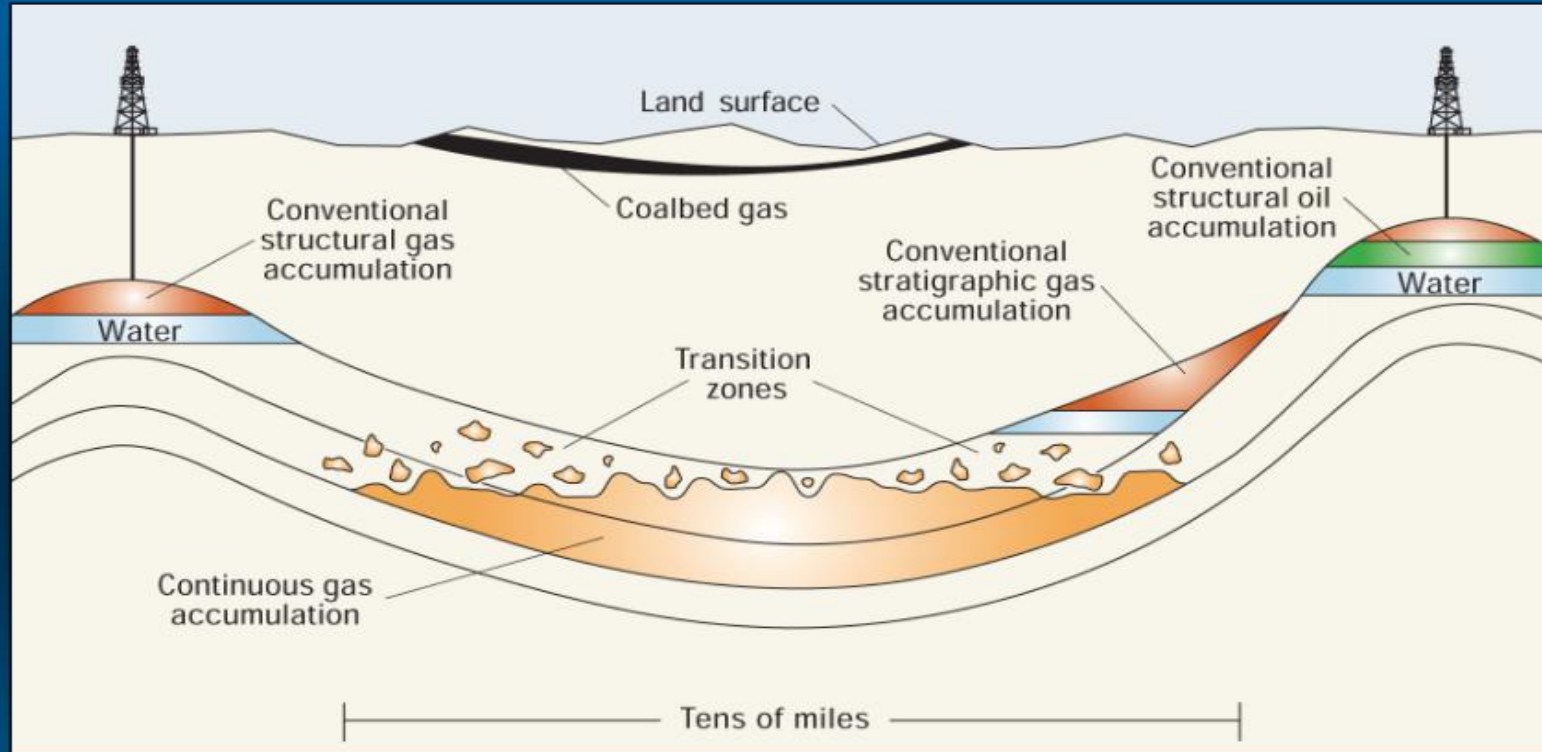


Source: USGS 3 April 2012



Conventional vs Continuous Resources

Conventional vs. Continuous Resources



Conceptual diagram illustrating the differences in geologic context between conventional and continuous (nonconventional) petroleum resource accumulations. Modified from Schenk and Pollastro (2002).

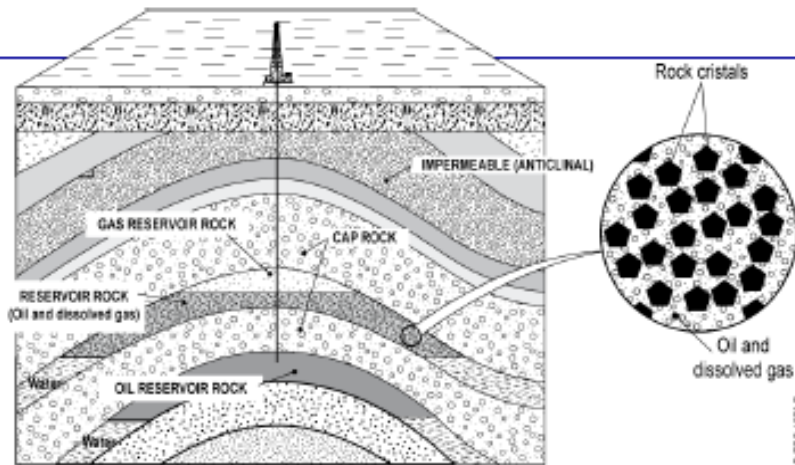


Reservoir Rocks

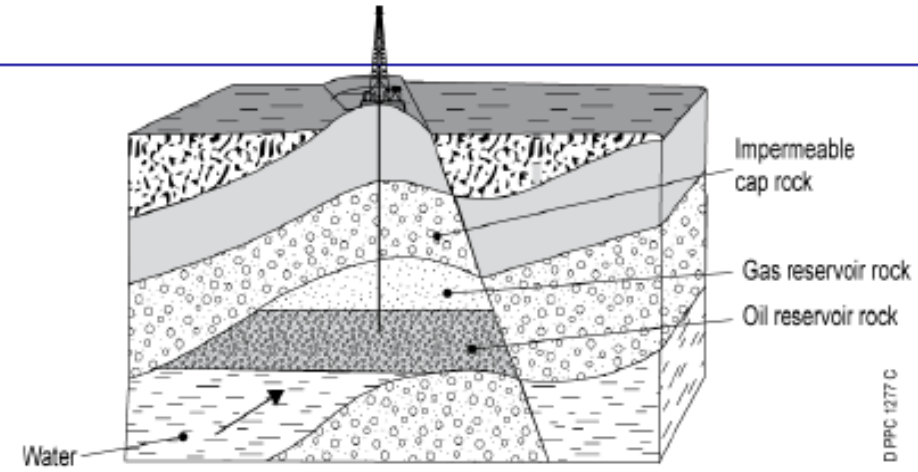
- There are 3 main rock families
 - Igneous, Metamorphic, Sedimentary
- Hydrocarbons are found only in sedimentary rocks
 - Clastic rocks composed of grains with different sizes (sandstones)
 - Carbonated rocks composed of carbonate material (limestone, dolomite)
- The Reservoir trilogy
 - Porosity: Φ
 - Permeability: K
 - Saturation: S



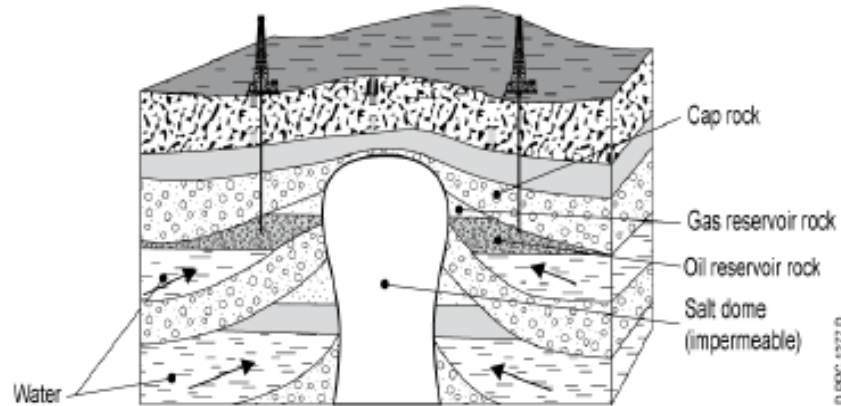
Reservoir Types



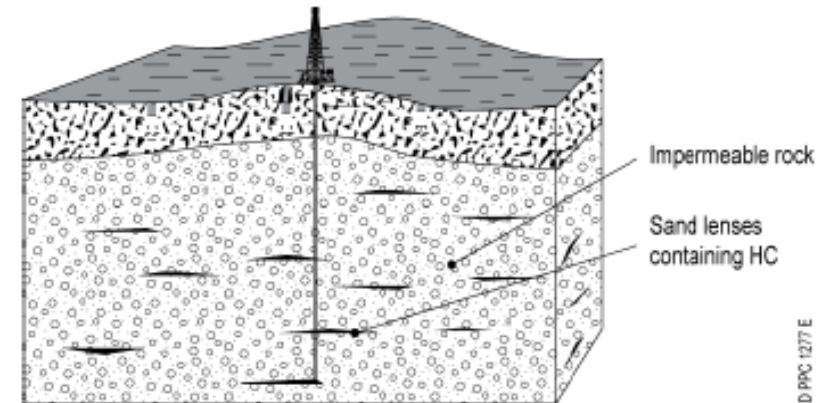
TRAP UNDER ANTICLINE



TRAP ASSOCIATED TO A FAULT



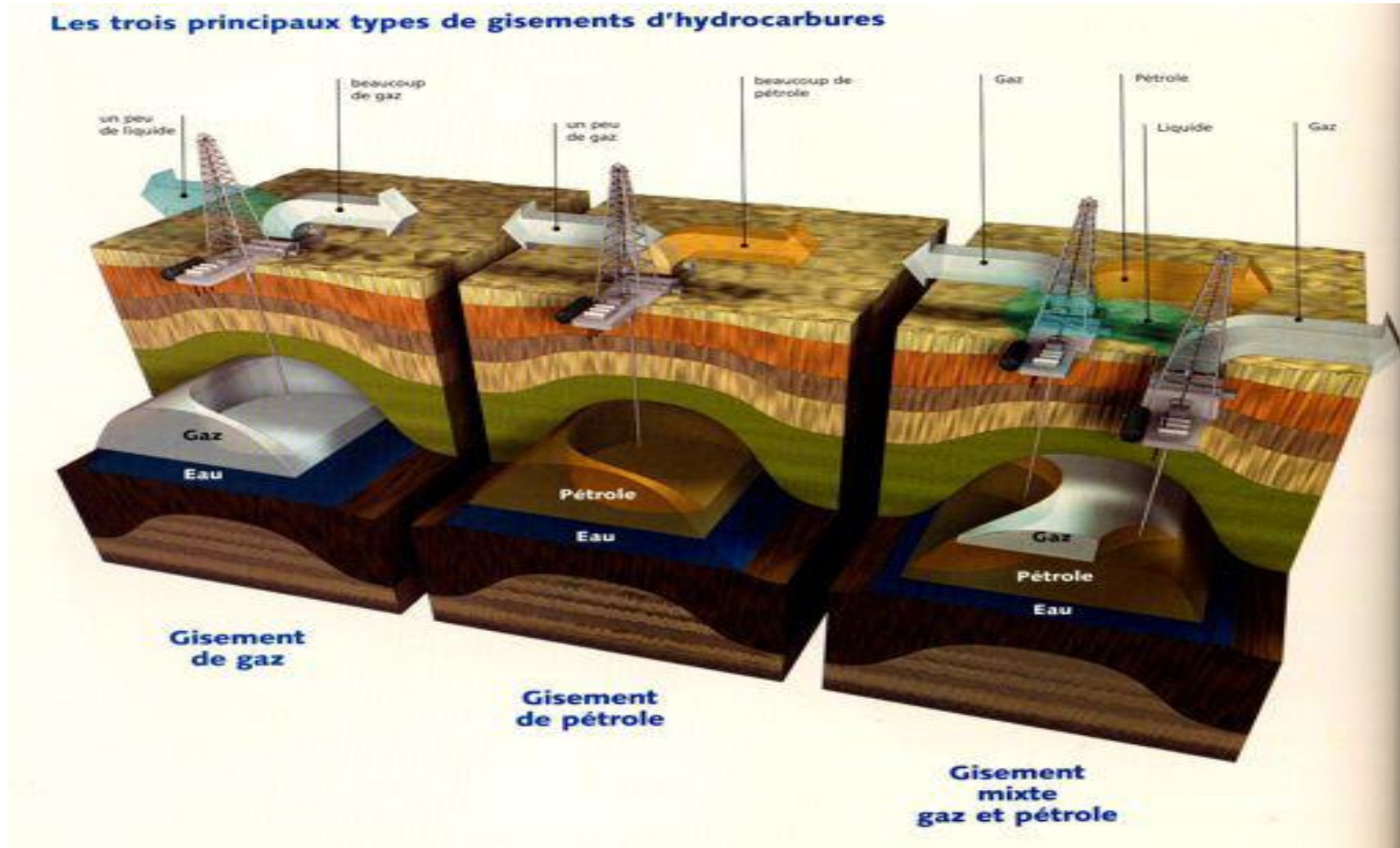
TRAP ASSOCIATED TO A SALT DOME



SAND LENSES TRAPPED IN IMPERMEABLE ROCKS



Various types of hydrocarbon fields



Key Considerations about Energy Fundamentals

For the last 70 years :

- ◆ Oil has been the dominant source of Primary Commercial Energy (40% of world total in average)
- ◆ Oil has been the economic regulator of all energy prices.
- ◆ Oil has been the physical regulator of the World Energy System.
- ◆ OPEC has been the regulator of World Oil System.
- ◆ Saudi Arabia has been the regulator of OPEC.

During the last decades, the emergence of Light Tight Oil (LTO), Shale Oil (LTO) and Shale Gas production in the US has changed the game. US is now the N°1 Oil Producer in the world.

The 2020 Covid-19 sanitary crisis and the war in Ukraine again shows that the World Economy and its Energy balance can be strongly upset by unexpected events.

The new constraints attached to Climate Change and Energy Transition will have major consequences on the World Oil Production scenarios for the next decades to come.

What about 2030? 2050? 2100?





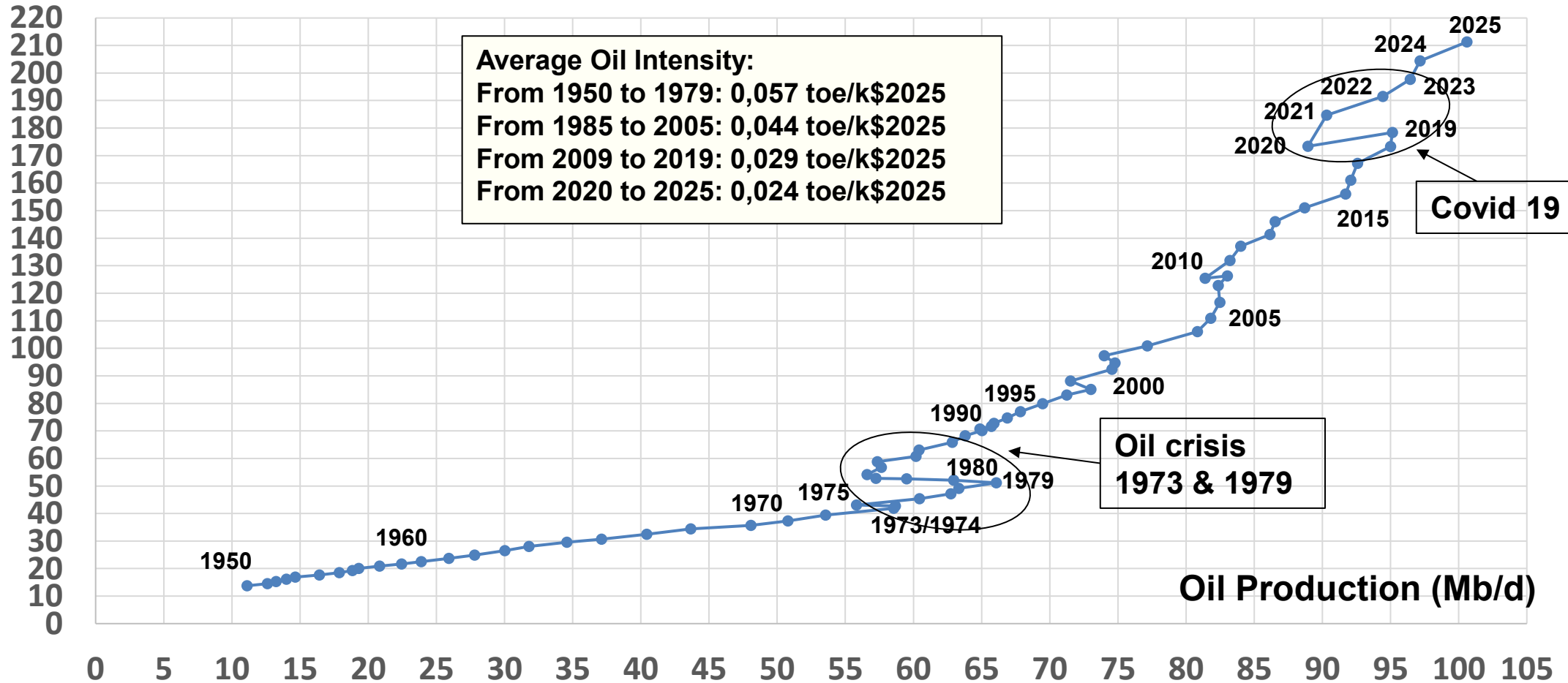
Oil, Energy and Global Economy



World GDP PPP (\$2025) vs Oil Production (1)

A good correlation, with impacts of external events

World GDP PPP (T\$2025)



Source: Ch.Guéritte/Data from World Bank July 2026, Maddison, El Stat.Review 2026

Oil includes condensates, NGL, Tight Oil, Shale Oil, Xtra heavy Oil

GDP expressed in PPP, constant money US\$ 2025, using US CPI

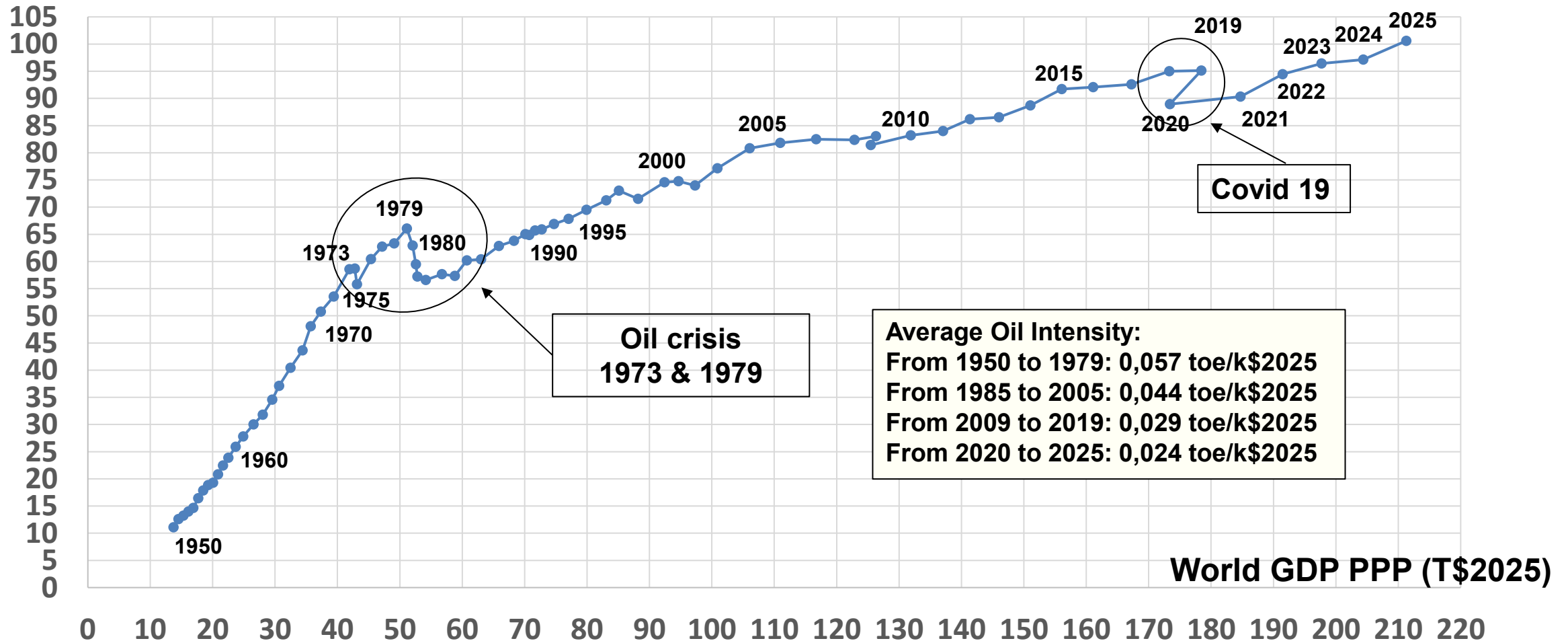
23



Oil Production vs World GDP PPP (\$2025) (2)

A good correlation, with impacts of external events

Oil Production (Mb/d)



Source: Ch.Guéritte/Data from World Bank July 2026, Maddison, El Stat.Review 2026

Oil includes condensates, NGL, Tight Oil, Shale Oil, Xtra heavy Oil

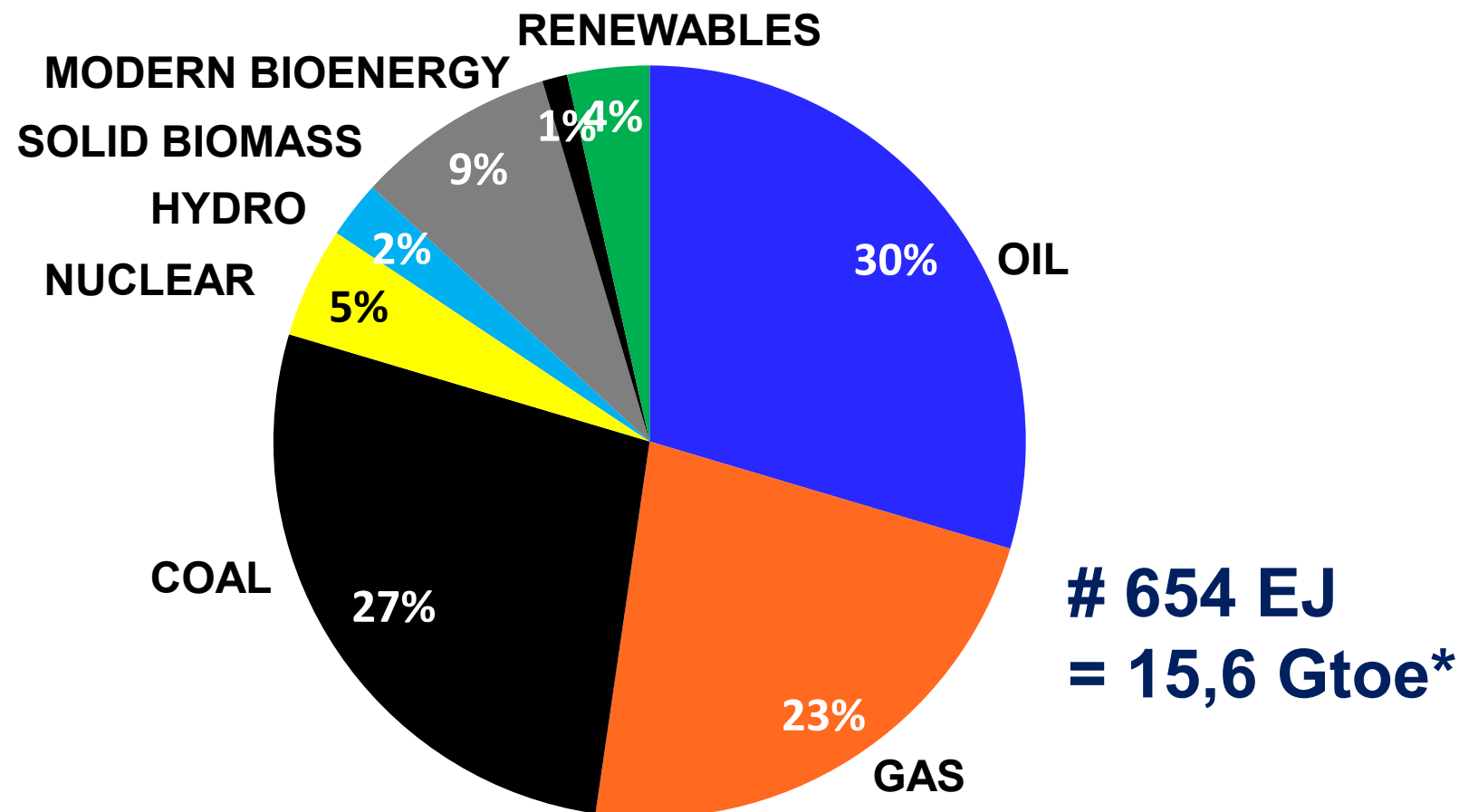
GDP expressed in PPP, constant money US\$ 2025, using US CPI

24



World Primary Energy Demand – 2024

+ 2,0% vs 2023



* out of which electricity generation # 6,2 Gtoe # 29 700TWh (eq. Primary Energy)

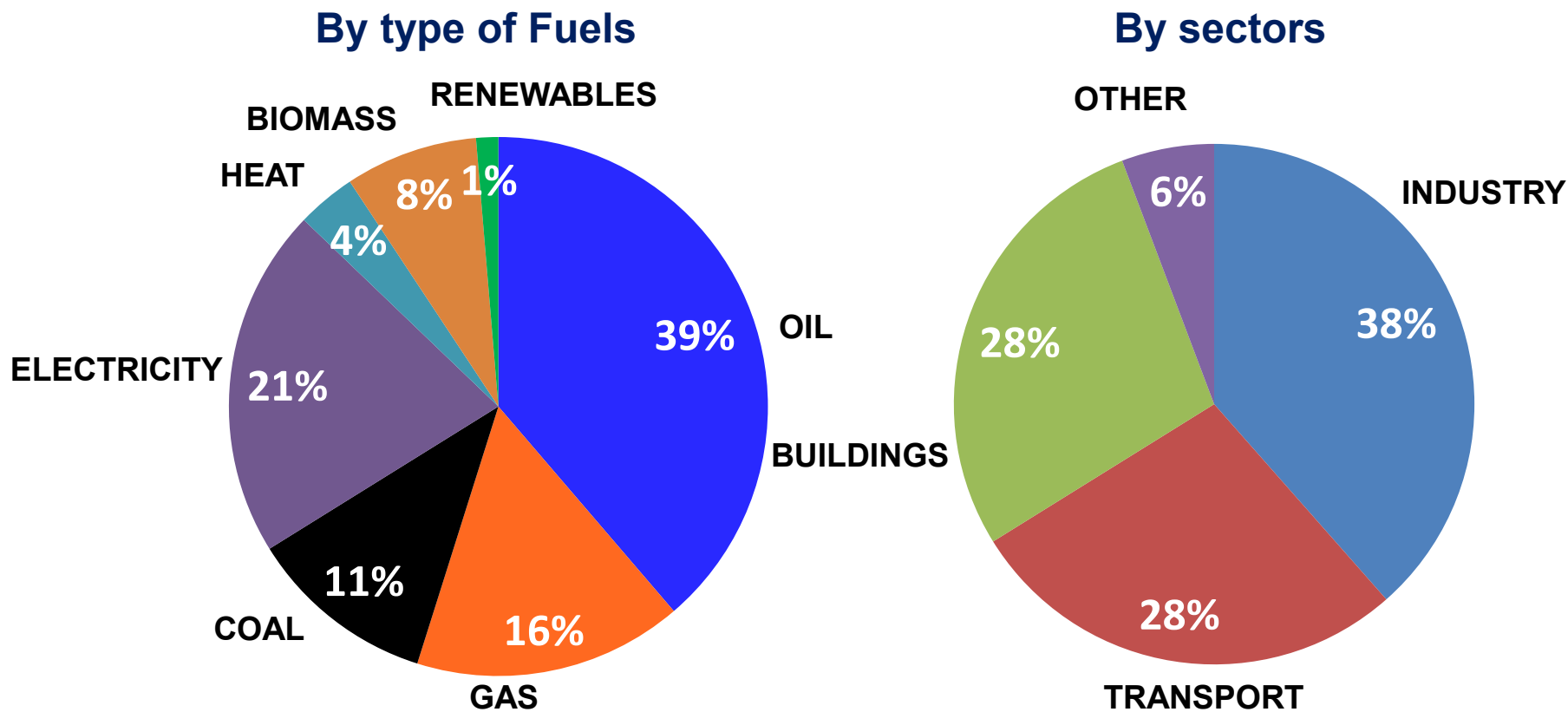
Source: Data from IEA WEO 2025. Nota: Sums might not be equal to 100% due to rounding

Solid Biomass: tradit. wood & charcoal & solid residues. Modern Bioenergy: liquid & gaseous bioenergy (biofuels & biogases) Renewables: Solar, Wind, Geothermal, Marine Energy,...

TPA Toolbox Energy Book 4 - Oil



Total Final Consumption – 2024 + 2,0% vs 2023



453 EJ = 10,8 Gtoe

Nota: Sums might not be equal to 100% due to rounding
OTHER relates to agricultural sector & other non-energy use
Source: Data from IEA WEO 2025



How to explain the difference between 15,6 & 10,8 Gtoe?

To produce final end-used Energy products, it is necessary to transform them.

1) Oil products are fabricated from crude Oil in refineries where industrial processes generate losses.

2) Electricity is an important part of final consumption. Electricity is not a primary Energy, it must be produced through thermal or nuclear Power Plants, renewable energies which have each a limited Efficiency ratio.

3) Other type of losses exist in transmission & distribution systems.

Losses in Power Plants # 3750 Mtoe
Other losses # 1050 Mtoe
Total losses # 4800 Mtoe

	Electricity generation 2024 by fuel				Equivalent Primary Energy		
	Mtoe	TWh		EJ	Mtoe	TWh	Conv. Coeff.
Oil	65	757	2%	3	197	2294	33%
Gas	583	6785	22%	24	1576	18338	37%
Coal	928	10798	35%	39	2813	32721	33%
Nuclear	244	2835	9%	10	739	8591	33%
Hydro	382	4448	14%	16	382	4448	100%
Bioenergy	65	760	2%	3	251	2923	26%
Solar PV	178	2073	7%	7	178	2073	100%
Solar CSP	2	20	0%	0	2	20	100%
Wind	218	2533	8%	9	218	2533	100%
Geothermal	9	100	0%	0	86	1000	10%
Marine	0	1	0%	0	0	1	100%
Renewables	406	4727	15%	17	484	5627	84%
Total	2675	31110	100%	112	6443	74942	42%

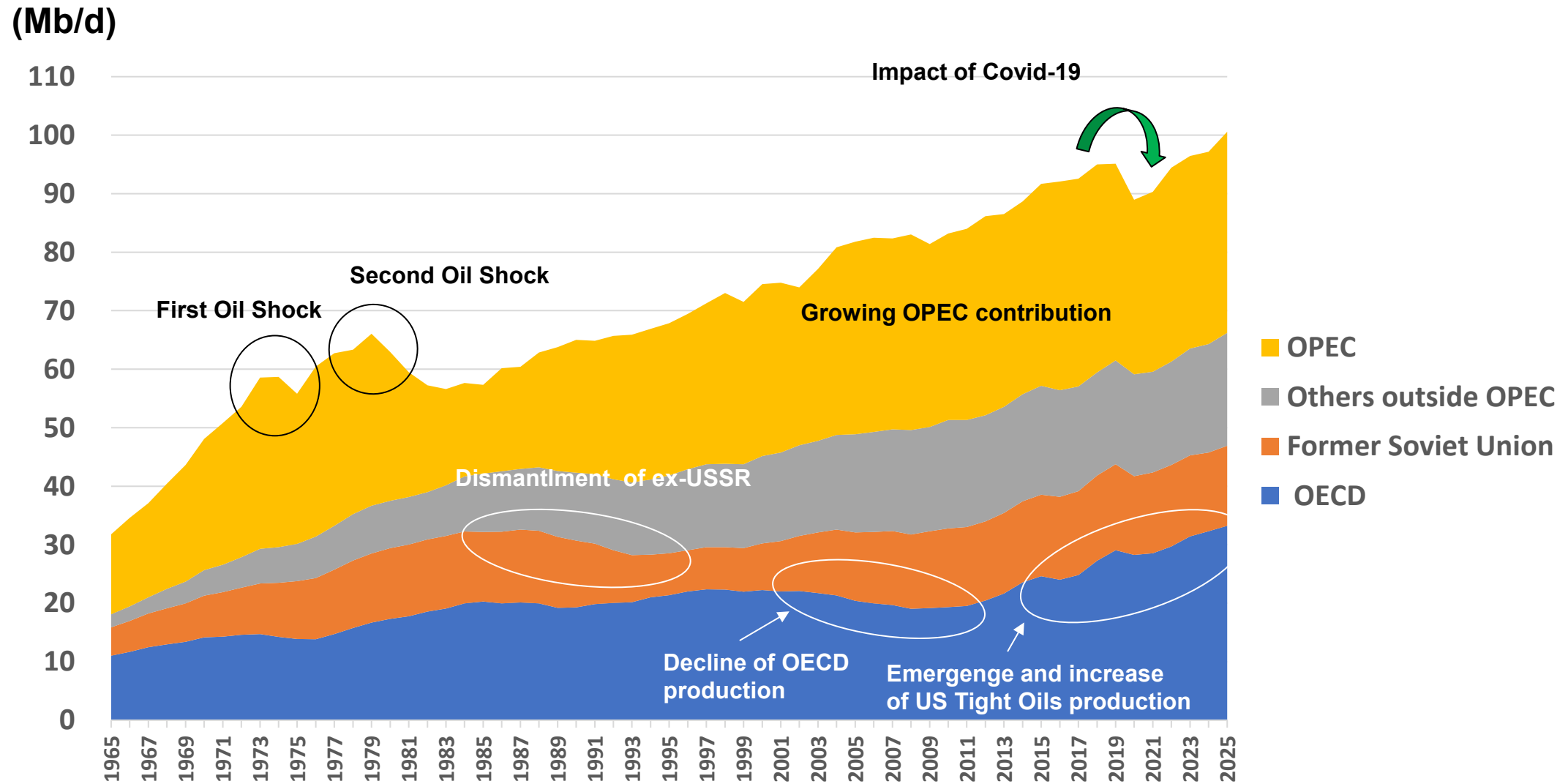
Source: Data from IEA WEO 2023. 1TJ = 0,2778 GWh = 23,88 toe

For the conversion from Final Energy to Primary Energy, international standards are used for Plants Energy Efficiency



History of Oil/Liquids Production from 1965 to 2025

A constant growth – Covid impact in 2020 – Rebound thereafter

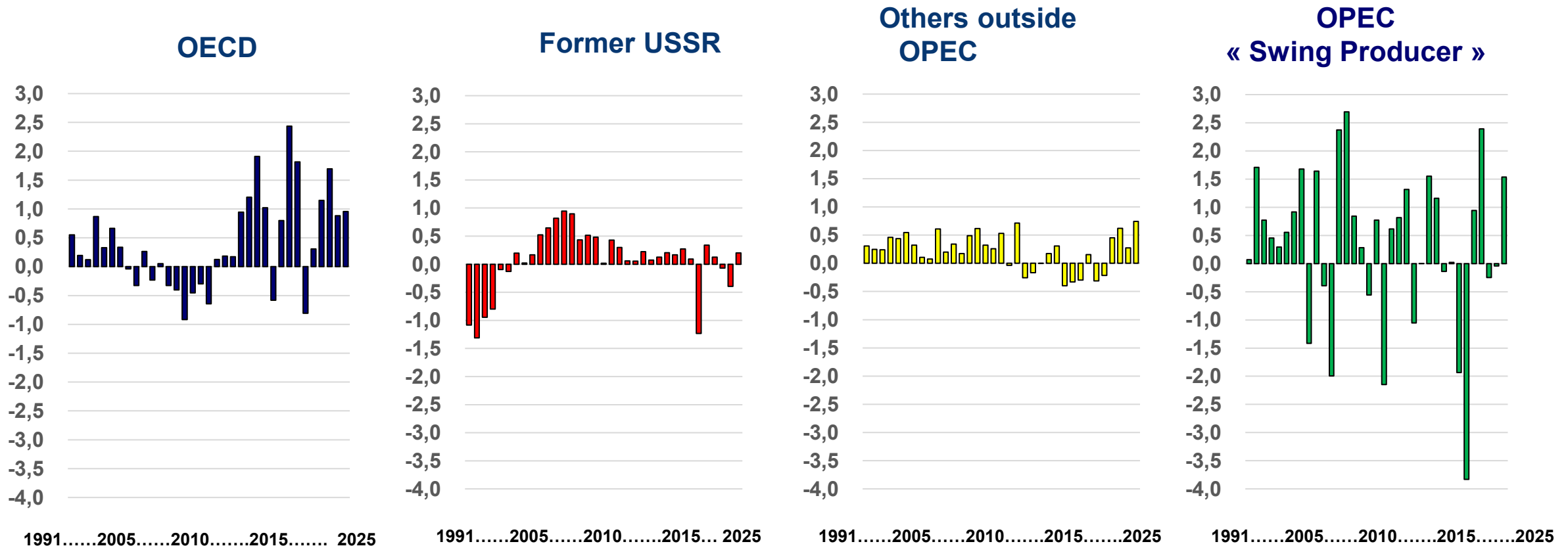


Source: Ch.Guérutte/Data from EI Stat. Review 2026.
Includes crude oil, condensates, NGLs, shale oil, tar sands. Excludes Biofuels



In the recent past, Oil growth was coming from OECD, namely US (LTO), decline in 2016, rebound in 2017, sharp increase in 2018, +1,7 Mb/d in 2019 – Decline in 2020 (Covid) for all regions- Rebound thereafter - OPEC still “Swing Producer”

Annual changes in Oil Production (All Liquids) from 1990 to 2025 – (Mb/d)



In the past, OPEC was the Regulator of the World Oil System and still is LTO production in the US has now a major impact



Impact of Shale Oil Production A Game Changer

**During the past decades, OPEC was the World Oil market
« Swing Producer »**

**The Shale Oil, Light Tight Oil (LTO) Producers in the US
did create a new balance.**

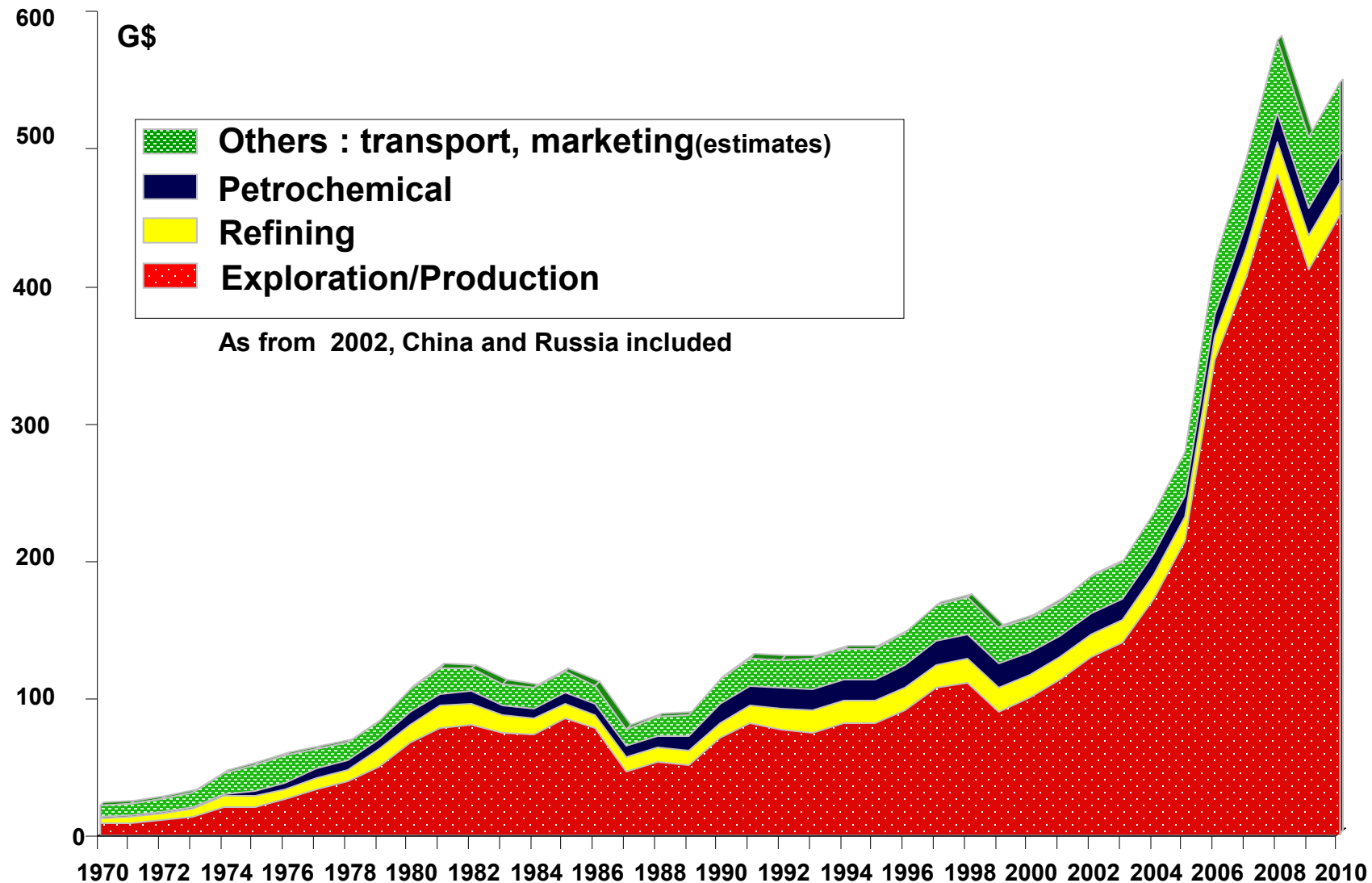
In 2025, US is by far the 1st Oil Producer in the World



Investments
(Figures & estimates vary according to sources)
See also Book 2 Energy – Chapter 15



Reminder: Oil Industry Global World Investment 1970-2010



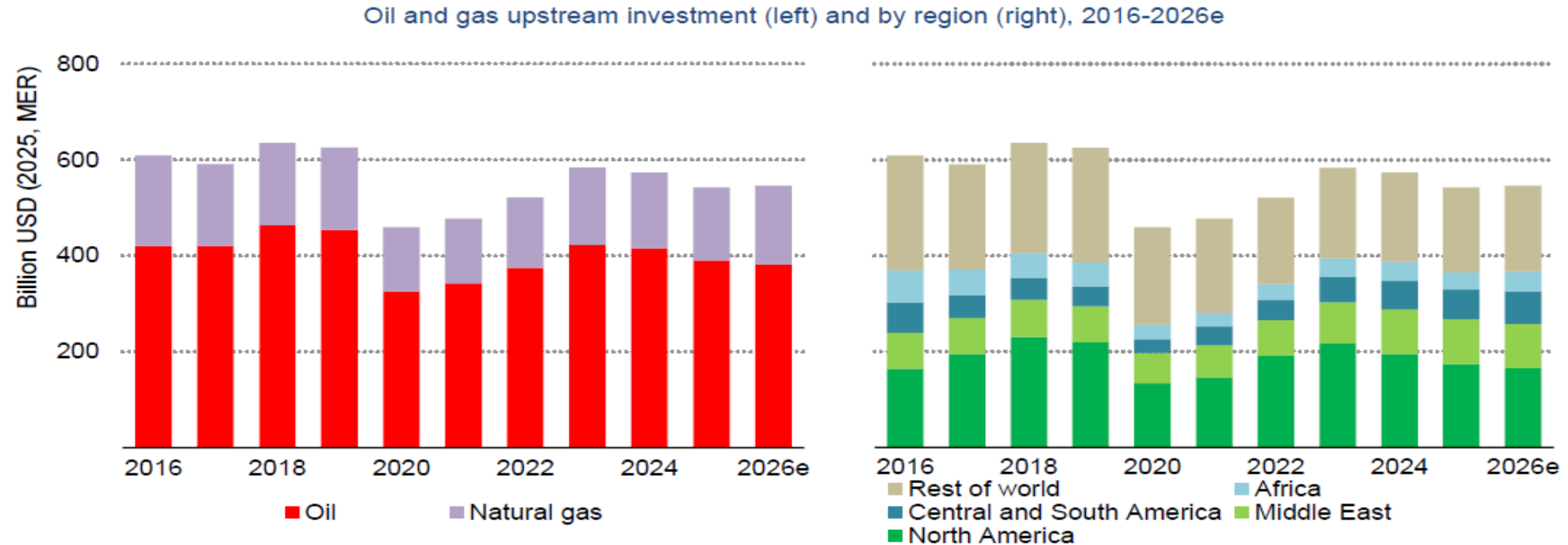
Source : IFP et divers



Oil & Gas Upstream Capex 2016 – 2026e (G\$)

After a high in 2014, a decline. A lowest in 2020 (Covid). A rebound thereafter

Global upstream investment rises marginally in 2026, with declines in North America and the Middle East offset by increases in Africa and Central and South America



IEA. CC BY 4.0.

North American investment falls in 2026 due to capital discipline and technological gains, while the conflict weighs on investment in the Middle East; these drops are offset mainly by increases in Central and South America and Africa as recent discoveries are developed.

Notes: MER = market exchange rate. 2026e = estimated. For regional definitions, see the [Methodology Annex](#).

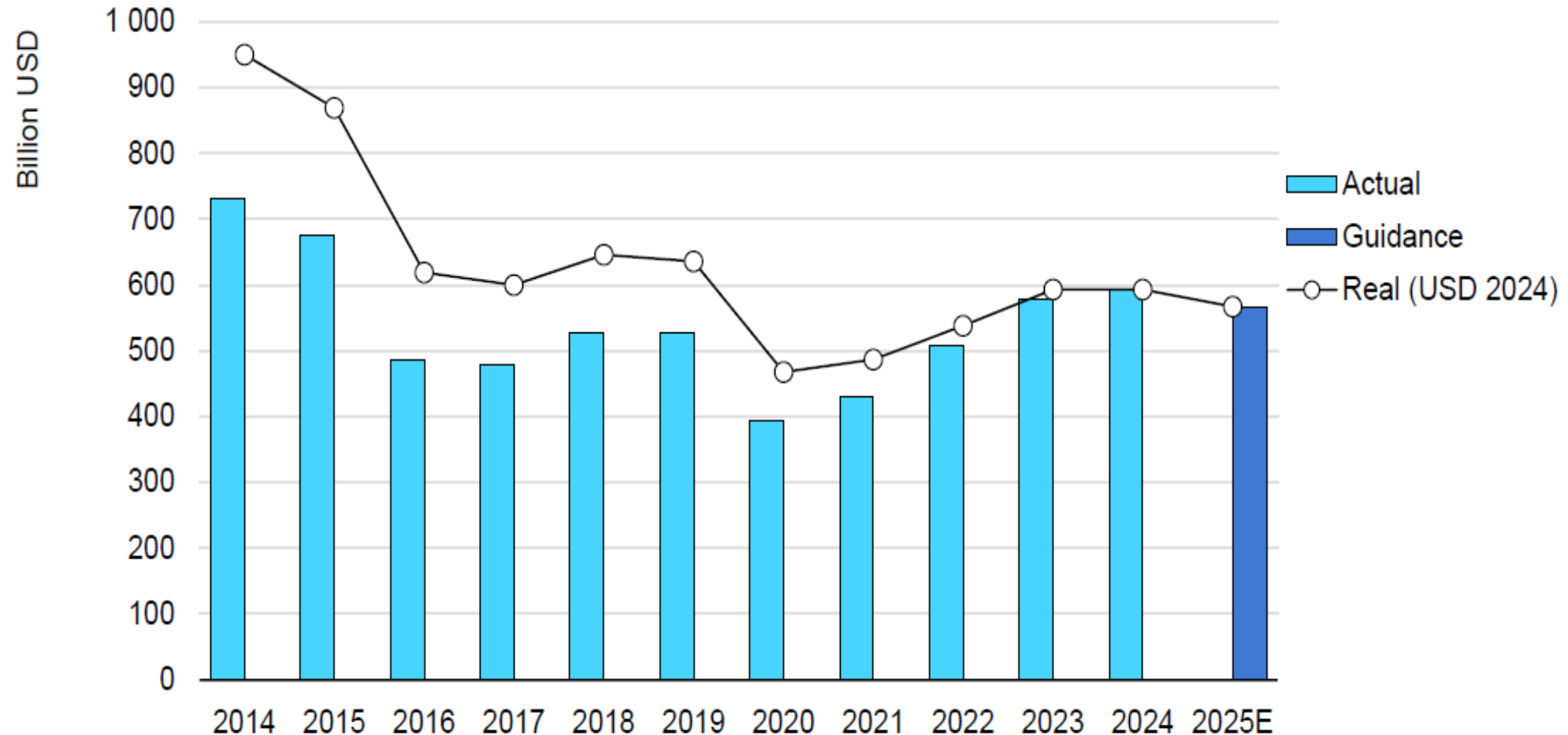
Sources: IEA analysis based on Bloomberg (2026), Bloomberg Terminal; FRED (2026), [Producer Price Indexes](#); IEA (2025), [WEO Database](#) (accessed 20 May 2026); IMF (2026), [World Economic Outlook database](#) (accessed 20 May 2026); Rystad (2026), [Rystad Energy Cube Browser](#); and company reporting.



Oil & Gas Upstream Capex 2014 – 2025 (G\$)

After a high in 2014, a decline. A lowest in 2020 (Covid). A rebound thereafter

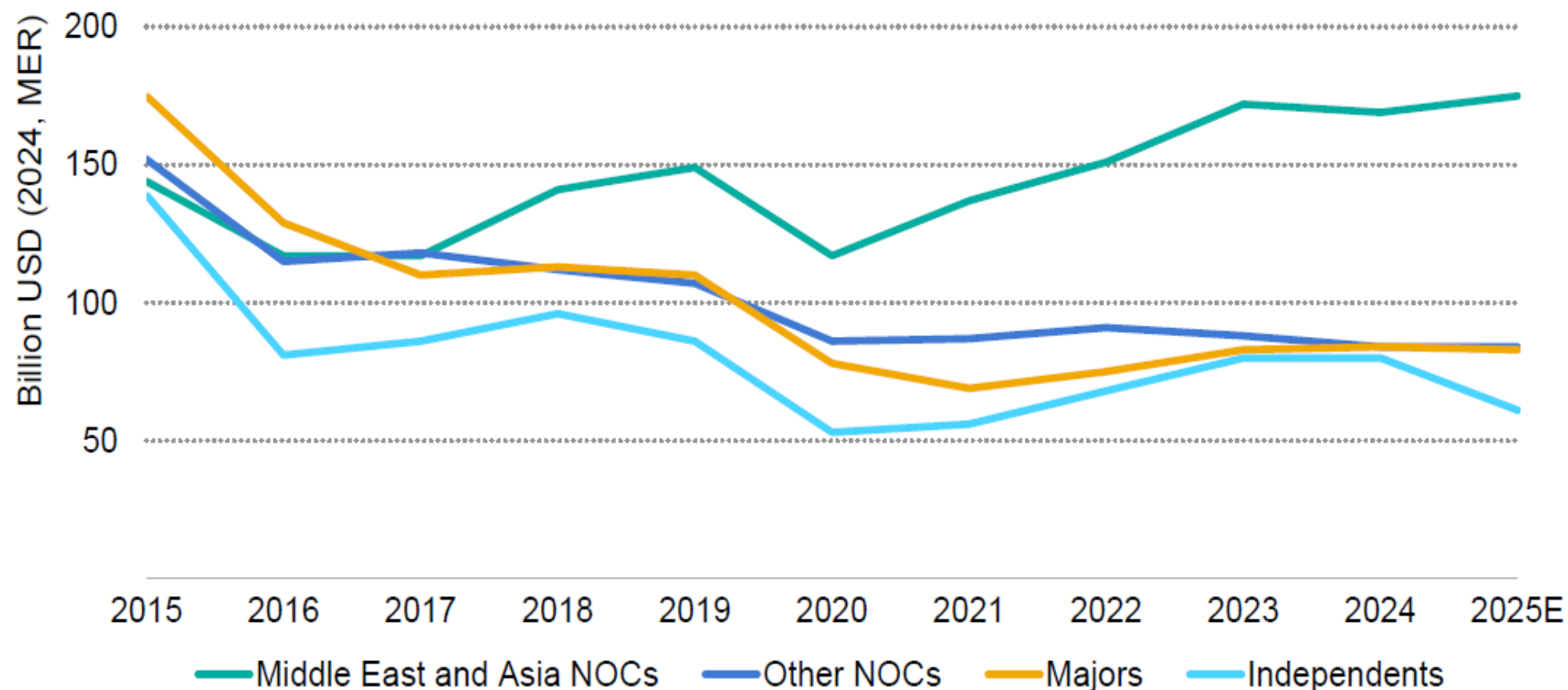
Global upstream oil and gas capital spending



Oil & Gas Upstream Capex 2015 – 2025 (G\$)

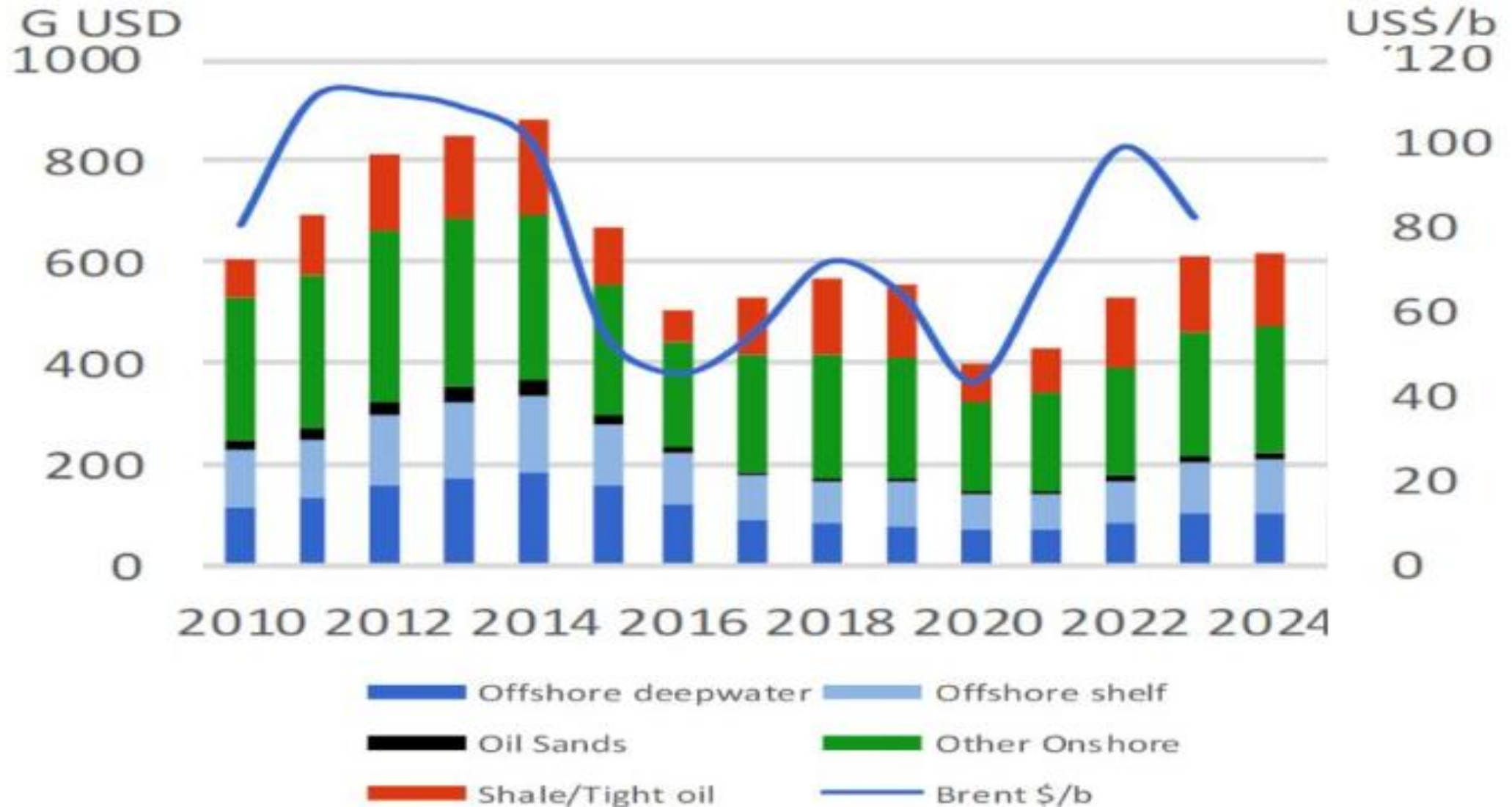
Increased Capex from Middle East & Asia NOC's

Global upstream oil and gas capital spending by operator segment



Oil Upstream Capex 2010 - 2024

Rystad 2024



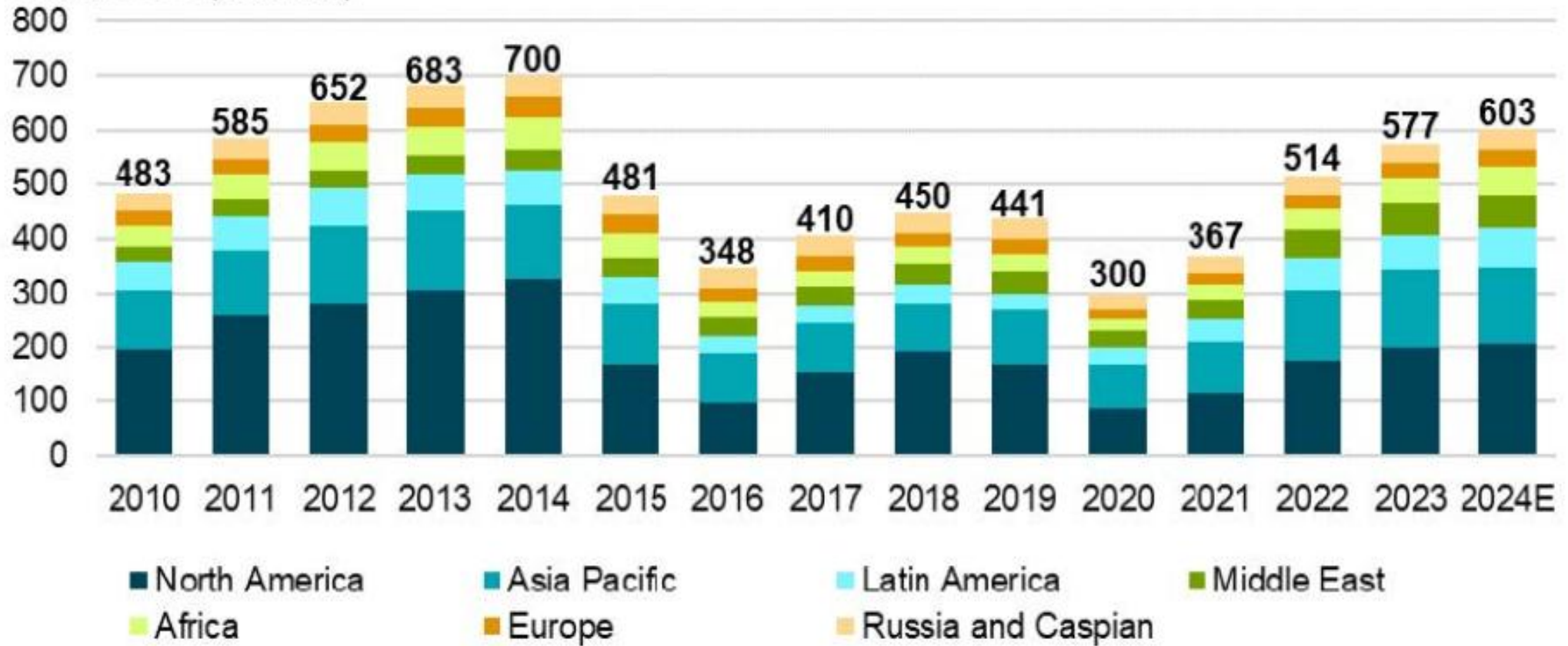
Source: Rystad Energy 2024



Oil Upstream Capex 2010 - 2024 by International Energy Forum (IEF) 2024

Upstream Oil & Gas Capex

Billion USD (nominal)



Source: IEF, S&P Global Commodity Insights

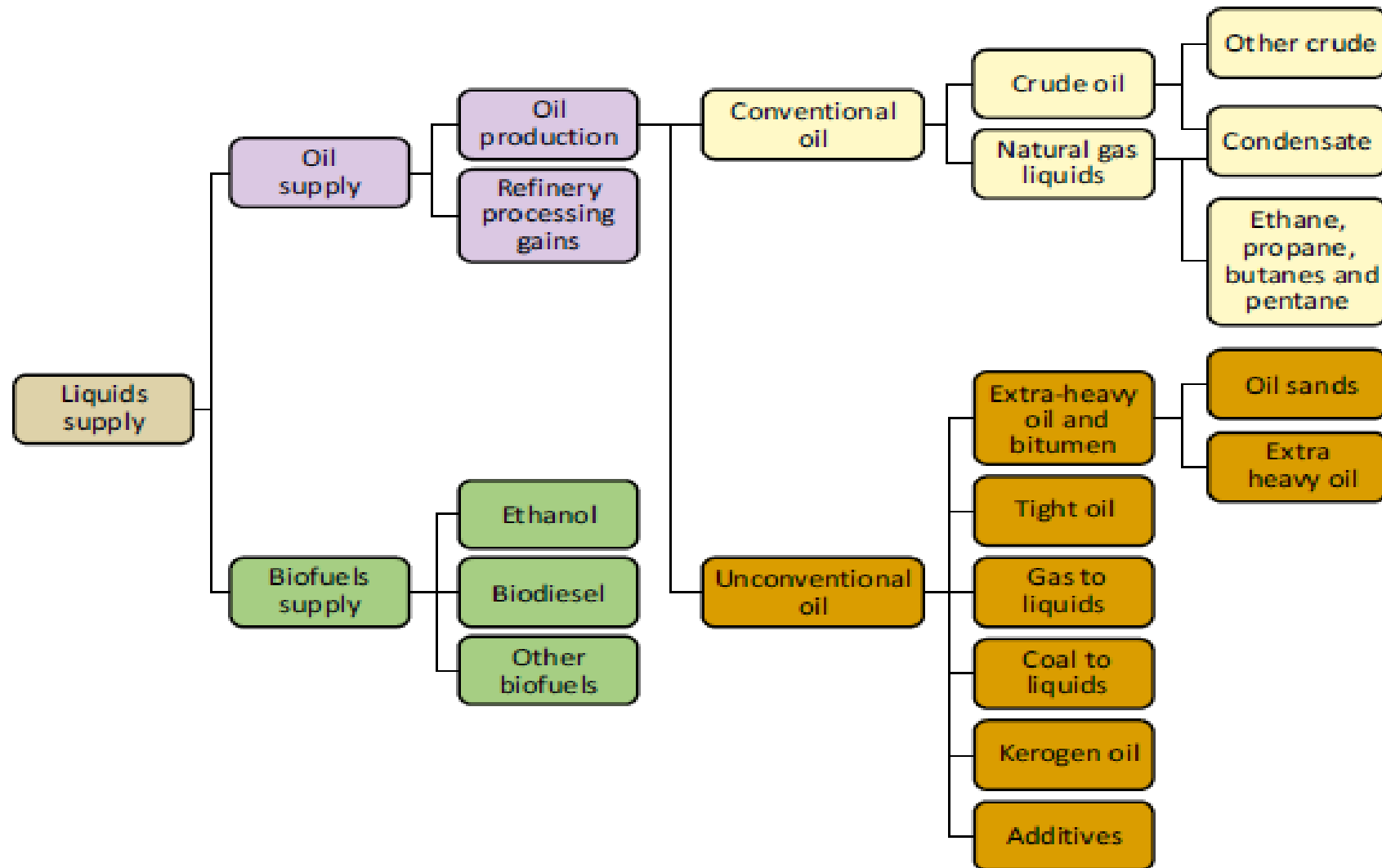
Source: Rystad Energy 2024



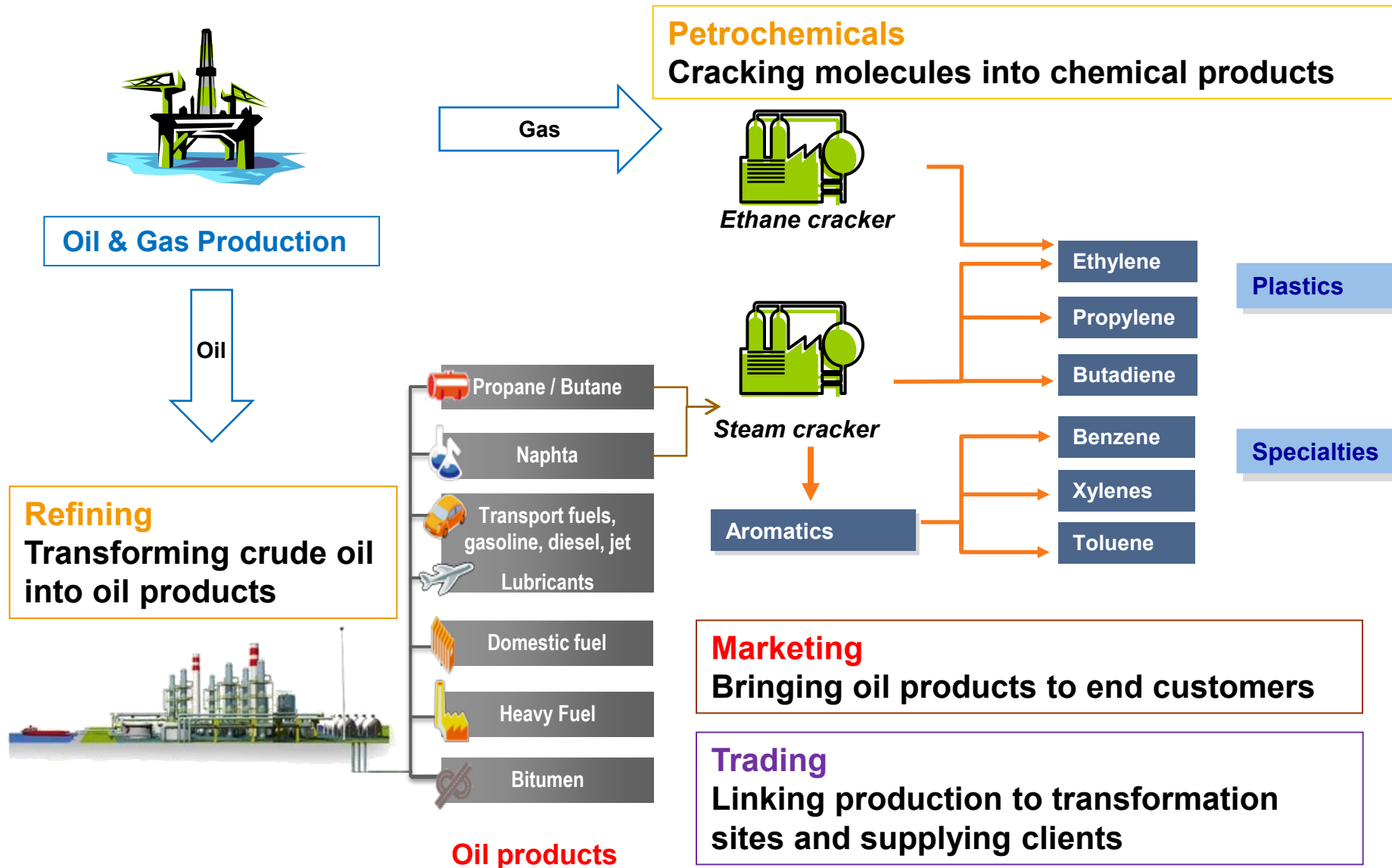
Oil & Gas Industry Upstream, Downstream Activities



Liquids, Oil & Oil products: various categories

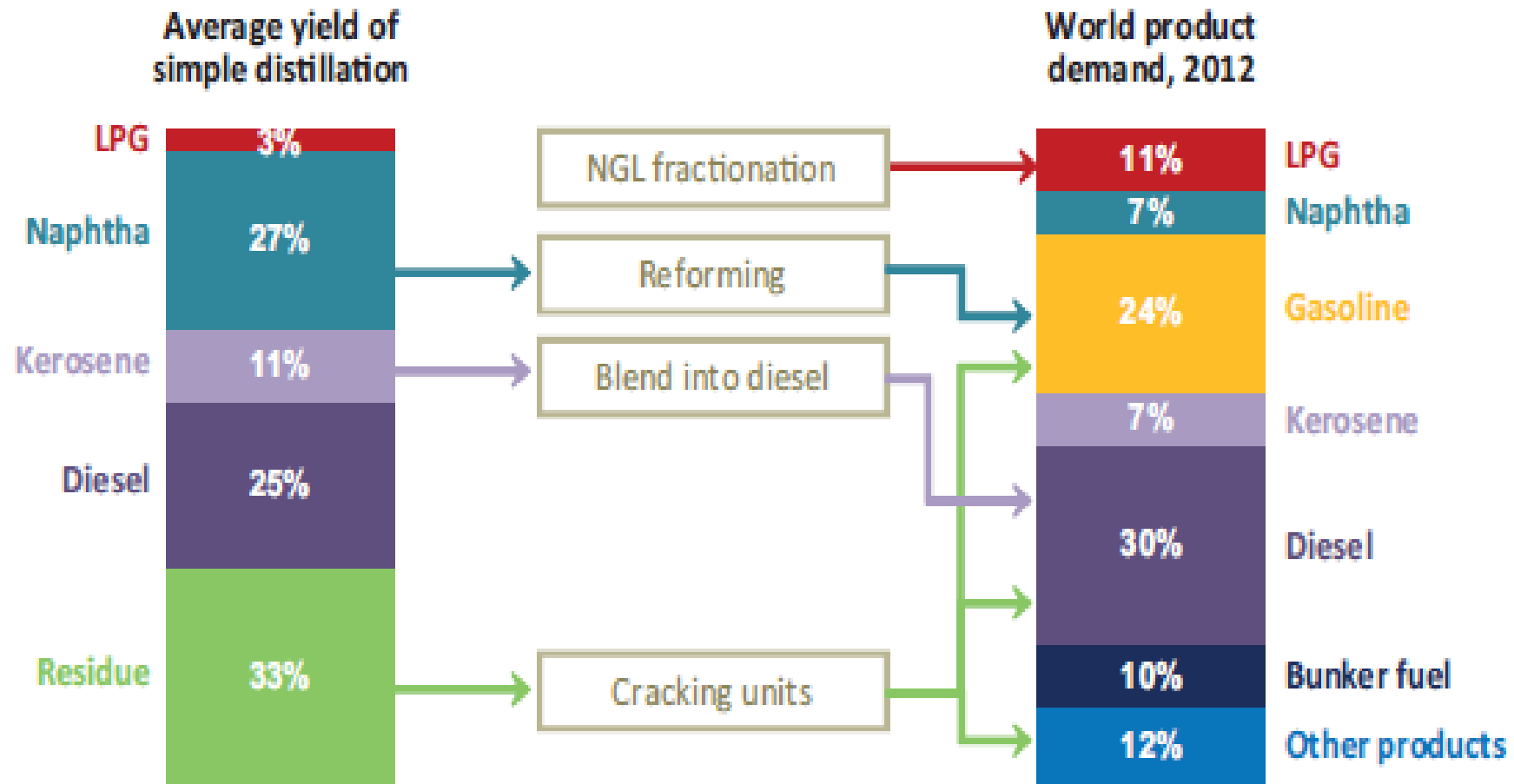


Downstream Fundamentals – An Integrated Value Chain

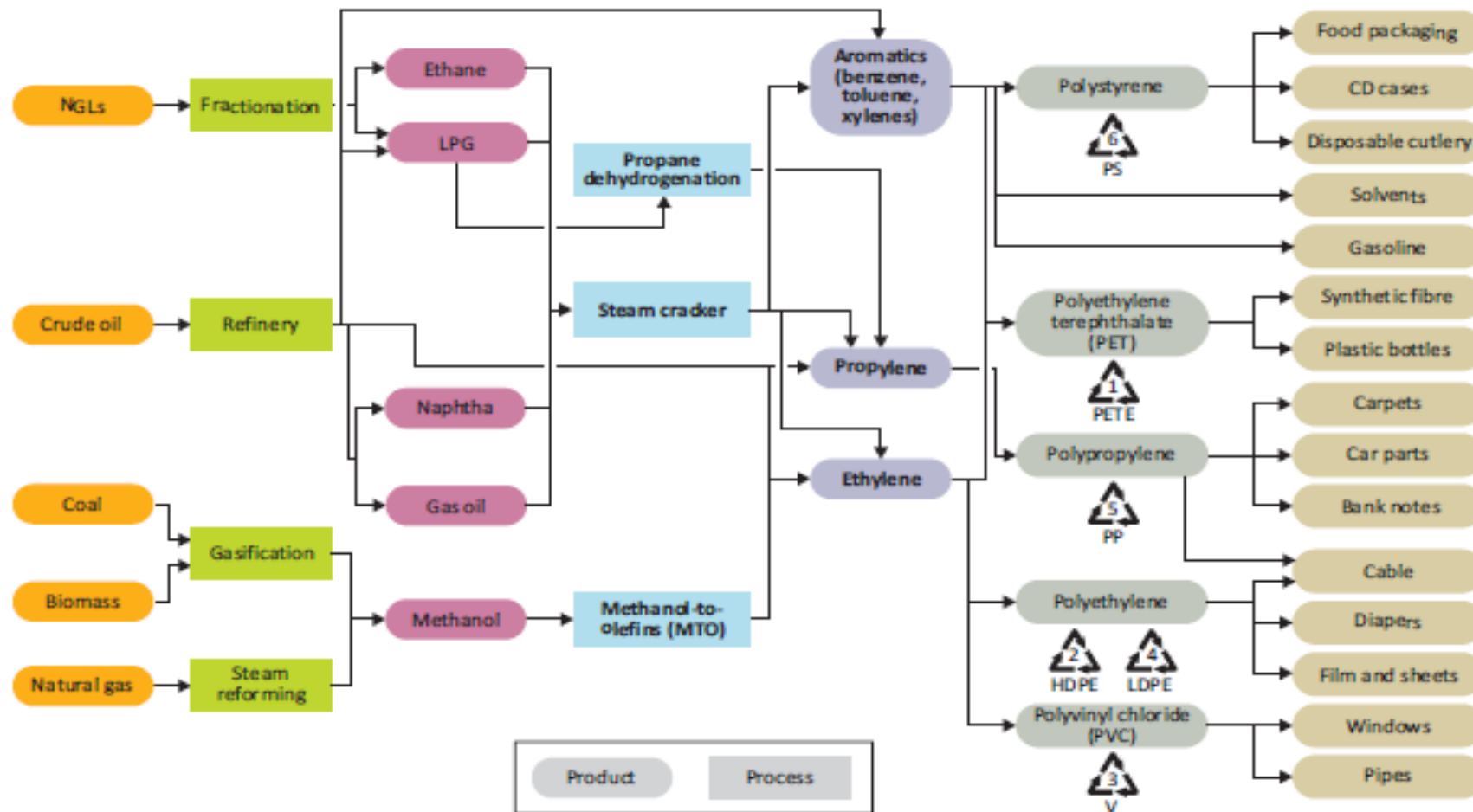


A reminder: From crude to oil products

Basic process scheme



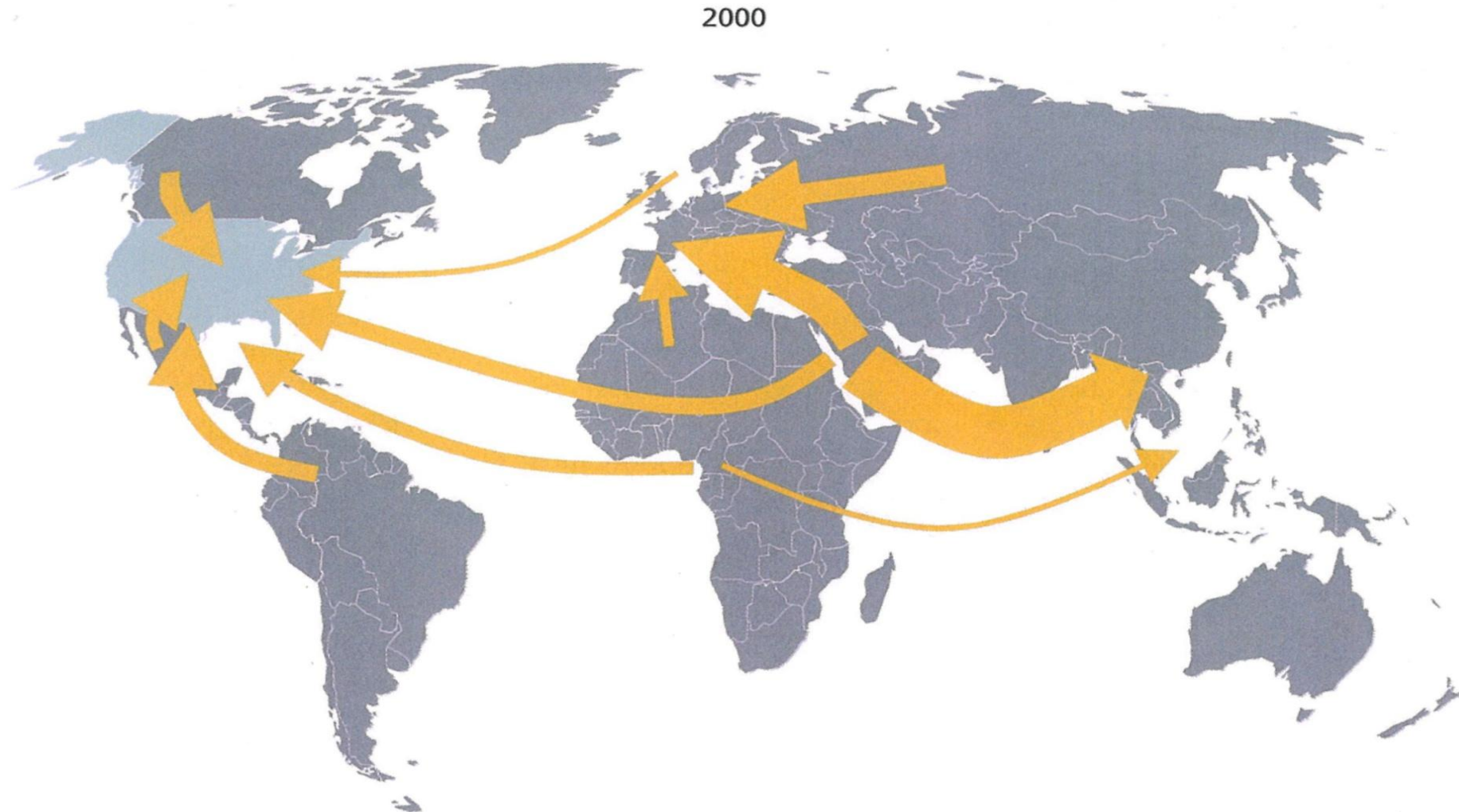
A reminder: From energy sources to petrochemicals products: Basic process scheme



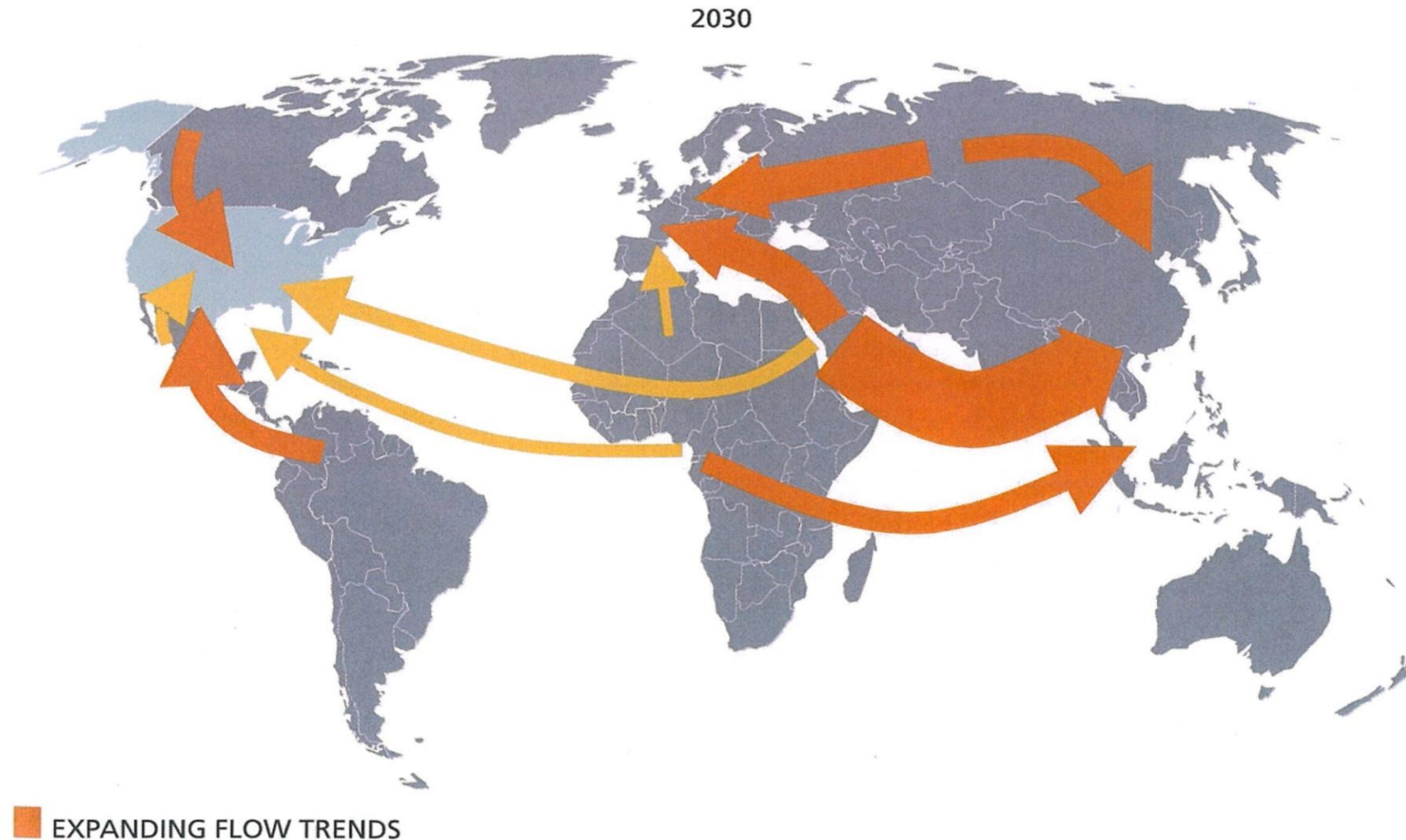
Oil Transportation



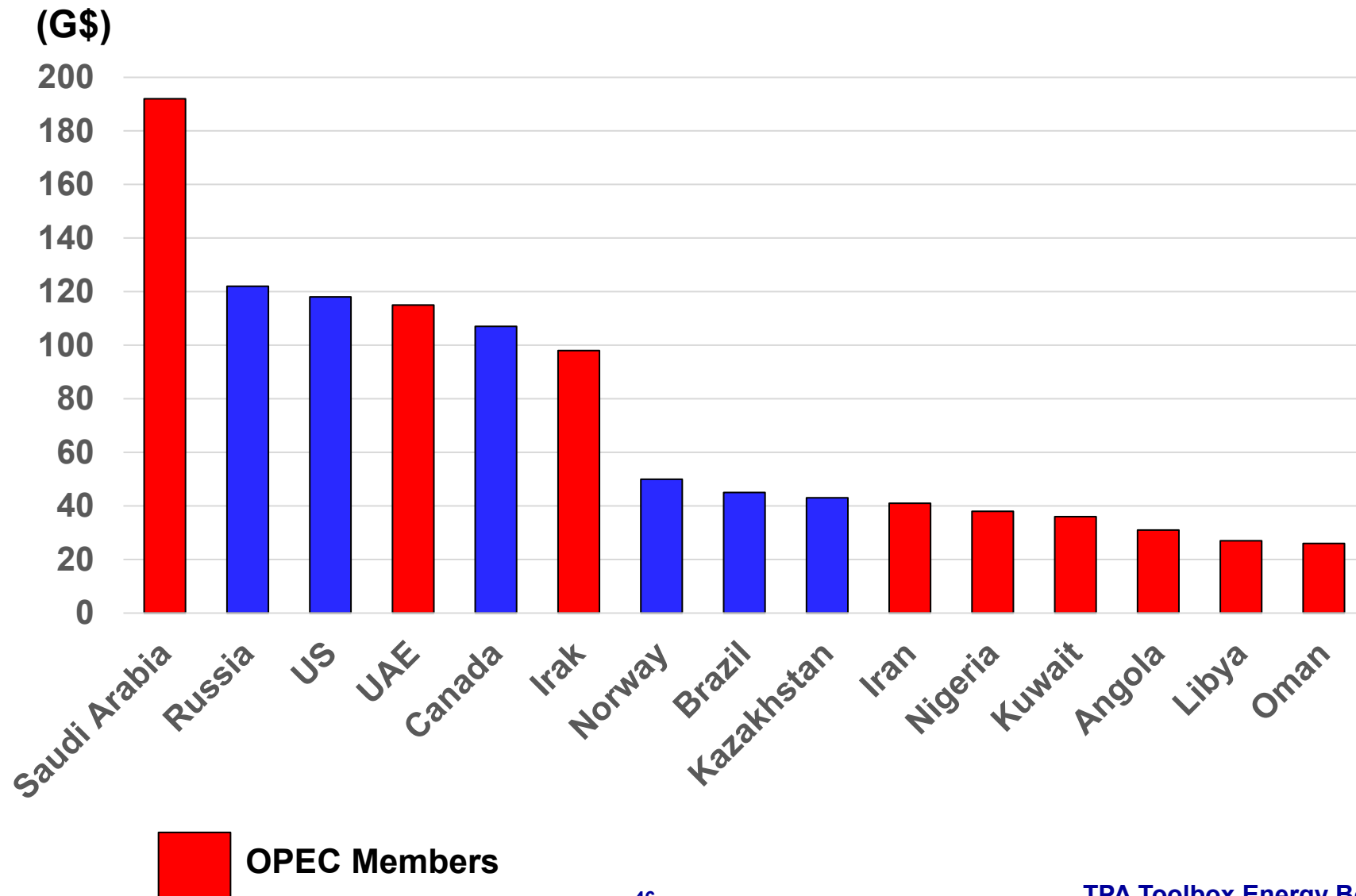
Global Oil Flow Trends (2000)



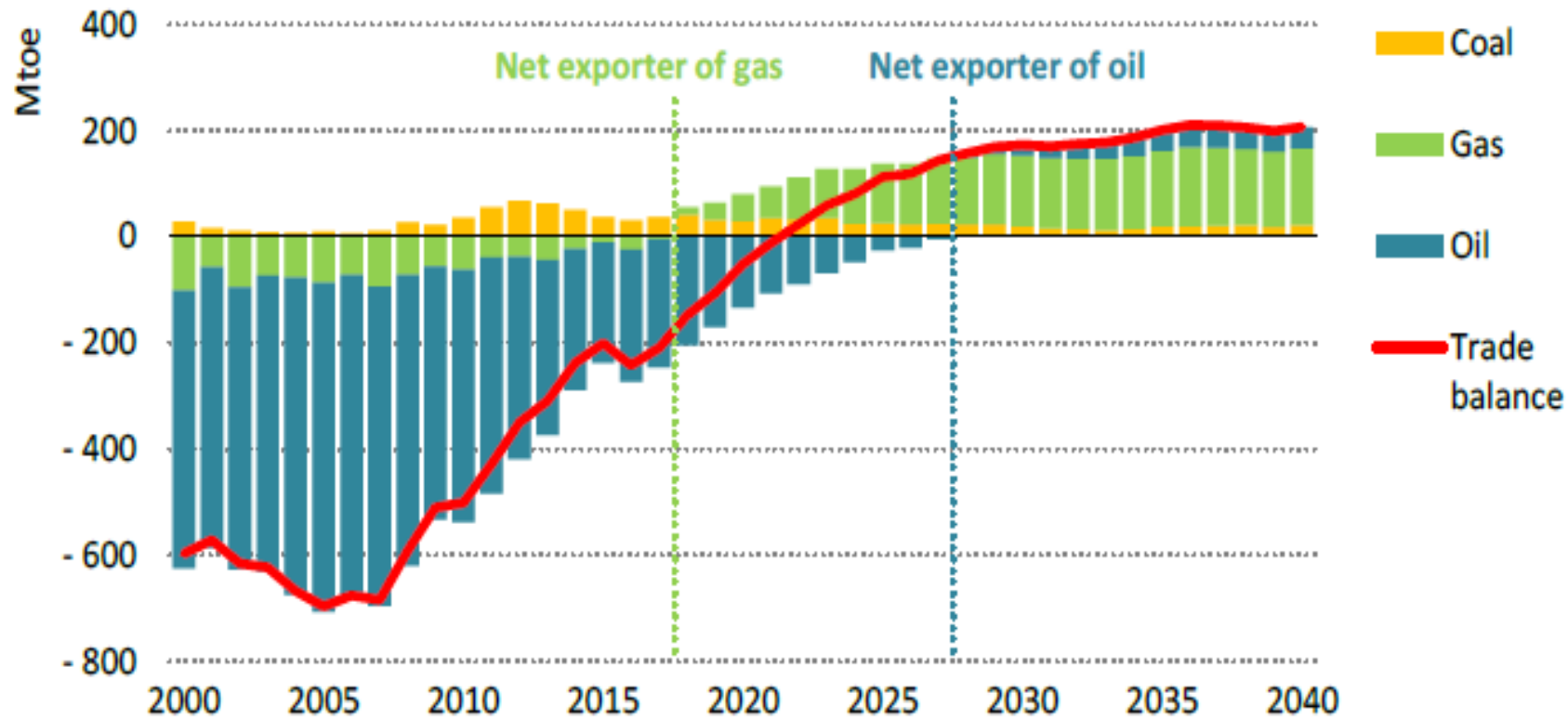
Global Oil Flow Trends (2030)



Fifteen first Countries by Oil Exports Values - 2024 (G\$) Total World Exports Values # 1300 G\$



A particular Case: Thanks to Light Tight Oil and Shale Gas, US are now Net Exporter of HC - **Reminder**: A 2017 view by IEA



The United States is switching already to become a net gas exporter, and is projected to become a net oil exporter in the late 2020s



Oil Business and Geopolitics: Close links



Oil major geopolitical hot points

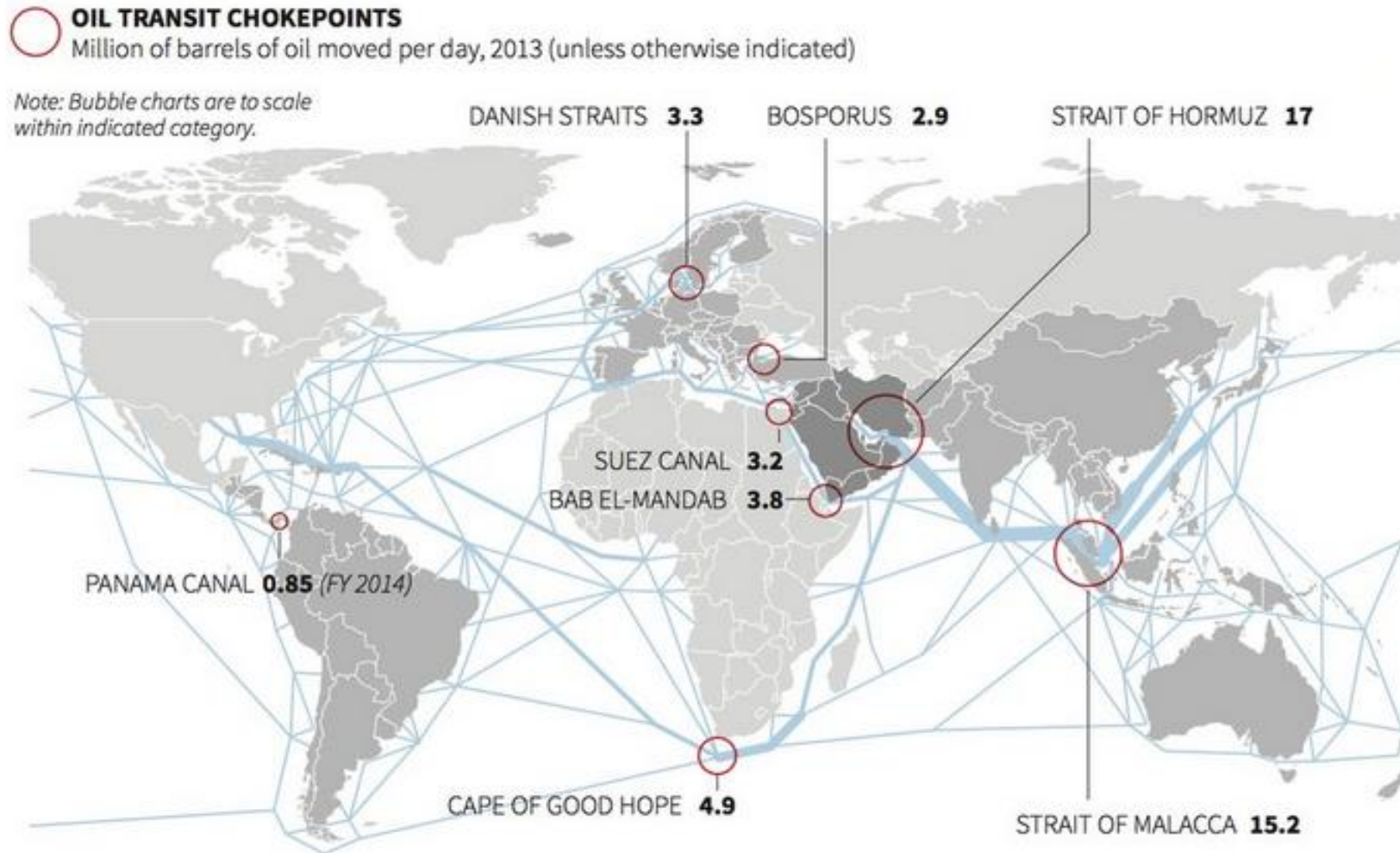
Chokepoint	Connecting	Bordering	Type	Width	Affected by	Incidents	Alternatives
Strait of Hormuz	Persian Gulf, Gulf of Oman, and the India Ocean	Iran, UAE, Oman	Natural Strait	48 km	War, Piracy, Threat of terrorism	Tanker War (1986-87)	None
Bab el-Mandeb	Red Sea and Arabian Sea	Eritrea, Somalia, Djibouti, Yemen	Natural Strait	32 km	Piracy, Highjacking, Terrorist attacks	USS Cole Attack (2000) Houthi attacks (Current), Somalian Piracy	Long
Suez Canal	Mediterranean and Red Sea	Egypt	Artificial Waterway	0.2 km	War, Diplomatic issues, Operational incidents	Ever Given (2021)	Long
Malacca Strait	Indian Ocean, South China Sea, Pacific Ocean	Indonesia, Singapore, Malaysia	Natural Strait	2.5 km	Diplomatic disputes, Piracy, Threat of terrorism	Orapin 4 piracy attack (2014)	Short
Turkish Straits (Bosphorus and Dardanelles)	Black Sea and Mediterranean	Turkey	Natural Strait	1 km	Environmental issues	Pollution of Marmara Sea and strait due to heavy ship traffic	None
Panama Canal	Atlantic and Pacific Oceans	Panama	Artificial Canal	0.3 km	Infrastructure limitations, weather and climate	Closure due to heavy rains (2010), Restrictions due to insufficient water (current)	Long
Gibraltar Strait	Mediterranean Sea and Atlantic Ocean	Spain, Gibraltar (UK), Morocco	Natural Strait	13 km	Weather and Climate, Diplomatic issues	Blockade by the Spanish Republican Navy (1936)	Long/limited capacity -- Suez Canal

Source: Disruption of Maritime Trade chokepoints and global LNG trade: An agent-based modelling approach, Maritime Transport Research, Vol 3, 2022 (updated)

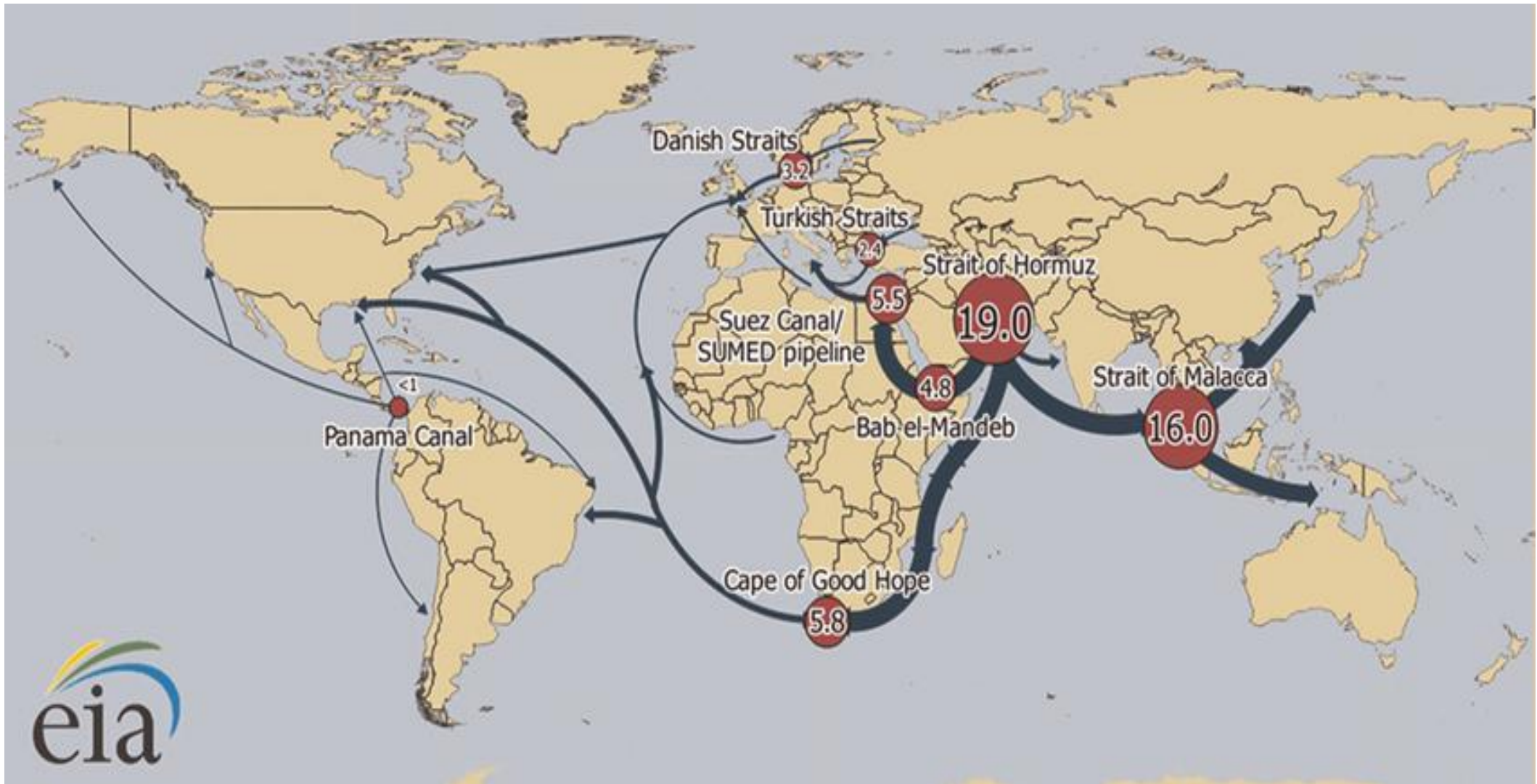


Oil major geopolitical hot points

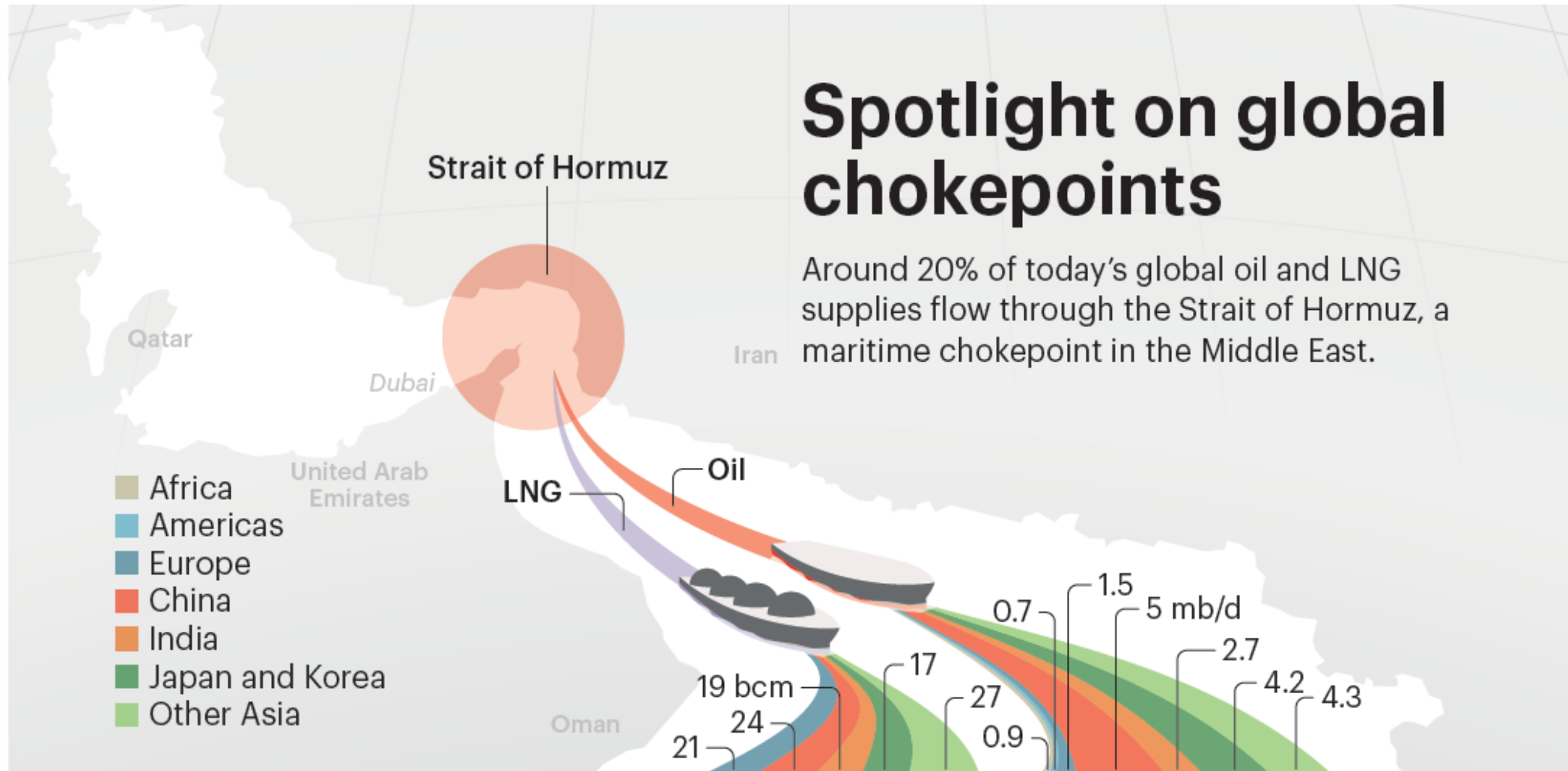
Situation 2013



Oil major geopolitical hot points Situation 2024 (Figures in Mb/d)



Strait of Hormuz Exports & Imports Situation 2024



Source: IEA WEO 2024

Reminder: 2017 - Tensions in the Middle East.....



Courrier International 15 juin 2017



Courrier International 16 novembre 2017



Oil Price

2018 A new Geopolitical Impact



June 2019 - Tensions in the Middle East Oman Sea



Source: News Agency - ISNA/AP



2022 – Russia/Ukraine War

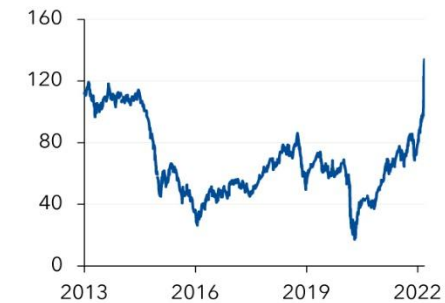
Major Impact on World Economy and Energy Markets

Growing pressures

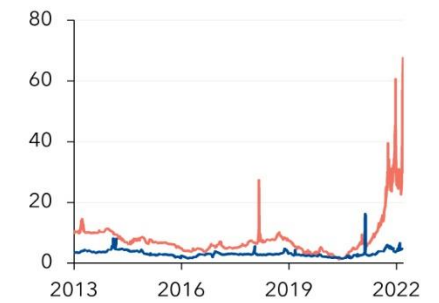
Prices for energy, grains, and metals soared since the invasion of Ukraine, signaling that inflation rates are poised to accelerate.



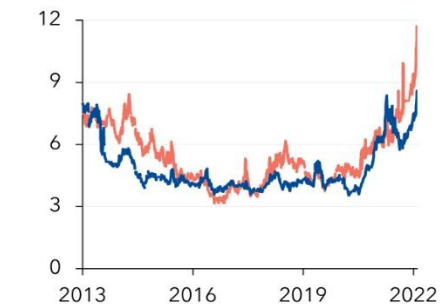
Brent Crude Oil
(\$US/barrel)



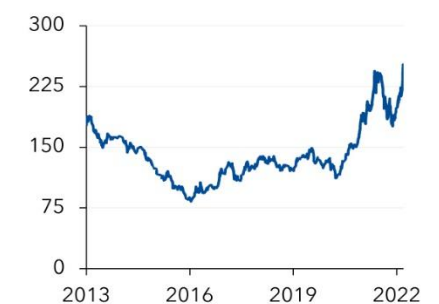
European & US Natural Gas*
(\$US/MMBtu)



Corn, Wheat
(\$US/bushel)



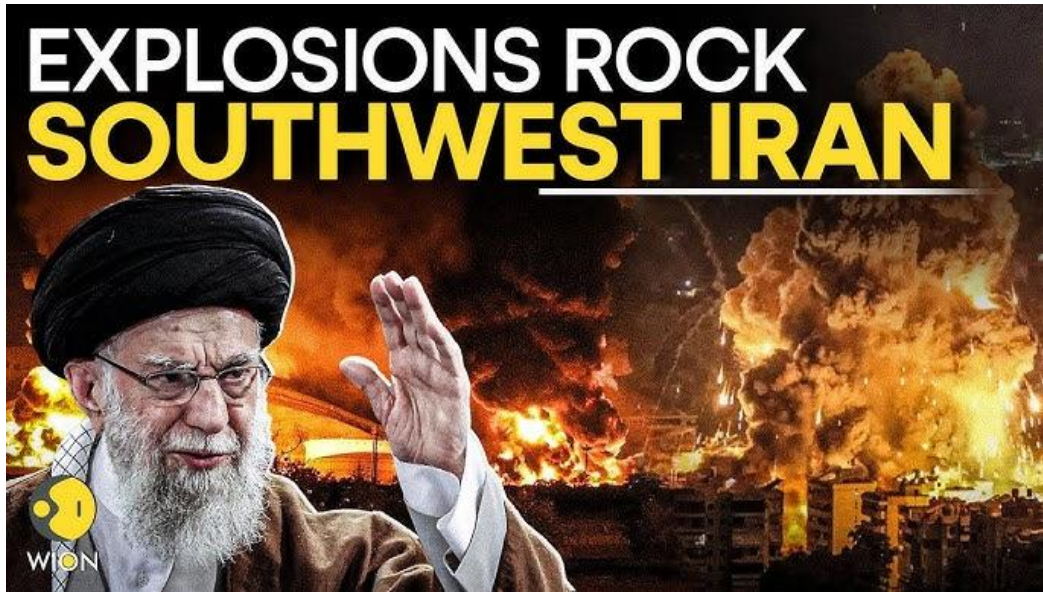
Metals Index**
(2016=100)



Source: Harvard University – International Monetary Fund

Source: Bloomberg, USDA, Datastream, and IMF staff calculations.
Note: *European & US natural gas prices use the Dutch TTF and Henry Hub as proxies, respectively. **Base Metals Price Index includes aluminum, cobalt, copper, iron ore, lead, molybdenum, nickel, tin, uranium, and zinc.

June 2025/Israel – Iran – US war - Threats on Hormuz strait



March 2026/Israel – Iran – US war - Threats on Hormuz strait



Téhéran – 1st March 2026



March 2026/Israel – Iran – US war - Threats on Hormuz strait

Oil

20 mb/d, around 25% world seaborne oil trade, transits the Strait – 80% destined for Asia.

3.5 to 5.5 mb/d of pipeline capacity with the potential to re-direct crude flows to avoid the Strait.

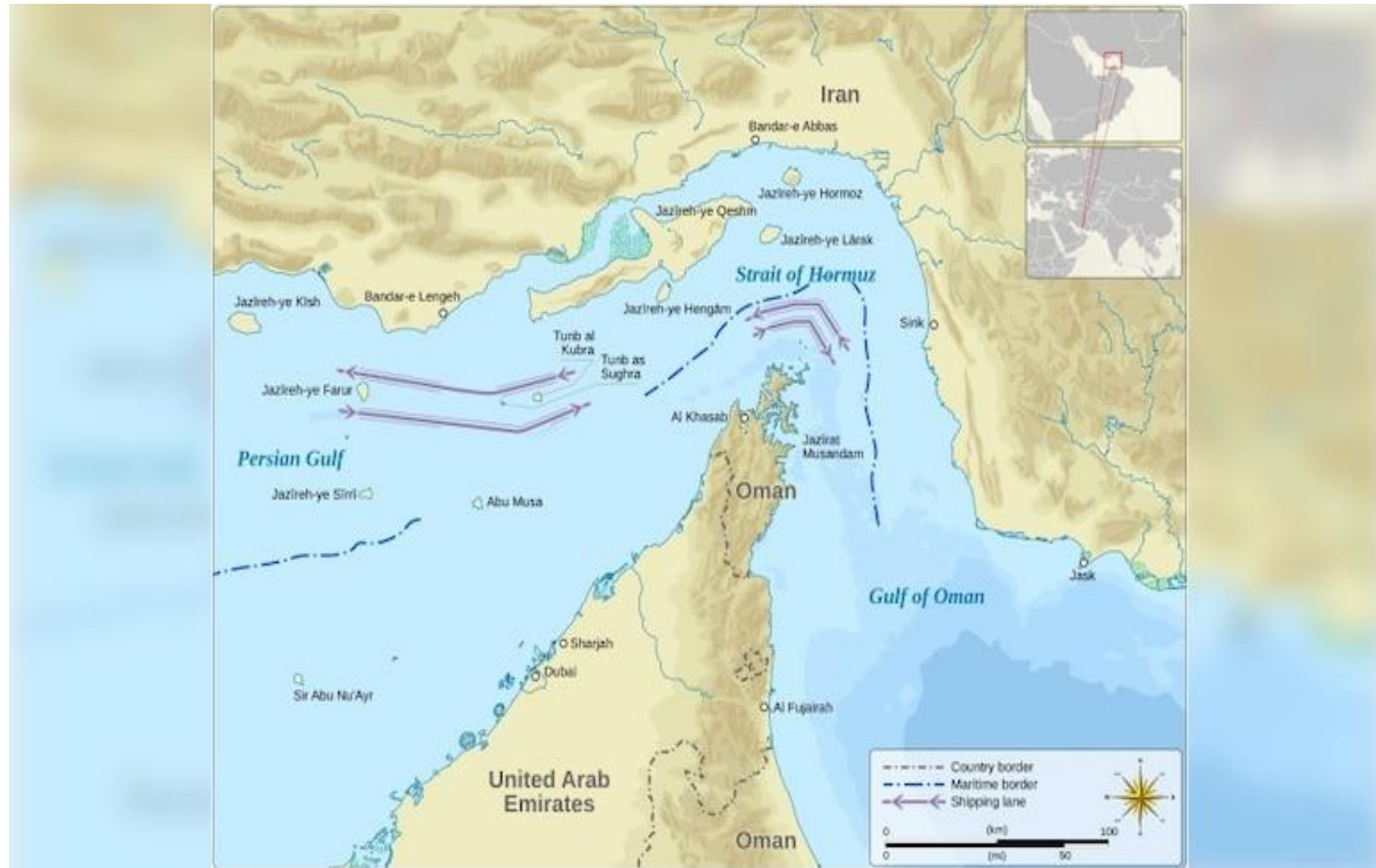
Lasting disruptions unlikely, but even if short-lived would have significant impact on oil markets.

Natural gas

About 93% of Qatar's and 96% of the UAE's LNG exports transit through the Strait, representing 19% of global LNG trade.

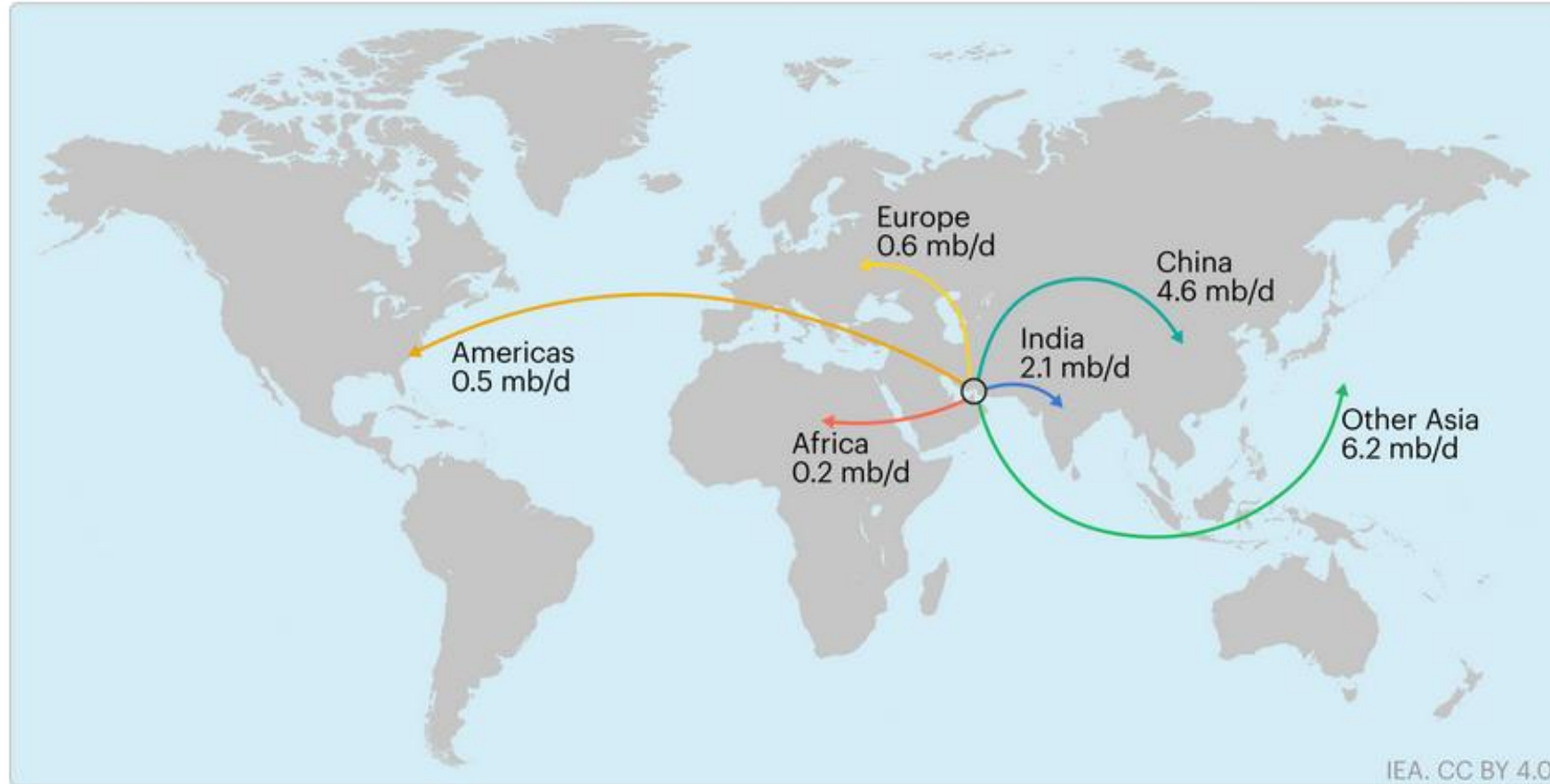


March 2026/Israel – Iran – US war - Threats on Hormuz strait



March 2026/Israel – Iran – US war - Threats on Hormuz strait

Crude oil exports transiting the Strait of Hormuz by destination (2025)



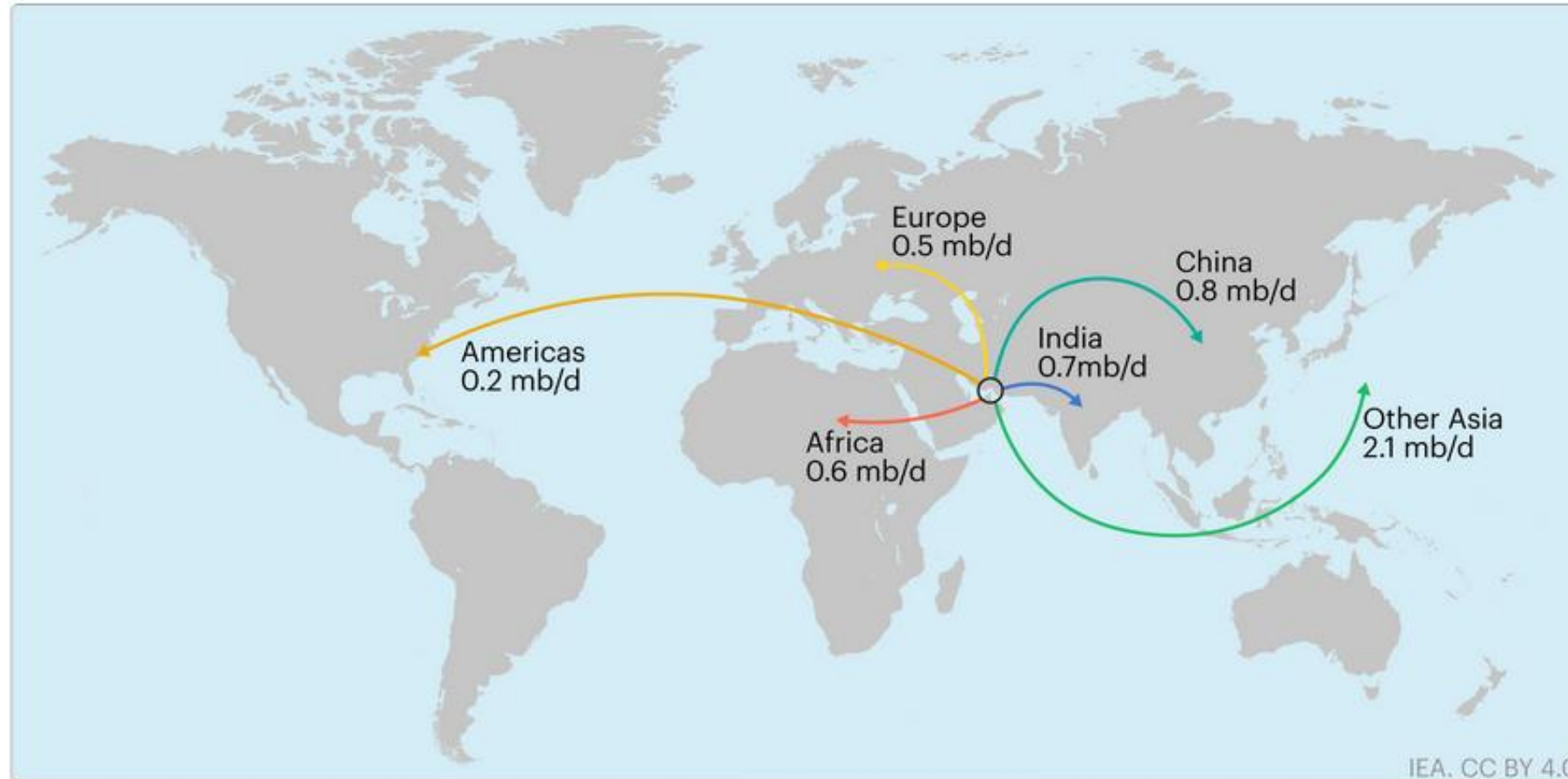
Total does not match sum of adding individual numbers due to destinations not indicated. Source: IEA analysis based on Kpler.

Source – IEA March 2026



March 2026/Israel – Iran – US war - Threats on Hormuz strait

Oil product exports transiting the Strait of Hormuz by destination (2025)

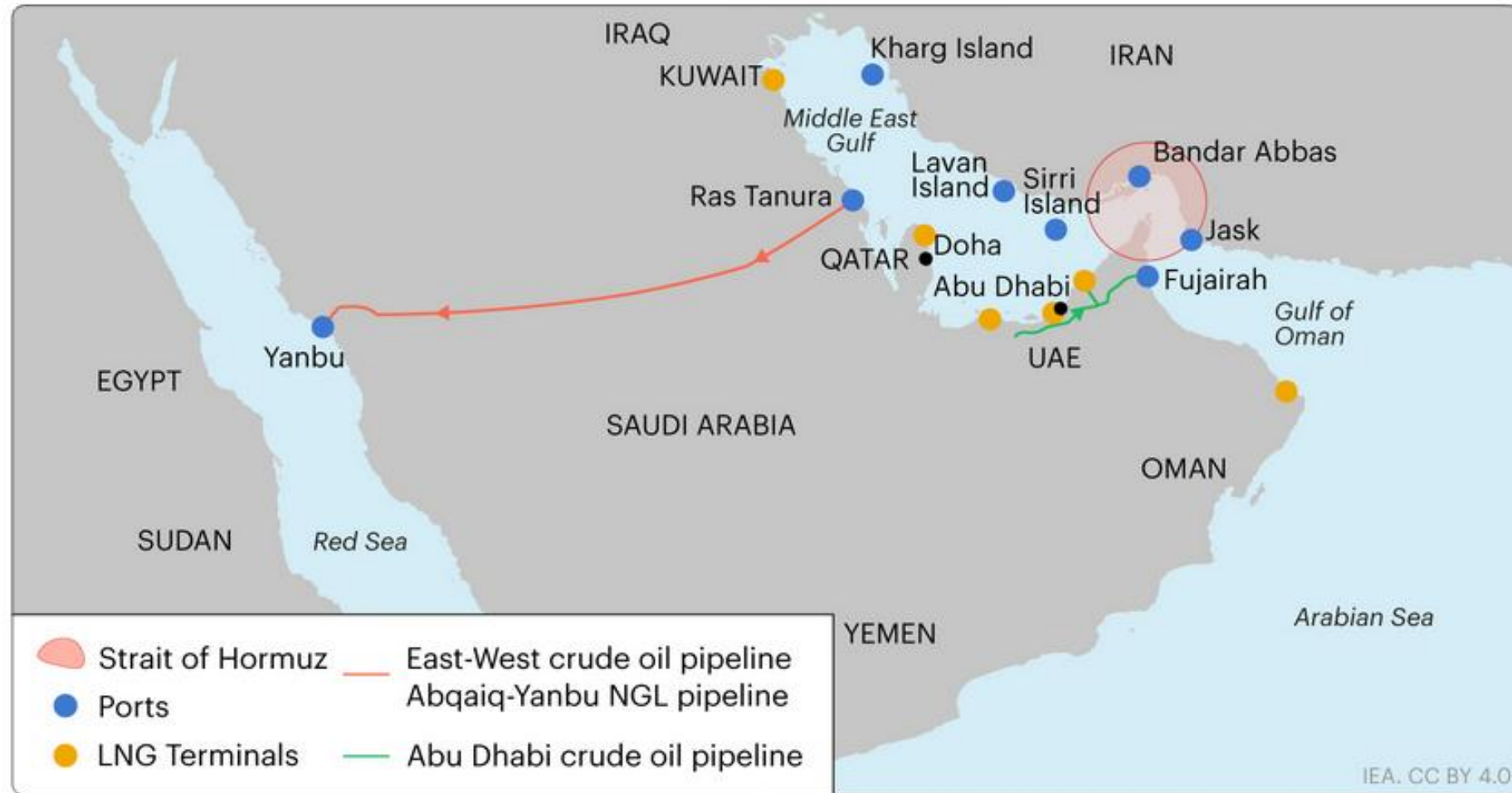


Total does not match sum of adding individual numbers due to destinations not indicated. Source: IEA analysis based on Kpler.

Source – IEA March 2026

March 2026/Israel – Iran – US war - Threats on Hormuz strait

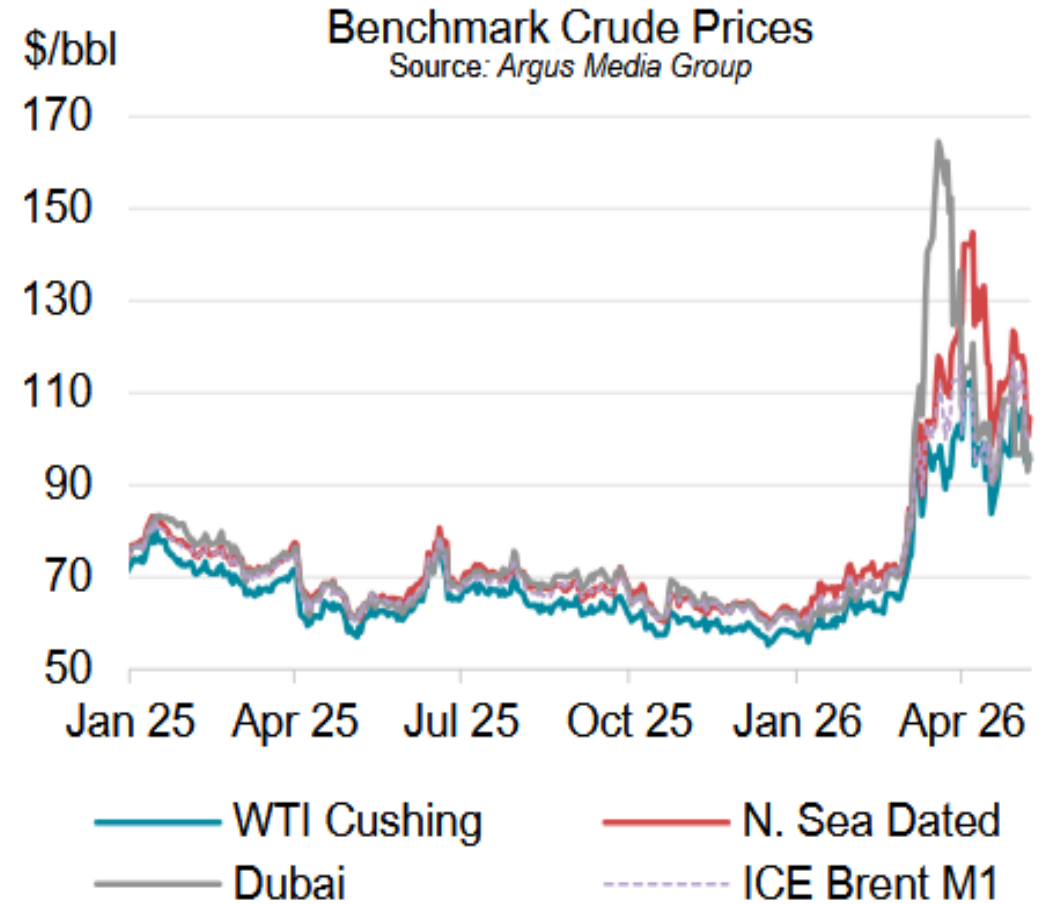
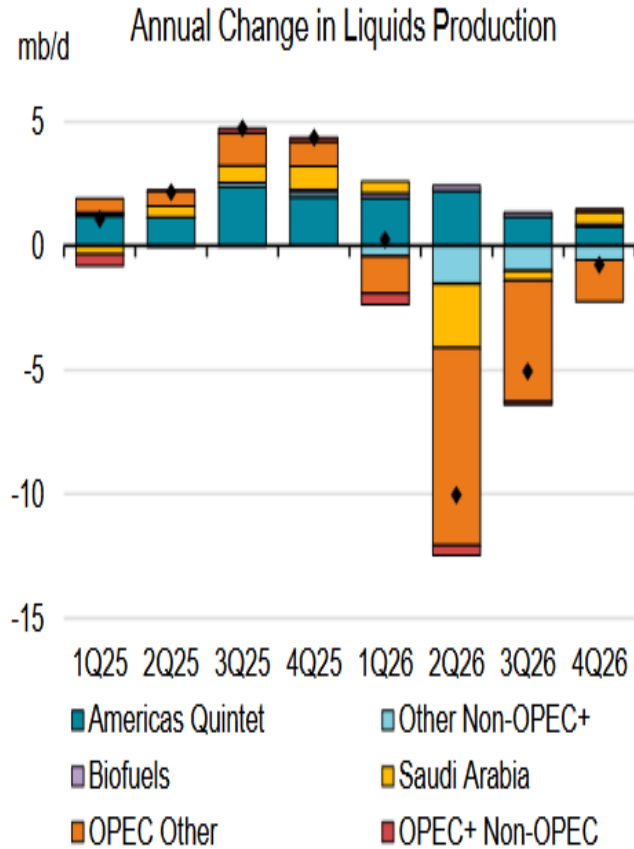
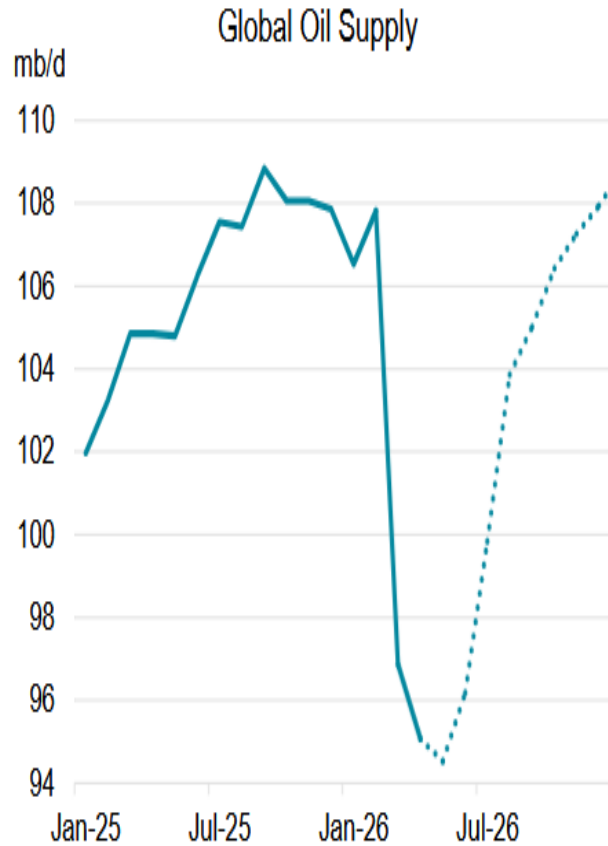
Alternative routes



Source – IEA March 2026



Global Oil Supply & Prices - IEA view May 2026



Source – IEA Oil Market Report 13 May 2026

2

Resources and Reserves



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1. Oil Industry: general considerations

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6. Oil production and consumption: past and present

7. Oil production and consumption: various perspectives

8. Available resources vs CO₂ emissions: the dilemma

9. Oil upstream: technical features and economics

10. Oil prices: yesterday & today

11. The drivers for a long term oil price

12. Oil prices: various scenarios for the future

13. Oil industry stakeholders: governments, NOCs and IOCs



Oil: the physical regulator of the World Energy System ... up to now.

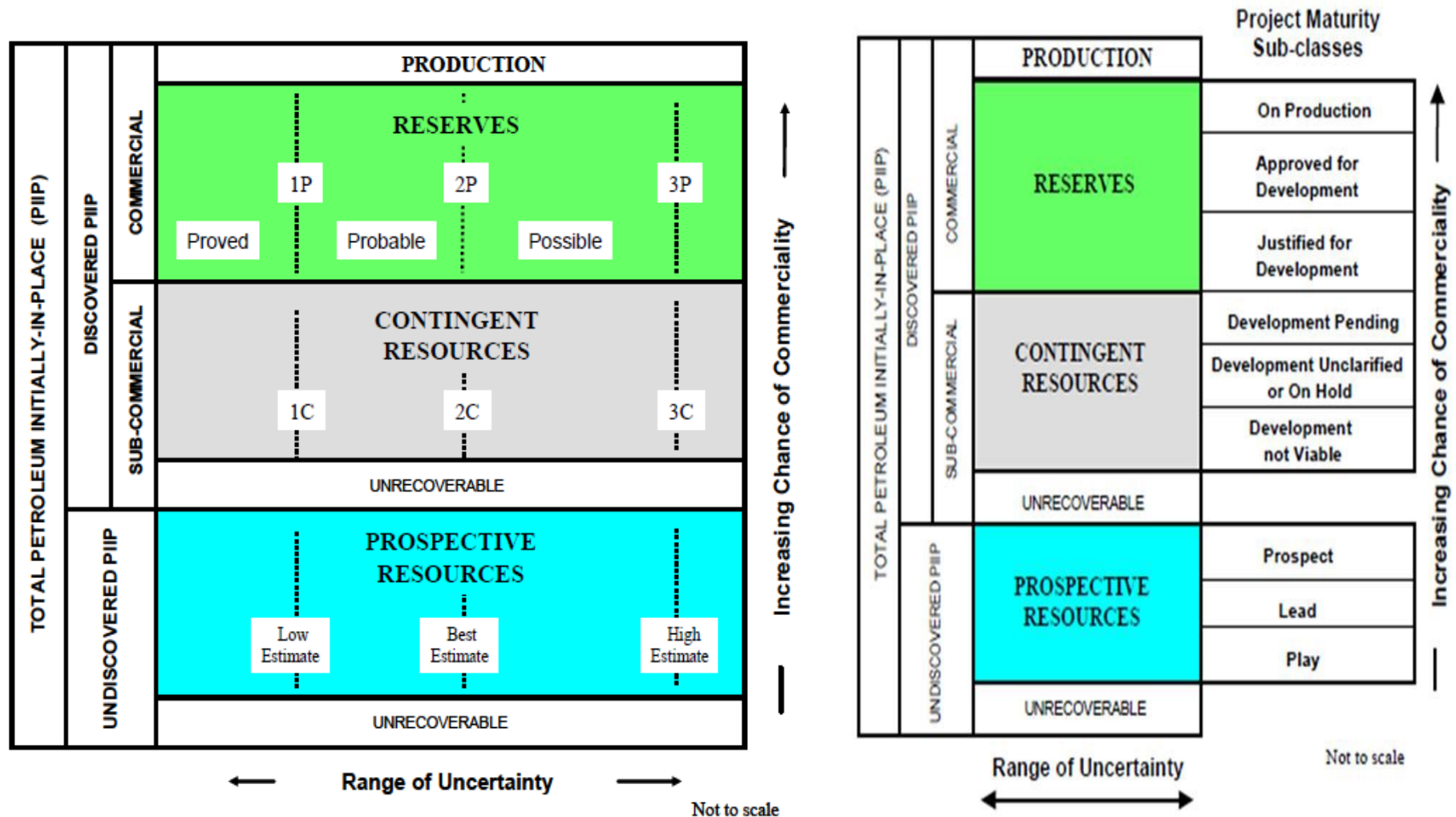
Basic points:

- ◆ **Oil = a key element of world trade balances**
- ◆ **For the last 50 years oil has regulated the variation of world energy demand**
- ◆ **OPEC has been the « regulator of the regulator »**
- ◆ **Saudi Arabia has been the « regulator of OPEC »**
- ◆ **Ghawar has been the « regulator of Saudi Oil »**
- ◆ **What about the future ? The Peak Oil issue and Climate Change Challenges**



Some definitions (1)

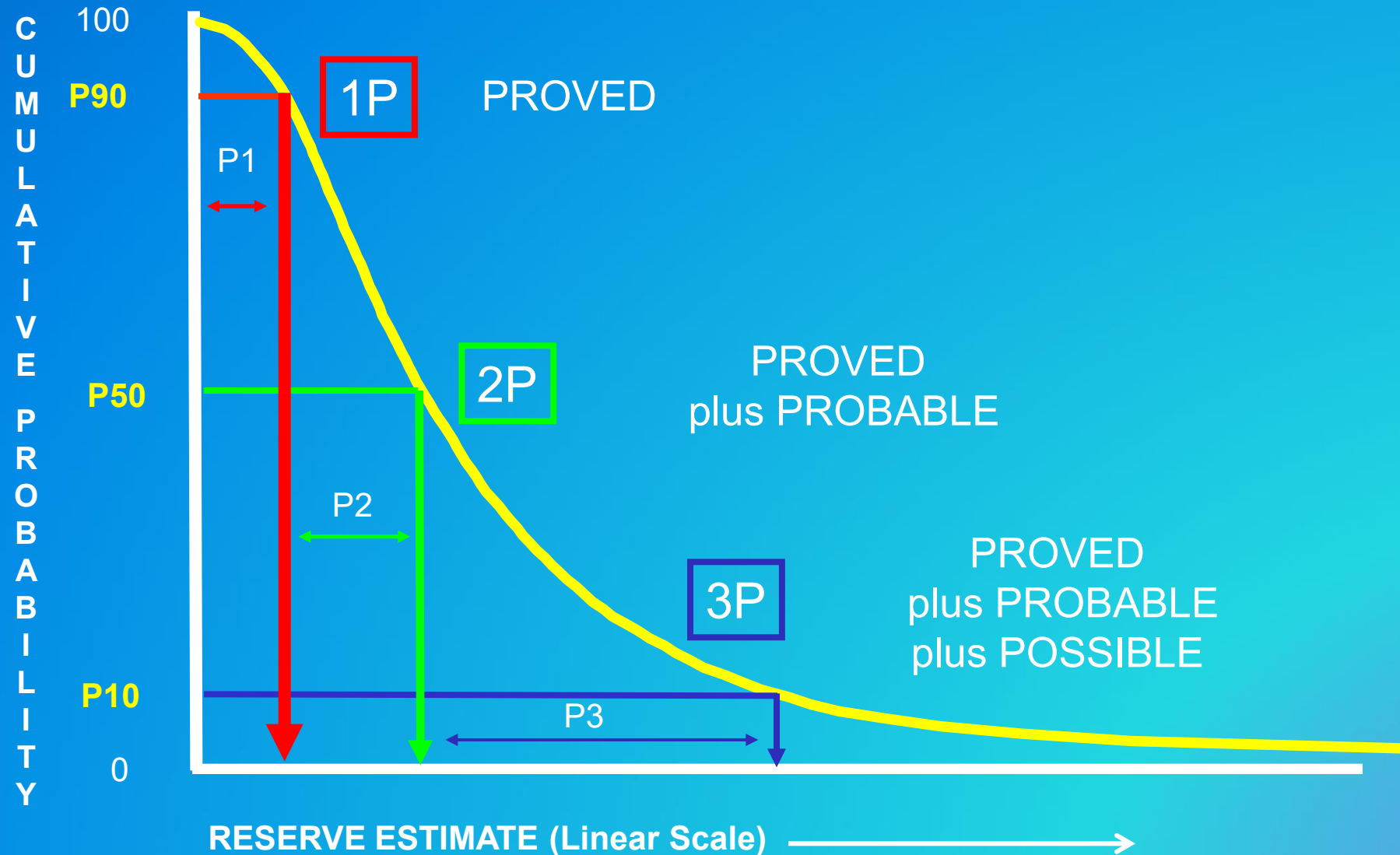
Categories of petroleum Reserves and Resources (SPE)



Source: SPE 2011



Reserves – Booking categories



Some definitions (2)

Proven Reserves

At Companies' level:

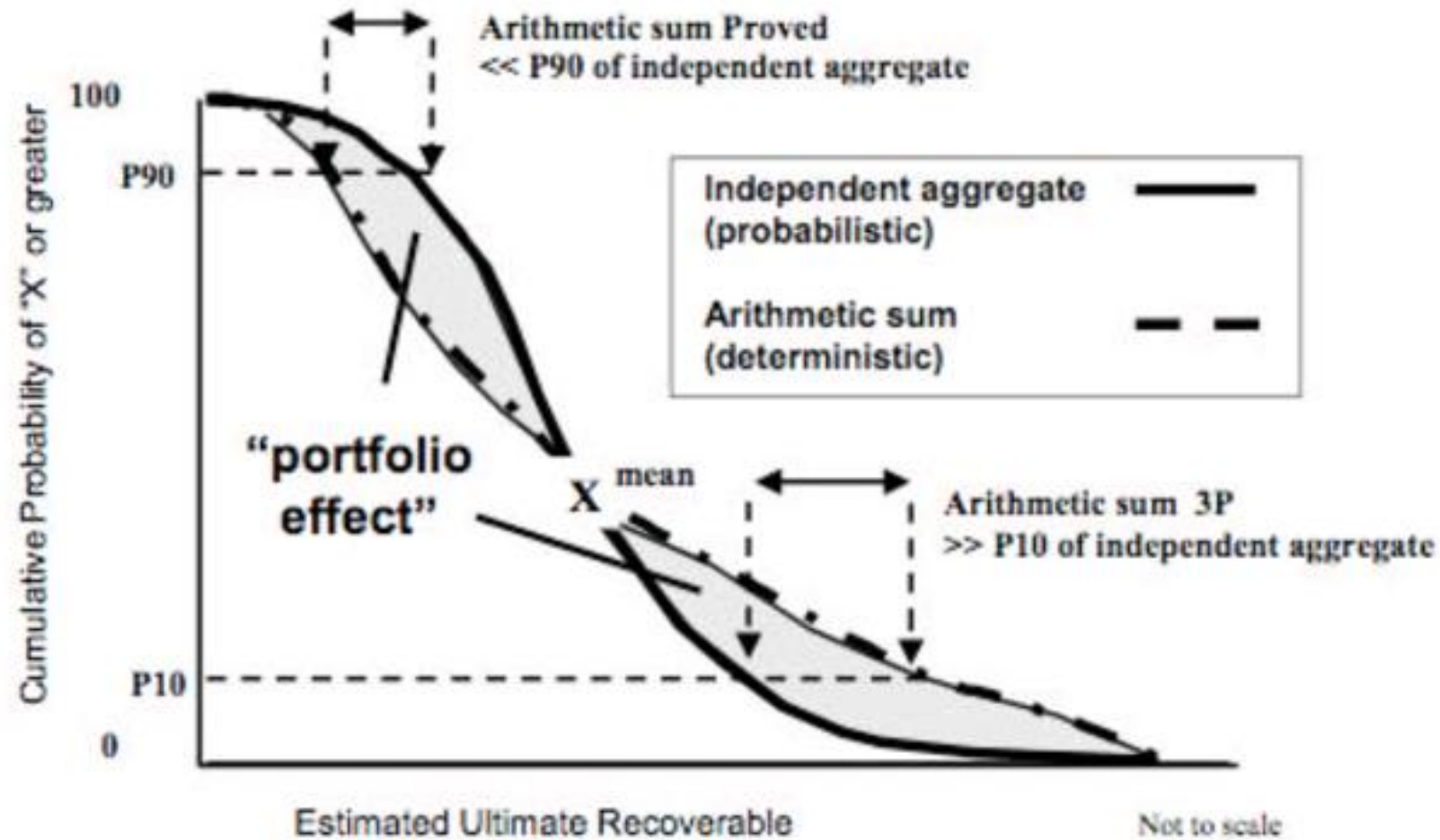
- **Reserves:** an economic concept, evaluated at a given crude oil price.
- **Strict definition imposed by SEC (Securities Exchange Commission).** SEC needs audits. SEC forbids to report Probable.
- **The only criteria developed in international oil companies financial accounts.**
- **Some « political » aspects in the Proven Reserves figures from OPEC National Companies.** OPEC doesn't need audit.

In Publications referred to below:

- **Those quantities that can be recovered with reasonable certainty from known reservoirs under current economic and operating conditions. Do not necessarily correspond to criteria and guidelines at Companies' level which are more restrictive.**
- **Different estimates from different entities!**



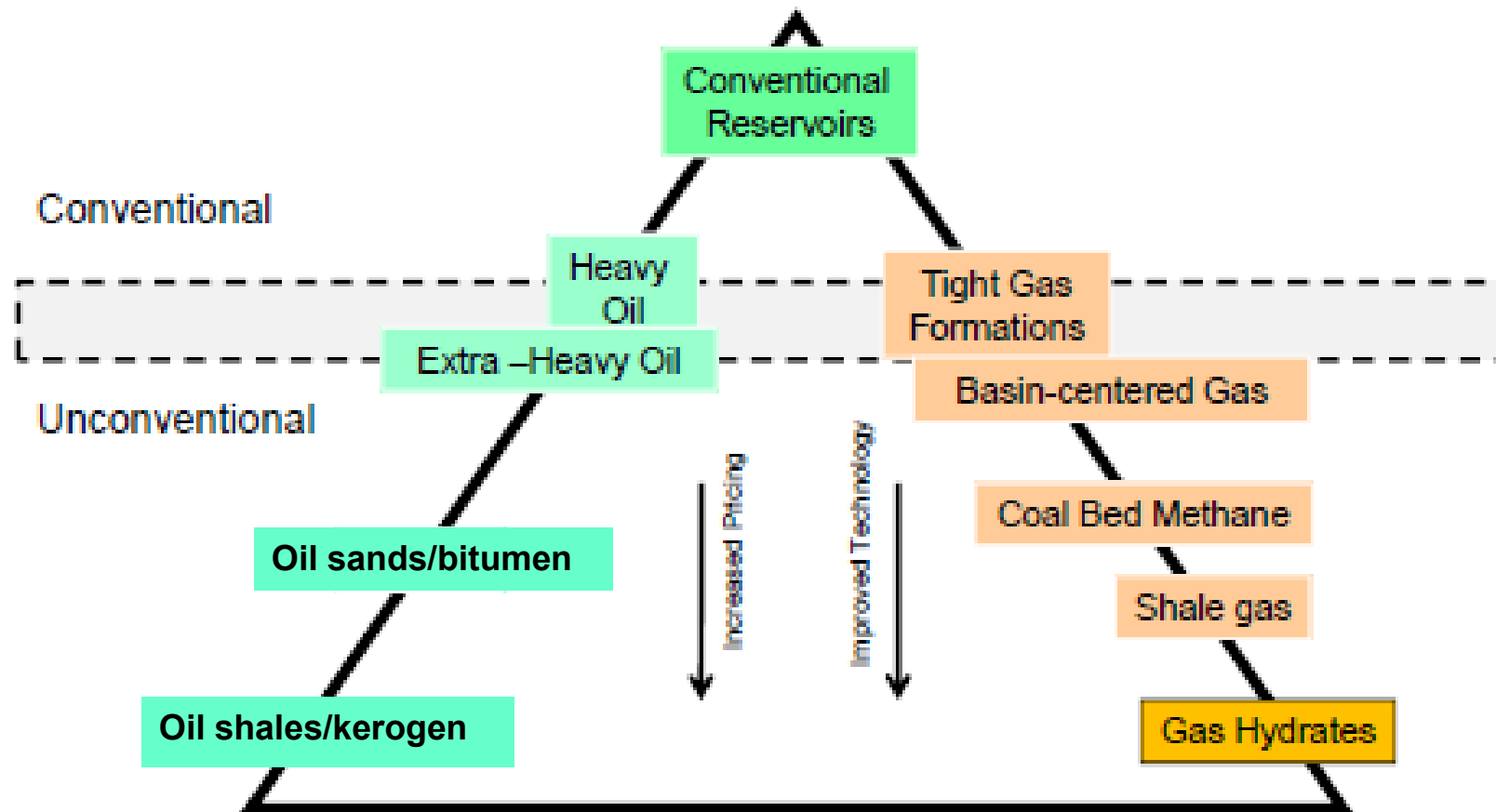
Some definitions (3) Proven Reserves



Nota: It is incorrect to add Proven Reserves at Country level

Some definitions (4)

Conventional and unconventional Resources (SPE)



Source: SPE 2011

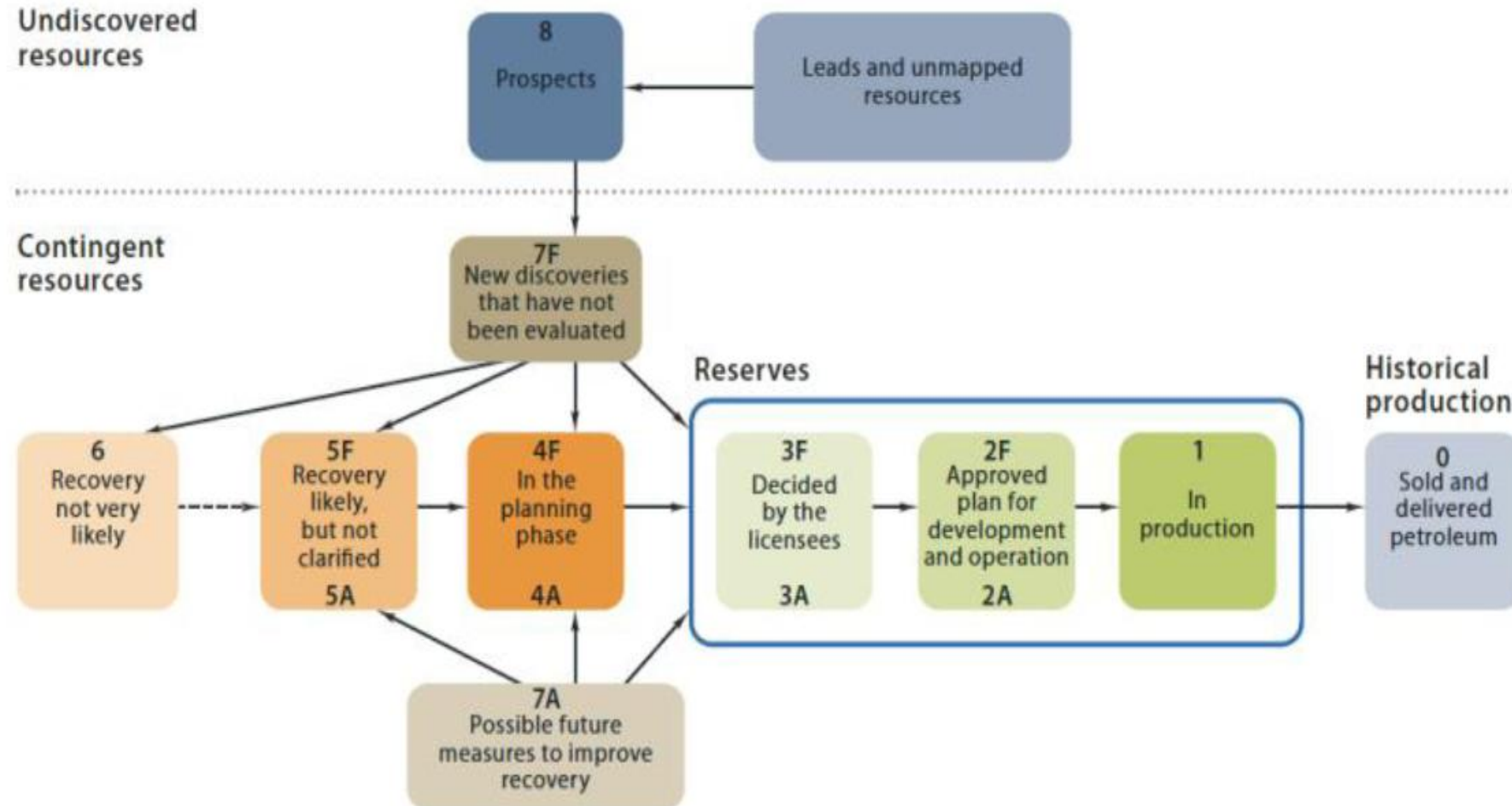
Nota: Contrary to SPE, IEA includes LTO in unconventional

(modified from Holditch, JPT Nov. 2002)



Some definitions (5)

Clasification of Reserves & Resources (NPD)

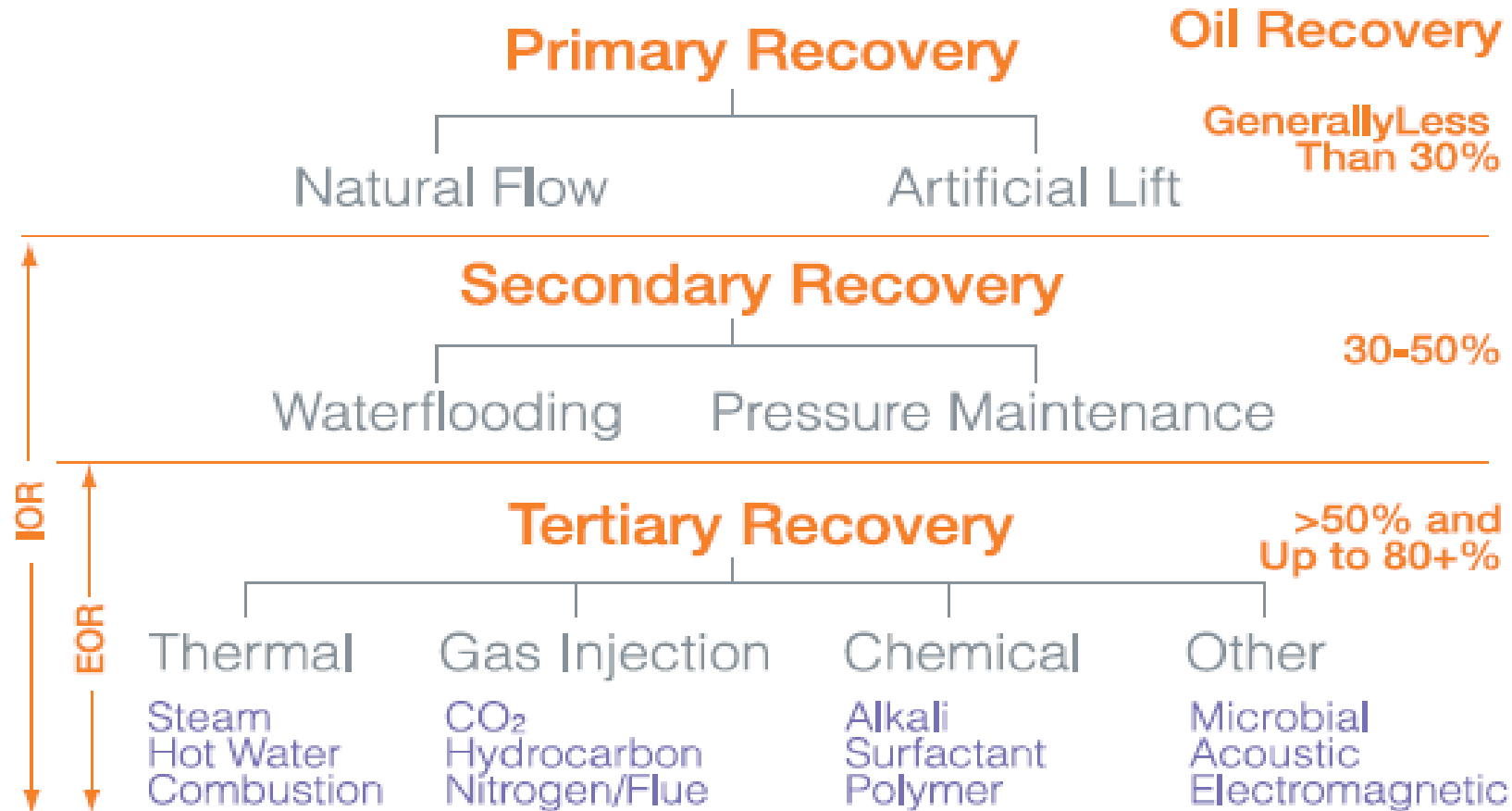


Source: Norwegian Petroleum Directorate - NPD



Some definitions (5)

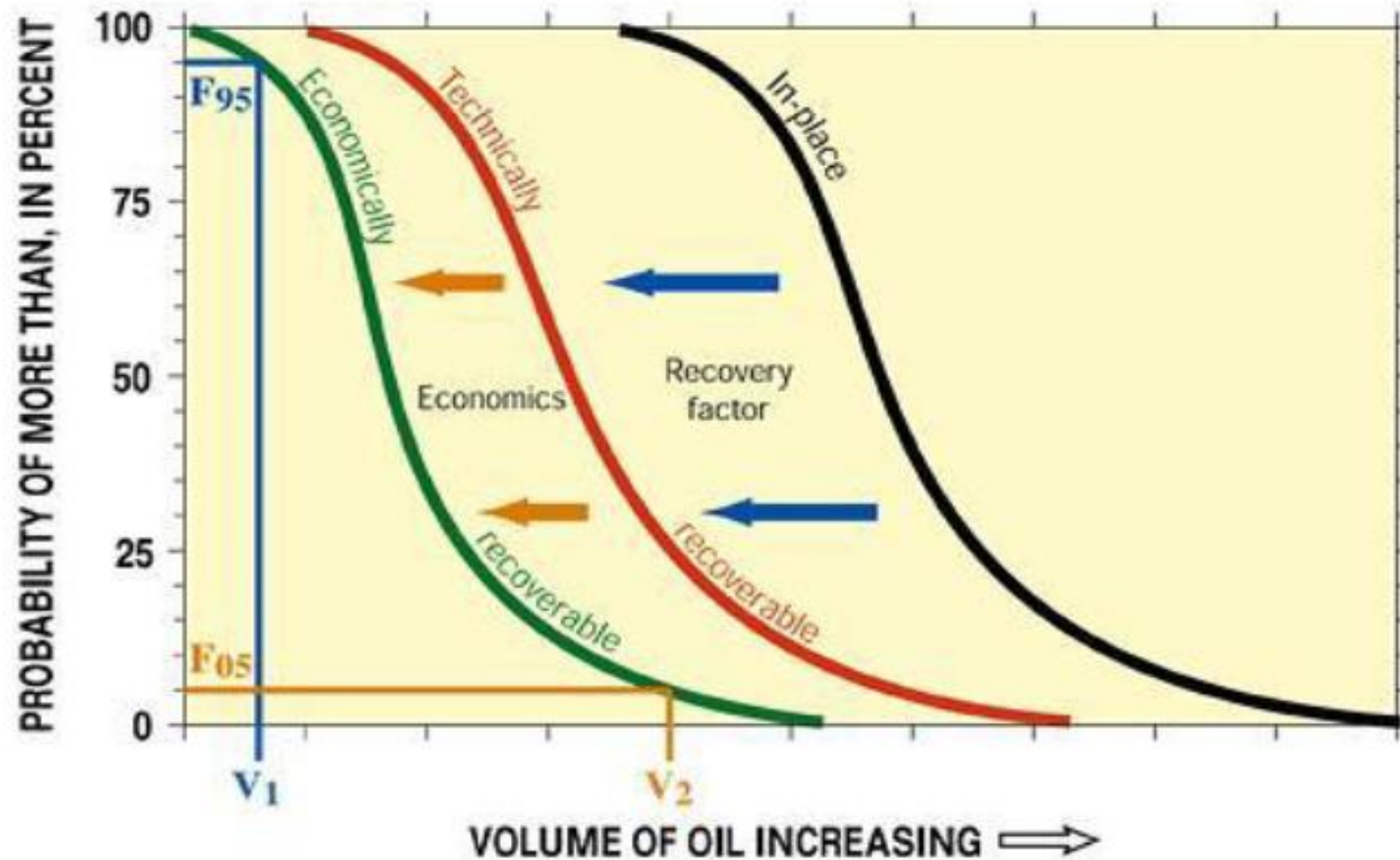
Improved Oil Recovery (IOR) and Enhanced Oil Recovery (EOR)



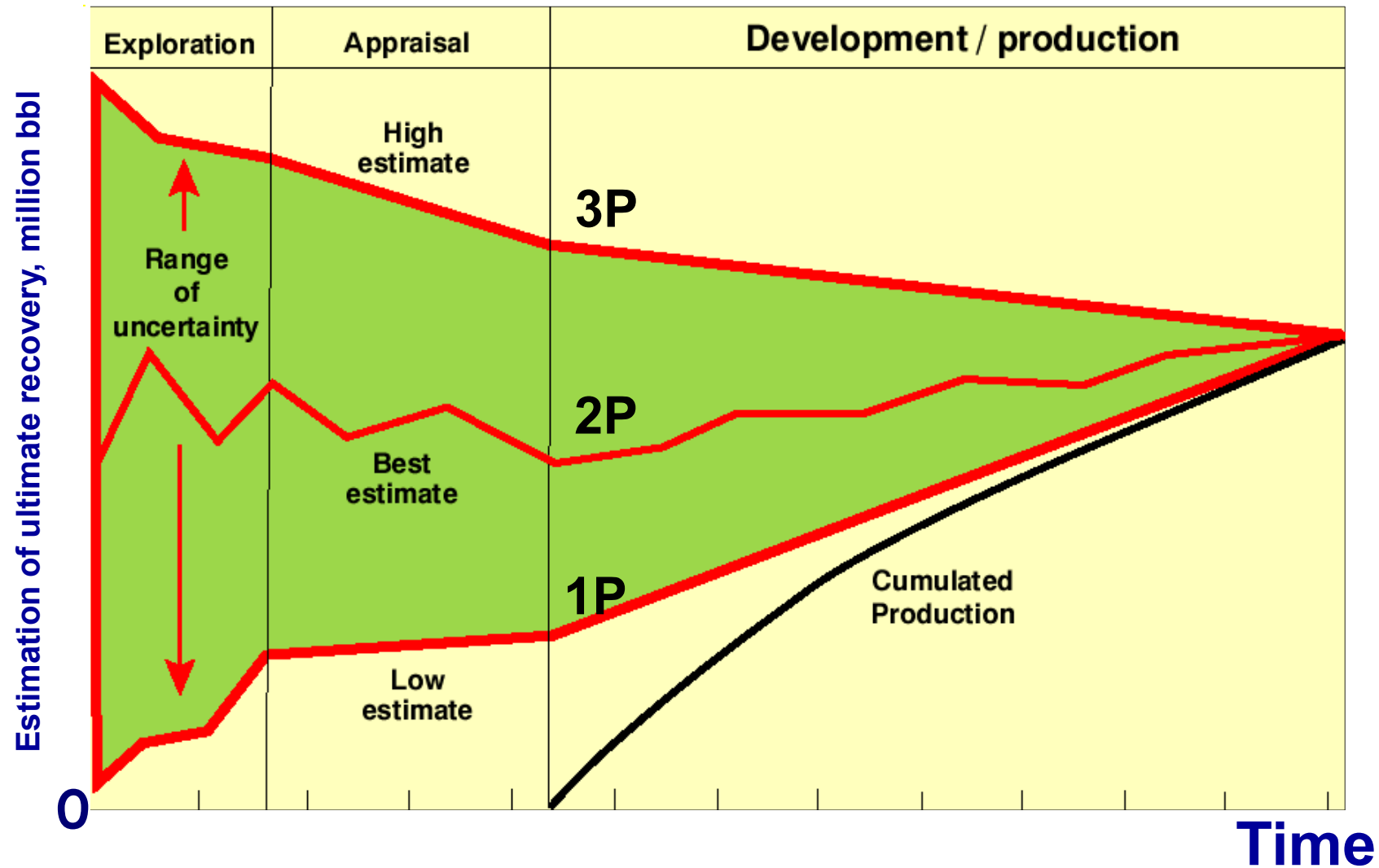
From SPE-SPE-84908, 87864



From Oil In Place to Reserves



Reserves: Uncertainty vs Time



Courtesy J. Pouzet



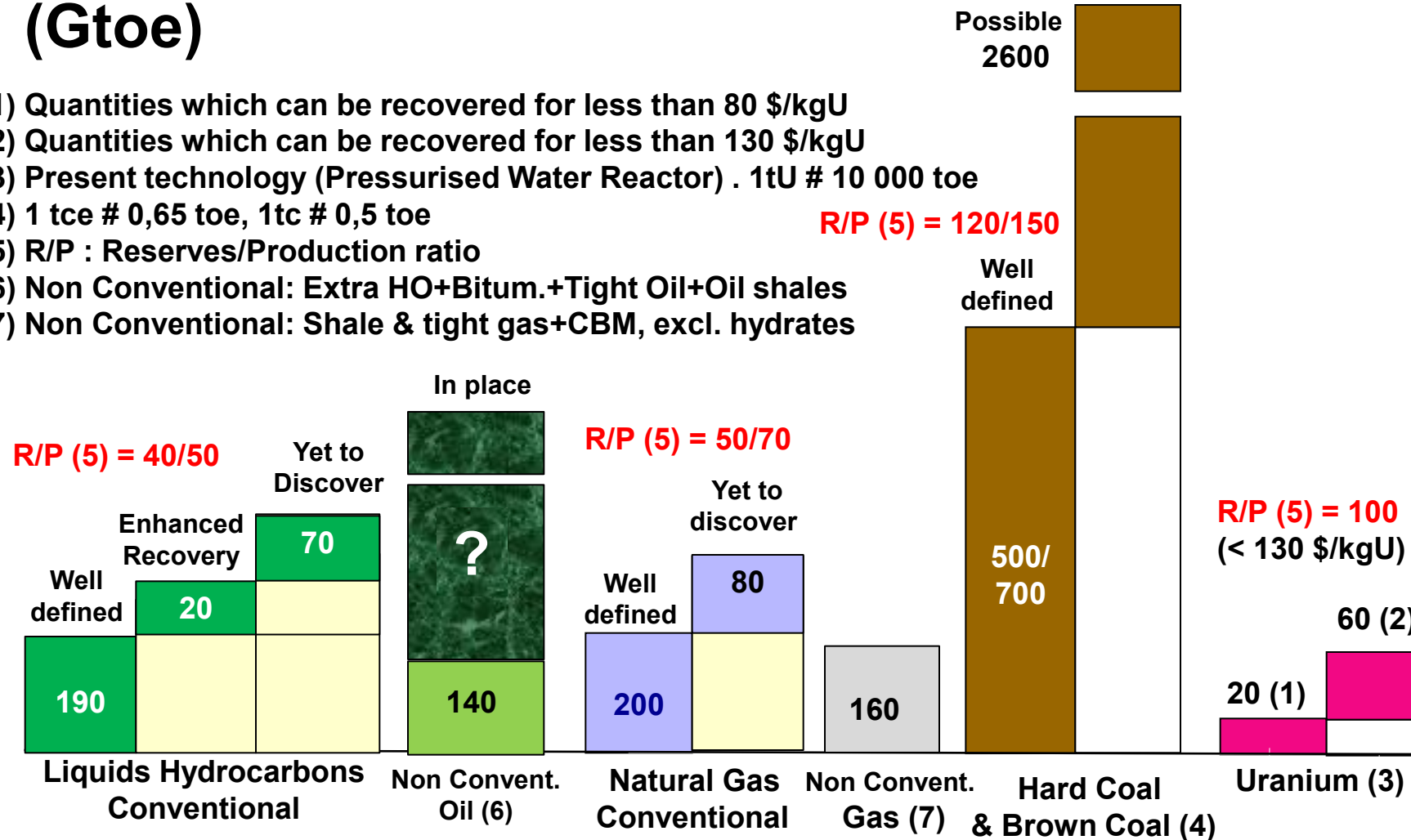
Warning:
Reserves & Resources estimates vary according to categorizations selected by the various sources.
In the following, Resources are defined either by 2P (Proven + Probable) estimates or by Commercial 2P (Proven + Probable) + Technical 2C (Contingent) estimates



Reminder - World Resources (Gtoe) – Vision 01/01/2019

(Gtoe)

- (1) Quantities which can be recovered for less than 80 \$/kgU
- (2) Quantities which can be recovered for less than 130 \$/kgU
- (3) Present technology (Pressurised Water Reactor) . 1tU # 10 000 toe
- (4) 1 tce # 0,65 toe, 1tc # 0,5 toe
- (5) R/P : Reserves/Production ratio
- (6) Non Conventional: Extra HO+Bitum.+Tight Oil+Oil shales
- (7) Non Conventional: Shale & tight gas+CBM, excl. hydrates



Source: Total, WCA, CEA, BP

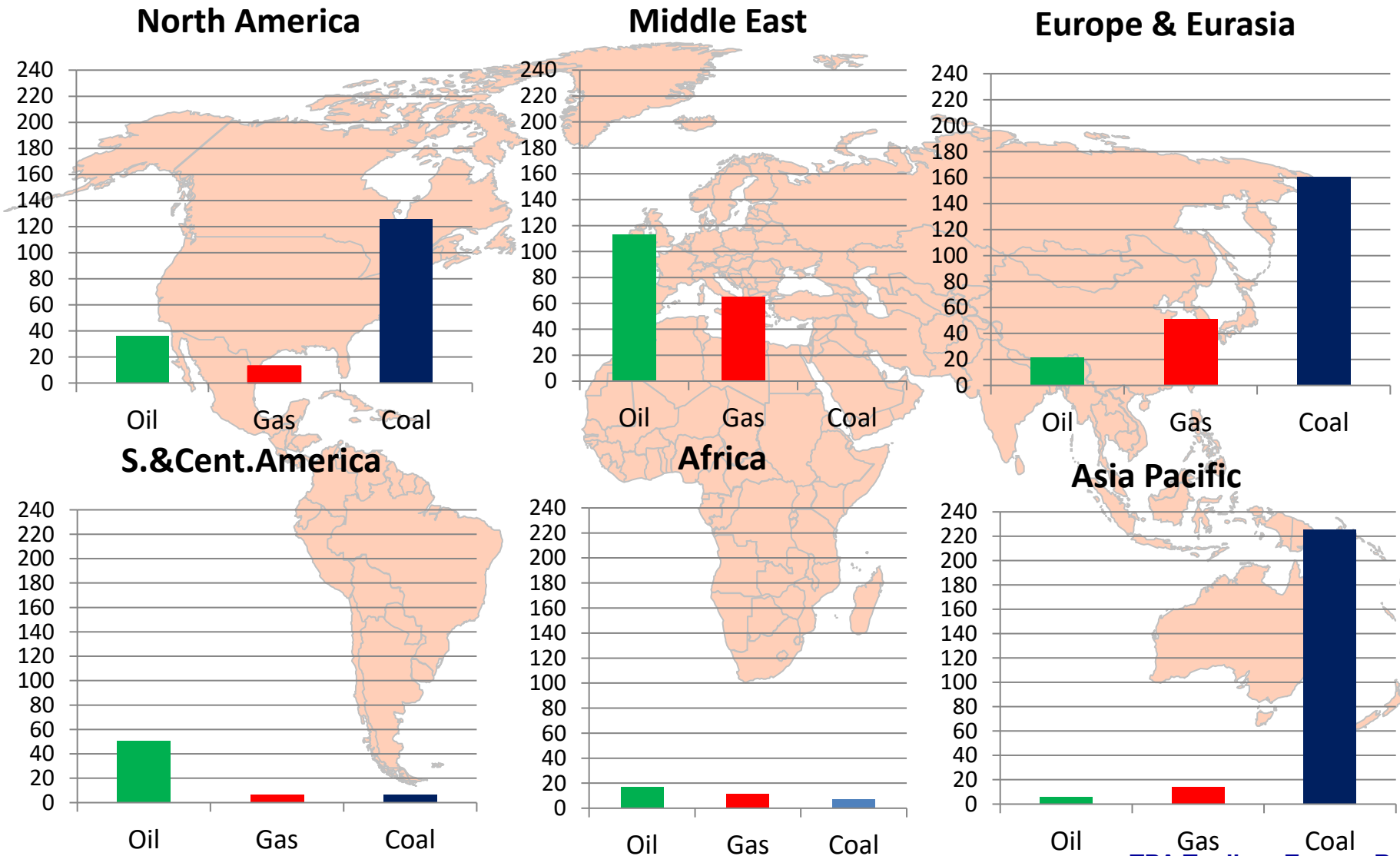
R/P varies vs sources. Not at scale

Nota: Oil Proven Reserves BP end 2018= 1730 Gb # 240 Gt, R/P # 50



World fossile energies Proven Reserves (Gtoe)

By geographical areas # 930 Gtoe End 2020



Source: Data from BP Stat. Review 2022/No update end 2021
 1 t coal # 0,70 tec # 0,49 toe



NB from BP:

For the 2017 edition of the BP Statistical Review of World Energy, we changed sources. We switched the Chinese coal reserve data previously sourced from World Energy Council – (WEC) to national data from Ministry of Land and Resources from 2007 onwards. Other countries coal reserves are now sourced from BGR Federal Institute for Geoscience and Natural Resources (BGR) Energy Study 2016 and later.

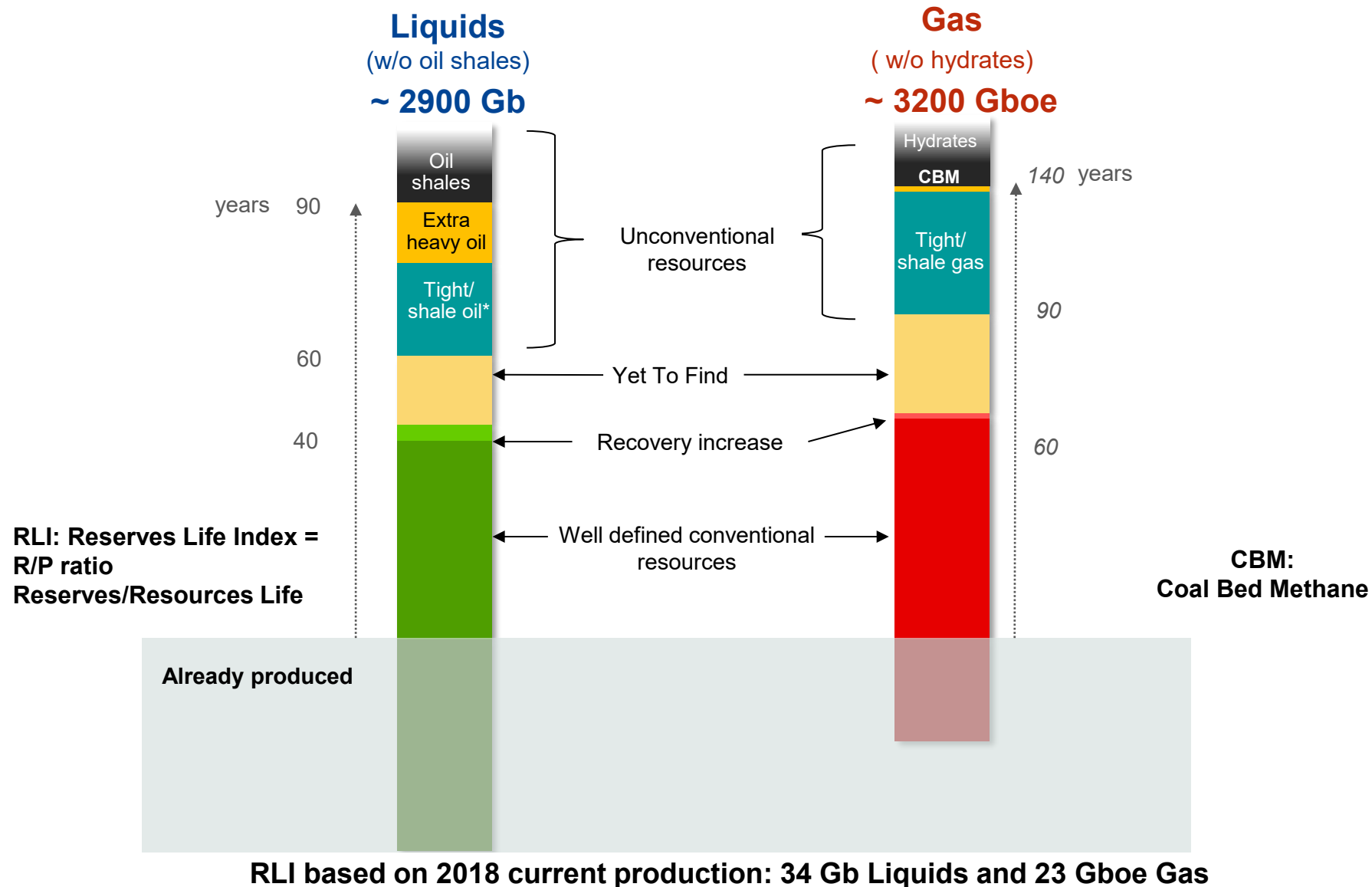
Additional comment: Coal reserves estimates for China have been drastically decreased by # 40% at end 2017 compared to end 2016.

BP so-called « Proven Reserves » should be better qualified as « Proven + Probable Reserves »

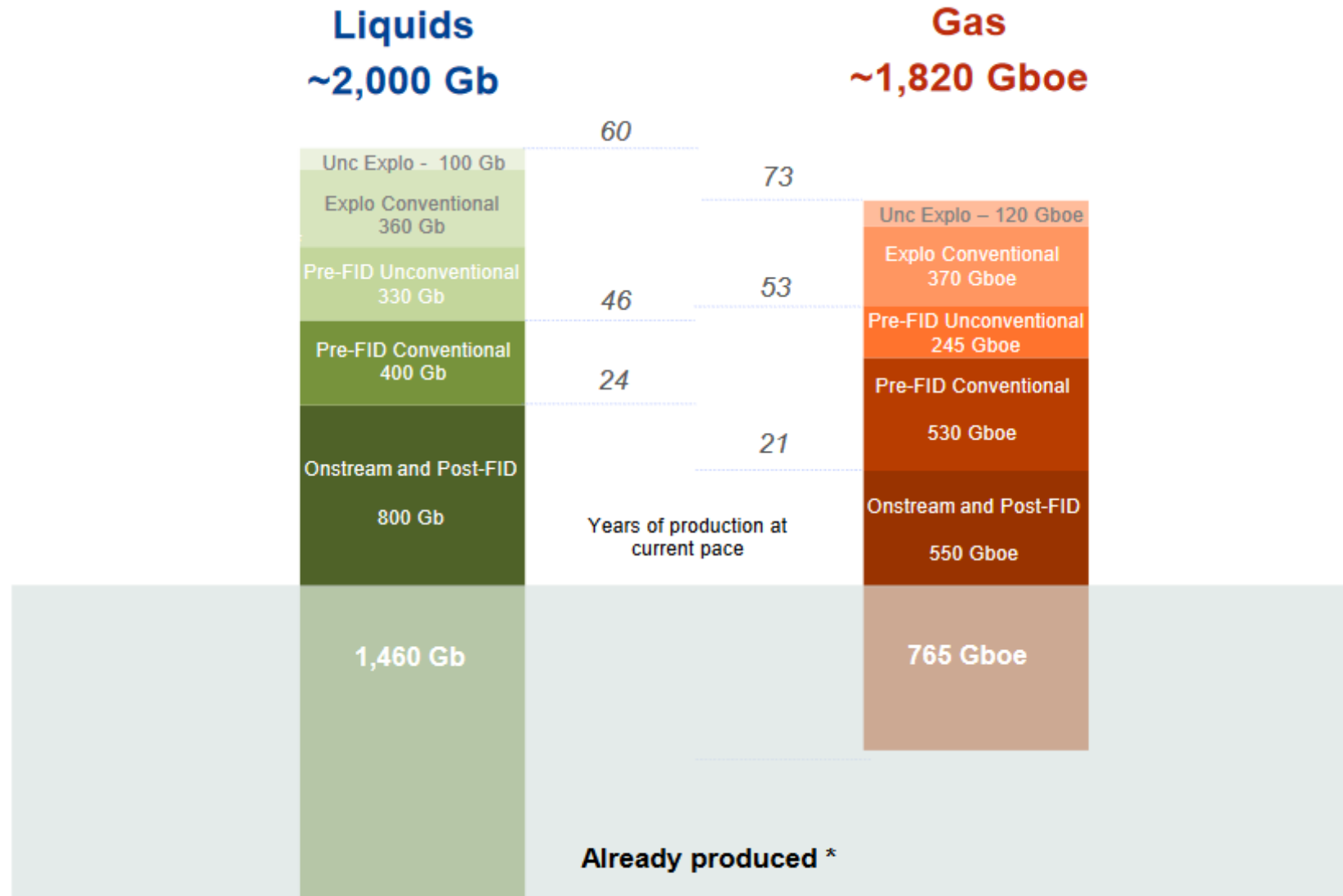
**BP has terminated their publication of BP Statistical Review of World Energy in 2023. The publication has been handed over to Energy Institute (Aberdeen University membership)
In this publication, the evolution of World HC reserves is no longer published.
The last figures are those at 31/12/2020**



Reminder - World Oil & Gas Resources at 01/01/2019



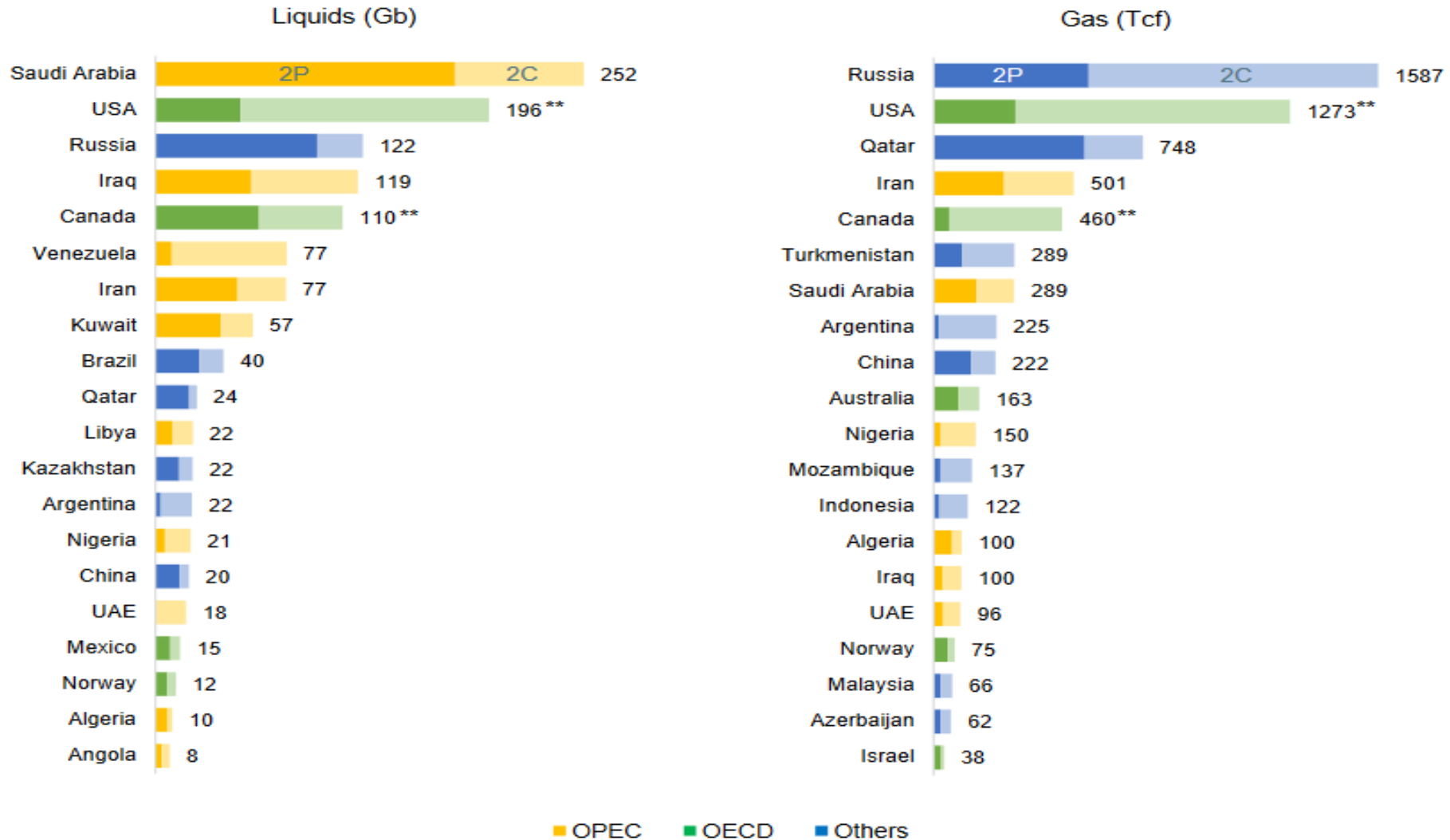
World Oil & Gas Resources at 01/01/2023 by TotalEnergies – Different classification



Source: TotalEnergies E&P Data Book 2023



Top 20 Resources by Countries

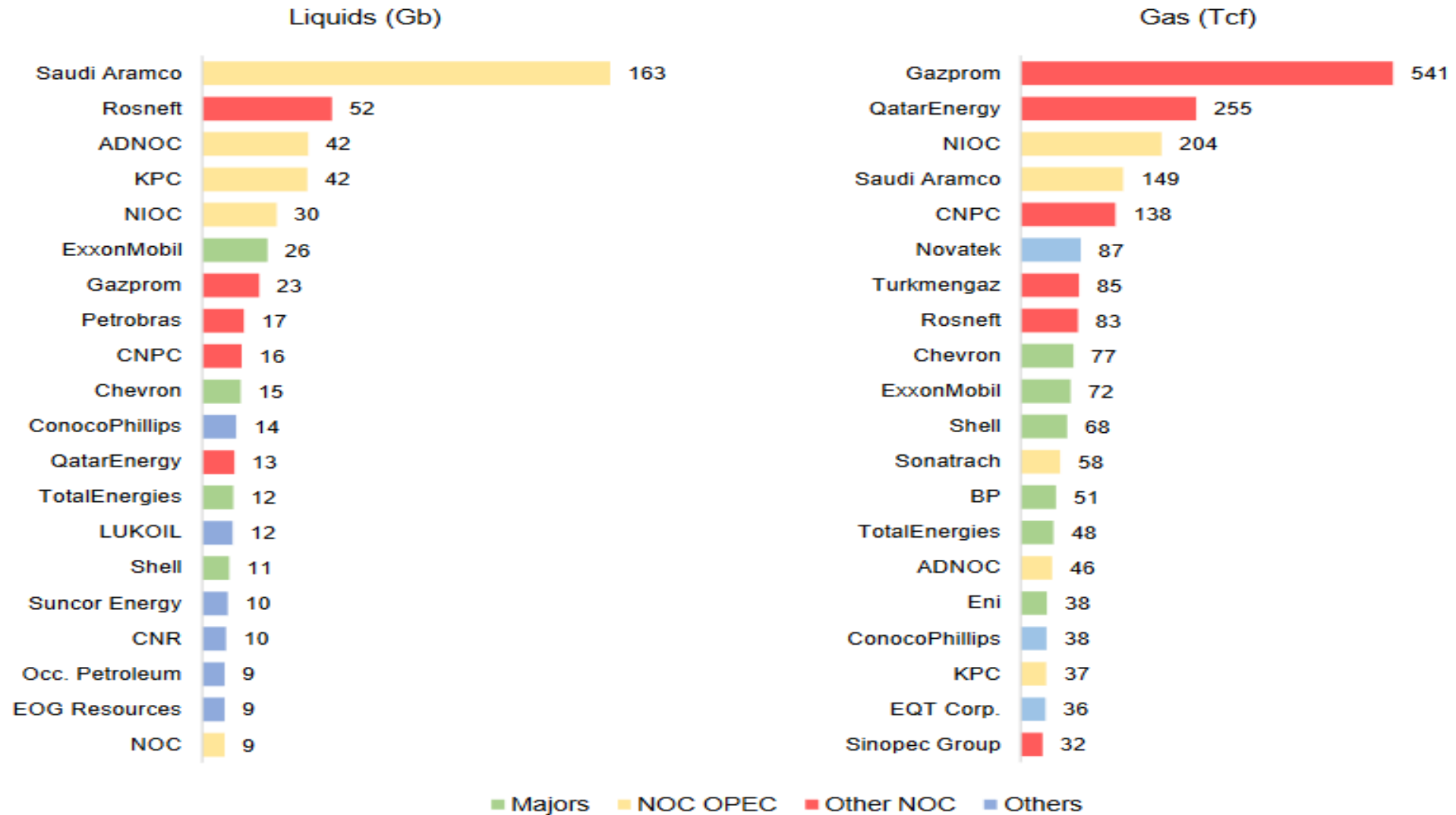


Source: TotalEnergies E&P Data Book 2023

Source: Profil Mondiaux Hydrocarbures 2023. Exclude unlikely contingent and YtF
 **Consideration of shale production until 2050



Top 20 Resources by Companies



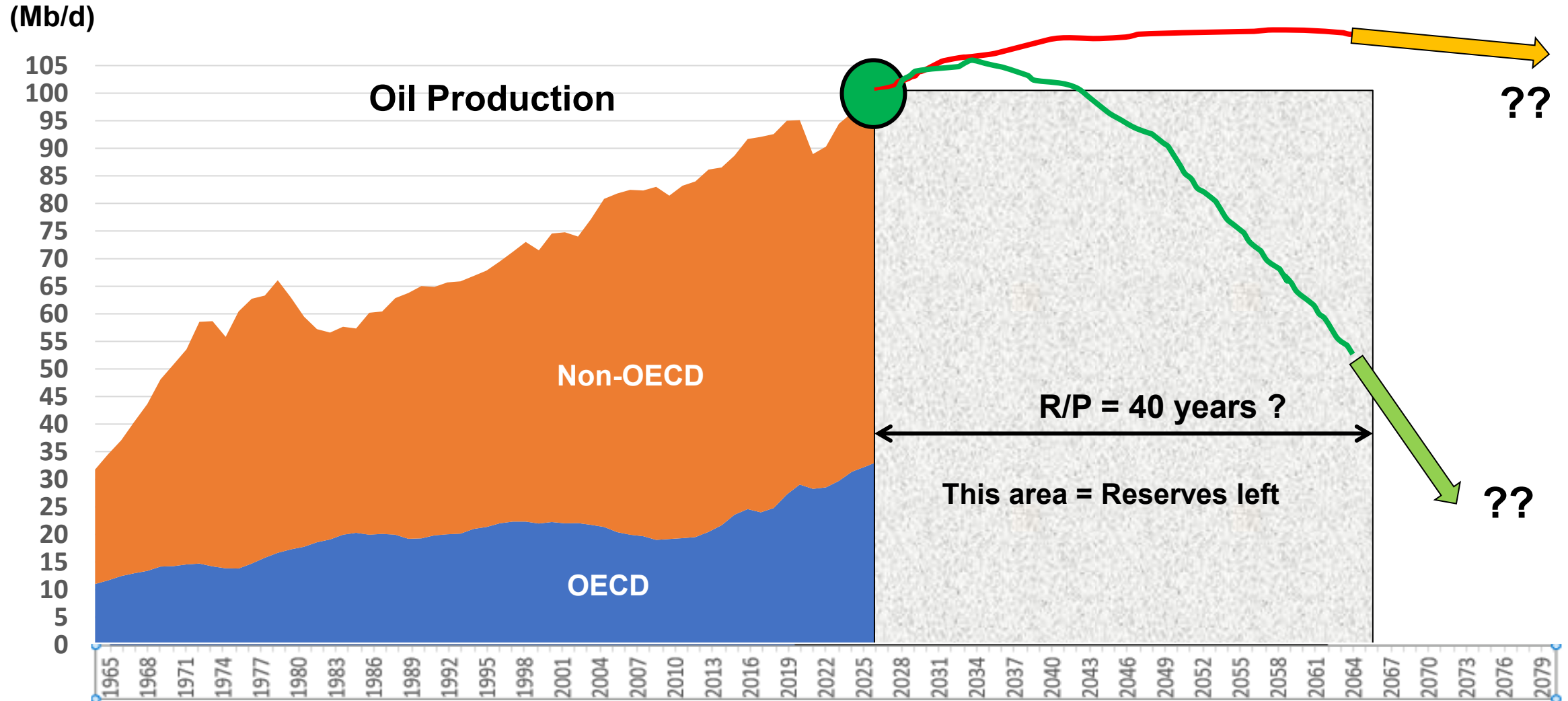
Source: TotalEnergies E&P Data Book 2023



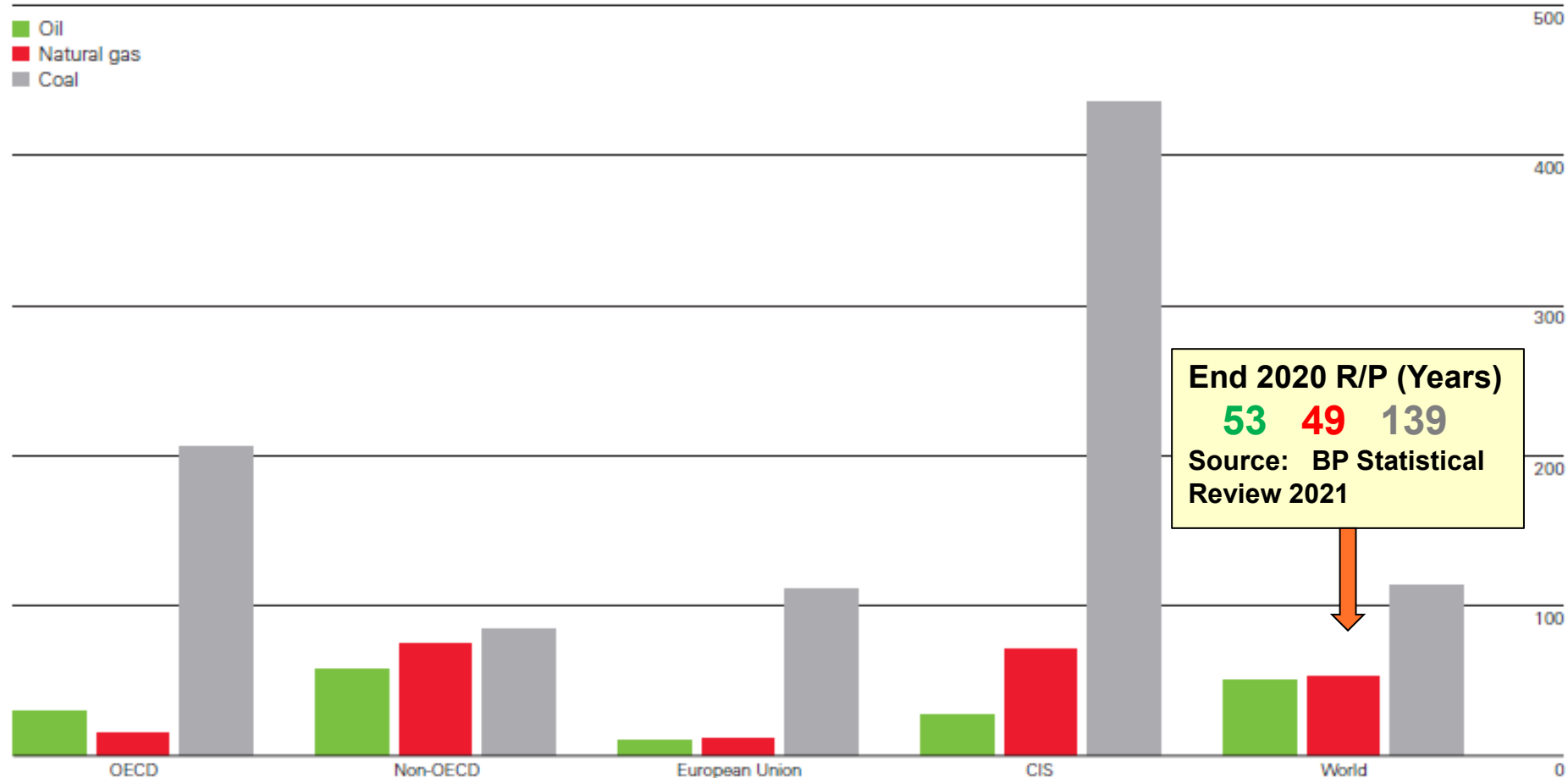
R/P Ratio depends upon the different categorization of reserves and resources, and varies according to sources



What does the R/P (Reserves/Production) ratio mean? Illustration



Fossil Fuel Reserves-to-Production at end 2015 & end 2020 (R/P) ratios - BP vision (Years)

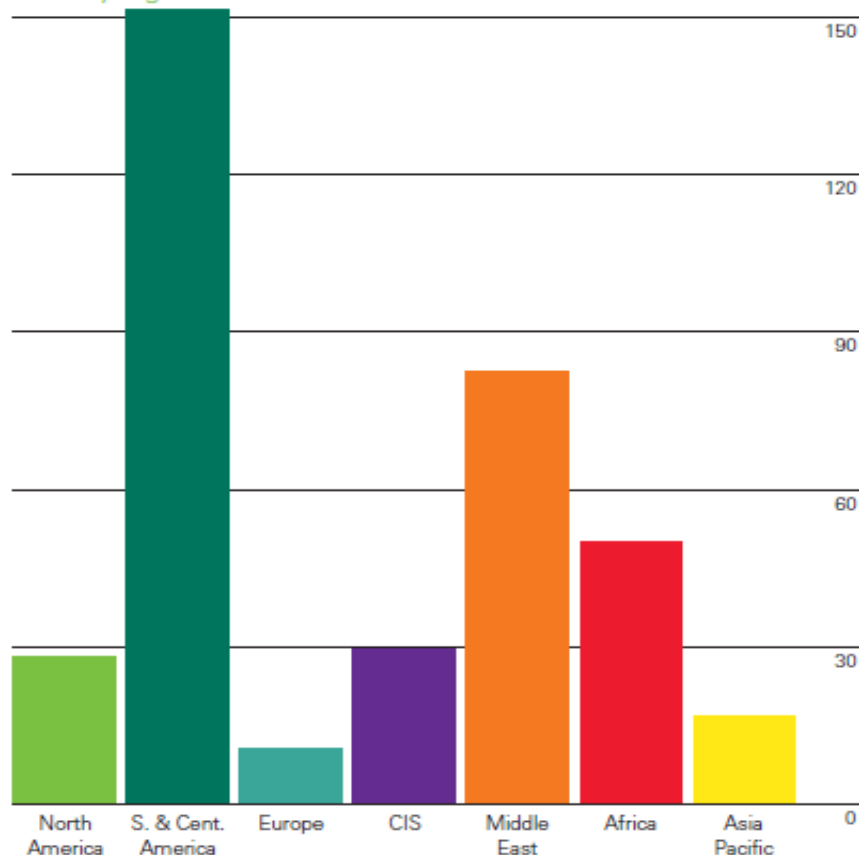


Oil R/P (« Proved Reserves ») Ratio by Regions

Reserves-to-production (R/P) ratios

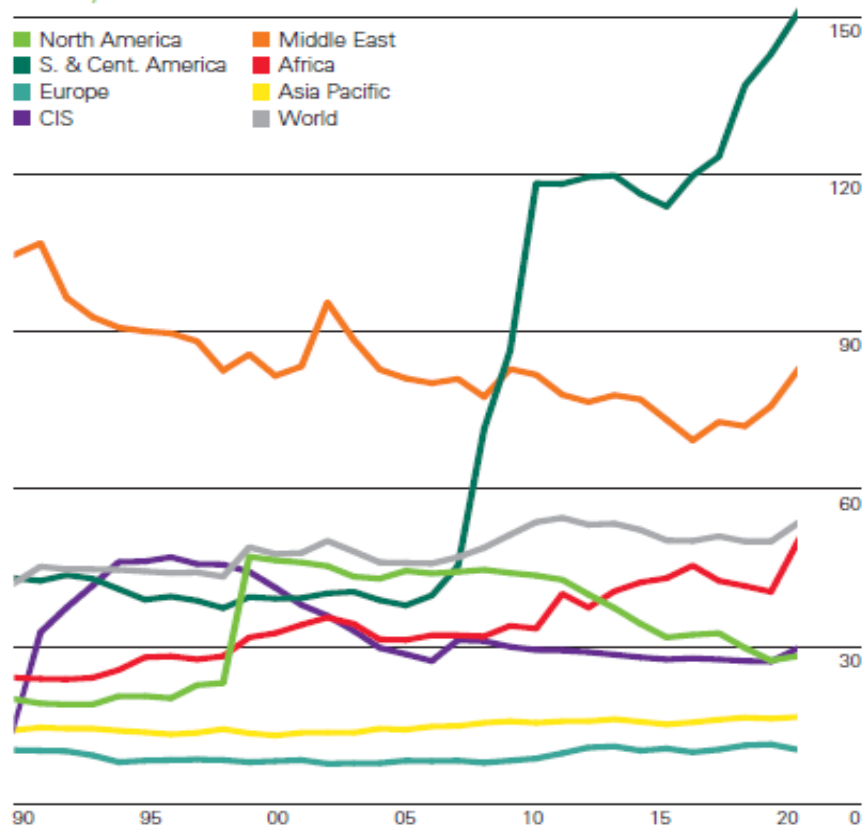
Years

2020 by region



Oil R/P World # 53 years

History

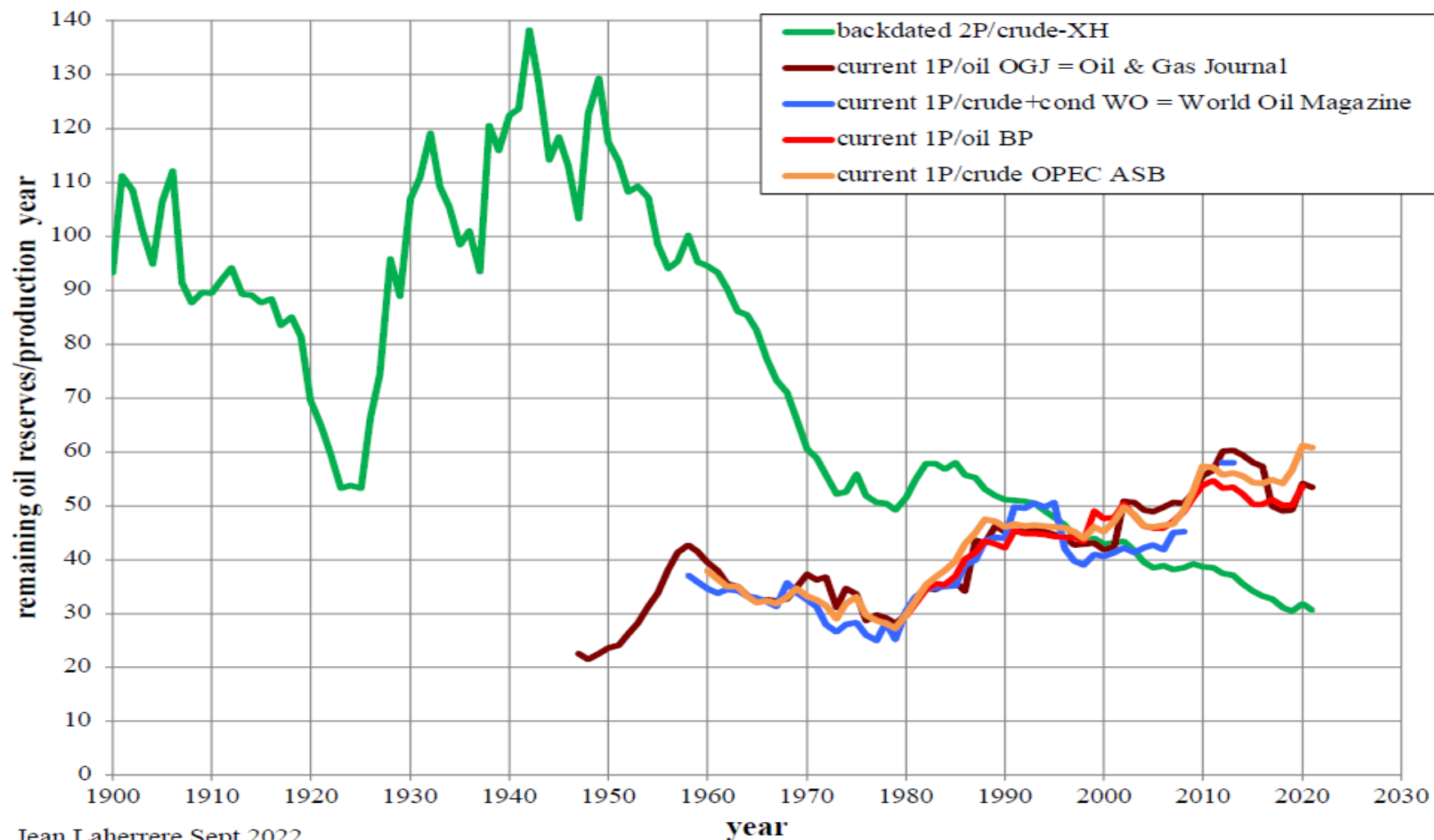


Global proved oil reserves were 1732 billion barrels at the end of 2020, down 2 billion barrels versus 2019. The global R/P ratio shows that oil reserves in 2020 accounted for over 50 years of current production. OPEC holds 70.2% of global reserves. The top countries in terms of reserves are Venezuela (17.5% of global reserves), closely followed by Saudi Arabia (17.2%) and Canada (9.7%).



Oil R/P (« Proved Reserves ») Ratio by Sources

World oil R/P from different definitions & sources



Jean Laherrere Sept 2022

Source: Jean Laherrère September 2022

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TPA Toolbox Energy Book 4 - Oil

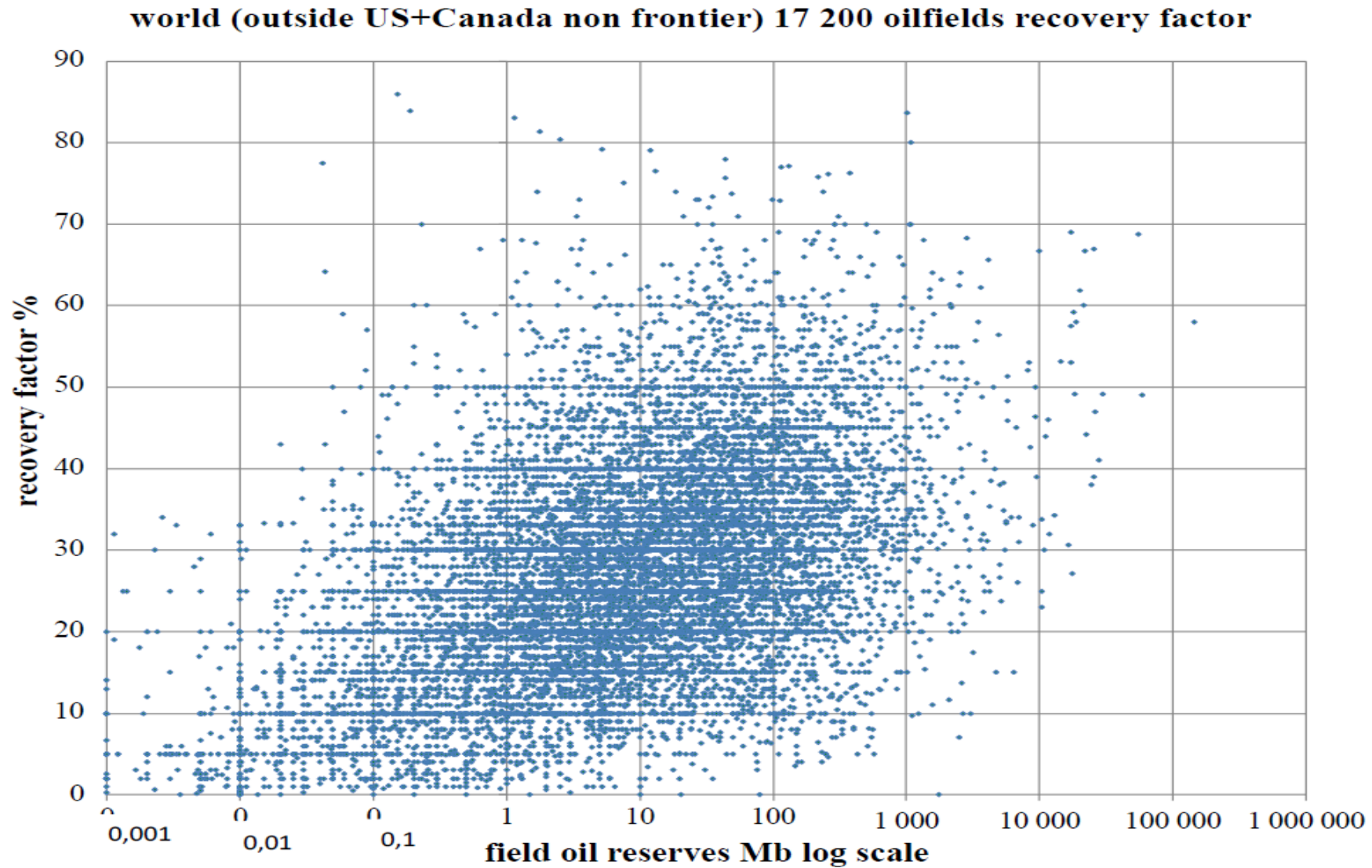


Recovery Factors

- ◆ **Conventional natural gas range** 50 to 90%
 - World average ~ 70%
- ◆ **Conventional oil range** 10-20 to 50-60%
 - World average ~ 35 %
- ◆ **Heavy oil range** below 10%
 - Orinoco belt (Venezuela) resources 900-1400 Gb → reserves ~220 Gb
 - Athabasca basin (Canada) resources 1700 Gb → reserves ~160 Gb
- ◆ **Secondary and Enhanced Oil Recovery operations**



Recovery Factors Oil – A large cloud of values

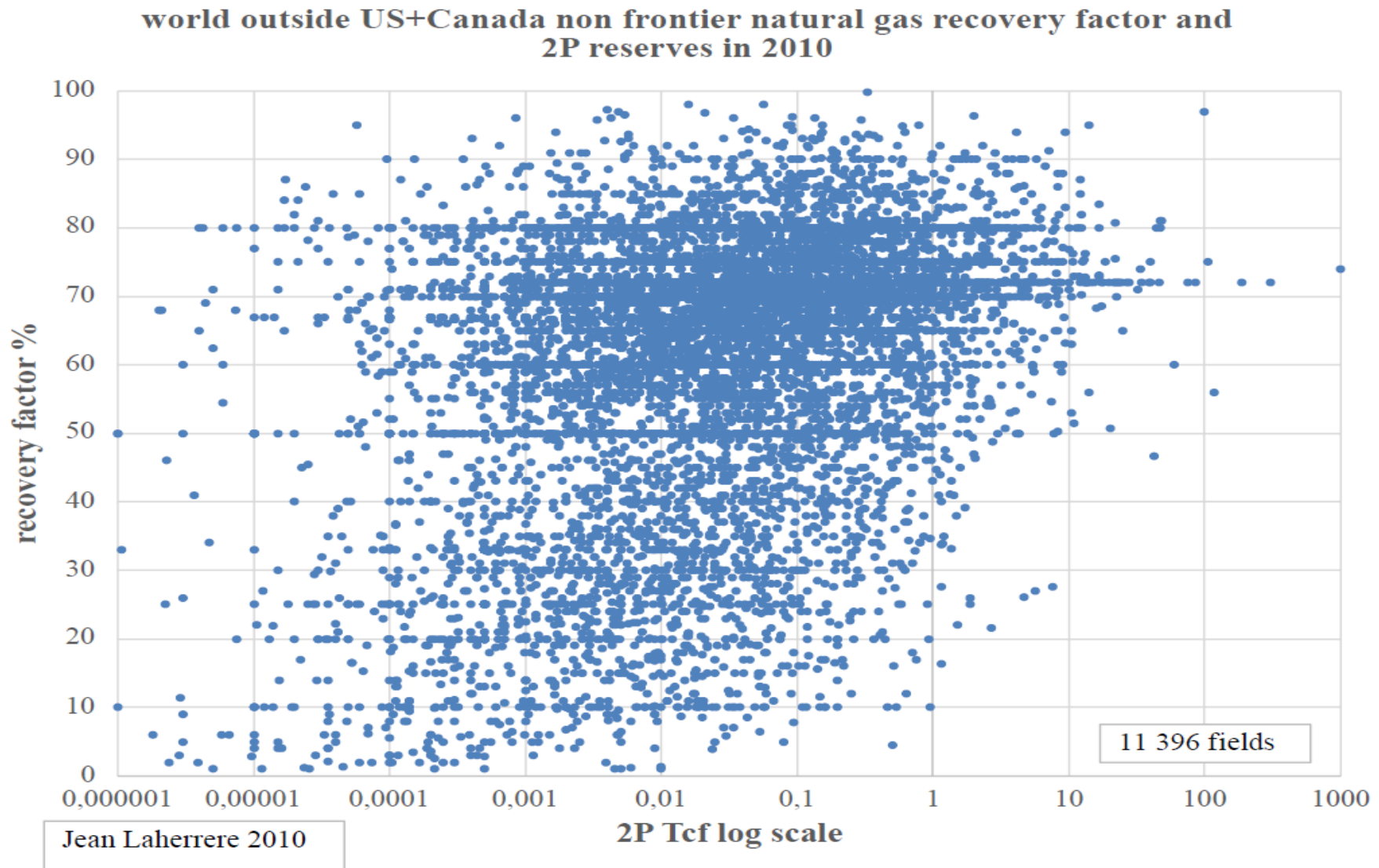


Jean Laherrere Oct 2010

ok 4 - Oil

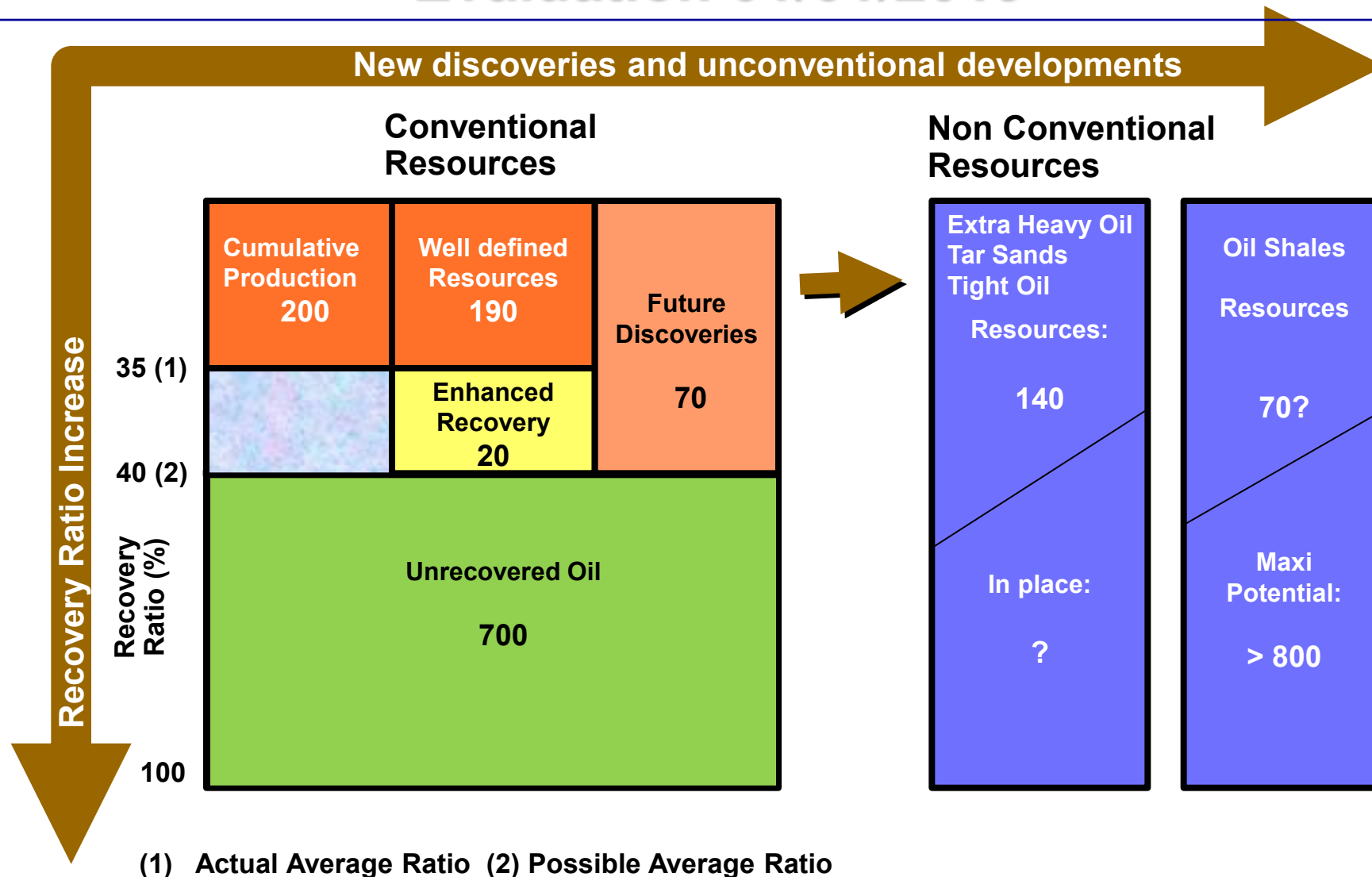


Recovery Factors Gas – A large cloud of values



Reminder - Oil Resources (Gt) - A simplified diagram

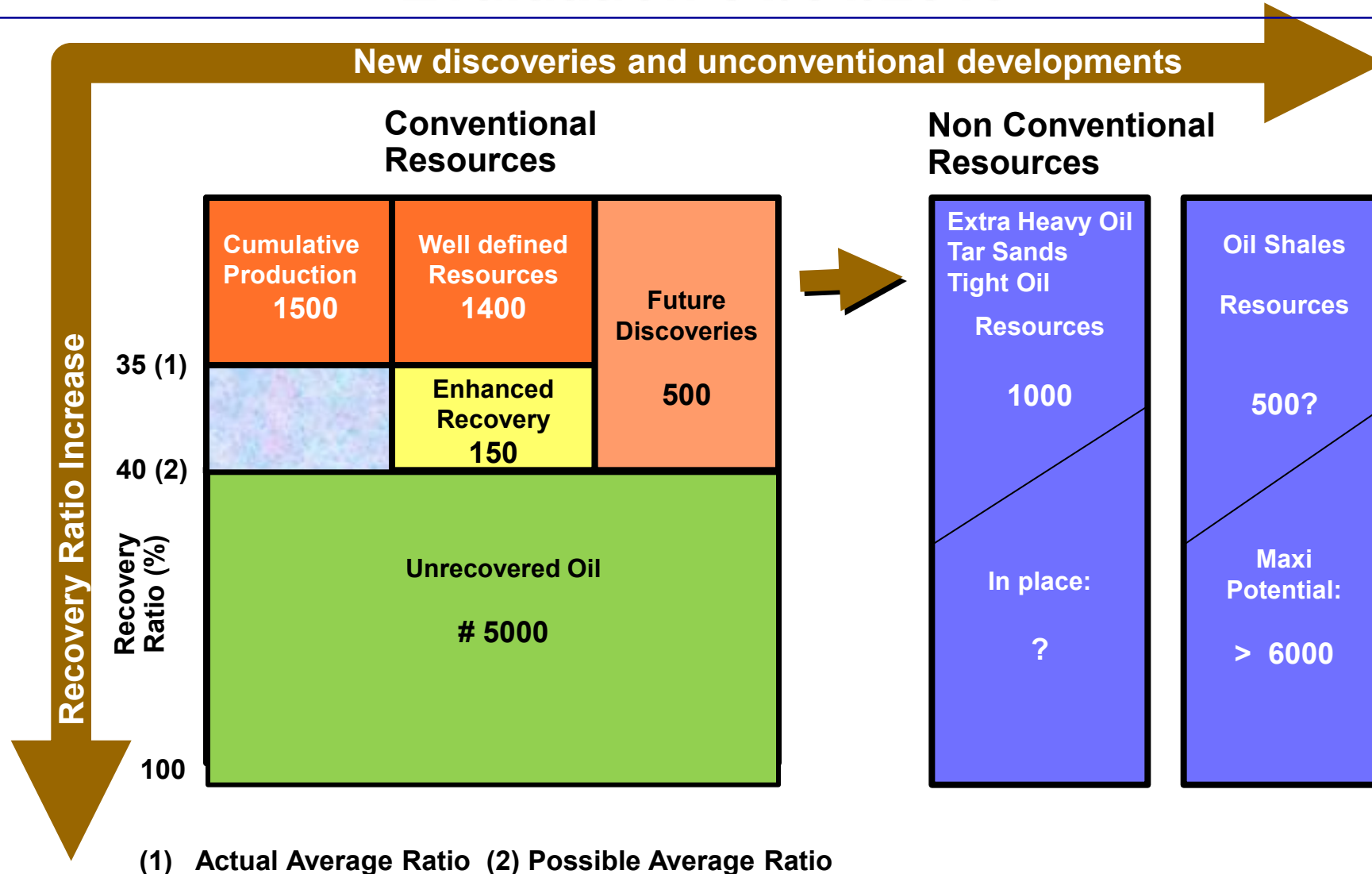
Evaluation 01/01/2019



Source: Data from Total
Estimates, rounded figures



Reminder - Oil Resources (Gb) - A simplified diagram Evaluation 01/01/2019

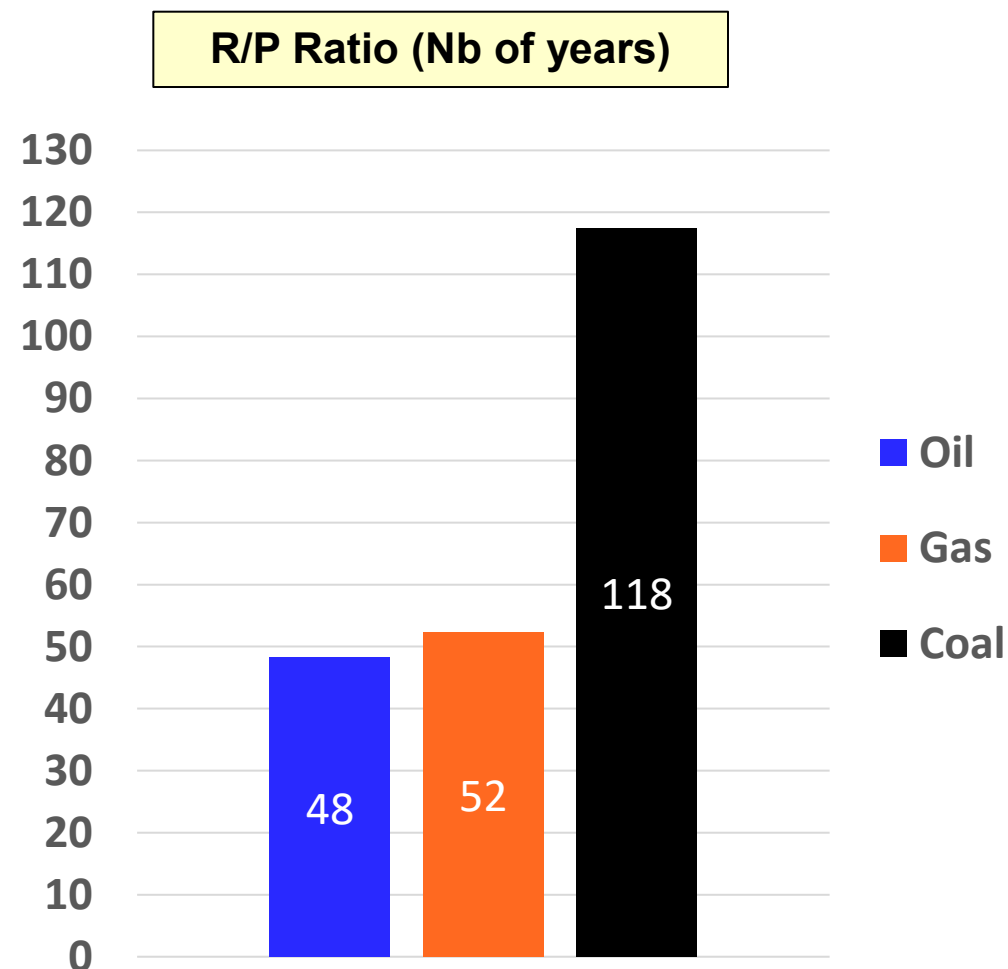
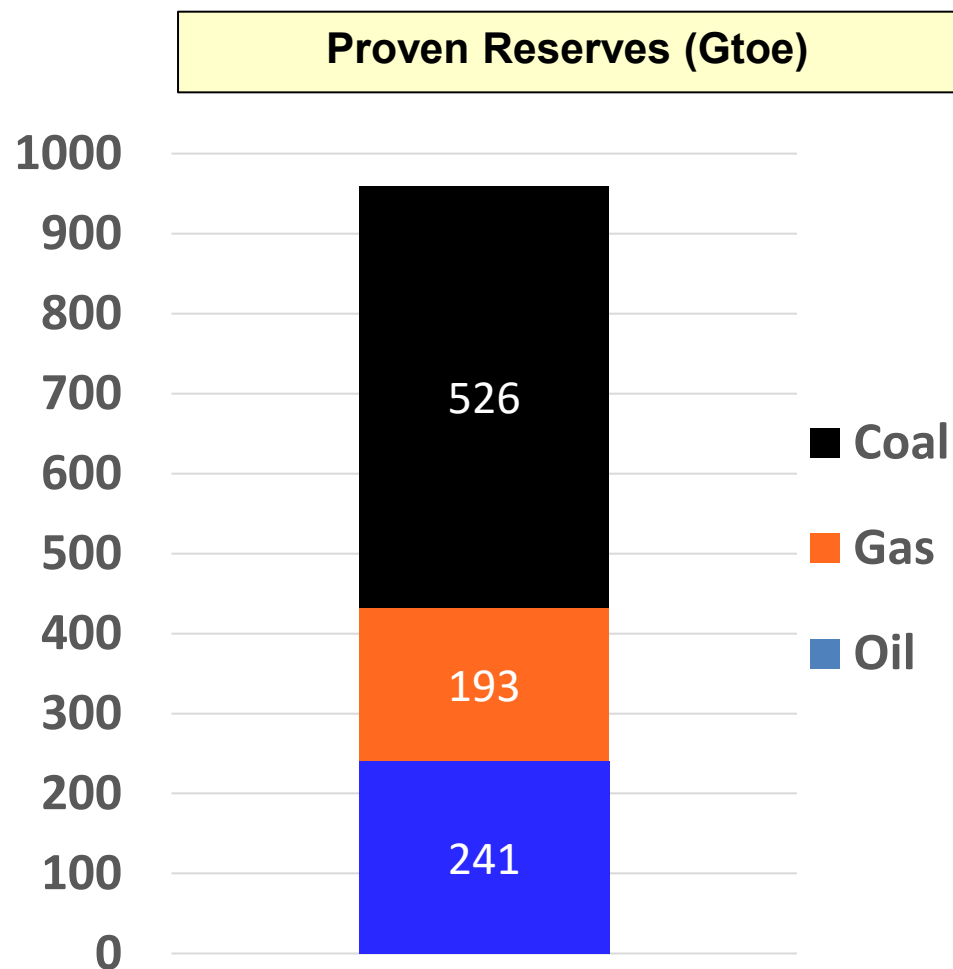


Source: Data from Total
Estimates, rounded figures



Fossil Fuels – « Proven Reserves » end 2024

960 Gtoe # 7,0 Tboe (Drastic decrease in China Coal Reserves vs end 2016)



Source:: Data from IEA 2025



Oil Reserves and Resources end 2024 IEA (Gb)

(Consensus on proven reserves, different opinions on additional resources)

Oil (billion barrels)	Proven reserves	Resources	Conventional crude oil	Tight oil	NGLs	EHOB	Kerogen oil
North America	222	2 410	231	233	150	795	1 000
Central and South America	296	848	247	57	49	492	3
Europe	14	109	54	19	28	3	6
Africa	124	445	306	54	82	2	-
Middle East	902	1 139	861	29	206	14	30
Eurasia	146	940	227	85	57	552	18
Asia Pacific	51	270	115	72	64	3	16
World	1 756	6 161	2 042	549	636	1 862	1 073

Notes: NGLs = natural gas liquids; EHOB = extra-heavy oil and bitumen. The breakdown of coal resources by type is an IEA estimate. Coal world resources exclude Antarctica.

Sources: BGR (2023); CEDIGAZ (2024); Energy Institute (2024); OGJ (2023); US EIA (2023); USGS (2012a and 2012b); IEA databases and analysis.

Source: IEA WEO 2025

Note: EHOB: Extra Heavy Oil & Bitumen



Conventional and Unconventional Oil Resources End 2024 (Gb)

IEA WEO 2025:

Proven Reserves end 2024: 1756 Gb

Remaining Resources at end 2024:

Conventional : 2042 Gb

Tight Oil : 549 Gb

NGL : 636 Gb

EHOB : 1862 Gb

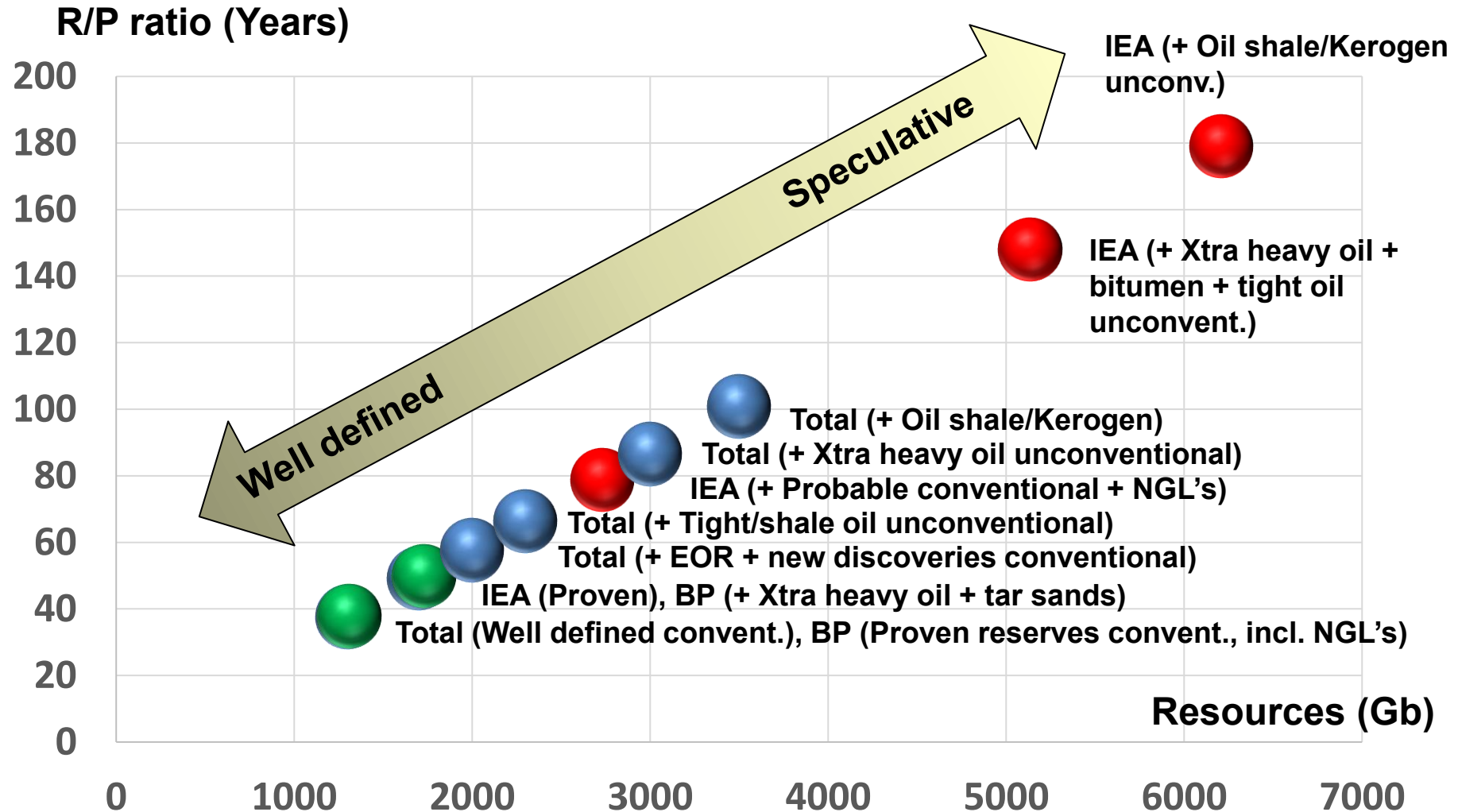
Kerogen Oil : 1073 Gb

Total # 6161 Gb

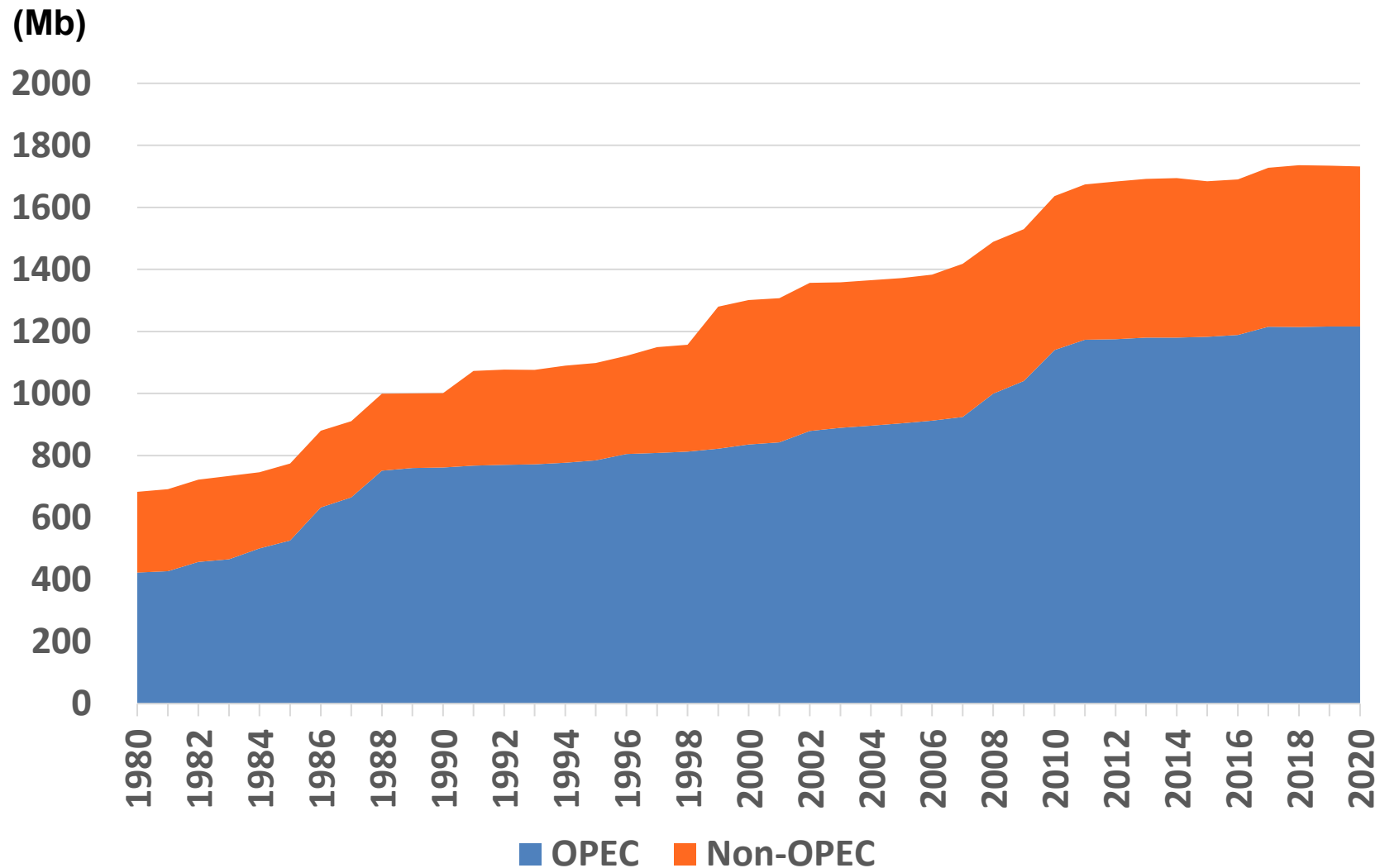
Source: IEA WEO 2024
EHOB: Extra Heavy Oil and Bitumen



Reconciliation of Oil Resources Estimates at end 2019 – Gb & Number of Years



History of Proven Reserves estimates 1980 – 2020: A regular growth till 2010, then stabilisation



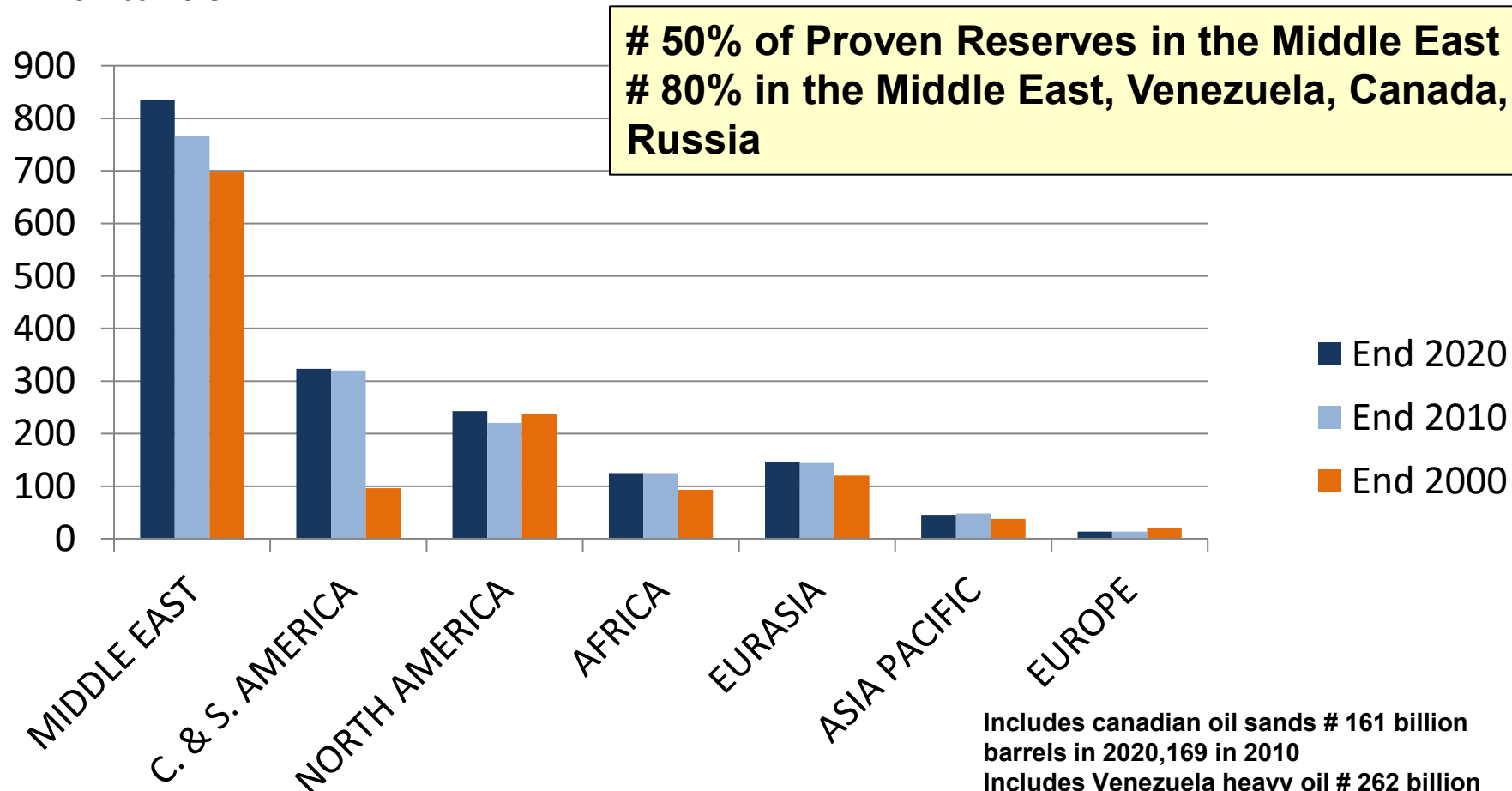
Source: Data from BP Stat. Review 2021



World Proven Oil Reserves – Regional shares Evolution 2020/2010/2000

Proven Oil Reserves at end 2020 # 1 730 Billion barrels (Includes condensates & NGL's)

Billion barrels



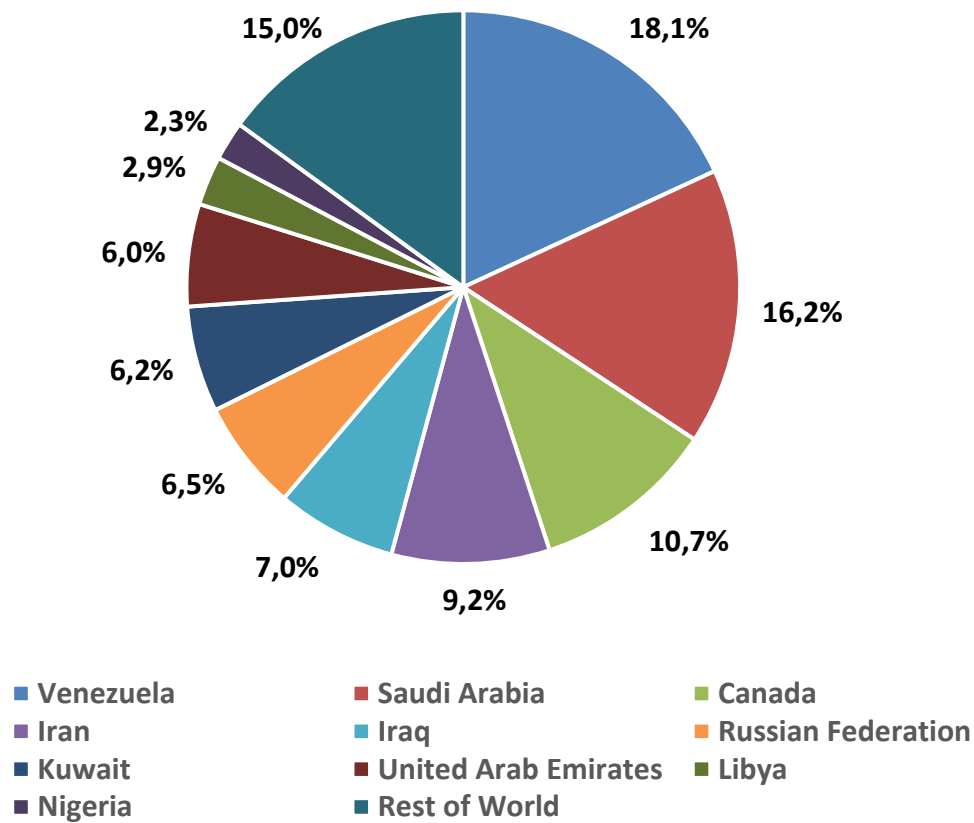
Includes canadian oil sands # 161 billion barrels in 2020, 169 in 2010
Includes Venezuela heavy oil # 262 billion barrels in 2020, 220 in 2010

Source: Data from BP Statist. Review 2021

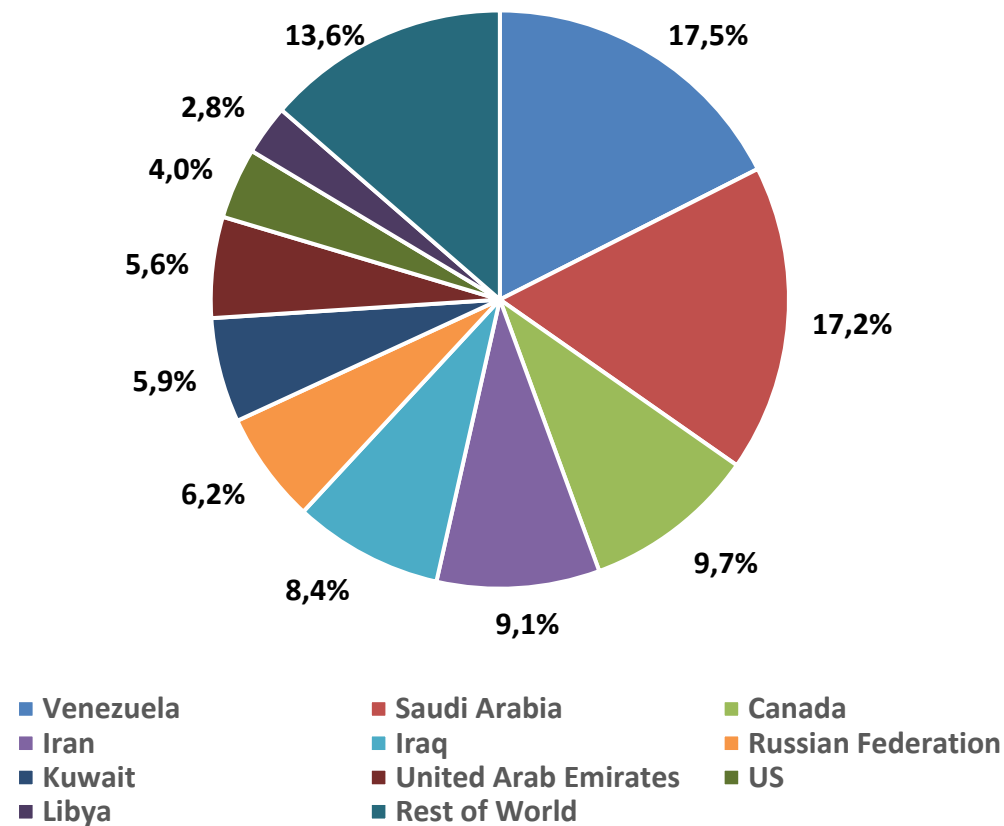


World Oil Proven Reserves 2010 - 2020

At end 2010
1 640 billion barrels
N°1 Venezuela N°2 Saudi Arabia



At end 2020:
1 730 billion barrels
N°1 Venezuela N°2 Saudi Arabia



Source: Data from BP Statistical Review 2021 shares in barrels

Nota: Includes 423 Gb of Xtra heavy oil and tar sands

TPA Toolbox Energy Book 4 - Oil

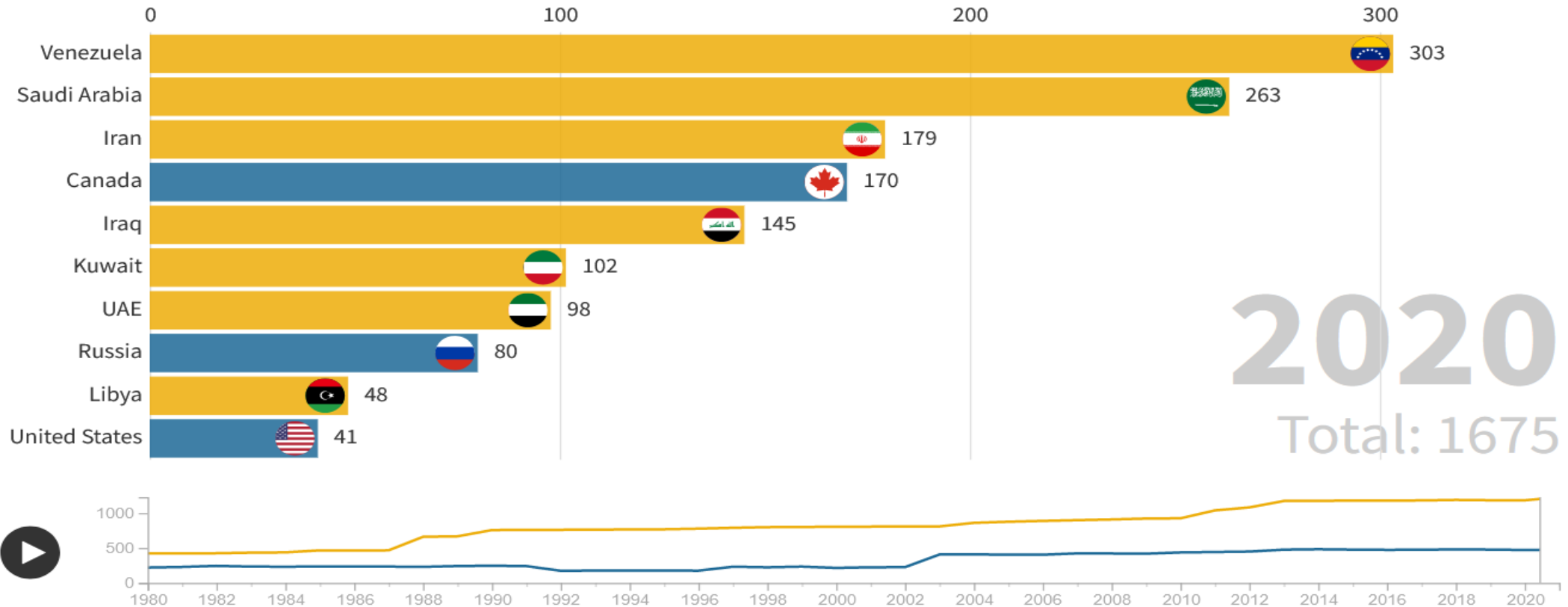


World Leaders in Proven Oil Reserves (End 2020)

Leaders in proved oil reserves, 1980-2021

Units are billions of barrels.

■ Non-OPEC countries ■ OPEC member countries



Source: U.S. Energy Information Administration
Institute for Global Sustainability | Boston University | visualizingenergy.org | CC BY 4.0

visualizingEnergy

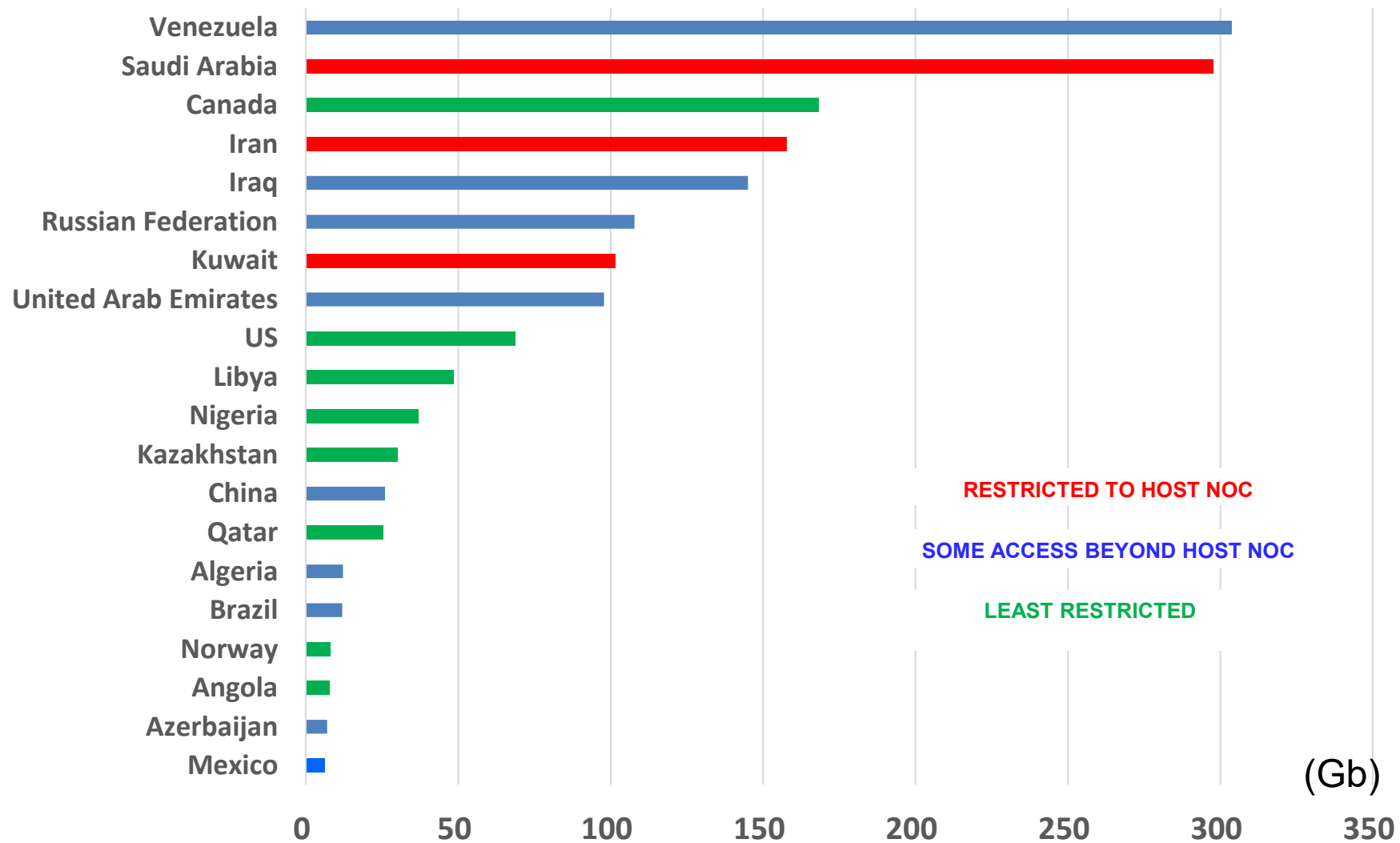
Source: VisualizingEnergy 2023

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Access to World Proven Oil Resources (End 2020)

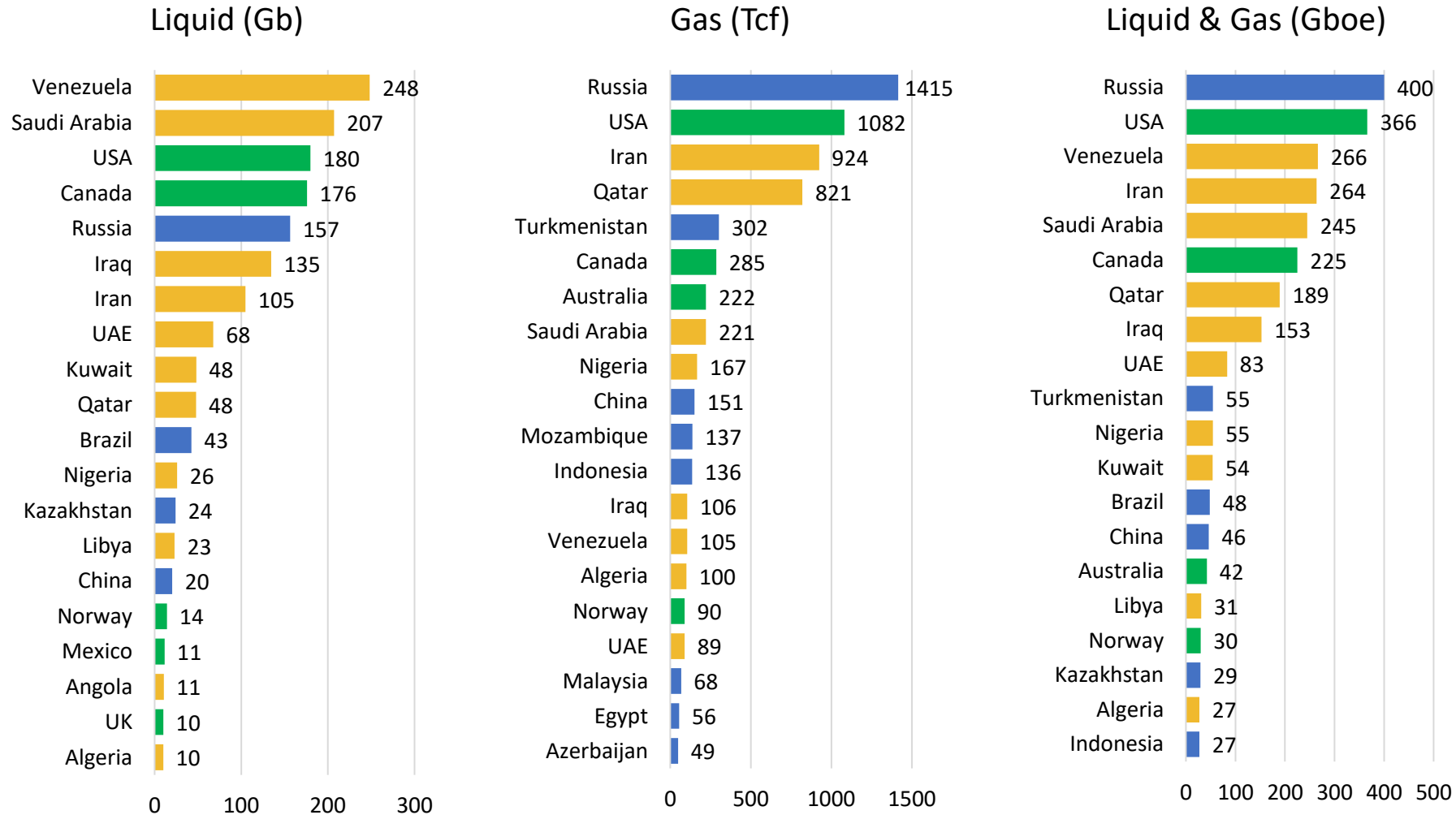


Data from BP statistical Review 2021



Access to World Oil Resources (End 2018)

Reminder - A View by Total



Source: Total July 2019 & WMK
Include Commercial Reserves (2P) and Contingent Resources

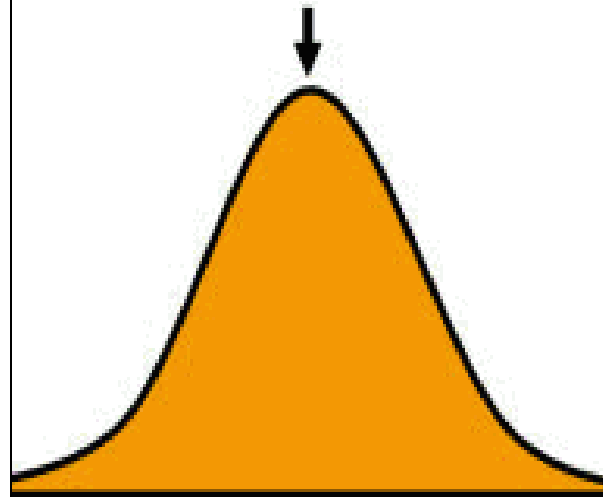


Wake up!!!

Are we here ?

A few 'peak oil' websites

3w.peakoil.net
3w.aspoFrance.org
3w.oilcrisis.com
3w.peakoil.com



Peak Oil

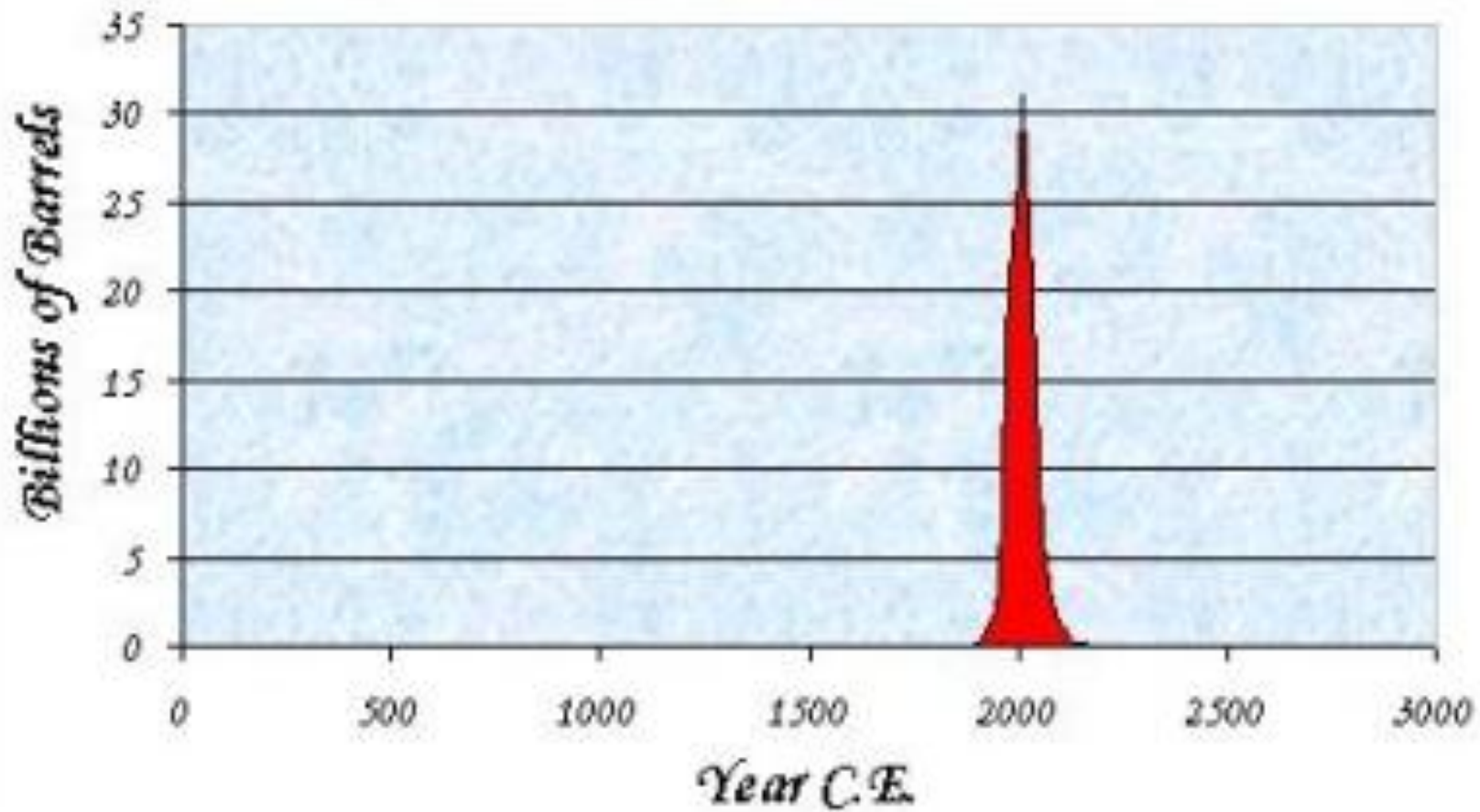
www.oilcrisis.com

ASPO France members
(June 2006):

[Jean Laherrère \(formerly Total\)](#)
[Pierre-René Bauquis \(fy Total\)](#)
[Carlos Cramez \(fy Total\)](#)
[Jean-Luc Wingert](#)
[Xavier Chavannes \(Paris VII\)](#)
[Jean-Marc Jancovici \(fy Envt\)](#)
[Alain Perrodon \(fy Elf\)](#)
[Paul Alba \(fy Elf\)](#)
[Maurice Allègre \(fy IFP\)](#)
[Jacques Varet \(BRGM\)](#)
[Adolphe Nicolas \(Montpellier Uni\)](#)
[Jean-Marie Bourdair \(ex Total\)](#)
[Bernard Rogeaux \(EDF\)](#)

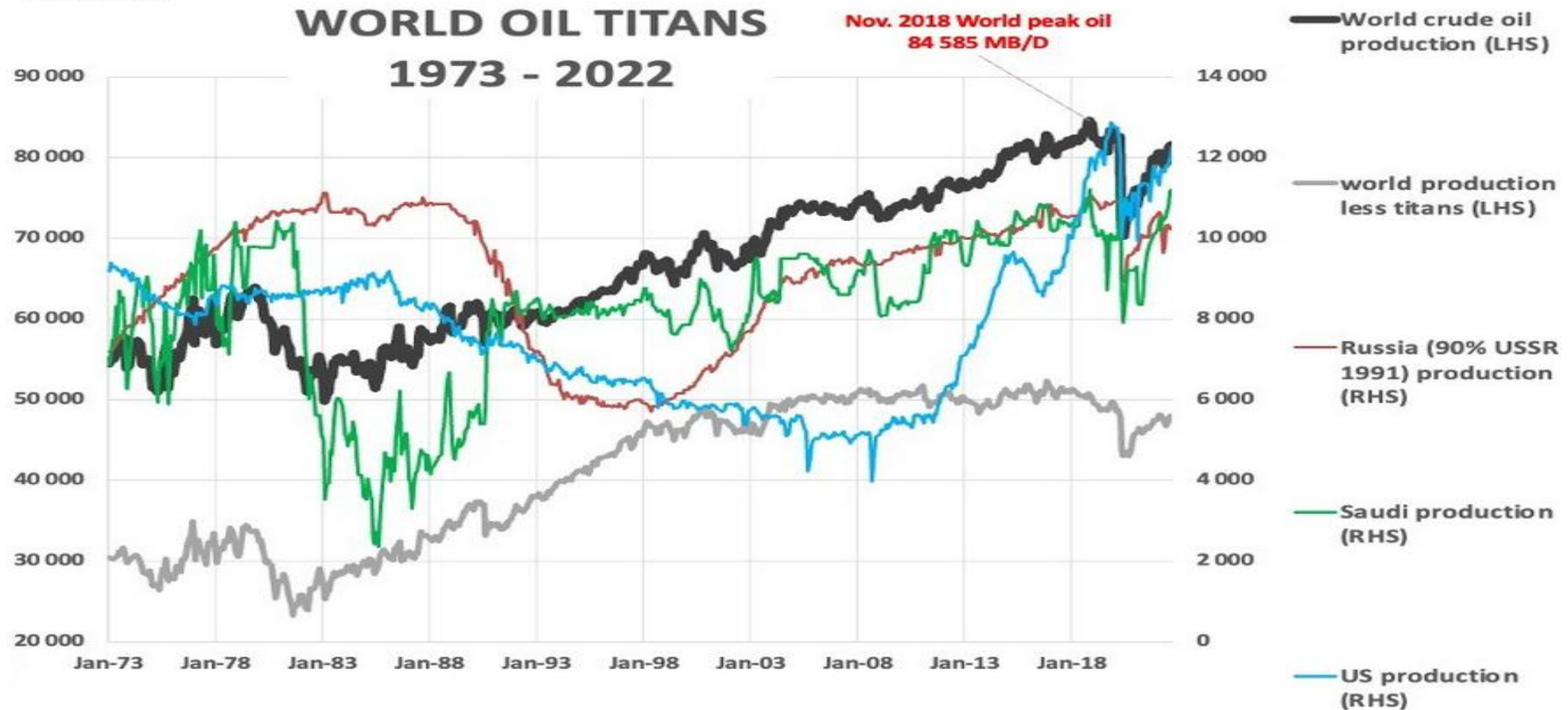


The Age of Oil



The Peak Oil in 2018?

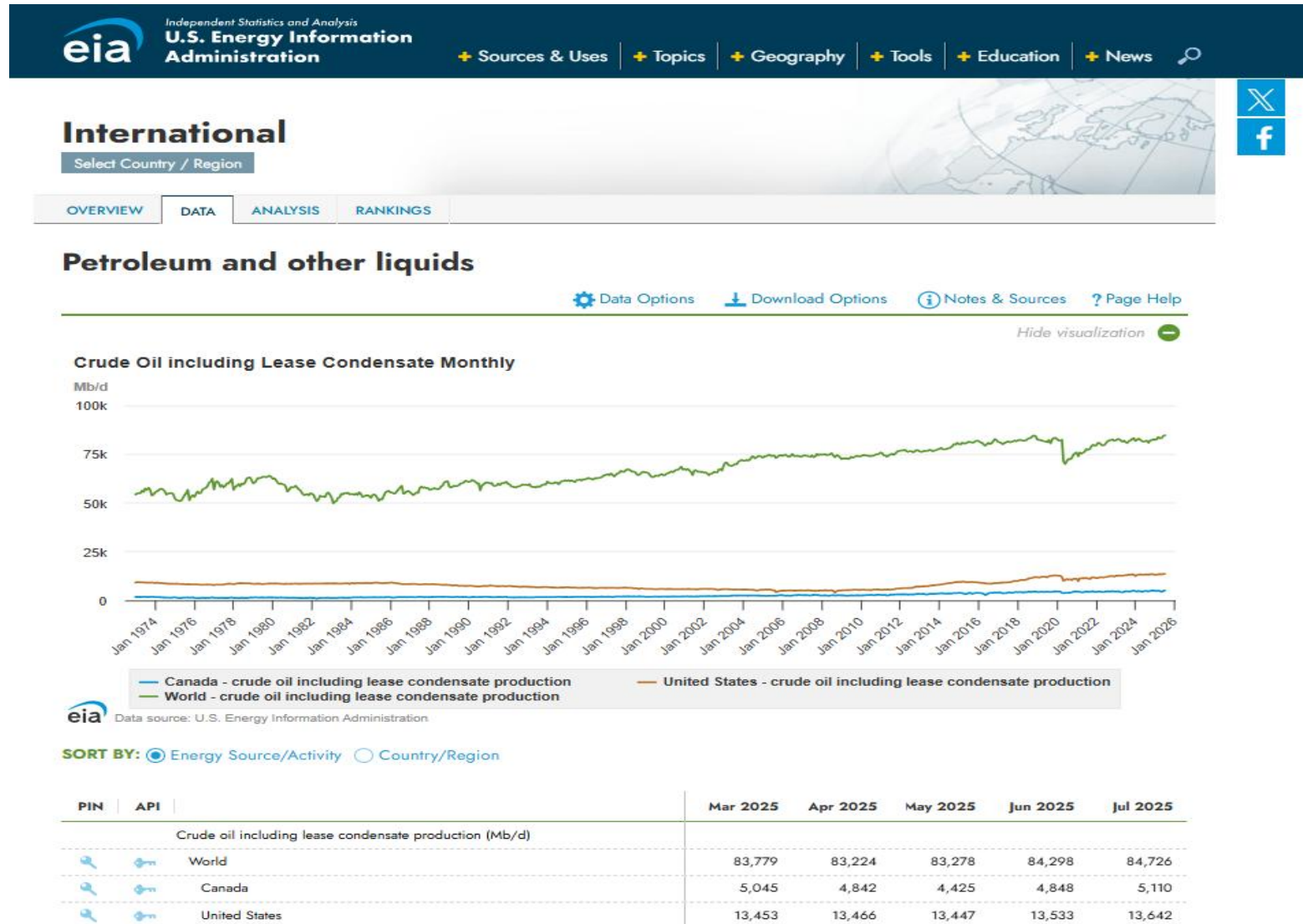
THE SHIFT PROJECT 2023
LIED 2023
Michel LEPETIT



Sources : US EIA, Global Warming estim.



The Peak Oil in 2018? But Oil Production is still growing!



Reserves estimates

A difficult assessment

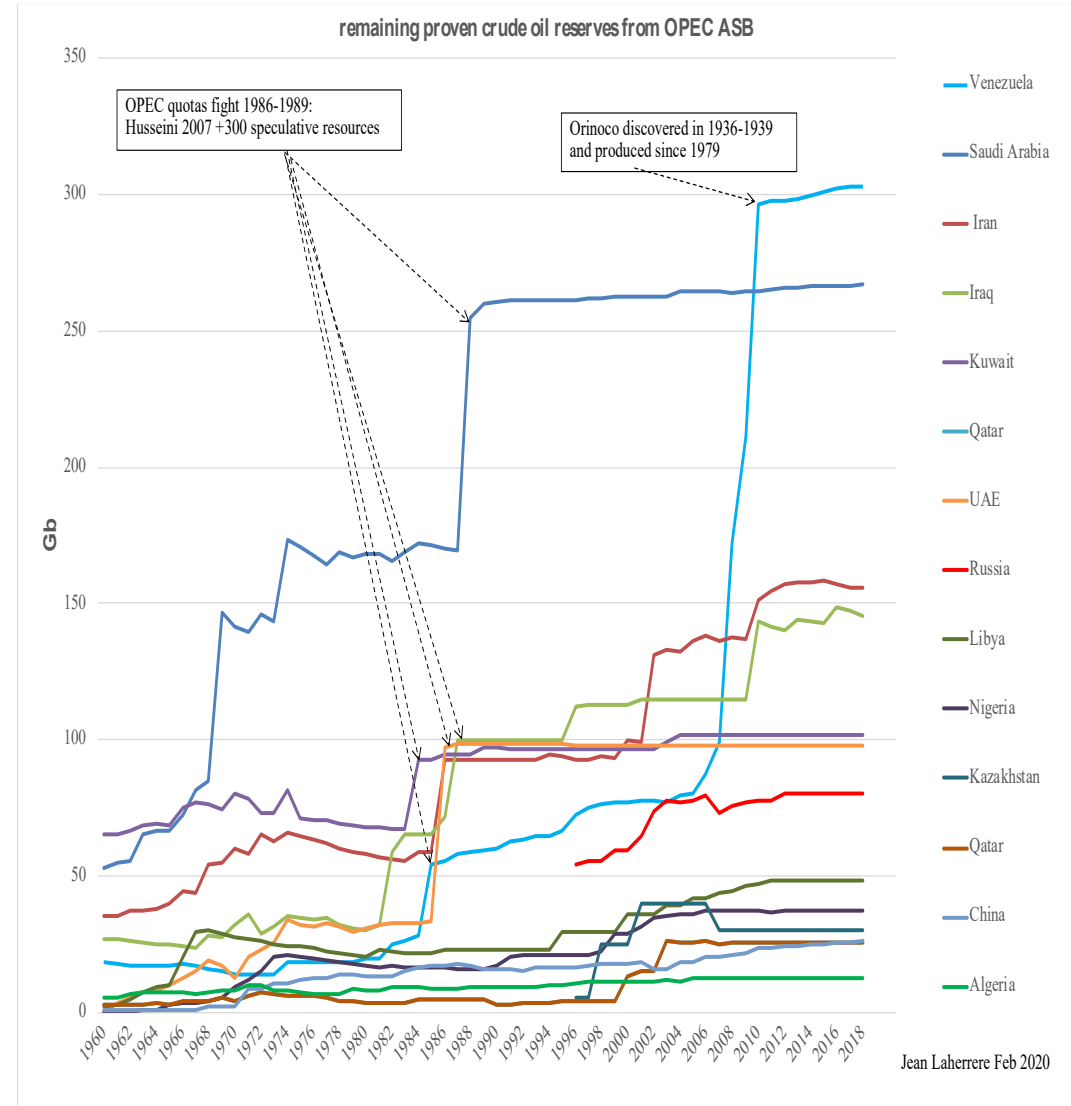
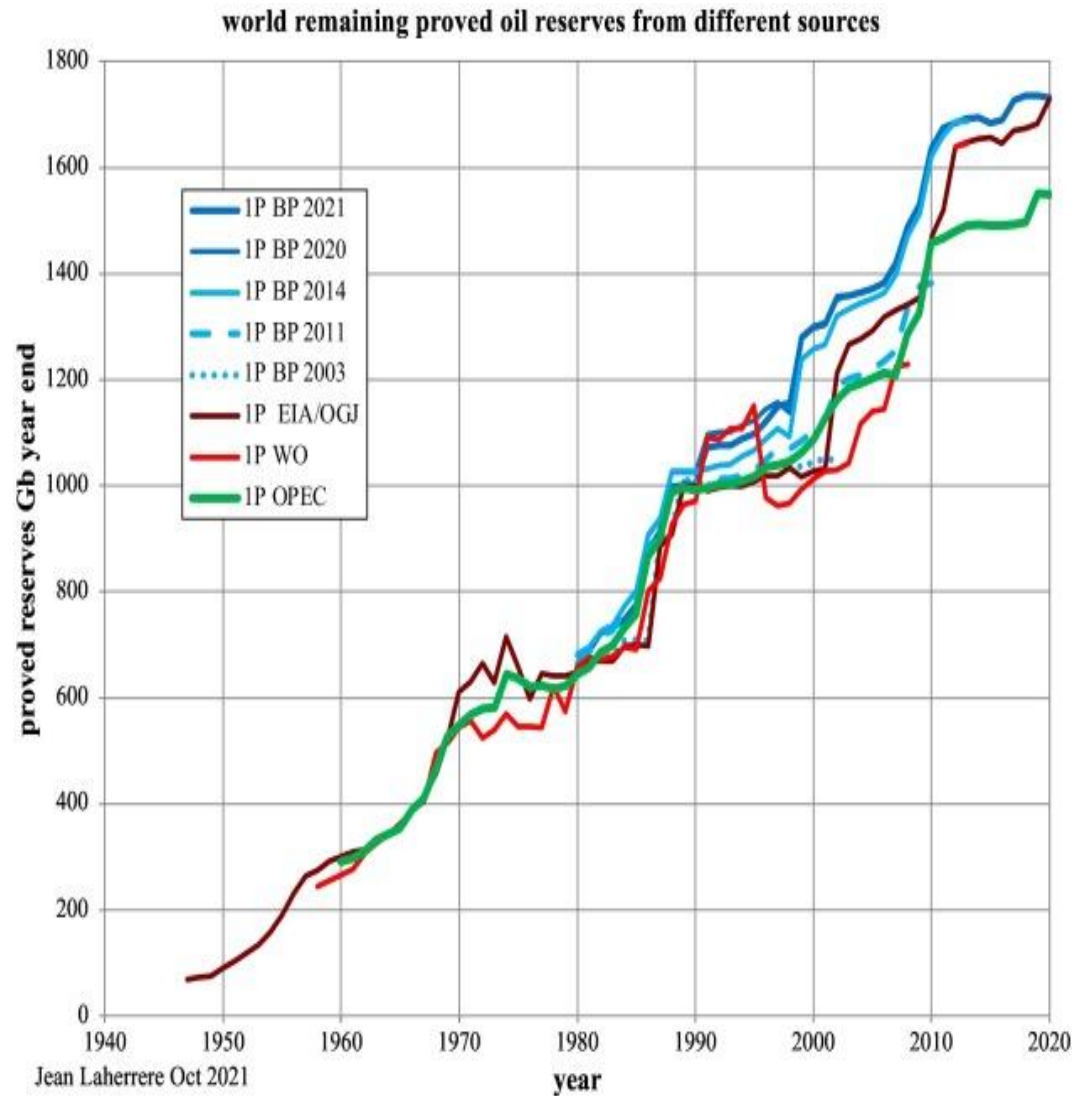


Brief summary of past findings and views

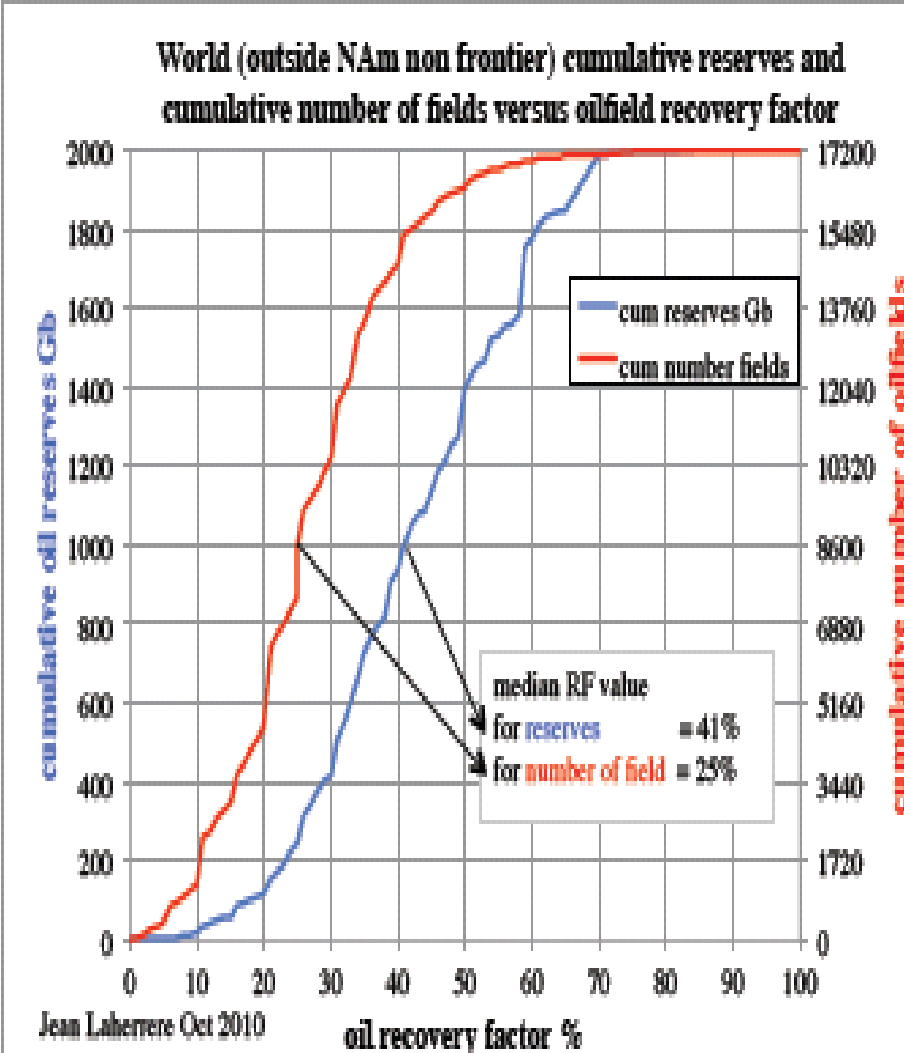
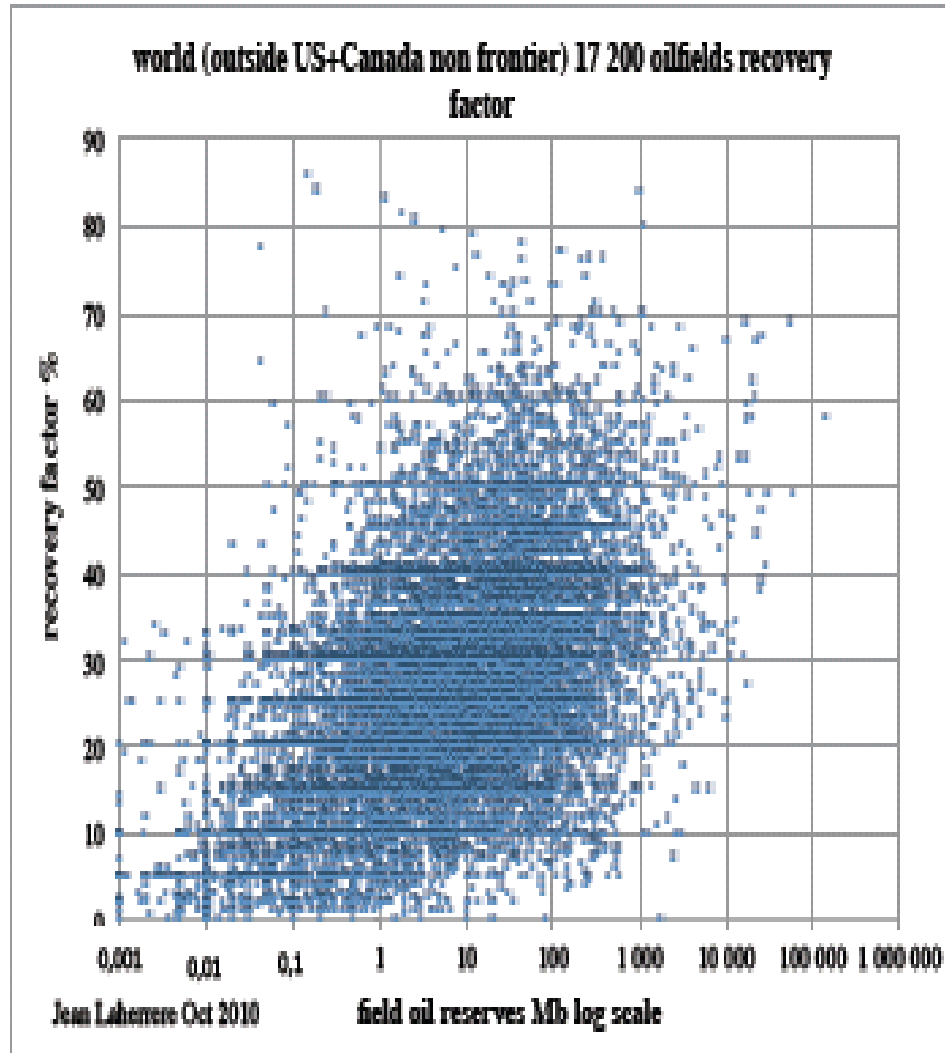
- ◆ The only "publically available data" on Oil Reserves are the so called "Proven Reserves".
- ◆ Unfortunately, they are useless to study and predict "Peak Oil".
- ◆ The only "usable" concepts for "peak oil estimation", at oil basins levels, countries levels or world level are :
 - Ultimate reserves concept
 - Evolution of past exploration performances (creaming curves) and production curves (logistic curves)
 - King Hubbert methodology (world applicability)



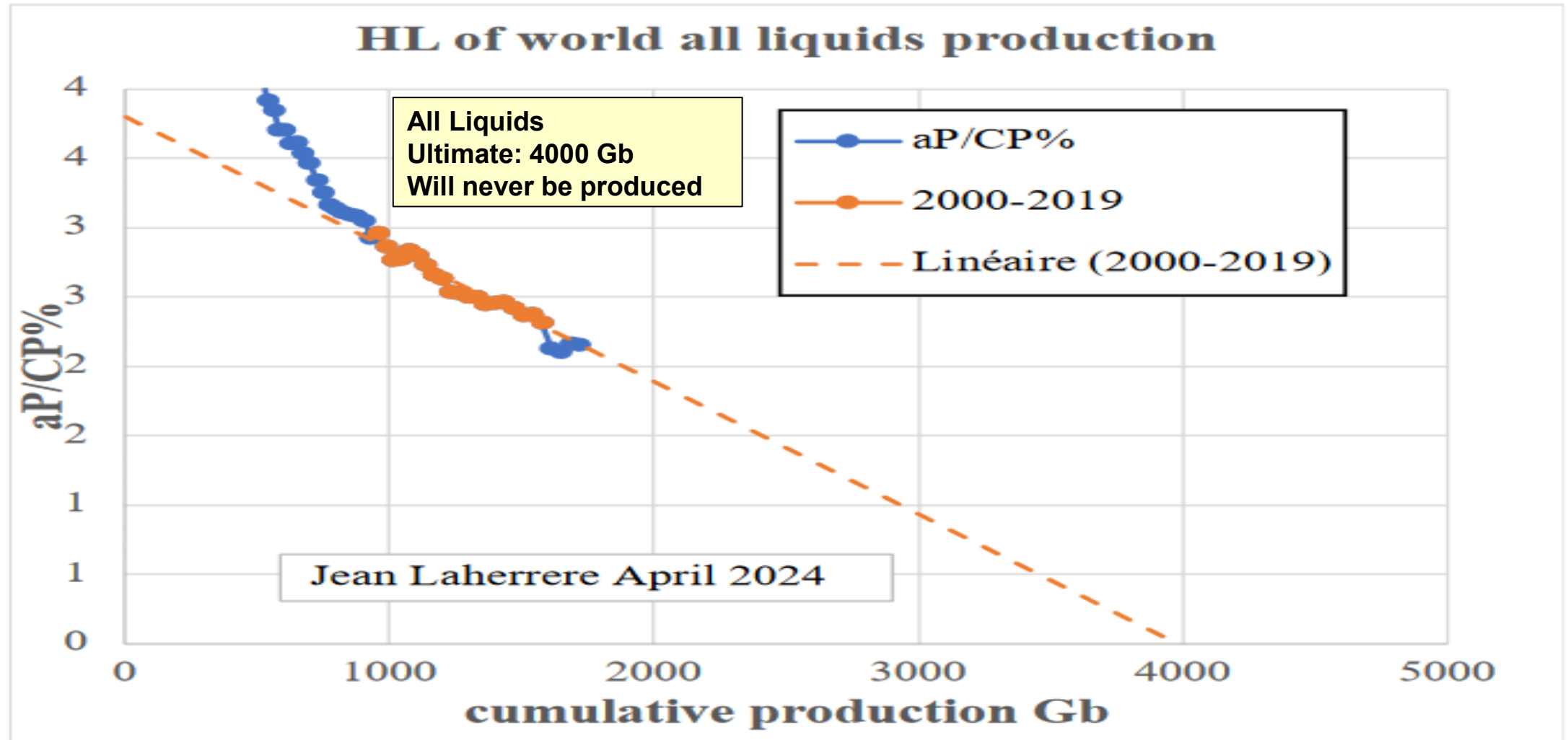
Remaining Reserves: a difficult assessment



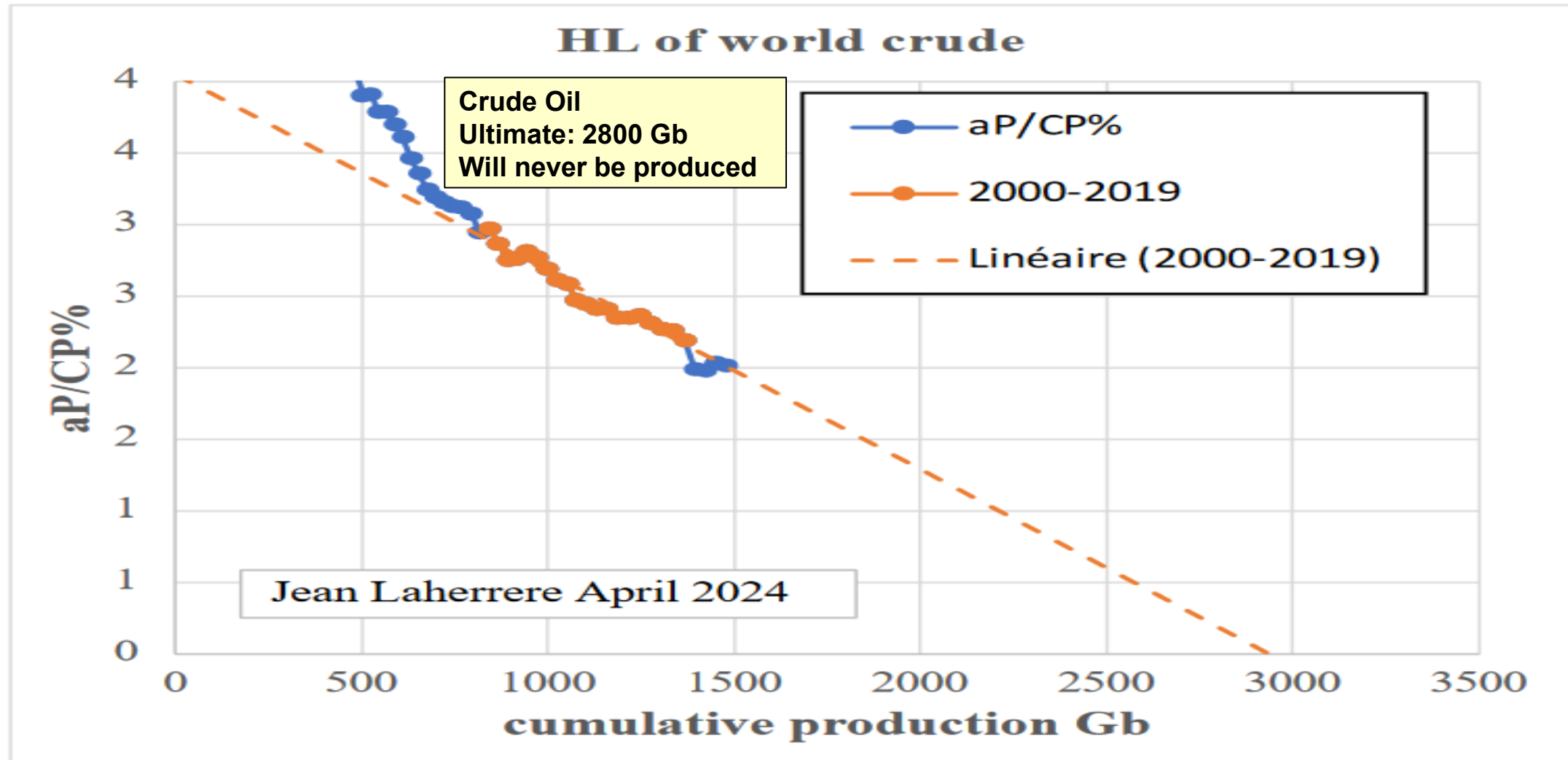
Remaining Reserves: a difficult assessment



Remaining Reserves (All Liquids) : a difficult assessment Analysis based upon Hubbert Linearization (HL) - Gb

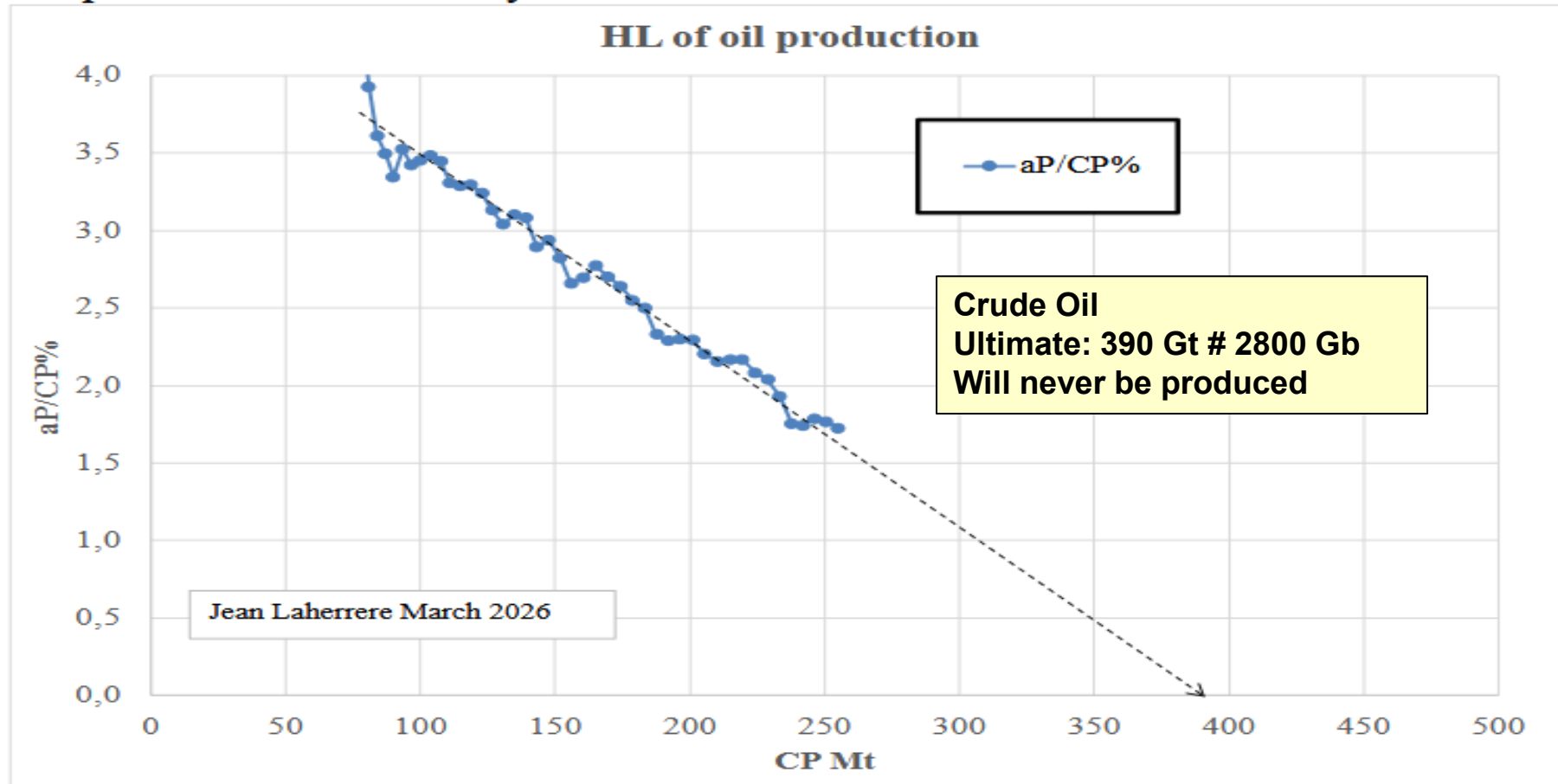


Remaining Reserves (Crude Oil) : a difficult assessment Analysis based upon Hubbert Linearization (HL) - Gb



Remaining Reserves (Crude Oil) : a difficult assessment Analysis based upon Hubbert Linearization (HL) - Gt

HL of oil production trends fairly well towards 390 Gt

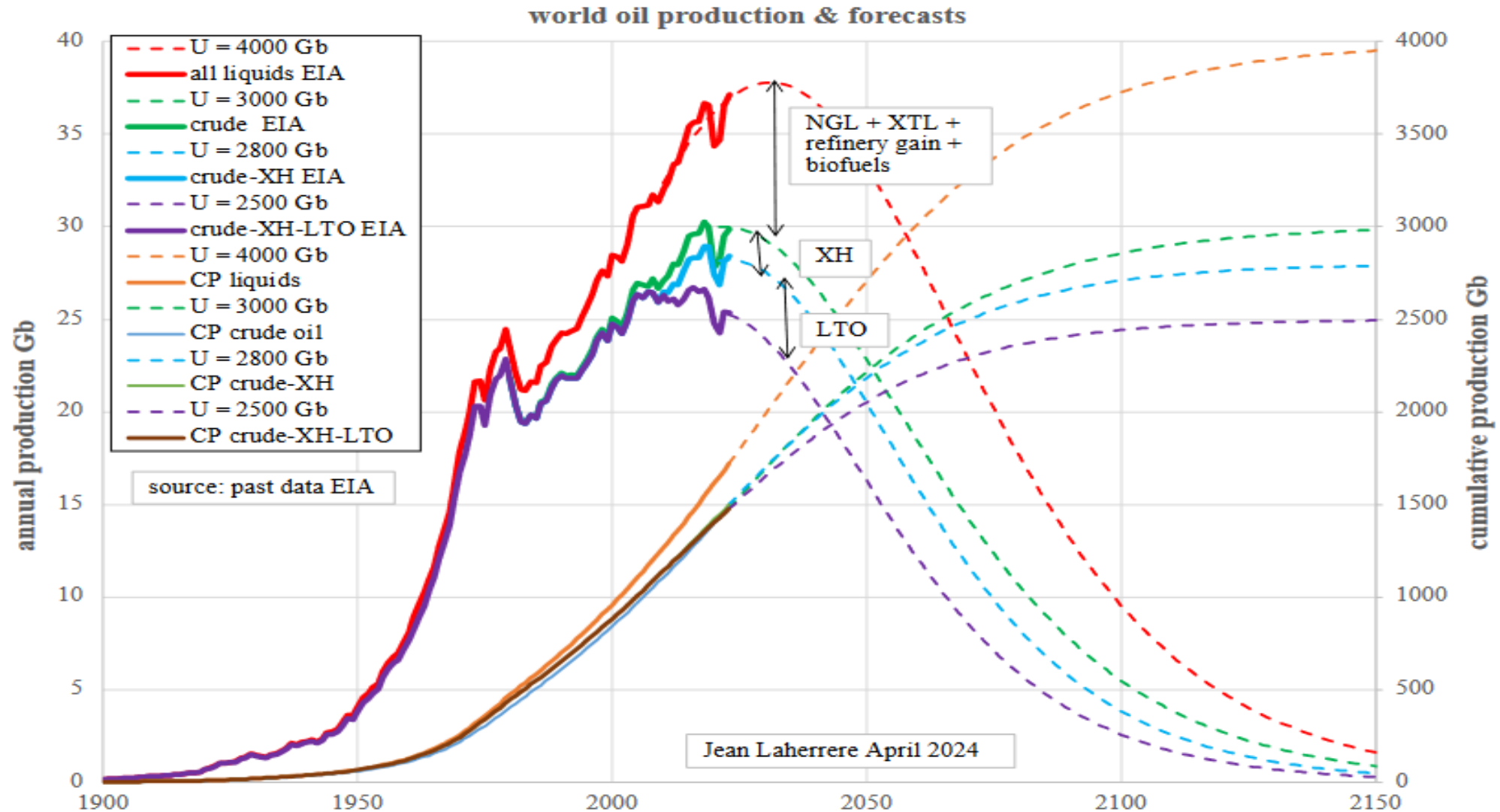


For 390 Gt ultimate, world oil production has peaked in 2017 and will decline in future



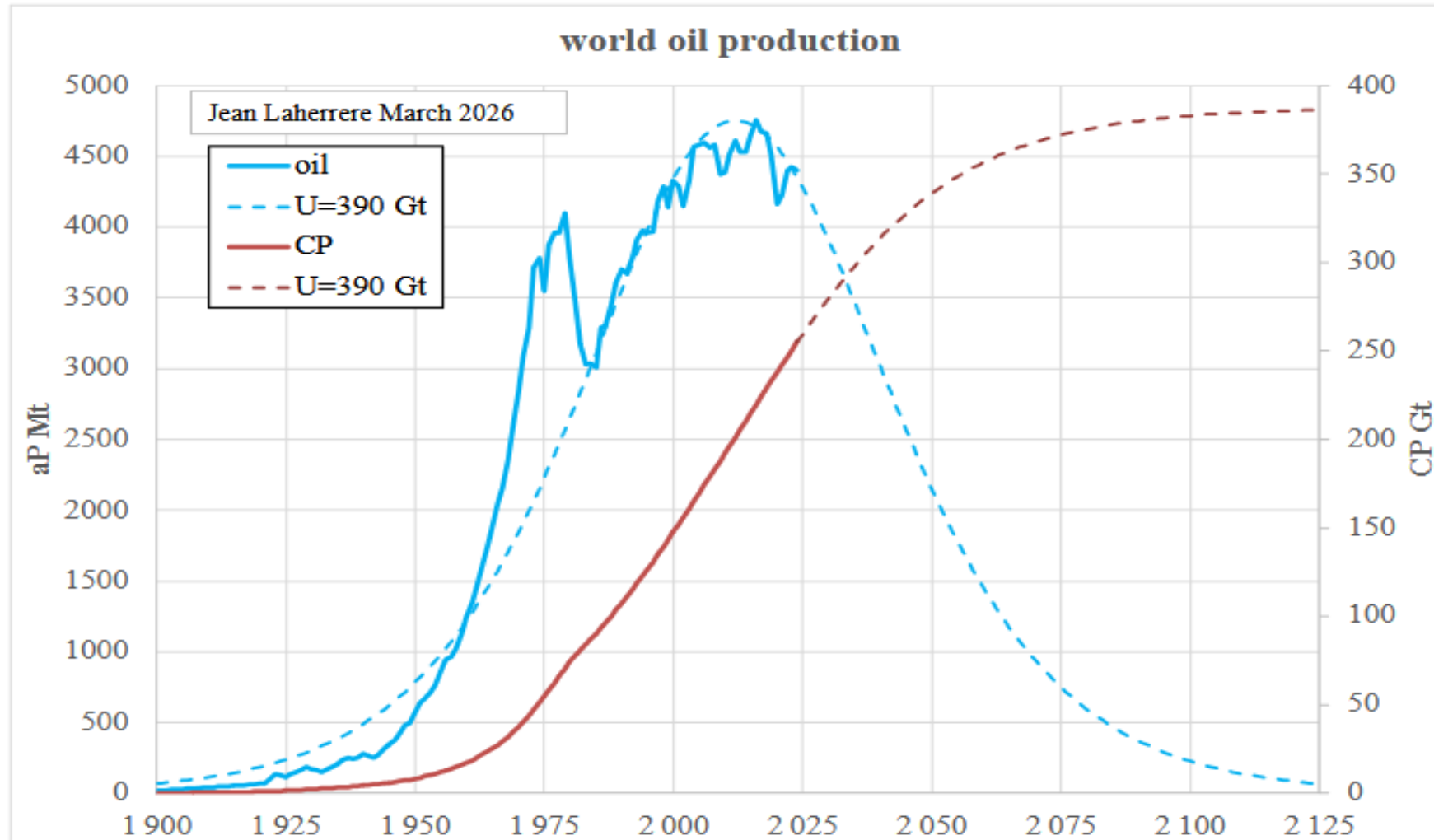
Liquids/Oil Production and forecasts & Ultimates (Data: US EIA)

Analysis based upon Hubbert Linearization (HL) - Gb

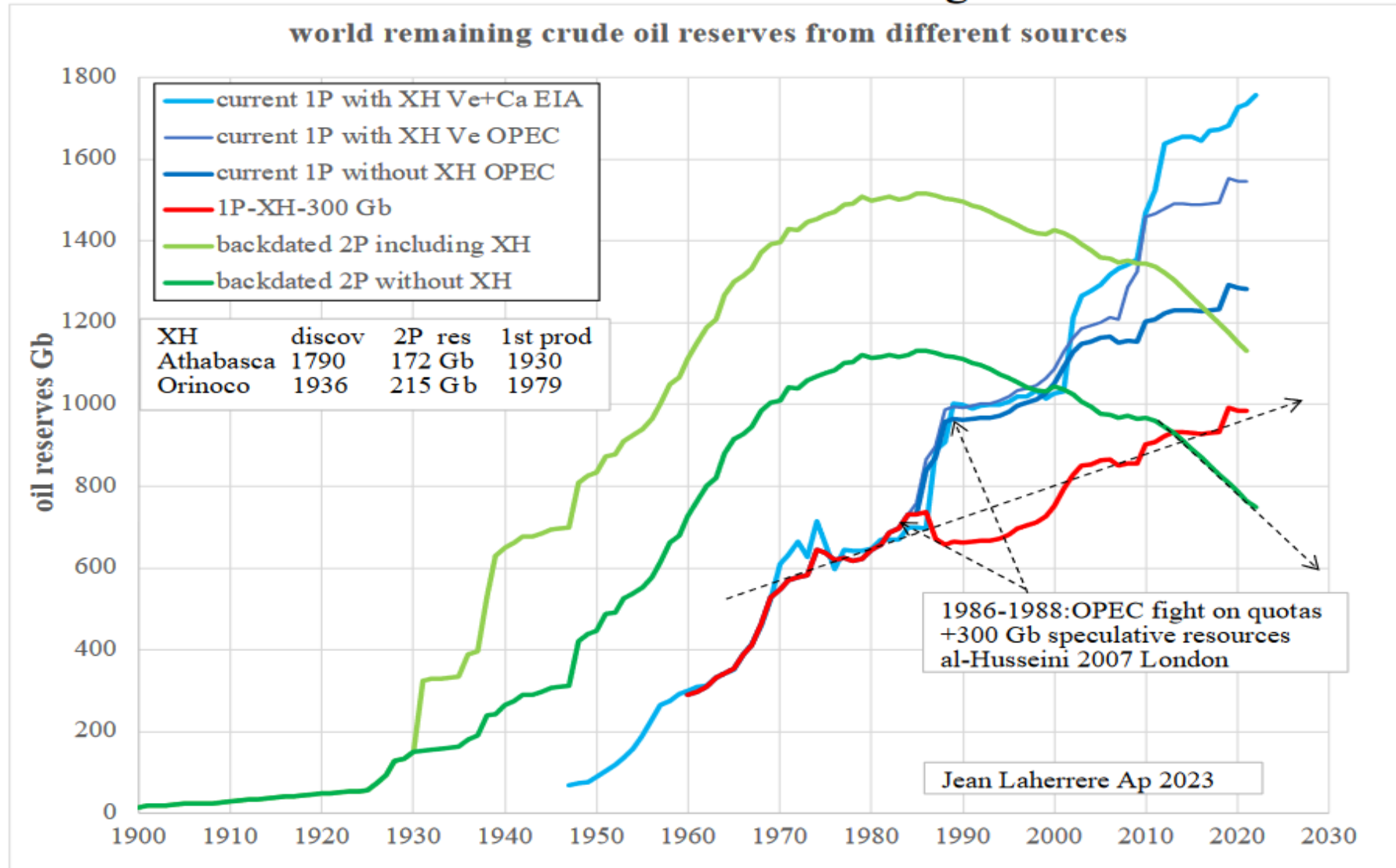


Oil Production and forecasts & Ultimates

Analysis based upon Hubbert Linearization (HL) - Mt



Remaining Reserves: a difficult assessment



Proven Reserves end of year

Proven Reserves depend upon the economic environment

	1973		2024	
	Gtoe	Years of production	Gtoe	Years of production
Oil world reserves	86	30	241	48
Gas world reserves	52	48	193	52

HC « Proven Reserves » have drastically increased during the last 50 years, the R/P ratio not in the same proportions.

Source: Figures 1973 BP Stat. Rev. No update end 2022

Figures 2024: IEA WEO 2025

1 toe # 7,3 boe - 1000 m3 Gas # 0,9 toe



But a closer look at ultimate Reserves/Resources (for conventional Oil) suggests a different picture: Period 1973-2024

Ultimate reserves (conventional crude, worldwide)	1973	2024
G barrels Gt	2000 - 3000 270 - 400	# 2100 # 290

*Between 1973 and 2024, ultimate Reserve estimates (Resources) for **conventional oil** have practically remained flat, taking into account the degree of uncertainty. The current impact of unconventional oil will be major but depends upon the economic environment, oil prices and production costs*



3

**The Impact of Unconventional
Hydrocarbons →
Additional potential resources
(See BOOK 6)**



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4

History of Discoveries



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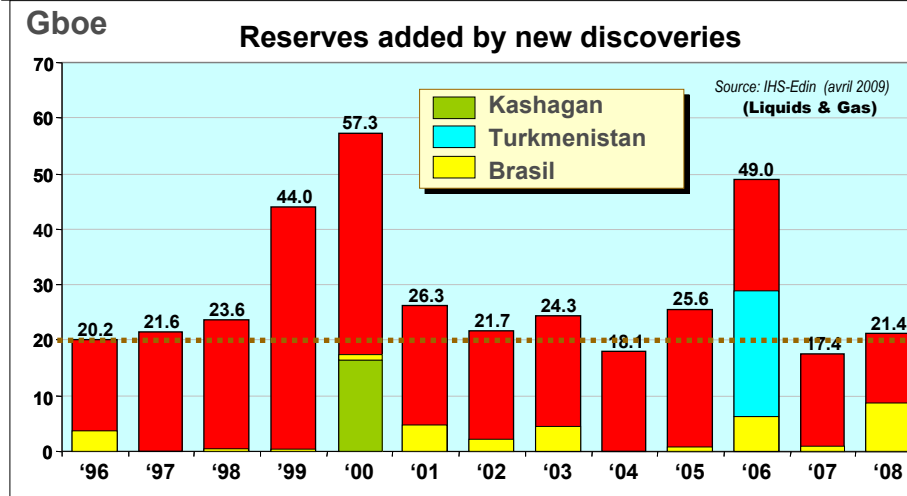
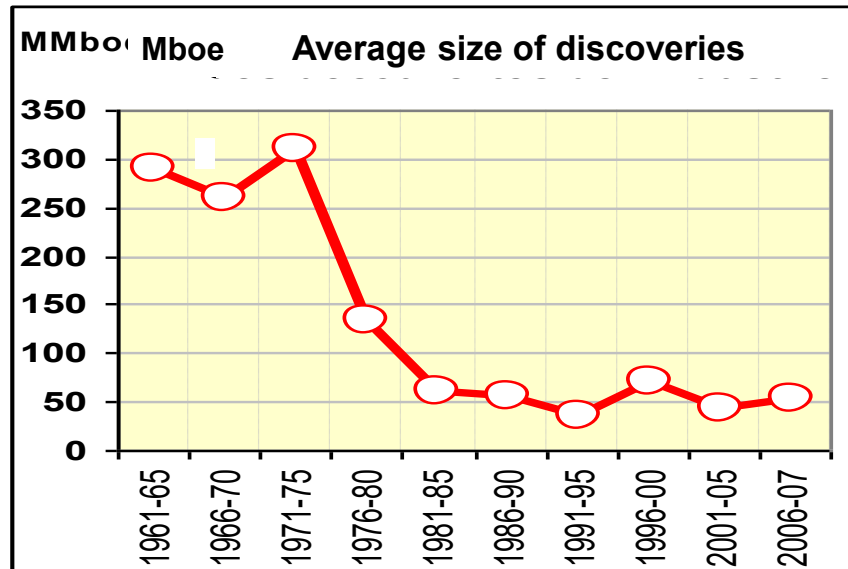
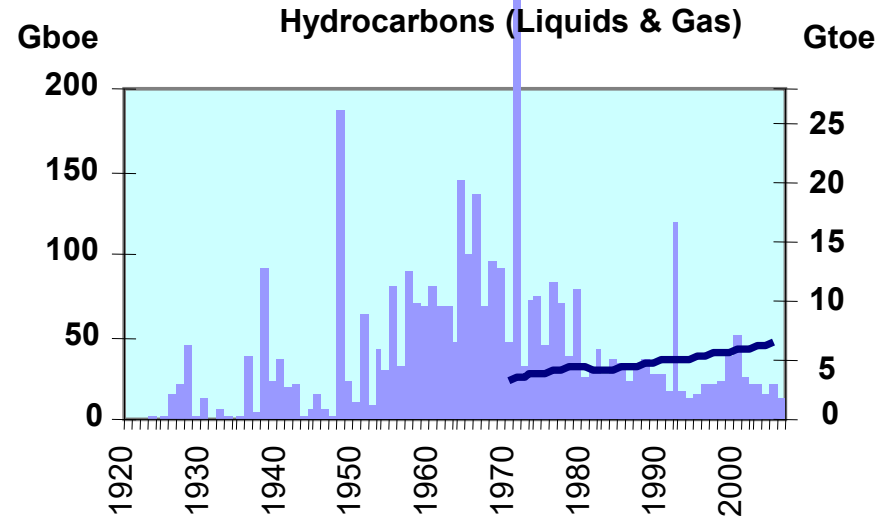
The time of very large discoveries is over



History of Hydrocarbon Discoveries (proved and probable) and Production Period 1920 - 2010

- World demand reaches # 50 Gboe per year
- World discoveries flat since 1996 at 20 Gboe per year (excluding the nugget effect).

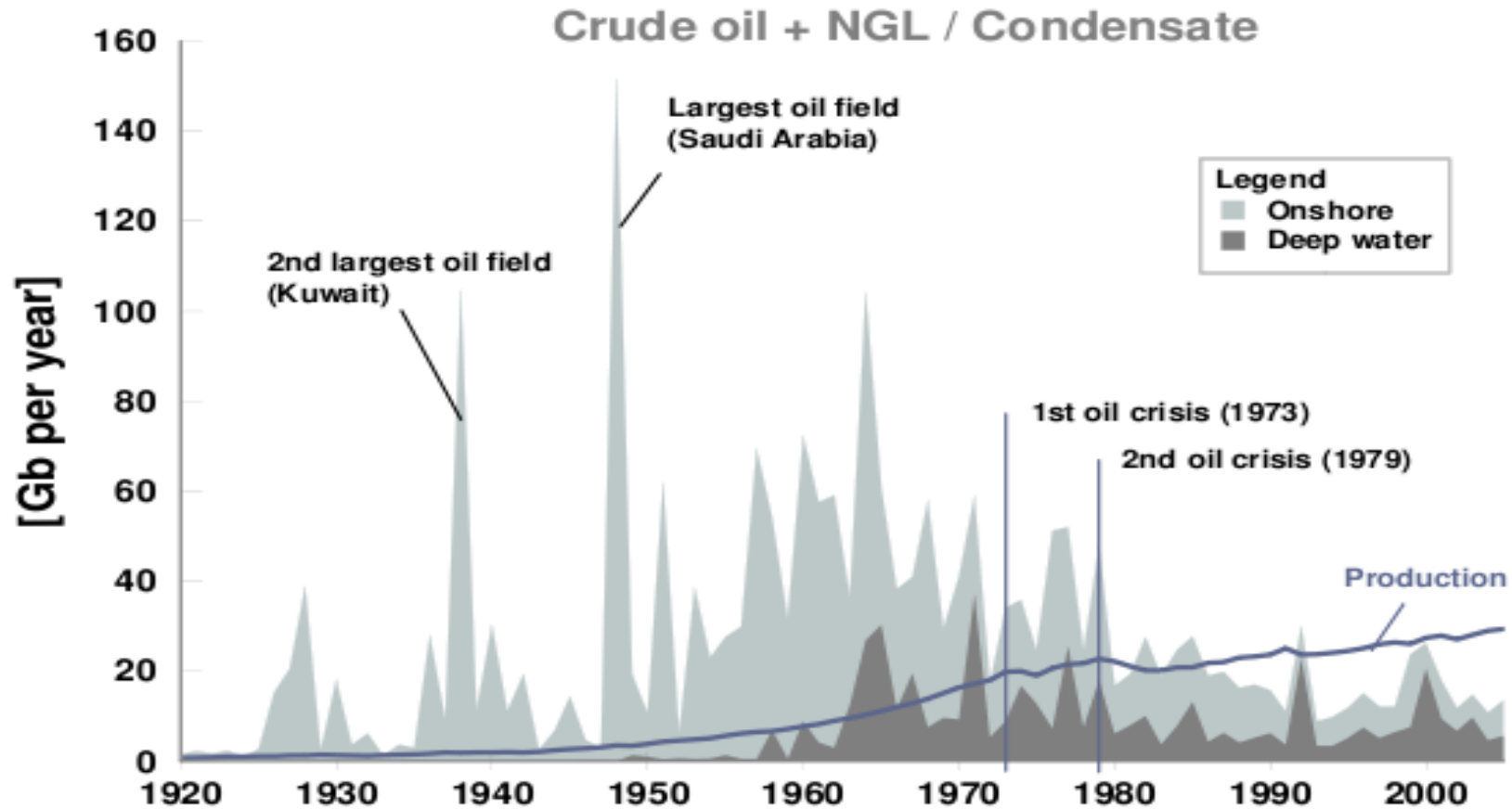
- 10 Gb oil and 10 Gboe gas
- 8 Gboe discovered by NOC
- 10 Gboe discovered by IOC
- 2 Gboe discovered by others



- size of average discovery : constant since 1980



History of Oil Discoveries (proved and probable) and Production 1920 - 2005

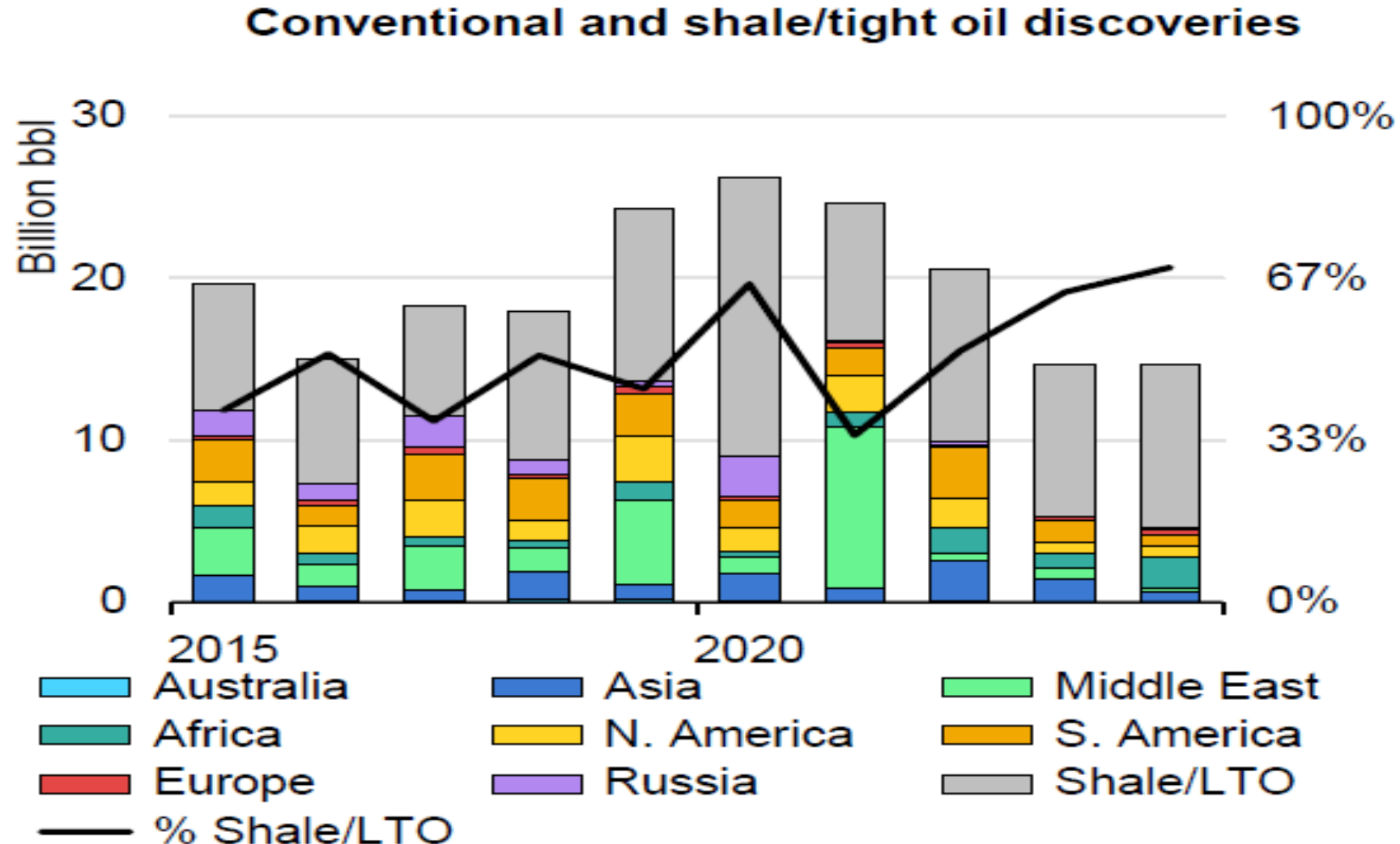


Source: IHS Energy 2006



Conventional and Shale/Tight Oil Discoveries by Regions

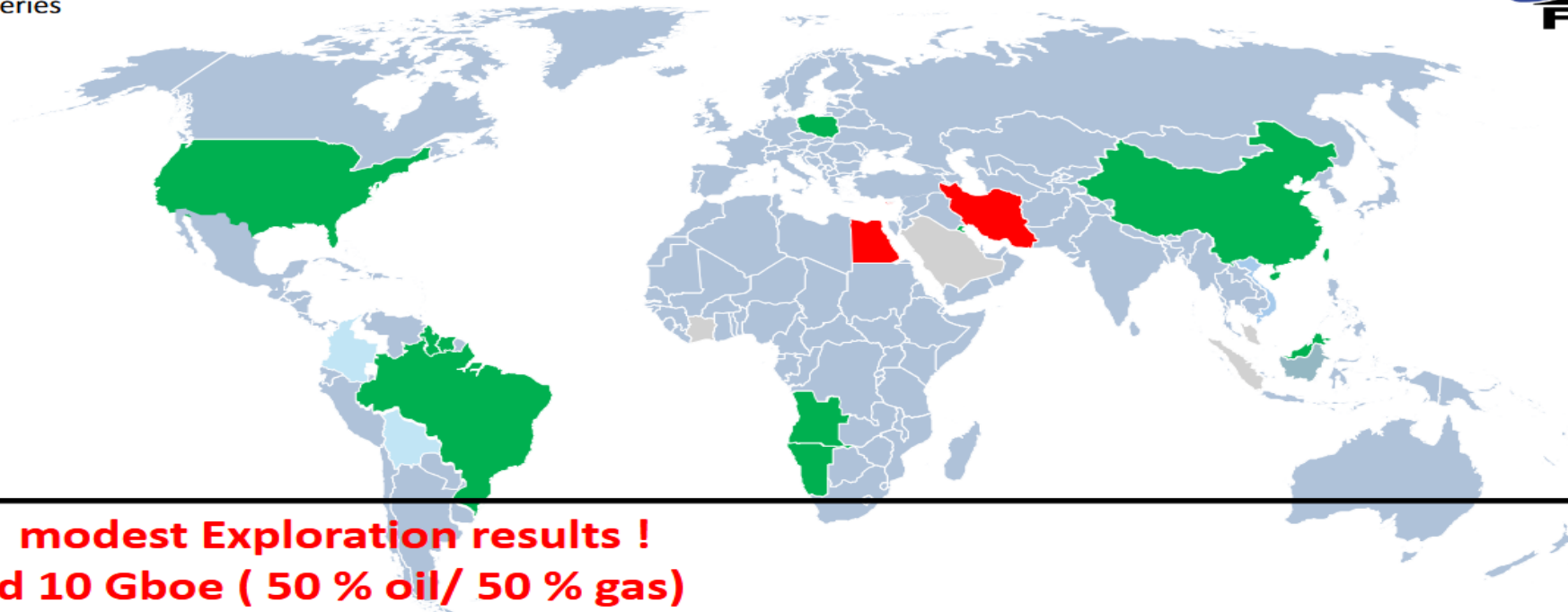
A sharp decline of discovered Resources with a high contribution of Shale/Tight Oil in the US



2025 Exploration – New major conventional Discoveries # 10 Gboe (50% Oil, 50% Gas)

2025 Conventional EXPLORATION SYNTHESIS Exploration / Appraisal

■ OIL and
■ GAS Discoveries



**2025 : modest Exploration results !
Around 10 Gboe (50 % oil/ 50 % gas)**

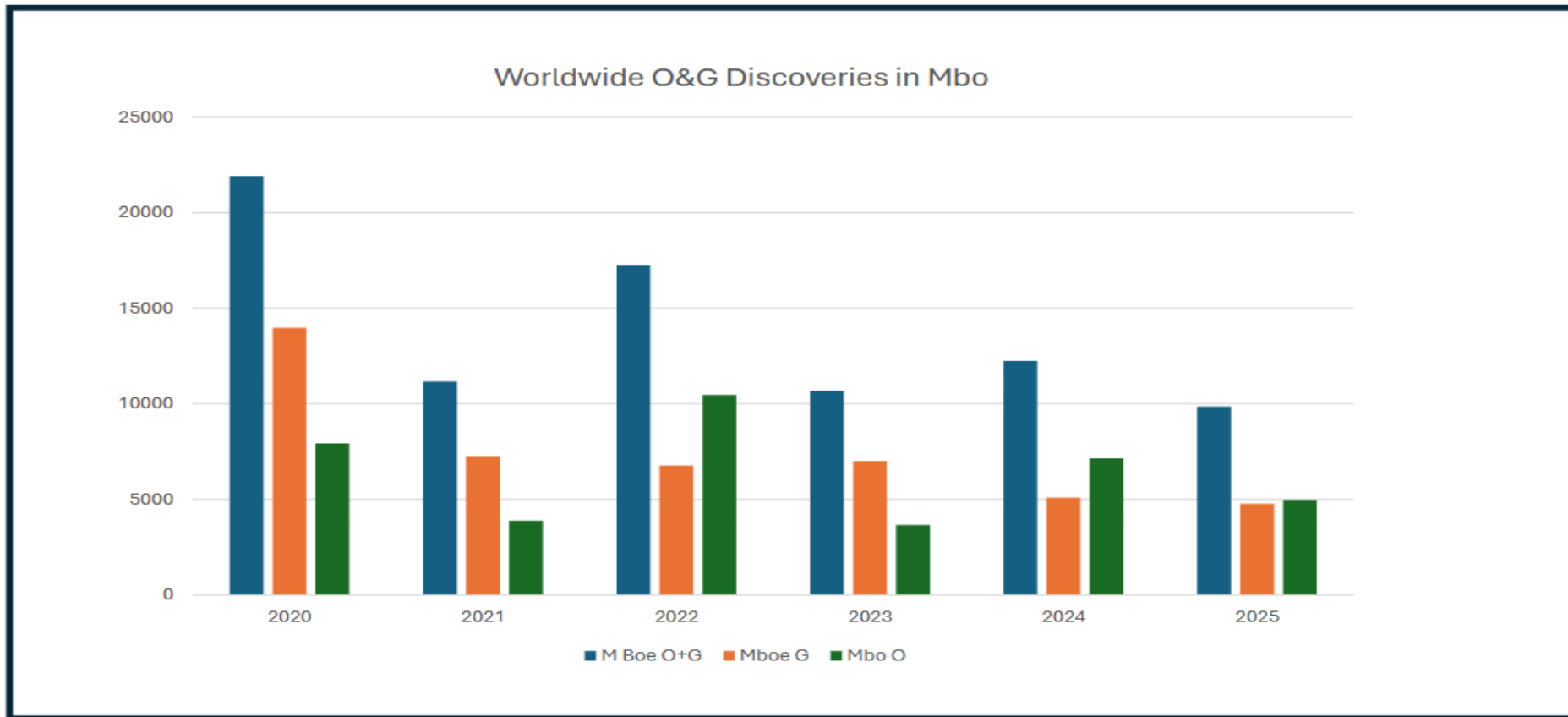
Oil discoveries : China, Malaysia, Namibia, Angola, Brasil, USA (GOM) , Poland
Gas discoveries: Iran, Egypt



2025 Exploration – A low levels of discovered quantities

2025 : A very low level of discovered barels

even with a slightly increase in global budget (13 G\$ against 10 G\$ in previous years)



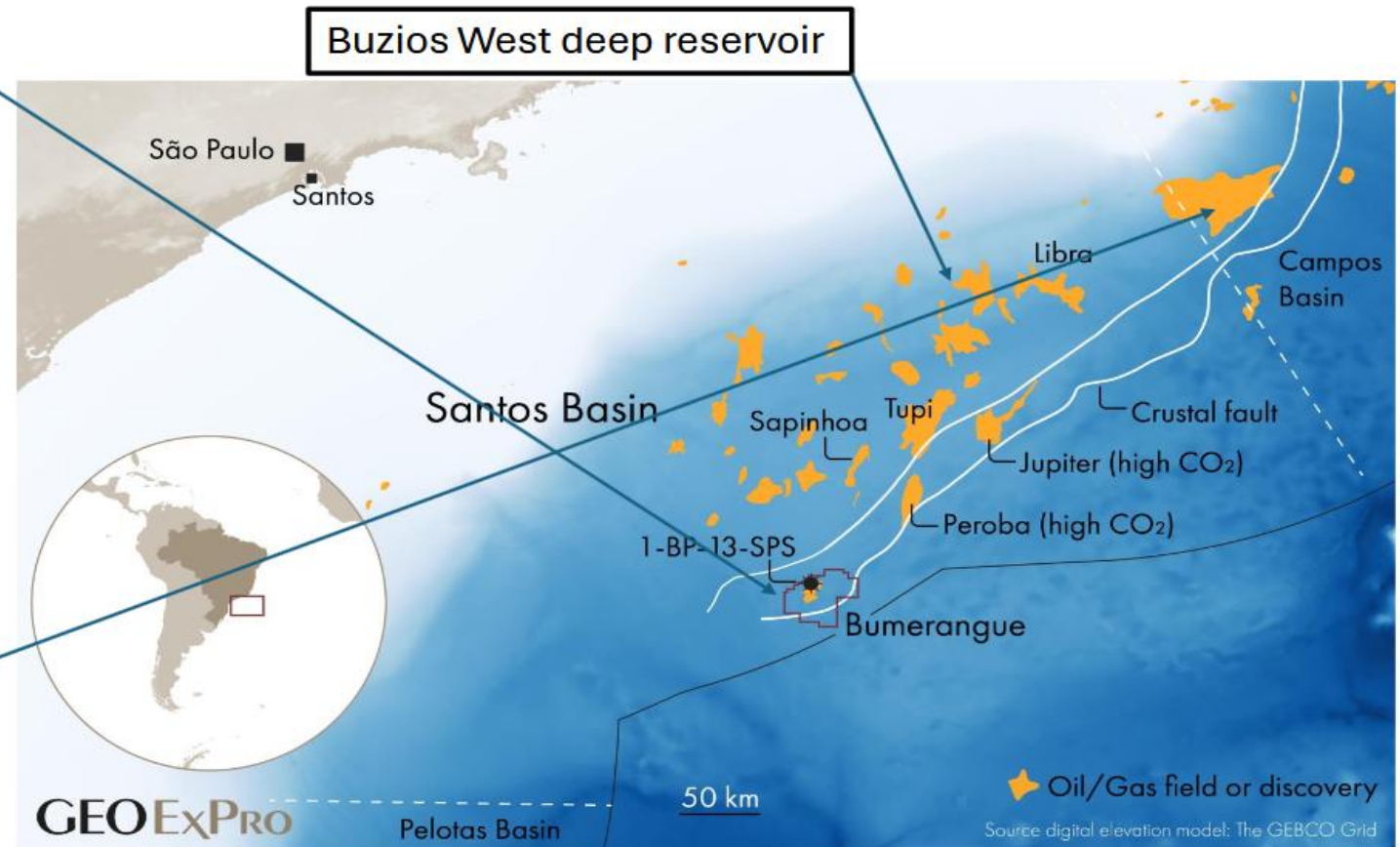
Source: Marc Blaizot – ASPO February 2026



2025 Exploration – A low levels of discovered quantities

And the winner is ... **Brazil** ... Santos Basin presalt : half of the worldwide discoveries

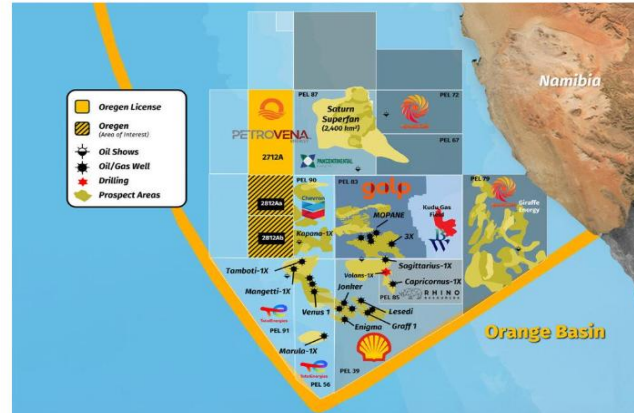
- **1-Well Boomerangue** by BP encountered a 1000 m G&O column with 100 meters of oil and rich gas of 900 m in excellent carbonates reservoir but High CO₂ Content as per expectation (Jupiter trend)
- -dense faulting in a very large trap of more than 300 sqkm !
- Close to 3Gboe of reserves (1/3 oil ?)
- **2-Buzios West** by Petrobras encountered a new reservoir in presalt carbonates : 1 Gbo
- **3-Alto de Cabo Frio** by Petrobras and BP : appraisal confirms 2022 discovery in presalt carbonate : + 400 Mbo



2025 Exploration – Other Exploration activities

Namibia –Orange Basin DO- The story goes on !

- Galp drilled Mopane 3 (appraisal of Mopane 1 field) but deepened it and find a new light oil in **high permeability reservoir**,
- Rhino and Azule drilled two wells SE of Mopane and had two discoveries
- **Capricornus-1x** which show a 38 m high-quality light oil reservoir with no OWC. Testing indicated a flow rate of over **11,000 barrels per day !**
- **Volans 1** TD at 4,497.5m ;25m of net pay in rich gas condensate-bearing excellent reservoirs, no OWC. High condensate-to-gas ratio (CGR) of >140 bbl/mmscf with 40° API gravity.

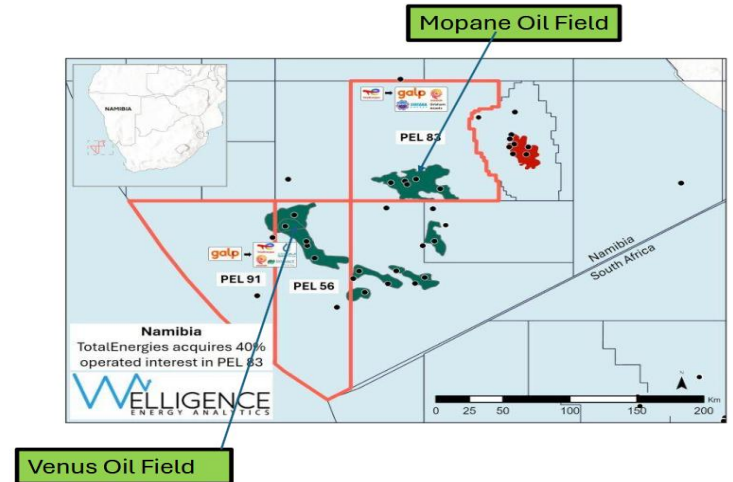


But in **Namibia** the winner is ...**Totalenergies**

The long lasting farm-out of Galp on its Mopane giant discovery went to Totalenergies becoming operator with 40 % (against a 10 % in Venus for Galp)

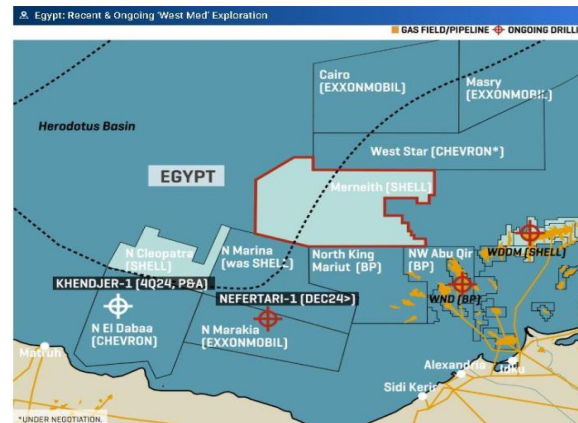
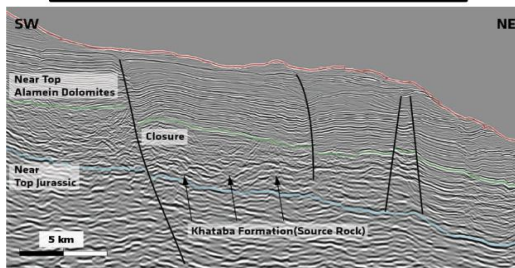
Confirmation of larger discovery with appraisal Mopane -3

Confirmation on ongoing development studies for a **probable FID** in Totalenergies operated Venus field **end of 2026** Even if technological challenges are huge : 3000 m WD (deepest development in the world) and permeability a key question



Egypt : Exxon first pace in the Heterodotus Basin ?

Nefertari 1 well discovered gas (3 Tcf ?) in the Herodotus Basin shelf probably in Lower Cretaceous/Jurassic , similar reservoirs to Western desert ? A first calibration for Herodotus giant basin : Cairo and Masry leases to be drilled in 2027 and signature of a permit west of Zohr

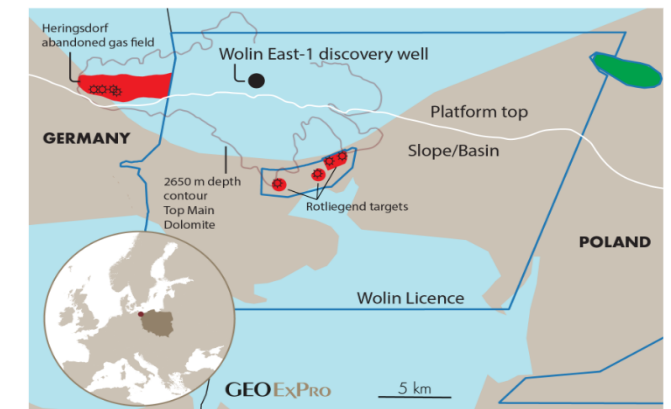


Last Exploration paces in Europe ? An Offshore Poland discovery !

Wolin East-1 discovery close to German border by CEP 100% operator (Central Europe Petroleum: Canadian Company) **WD : 6m ; TD : 2715 m**

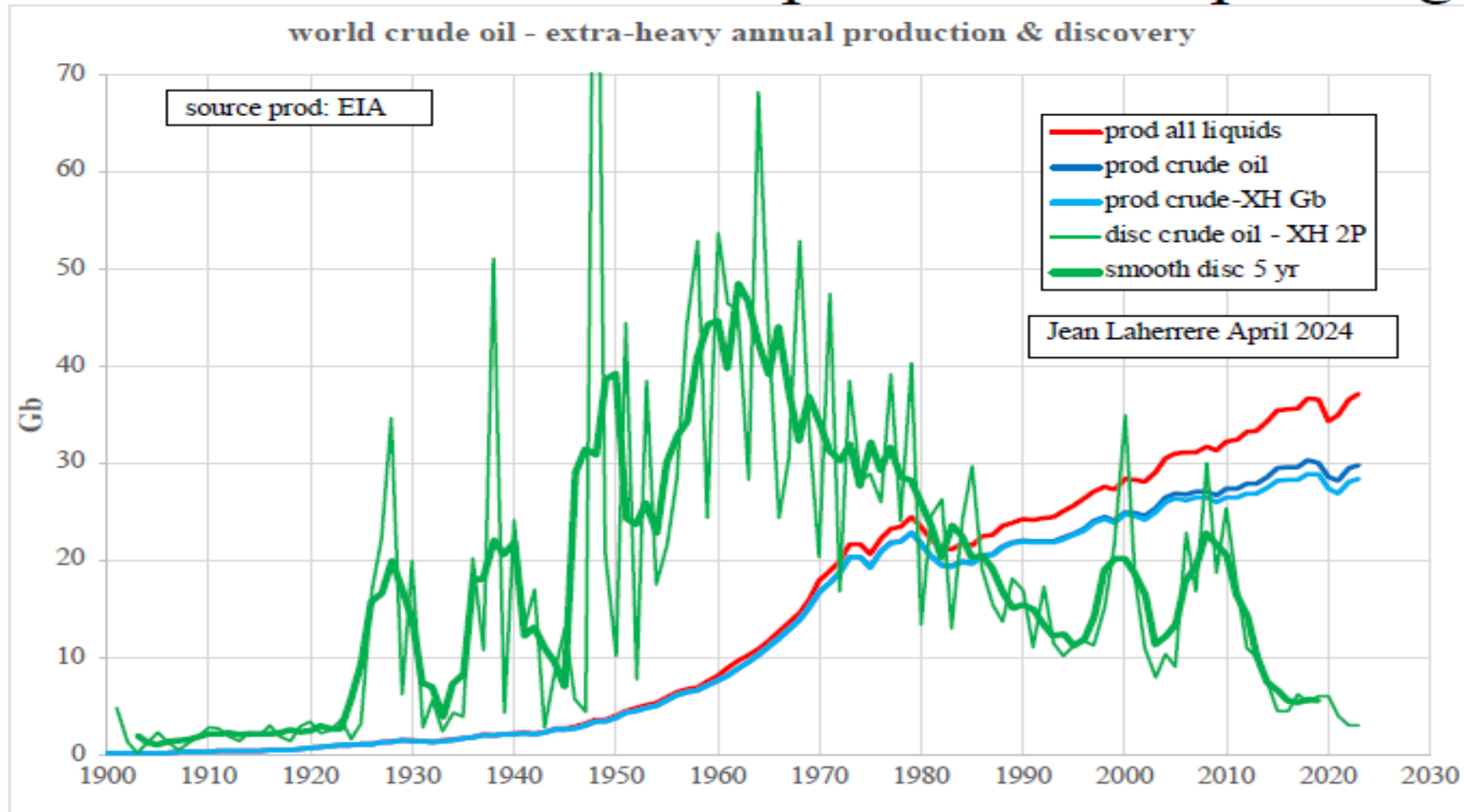
Encountered a 60 m HC column in good dolomitic reservoir Haupt Dolomite (Zechstein), Light oil : 33° API

Not tested but good Phi-K properties assumed from logs/cores
Reserves could be as high as 200 Mboe,



Oil Discoveries and Production

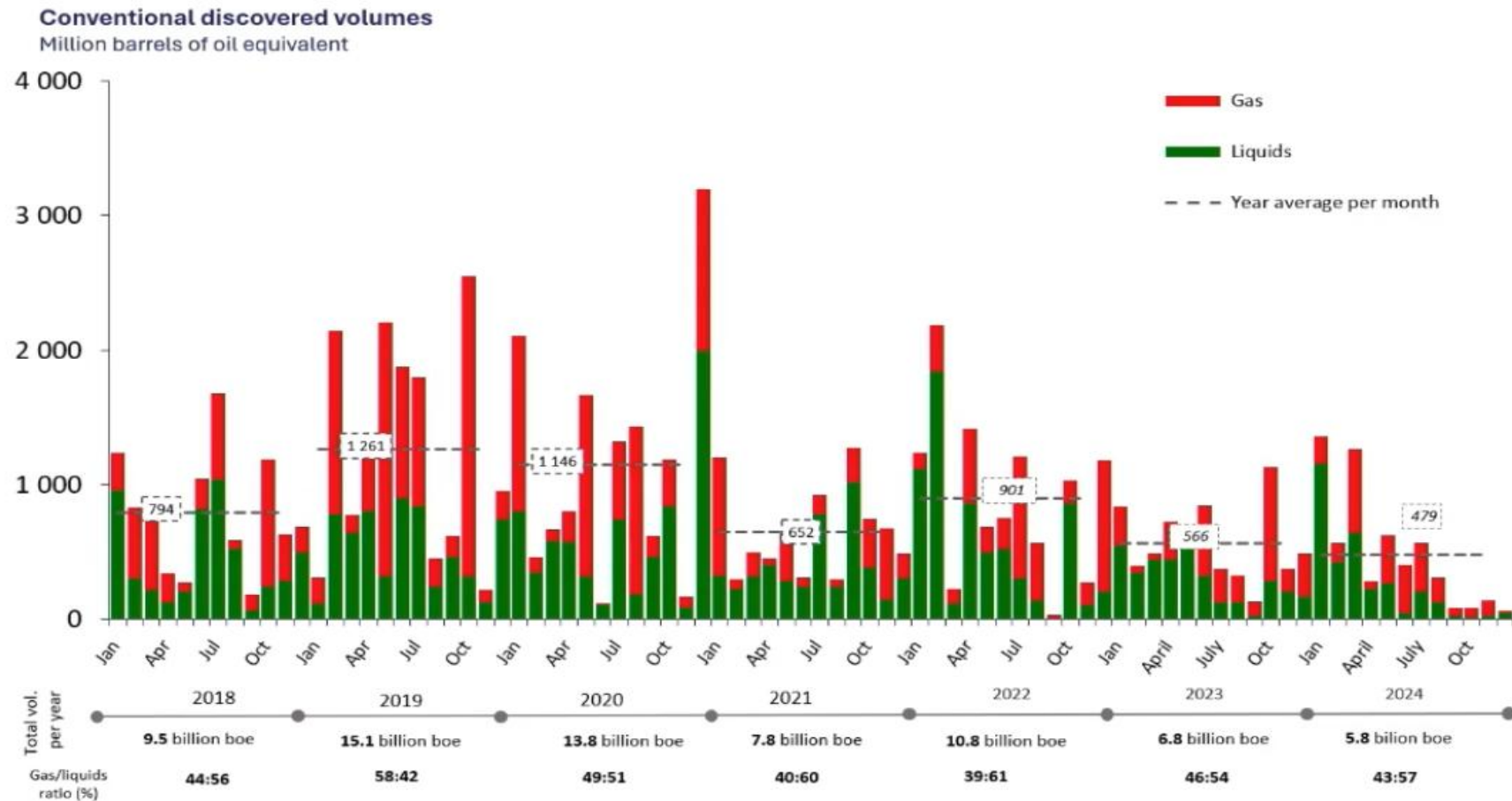
In 2020: Oil Discoveries = 5 Gb/year, 20% of
Crude Oil Production = 30 Gb/year



2018 - 2024 Oil & Gas Discoveries by Categories

Record-low Discoveries in 2024

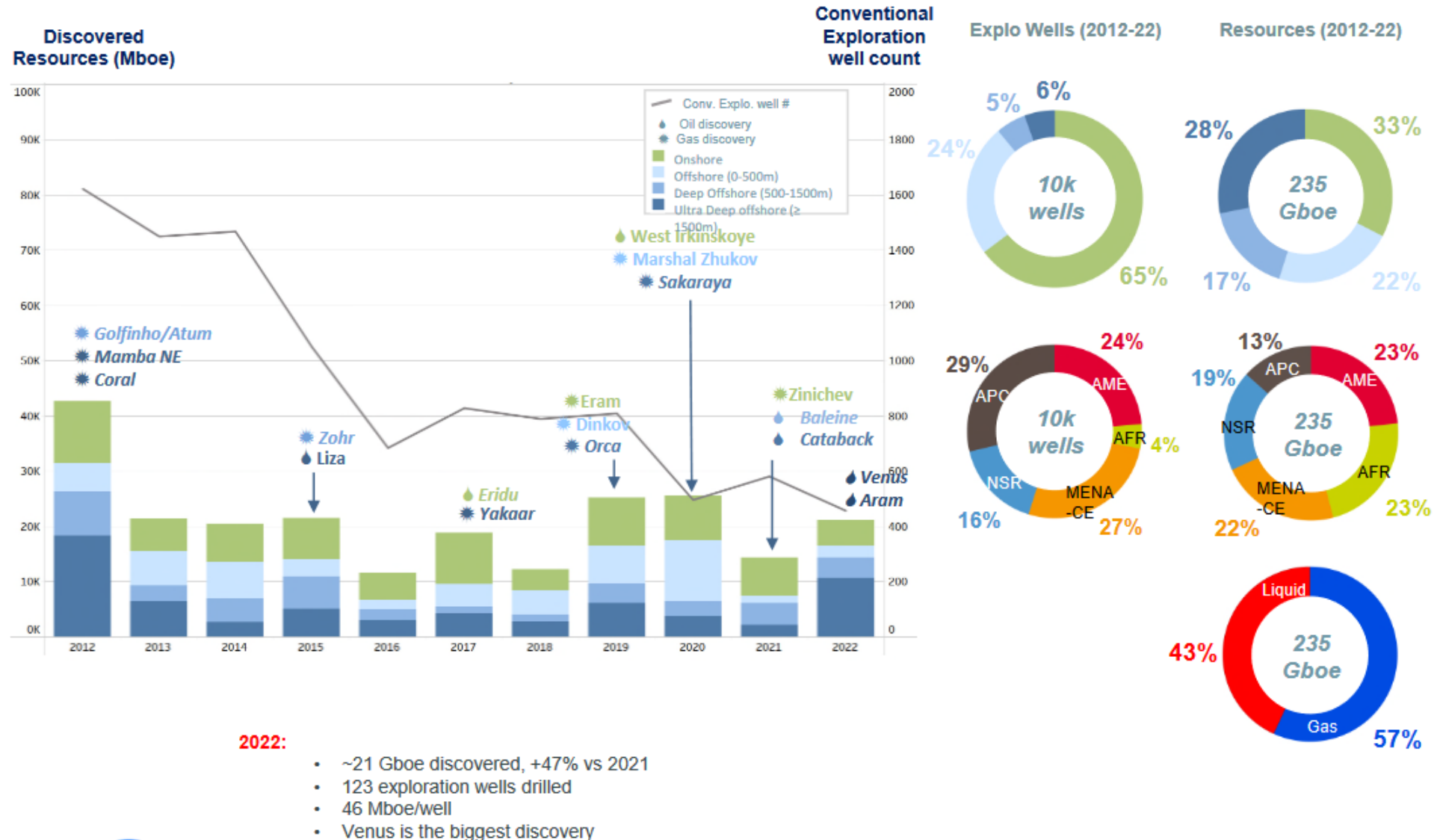
2024 recorded record-low new oil discoveries: 3 billion barrels



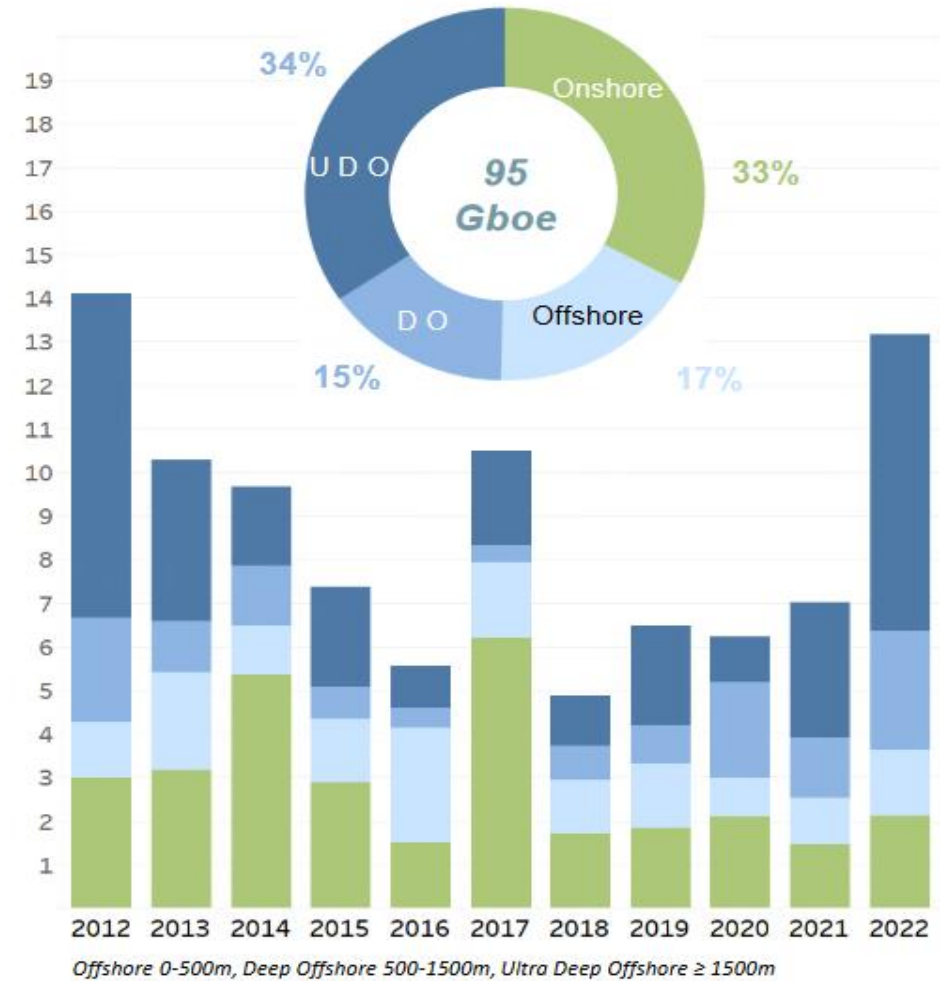
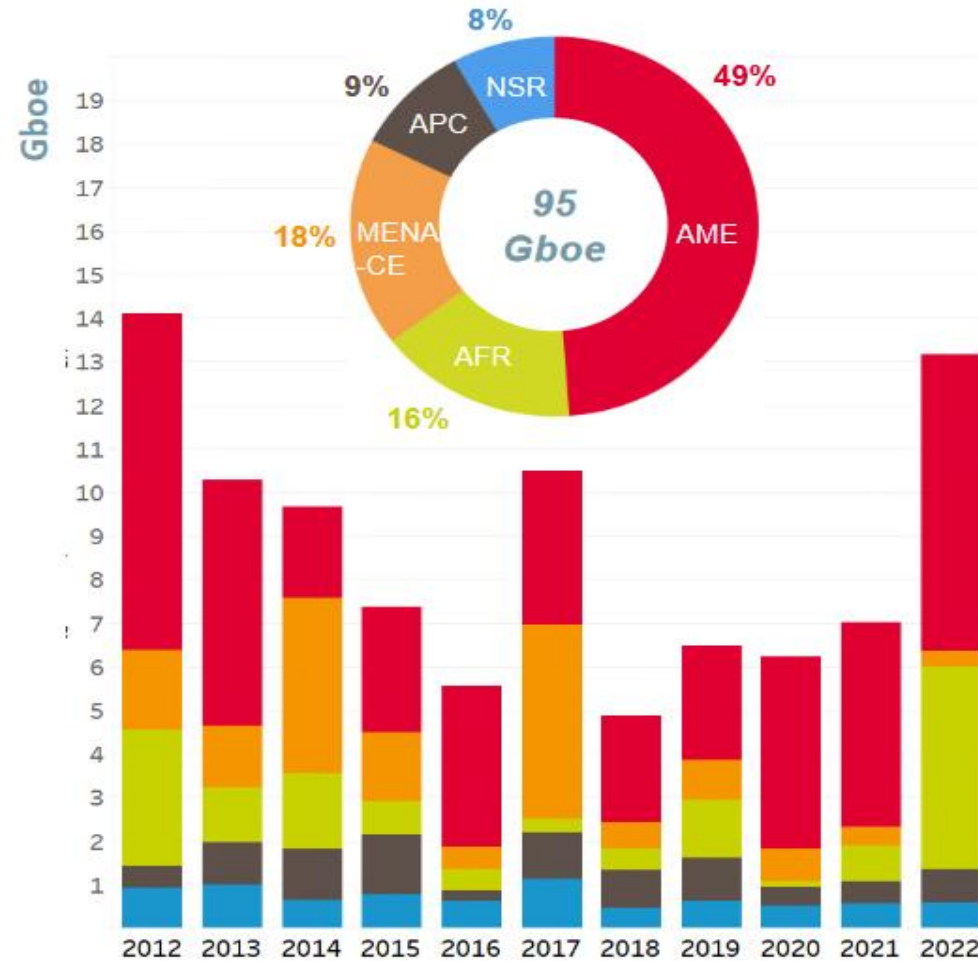
Source: Rystad Energy UCube; Rystad Energy research and analysis



2012 - 2022 Oil & Gas Discoveries by Categories



2012 - 2022 Liquids Discoveries by Regions

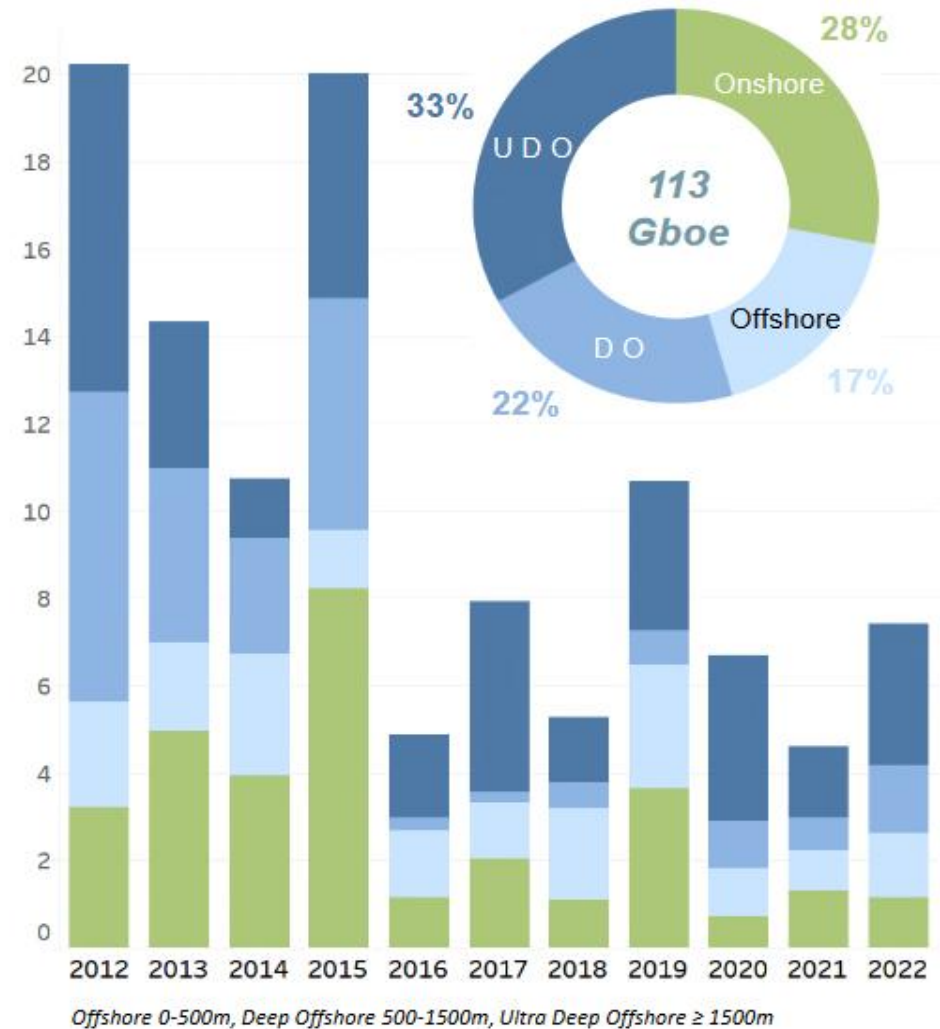
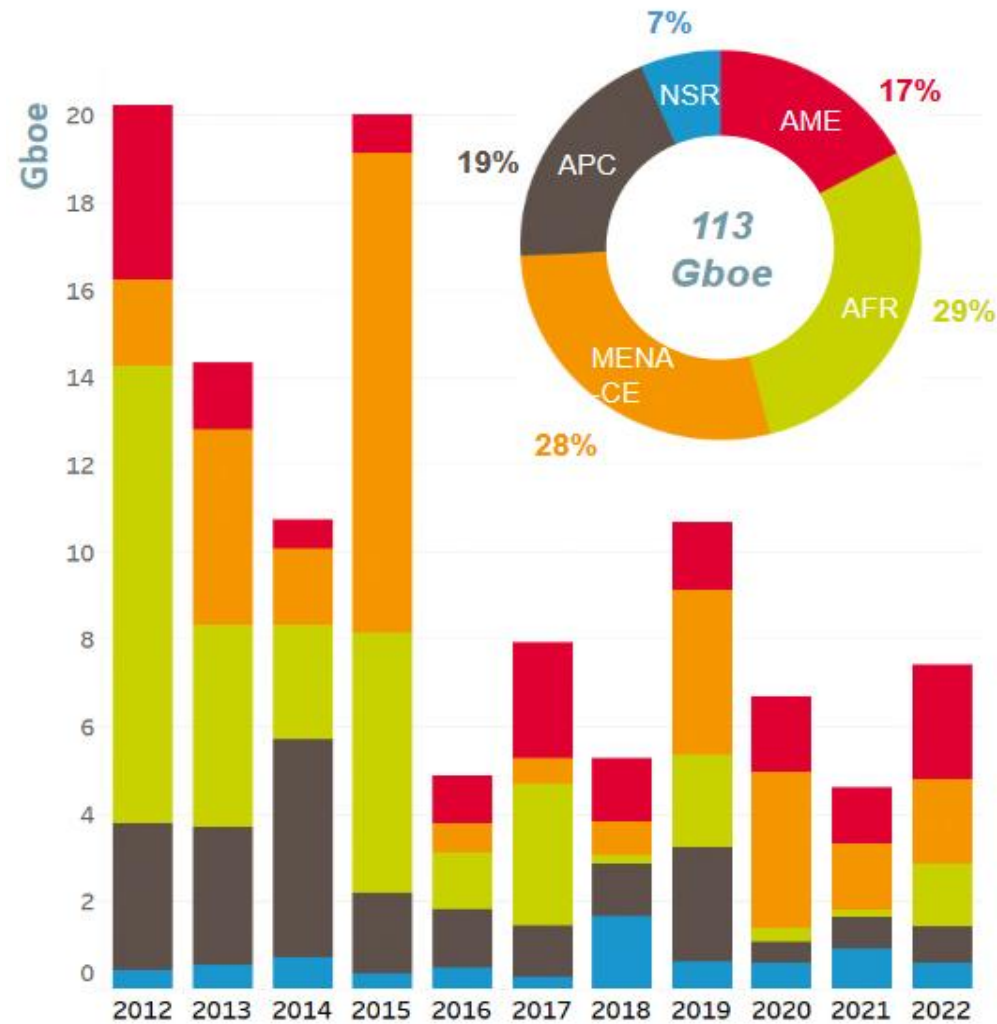


Source: TotalEnergies E&P Data Book 2023

Sources: IHS excluding Shelf GOM US, Lower48 & South onshore, Canada and Mairare, Tita, Urissane, Opal, Monai, Marolo in Brazil



2012 – 2022 Gas Discoveries by Regions

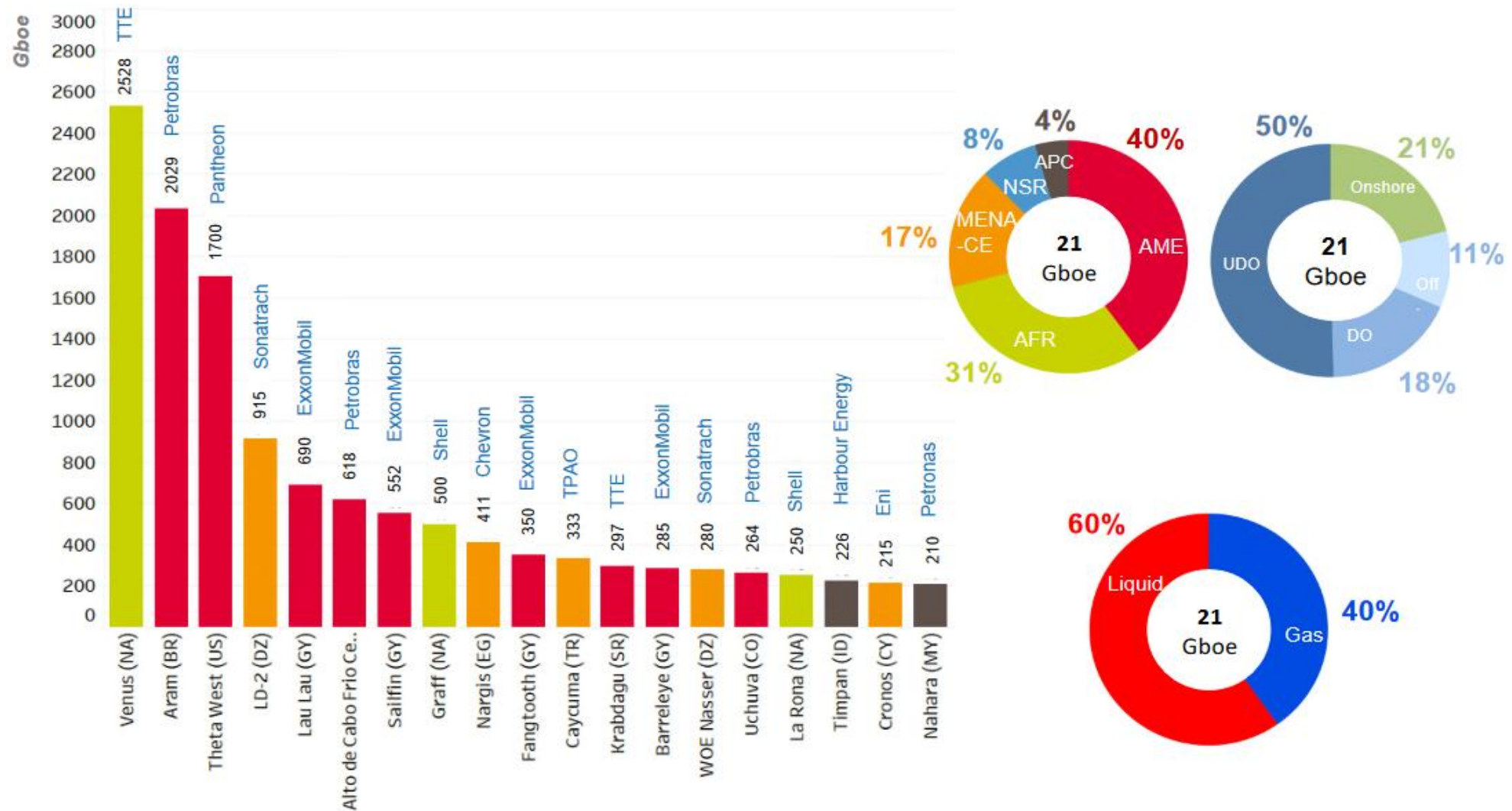


Source: TotalEnergies E&P Data Book 2023

Sources: IHS excluding Shelf GOM US, Lower48 & South onshore, Canada and Mairare, Tita, Urissane, Opal, Monai, Marolo in Brazil



2022 Oil & Gas Discoveries by Regions and Operators



Source: TotalEnergies E&P Data Book 2023

Sources: IHS, Westwood, WoodMackenzie (excluding: Shelf GOM US, Lower48 & South onshore Canada) and internal TTE



5

Production Profiles, Various Scenarios, Peak Oil

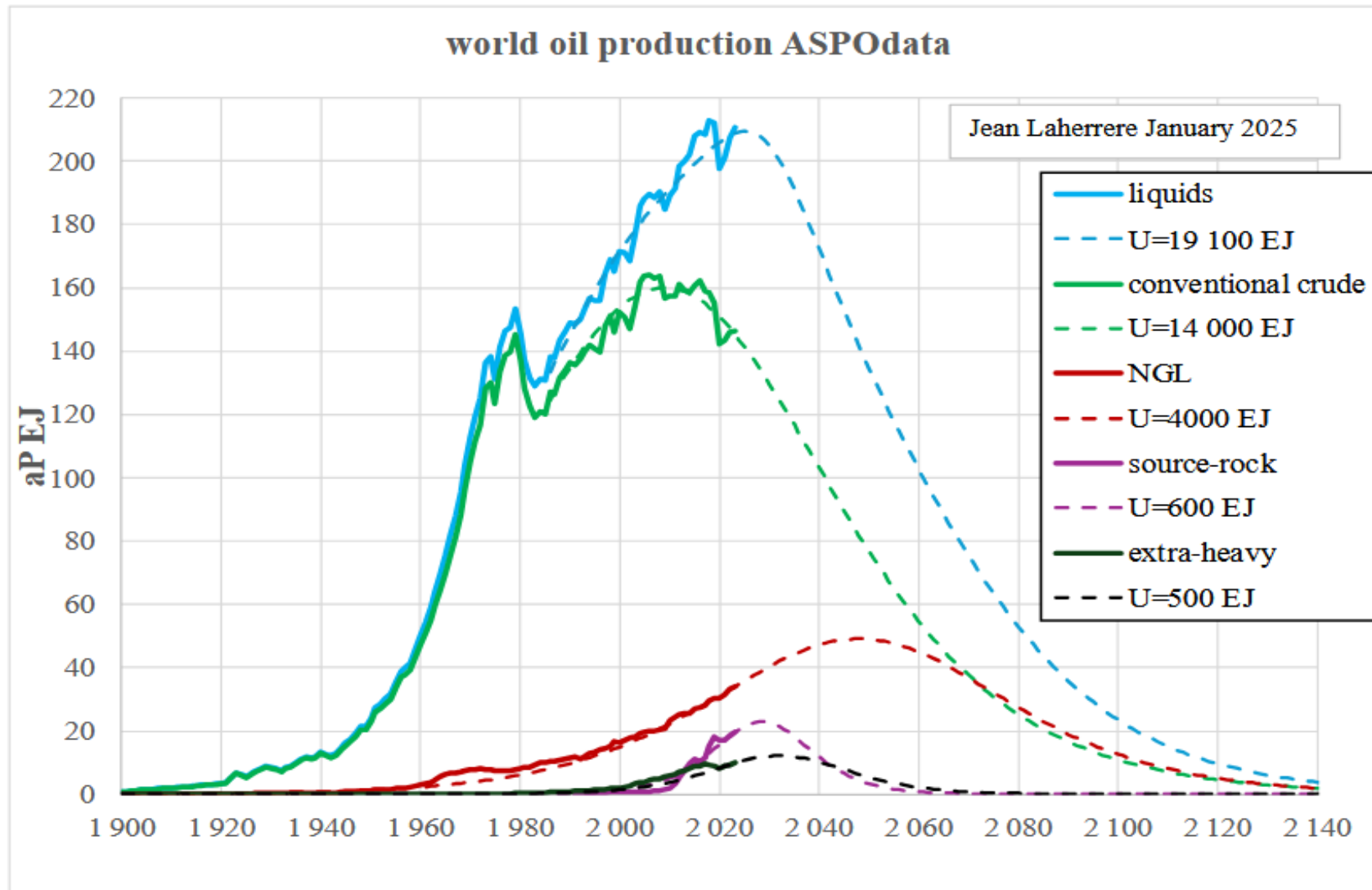


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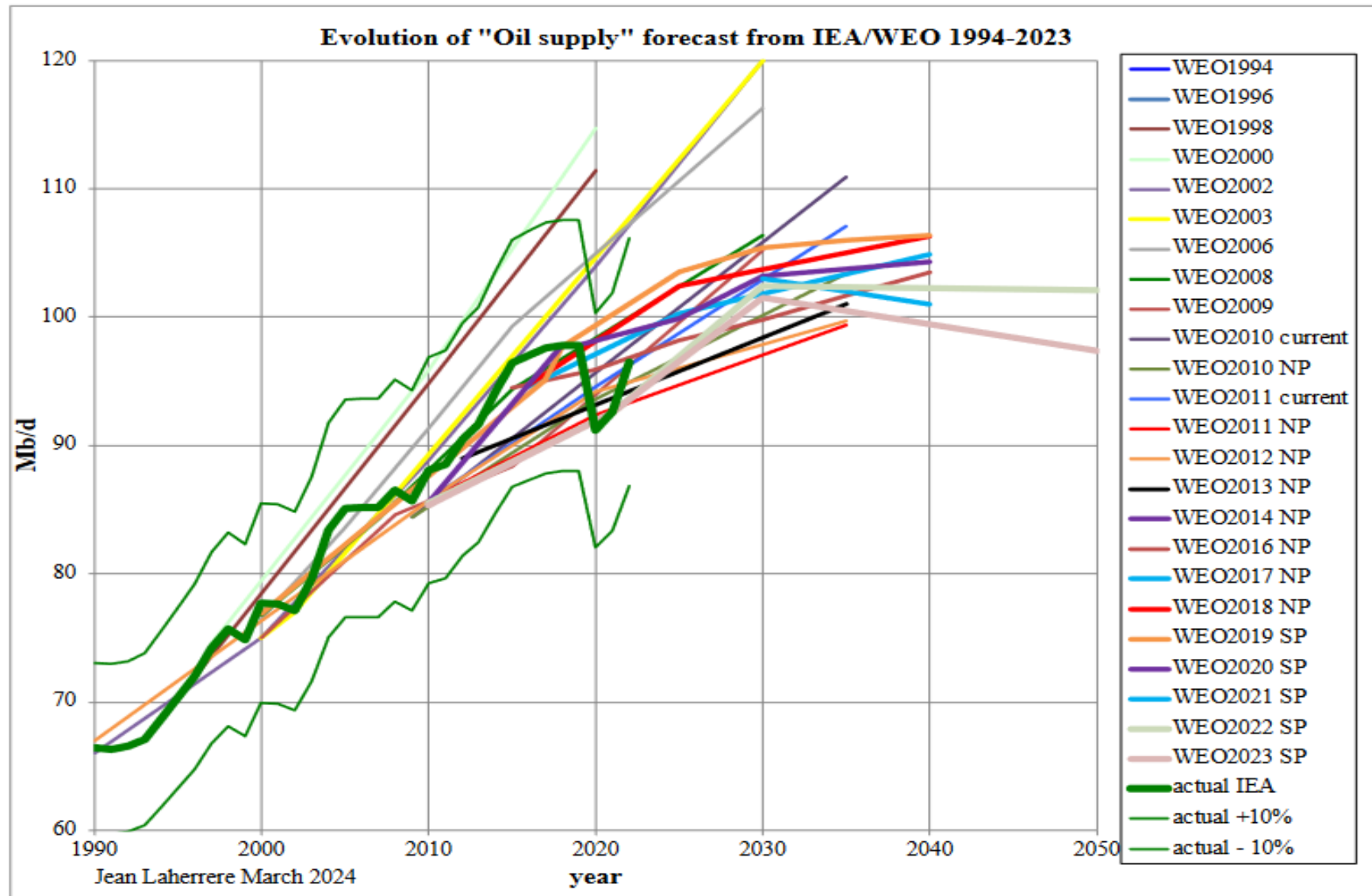
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Various World all Liquids profile forecasts



Developing Oil Production forecasts is not an easy task!



Peak Oil or not Peak Oil?

- Oil & Gas are finite resources, the size of discoveries are decreasing over time, the time of easy oil is over.
- It is therefore anticipated that the world oil and gas production profiles will reach a maximum and then decline.
- During the last decades, large debates have emerged regarding the occurrence of a peak oil, with different opinions from companies, geologists, technical experts,.....For conventional Oil, Peak Oil has been reached in 1970 in the US.....World Peak Oil in 2018?
- The questions addresses the evolution of the demand, the level of technical and commercial remaining resources, the amounts of new investments, the influence of geopolitical aspects, together with the new constraints related to Climate Change and Energy transition.
- The development of unconventional hydrocarbons generates additional potential resources, with additional potential production, depending upon economic viability. But these developments will be also constrained by the growth of CO₂ emissions and the Climate Change challenges.
- So, a peak oil? More probably, an undulating production plateau. Start-up of decline: 2026-2027, later? Depends upon the evolution of the Energy mix constrained by the Climate Change.



1 – Key considerations about Peak Oil impact

- ◆ Oil and gas will still be produced until the end of the 21st century, very likely at lower levels of production than today. The challenges characterizing the CO₂ emissions growth and the climate change major problem will have an impact on the oil demand and the management of oil production.
- ◆ When the world oil production will reach the “peak” or most probably a “plateau”, radical changes will occur.
- ◆ The oil and gas industries environment will probably be characterized by prices evolution with less political interference in those prices. Renewable Energy will take a more prominent share.
- ◆ After the oil peak or plateau, oil and gas prices will see a change of logic: they will become related to those of their substitutes (reversal from the past).
- ◆ GHG emissions and remaining “carbon budget” will play an important role.
- ◆ As soon as world oil production starts declining, OPEC will lose its price-policing role.
- ◆ And Oil & Gas future productions will continue to be subject to geopolitical turmoils.
- ◆ The Energy Transition prospects are subject to recent US Trump Administration which is promoting a new strong development of hydrocarbons sector (Drill, baby, drill!)



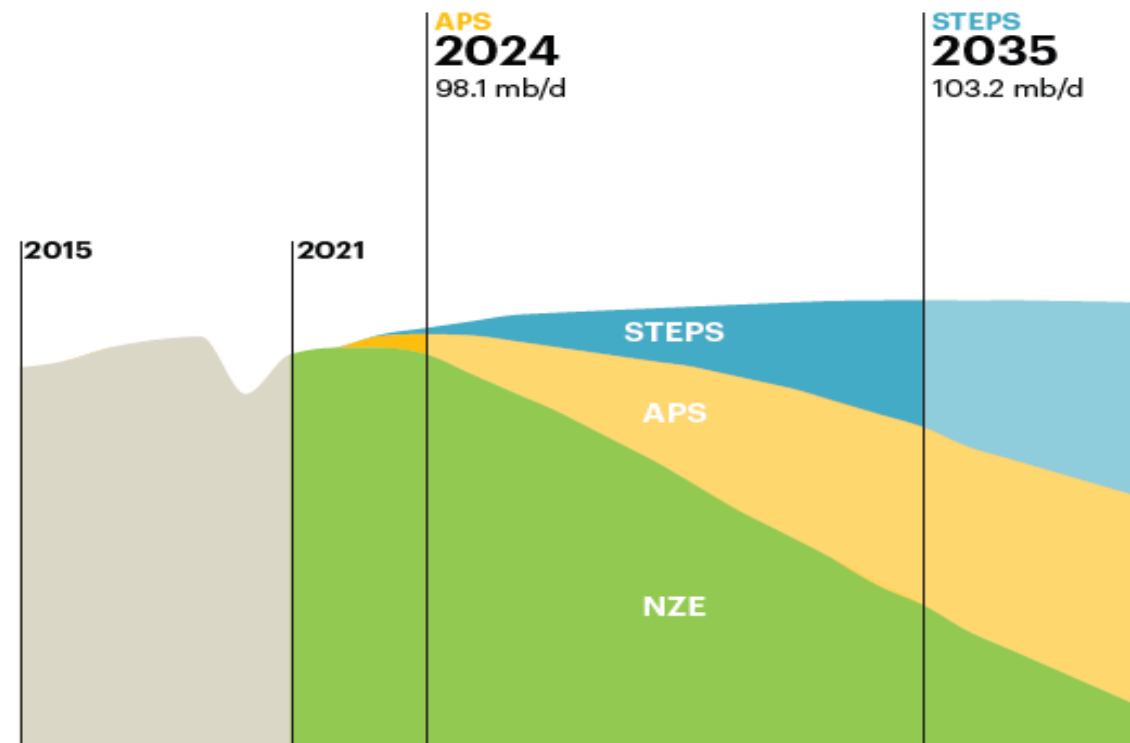
2 – Key considerations about Peak Oil impact

- ◆ Many challenges will have an impact: the development of light Tight Oil, Shale Oil in the US, the consequences of crude oil prices fluctuations, the political attitude of OPEC members regarding the control of the market, the control of CO₂ emissions and the management of climate change evolution, involving the development of renewable energy.....
- ◆ The Covid-19 sanitary crisis has generated important consequences on the Hydrocarbons business in 2021, 2022 and later, together with the Russia-Ukraine war in 2022, and more recently beginning 2026 the US-Iran war.
- ◆ Nevertheless, putting aside the current geopolitical situation, the whole 21st century could be a dynamic age for energy companies, for the service companies and contractors, which have to strongly adapt themselves to the energy transition and to an uncertain environment.
- ◆ It could also be a golden age for renewable energy and nuclear energy subject to good economic decisions and to a top level management & control, in relation to safety issues.
- ◆ Societal and environmental aspects will remain more and more important, as part of the decision making processes.



Reminder: Oil/Liquids Production IEA 2022 Scenarios

When does oil demand peak...



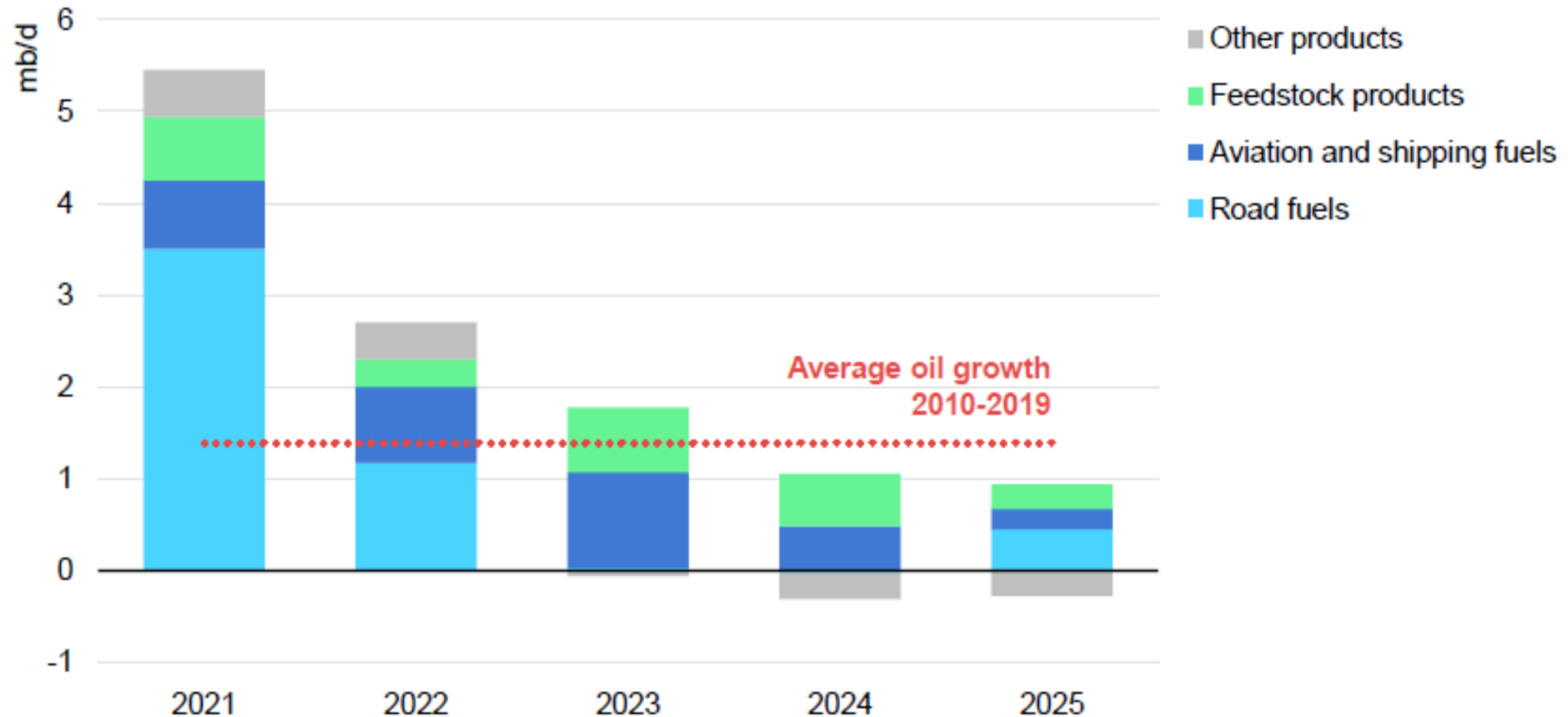
**Peaks in oil demand rest on changes in transport.
Oil use in petrochemicals is harder to shift.**



World Oil Demand Growth by Sector by IEA 2026

Oil Demand Growth is declining

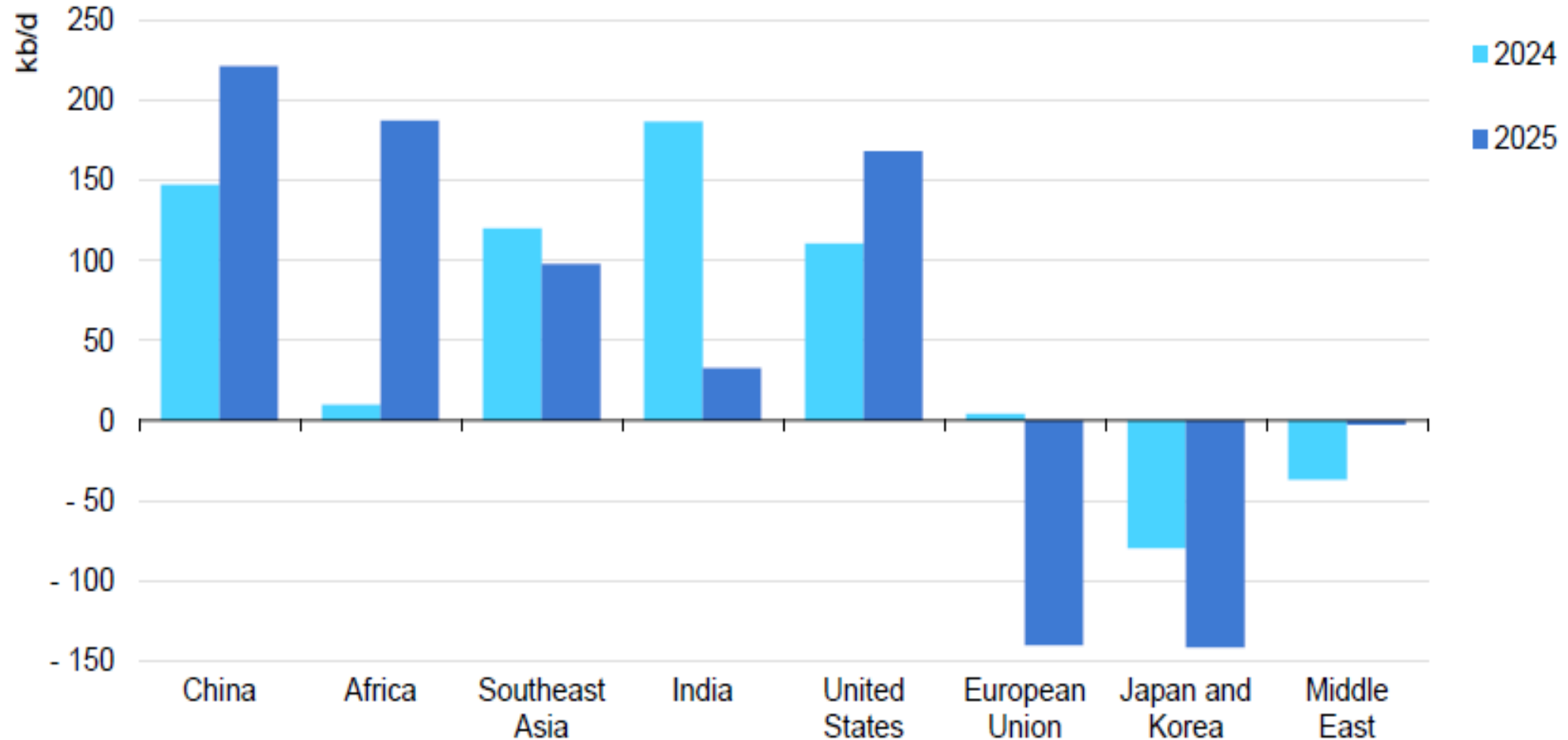
Global oil demand growth by sector, 2021-2025



World Oil Demand change by Region by IEA 2026

Decline in EU, Japan & Korea

Annual change in oil demand by region, 2024-2025



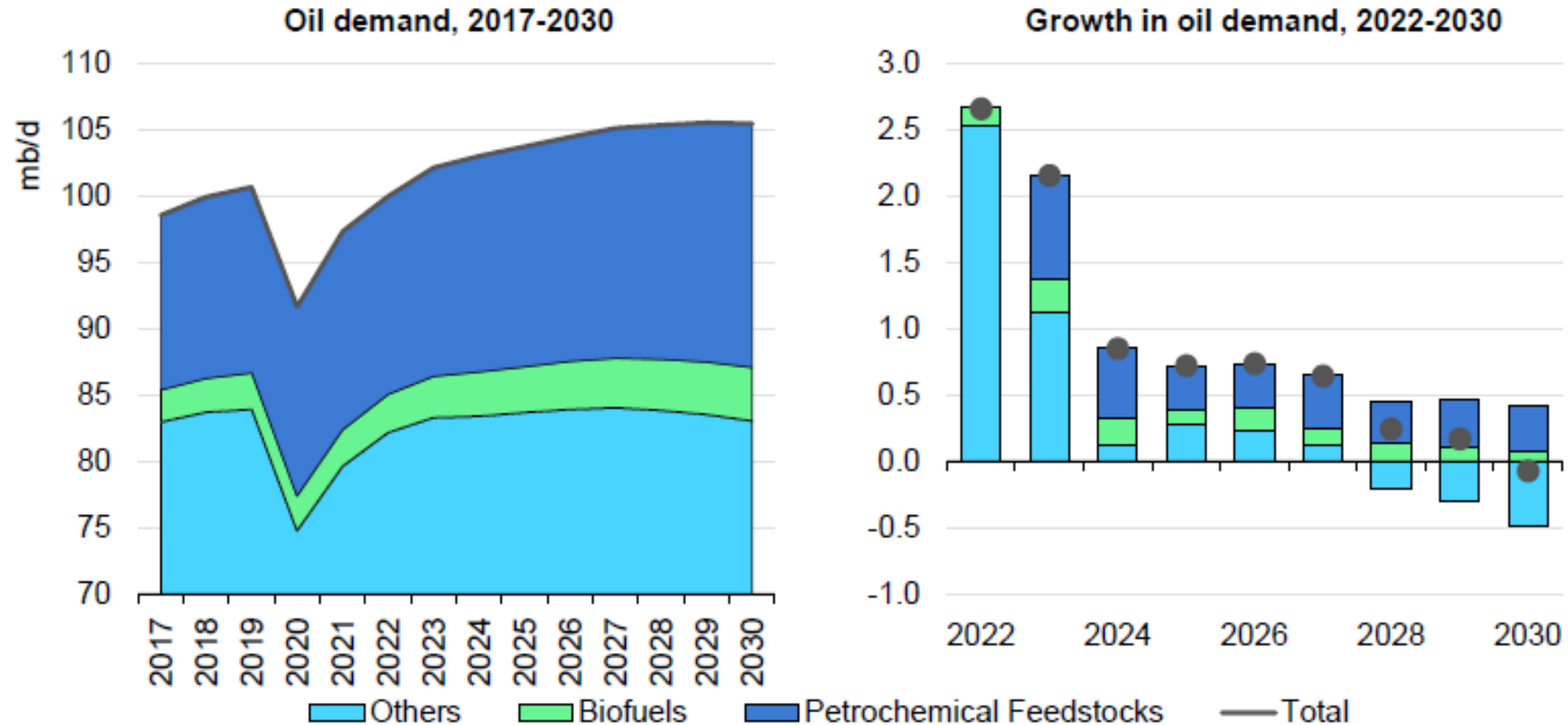
Source: IEA Global Energy Review 2026



World Oil Demand dominated by Petrochemicals

IEA 2025 Forecasts – A plateau at 105 Mb/d as from 2027?

World oil demand forecast to plateau this decade



World Oil Demand by Region

IEA 2025 Forecasts – A stabilization as from 2026/2027?

World oil demand by region, 2019-2030 (mb/d)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2024-30 Growth Rate	2024-30 Growth
North America	24.9	21.9	23.7	24.3	24.6	24.5	24.6	24.5	24.4	24.3	24.1	24.0	-0.4%	-0.6
S&C America	6.7	5.7	6.3	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.4	7.4	1.4%	0.6
Europe	15.8	13.7	14.4	14.9	14.8	14.9	14.9	14.8	14.6	14.5	14.3	14.1	-0.8%	-0.7
Africa	4.2	3.9	4.4	4.5	4.6	4.6	4.8	4.9	5.0	5.2	5.3	5.4	2.9%	0.9
Middle East	8.9	8.3	8.6	9.1	9.2	9.2	9.4	9.5	9.6	9.6	9.4	9.2	-0.1%	0.0
Eurasia	4.3	4.0	4.3	4.4	4.4	4.3	4.4	4.4	4.5	4.6	4.6	4.6	1.1%	0.3
Asia Pacific	36.0	34.2	35.6	36.3	38.0	38.6	38.9	39.4	39.8	40.1	40.4	40.7	0.9%	2.0
World	100.7	91.7	97.4	100.0	102.2	103.0	103.8	104.5	105.1	105.4	105.6	105.5	0.4%	2.5
Annual change	0.7	-9.0	5.7	2.7	2.2	0.9	0.7	0.7	0.6	0.2	0.2	-0.1		



World Oil Demand by Product

IEA 2025 Forecasts – A stabilization as from 2026/2027?

World oil demand by product, 2019-2030 (mb/d)

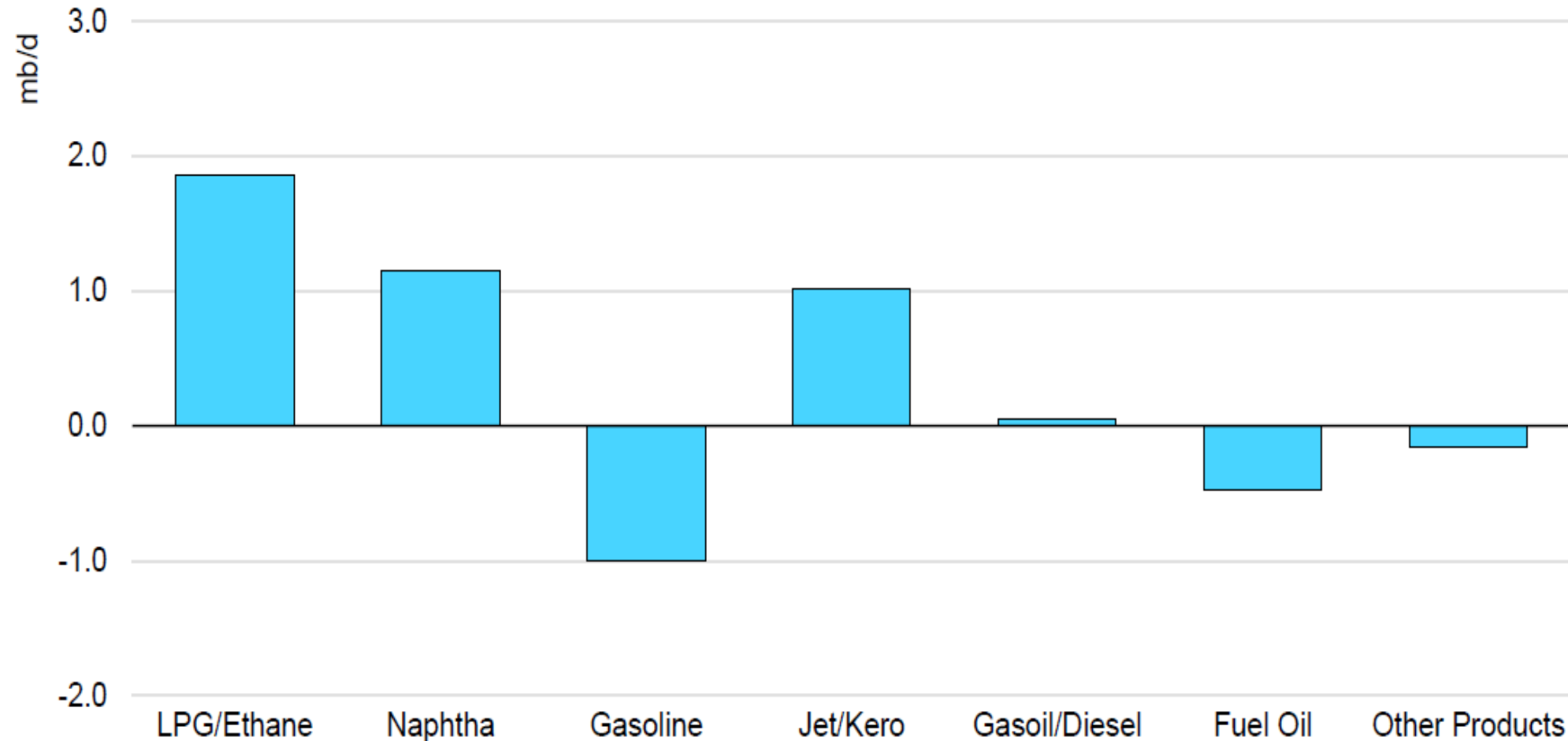
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2024-30 Growth Rate	2024-30 Growth
LPG/Ethane	13.2	13.3	13.6	14.2	14.6	15.1	15.4	15.6	16.1	16.4	16.7	17.0	2.0%	1.9
Naphtha	6.7	6.6	7.0	6.8	7.1	7.3	7.5	7.8	7.9	8.1	8.2	8.4	2.5%	1.2
Gasoline	26.9	23.9	26.0	26.6	27.1	27.2	27.4	27.3	27.2	27.0	26.7	26.2	-0.6%	-1.0
Jet/Kerosene	7.9	4.6	5.2	6.1	7.2	7.6	7.7	7.8	8.0	8.2	8.4	8.6	2.1%	1.0
Gasoil/Diesel	28.7	26.7	28.2	28.7	28.4	28.3	28.3	28.4	28.5	28.5	28.4	28.3	0.0%	0.0
Residual fuel oil	6.2	5.8	6.3	6.5	6.5	6.5	6.5	6.5	6.4	6.3	6.2	6.1	-1.2%	-0.5
Other products	11.1	10.8	10.9	11.2	11.2	11.0	11.0	11.0	11.0	11.0	11.0	10.9	-0.2%	-0.2
Total products	100.7	91.7	97.4	100.0	102.2	103.0	103.8	104.5	105.1	105.4	105.6	105.5	0.4%	2.5
Annual change	0.7	-9.0	5.7	2.7	2.2	0.9	0.7	0.7	0.6	0.2	0.2	-0.1		



Oil Demand changes 2024 – 2030/IEA 2025

Increase for LPG, Naphta, Kero – Decrease for Gasoline, Fuel Oil

Growth in world oil demand by product, 2024-2030



Source: IEA Oil 2025 – Analysis & forecast to 2030



World Oil Supply by Region

IEA 2025 Forecasts – A stabilization as from 2026/2027?

World Oil Production by Region (mb/d)

World Oil Production by Region (million barrels per day)								
	2024	2025	2026	2027	2028	2029	2030	2024-30
Africa	7.2	7.4	7.4	7.5	7.5	7.4	7.3	0.1
Latin America	7.4	7.7	7.9	8.0	8.4	8.5	8.3	0.9
North America	28.3	28.9	29.0	29.3	29.3	29.2	29.2	0.9
China	4.3	4.4	4.4	4.4	4.3	4.3	4.2	-0.1
Other Asia	3.1	3.0	3.0	2.9	2.9	2.8	2.8	-0.3
Europe	3.3	3.4	3.4	3.2	3.1	3.0	2.8	-0.5
Eurasia	13.5	13.6	13.7	13.7	13.6	13.5	13.5	0.0
Middle East	30.2	30.6	31.1	31.6	32.1	32.4	32.7	2.5
Total Oil Production	97.3	99.0	99.9	100.5	101.2	101.1	100.6	3.4
Processing Gains	2.4	2.4	2.5	2.5	2.5	2.5	2.5	0.1
Global Biofuels	3.4	3.5	3.7	3.8	3.9	4.0	4.1	0.7
Total Supply	103.1	104.9	106.0	106.8	107.6	107.6	107.2	4.1
<i>OPEC Crude</i>	27.2	27.6	27.7	27.7	27.6	27.6	27.7	0.4
<i>OPEC NGLs¹</i>	5.5	5.7	5.9	6.3	6.5	6.7	6.9	1.3
<i>Non-OPEC OPEC+</i>	17.1	17.1	17.1	16.9	16.7	16.5	16.3	-0.8
Total OPEC+	49.9	50.4	50.6	50.8	50.8	50.8	50.9	1.00
<i>Memo: Call on OPEC+</i>	41.6	40.9	40.6	40.3	39.6	39.6	39.8	-1.8

IEA. CC BY 4.0.

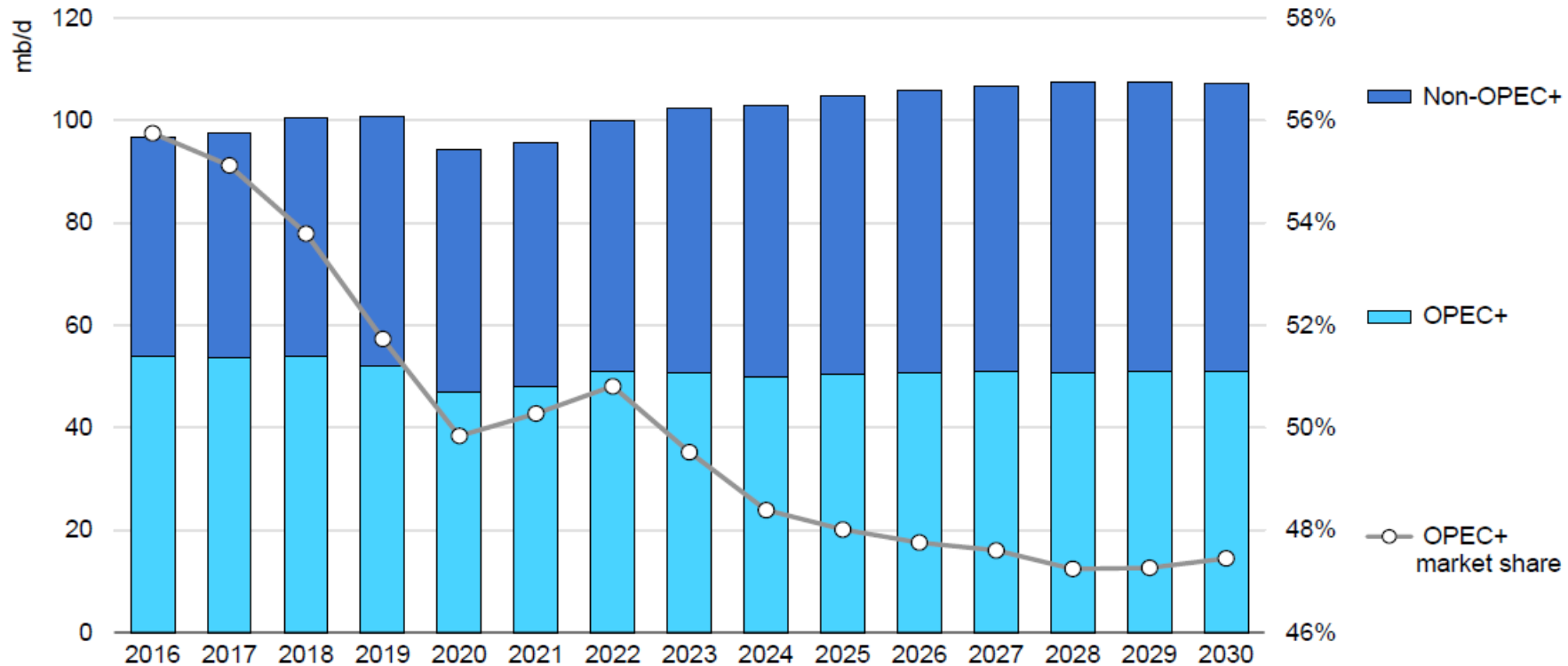
Notes: Forecast OPEC+ crude supply based on quota targets effective July 2025. ¹ Includes condensates reported by OPEC countries, oil from non-conventional sources, e.g. GTL in Nigeria and non-oil inputs to Saudi Arabian MTBE.



World Oil Supply OPEC+ & Non-OPEC

IEA 2025 Forecasts – Important decrease of OPEC+ market share

OPEC+ struggles to reclaim market share through the forecast period



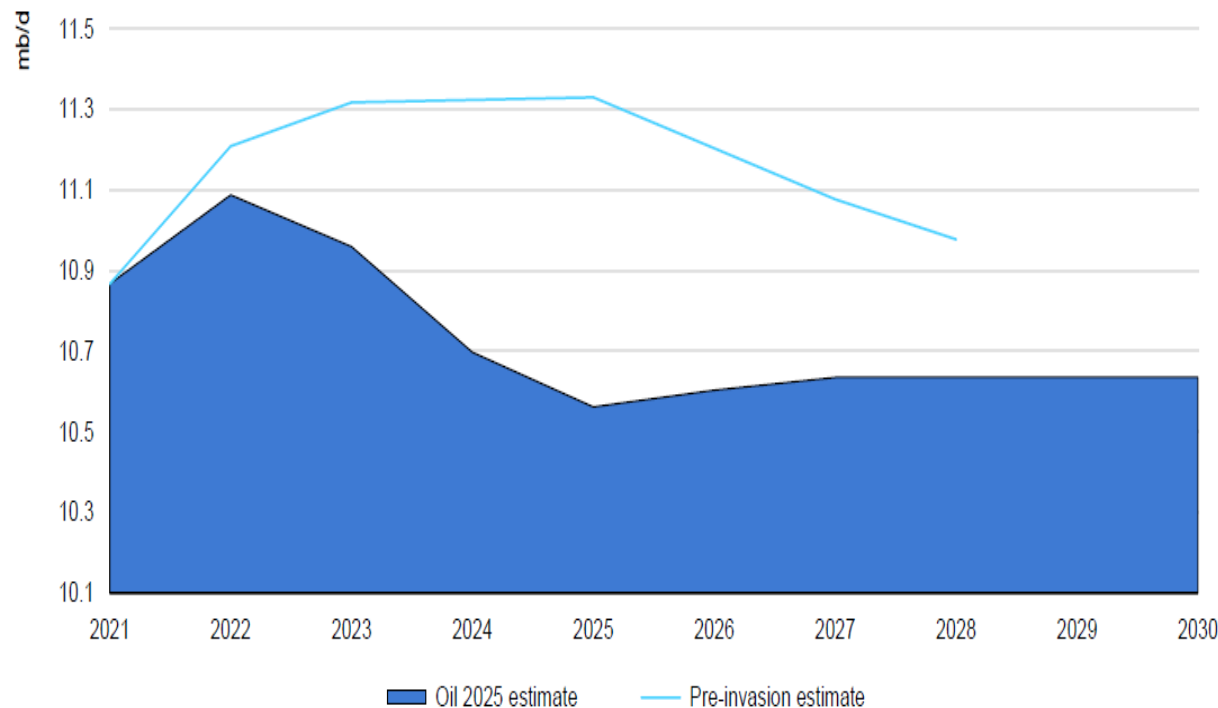
IEA. CC BY 4.0.

Notes: Forecast OPEC+ crude supply based on quota targets effective July 2025. Russia, Iran and Venezuela remain under sanctions. Russian and Iranian production levels are held at current levels through the forecast period. Venezuelan output is assumed to decrease to 600 kb/d by 2026 based on current sanctions. Chart is based on current OPEC+ composition throughout the 2016-2030 period.

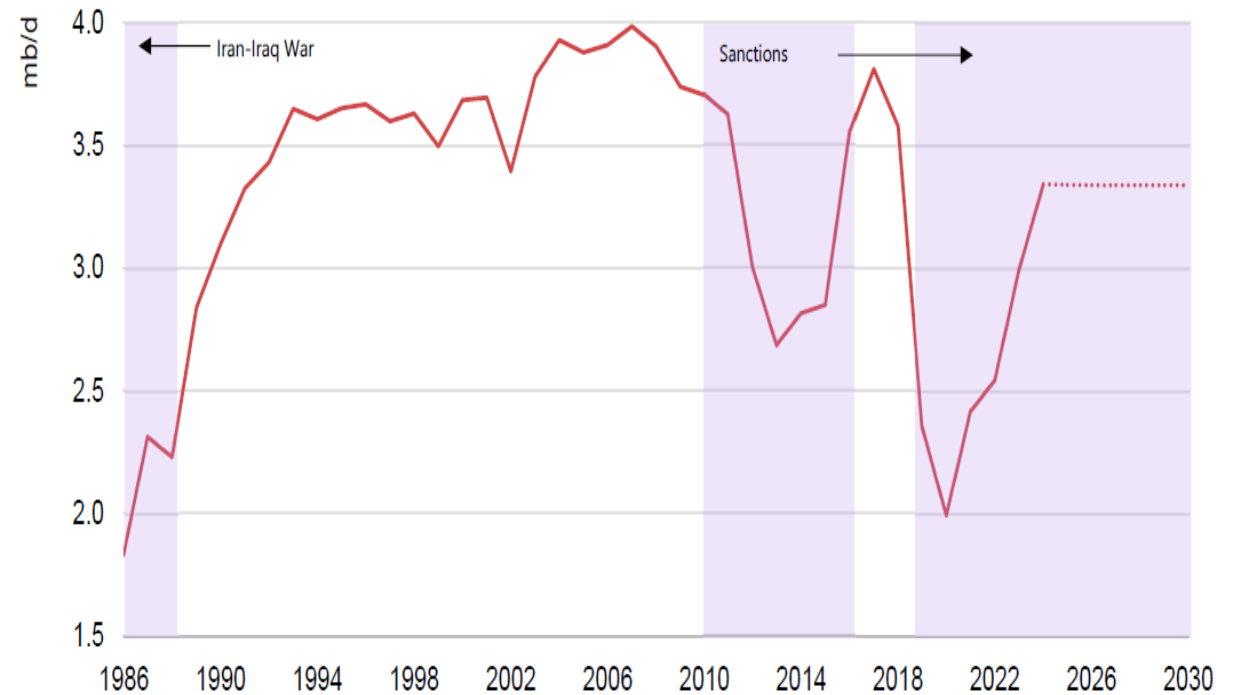


World Oil Supply – Two examples: Russia & Iran

Russia estimated total oil supply, 2021-2030

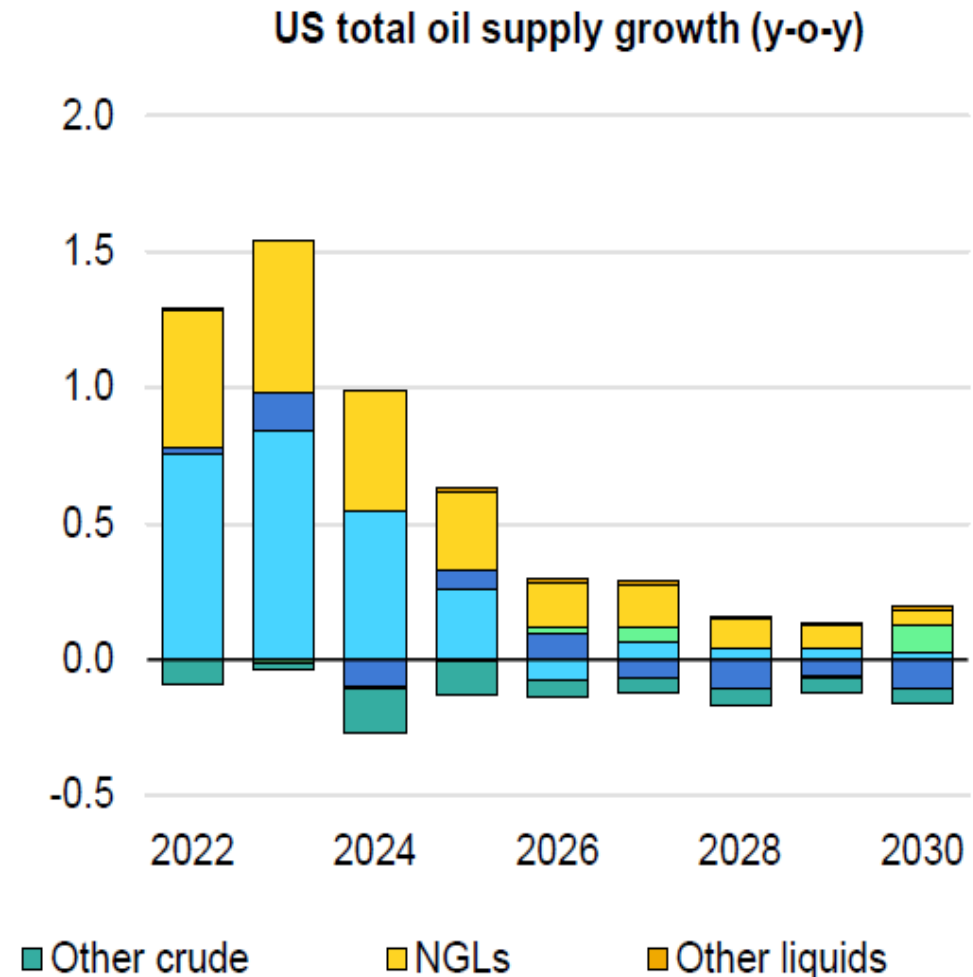
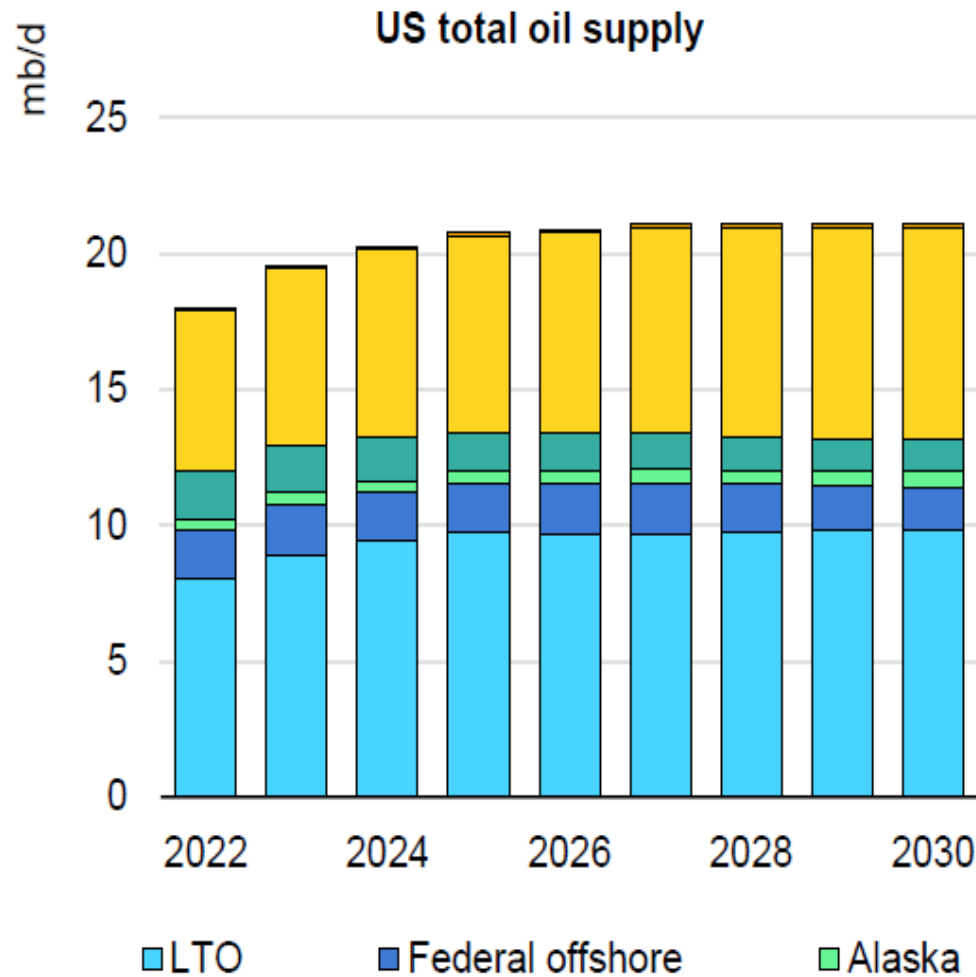


Iran crude oil production, 1986-2030



US Oil Supply – Moderate growth.....

US growth expectations moderate over the remainder of the decade, 2022-2030



Source: IEA Oil 2025 – Analysis & forecast to 2030



Oil & Refined Products Demand - IEA 2025 Forecasts

Oil demand and call on refined products (mb/d), 2024-2030

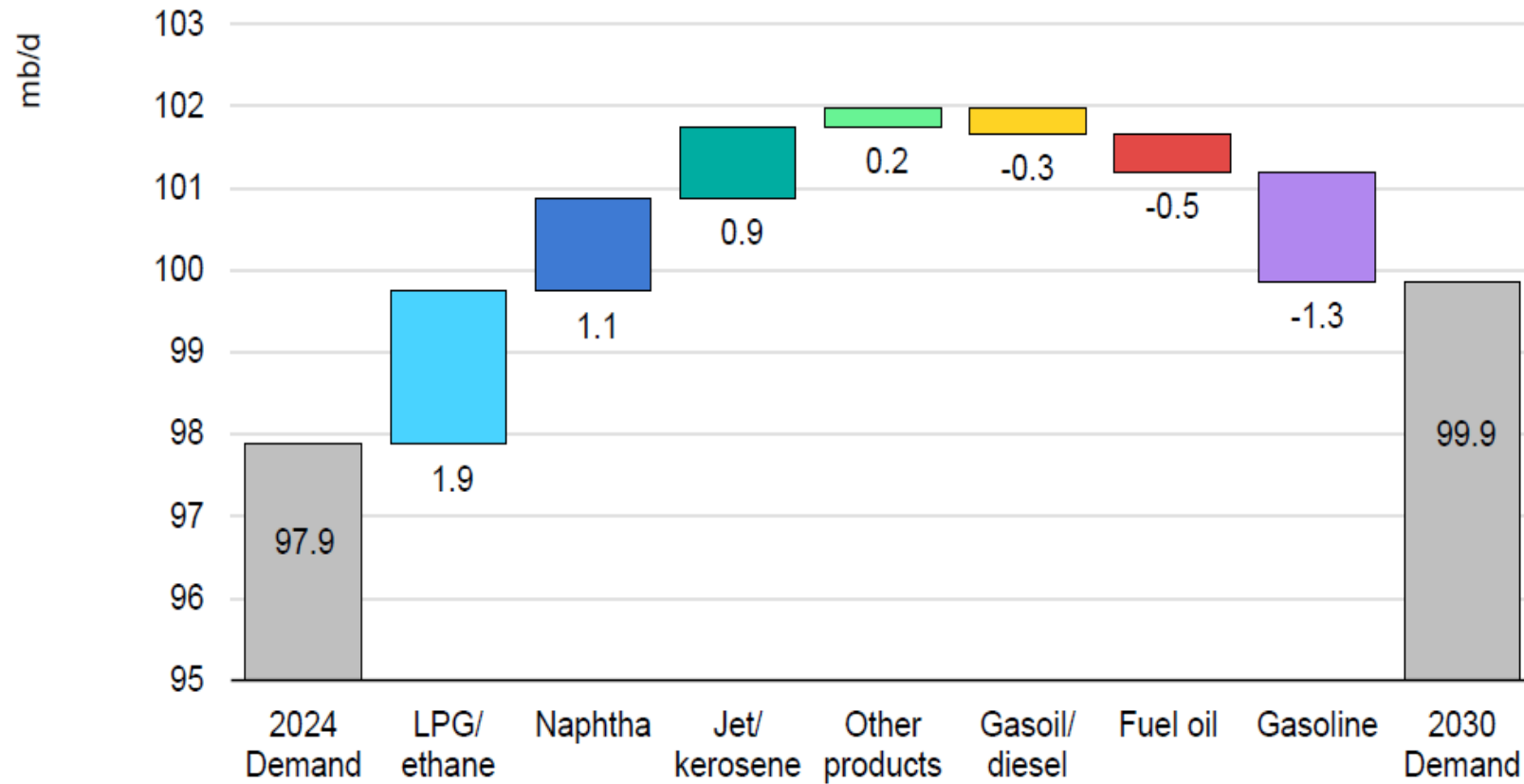
	2024	2025	2026	2027	2028	2029	2030	2024-30 growth
Total liquids demand	103.0	103.8	104.5	105.1	105.4	105.6	105.5	2.5
Biofuels	3.4	3.5	3.7	3.8	3.9	4.0	4.1	0.7
Total Oil demand	99.6	100.3	100.8	101.4	101.5	101.5	101.4	1.8
CTL/GTL*/additives	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.2
Direct use of crude oil	1.0	1.0	0.9	0.8	0.7	0.6	0.5	-0.5
Total call on oil products	97.9	98.4	99.1	99.7	99.9	100.1	100.0	2.1
Fractionation products**	12.2	12.6	12.9	13.4	13.7	13.9	14.1	1.9
Refined product demand	85.6	85.8	86.2	86.3	86.2	86.1	85.9	0.3
Refinery market share	83.1%	82.7%	82.5%	82.1%	81.8%	81.6%	81.4%	-1.7%

Notes: *CTL = coal-to-liquids and GTL = gas-to-liquids. **Ethane, LPG and pentanes plus, excluding estimated diluent use in North America.



Oil Products Demand 2024/2030 - IEA 2025 Forecasts

Oil product demand by major product category, 2024-2030



IEA. CC BY 4.0.

Notes: Demand is net of CTL/GTL volumes and biofuels supply. Demand includes volumes met by NGLs supply. Other products demand excludes crude oil used in power generation.

Source: IEA Oil 2025 – Analysis & forecast to 2030

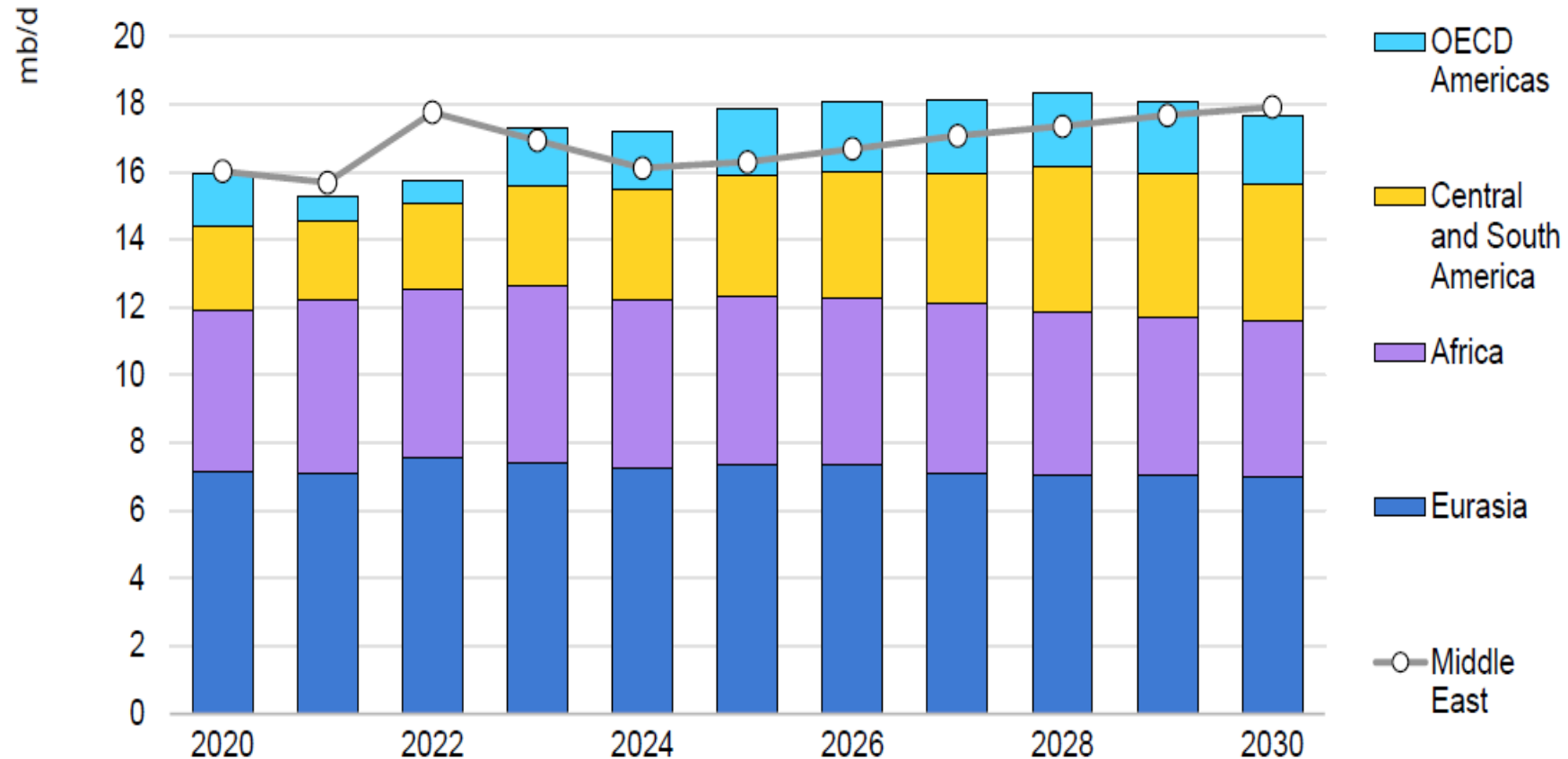
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Crude Oil Exports flows 2020 - 2030 - IEA 2025 Forecasts

Regional crude export flows, 2020-2030



IEA. CC BY 4.0.

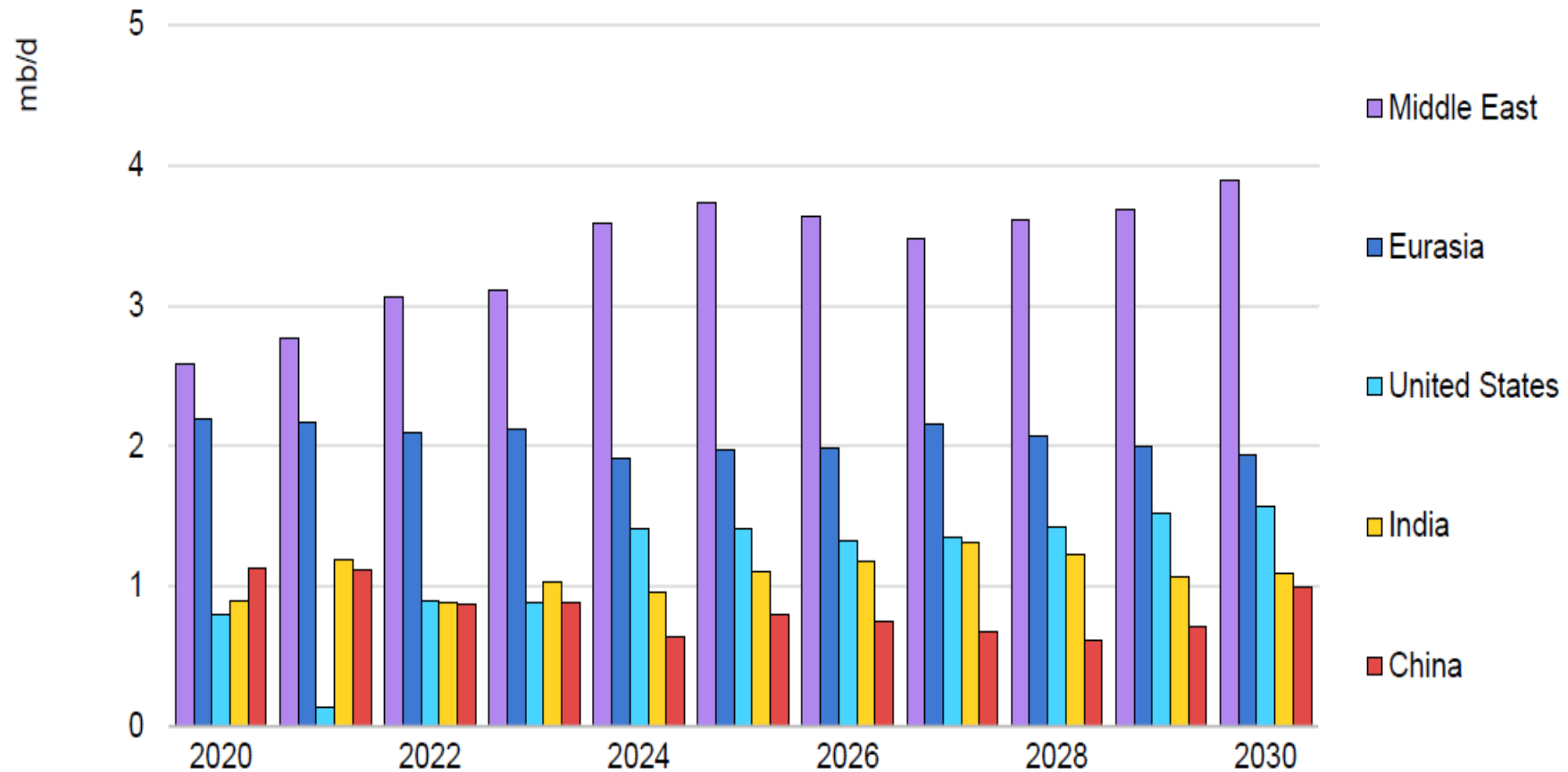
Note: Crude export flows are net of intra-regional flows.

Source: IEA Oil 2025 – Analysis & forecast to 2030



Major Refined Products Exporters 2020 - 2030 - IEA 2025

Major refined product exporters, 2020-2030



IEA. CC BY 4.0.

Note: Refined product exports exclude NGLs and biofuels.

Source: IEA Oil 2025 – Analysis & forecast to 2030

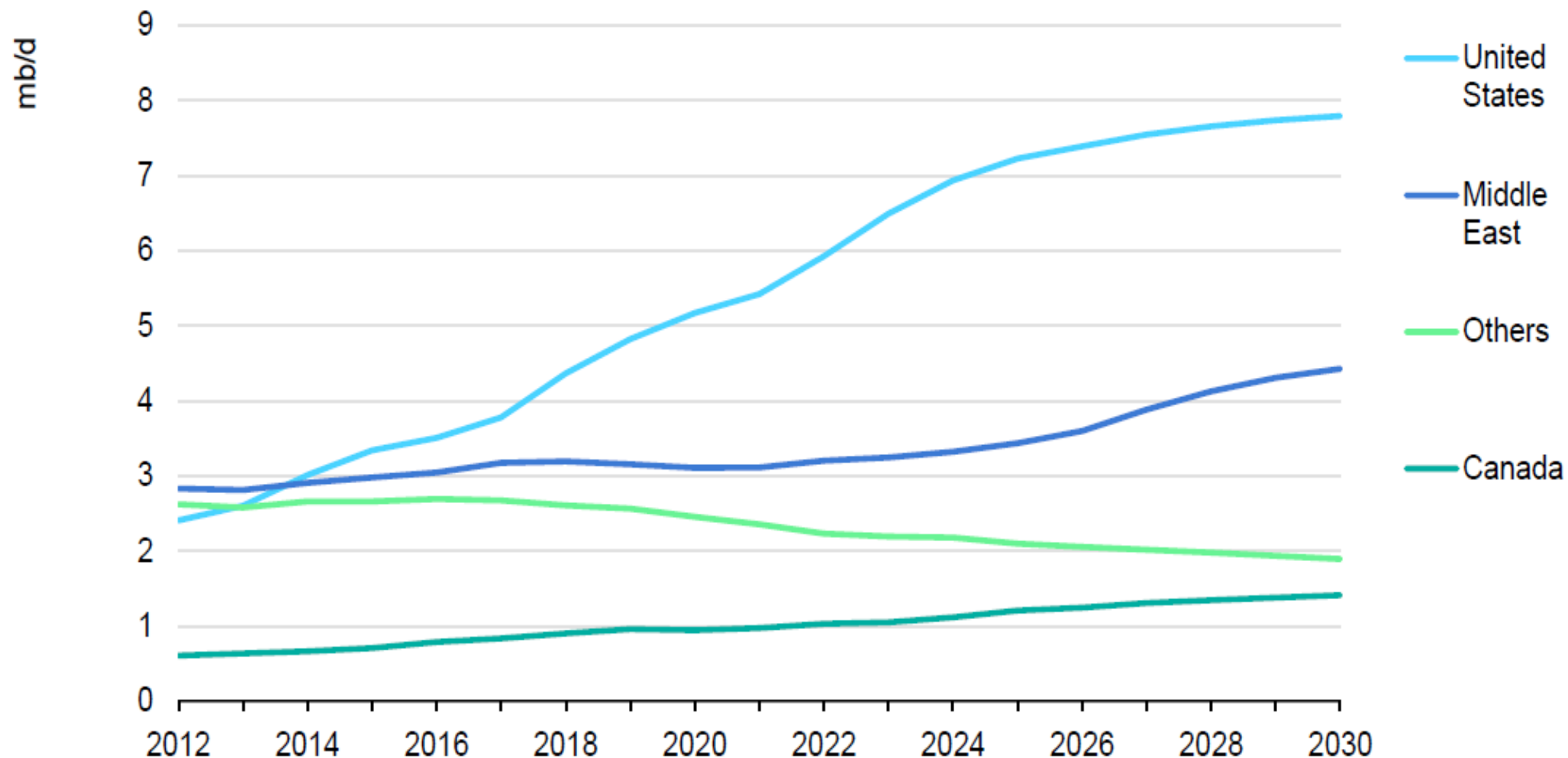
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Global NGL output 2012 – 2030. US n°1

Global NGLs output, 2012-2030

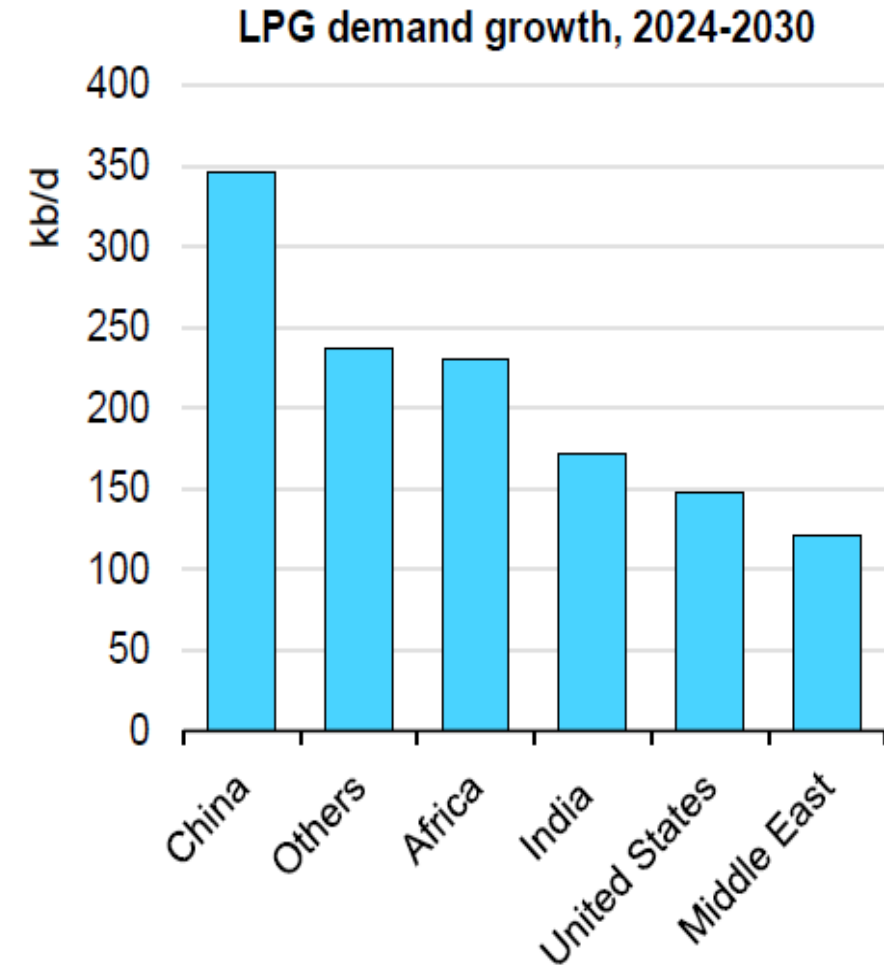
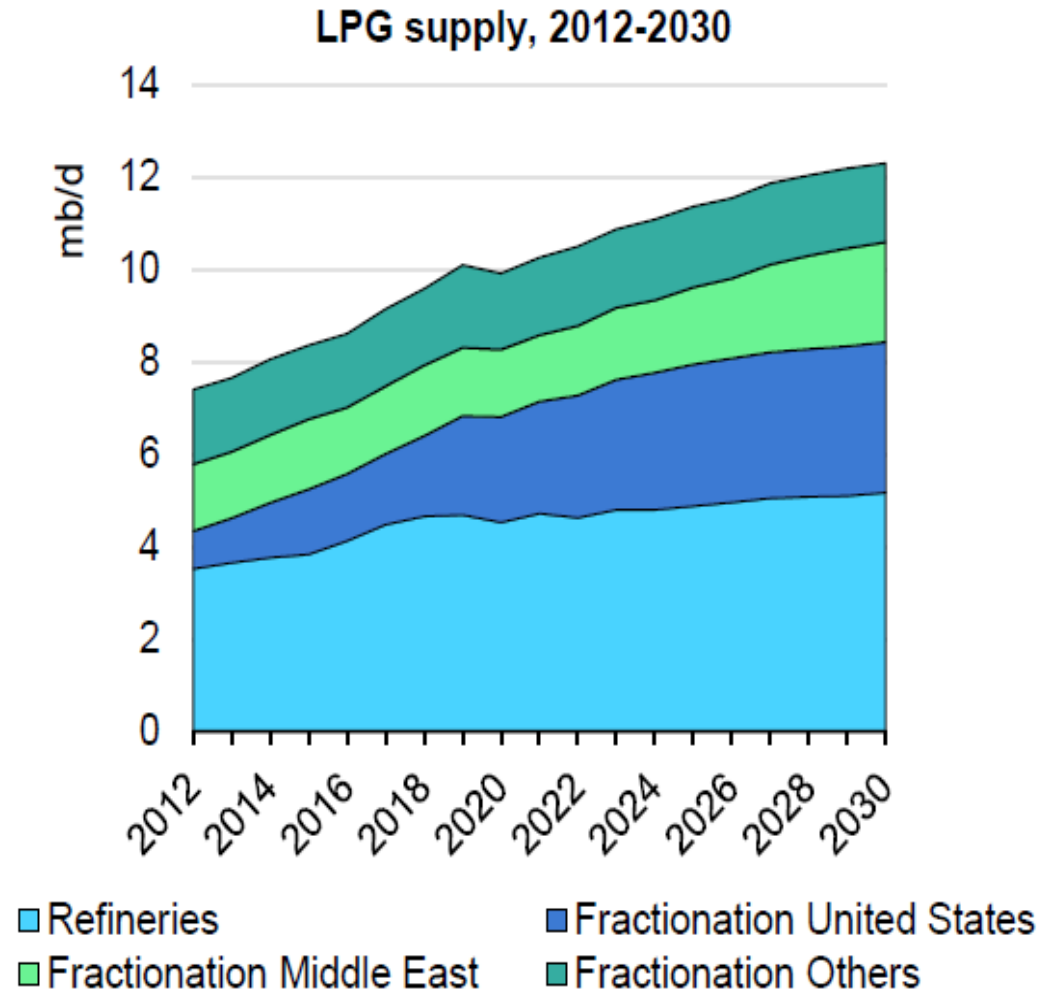


Source: IEA Oil 2025 – Analysis & forecast to 2030
NGLs include Ethane, Propane, Butane, Pentane+



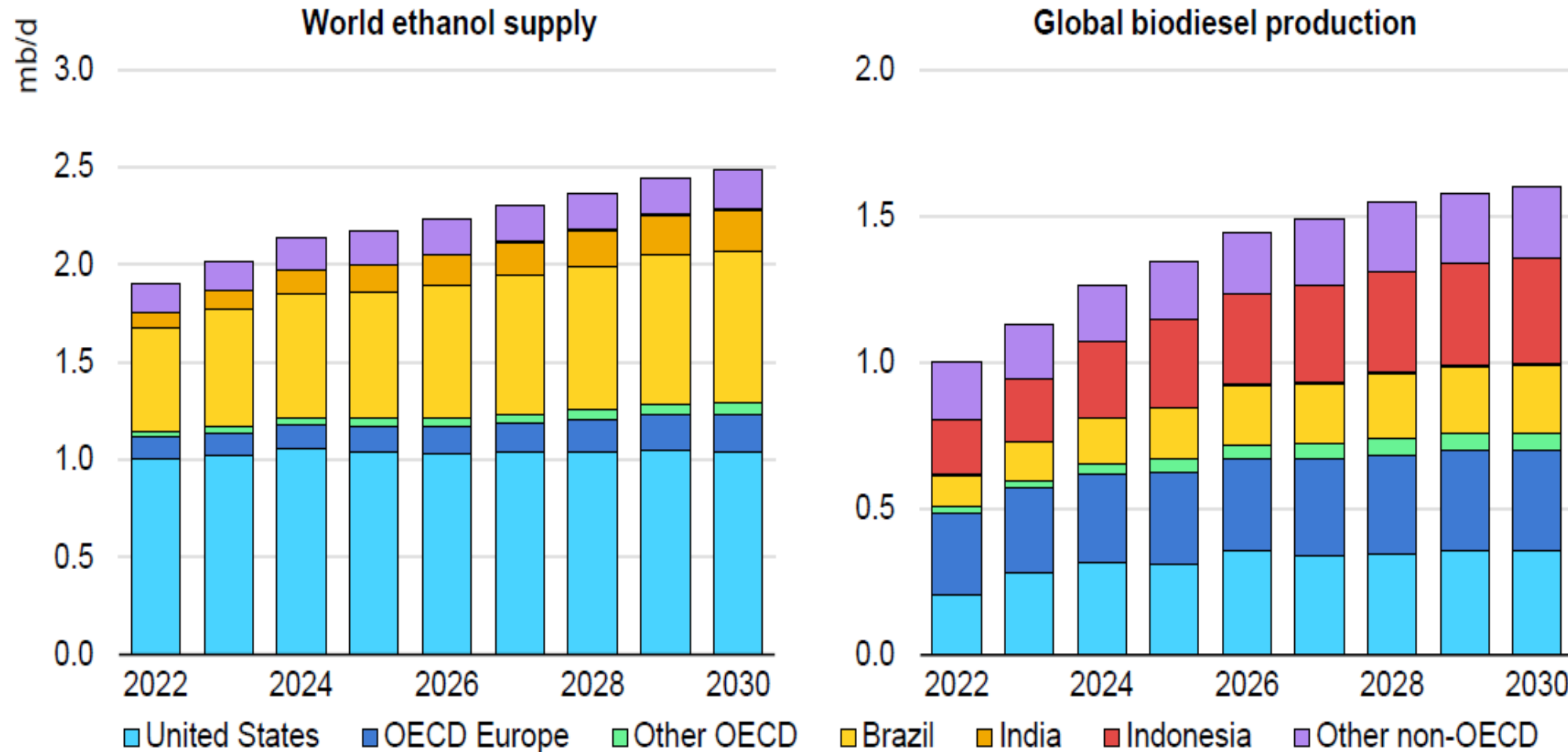
Global LPG Supply & Demand 2022 - 2030. A regular growth

Global LPG supply and demand



Global Biofuels Supply 2022 - 2030. A regular growth

Global biofuel supply split by ethanol and biodiesel, 2022-2030



Characteristics of Oil & Gas Projects and New Challenges

- **Projects are becoming more and more complex.**
- **There is a need for improved access, large-scale investments and advanced technology.**
- **National companies (NOC) are more aggressive.**
- **There is a growing importance of Company Social Responsibility (CSR) requirements.**
- **Oil and gas resources require higher capital expenditures to be brought on stream. Spendings are correlated to Oil Price evolution: 400 G\$ spent in 2010 for worldwide E&P, # 650 G\$ in 2014 (+5% vs 2013), Capex down to 380 G\$ in 2016 & 2017, 400 G\$ in 2018. Spendings < 400 G\$ in 2020, 2021 and 2022. Rebound in 2023. # 550 G\$ in 2025.**
- **Climate change issue and people acceptability strongly challenge Oil & Gas sector and Hydrocarbons production.**
- **Geopolitical turmoils in the World together with the new US Administration promoting the hydrocarbons industry will continue to affect the Oil & Gas Business.**



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Oil production and consumption: past and present



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7. Oil production and consumption: various perspectives
8. Available resources vs CO₂ emissions: the dilemma
9. Oil upstream: technical features and economics
10. Oil prices: yesterday & today
11. The drivers for a long term oil price
12. Oil prices: various scenarios for the future
13. Oil industry stakeholders: governments, NOCs and IOCs



Warning: Be careful, « Oil Production » may have different definitions

Liquids Production includes Crude Oil Production plus Condensates and NGL's Production deriving from Natural Gas Production

Example: Year 2025

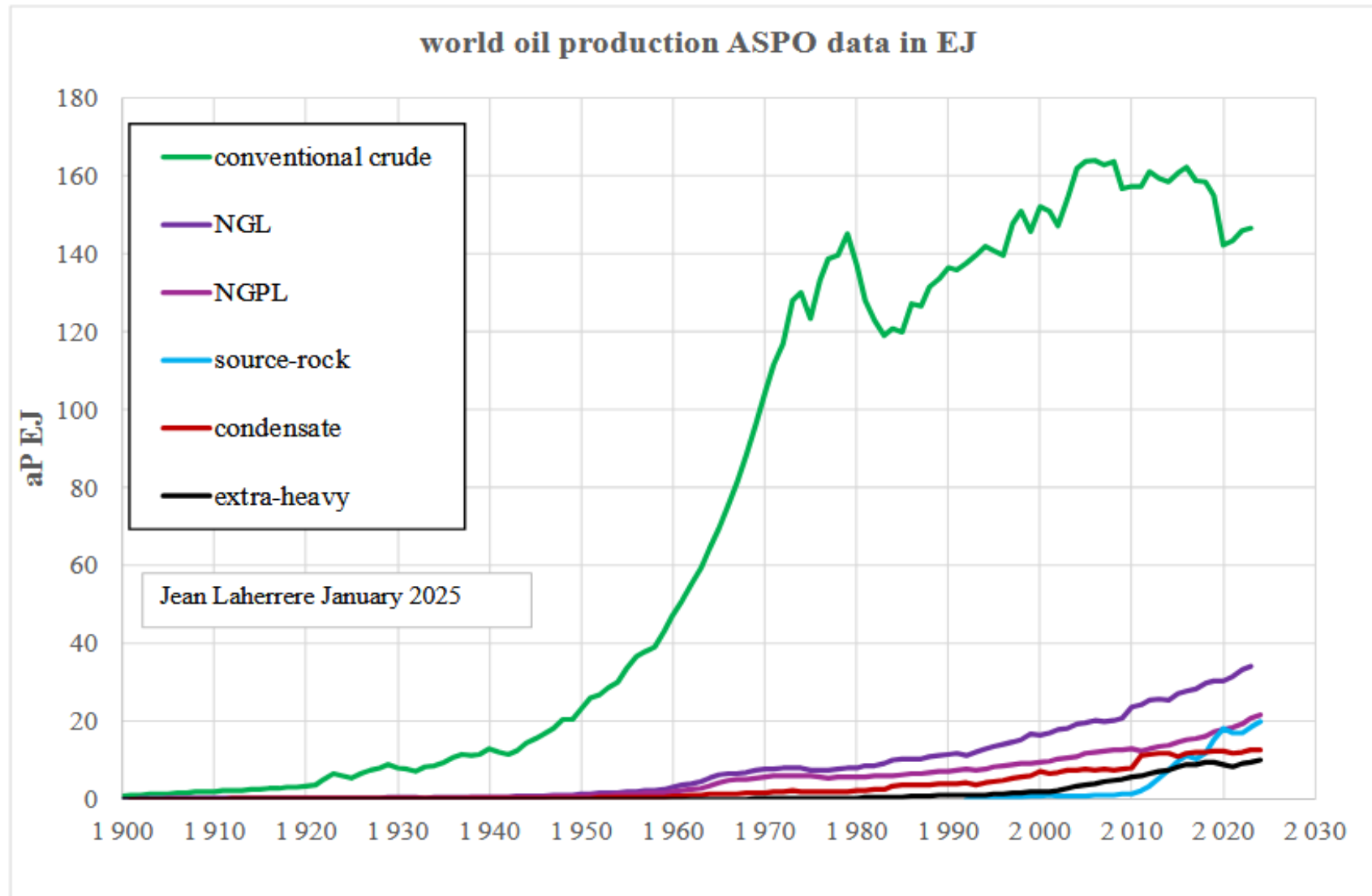
Products	Mb/d
Crude Oil* + Condensates	85,8 (85%)
NGL's + others	14,8 (15%)
Total Liquids	100,6 (100%)

- Includes Conventional Crude Oil + Shale/Tight Oil + Xtra Heavy Oil + Bitumen

Source: EI Stat. Review of World Energy 2026



History of World Petroleum Liquids profiles (ASPO data) (EJ)

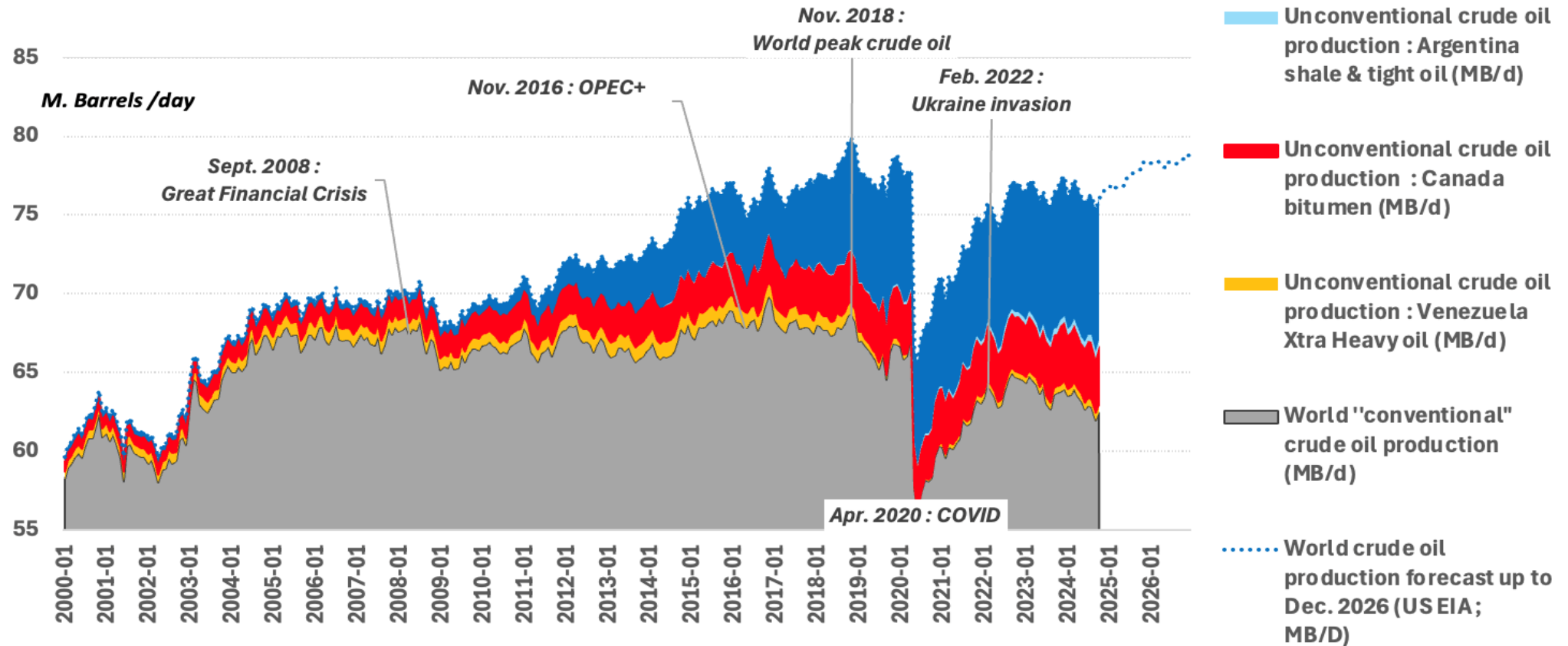


History of World Crude Oil Production 2000 – 2025

As from 2020, strong impact of Unconventional Crude Oil

THE SHIFT PROJECT 2025
ASPO 2025
Michel LEPETIT

World Crude Oil Production (estimates)
Conventional & Unconventional
01/2020 - 10/2024 & US EIA forecast up to Dec. 2026



Sources : US EIA, Alberta ER., Canada Energy Reg., Rystad, Global Warning

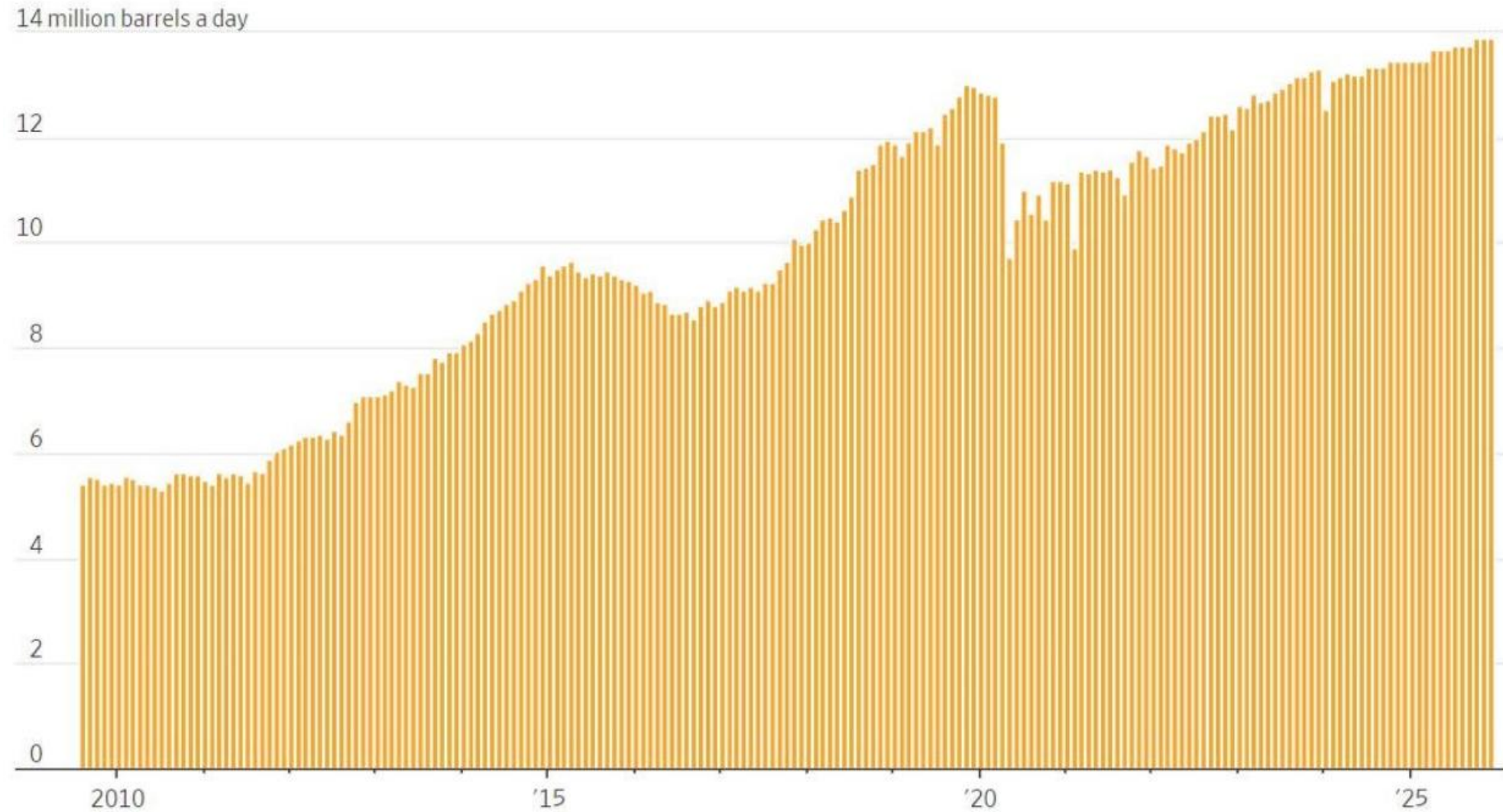
Source: Michel Lepetit/The Shift Project 2025

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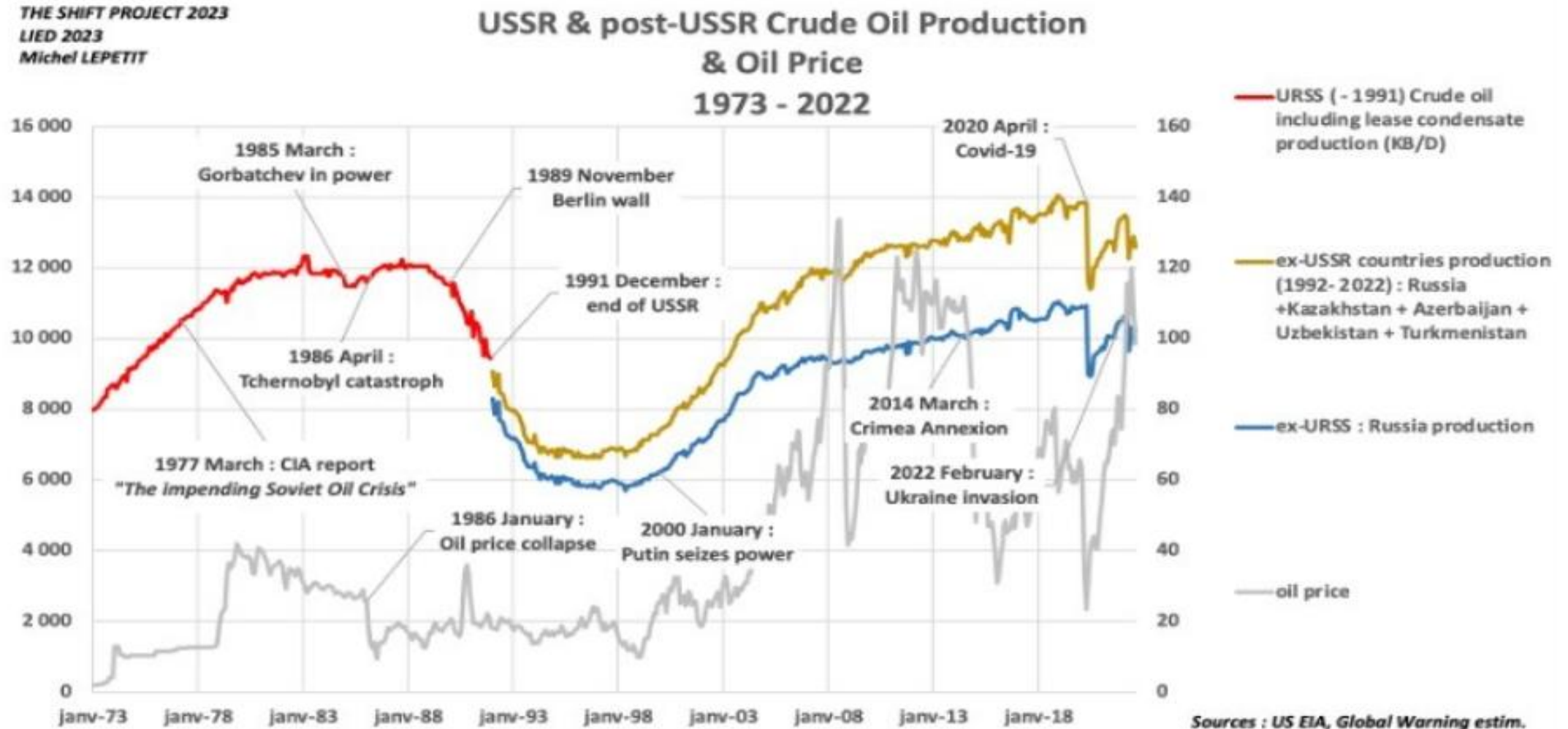
History of US Crude Oil Production



Source : Energy Information Administration
Note : includes projections through 2025



A Zoom on ex-USSR and Russia Production 1973 - 2022 with geopolitical implications



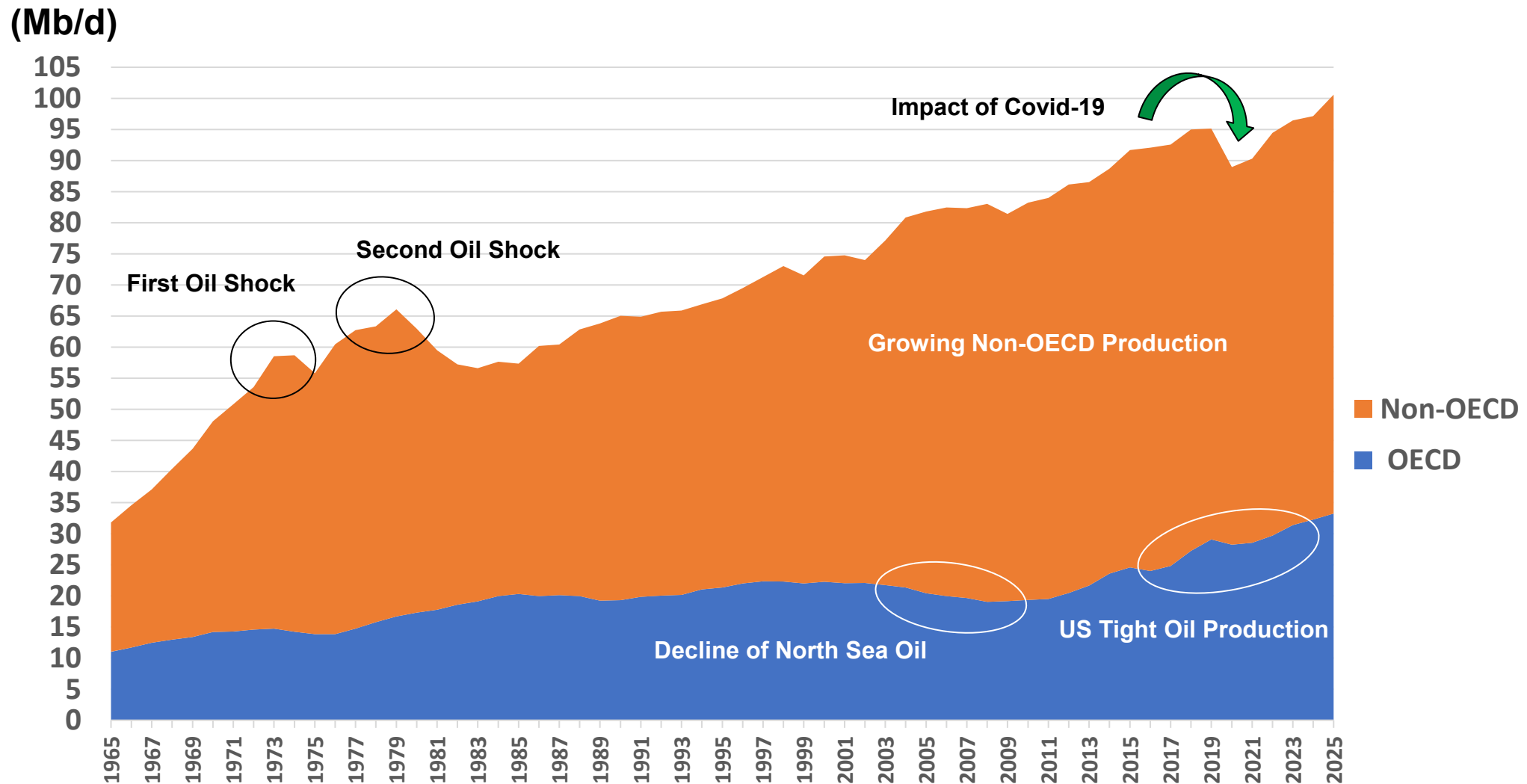
Source: Michel Lepetit/The Shift Project February 2023

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History of Oil Production (All Liquids) from 1965 to 2025

A constant Growth – Covid impact in 2020 – Rebound thereafter



Source: Ch.Guérutte/Data from EI Stat. Review 2026.
Includes crude oil, condensates, NGLs, shale oil, tar sands. Excludes Biofuels

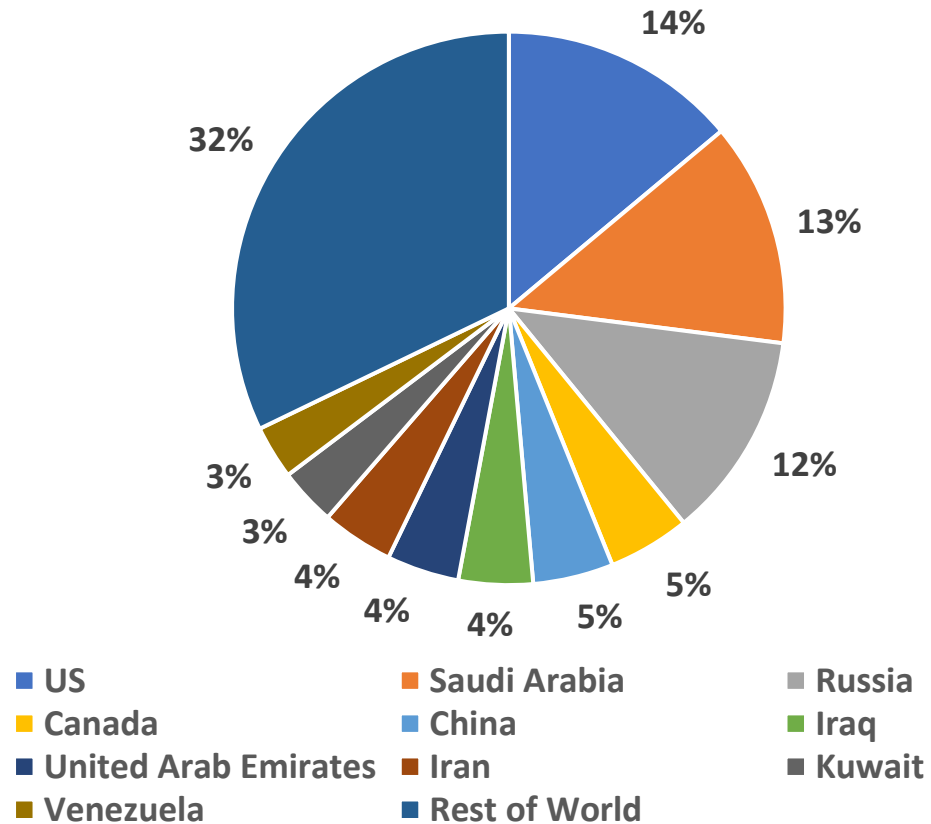


World Oil Production (All liquids) 2015 - 2025

2015

92 Million b/d

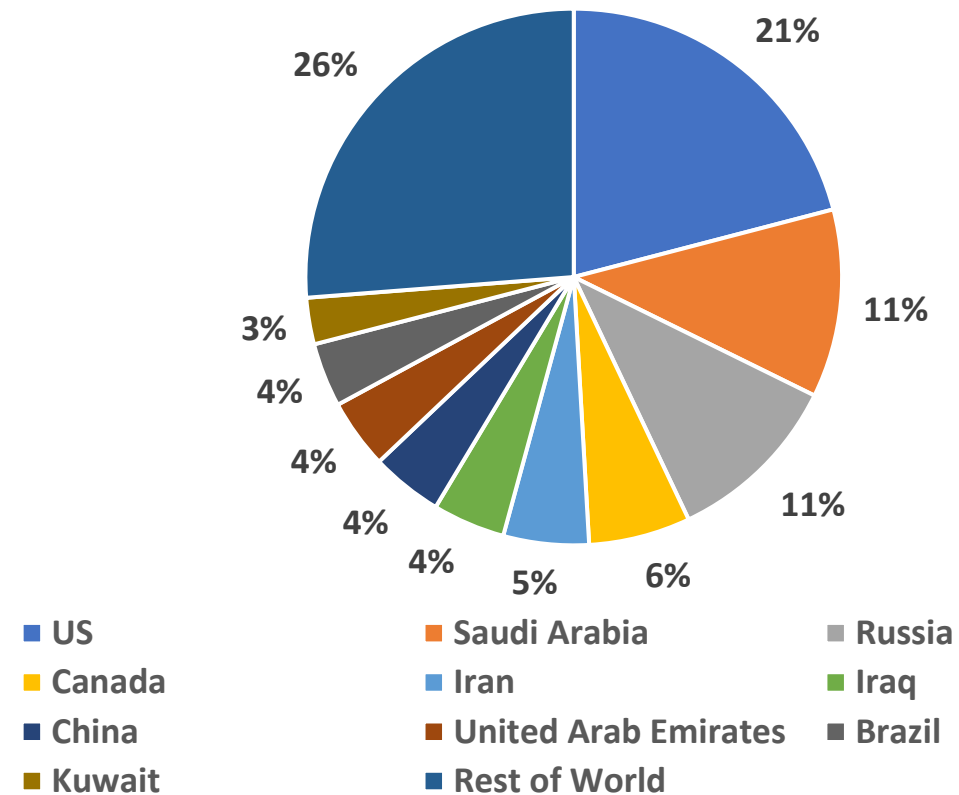
N°1 US, N°2 Saudi Arabia



2025

101 Million b/d

N°1 US, N°2 Saudi Arabia



Source: Data from EI Stat. Review 2026 shares in barrels. Includes crude oil, shale oil, oil sands, condensates, NGLs. Excludes Biofuels

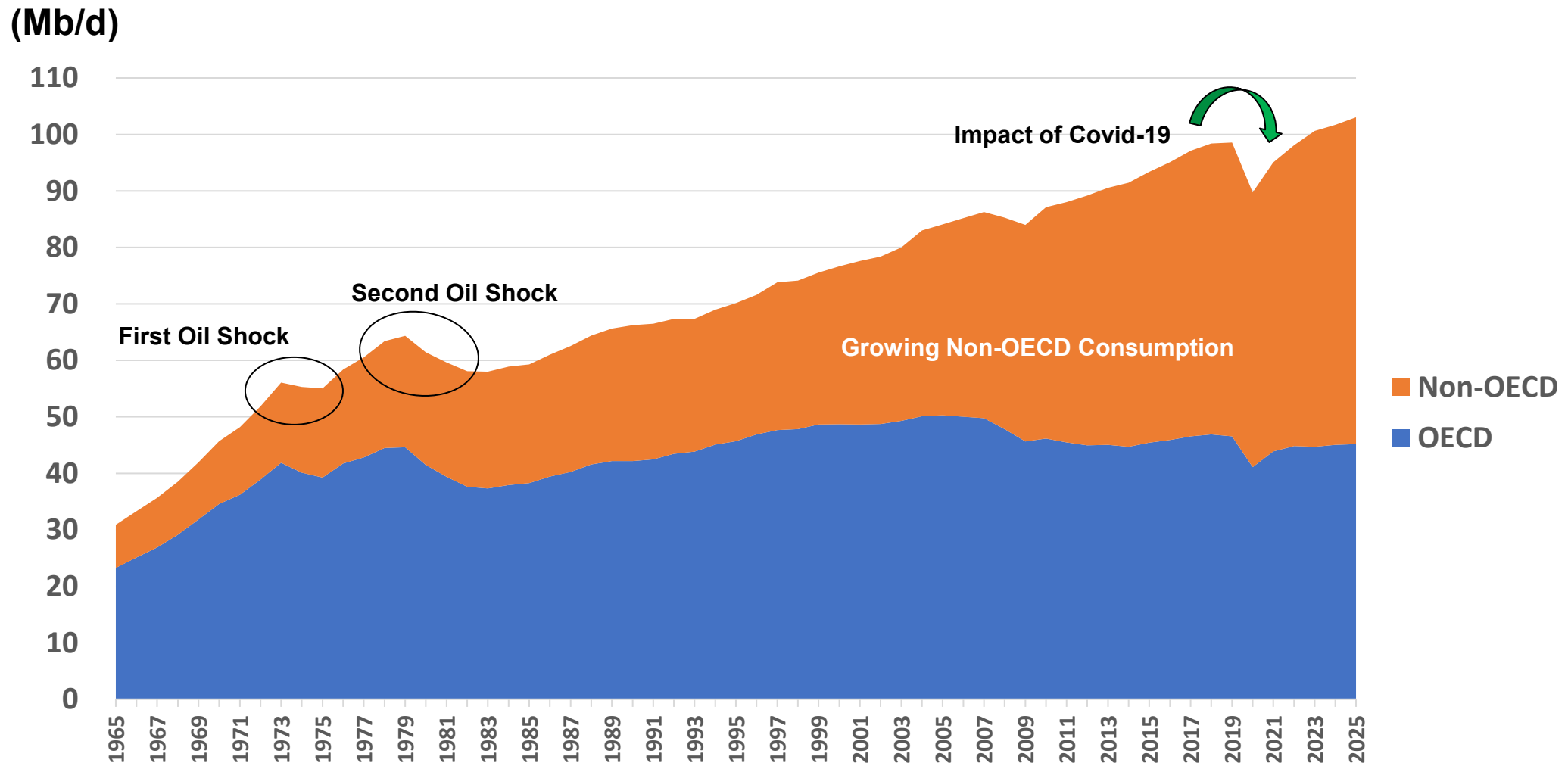
Note: Differences between consumption and production are due to stocks changes, consumption of substitute fuels,...

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History of Oil Consumption (All Liquids) from 1965 to 2025

A constant Growth – Covid impact in 2020 – Rebound thereafter



Source: Data from EI Stat. Review 2026. Includes inland demand, international aviation, marine bunkers, refinery losses, derivatives coal & gas. Excludes Biofuels

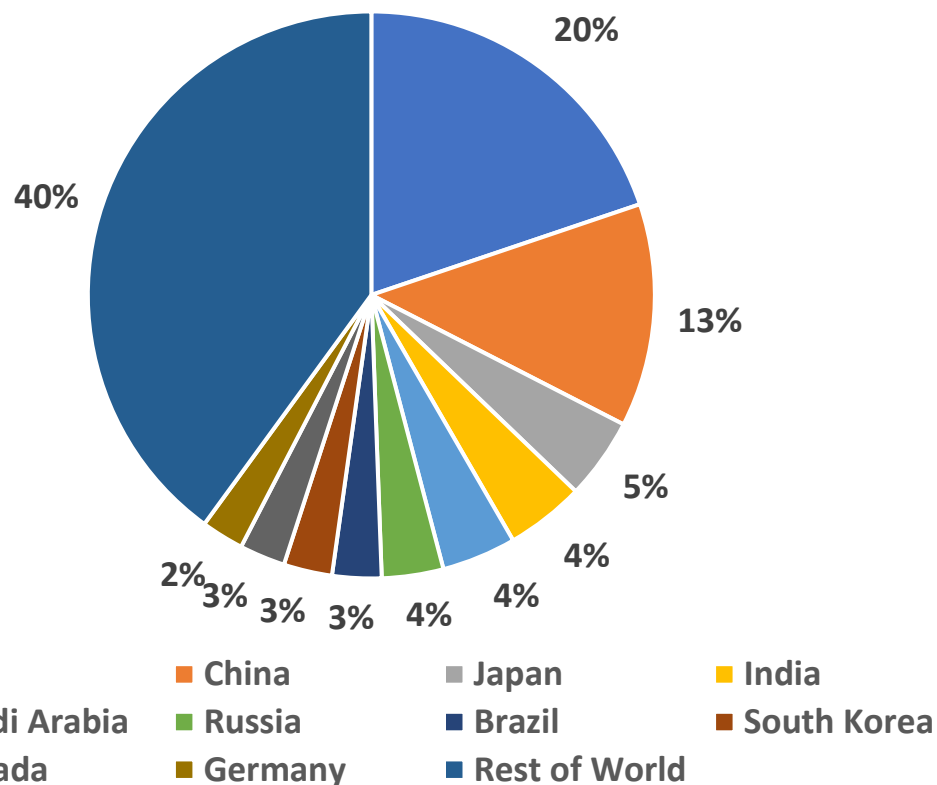


World Oil Consumption (All liquids) 2015 – 2025

2015

93 Million b/d

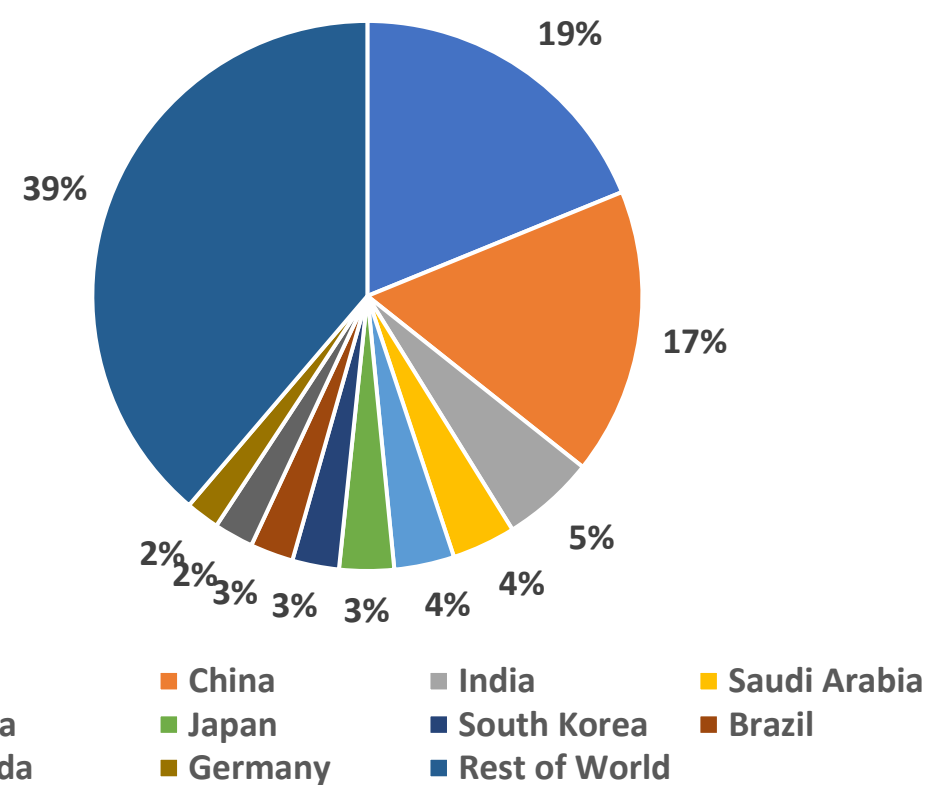
N°1 US, N°2 China



2025

103 Million b/d

N°1 US, N°2 China

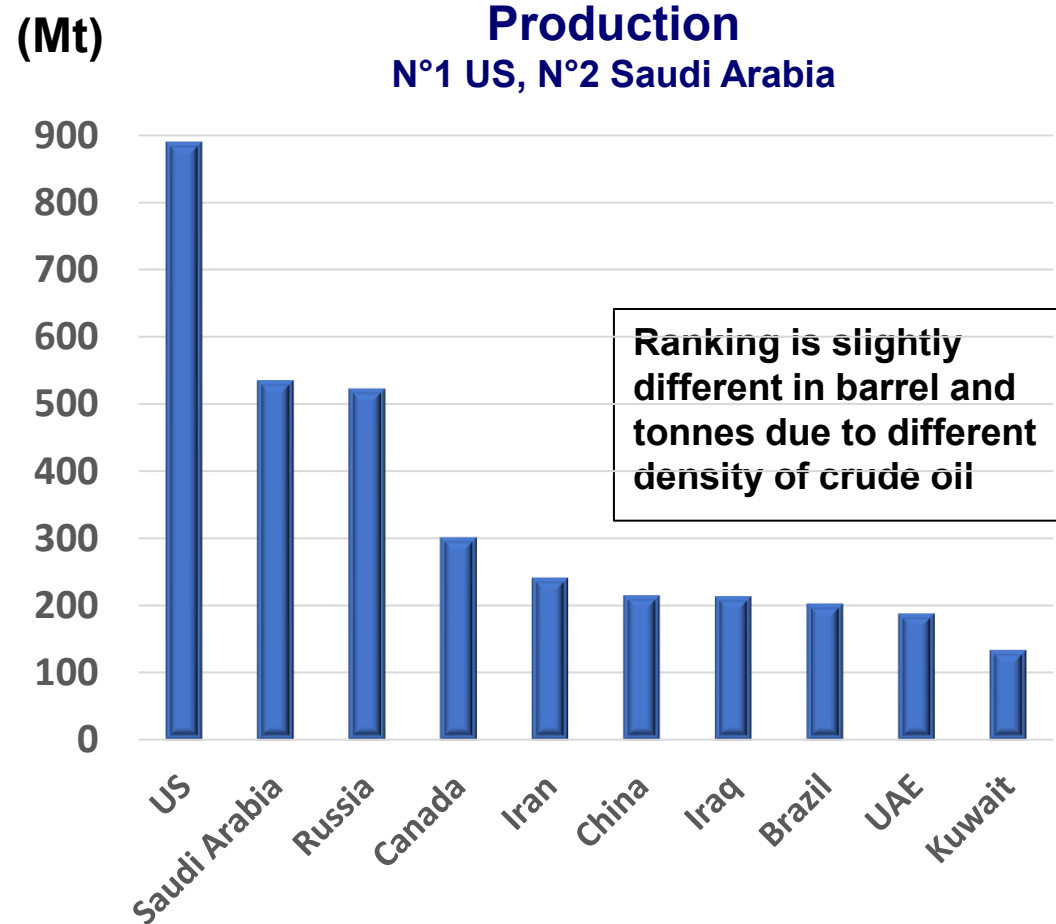


Source: Data from EI Stat. Review 2026. Includes inland demand, international aviation, marine bunkers, refinery losses, derivatives coal & gas. Excludes Biofuels

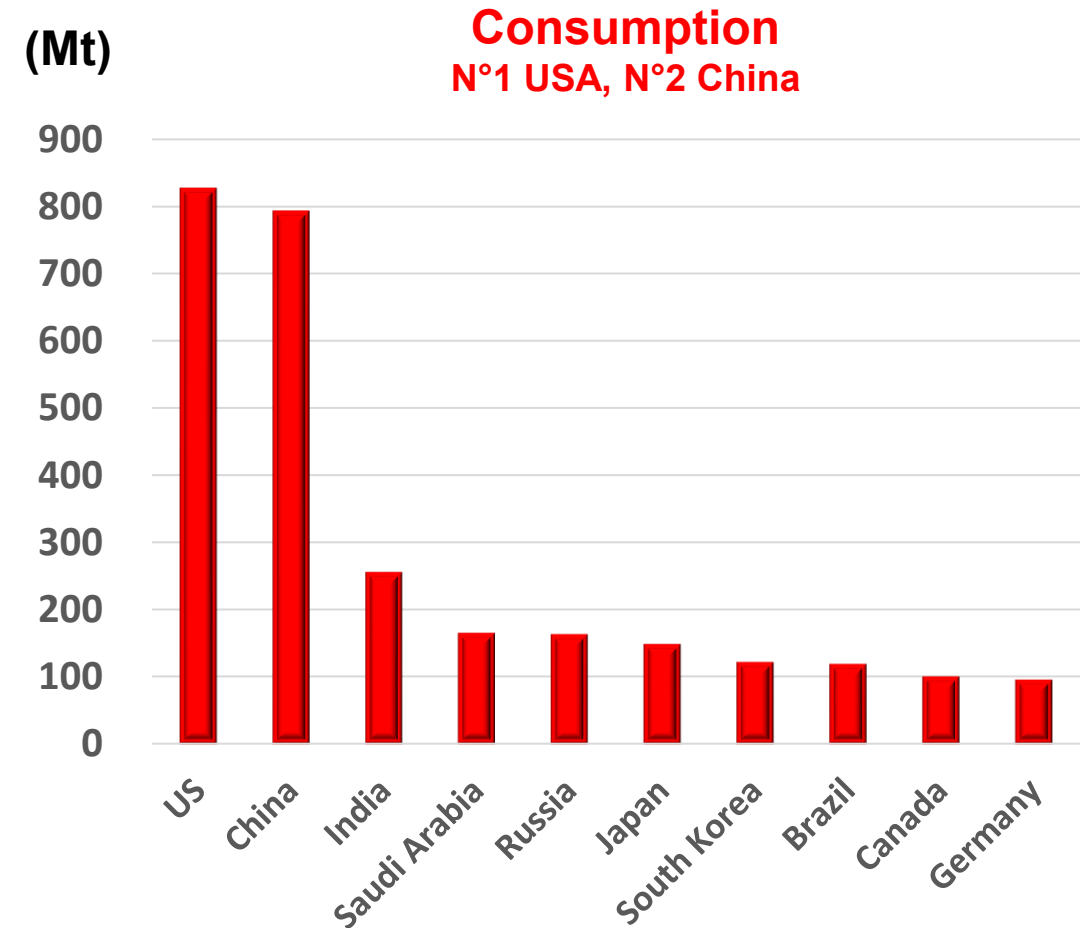
Differences between consumption and production are due to stocks changes, consumption of substitute fuels,...



Main Oil Producing and Consuming Countries All liquids (Excludes Biofuels) - Year 2025 (Mt)



Total World # 4 700 Mt



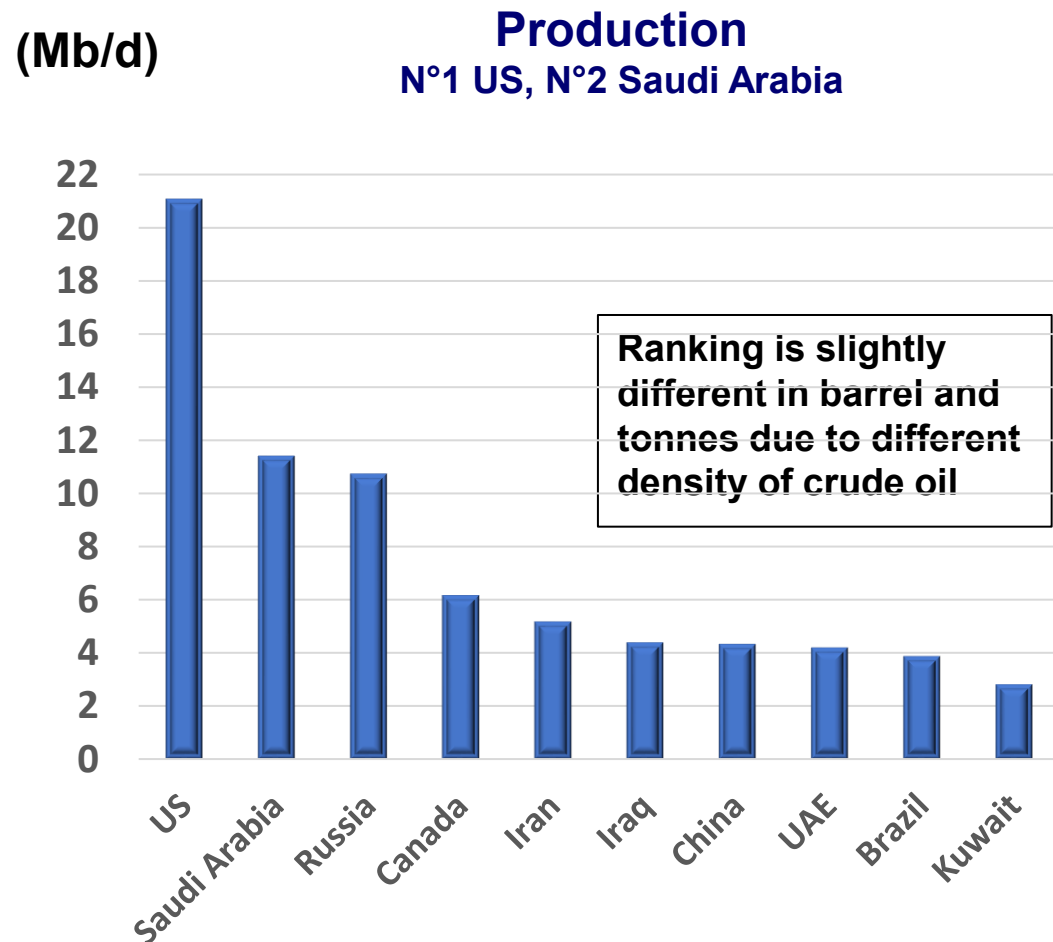
Total World # 4 700 Mt

Source: Data from EI Stat. Review 2026 - Ranking according to quantities in Mt

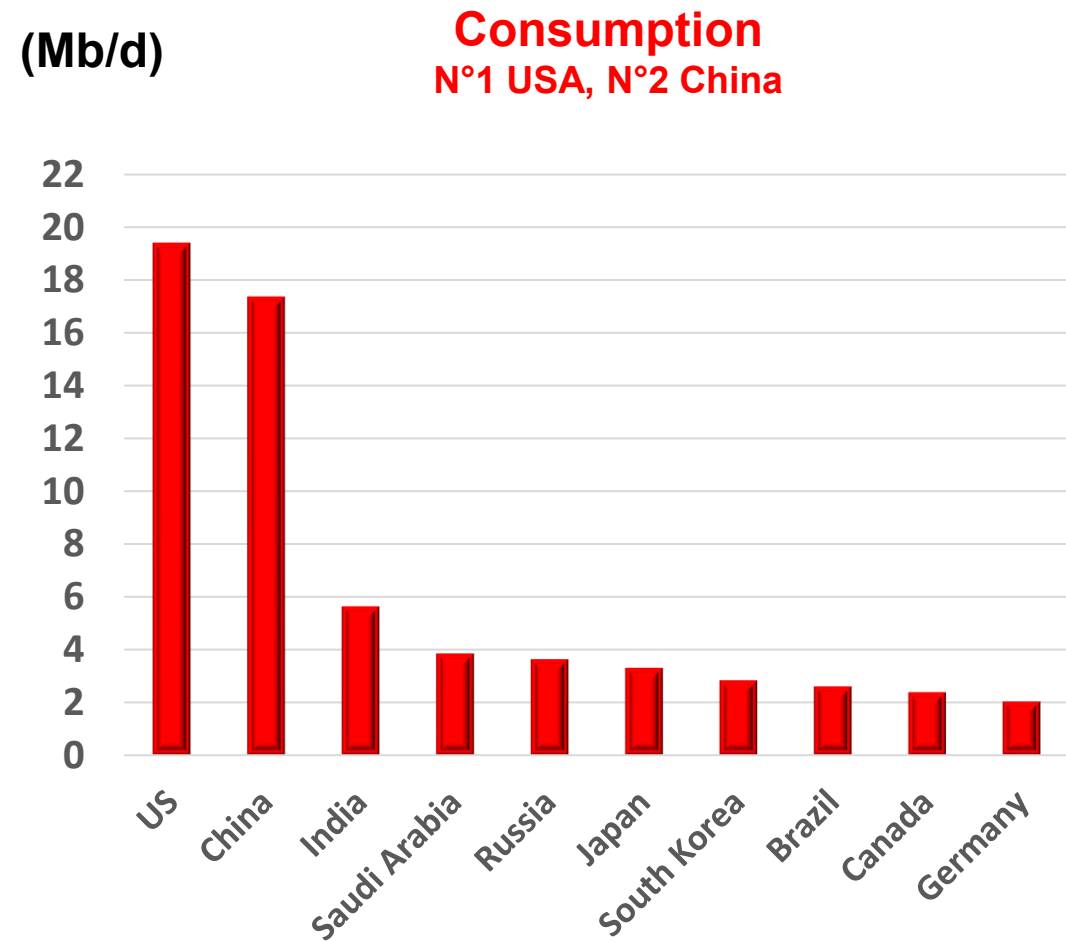


Main Oil Producing and Consuming Countries

All liquids (Excludes Biofuels) - Year 2025 (Mb/d)



Total World # 101 Mb/d



Total World # 103 Mb/d

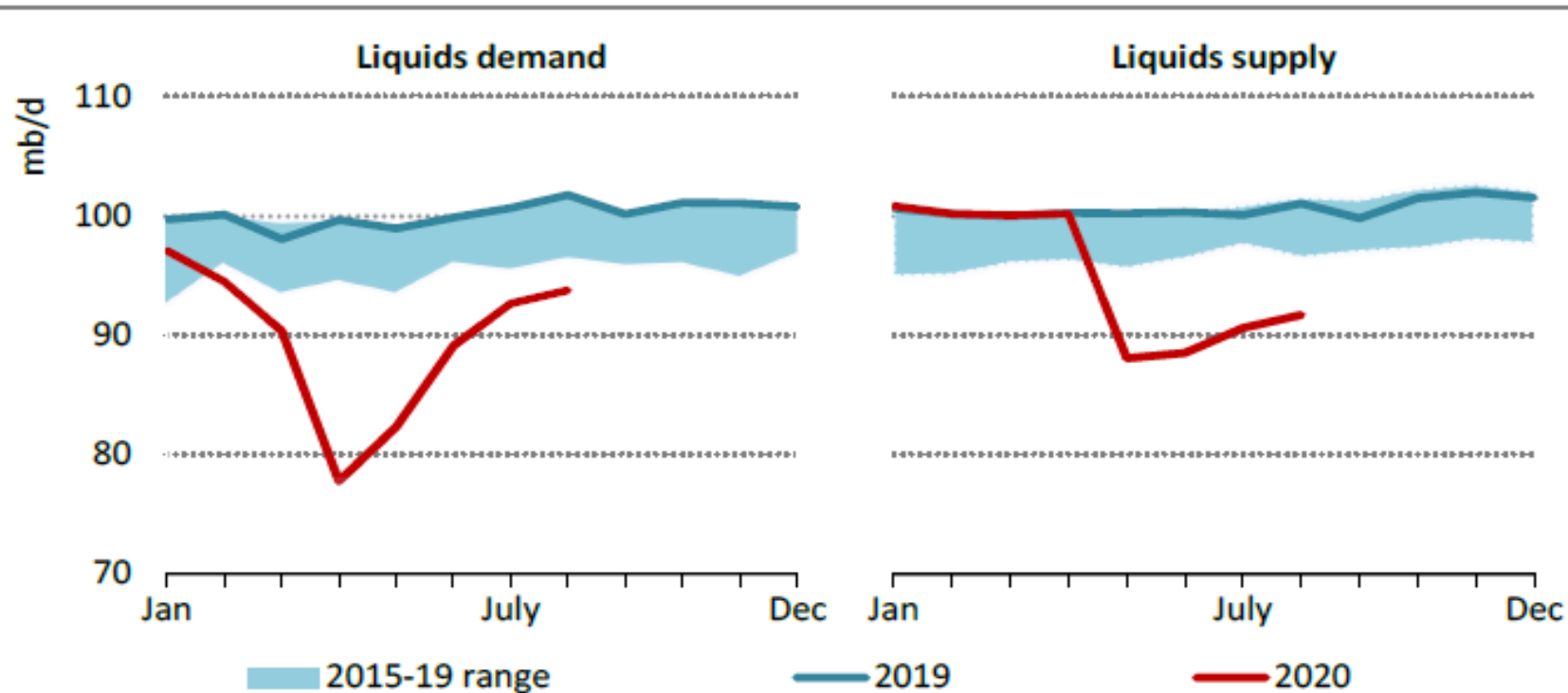
Source: Data from EI Stat. Review 2026 ranking according to quantities in Mb/d

Note: Differences between consumption and production are due to stocks changes, consumption of substitute fuels....

Toolbox Energy Book 4 - Oil



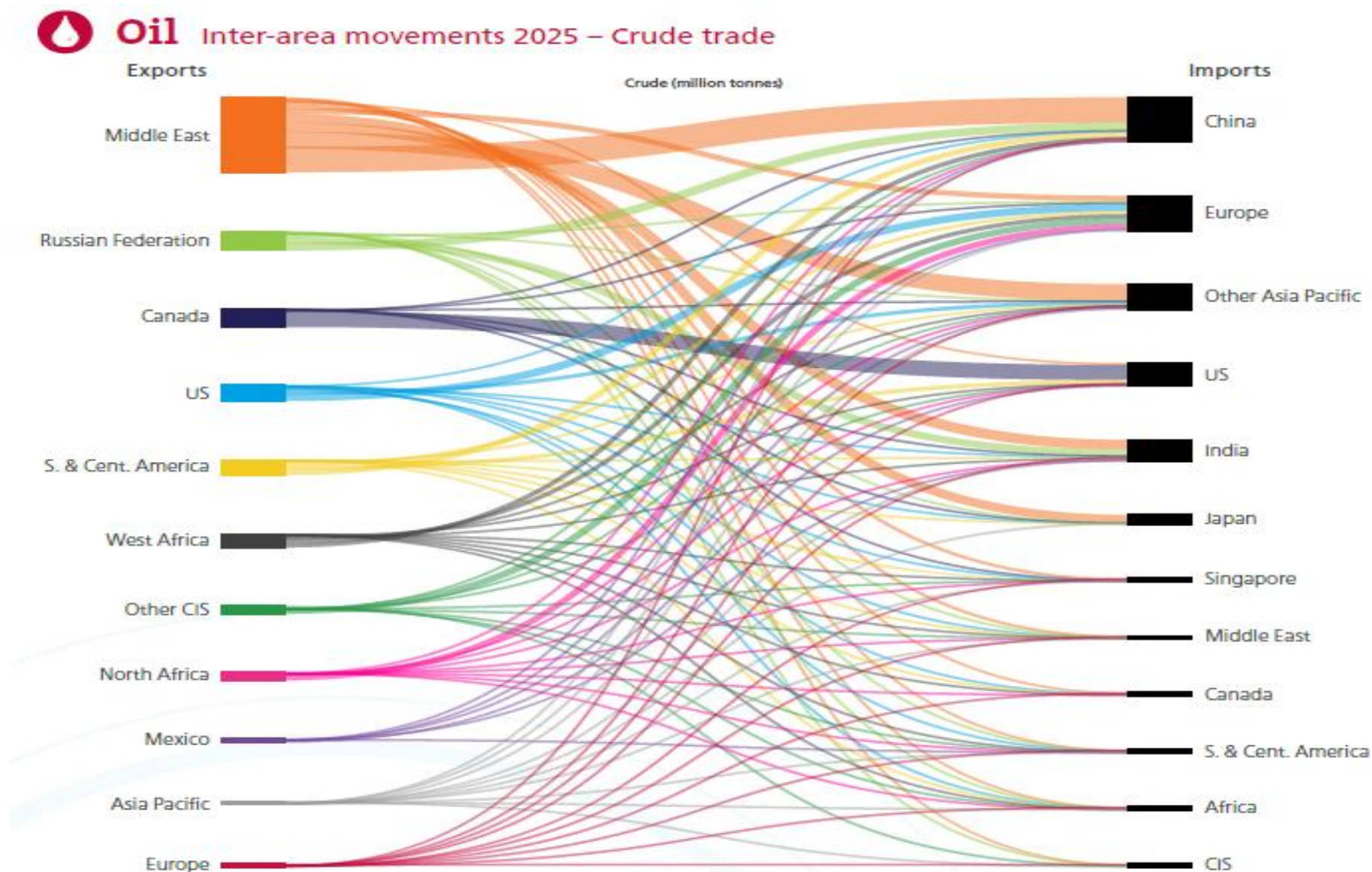
Reminder - Impact of Covid-19 on Oil Demand & Supply Year 2020 by IEA 2020



The oil supply response initially lagged the collapse in demand, putting enormous pressure on available oil storage space, before markets started to rebalance in the second-quarter

Notes: mb/d = million barrels per day. Both supply and demand include biofuels (in physical volumes); supply also includes processing gains. The differences between supply and demand reflect net additions to or withdrawals from inventories.

Major Oil Trade Movements - 2025



Source: EI Stat. Review 2026



Oil – Trade Movements 2025 (Mt)



Oil Inter-area movements 2025 crude trade

Crude (million tonnes)

To

From	Canada	Mexico	US	S. & Cent. America	Europe	Russian Federation	Other CIS	Middle East	Africa	Australasia	China	India	Japan	Singapore	Other Asia Pacific	Total
Canada	–	–	194.7	†	8.3	–	–	–	†	–	16.3	0.1	0.1	0.2	2.7	222.3
Mexico	–	–	19.1	0.1	8.9	–	–	–	–	–	0.8	1.4	–	–	3.7	33.9
US	19.1	–	–	10.8	91.8	–	–	†	6.9	1.1	2.3	17.6	4.3	4.3	44.5	202.8
S. & Cent. America	0.5	–	50.3	–	38.8	–	–	0.1	3.7	†	68.0	9.3	1.6	2.6	10.2	184.9
Europe	0.2	–	3.0	0.1	–	–	†	0.1	0.4	†	4.2	0.6	–	0.4	1.3	10.2
Russian Federation	–	–	–	0.5	28.5	–	14.3	5.5	0.3	–	100.7	84.9	0.1	–	1.8	236.5
Other CIS	–	–	1.5	1.2	78.8	†	–	5.0	0.7	–	4.0	–	–	0.2	3.1	94.4
Iraq	–	–	8.9	0.2	31.8	–	†	1.7	0.6	–	64.6	49.7	–	3.9	17.7	179.1
Kuwait	–	–	0.7	–	0.1	–	–	6.7	0.1	–	19.0	8.8	7.4	0.2	33.8	76.8
Saudi Arabia	2.8	–	13.4	3.5	32.4	–	–	15.1	3.4	–	80.8	36.5	45.8	3.2	89.3	326.2
UAE	†	–	1.4	–	0.6	–	–	0.3	0.2	†	37.5	26.7	49.1	19.9	58.5	194.4
Other Middle East	†	–	–	0.7	0.8	–	†	7.9	–	0.1	127.1	4.7	6.0	7.5	17.7	172.5
North Africa	0.7	–	3.9	1.3	69.7	–	†	0.1	0.3	0.3	1.6	4.6	–	0.1	4.0	86.5
West Africa	3.5	–	10.4	4.0	51.0	–	–	2.9	4.2	0.6	51.8	15.5	–	0.6	16.8	161.3
East & S. Africa	–	–	–	†	0.8	–	–	†	†	–	0.7	0.1	0.3	0.3	2.1	4.2
Australasia	–	–	–	–	–	–	–	0.7	–	–	0.7	–	0.3	1.7	5.7	9.1
China	–	–	–	0.3	–	–	–	–	0.1	–	–	–	–	†	0.7	1.1
India	†	–	–	†	†	–	–	0.1	†	†	–	–	–	–	†	0.1
Japan	–	–	–	–	–	–	–	–	†	–	–	–	–	†	0.1	0.1
Singapore	–	–	–	–	0.1	–	–	–	–	–	–	0.2	–	–	†	0.4
Other Asia Pacific	†	–	–	–	†	–	†	0.7	–	6.3	1.3	1.6	0.4	1.8	–	12.1
Total imports	26.8	–	307.2	22.6	442.5	†	14.3	46.9	20.8	8.4	581.2	262.2	115.3	47.0	313.8	2209.0

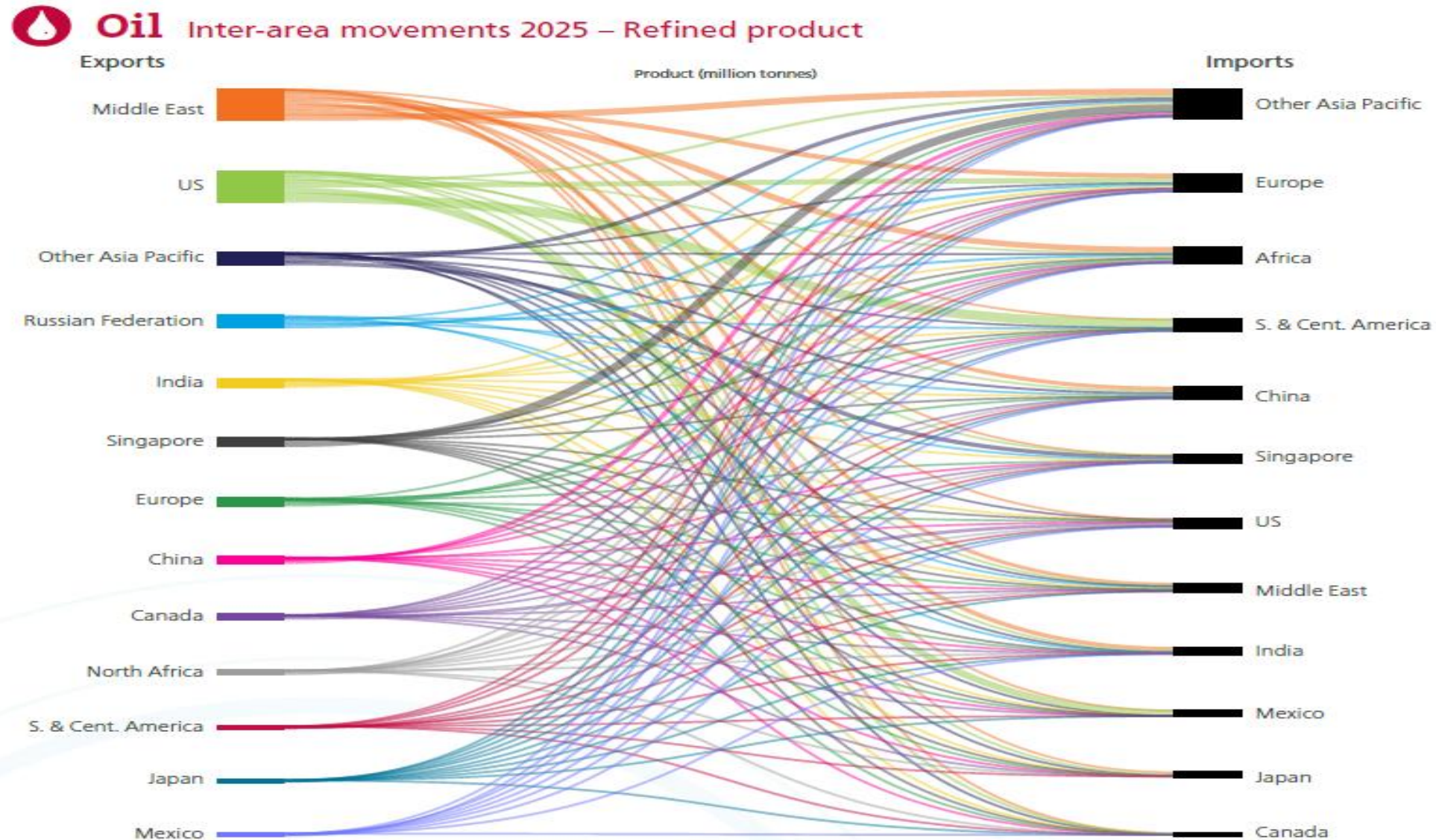
Source: Includes data from FGE NexantECA.

† Less than 0.05.

Notes: Does not include biofuels trade. Bunker fuel use is not included as exports. Intra-area movements (for example, between countries within Europe) are excluded. Crude imports and exports include condensates.



Major Refined Products Trade Movements - 2025



Major Refined Products Trade Movements – 2025 (Mt)



Oil Inter-area movements 2025 refined product

Product (million tonnes)

To

From	Canada	Mexico	US	S. & Cent. America	Europe	Russian Federation	Other CIS	Middle East	Africa	Australasia	China	India	Japan	Singapore	Other Asia Pacific	Total
Canada	–	0.1	27.9	2.0	0.9	–	†	†	†	†	2.4	0.2	1.2	†	0.6	35.2
Mexico	†	–	5.8	0.2	0.6	–	†	†	†	†	†	0.6	†	0.5	†	7.8
US	18.6	52.2	–	80.7	44.6	†	†	1.4	14.7	0.9	16.5	10.9	10.6	2.0	20.5	273.6
S. & Cent. America	0.1	0.3	7.9	–	3.5	†	†	0.6	4.6	†	6.1	1.8	0.9	6.3	0.9	33.1
Europe	3.8	0.1	14.7	5.2	–	†	1.8	7.2	28.3	†	1.7	1.0	0.3	3.5	2.2	69.8
Russian Federation	–	–	–	10.5	22.8	–	4.8	11.7	20.8	–	14.7	8.4	–	7.5	13.6	114.8
Other CIS	†	†	†	0.1	2.0	0.4	–	3.6	0.3	†	0.6	†	–	0.5	1.2	8.7
Iraq	–	–	3.4	†	2.9	–	†	9.2	0.2	–	1.2	2.2	0.2	2.5	3.8	25.5
Kuwait	†	–	1.5	0.1	13.3	–	†	3.6	5.7	†	2.9	3.9	3.3	2.1	7.0	43.3
Saudi Arabia	†	–	2.7	0.7	14.0	–	0.3	0.4	14.9	†	4.4	6.5	0.2	3.8	5.5	53.4
UAE	†	†	0.4	0.9	5.9	–	0.1	5.7	14.9	0.9	13.6	13.1	4.9	5.1	20.2	85.8
Other Middle East	†	†	1.1	0.8	4.7	†	0.1	9.3	12.5	0.3	10.3	8.2	4.0	2.5	18.2	72.1
North Africa	†	–	2.9	0.5	14.3	†	0.1	7.6	1.6	†	1.8	0.3	†	0.2	5.5	34.9
West Africa	†	–	1.9	0.7	2.6	†	†	†	0.6	†	1.2	†	†	1.9	0.4	9.4
East & S. Africa	†	†	0.2	0.1	0.1	†	†	0.2	1.3	†	†	†	†	0.2	0.2	2.3
Australasia	†	†	–	†	0.8	–	†	†	†	–	1.3	†	0.6	1.0	1.5	5.3
China	0.4	0.5	0.3	3.7	6.1	0.2	0.2	1.4	4.7	3.4	–	0.3	1.7	4.9	26.7	54.5
India	0.2	†	4.6	1.8	22.0	†	†	14.1	15.0	5.1	2.4	–	0.5	5.0	10.8	81.5
Japan	0.1	†	0.6	0.3	†	–	†	†	†	1.9	0.9	0.1	–	1.8	4.9	10.6
Singapore	0.2	0.6	0.5	†	1.6	†	†	0.6	0.8	12.4	4.2	0.9	0.3	–	53.1	75.2
Other Asia Pacific	0.1	0.1	7.8	1.4	2.9	0.1	0.1	3.0	1.5	31.7	18.2	2.7	7.9	33.2	–	110.7
Total imports	23.6	53.9	84.1	109.8	165.8	0.7	7.5	79.7	142.3	56.7	104.5	61.1	36.4	84.6	196.7	1207.4

Source: Includes data from FGE NexantECA

† Less than 0.05.

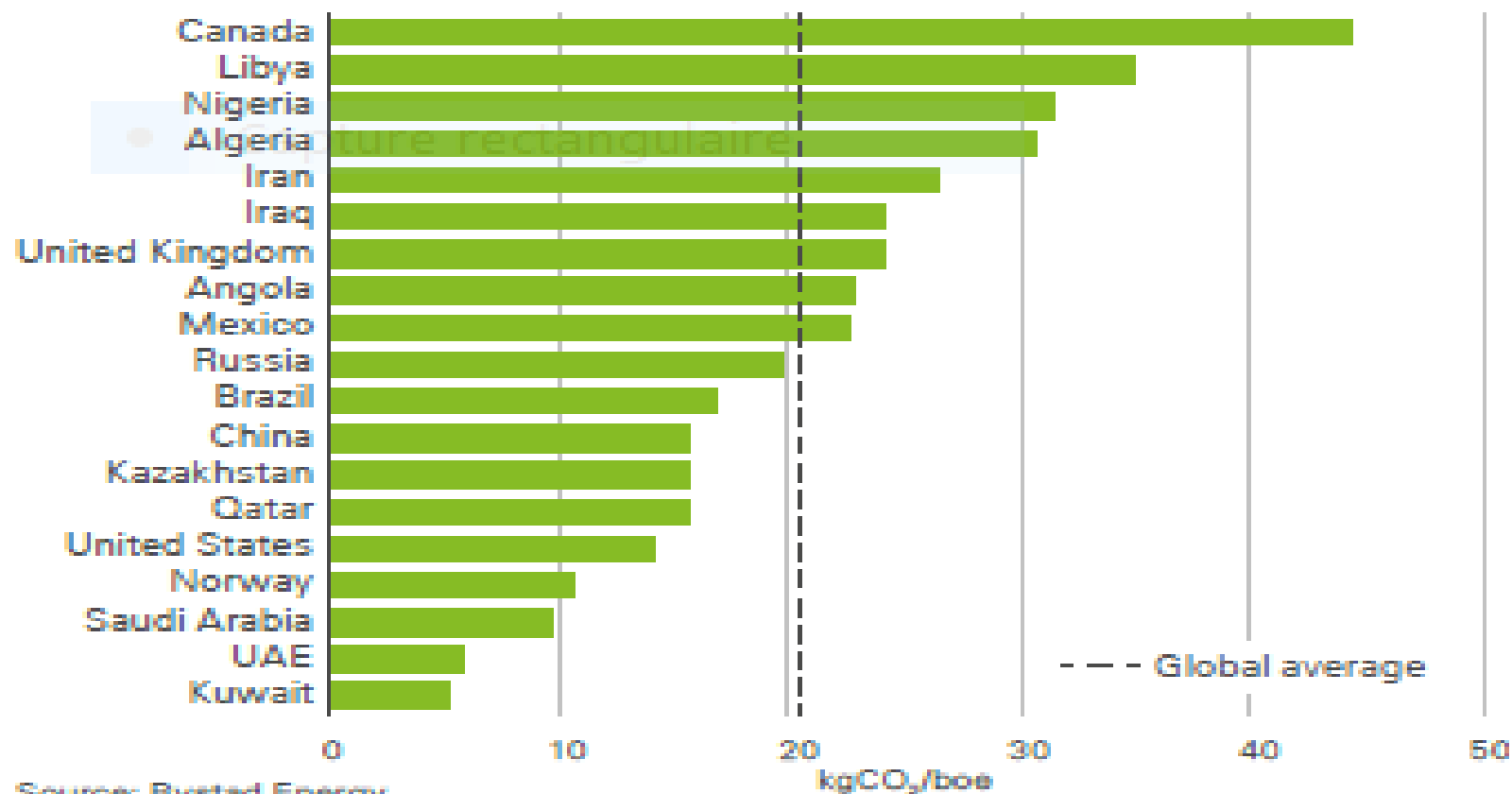
Notes: Does not include biofuels trade. Bunker fuel use is not included as exports. Intra-area movements (for example, between countries within Europe) are excluded.



Various qualities of Oil

Carbon Intensity of Oil Production - 2019

Average carbon intensity of oil production
by country, 2019



Source: Rystad Energy

Includes countries with oil production above 1 Mb/d in 2019



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Oil production and consumption: various perspectives



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OIL DEMAND and PRODUCTION PERSPECTIVES

Different sources, slight different visions



Preliminary remark:

In the following, the scenarios from the various organizations have been established taking into account the 2020 Covid-19 sanitary crisis as well as the Ukraine/Russia war economic consequences.

They might be adjusted later.

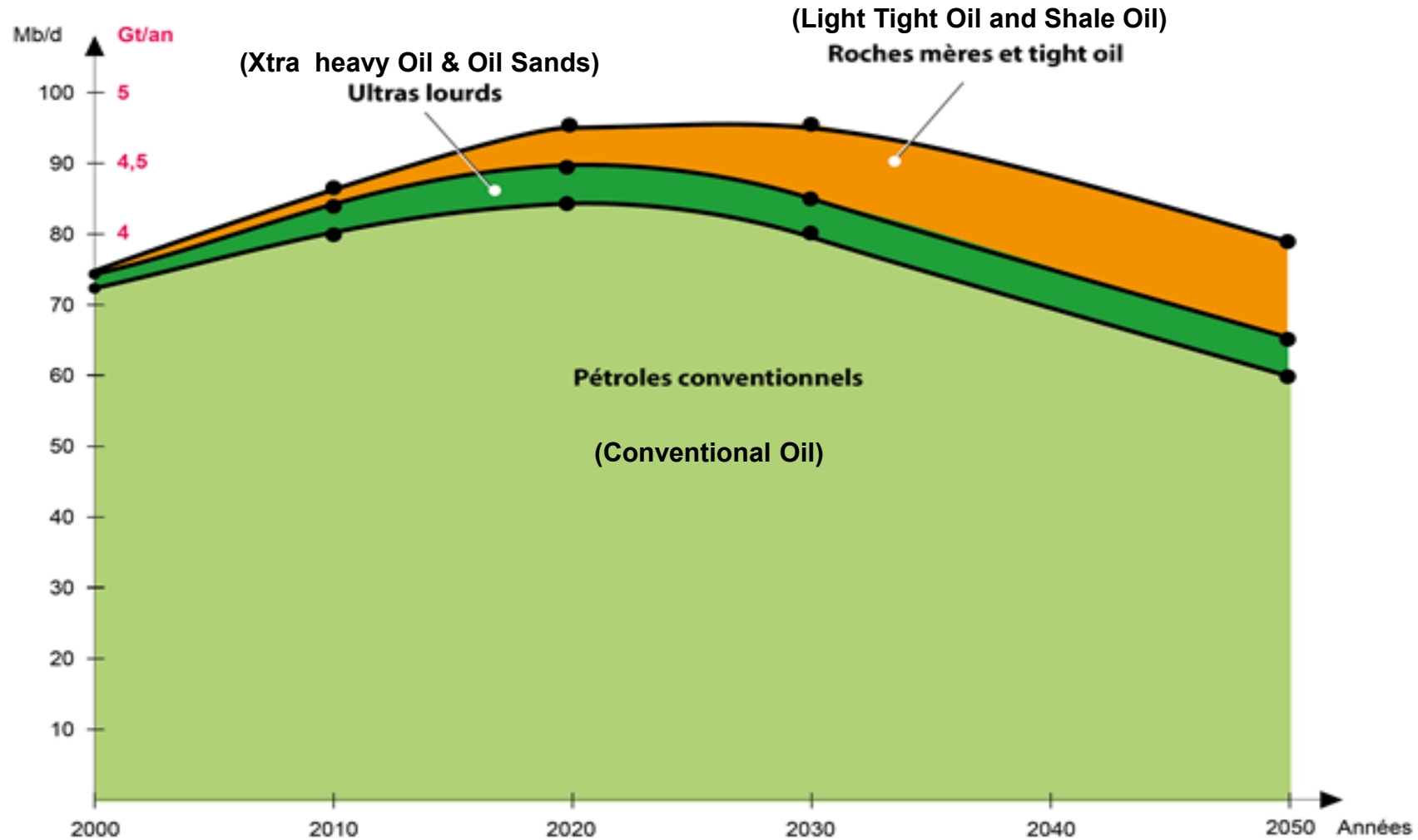
A number of these scenarios are not compatible with the objectives of Carbon Emissions reductions during the next decades to cope with the 1,5°C maximum increase of temperature in 2100.

Due to the Energy Transition process & the Climate Change challenges, new Oil Production/Demand perspectives will be dramatically different from previous expectations



One Scenario for Oil Production Perspectives 2000 – 2050 (Perrodon/Bauquis)

A 2015 Vision - Impact of Unconventional Oil (including NGLs)

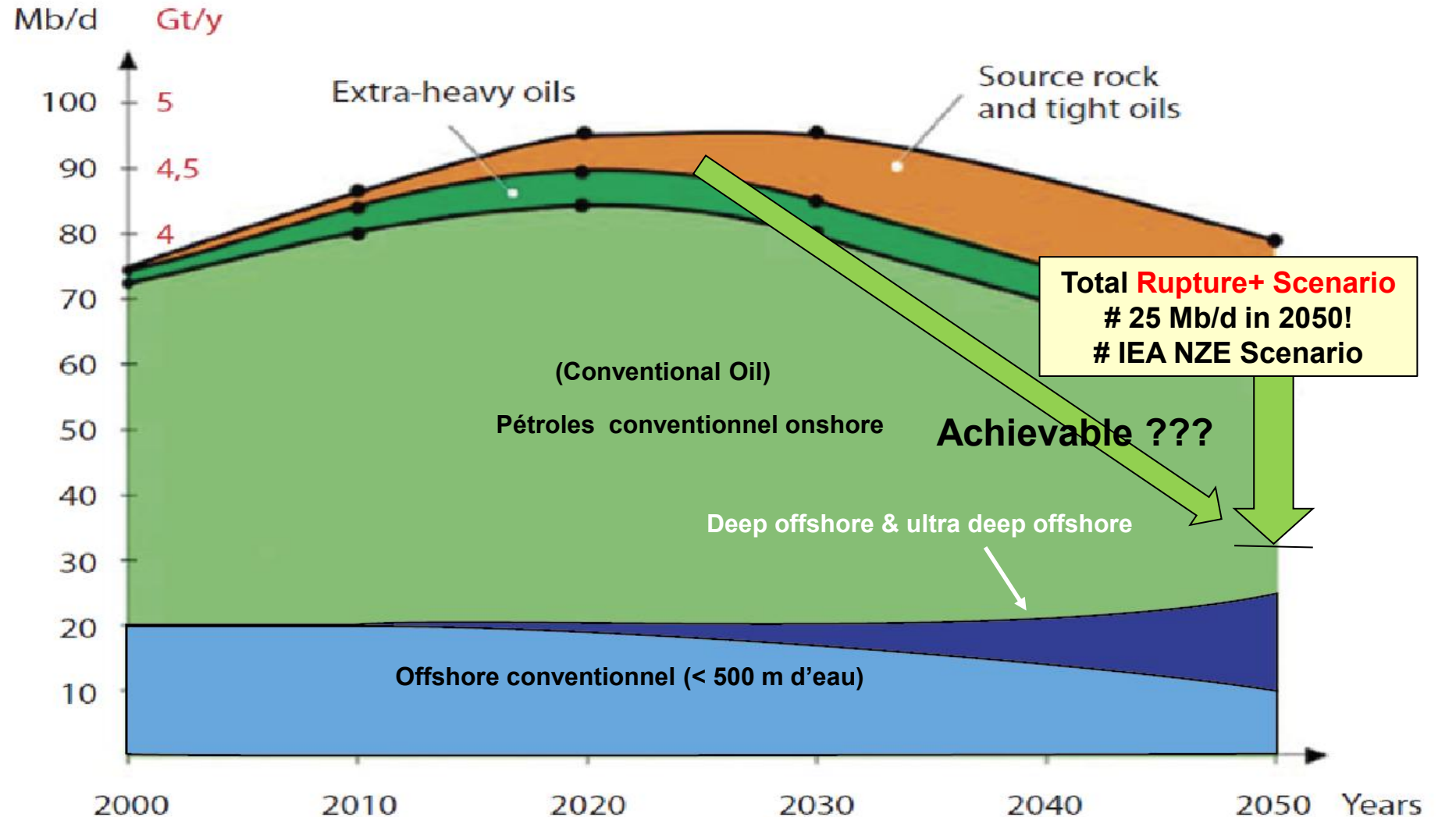


Source: Alain Perrodon et Pierre Bauquis, 20 novembre 2015

Assumptions for Crude Oil Price: 100\$/b in 2012, 70\$/b in 2020, 120\$/b in 2030, 150 \$/b in 2050 (cst 2015)



One Scenario for Oil Production Perspectives 2000 – 2050. A 2015 – 2018 Vision Impact of Unconventional Oil (including NGLs) & split onshore, conventionnal offshore, deep & ultra-deep offshore



TotalEnergies Scenarios (See Book 2 Energy - Chapter 7)





Neptune Floating Storage and Regasification Unit (FSRU) – Turkey



TotalEnergies

TotalEnergies Energy Outlook 2025

November 4th, 2025



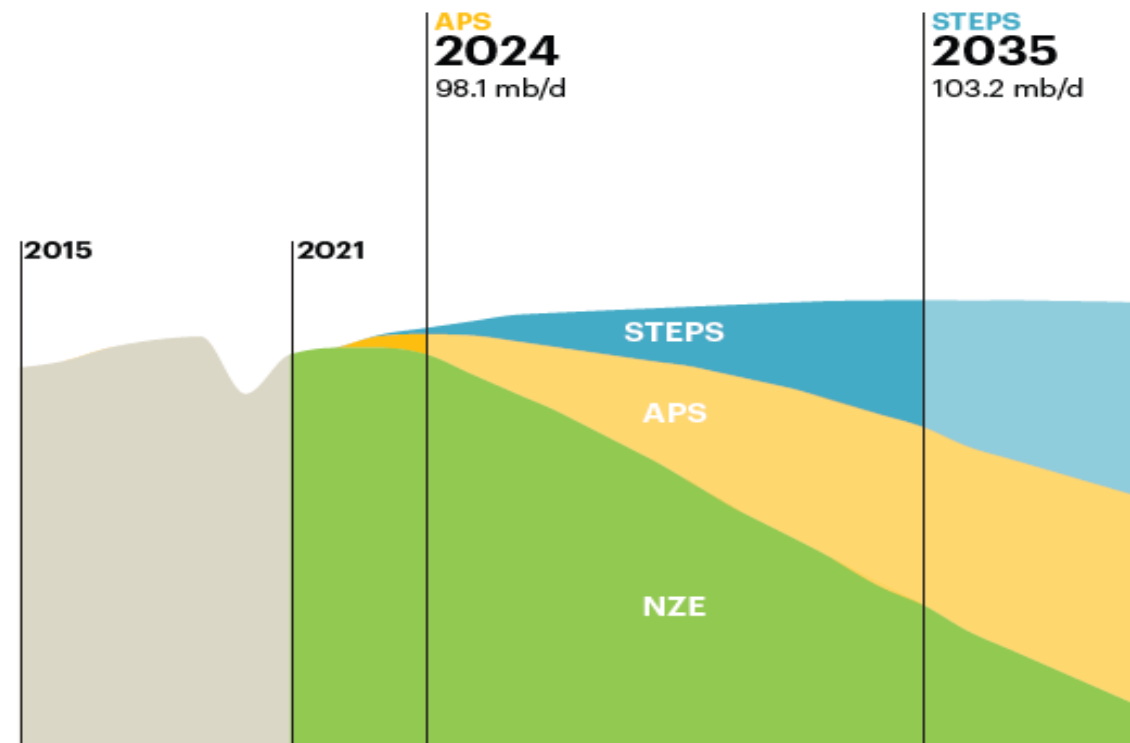
IEA WEO 2025 Scenarios

See BOOK 2 Energy – Chapter 7



Reminder: Oil/Liquids Production IEA 2022 Scenarios

When does oil demand peak...



Peaks in oil demand rest on changes in transport.
Oil use in petrochemicals is harder to shift.

World Liquids Demand (Mb/d)

IEA WEO 2025 Scenarios

			Current Policies		Stated Policies	
	2023	2024	2035	2050	2035	2050
Total liquids	101.6	102.5	108.9	119.1	104.0	102.1
Biofuels	2.4	2.5	3.5	5.7	3.5	4.6
Hydrogen based fuels	-	-	0.1	0.6	0.1	0.6
Total oil	99.2	100.0	105.3	112.8	100.4	96.9
CTL, GTL and additives	0.9	0.9	1.2	1.3	1.1	1.2
Direct use of crude oil	0.9	0.9	0.3	0.2	0.2	0.2
Oil products	97.4	98.2	103.8	111.3	99.1	95.5
LPG and ethane	14.4	14.6	18.2	20.0	17.6	18.0
Naphtha	7.0	7.0	9.1	11.6	8.7	10.6
Gasoline	25.3	25.4	24.4	25.6	22.7	19.3
Kerosene	7.2	7.6	9.5	11.6	9.5	10.9
Diesel	27.4	27.2	28.2	29.2	26.7	24.7
Fuel oil	6.4	6.4	5.8	5.6	5.3	4.6
Other products	9.7	10.0	8.6	7.7	8.6	7.4
Products from NGLs	12.8	13.1	15.1	14.4	14.7	12.2
Refinery products	84.6	85.1	88.7	96.9	84.4	83.3
<i>Refinery market share</i>	<i>83%</i>	<i>83%</i>	<i>81%</i>	<i>81%</i>	<i>81%</i>	<i>82%</i>

Note: CTL = coal-to-liquids; GTL = gas-to-liquids; LPG = liquefied petroleum gas; NGLs = natural gas liquids.

Source: IEA WEO 2025



Oil Demand (Mb/d)

IEA WEO 2025 Scenarios

				Current Policies		Stated Policies	
	2010	2023	2024	2035	2050	2035	2050
World	87.6	99.2	100.0	105.3	112.8	100.4	96.9
North America	22.2	22.1	22.0	21.9	21.7	20.7	17.5
United States	17.8	18.1	18.1	18.3	17.9	17.2	14.4
Central and South America	5.5	5.7	5.7	6.4	7.8	6.1	6.6
Brazil	2.2	2.5	2.5	2.7	3.2	2.6	2.7
Europe	13.8	12.2	12.2	9.4	6.0	9.1	5.1
European Union	10.6	9.0	9.0	6.6	3.3	6.4	2.9
Africa	3.3	4.5	4.5	5.8	8.6	5.7	7.8
Middle East	7.0	8.3	8.4	9.2	11.6	8.6	10.4
Eurasia	3.5	4.2	4.2	4.9	5.6	4.7	5.1
Russia	3.0	3.4	3.3	3.7	3.9	3.6	3.6
Asia Pacific	25.1	34.5	34.9	38.3	41.2	36.5	35.1
China	8.8	16.1	16.2	15.8	13.7	15.2	12.4
India	3.3	5.2	5.4	7.8	10.5	7.4	8.8
Japan	4.2	3.0	2.9	2.4	2.1	2.2	1.6
Southeast Asia	4.0	5.0	5.1	6.5	8.0	6.1	6.6
International bunkers	7.1	7.7	8.1	9.3	10.5	9.0	9.2

Source: IEA WEO 2025



Oil Production (Mb/d)

IEA WEO 2025 Scenarios

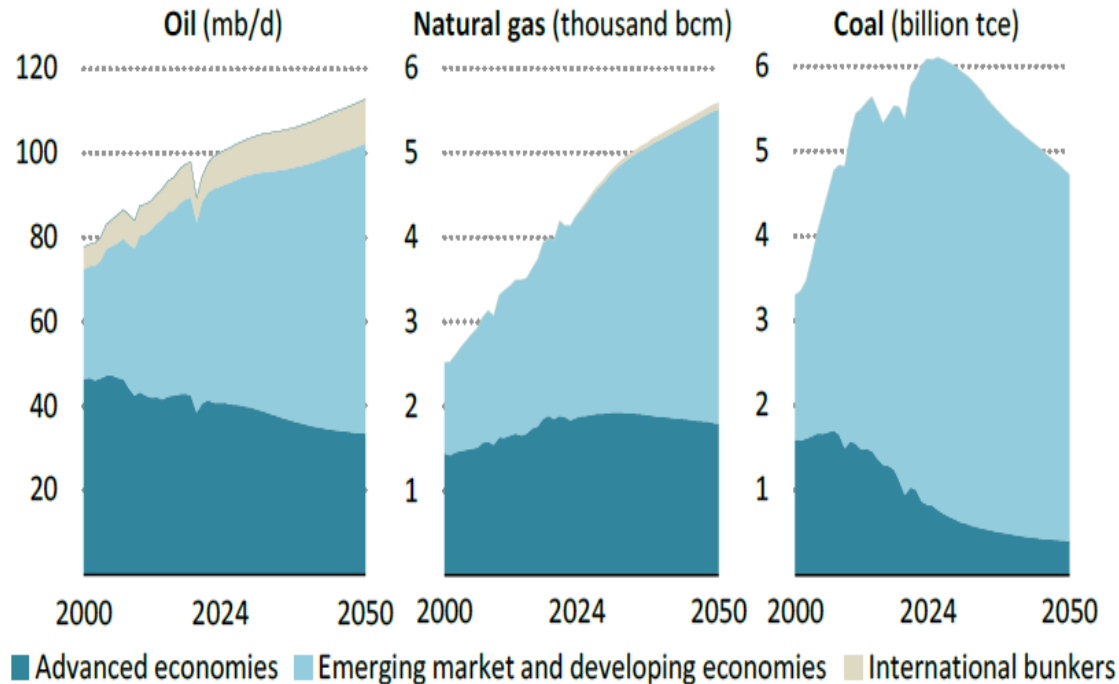
				Current Policies		Stated Policies	
	2010	2023	2024	2035	2050	2035	2050
World supply	85.2	99.2	99.8	105.3	112.8	100.4	96.9
Processing gains	2.1	2.4	2.4	2.6	3.4	2.6	2.9
World production	83.2	96.9	97.5	102.7	109.4	97.7	93.9
Conventional crude oil	66.7	62.6	61.7	61.0	66.3	57.4	56.8
Tight oil	0.7	9.2	9.8	11.8	11.9	11.2	11.2
Natural gas liquids	12.7	20.2	21.0	24.2	24.1	23.7	20.2
Extra-heavy oil & bitumen	2.6	3.9	4.1	4.5	5.7	4.2	4.5
Non-OPEC+	33.2	46.2	47.6	51.7	47.4	50.0	43.1
OPEC+	50.0	50.7	49.9	51.0	62.0	47.7	50.8
North America	14.0	27.5	28.4	29.3	27.4	28.8	24.8
Central and South America	7.4	7.1	7.4	10.1	11.1	9.3	9.5
Europe	4.4	3.4	3.3	2.4	1.3	2.2	1.2
European Union	0.7	0.5	0.4	0.4	0.3	0.3	0.2
Africa	10.3	7.3	7.2	7.1	6.9	6.6	6.0
Middle East	25.4	30.4	30.2	33.6	43.9	32.2	37.1
Eurasia	13.4	13.8	13.5	13.8	13.9	12.3	11.1
Asia Pacific	8.4	7.5	7.5	6.5	4.9	6.2	4.3
Southeast Asia	2.6	1.8	1.7	1.7	1.6	1.5	1.2

Source: IEA WEO 2025



Fossil Fuel Demand by Regions IEA WEO 2025 Scenarios

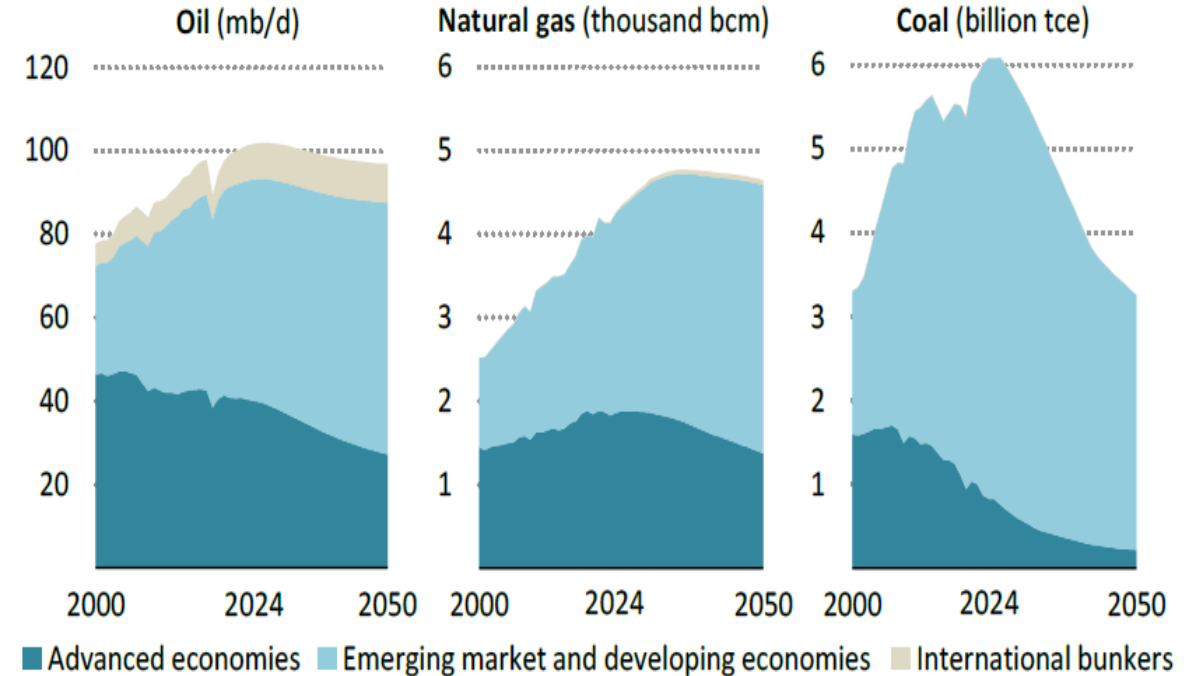
CPS Scenario



IEA. CC BY 4.0.

Oil and natural gas demand continue to rise to 2050; coal use falls, mainly as a result of reductions in the power sector in China and advanced economies

STEPS Scenario



IEA. CC BY 4.0.

Demand for coal peaks before 2030 and for oil around 2030. Natural gas reaches its maximum level around 2035 and then levels off.

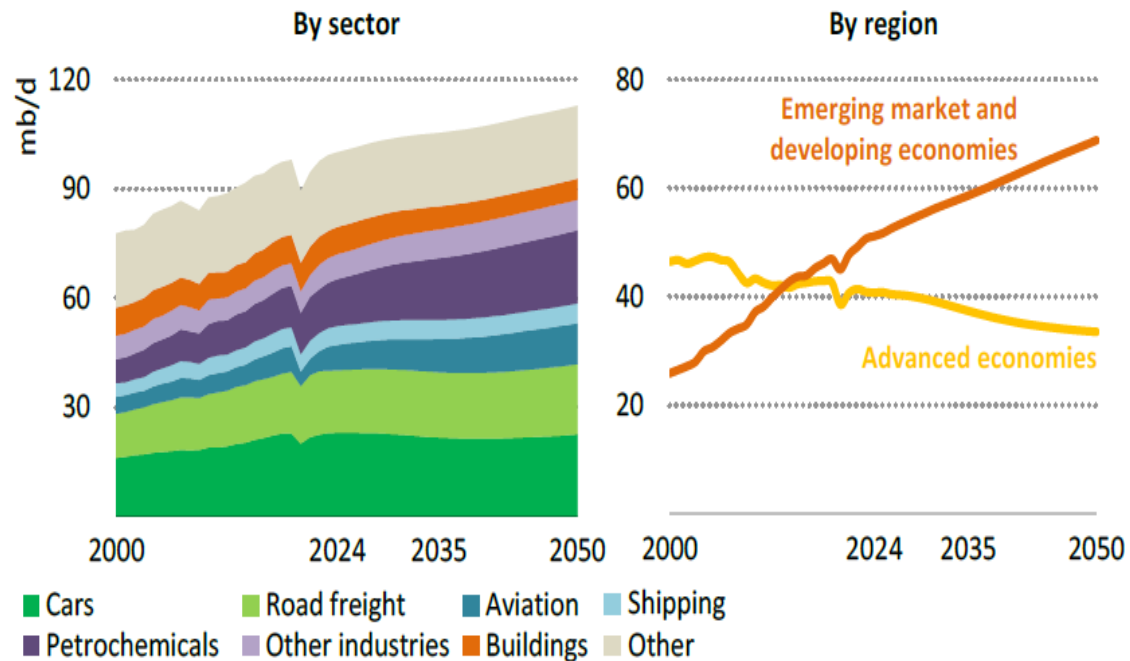
Note: mb/d = million barrels per day; bcm = billion cubic metres; tce = tonne of coal equivalent.

Source: IEA WEO 2025



Oil Demand by Sectors & Regions IEA WEO 2025 Scenarios

CPS Scenario

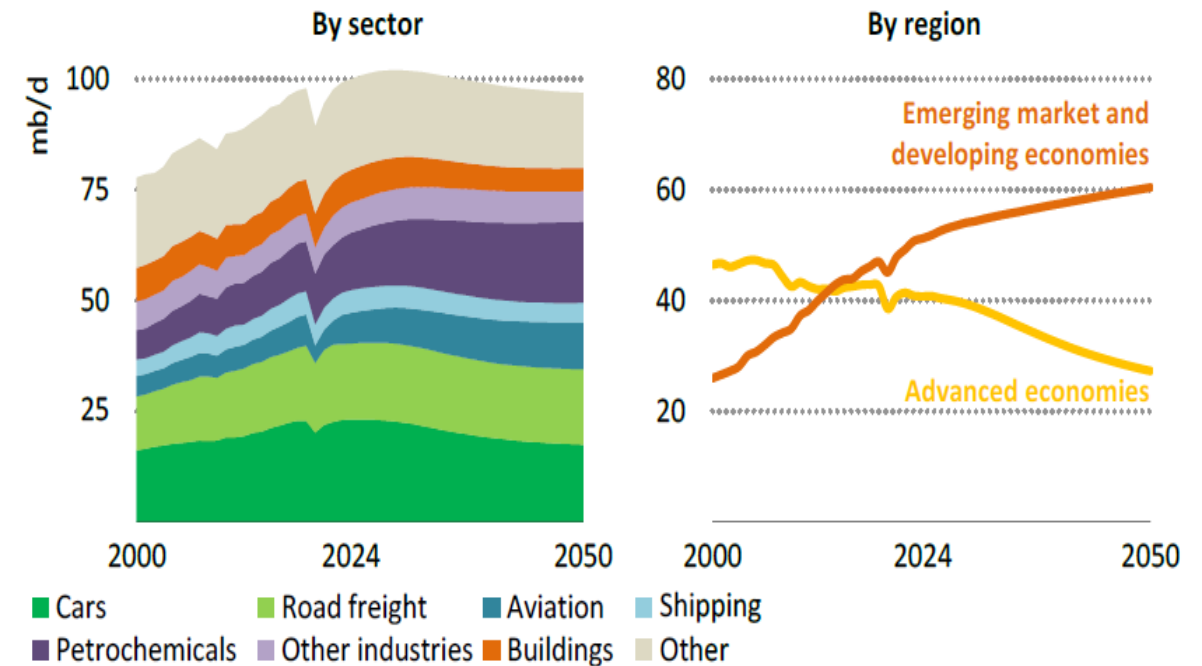


IEA. CC BY 4.0.

*Global oil demand rises to 105 mb/d in 2035 and 113 mb/d in 2050
led by increases in petrochemical feedstock and aviation*

Notes: mb/d = million barrels per day; Other industries = industry sector excluding petrochemicals; Other = other non-energy use, other energy sectors, power, agriculture and other transport. Excludes biofuels.

STEPS Scenario



IEA. CC BY 4.0.

*Electrification of road transport is the primary cause of the peak in oil demand around 2030;
oil use remains more resilient in petrochemical feedstock and aviation*

Notes: mb/d = million barrels per day; Other industries = industry sector excluding petrochemicals; Other = other non-energy use, other energy sectors, power, agriculture, other transport. Excludes biofuels.

Source: IEA WEO 2025



Reminder: Forecasts vs Facts

Worldwide outlook for oil supply/ demand

(IEA Reference Scenario 2007: A constant growth until 2030 – A vision reviewed later !)

Million barrels per day	2005	2010*	2020	2030
World demand	77.0	91.1	98.5	116.3
OECD	46.0	49.0	50.8	52.9
FSU/ Central & Eastern Europe	4.2	4.7	5.1	5.6
Rest of world	23.2	33.7	38.7	53.3
Variation in stocks	3.6	3.7	3.9	4.5
World supply	76.8	91.1	98.5	116.3
OECD	21.8	18.7	18.3	18.3
FSU/ Central & Eastern Europe	8.3	14.0	14.9	17.2
Rest of world (excl. OPEC Middle East)	22.4	26.4	27.1	24.7
OPEC Middle East	21.3	27.5	31.8	45.0
Gains in refining	1.7	2.0	2.2	2.6
Non conventional oil (incl. GTL)	1.3	2.5	4.2	8.5

* Has been affected by the economic crisis: # 87 Mb/d in 2010, 91 Mb/d in 2013

Source : World Energy Outlook 2007



Scenarios from others Organizations



OPEC Scenarios

(See Book 2 Energy – Chapter 7)





Organization of the Petroleum Exporting Countries

2025

World Oil Outlook 2050



BP Scenarios

See Book 2 Energy – Chapter 7





bp Energy Outlook

2025 edition



ExxonMobil Scenarios

See Book 2 Energy – Chapter 7



ExxonMobil



2025 Global Outlook



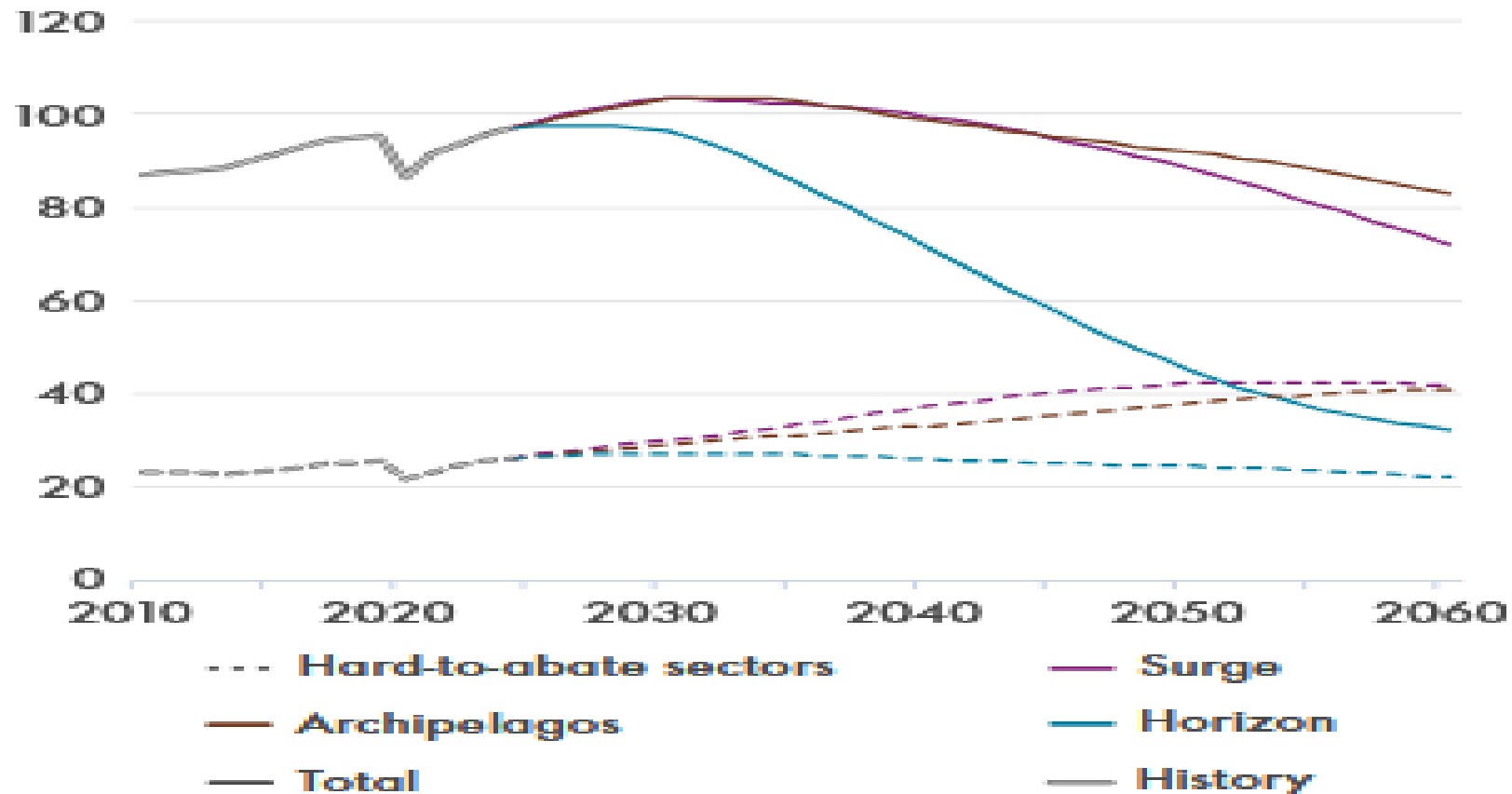
Shell Scenarios



Oil Demand 2010 - 2050

World oil demand in three scenarios
(hard-to-abate sectors shown are aviation, marine and petrochemical feedstock)

Demand, million barrels per day

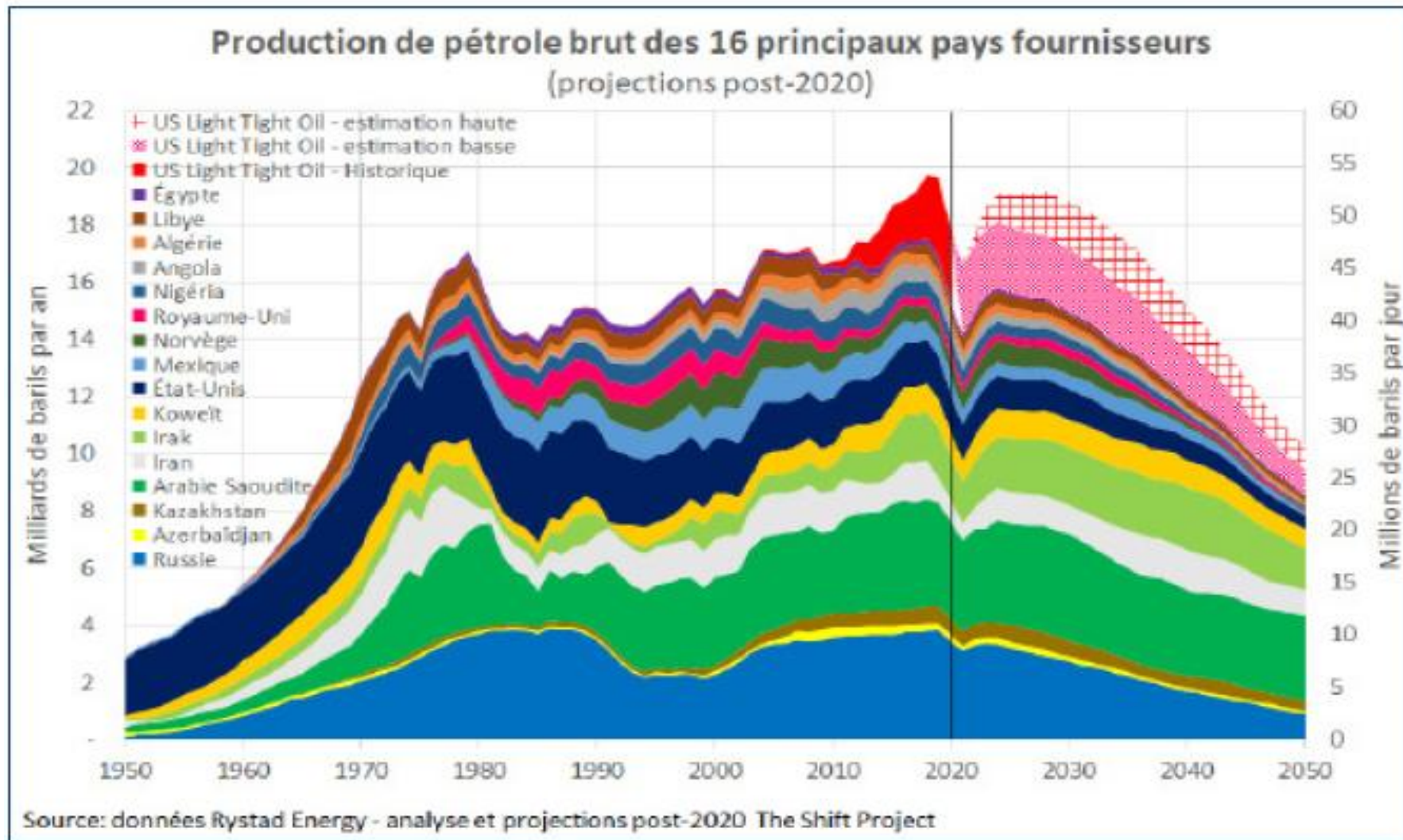


The Shift Project Scenarios



A Scenario for the Future (16 main Oil Suppliers)

The 2021 Vision of the Shift Project



8

Available resources vs CO₂ emissions: the dilemma



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**Some considerations about the Climate
Change Problem
What does it mean for the Energy industries...
in terms of production of existing Reserves?**



Year 2024

Primary Energy Demand/Production = 15,6 Gtoe

Fossil Energy Demand/Production = 12,4 Gtoe

Hydrocarbons Demand/Production = 8,3 Gtoe

CO₂ Emissions = 35,2 GtCO₂



2,84 tCO₂/toe Fossil





Maximum « Budget » Fossil Energy Production

(to cope with 1,5°C/2°C temperature increase)

$$670 \text{ GtCO}_2 / 2,84 \text{ toe} = 236 \text{ Gtoe}$$



236 Gtoe/12,4 Gtoe = 19 years of production Fossil
For 240 GtCO₂ = 7 years of production Fossil

Nota: 670 GtCO₂ corresponds to an average 1,5/2°C. An objective of 1,5°C would correspond to **240 GtCO₂** which would reduce considerably the Remaining Reserves to be reasonably produced.



 **« Budget » Hydrocarbons Production,
assuming Coal is completely stopped as from to-
morrow and fully replaced by Natural Gas:**

$$\# 670 \text{ GtCO}_2 / 2,4 \text{ toe} = 280 \text{ Gtoe}$$



280 Gtoe/12,4 Gtoe = 23 years of production HC
For 240 GtCO₂ = 8 years of production HC

Nota: 670 GtCO₂ corresponds to an average 1,5/2°C. An objective of 1,5°C would correspond to **240 GtCO₂** which would reduce considerably the Remaining Reserves to be reasonably produced.



It doesn't match!

R/P Well defined Resources Oil : 40/50 years

R/P Well defined Resources Gas: 50/70 years

Consequence: A considerable quantity of already well defined Resources would not be produced or developed. Only the Resources with the lowest production/development and/or discovery cost would be eligible to supply energy.....

.....unless Ocean and Biosphere absorb much more CO₂ than expected, and unless CCS is extensively developed in many projects!



In order to satisfy the 1,5°C maximum increase of Temperature, a considerable quantity of Fossil existing Reserves will never be produced

R/P: Reserves on Production Ratio (Years) based on Carbon Budget

FuelCI: Fuel Carbon Intensity (tCO₂/toe)

Q: Consumption Fossil Fuel current year (Gtoe)

MCB: Maximum Remaining Carbon Budget (GtCO₂)

%Fuel: Contribution of the Fuel in the Fossil Fuel Mix (Primary Energy)

$$R/P = (MCB/(\%Coal*CoalCI+\%Oil*OilCI+\%Gas*GasCI))/Q$$



In order to satisfy the 1,5°C maximum increase of Temperature, a considerable quantity of Fossil existing Reserves will never be produced

To cope with 1,5°C, Maximum Carbon Budget = 240 GtCO₂ as from 2024.

Based upon the 2023 data, on the 2023 Energy Fossil Fuel mix (Coal, Oil and Gas), R/P = 6/7 years, while most of the publications mention 50/60 years for Oil and Gas proven/probable reserves, more than 100 years for Coal.

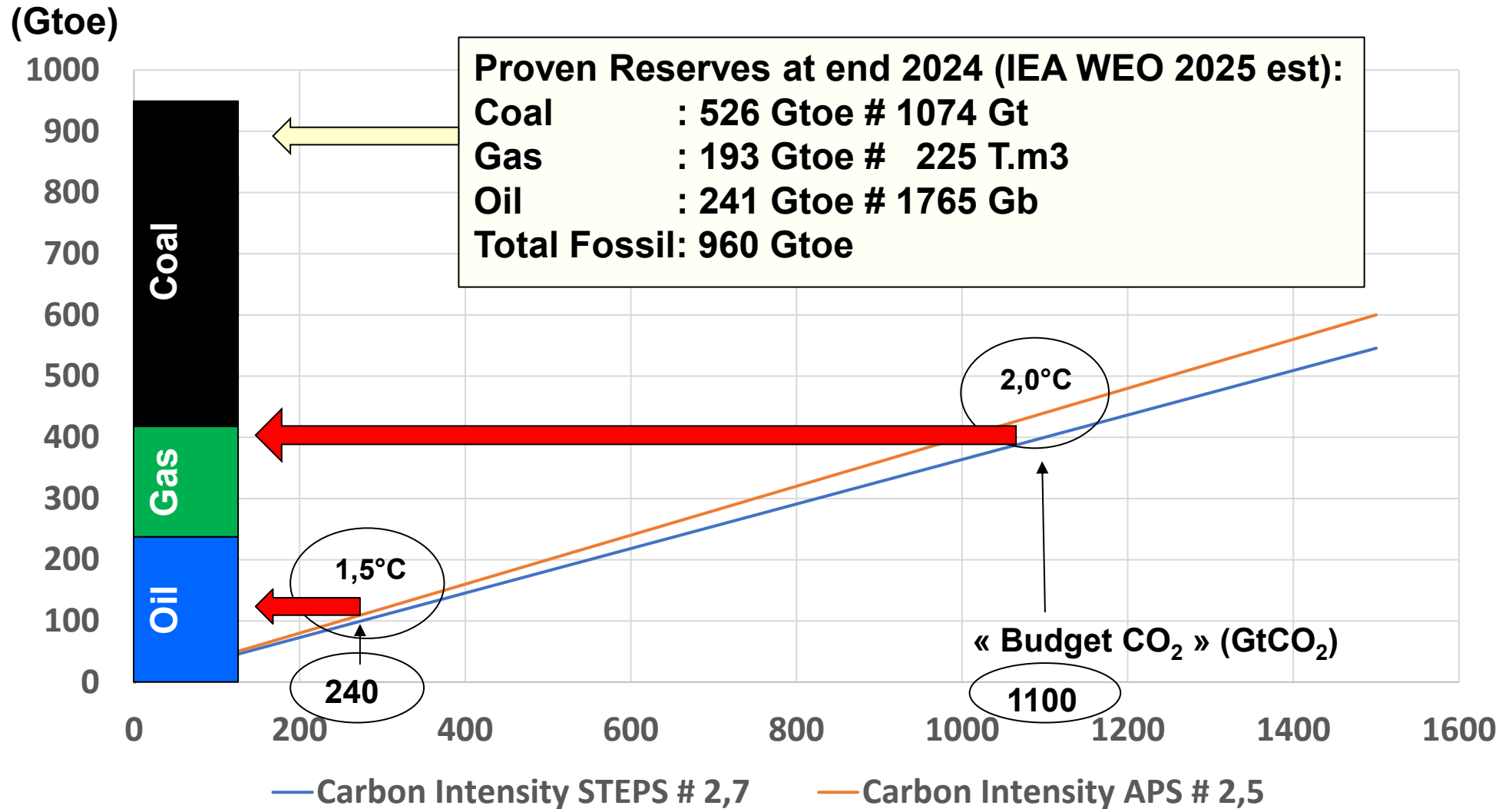
If we assume that all Coal is replaced by Natural Gas as from now, R/P = 14 years

Nota: The R/P ratio represents the number of years at future constant Production/Consumption. In reality, the production/consumption profile will decline regularly so that the actual period of production will be greater than the R/P ratio. Nevertheless, the R/P ratio is a pertinent indicator which clearly illustrates here the challenges for the Coal, Oil & Gas companies.



The Hydrocarbon Industry Dilemma:

To cope with 1,5/2°C, a very substantial part of « Proven » Reserves will never be produced



Source: Ch.Guéritte Data from IEA WEO 2025
Nota: Carbon Intensity in tCO₂/toe –Average 2022-2050



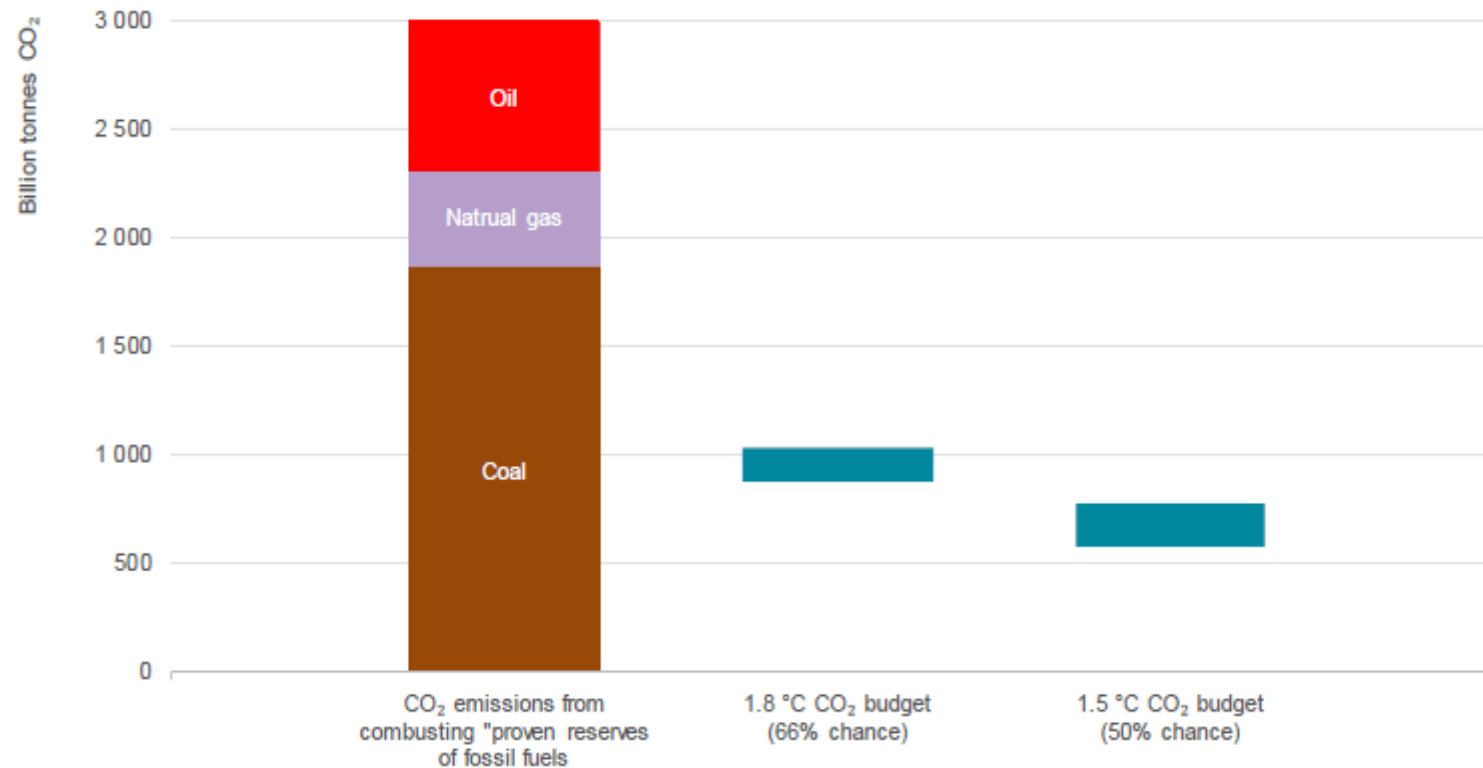
Stranded Reserves Volumes

The IEA view



Producing all current existing Proven Reserves not compatible at all with the 1,5°C objective!

CO₂ emissions from combusting all “proven reserves” of coal, oil and natural gas compared with remaining CO₂ budgets



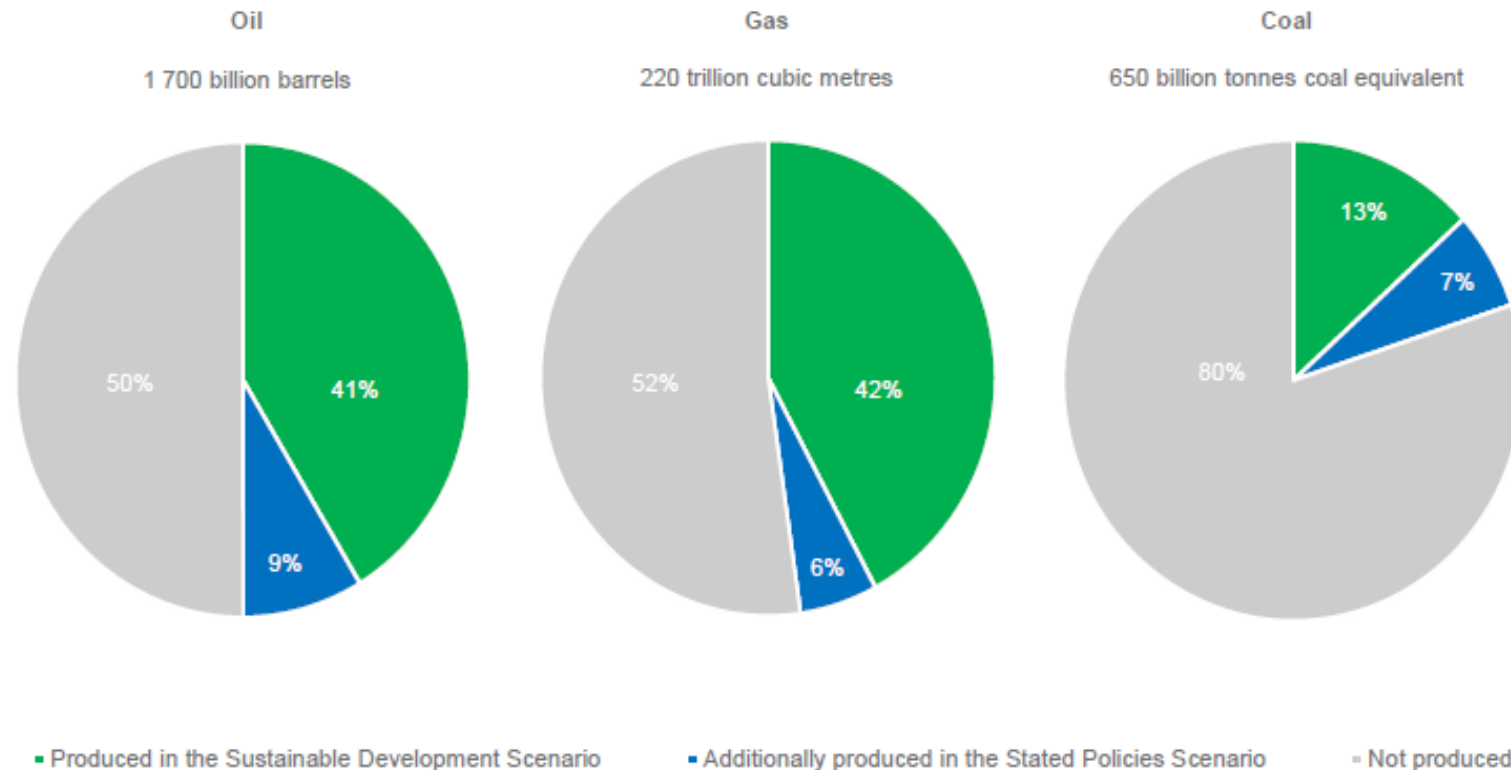
Notes: Reserves are the publicly reported level of "proven reserves", with 1 700 billion barrels of oil, 220 tcm of natural gas, and 850 billion tonnes of coal equivalent. CO₂ budgets are taken from the Intergovernmental Panel on Climate Change (IPCC) *Special Report on Global Warming of 1.5 °C* and are from the start of 2018. The different CO₂ budgets shown are associated with uncertainty in the temperature increase today relative to pre-industrial times. The SDS has a remaining CO₂ budget of 880 Gt CO₂.

Source: IEA 2019: The Oil and Industry in the Energy Transition



To cope with the 1,5°C Objective, a very substantial part of existing reserves will not be produced..... Unless CCS is extensively developed

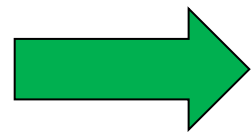
Proportion of “proven reserves” produced in the STEPS and SDS, 2018-40



Note: To align with most discussion on stranded volumes, reserves stated are the publicly reported level of “proven reserves”.

Source: IEA 2019: The Oil and Industry in the Energy Transition





Outstanding Challenges for the Energy World !



Oil Upstream: technical features and economics



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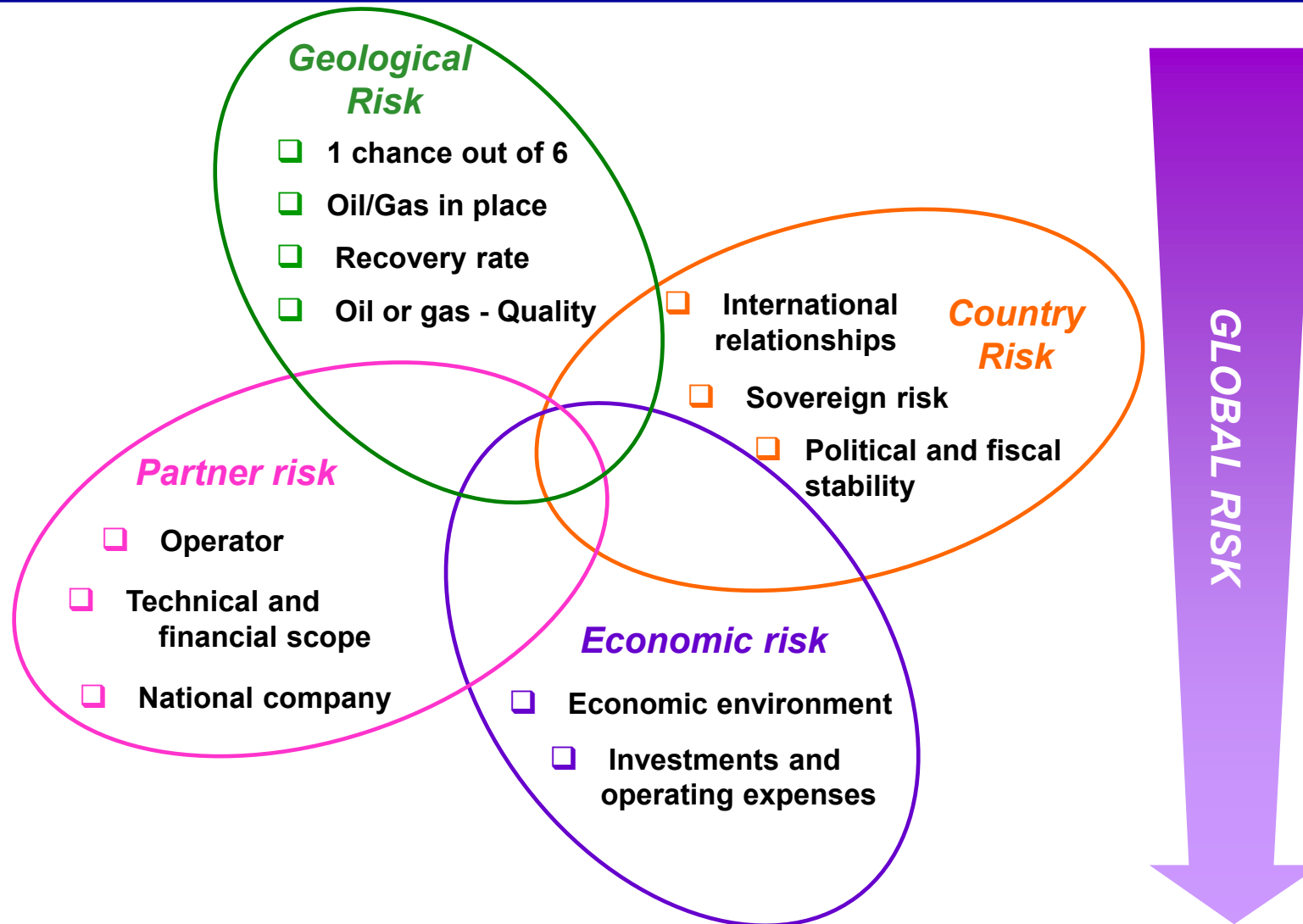


Fundamentals of Exploration/Production

- ◆ **INTERNATIONAL INDUSTRY** – With the constraints linked to the Climate change and the huge development of Energy Transition projects, the Oil & Gas Industry is facing important difficulties in term of image and reputation.
- ◆ **RISKY ACTIVITY**
 - In average, 1 exploration well out of 6 leads to a commercial discovery (Probability of success # 17%, depending upon continents, onshore, offshore. This success rate varies upon time.
- ◆ **VERY CAPITAL INTENSIVE INDUSTRY**
 - More than 60% of investment in the whole hydrocarbon industry
- ◆ **LONG TERM PROFITABILITY**
 - Several years between discovery and production
 - Production profiles longer than 10/15 years
- ◆ **POLITICAL IMPLICATION**
- ◆ **PRODUCTION COSTS DEPENDING ON LOCAL CONDITIONS**
 - Offshore/ onshore, geological, climate, depth of reservoir, size...
- ◆ **HIGH TECHNOLOGY**
 - 3D - 4D seismic, deep water drilling and production, horizontal drilling, slim hole drilling, multiphase transportation, heavy oil production and processing, shale gas....
 - transportation, heavy oil production and processing, shale oil & shale gas....



Risks in Exploration / Production

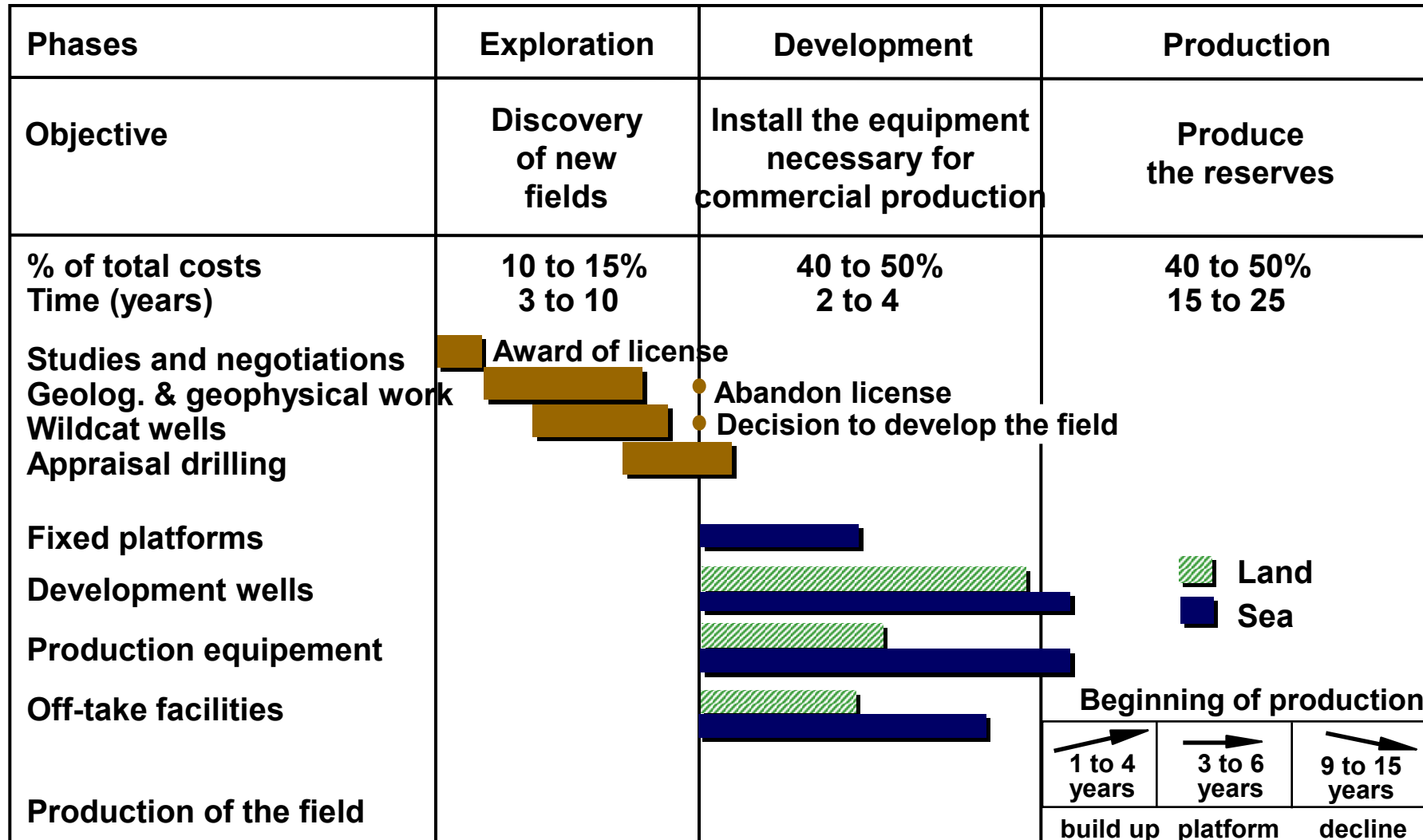


The Main Steps for the « Modern » Oil Industry

- **1848: First oil well in Aspheron Peninsula – Baku/Azerbaïdjan**
- **1859 : First oil find in US by drilling – Titusville/Pennsylvania by Edwin Drake**
- **1920's : Rotary drilling, first electrical well logging**
- **1930's : Offshore drilling**
- **1960's : Digital computing**
- **1970's : Directional drilling**
- **1980's : 3D seismic**
- **1990's : Horizontal drilling**
- **2000's : Oil & gas shale production**



The phases of the Exploration and Production process



Reservoir life

EXPLORATION



APPRAISAL

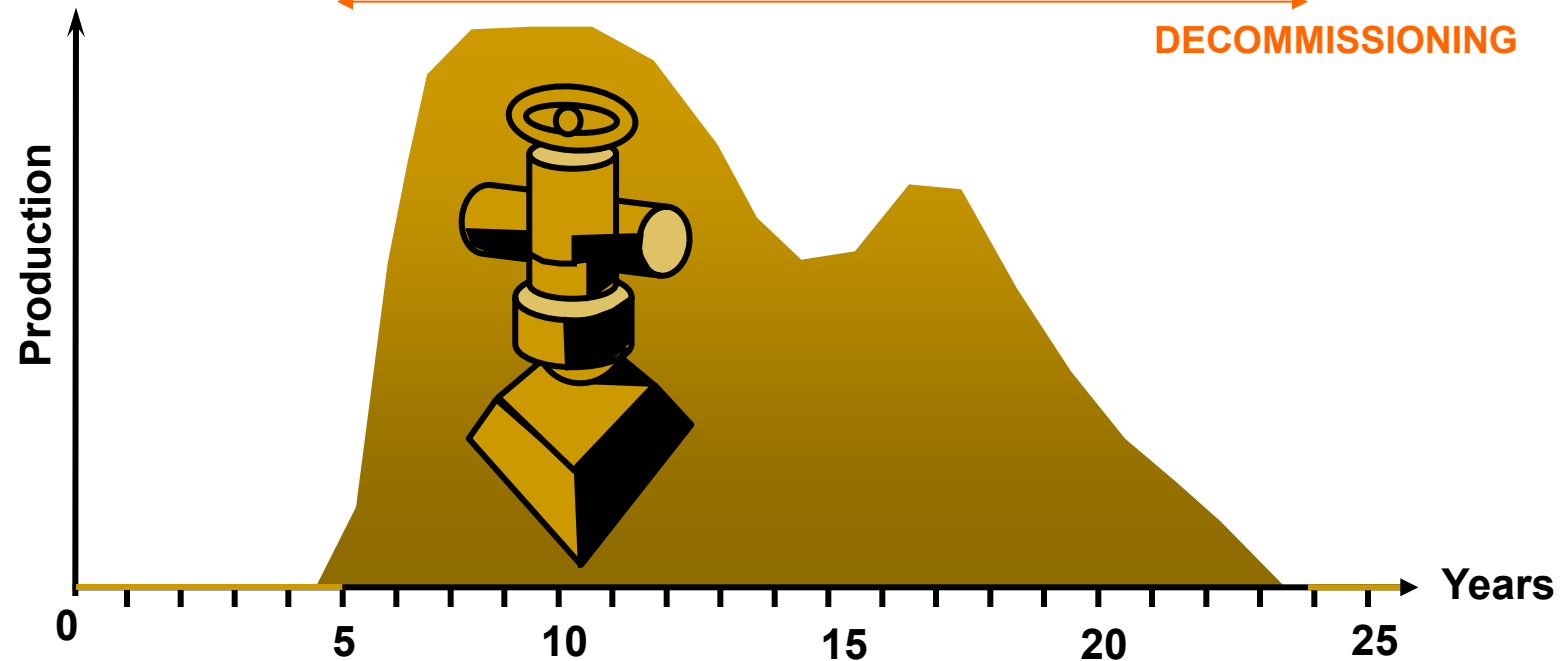


DEVELOPMENT



PRODUCTION

DECOMMISSIONING



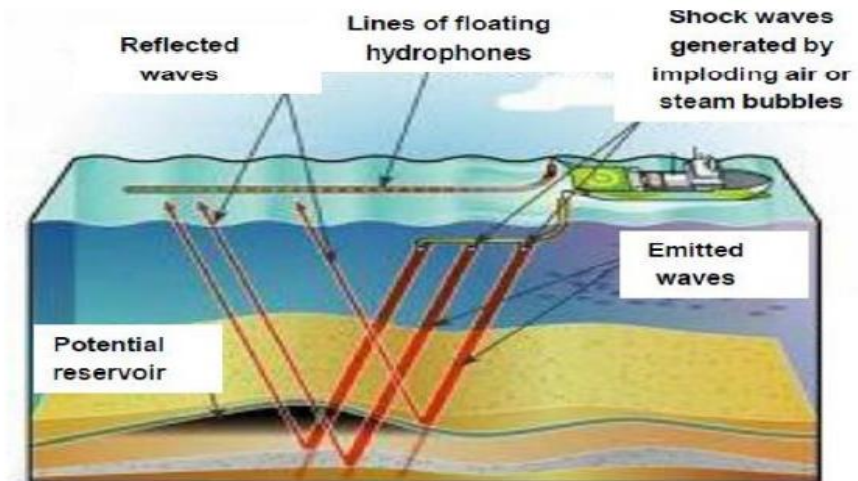
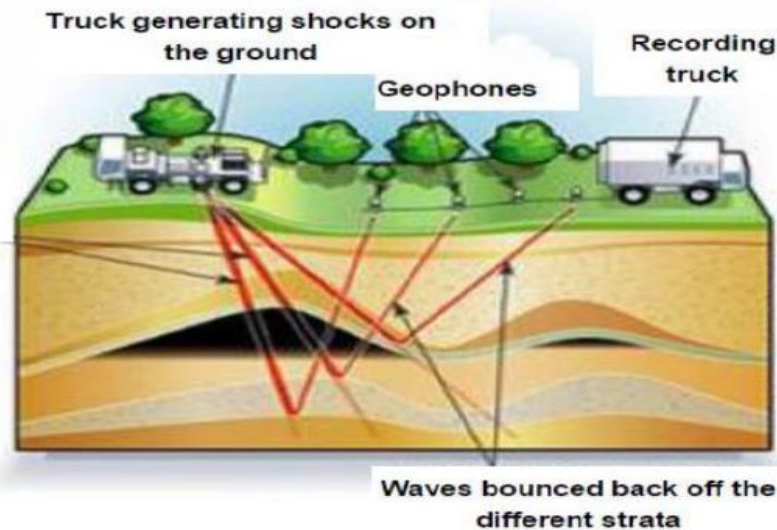
Geophysics



Geophysical works – Principle & Objectives (1)

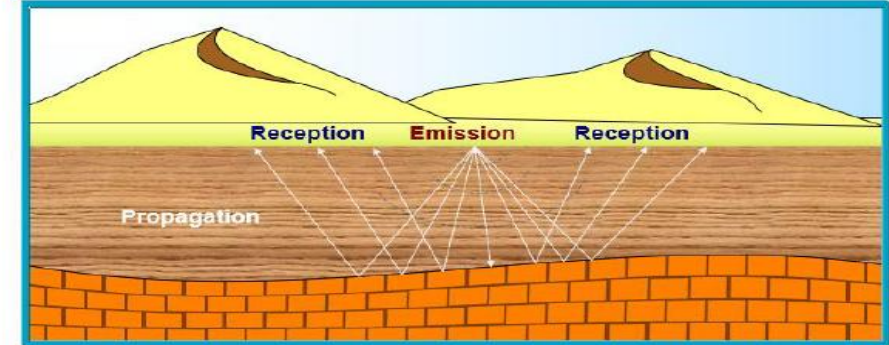
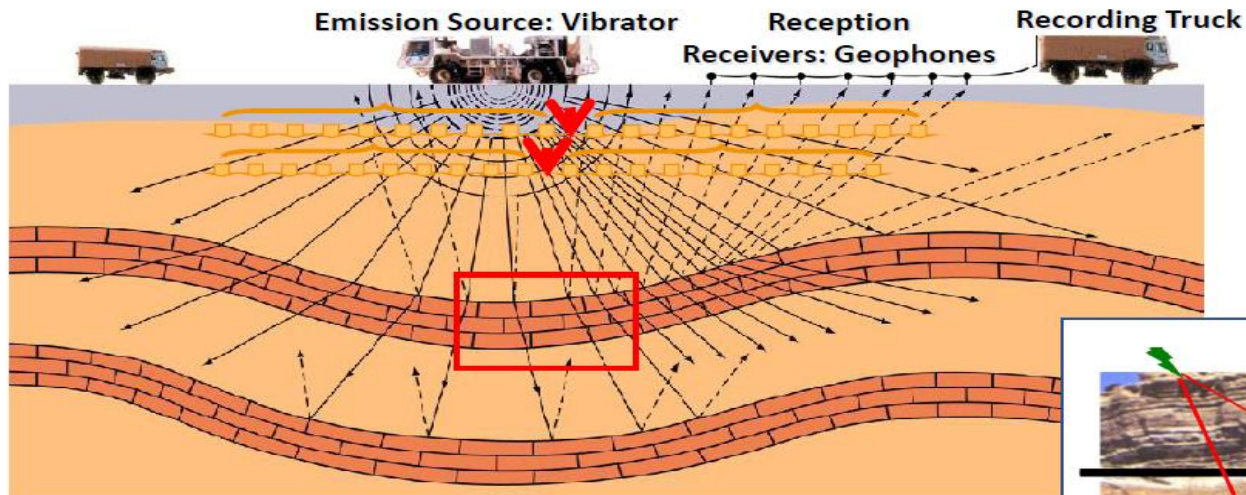
Seismic Technique: Principles & Objectives

- Objective is to get an image as accurate as possible of the sub-surface where oil or gas prospects can be identified (onshore, offshore)
- This image is obtained, like an echography of the sub-surface, by emission (source) and recording (geo/hydro-phones) of artificial seismic acoustic waves.

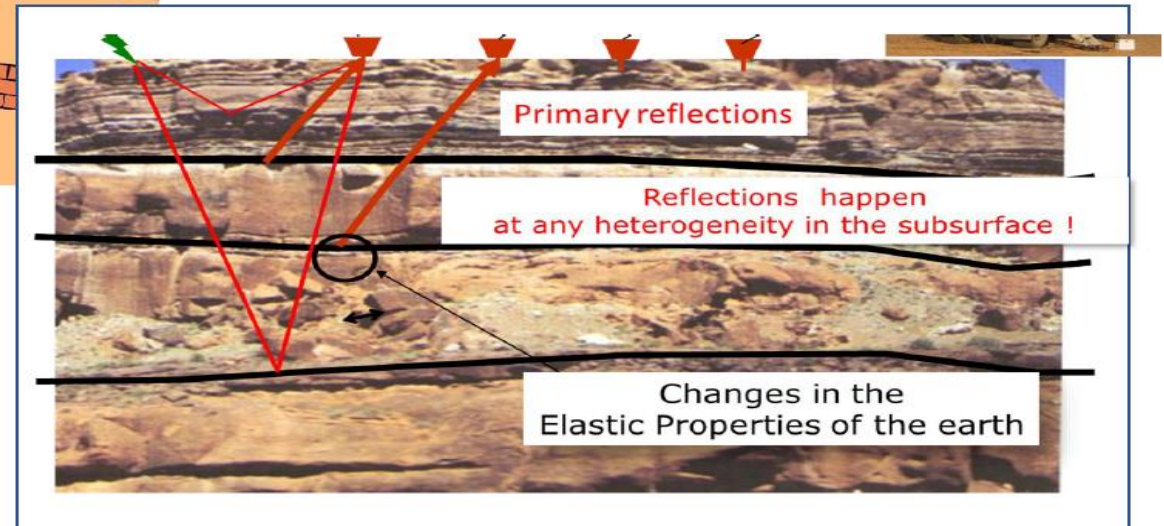


Geophysical works – Principle & Objectives (2)

Seismic Waves Propagation Principles



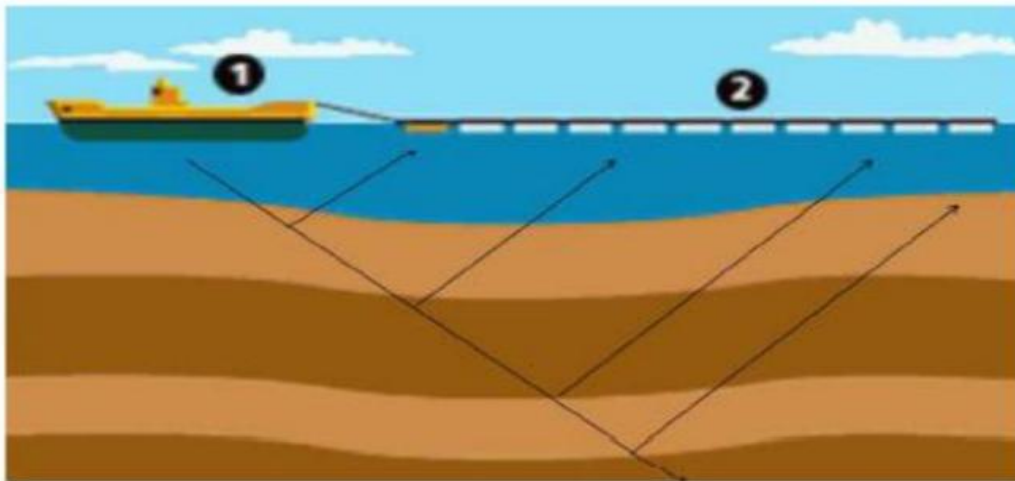
- Transmission, refraction & reflections of the seismic waves generated across or at each geological interfaces.
- Geometry and reflectivity depends on lithology contrast (density, propagation velocity)



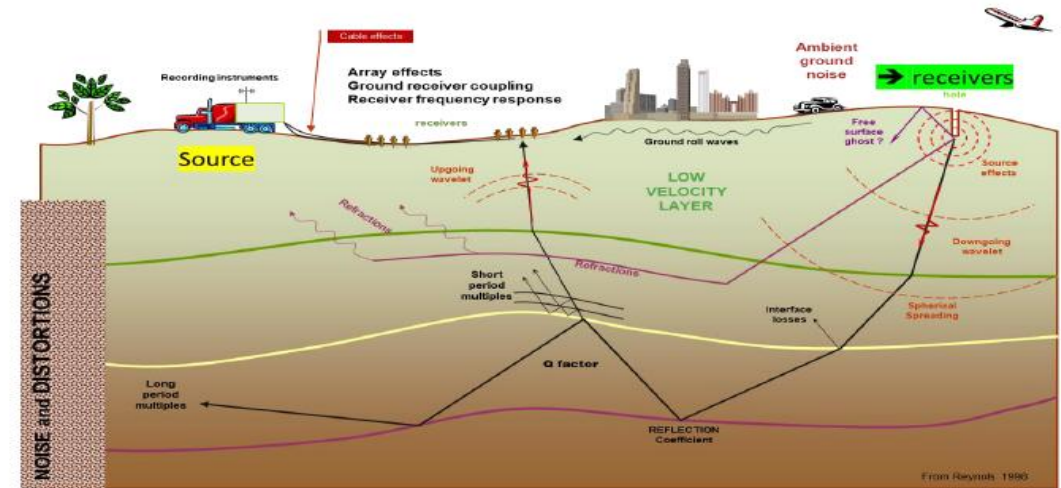
Geophysical works – Principle & Objectives (3)

Different Types of Seismic Waves

- Velocity of seismic waves travelling through the sub-surface changes with characteristics of each geological layer
- Time of propagation of reflected waves gives direct information about geometry of the geological layers
- All the other waves (multiples, refracted, ground-roll,..) are considered as noise or artefacts that can be misinterpreted on the resulting seismic section.



Reflected waves



Other « non-desired » waves



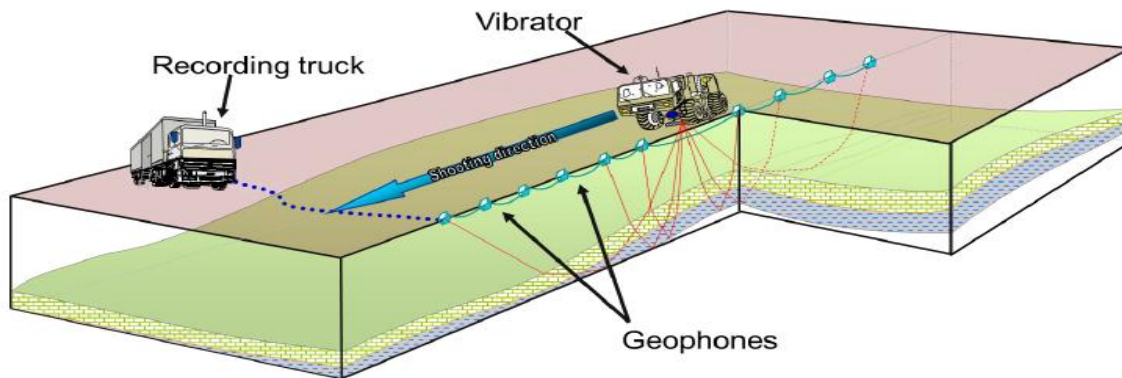
Geophysical works - Acquisition (1)

Land Seismic Acquisition: 2D & 3D Surveys

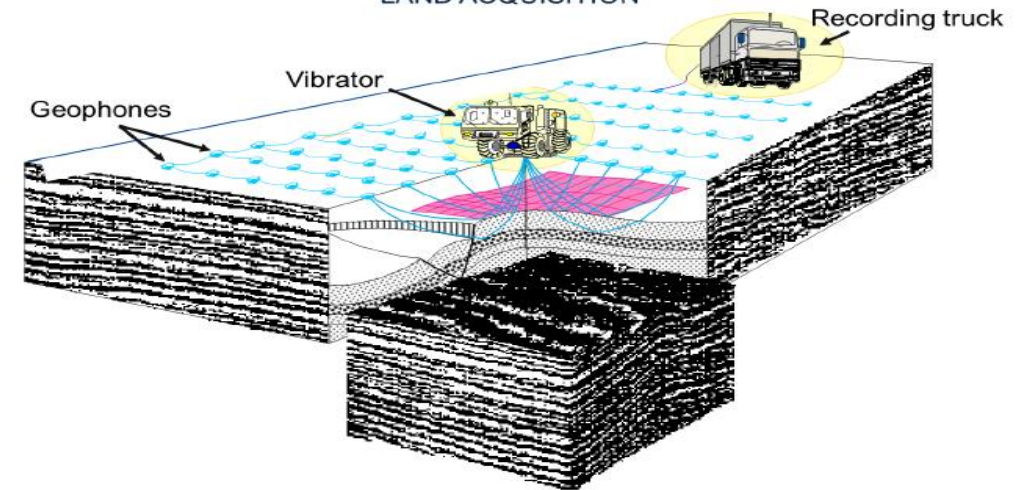
- Main source for onshore / land seismic acquisition is **VibroSeis** truck.
- Receivers are **geophones** made of 3 directions sensors (X,Y,Z)
- 2D seismic profiles are acquired at early exploration stage.
- More dense data (3D) is acquired for intensive exploration or at appraisal / development stage .
- Seismic acquisition operations and density is constrained by surface / topography conditions (mountain, urban, desert,...)



Principle of 2D reflection seismic
LAND ACQUISITION

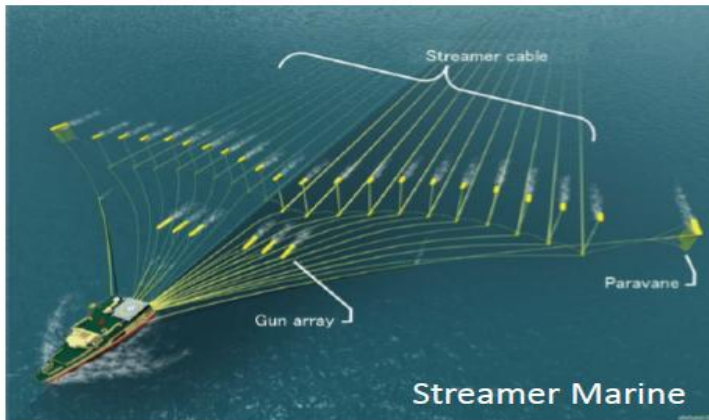


Principle of 3D reflection seismic
LAND ACQUISITION

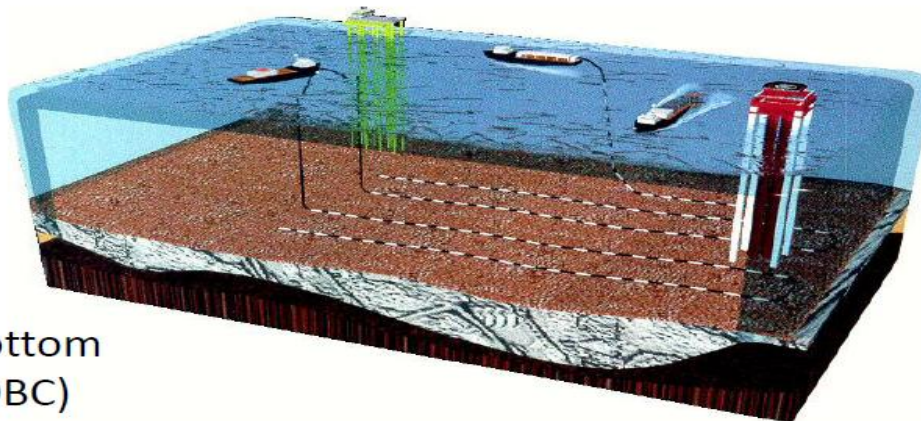


Geophysical works - Acquisition (2)

Marine Seismic Data Acquisition : Streamer, OBC, OBN

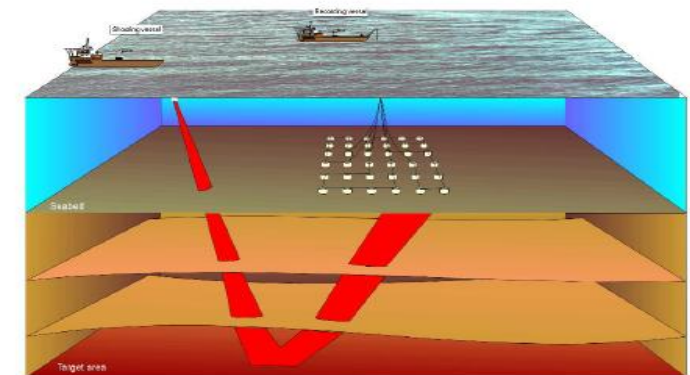


- Main seismic **source** used for marine seismic acquisition is **Airgun**
- Receivers = **hydrophones** are towed behind the boat along a long cable (6 to 10 km) named **streamer**
- Seismic profiles are acquired with various spacing between lines.
- Density of acquisition (2D, 3D) depends on exploration maturity of the area (extensive / intensive exploration, appraisal, development)
- When obstructions are present in the area, receivers are layed on the **seafloor** using Ocean Bottom Cable (OBC) or nodes (OBN) techniques



Ocean Bottom
Cables (OBC)

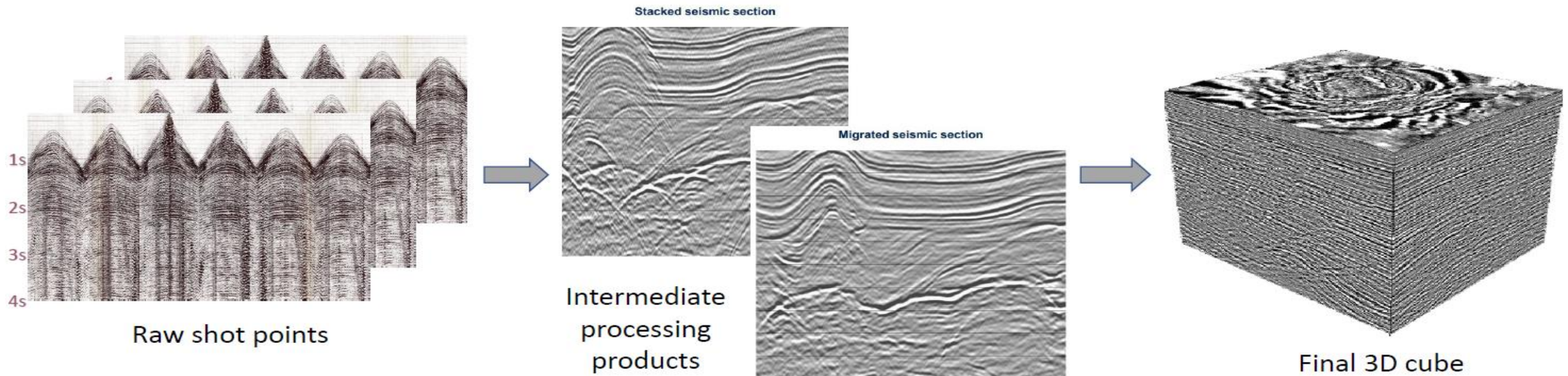
Ocean Bottom
Nodes (OBN)



Geophysical works Data & Processing (1)

Seismic Processing & Depth Imaging Objectives

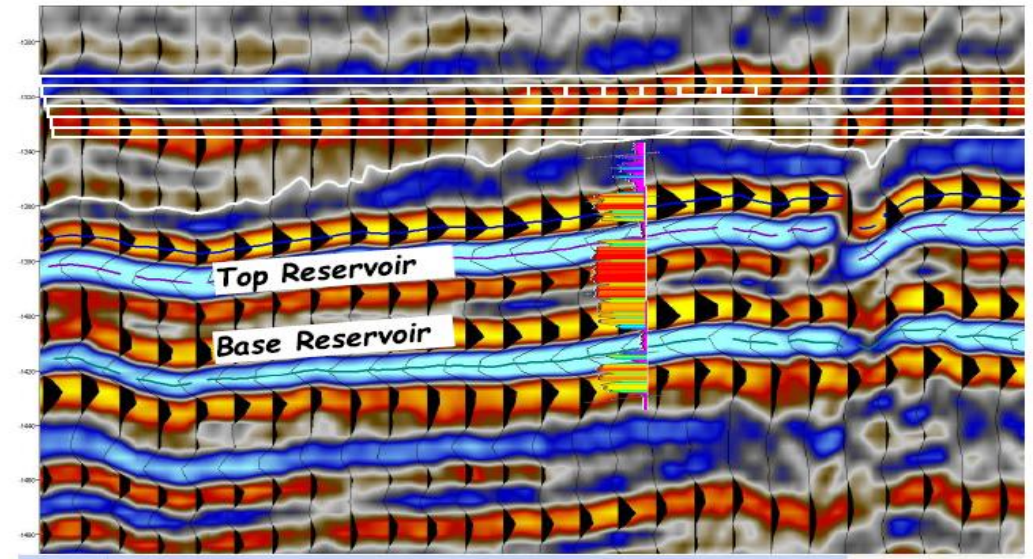
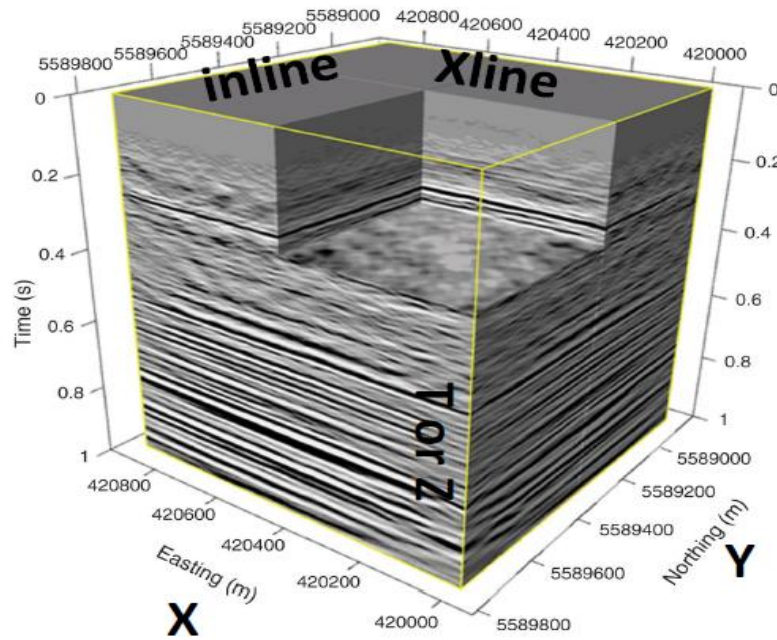
- Aim of 2D or 3D Seismic Data Processing is to transform thousands of recorded shot points into migrated seismic lines or volume ready for interpretation.
- In particular, it aims to re-position ($X-Y + T \rightarrow Z$) the seismic events with their attributes (amplitudes, frequency, ...) at their true origin in the sub-surface.



Geophysical works Data & Processing (2)

The 3D Seismic Data

- The 3D seismic cube contains two main types of information:
 - **POSITION** of the seismic cells or « bins » (X,Y,T,Z) → In-Lines, Cross-Lines
 - **SEISMIC ATTRIBUTES** (A1, A2,... An) → amplitude, frequency, phase,



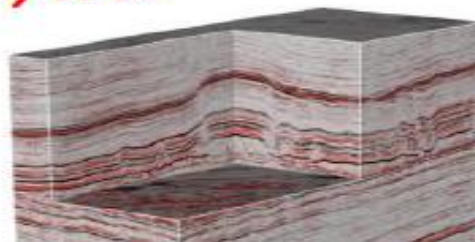
INL Seismic display: Wiggle, colour density



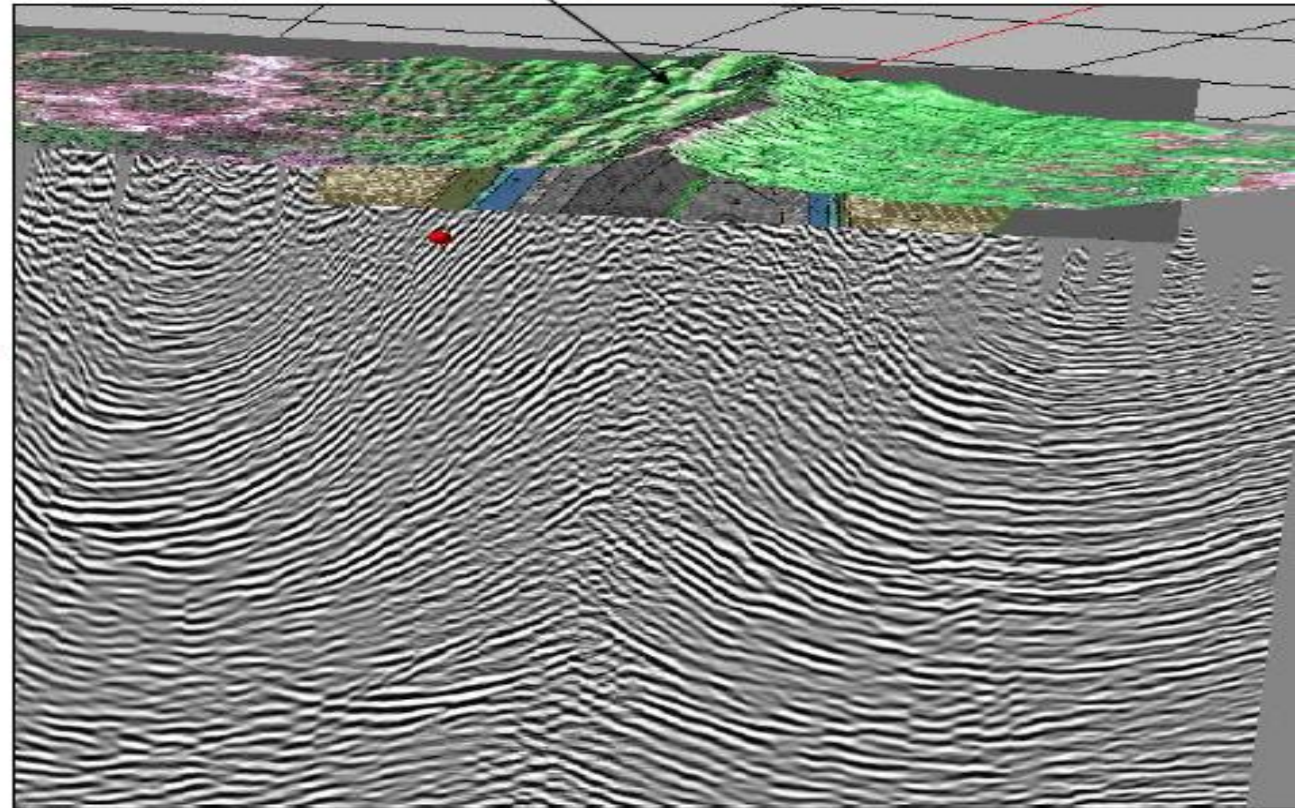
Geophysical works Data & Processing (3)

3D seismic

- 3D seismic provides larger volume of data which are more precise and reliable:
...it enables building 3D images and sometimes may provide direct indicators of hydrocarbons' presence in some layers.



Sea bottom seen by 3D seismic

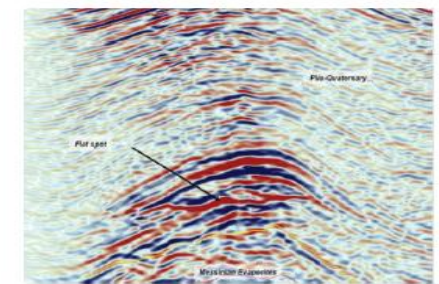
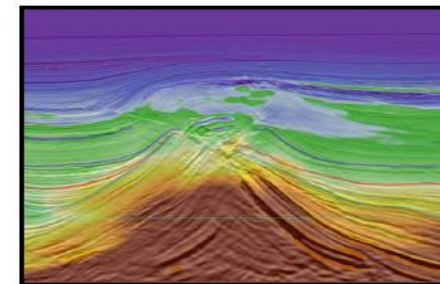
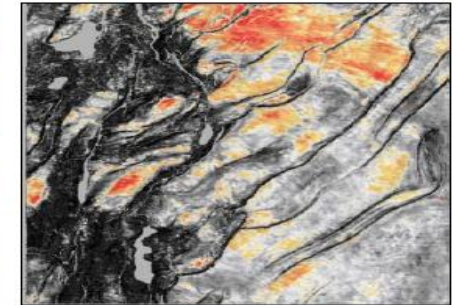
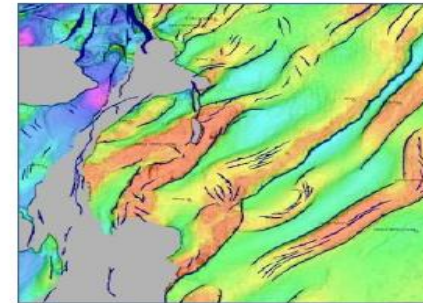
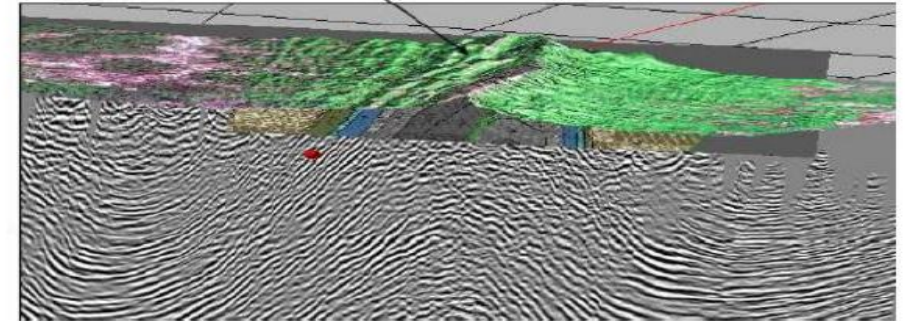


Geophysical works - Interpretation

Seismic Interpretation

- **Structural Interpretation:** aims to describe, map in depth and characterize the geometry of the geological layers in the subsurface, this at different scales (basin, block, prospect or field)
- **Stratigraphic Interpretation:** aims to describe, map and characterize the reservoir (extension, lithology, facies, petrophysics properties) from seismic attributes and geo-morphologies.
- **Fluid Interpretation:** aims to identify and assess the presence of hydrocarbons (Direct Hydrocarbon Indicators = DHI) in a basin or more locally on a prospect using seismic attributes (amplitudes) and angle/offset based methods (RVA, AVO)

Sea bottom seen by 3D seismic



Geophysical works - Costs

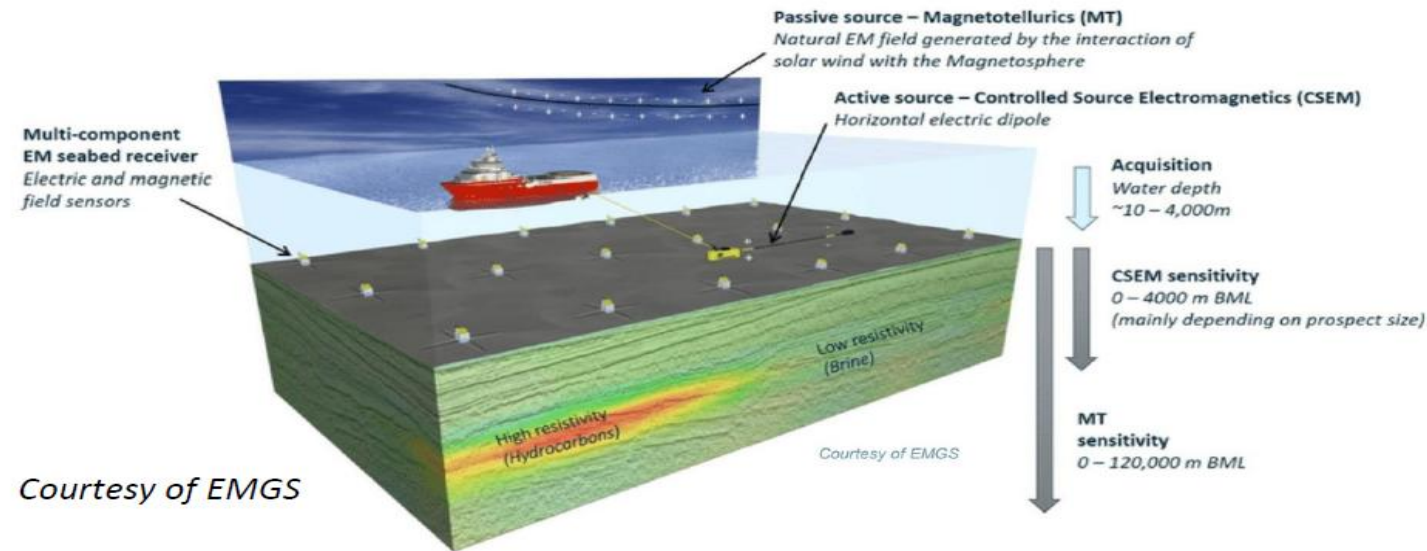
Seismic Costs (update 2022)

		ONSHORE	OFFSHORE	
		Vibroseis acquisition	for streamer acquisition	for OBN acquisition
Data	2D SEISMIIC	5 000 to 200 000 \$/km 150 to 300 km/month crew	2 000 \$/km 3 000 km/month crew	NA
	3D SEISMIC	10 000 to 1 000 000 \$/km ² 30 to 1 000 km ² /month	4000 to 100 000 \$/km ² 100 to 1 000 km ² /month	40 000 to 120 000 \$ /km ²
Processing	2D SEISMIIC	200 to 1 500 \$/km		
	3D SEISMIC	800 to 4 000 \$/km ²		
Interpretation		500 000 \$ to 5 000 000 \$ / project from a few months to several years		

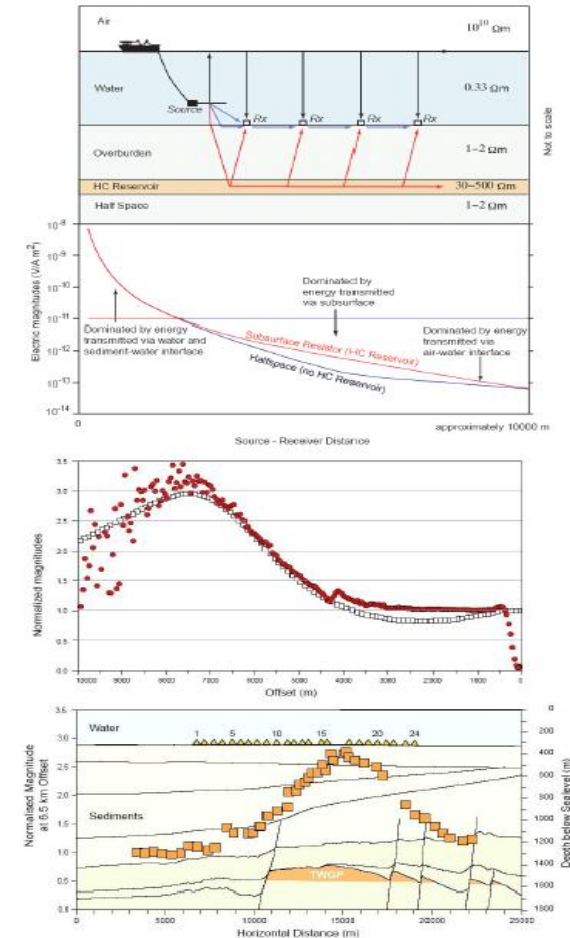


Geophysical works

Non-Seismic Geophysical Methods : CSEM



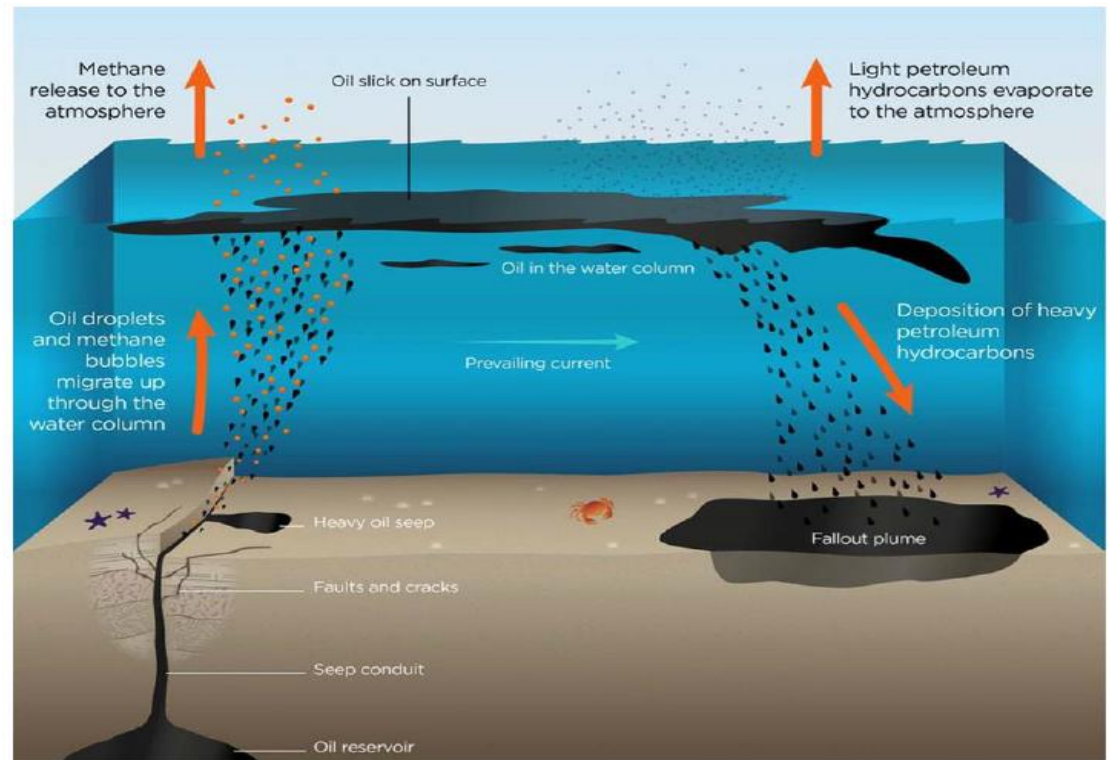
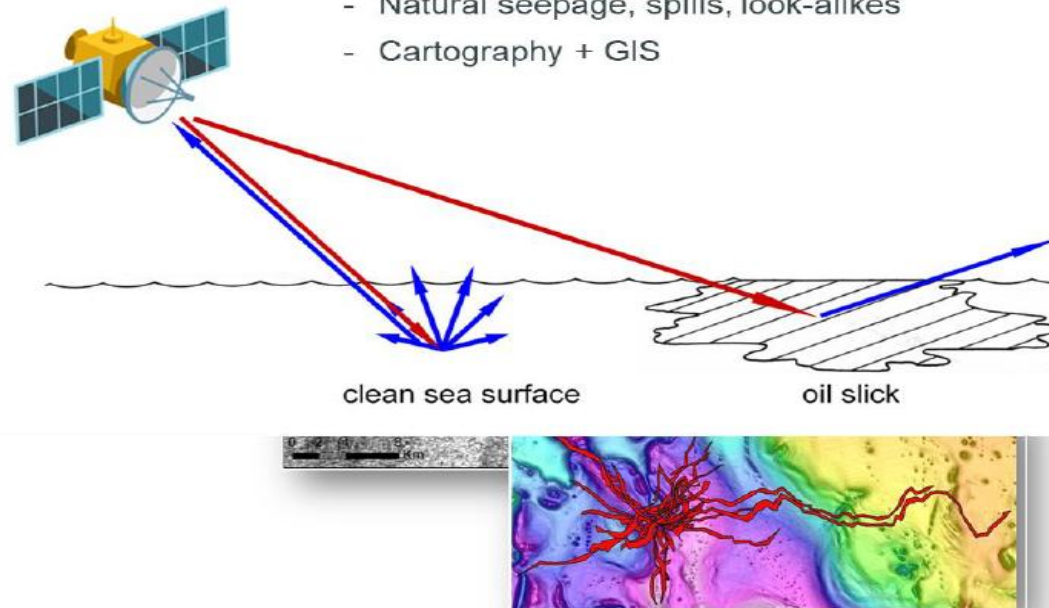
- The basis of the method is to transmit a diffusive electromagnetic field from a deep towed marine source and record the electrical and magnetic field which has passed through the Earth, from source to an array of sea-bottom receivers with electrical and magnetic sensors.
- The principle is that if anomalous resistive 'bodies' (hydrocarbons, but not only !) exist in the sub-surface their presence can be detected remotely at the seabed.



Geophysical works

Geospatial Data for Oil Seeps Detection

- **Objective:** Prove the presence a petroleum system
- Methodology
 - Use SAR images available
- Visual interpretation
 - Natural seepage, spills, look-alikes
 - Cartography + GIS



Courtesy of Helene Bideaud, Séminaire Geoint Sorbonne Université, 29/11/2022

11



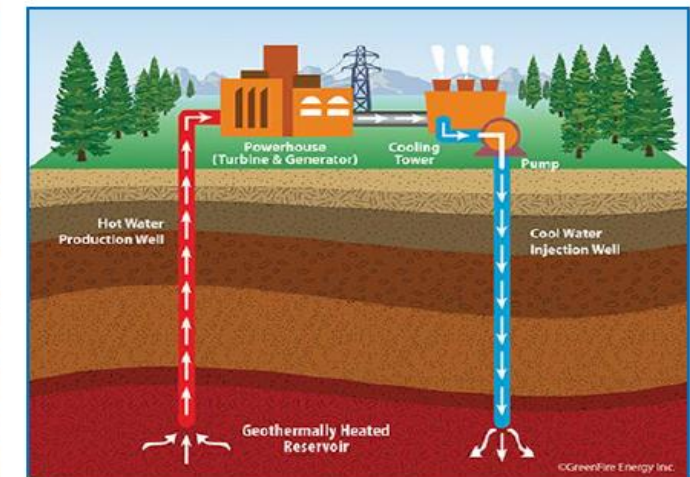
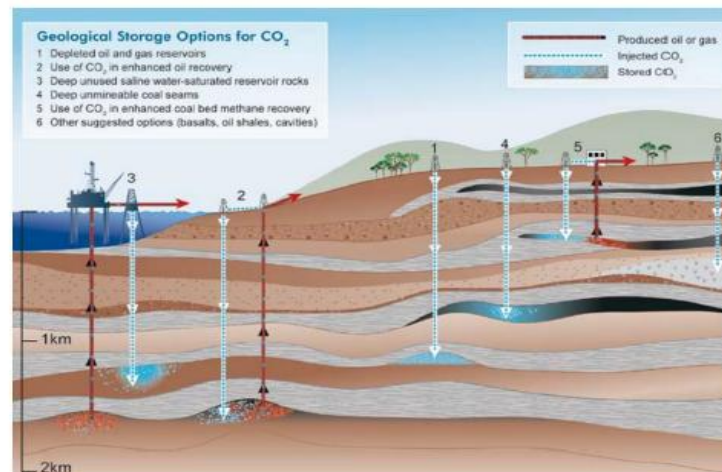
Geophysical works & Energy Transition

Geophysics & Energy Transition



Geophysical techniques and methods can contribute for **energy transition** in order to:

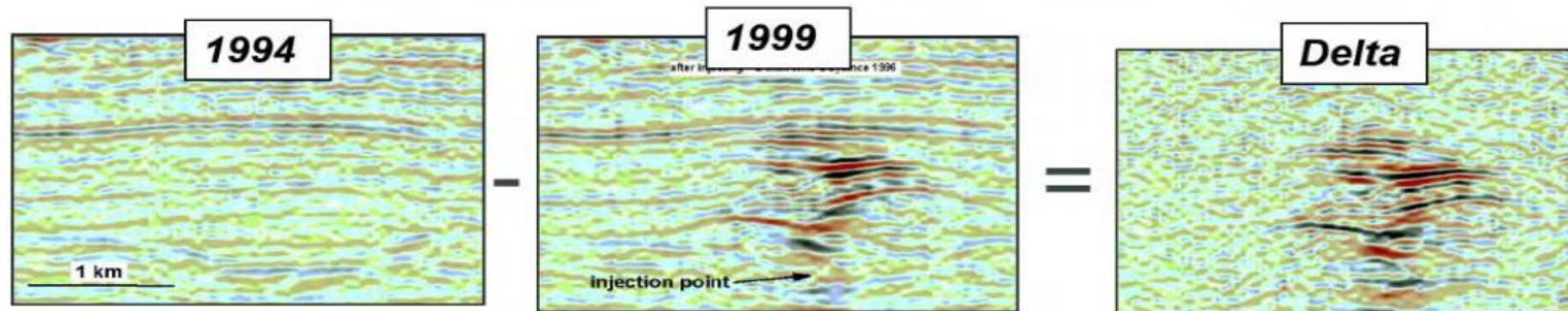
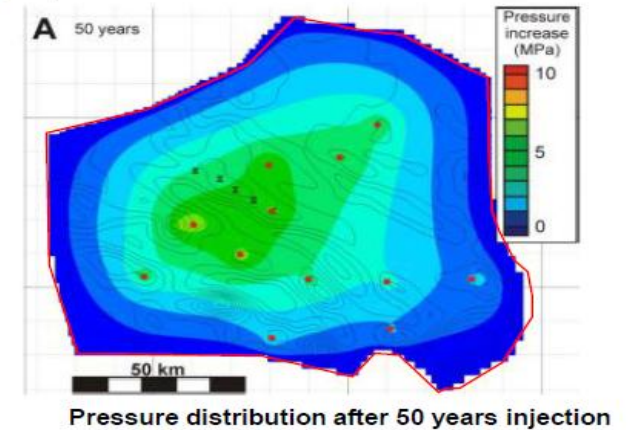
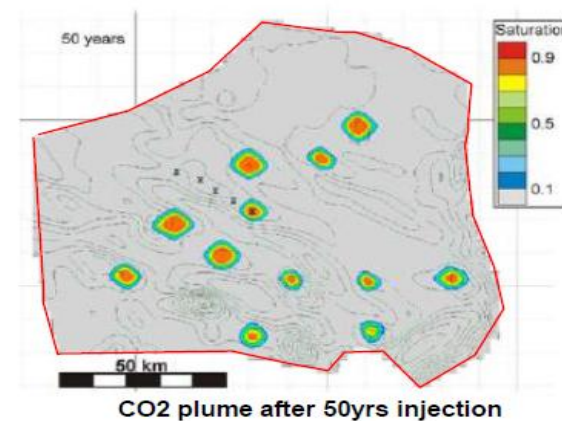
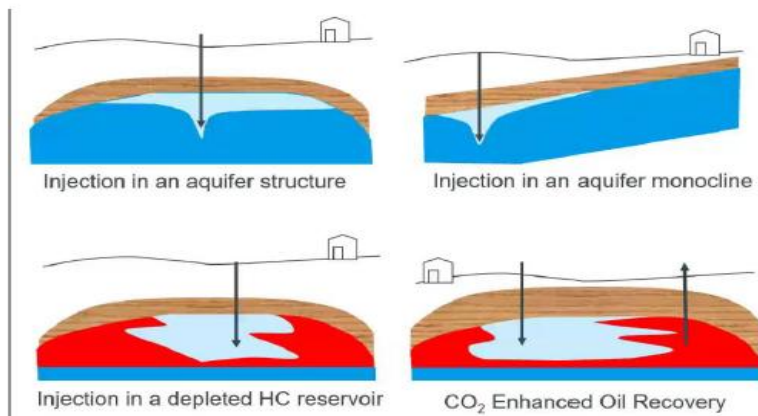
- Identify/ assess an area for CO₂ storage (CCS)
- Characterize fracture networks or guide wells (geosteering) for geothermal projects
- Secure the installation of offshore wind farms.
- Characterize high value minerals sedimentary deposits...



Geophysical works & CCS

Carbon Capture & Storage (CCS)

- CCS techniques and methods requires mapping of key surfaces (base seal) using seismic interpretation.
- Other seismic technics (4D monitoring) are also used to follow the evolution of CO₂ gas plume .



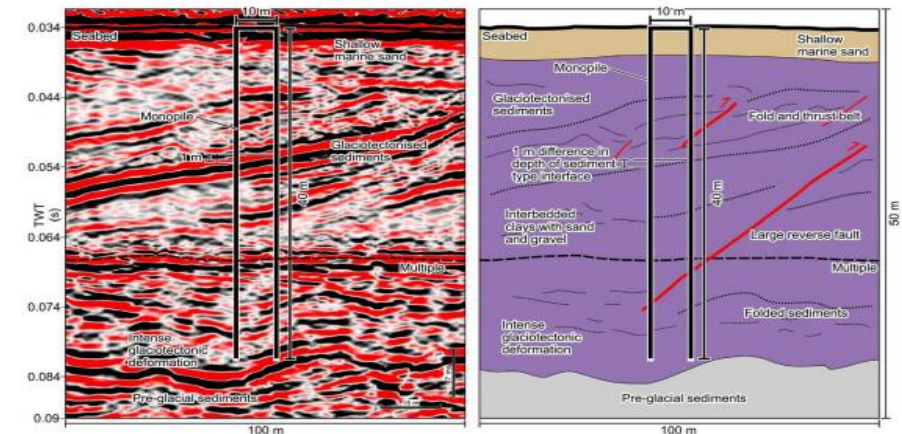
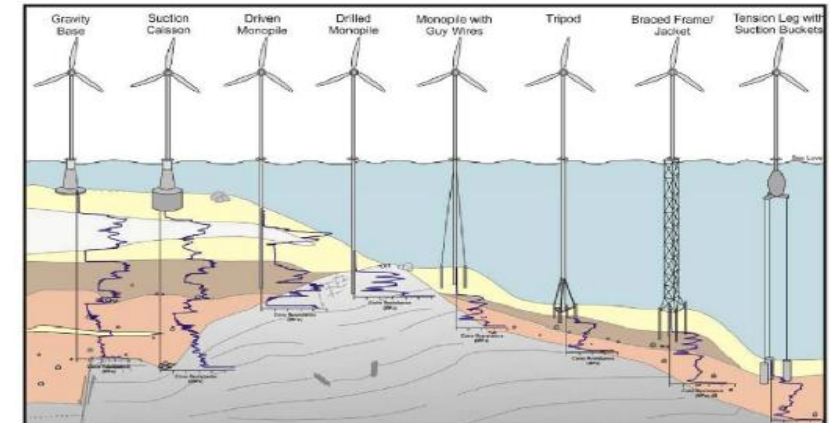
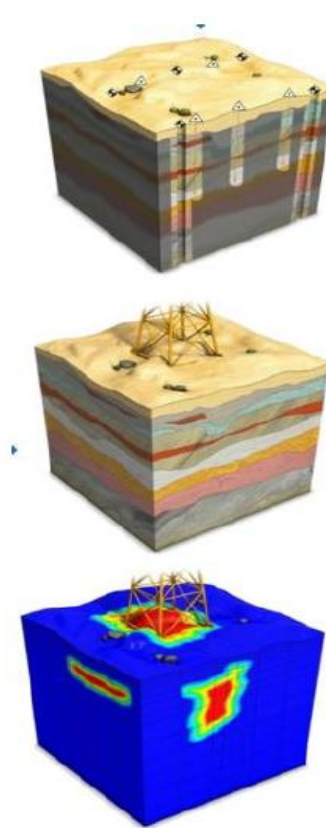
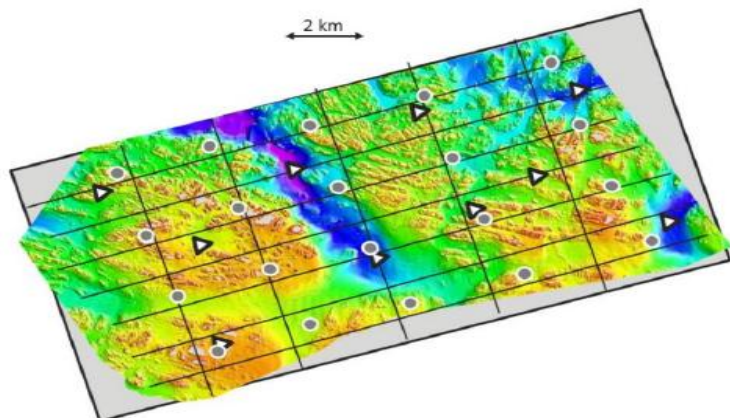
Imaging deep CO₂ migration from active seismic monitoring



Geophysical & Energy Transition

Offshore Wind Farms - Geotechnics

- Installation of offshore windfarms requires some geophysical work such as 3D HR seismic surveys
- Objective is to investigate the first 100's metres of the subsurface to identify and avoid potential problems in the installation / stability / coupling of the aeolian on the seafloor.



Geophysical works & Energy Transition

Geospatial Data for Energy Transition

Industrial Projects Monitoring

- The world's largest single solar plant: 3,2 million solar panels
- Gives clean energy to 90,000 individuals in Abu Dhabi
- Construction was completed within 23 months.
- Commercial operations started on 30th June 2019.



Sentinel-2 images from December 2017 to April 2019

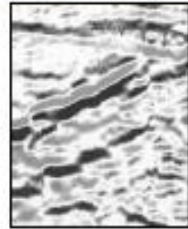
Construction of the solar plant viewed from space

Courtesy of Helene Bideaud, Séminaire Geoint Sorbonne Université, 29/11/2022

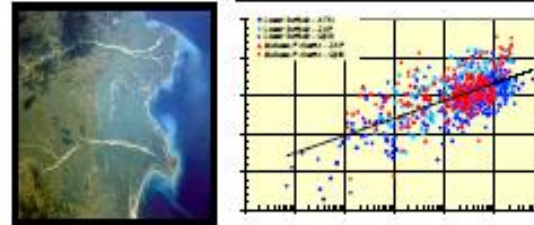


Reservoir Modelling

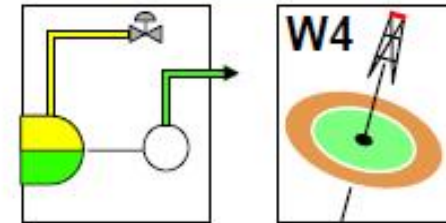
Geophysics



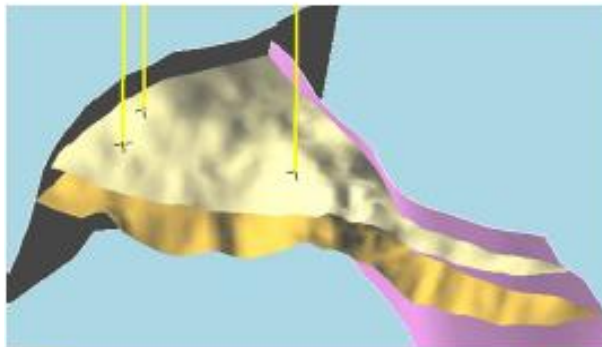
Geology



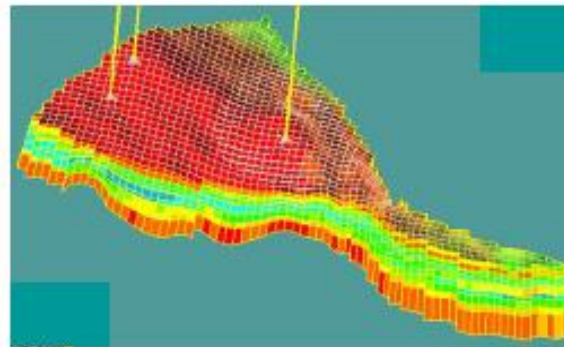
Reservoir



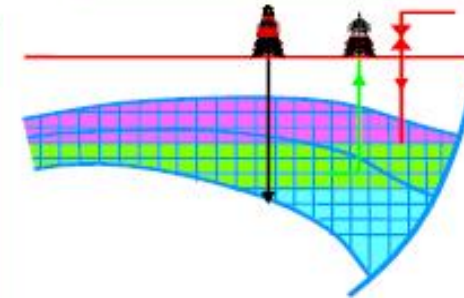
Structural Model



Geological model



Dynamic Model



Geometry - envelop

Sedimentary - petrophysics

Flow mechanism



Pangea

A super computer for seismic data analysis and reservoir simulation



Pangea

A super computer for seismic data analysis and reservoir simulation



Massive computing in TotalEnergies Pangea 2

- Located at Total E&P facilities at Pau (South-West of France)
- High Performance Computing (HPC) methodologies
- Power capacity: 6,7 petaflops
(1 petaflop = 10^{15} Floating Operations per second)
- Constructor: Silicon Graphics (SGI - ICE X)
- 220 000 Intel Xeon processors (# 80 000 laptops)
- Storage capacity: 26 petabytes (# 6 millions DVD)
- 200 km of fiber optic network
- Electrical power needed: 4,5 MW



Massive computing in TotalEnergies Pangea III

- Located at TotalEnergies facilities at Pau (South-West of France)
- High Performance Computing (HPC) methodologies
- Power capacity: 25 petaflops, **the 5th biggest computer for petroleum industry** (1 petaflop = 10^{15} Floating Operations per second)
- Constructor: IBM
- 558 nodes – 3348 GPU (Nvidia V100) (# 170 000 laptops)
- Storage capacity: 55 petabytes (# 13 millions DVD)
- 200 km of of fiber optic network
- Electrical power needed: 1,4 MW

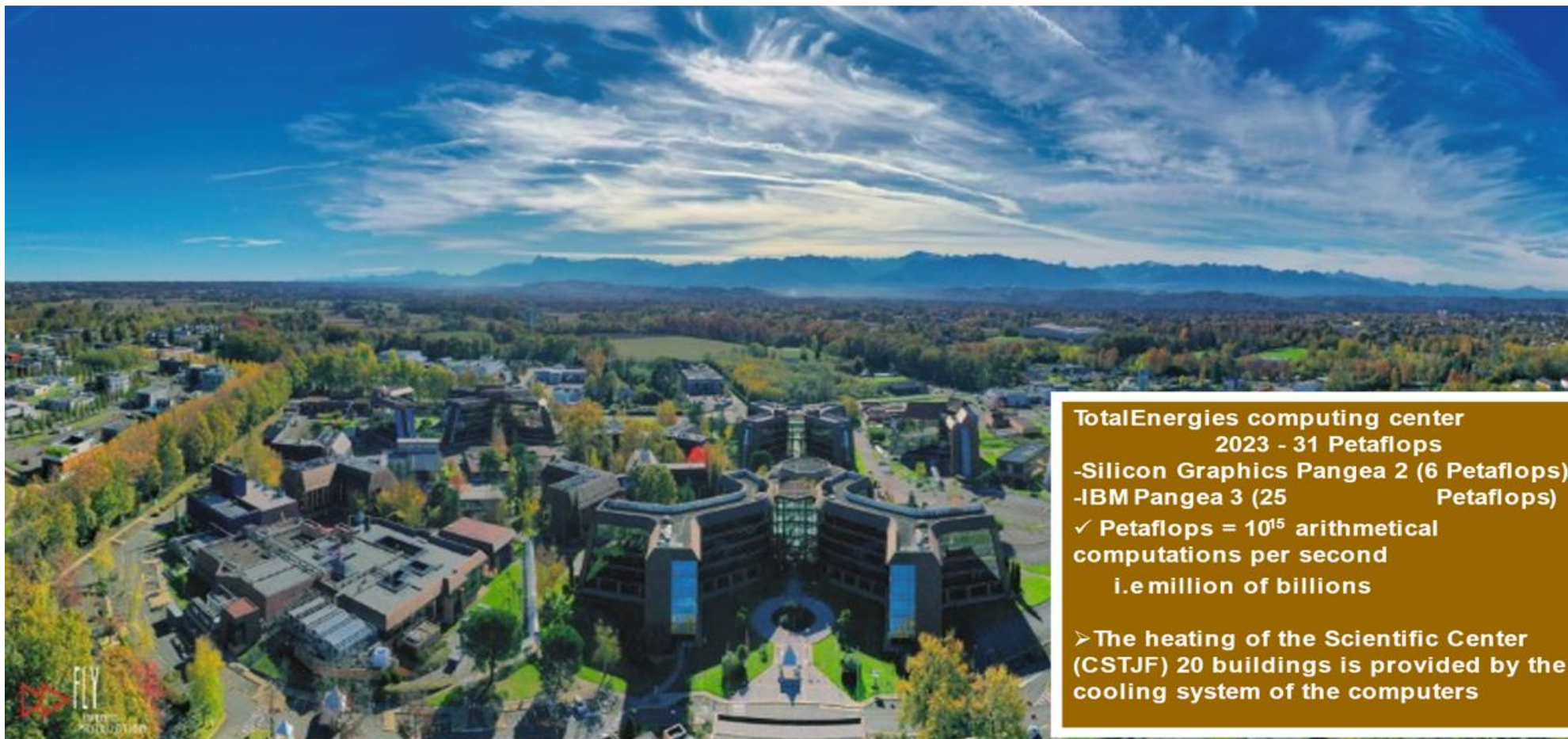


Massive computing necessary for Oil and Gas Industry but also for Energy Transition

Fossil	 	Seismic Imaging (Kirchoff, Green, RTM, FWI, WEM) Reservoir Simulation (IX, Eclipse, Gap-Resolve) Generalized Refining Transportation Marketing Planning System (GRTMPS) Molecular Modeling (MaterialStudio, Culgi)
Biofuel		Generalized Refining Transportation Marketing Planning System (GRTMPS) Molecular Modeling (MaterialStudio, Culgi) Methane Production Forecast via ML (BioAI)
Elec.		Batteries Simulation (SAFT – ACC) Simulation of hybrid electric systems for hydrogen generation (HSPtoH2)
Wind		Fluid flow simulations for the energy (Flotting Offshore Wind Turbine) Modeling of wake effects in wind turbines (TurboPark)
Solar		Simulation of solar energy production (SolarOPs) Aerodynamic optimization of photovoltaic shades (structural calculation and CFD)
Sustain.		Minimize CO2 emissions (surface / reservoir simulation coupling - ZEREM / IPC) Minimize CO2 / CH4 emissions (flare combustion analysis - ZEREM / PIRATE FLAME) CO2 storage simulation (GEOSX) Development of algae culture monitoring (Computer Vision – SmartAI) CCUS Simulation via ML (GAN)



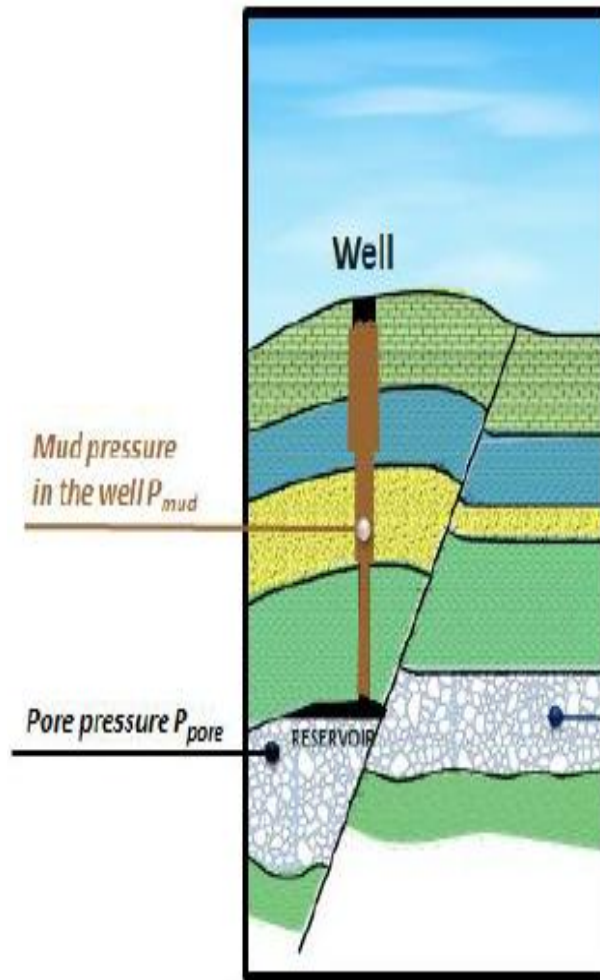
Centre Scientifique et Technique Jean Feger (CSTJF) TotalEnergies – Pau - France



Drilling



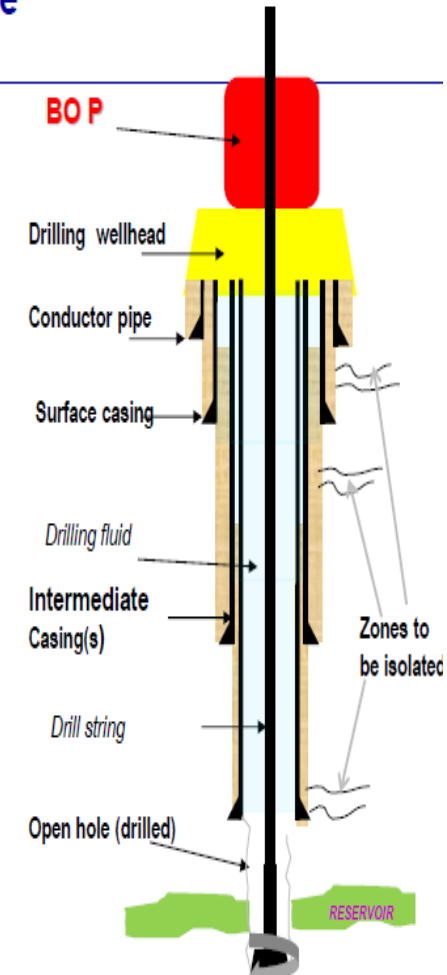
Well Design Characteristics



WELL DESIGN : casing programme

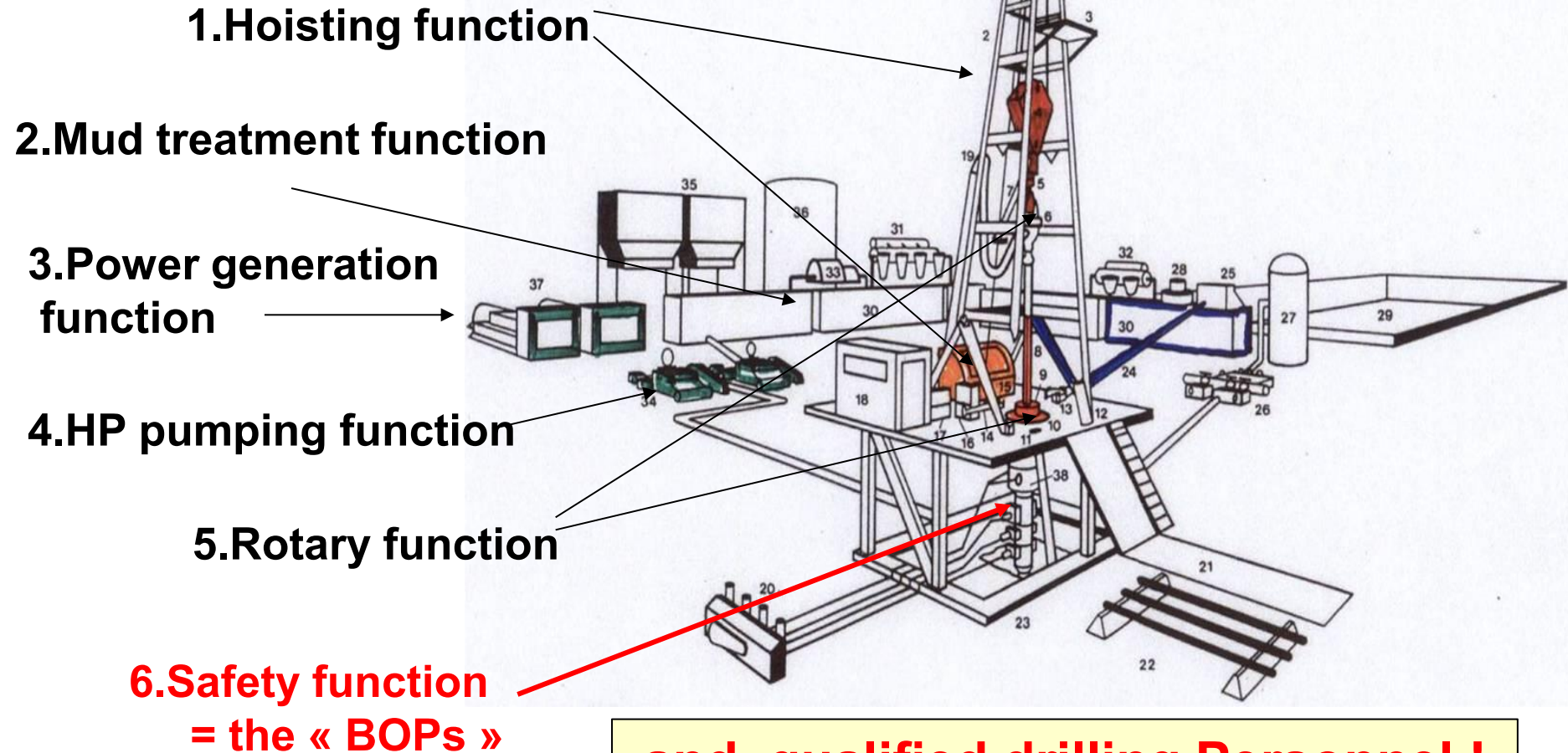
CASING and CEMENTING PROGRAMME

- ◆ protect unconsolidated or unstable formation
- ◆ separate formations with incompatible pore and fracturation pressure gradients
- ◆ isolate reservoir layers, receive completion string
- ◆ mechanically anchor the casing column in the ground and plug the annular space



The drilling unit (« the Rig »)

6 functions

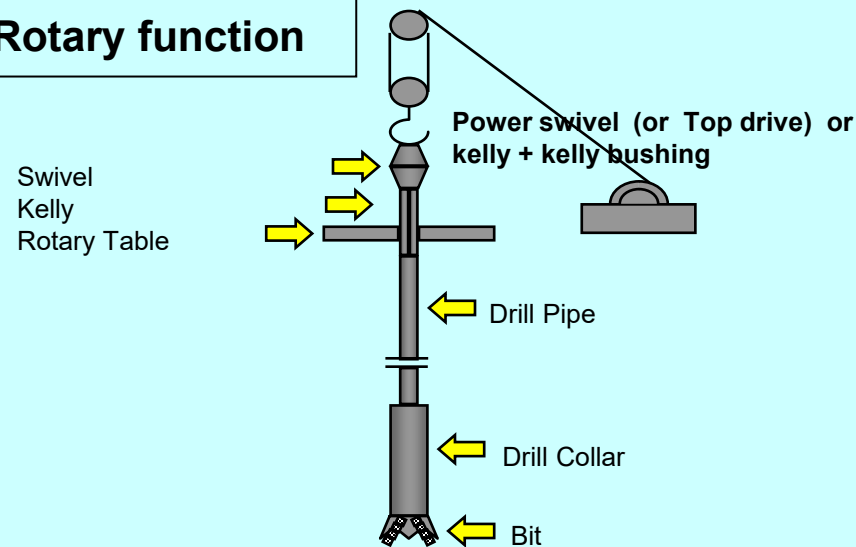


and, qualified drilling Personnel !

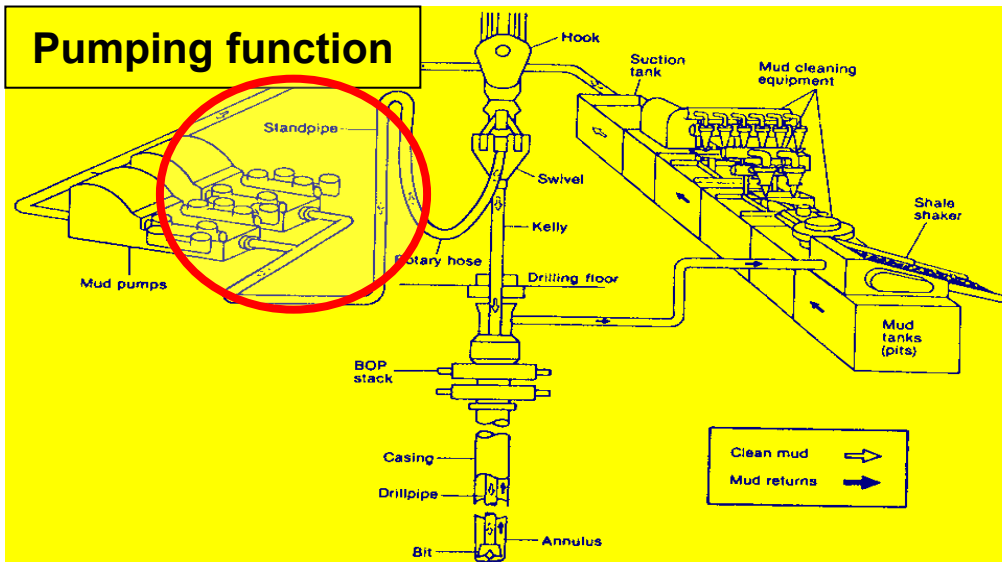


Rotary, pumping, hoisting and safety functions

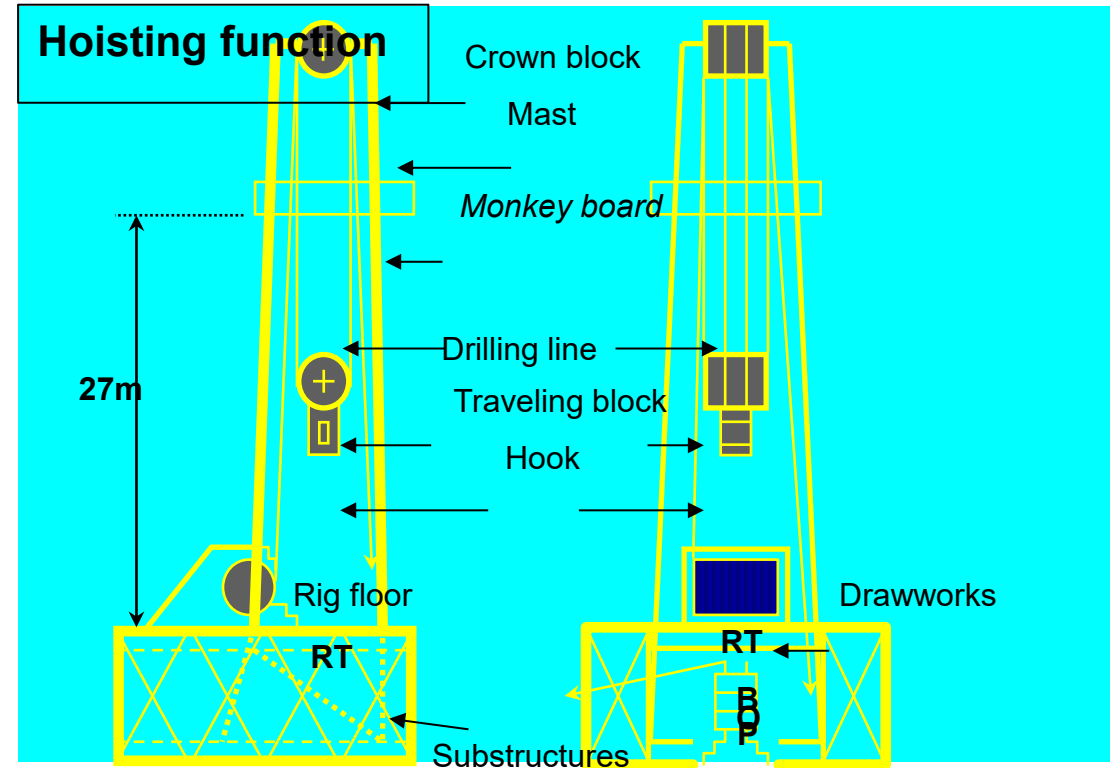
Rotary function



Pumping function



Hoisting function



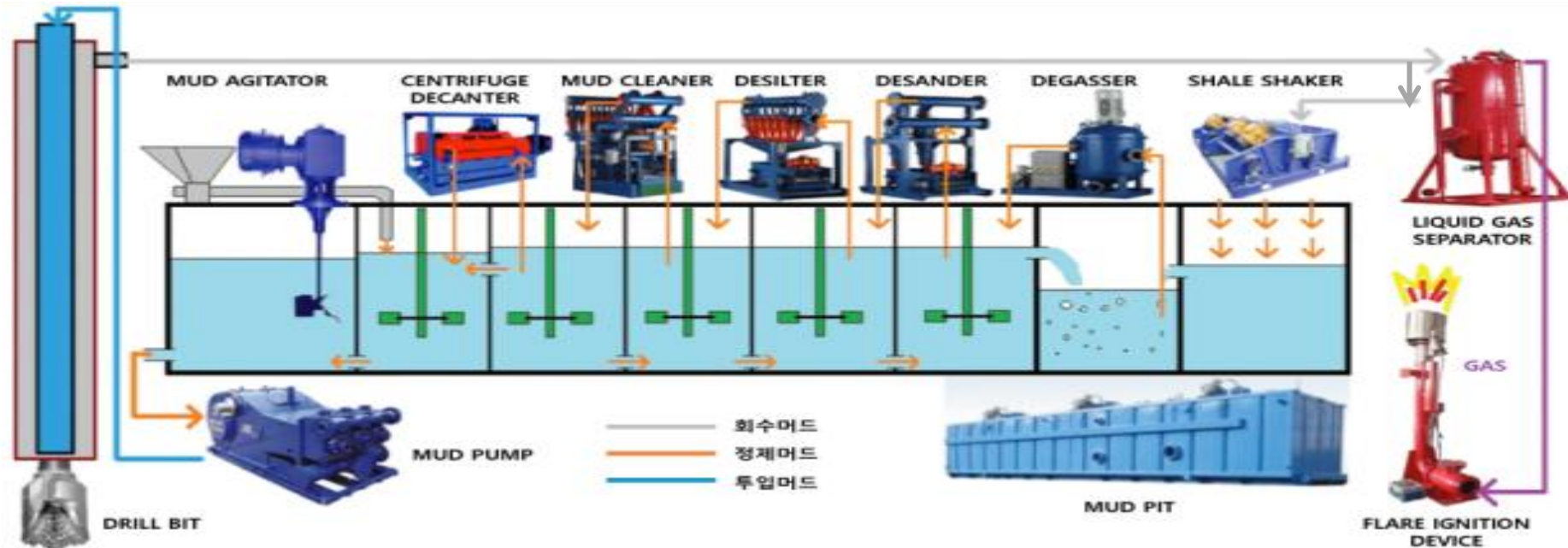
Safety function

BOPs (Blow out Preventer)



Mud treatment function

Mud treatment function

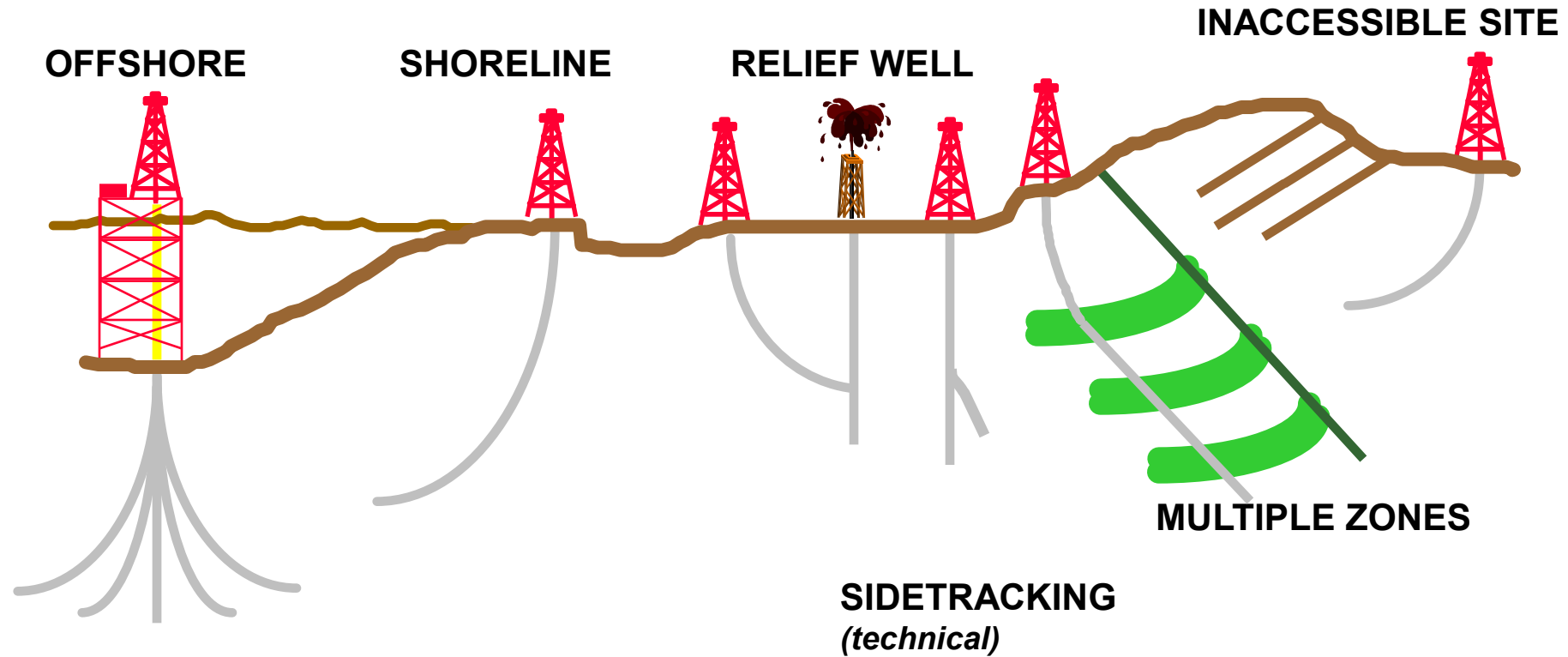


1. Poor boy degasser (by passed if no well control situation)
2. Shale Shaker for primary solids control **100 microns**.
3. Vacuum Degasser
4. Desander for second phase solids control of cuttings **40 microns**
5. Desilter for third phase solids control of cuttings **20 microns**.
6. Mud Cleaner a combination of Desander/ Desilter
7. Centrifuge for the **2-7 microns fine** solids separation.



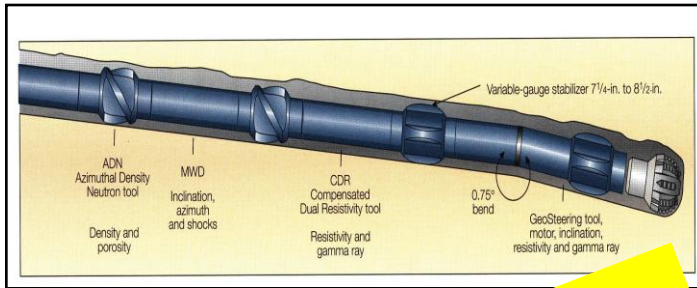
Directional Drilling

Main applications



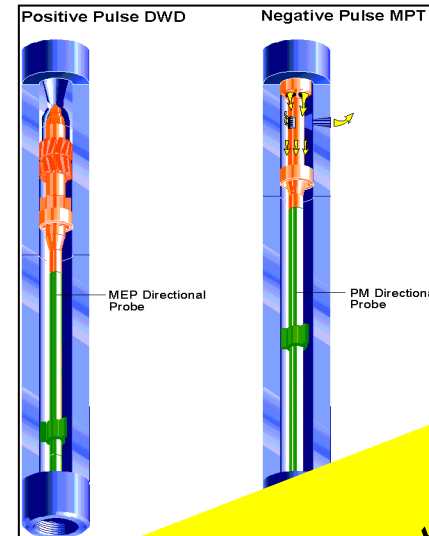
Directional Drilling: the Tools

Directional drilling



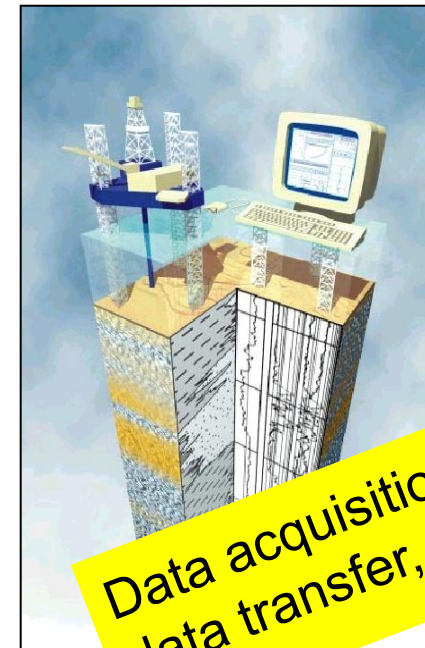
Top drive
PDMotors, RSS systems

Measurement While Drilling



MWD, LWD
FEWD, tools and telemetry !

Computer technology



Data acquisition,
data transfer, ...

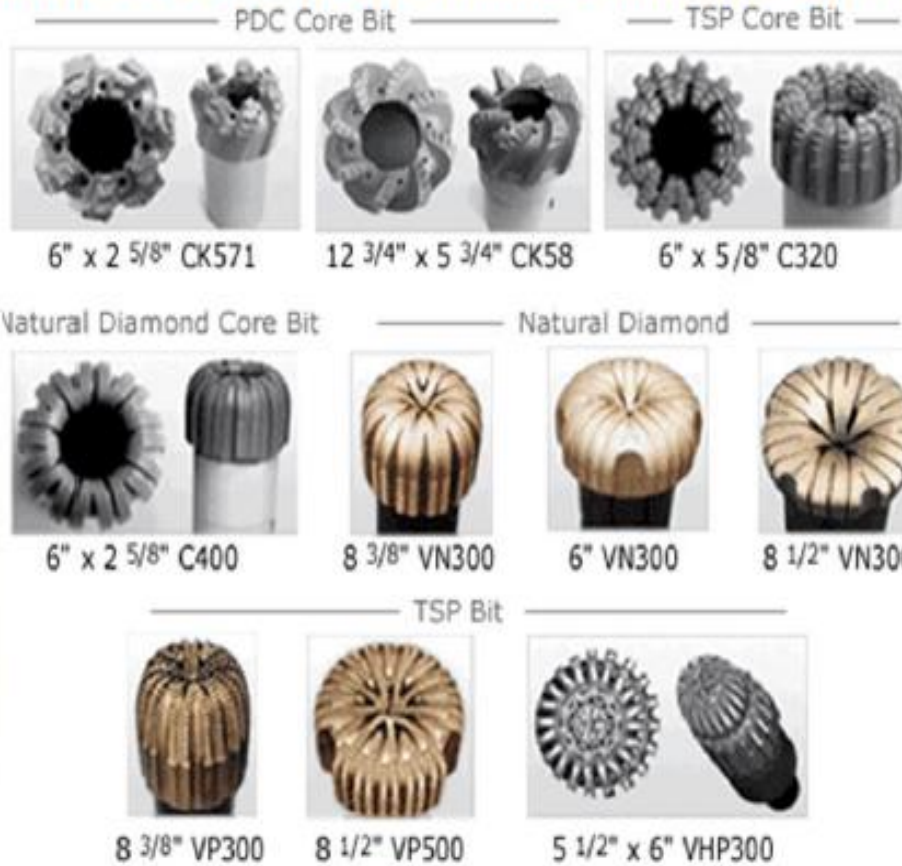


Drilling Technique Features

Drill bits

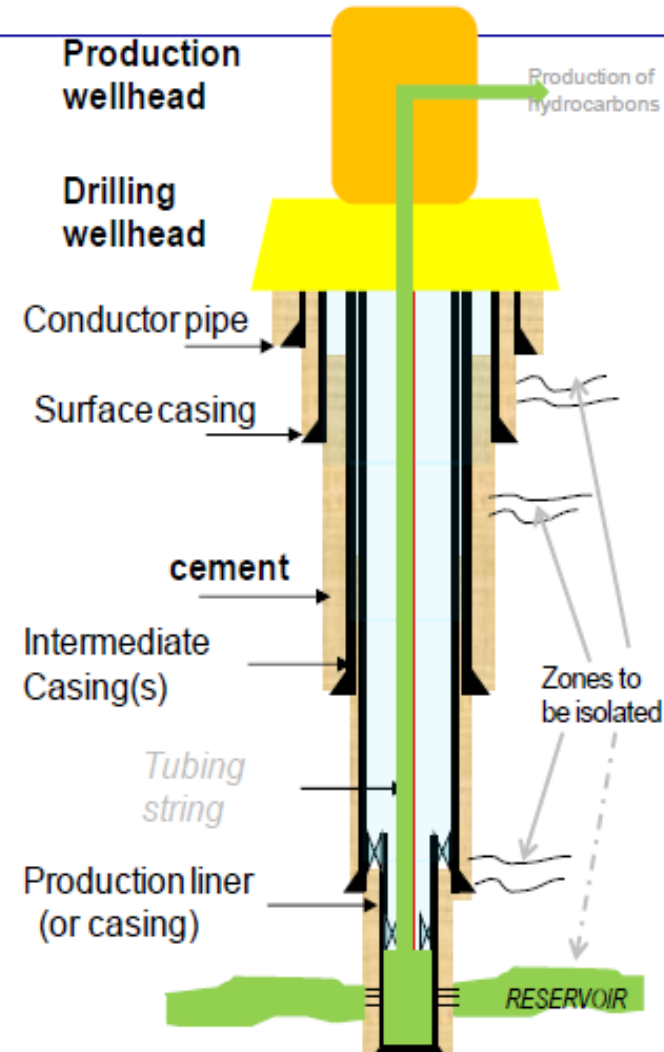


Diamond, PDC (Polycrystalline Diamond Cutter)

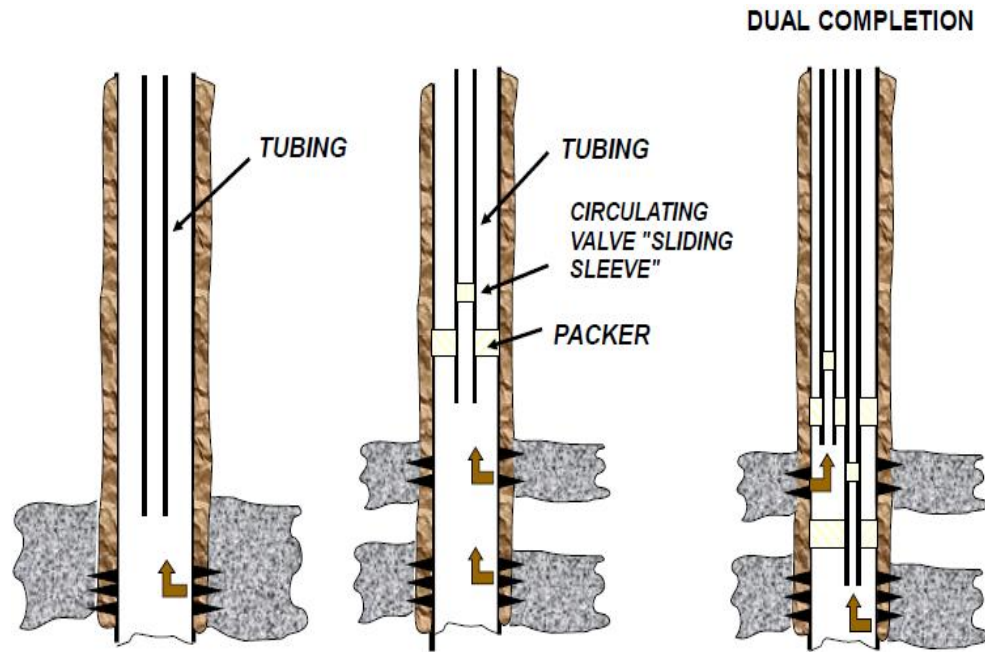


Well completion

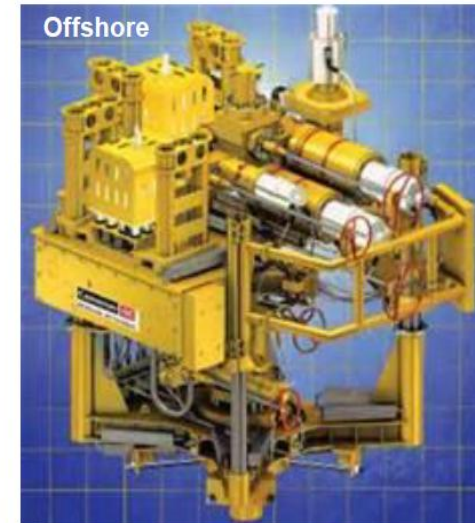
- ◆ **A completed well (in production phase)**
 - a succession of steel casing, liner and tubing strings
 - to channel hydrocarbons from the reservoir up to the surface (or sea bed) production wellhead



Well completion/Completion equipment



Well completion



Completion equipment

Hazards in E&P: Blow-out

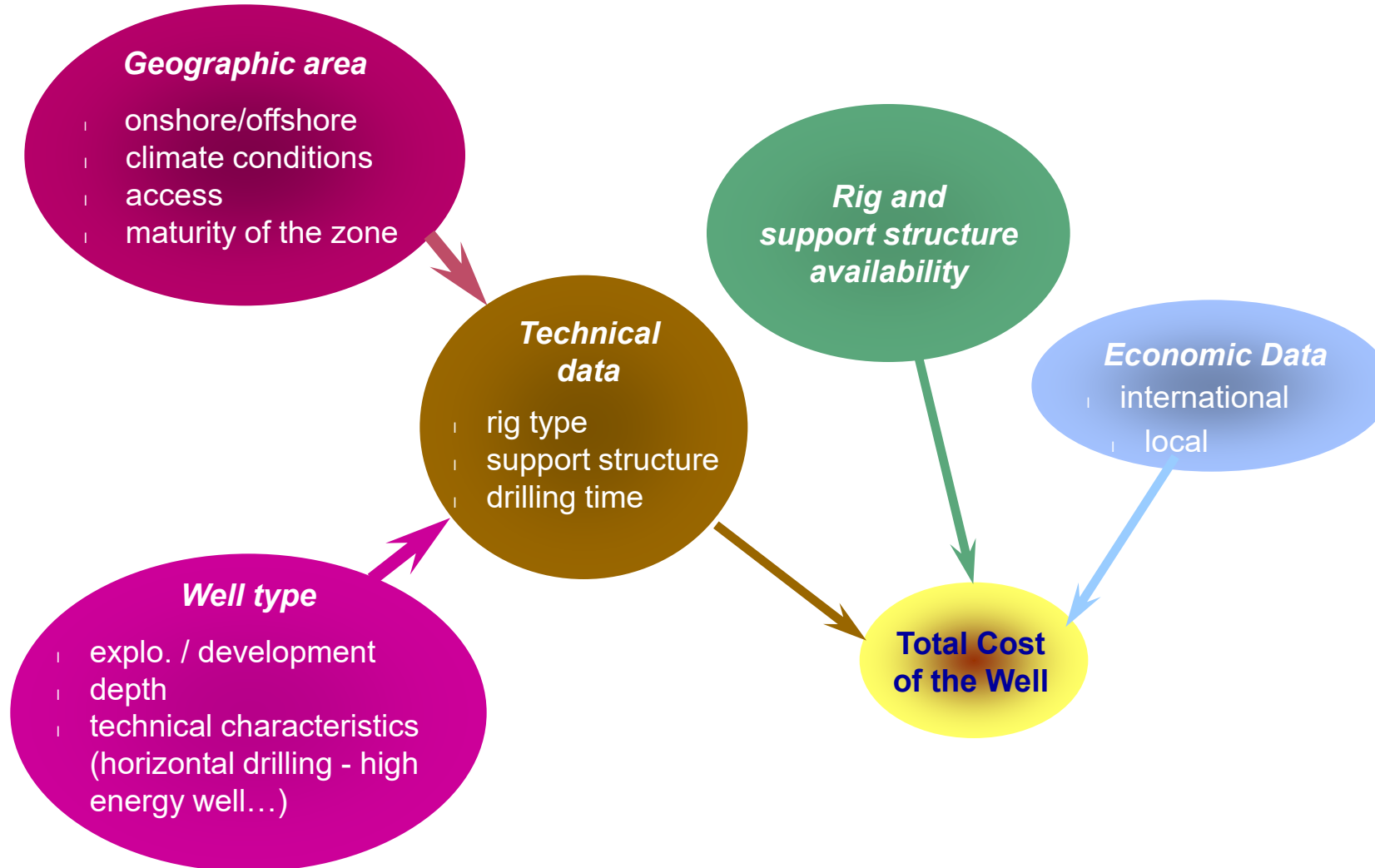
Texas 1901



Deep Water Horizon GOM 2010



Key factors affecting drilling costs

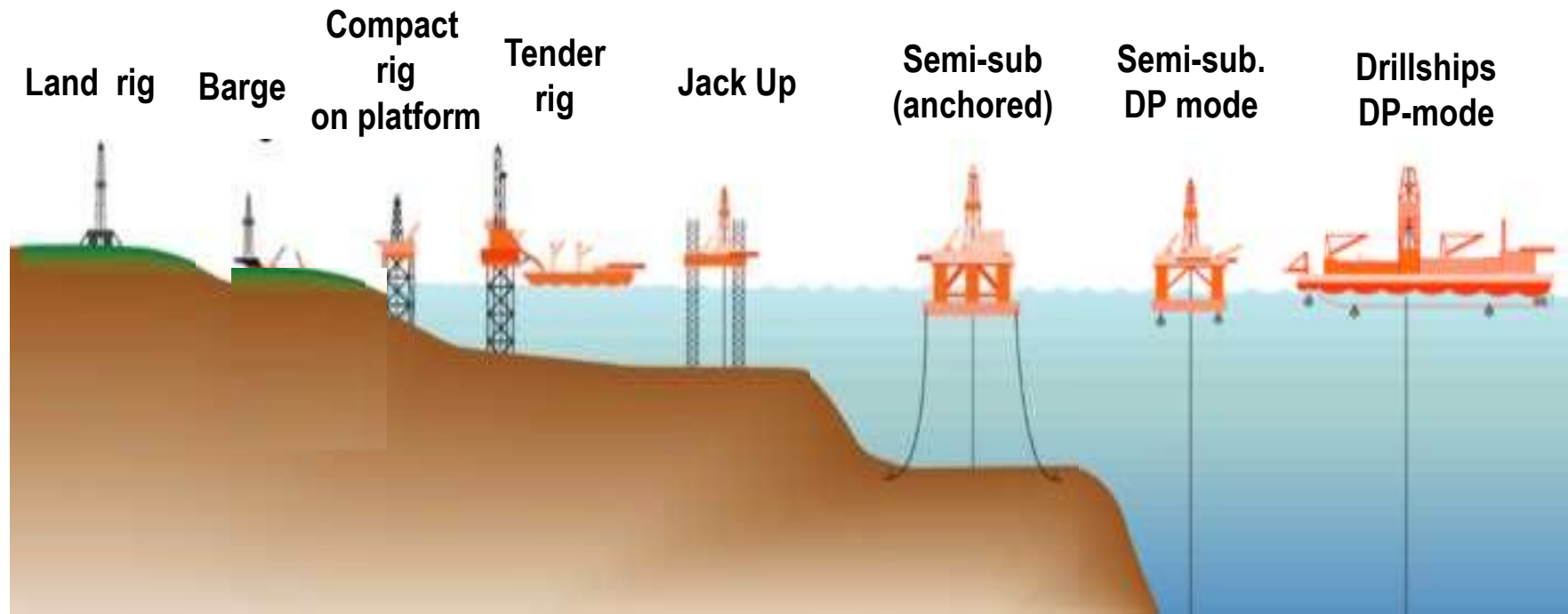


Drilling Operations and Offshore environment

RIG TYPES

Water depths

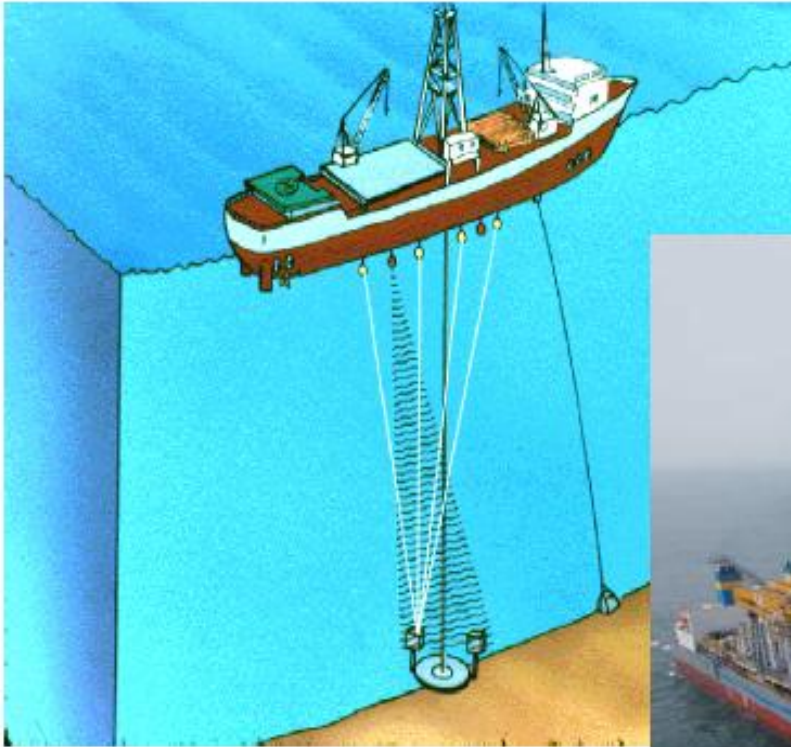
2 – 6m	20 – 150 m	80 – 1,500 m	500 – 3000 m
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Drilling Rigs

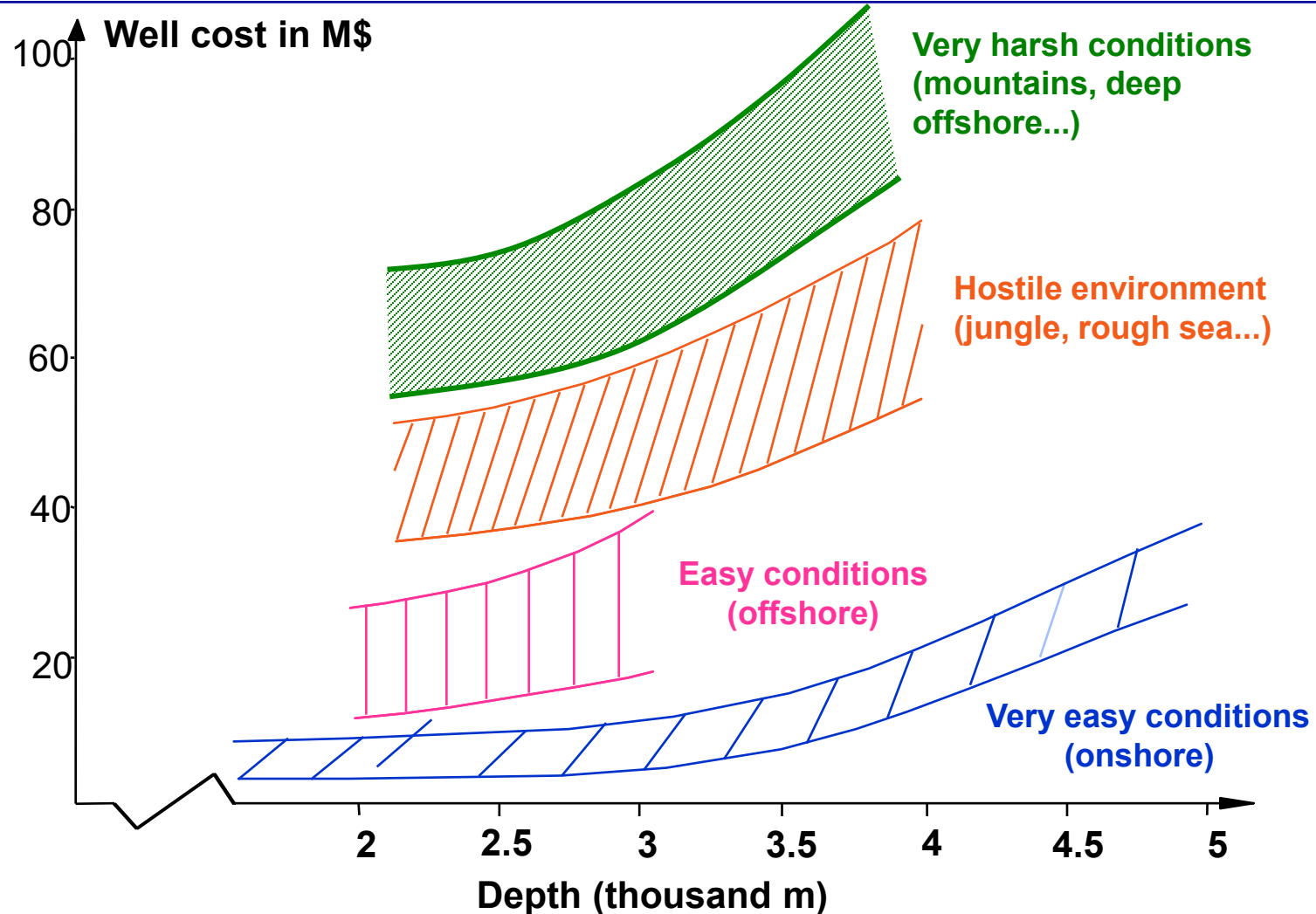


Dynamically positioned drillships



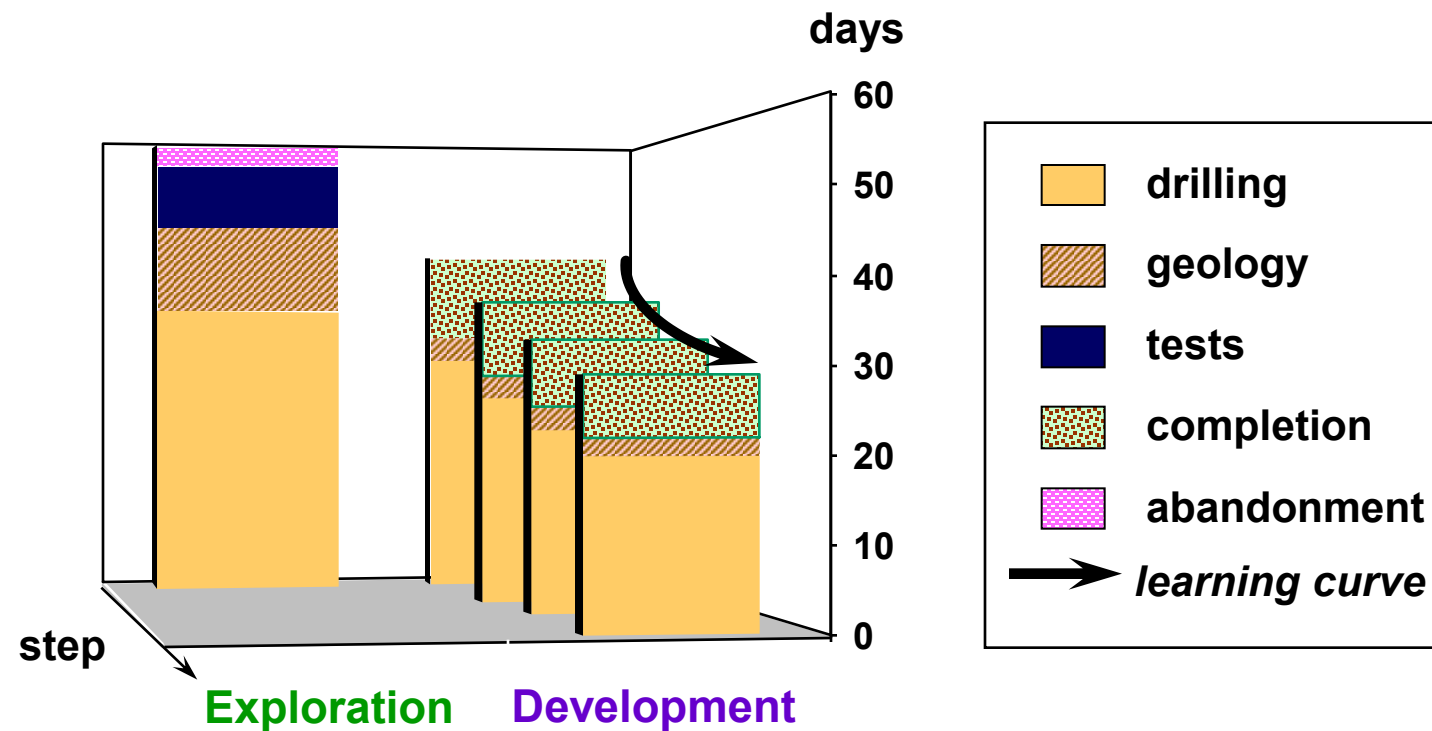
Exploratory drilling

(Costs can substantially fluctuate depending upon economic environment)



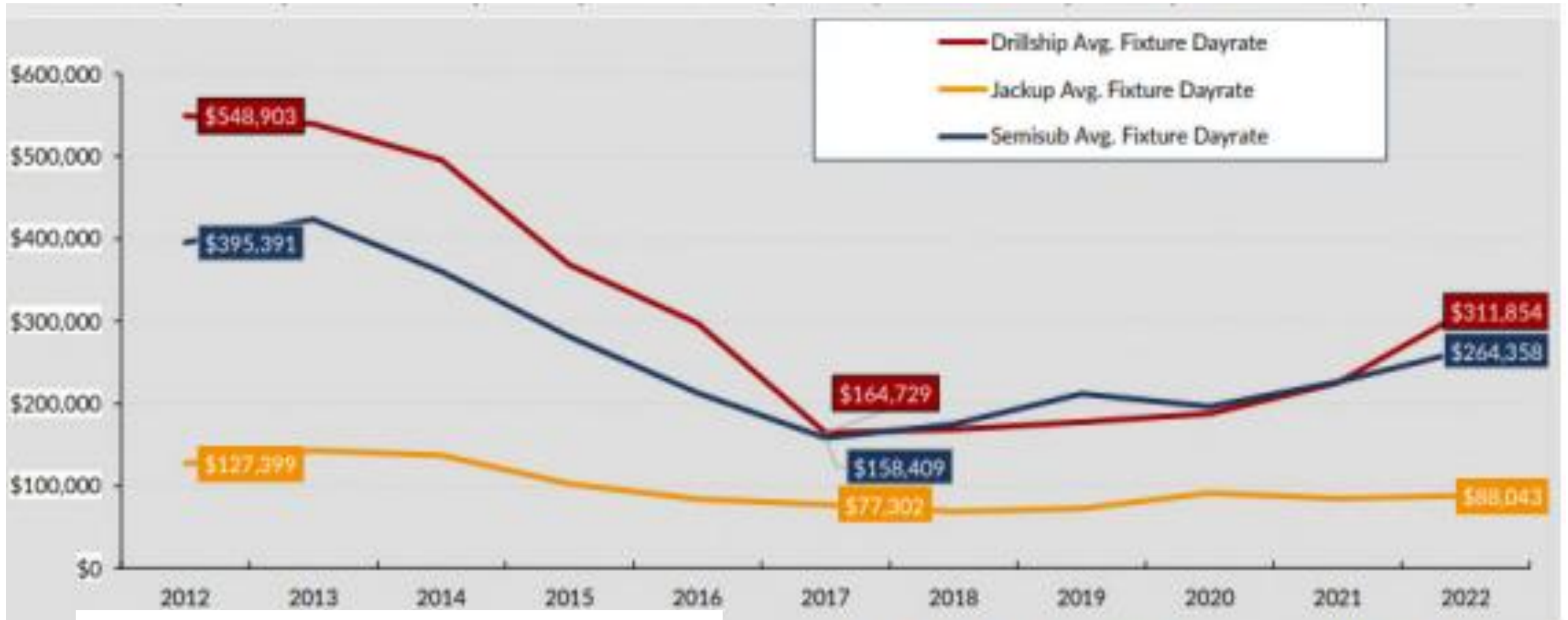
Development drilling

Drilling time :



Drilling Rigs Day Rates vs Types

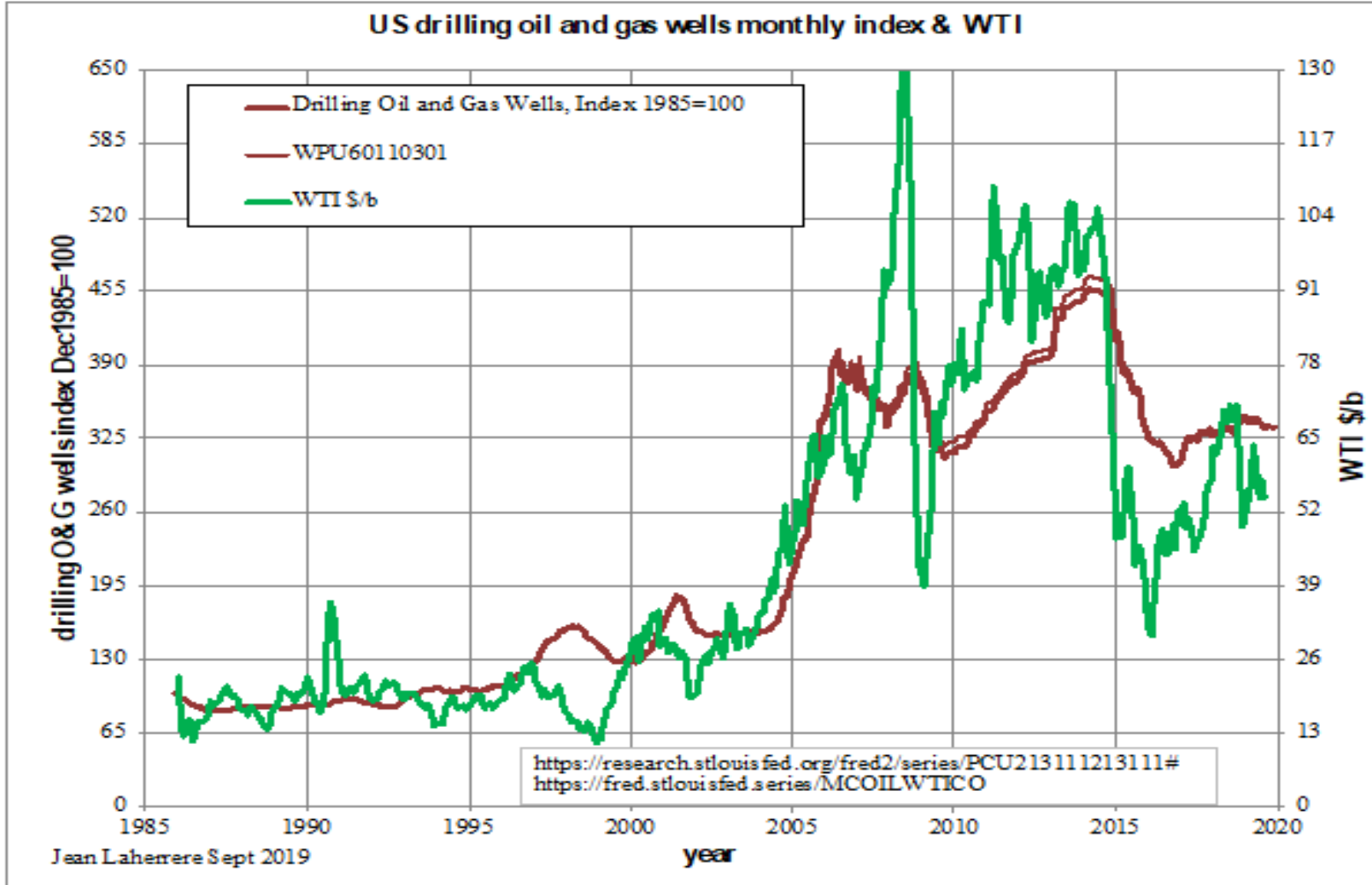
After higher rates before 2013, # 300000 \$/d in 2022 for a drillship



Terry Childs / Westwood Energy at IADC World Drilling June 2022



Drilling Rigs Costs correlated with Crude Oil Price

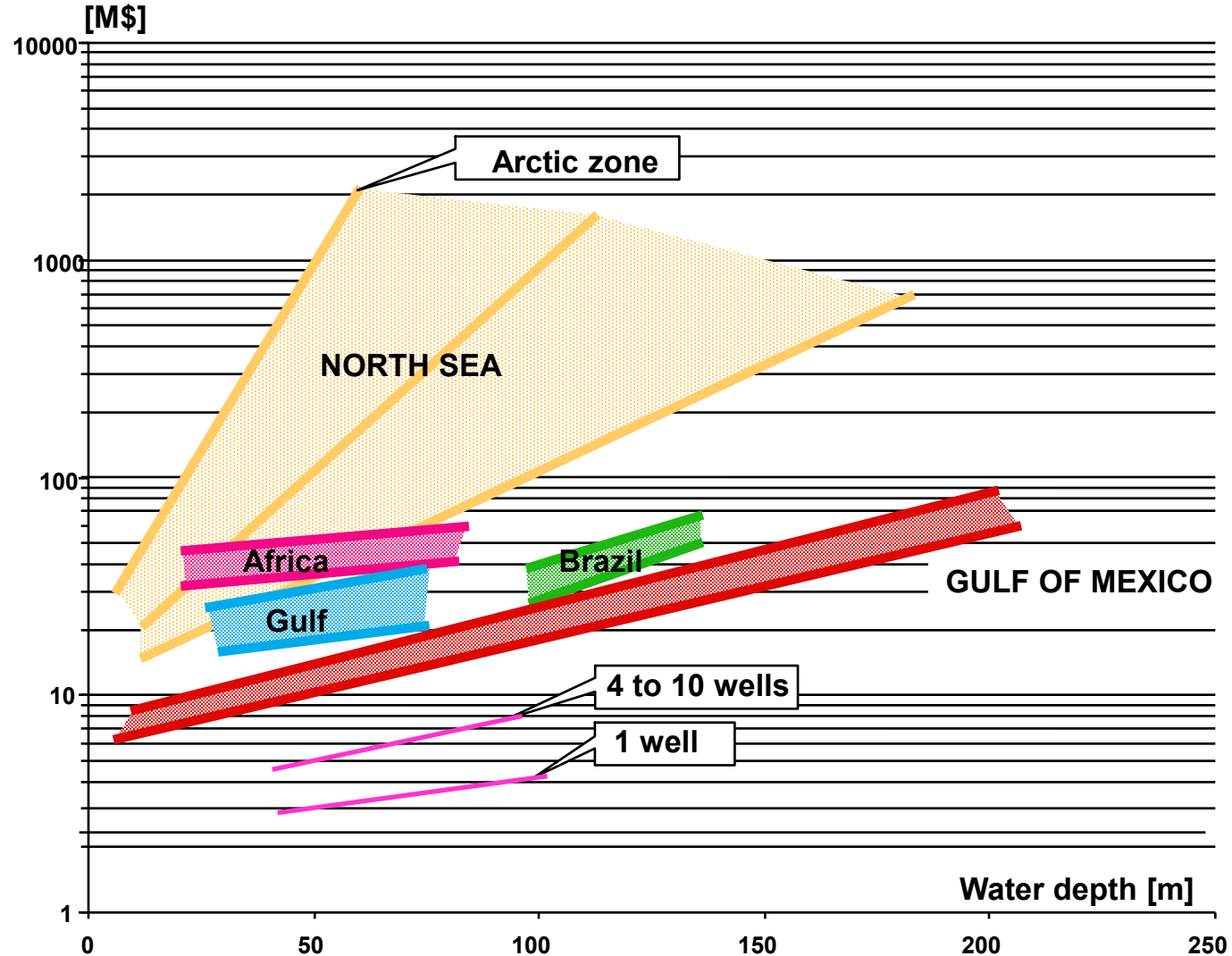


Production/Construction

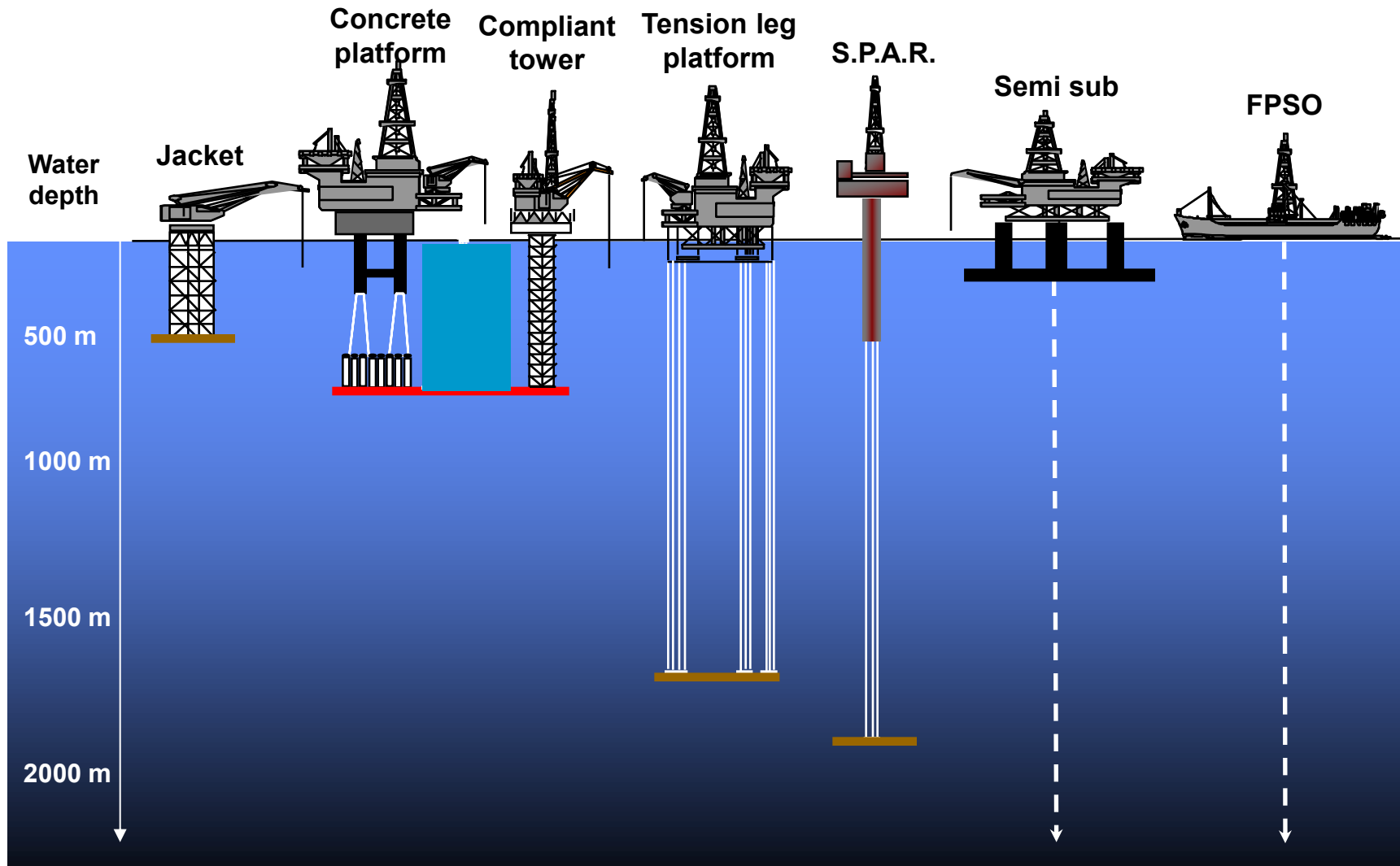


Cost of fixed platforms

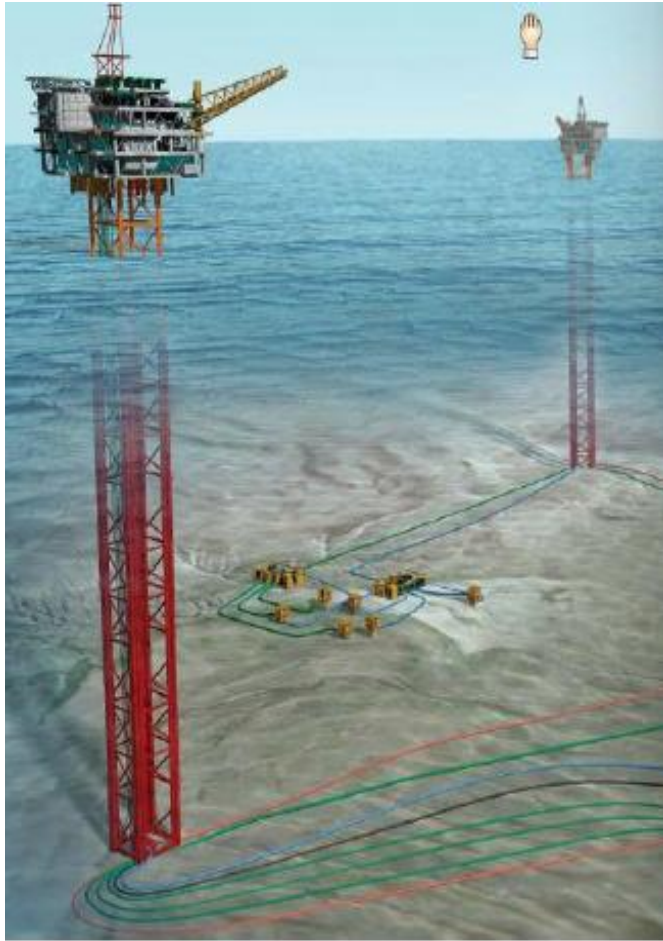
(Costs can substantially fluctuate depending upon economic environment)



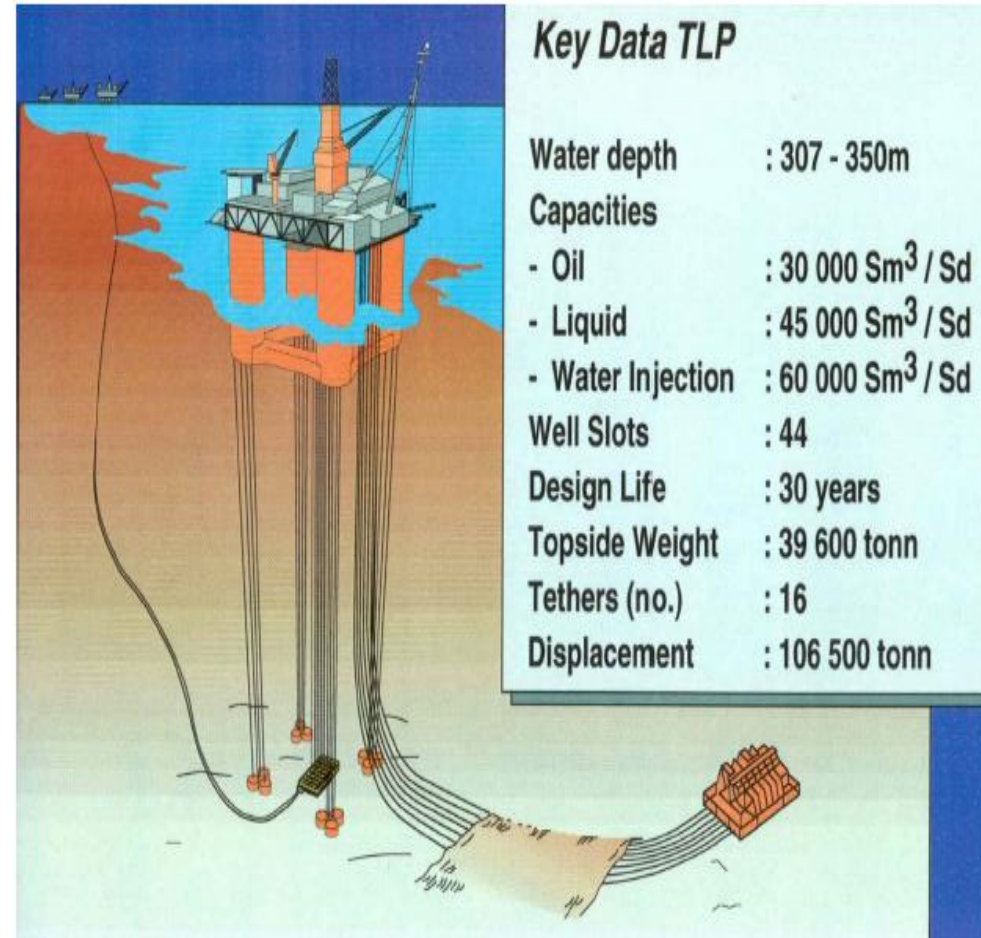
Offshore production systems



Different types of platform



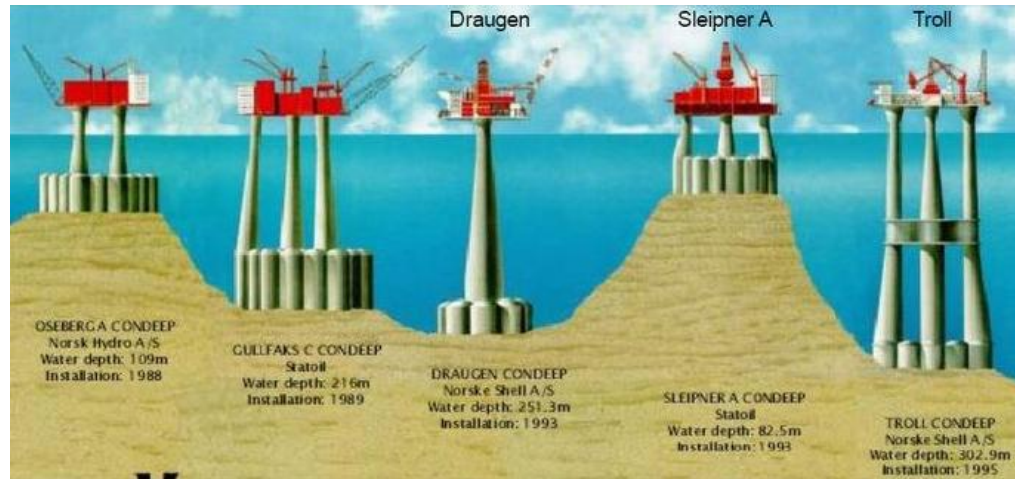
Compliant tower



Tension Leg Platform



Different types of platform/Floating unit



Concrete Platforms

Semi Submersible

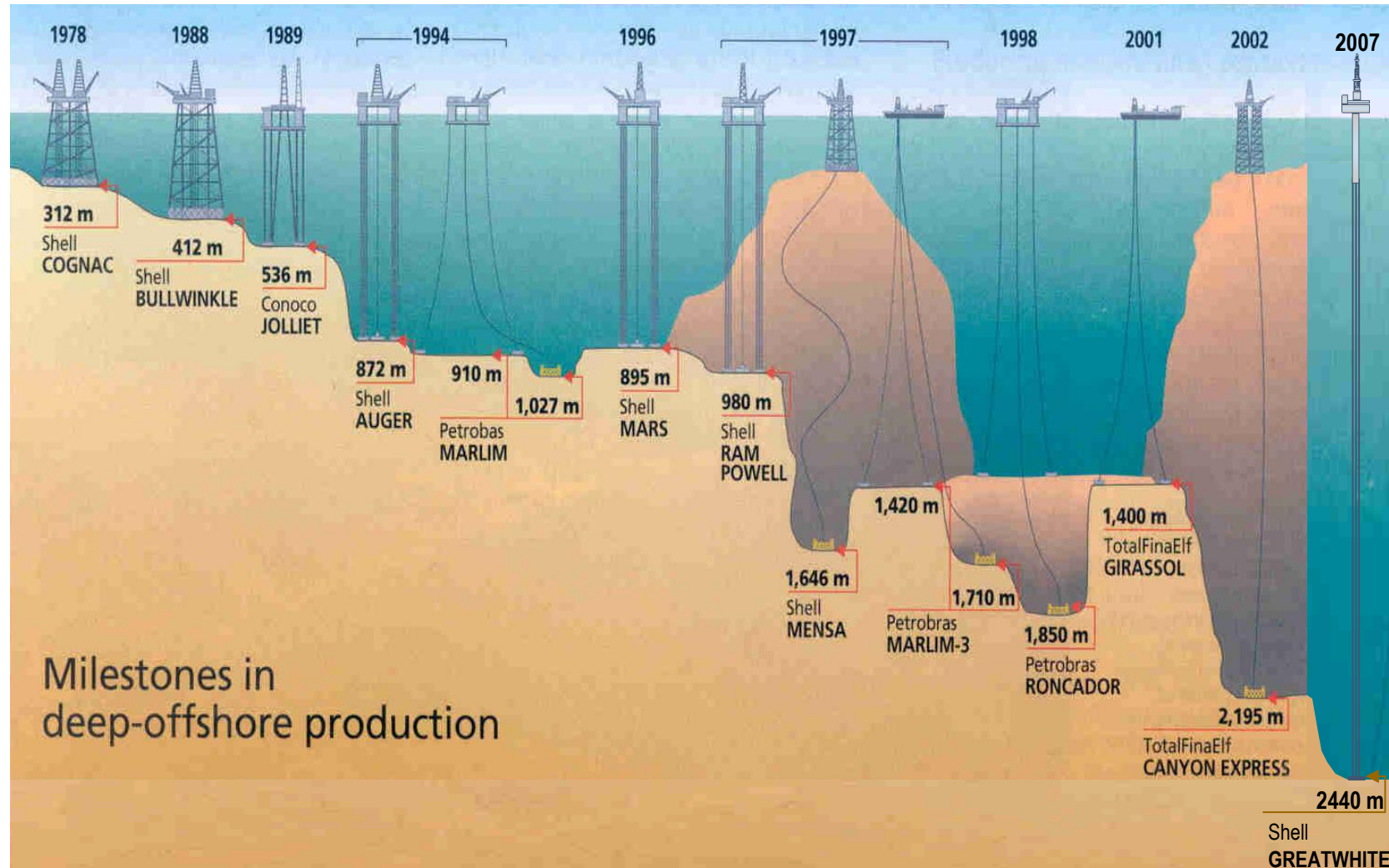
Floating Production Storage Offloading (FPSO)

GIRASSOL (Angola)

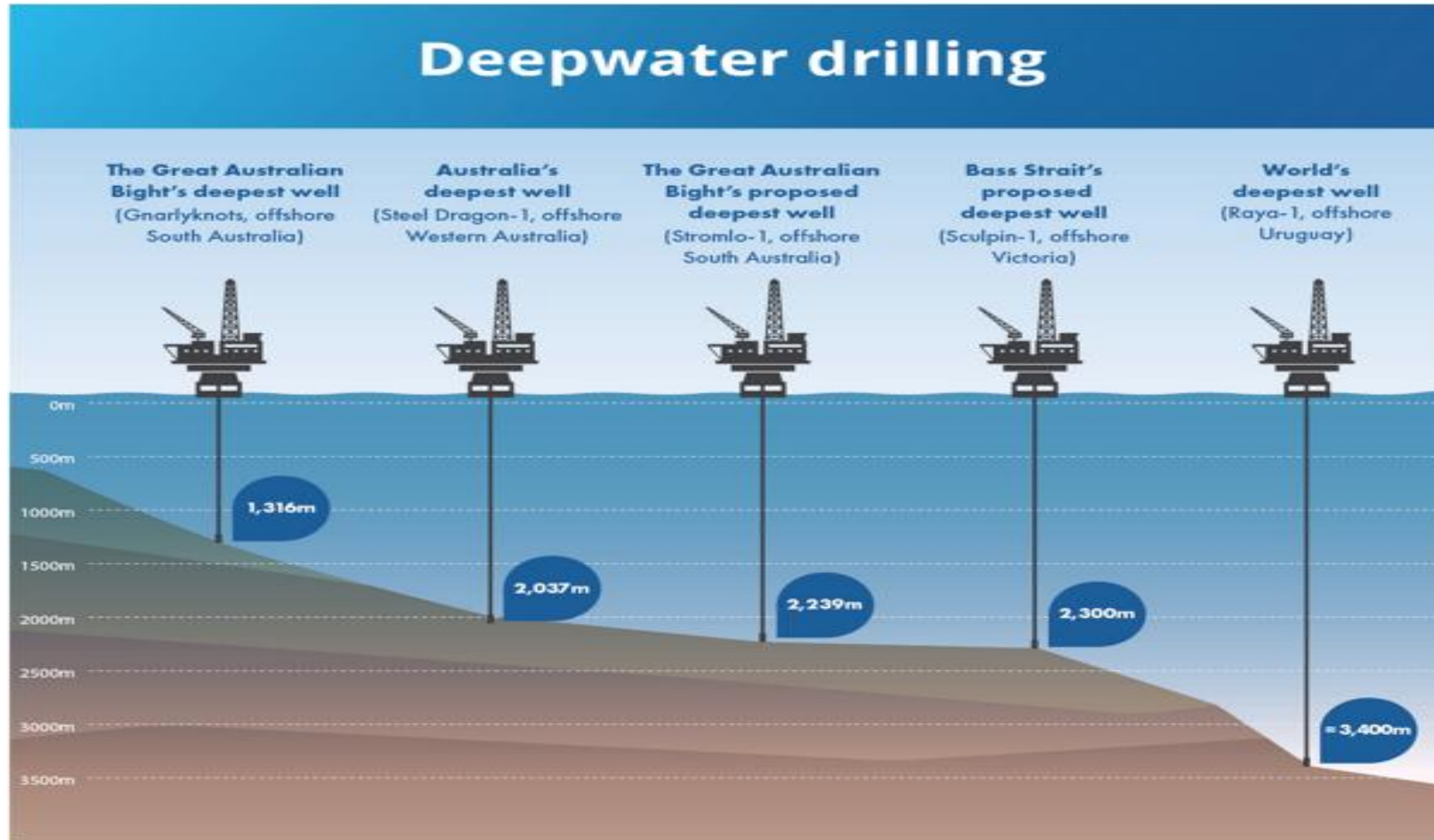
- ◆ Double side hull single bottom 300m x 60m x 31m
- ◆ 2,0 Mb storage capacity
- ◆ 25,000 T topsides
- ◆ 200,000 bpd oil production
- ◆ 390,000 bpd water injection at 150 bar
- ◆ 8 Mm³/d gas injection at 285 bar
- ◆ Living quarters for 140 pers
- ◆ 396,000 T displacement



Technological progress in deep water Production



Technological progress in deep water Production - 2019



Drilling/Production Platforms

Water depth	Resting on seabed		Column/chain/cable to seabed		Dynamical positioning	
fixed	Jacket Compliant tower GBS	500 m 900 m 300 m	TLP SPAR	1300 m 1700 m		
mobile	Jack-up	170 m				
floating			Semi-sub Drillship FPSO	3000 m 3700 m 1500 m	Semi-sub Drillship	3000 m 3700 m



Construction Jack-Up Barge



Deep Offshore – Some Recent projects and Current Records

Objectives: Ultra-Deep Offshore: 3000-4000m

2008 - 2020

- **Exploration Well: 3400 m – Raya 1 prospect/Uruguay Joint-venture
Total/ExxonMobil Contractor: Maersk Drilling**
- **Exploration Wells: 3150-3175 m - India/ONGC Contractor: Transocean**
- **Subsea Installation: 2809 - 2934 m – Silvertip/Tobago - Gulf of Mexico/Shell**
- **FPSO: 2482 - 2692 m – Chinook & Cascade – Gulf of Mexico/Petrobras**
- **Spar: 2320 – 2450 m – Great White – Gulf of Mexico/Shell**
- **Appomatox Development : 2200m - Gulf of Mexico/Shell – TLP – Break-even = 55 \$/b**
- **Aconcagua Development: 2200 m – Gulf of Mexico/Total**
- **Camden Hills Development: 2200 m – Gulf of Mexico/Marathon**



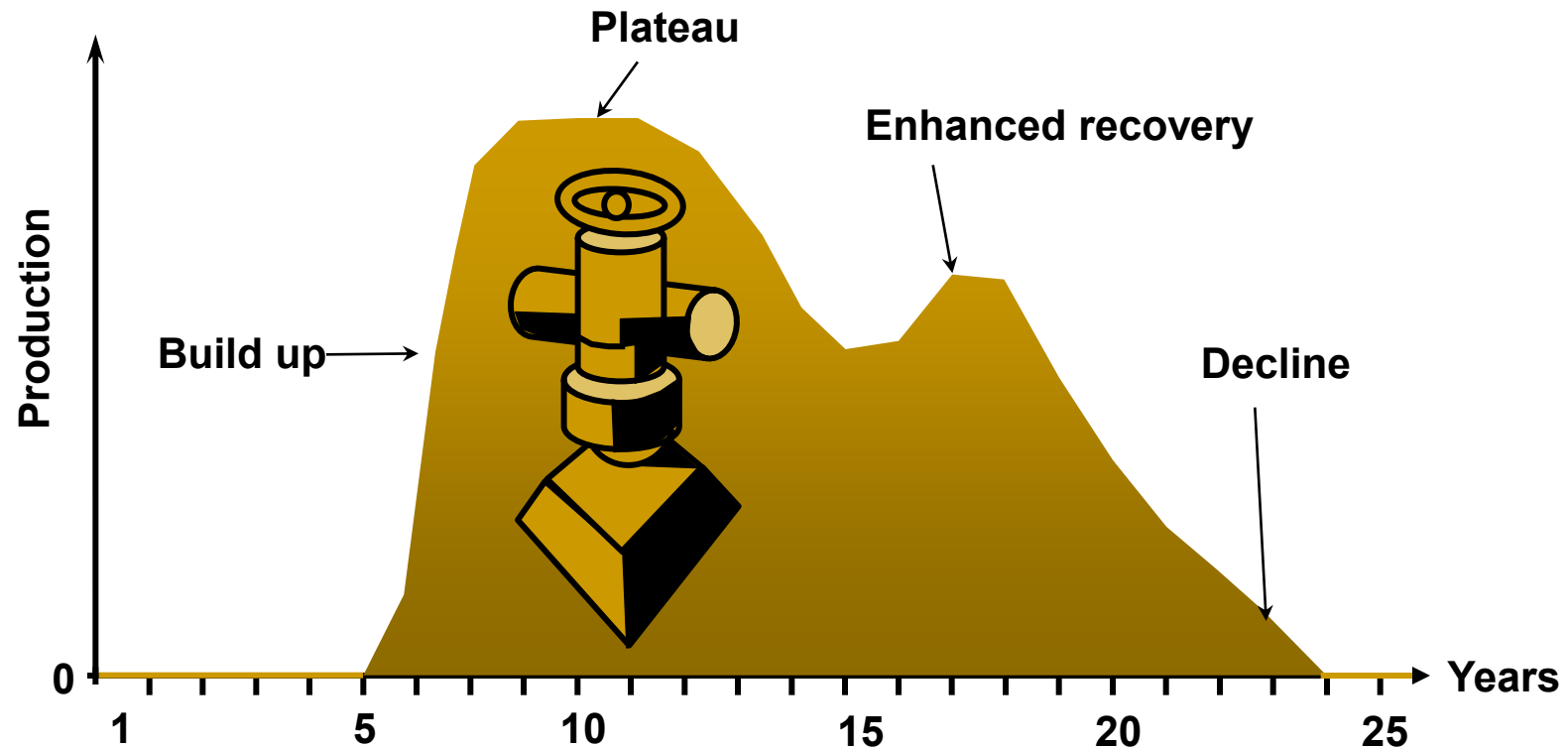
Production

➡ Produce the reserves

40 to 50% of total expenses

15 to 25 years

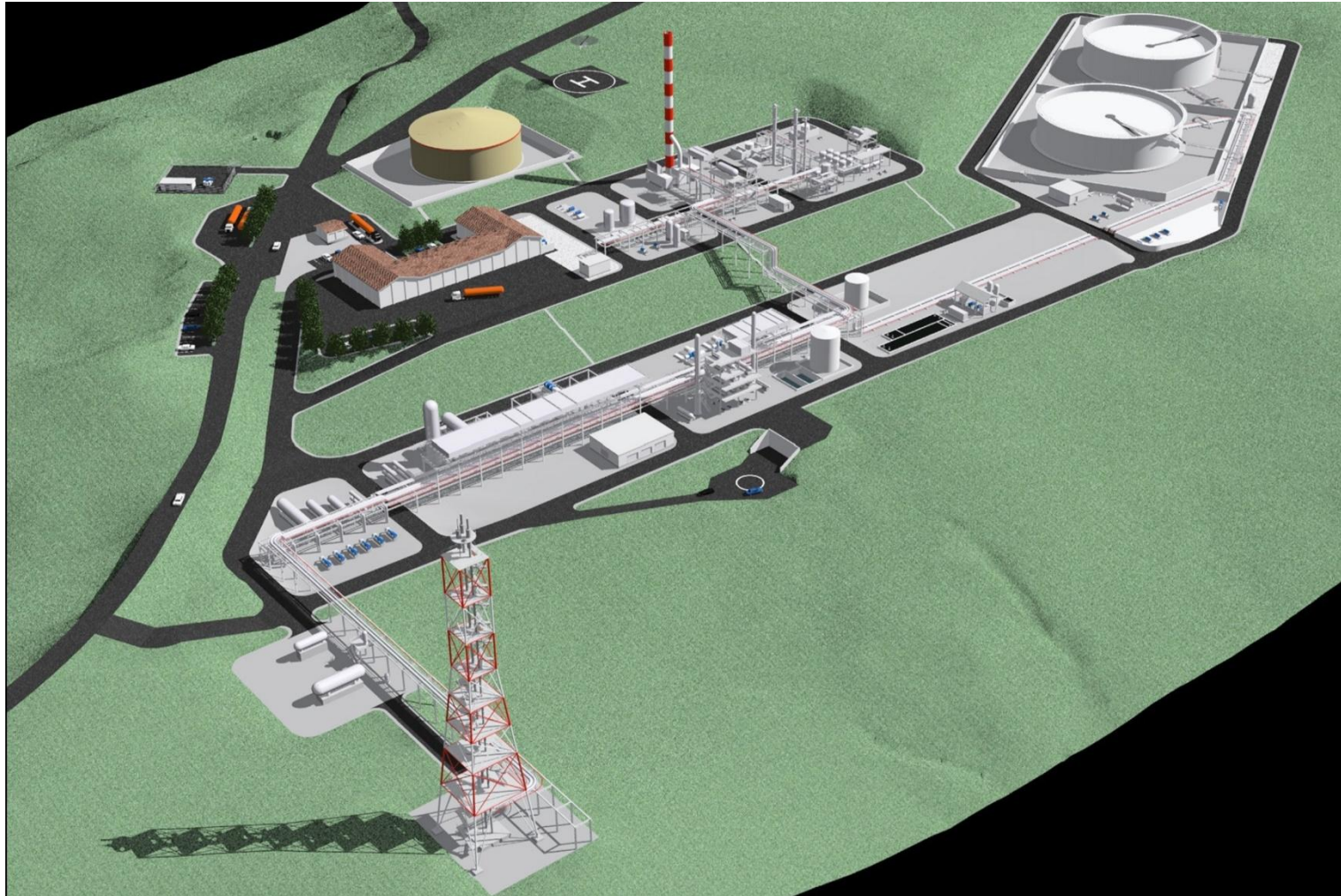
OPEX



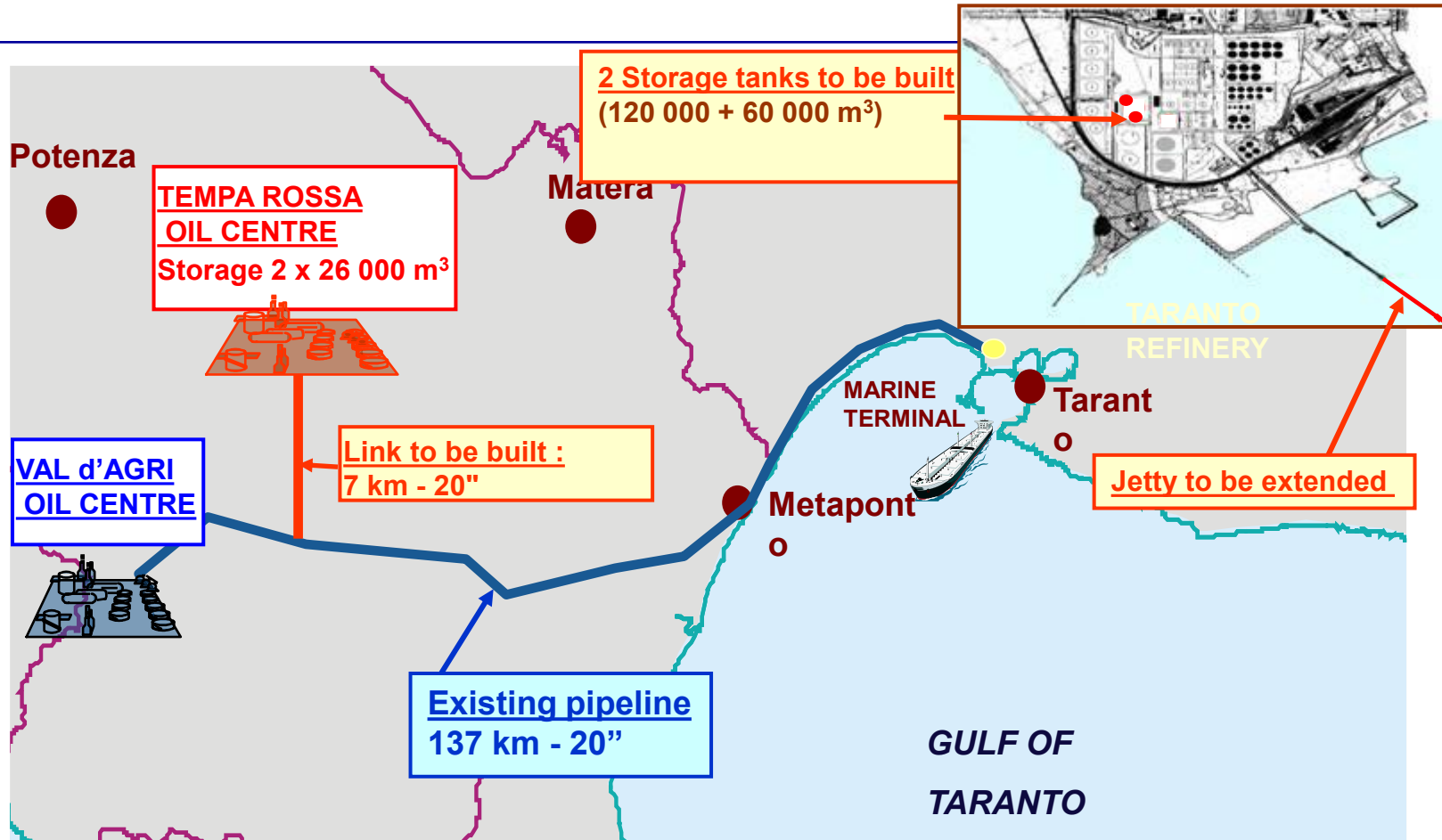
Projects



Tempa Rossa – Italy

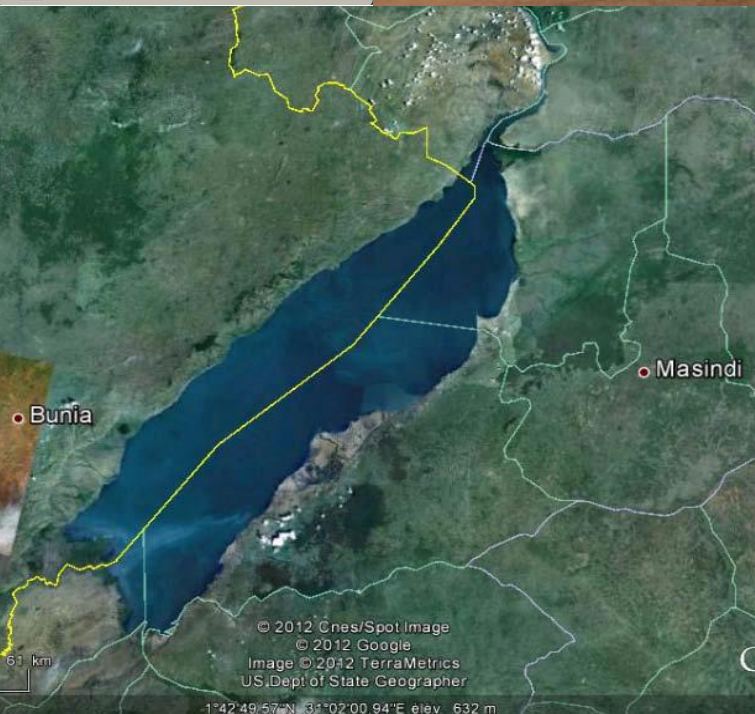
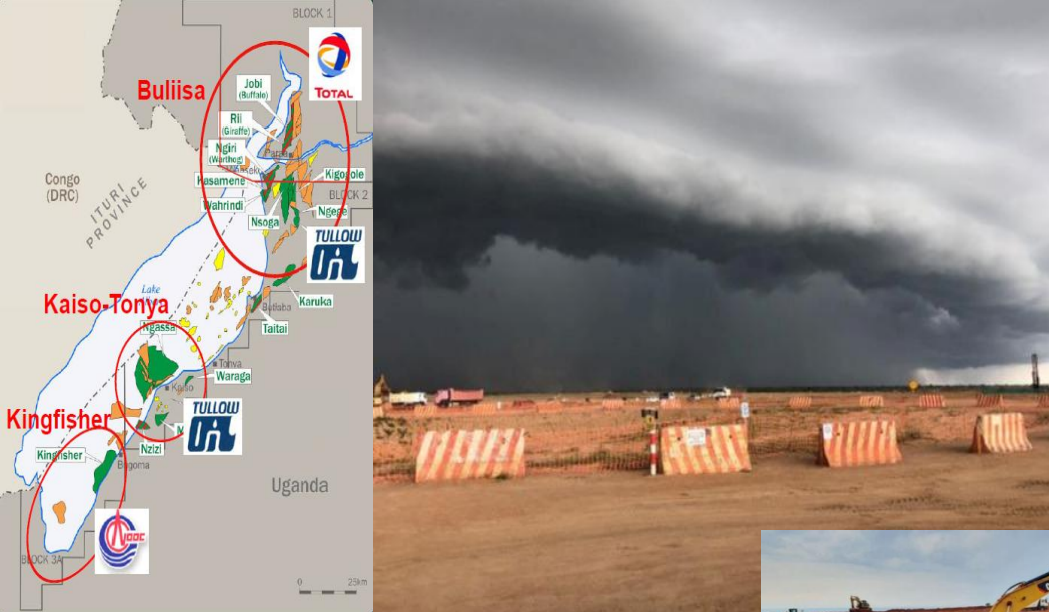


Tempa Rossa - Italy / Description



Production of heavy oil (average 17° API mini 12) from 5 existing wells (to be recovered and re-completed) and drilling of 1 additional well + 2 new wells.
Gathering flowlines from well sites to Oil Centre





Tilenga / Kingfisher / EACOP Uganda & Tanzania



Uganda & Tanzania



Tilenga

CAPEX
4500 mUSD

TTE share
56,7%



Tilenga

FID 02/2021

Execution Ongoing

RFSU 25/11/2025

Kingfisher

FID 02/2021

Execution Ongoing

RFSU 31/05/2025

EACOP

FID 02/2021

Execution Ongoing

First oil 01/03/2026

Tilenga

Plateau 190 kbopd,
29 well pads, 420
wells, single CPF

Kingfisher

150 Mboe reserves
to be developed
40 wells

EACOP

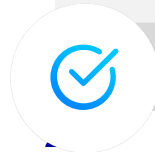
1500km pipeline +
pumping stations +
terminal/tanks/jetty

Kingfisher

1500 mUSD
TTE share
56,7%

EACOP

3800 mUSD
TTE share
62%

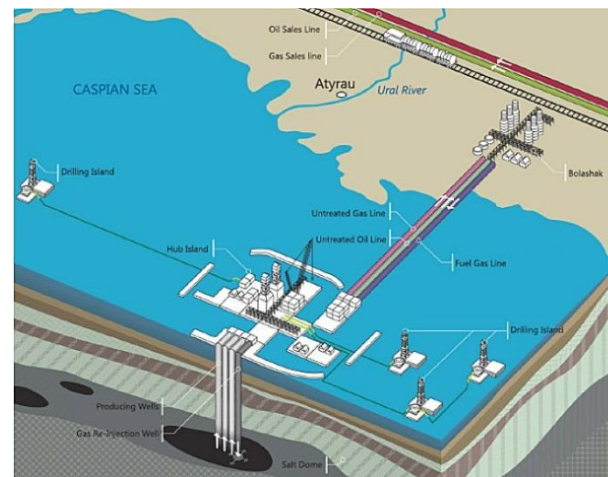
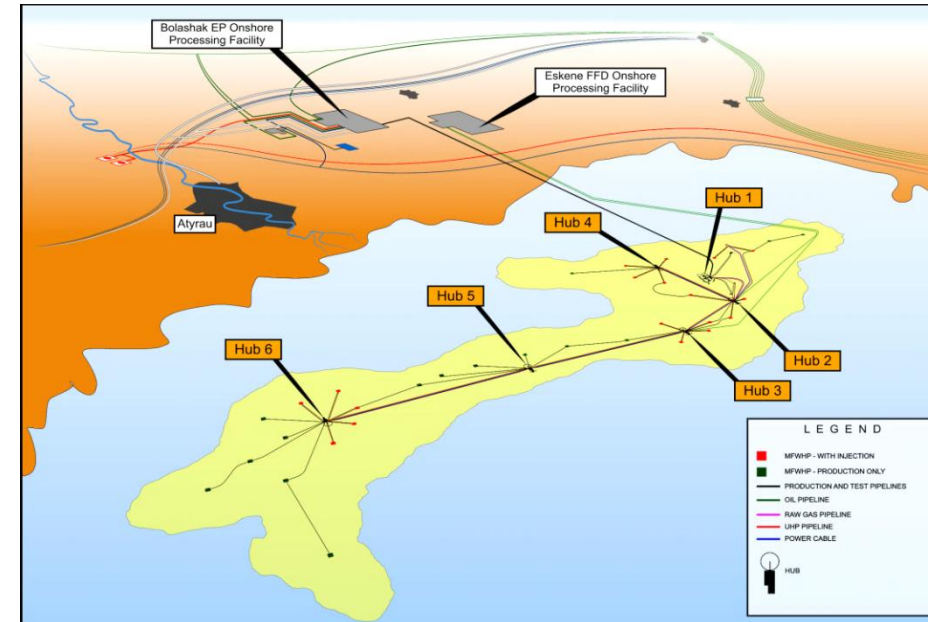


**Major oil development in a sensitive social
and environmental context**



Field Development – Kashagan/Kazakhstan Phase 1

- ▶ Phase I 370,000 bopd (capacity) production plateau (increasing to 450,000 bopd with additional Raw Gas Injection)
- ▶ 40 wells and 5 drilling islands (A Island, D Island, EPC2, Epc3, and EPC4) tied to Hub 1
- ▶ Offshore facilities: oil and gas separation, gas dehydration and raw gas injection
- ▶ Onshore facilities: oil trains, gas and sulphur plants and rail loading facilities for oil and sulphur



KASHAGAN Project

FACILITIES LAY OUT



North Sea - Norway

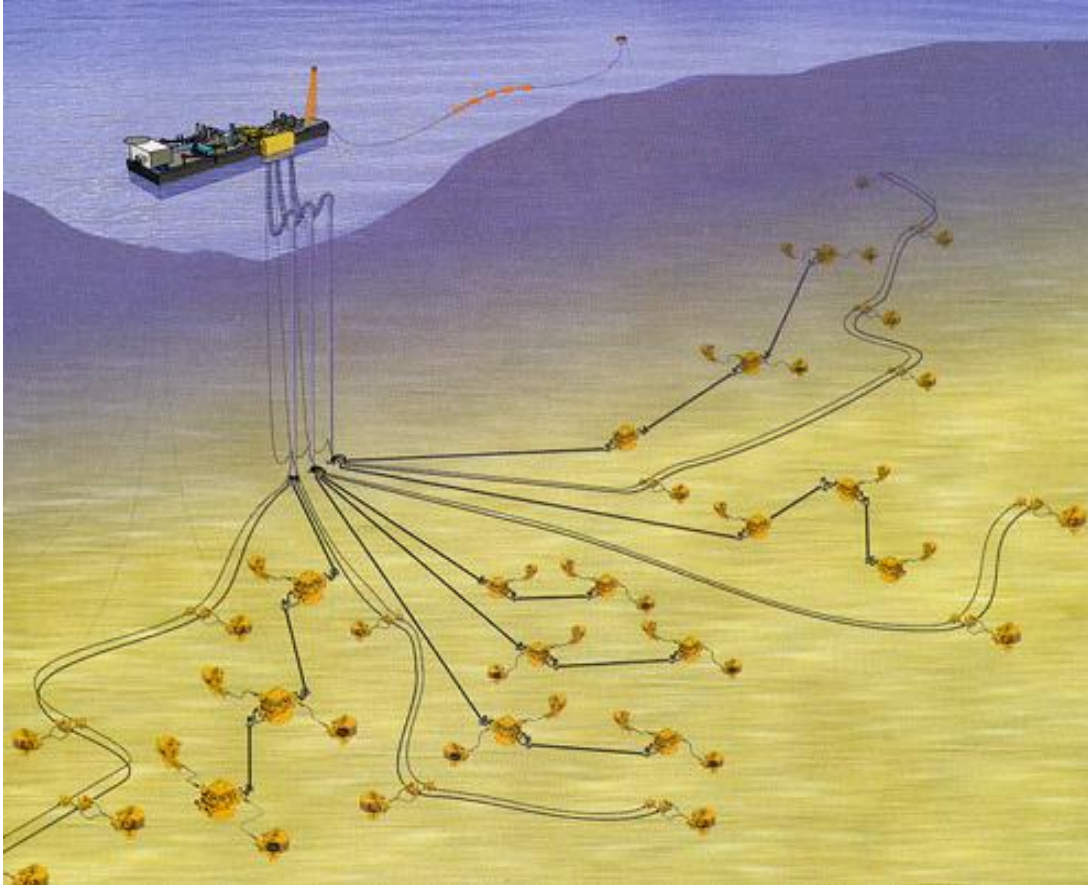
Ekofisk field reaches 50-year milestone



The Ekofisk complex in the Norwegian North Sea
(Courtesy ConocoPhillips)



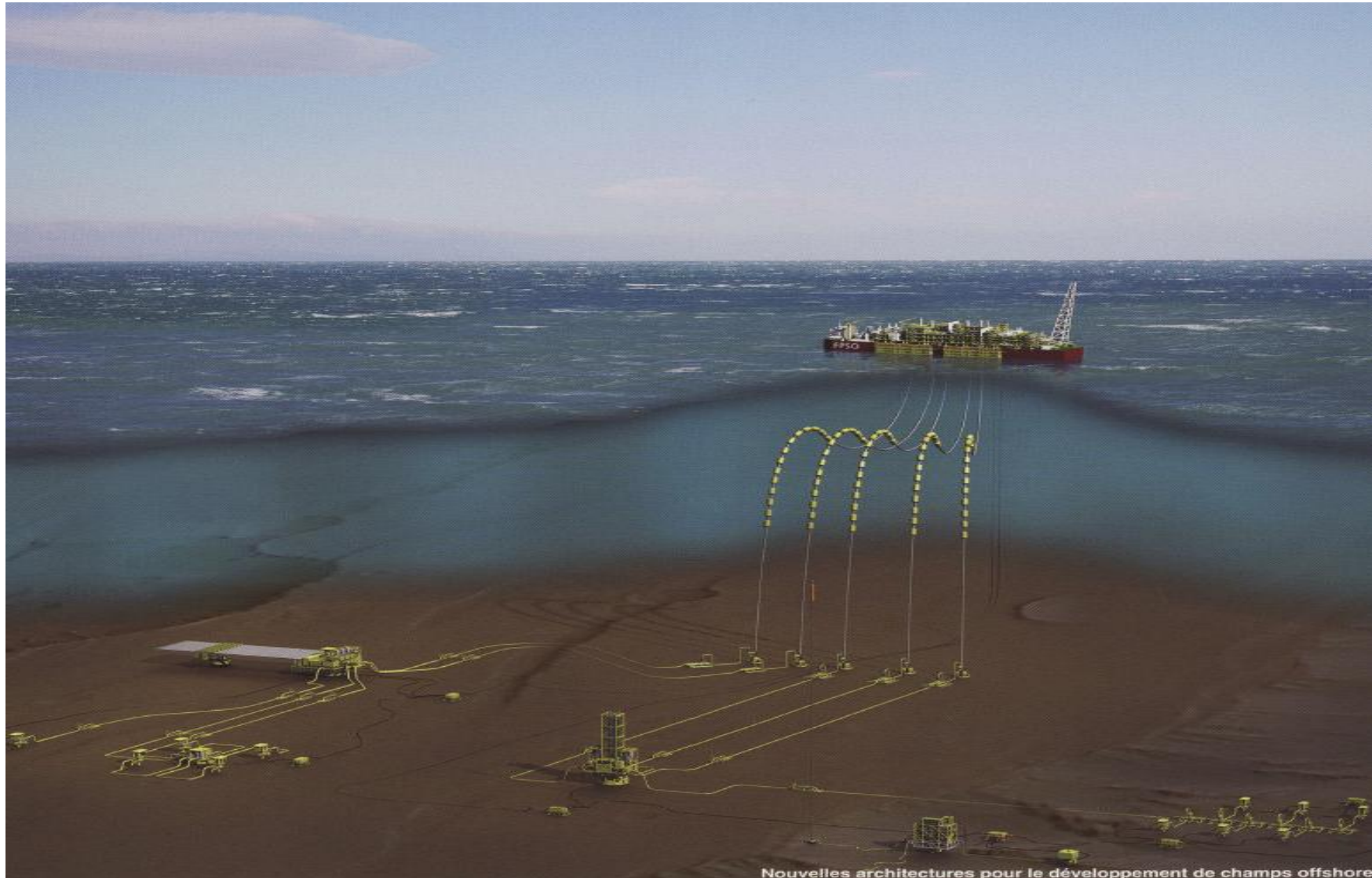
Field development using a FPSO (Floating Production Storage Offtake)



Tower risers



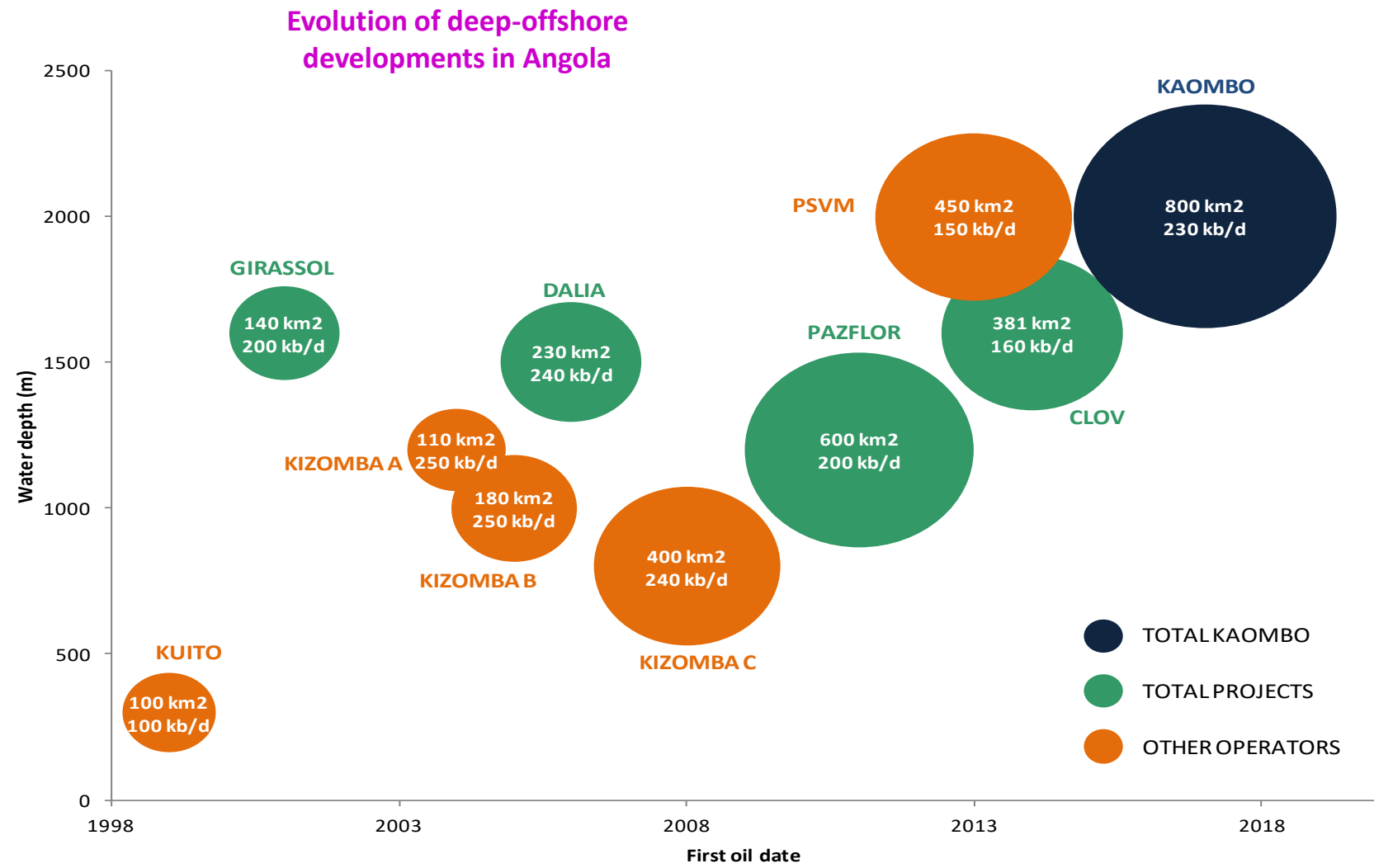
Deep offshore infrastructures



Nouvelles architectures pour le développement de champs offshore



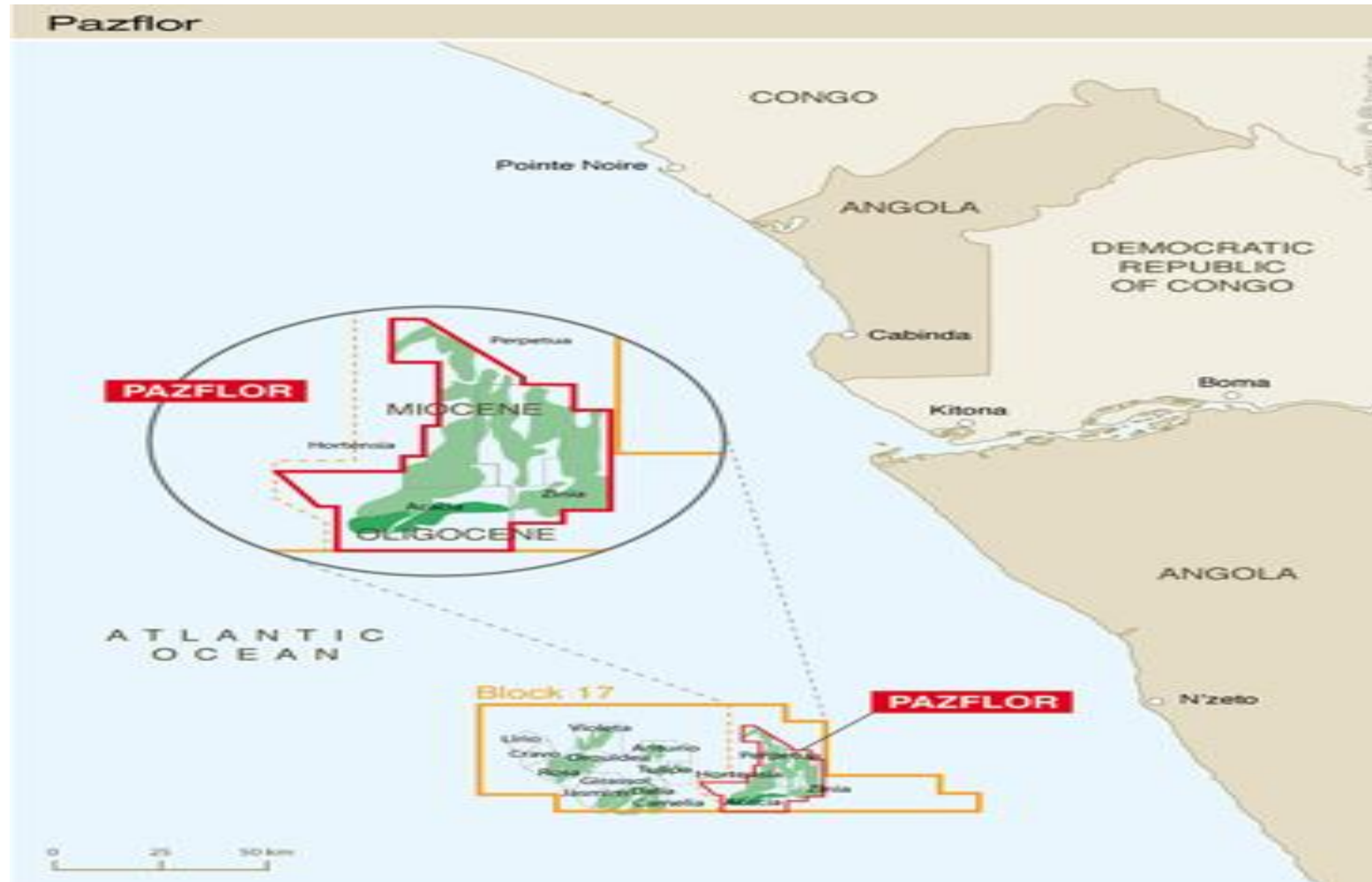
Deep Offshore in Angola



Going deeper and gathering more dispersed reserves

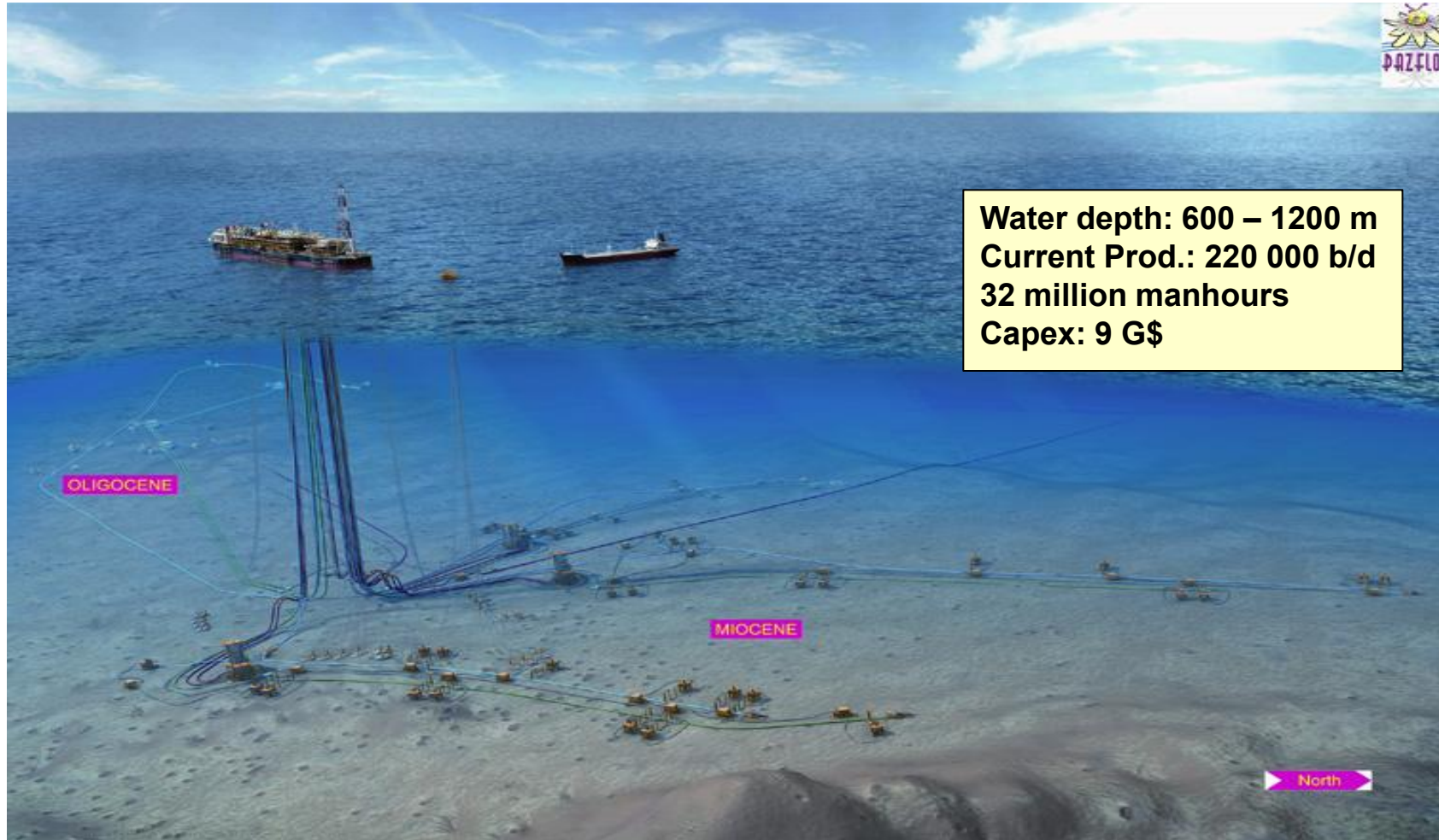


Deep Offshore Angola: Pazflor field location



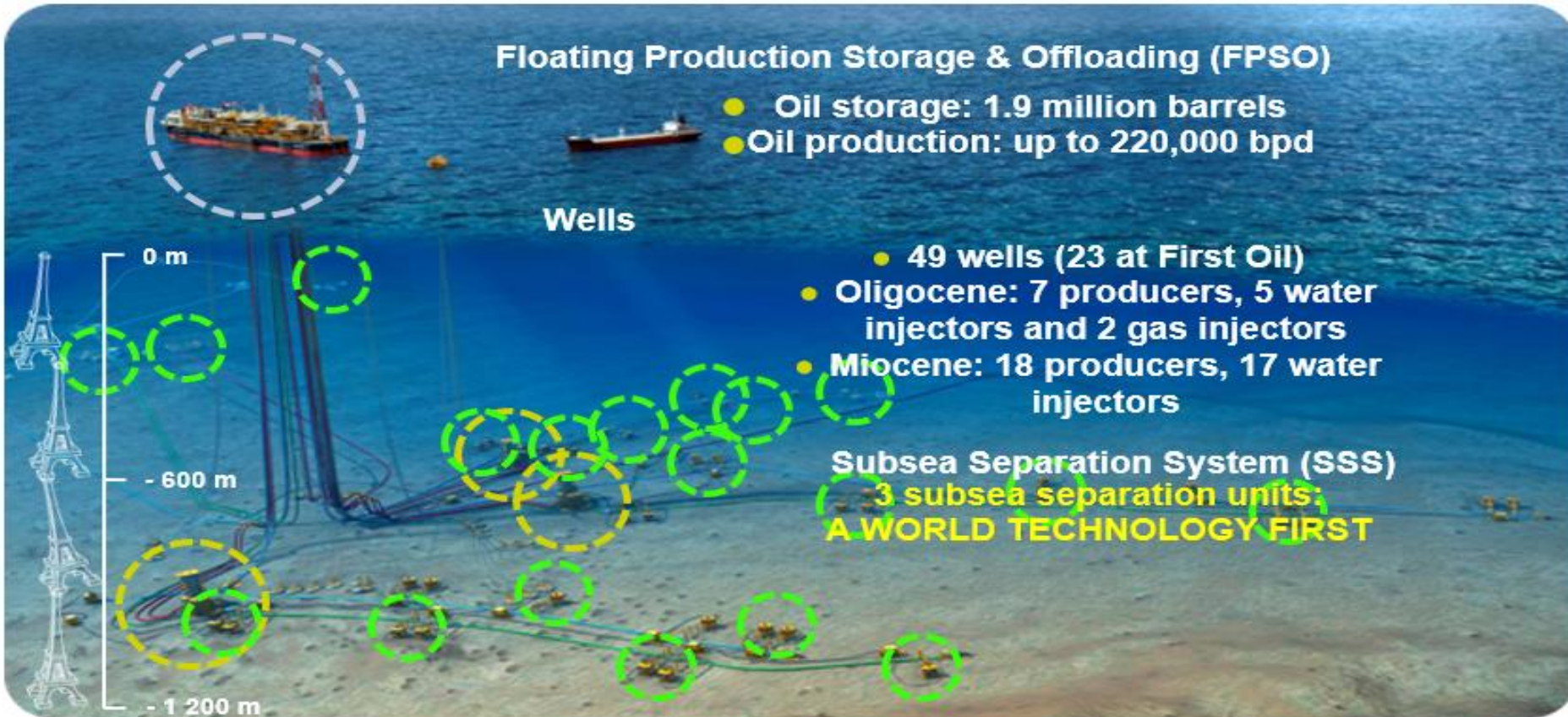
Deep Offshore: Pazflor field in Angola

1st oil: August 2011



Deep Offshore: Pazflor field in Angola

1st oil: August 2011



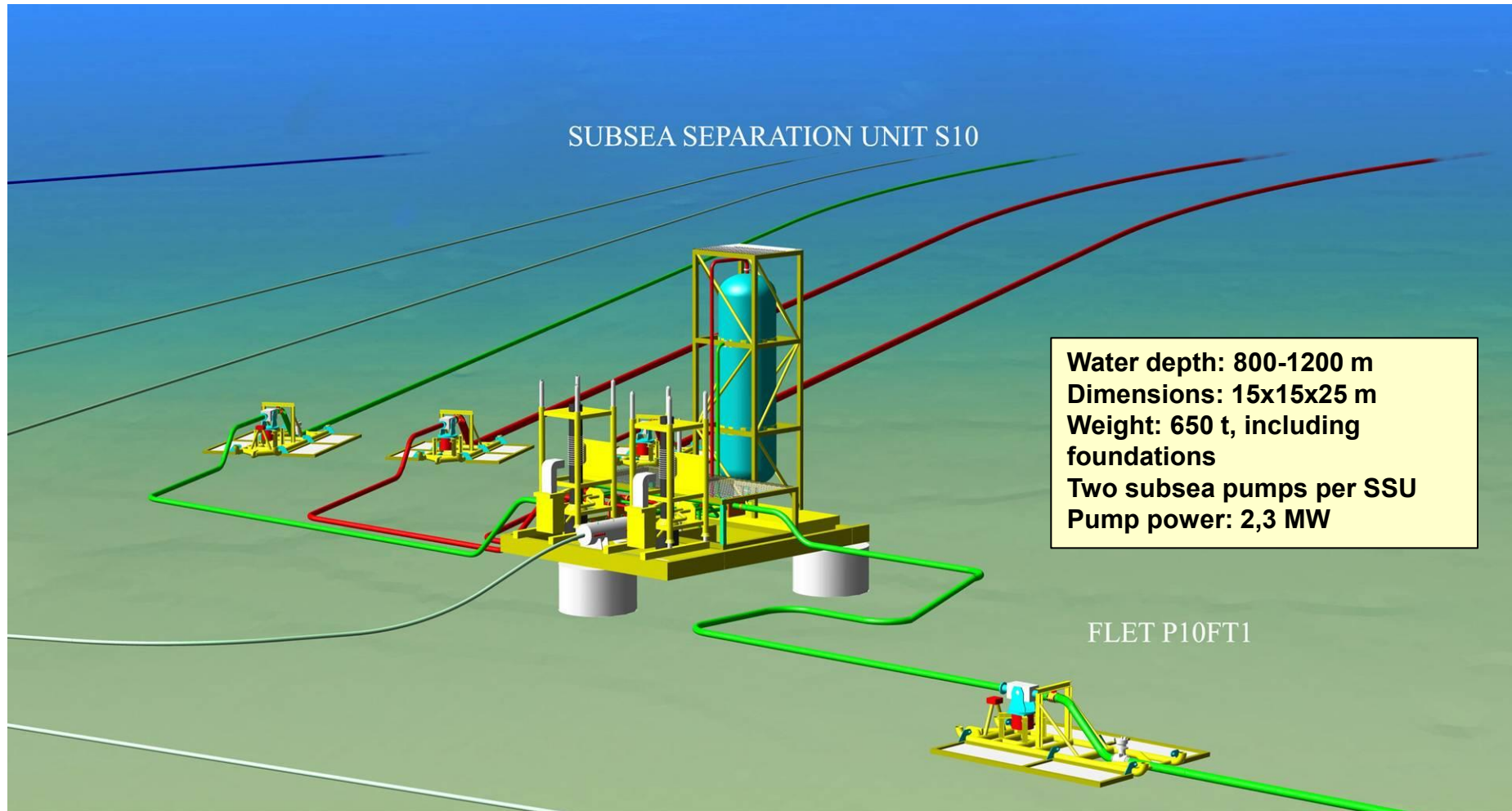
Subsea Umbilicals Riser Flowlines (SURF)
Total length of pipelines: 180 km
Total length of umbilicals: 84 km



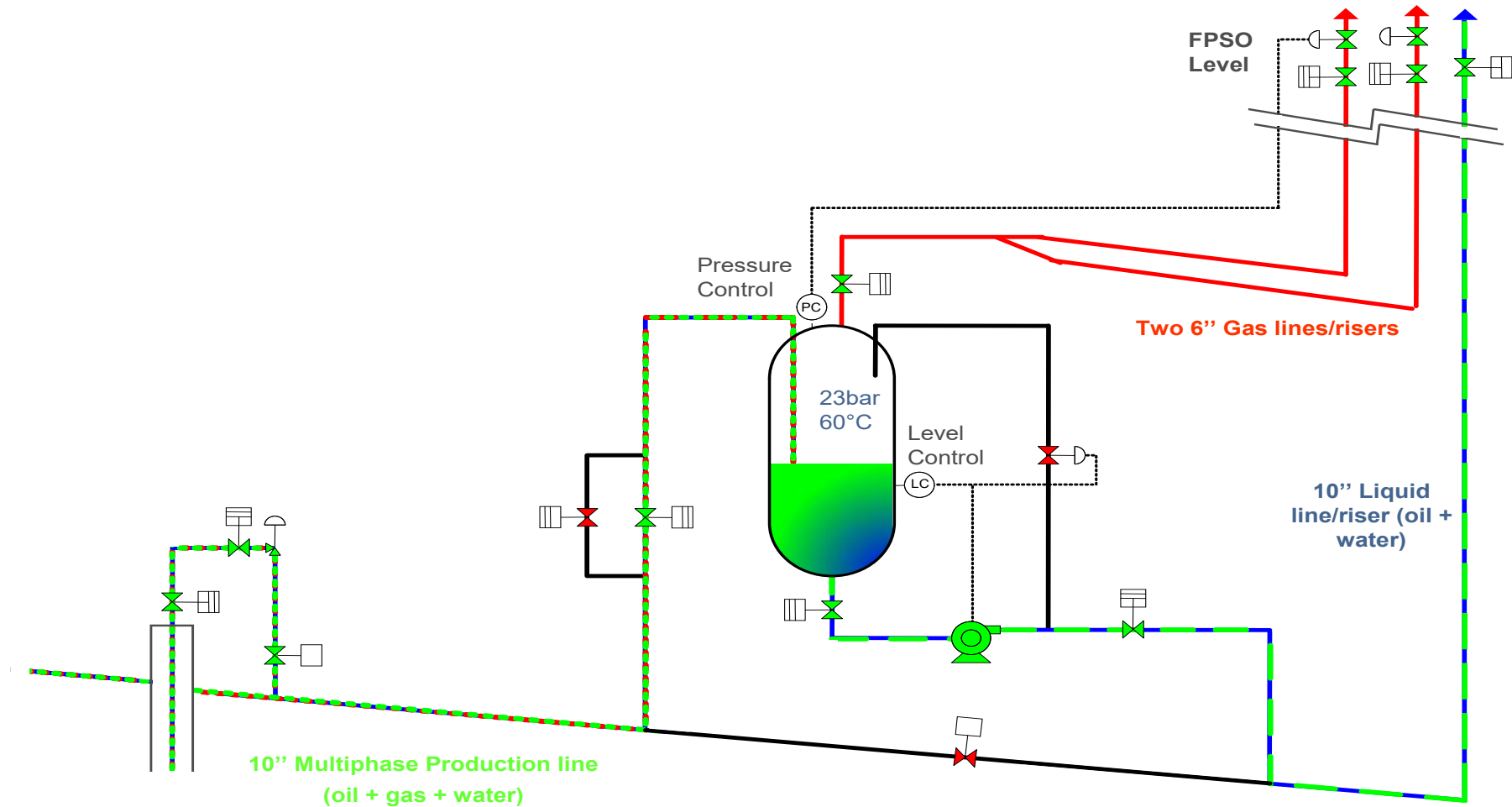
Deep Offshore: Pazflor field in Angola



Pazflor – Subsea Separation Unit (SSU)



Pazflor – Subsea Separation Flow Diagram



Pazflor FPSO



Lenght: 325 m
Width : 62 m
120 000 t of steel
Gas turbines power: 120 MWe



Pazflor FPSO



The biggest FPSO ever built

20 year operating life

- Hull (325m x 61m x 32m)
- 83,000 tonnes dry weight
- 300 Air buses A380 jets
- 1.9 million barrels storage
- Volume of 2 Stades de France
- Double sided

- Topsides
- ~41,000 tonnes (dry weight)
- 15 Modules

Heaviest 2800 tonnes

- Oil production 220,000 bpd
- Power generation capacity 120 mw
- Water injection capacity 382,000 bpd
- Gas injection capacity 4.3 Msm³/day
- Accommodation normal 140 POB

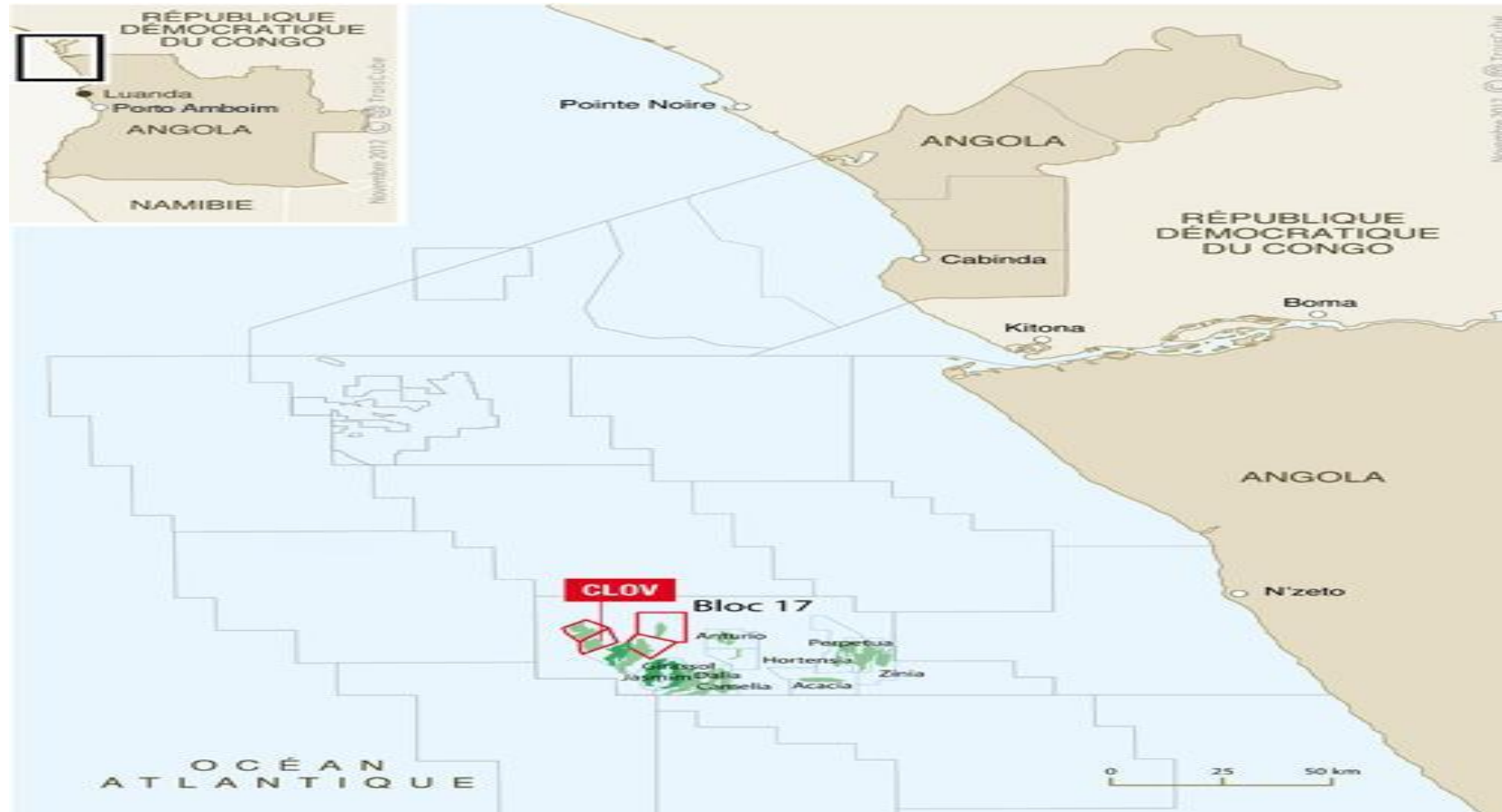
240 max POB major maintenance periods



Clov Project - Angola

Capacity: 160 000b/d - Start-up : 2014

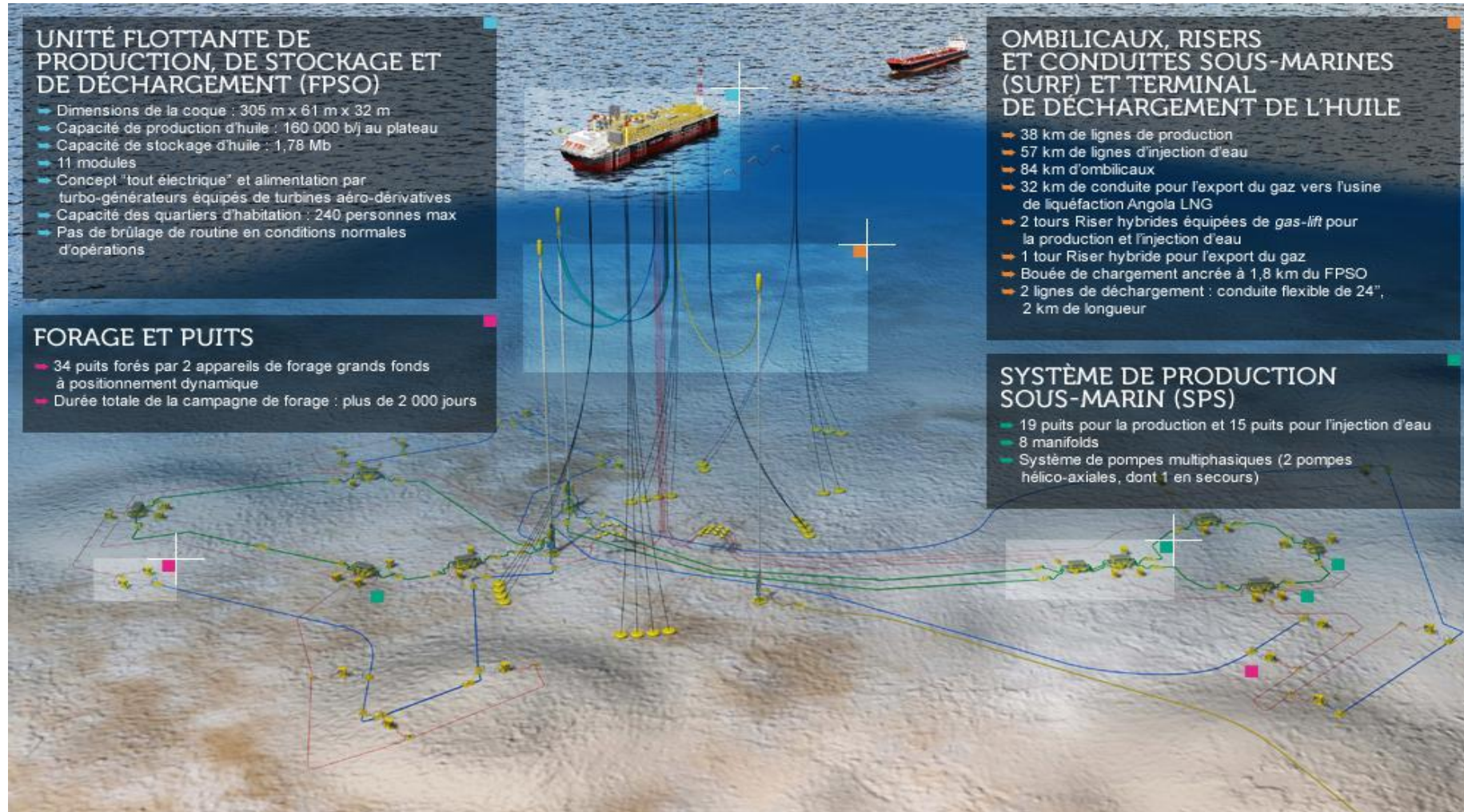
Water depth : 1100 – 1400 m



Clov Project



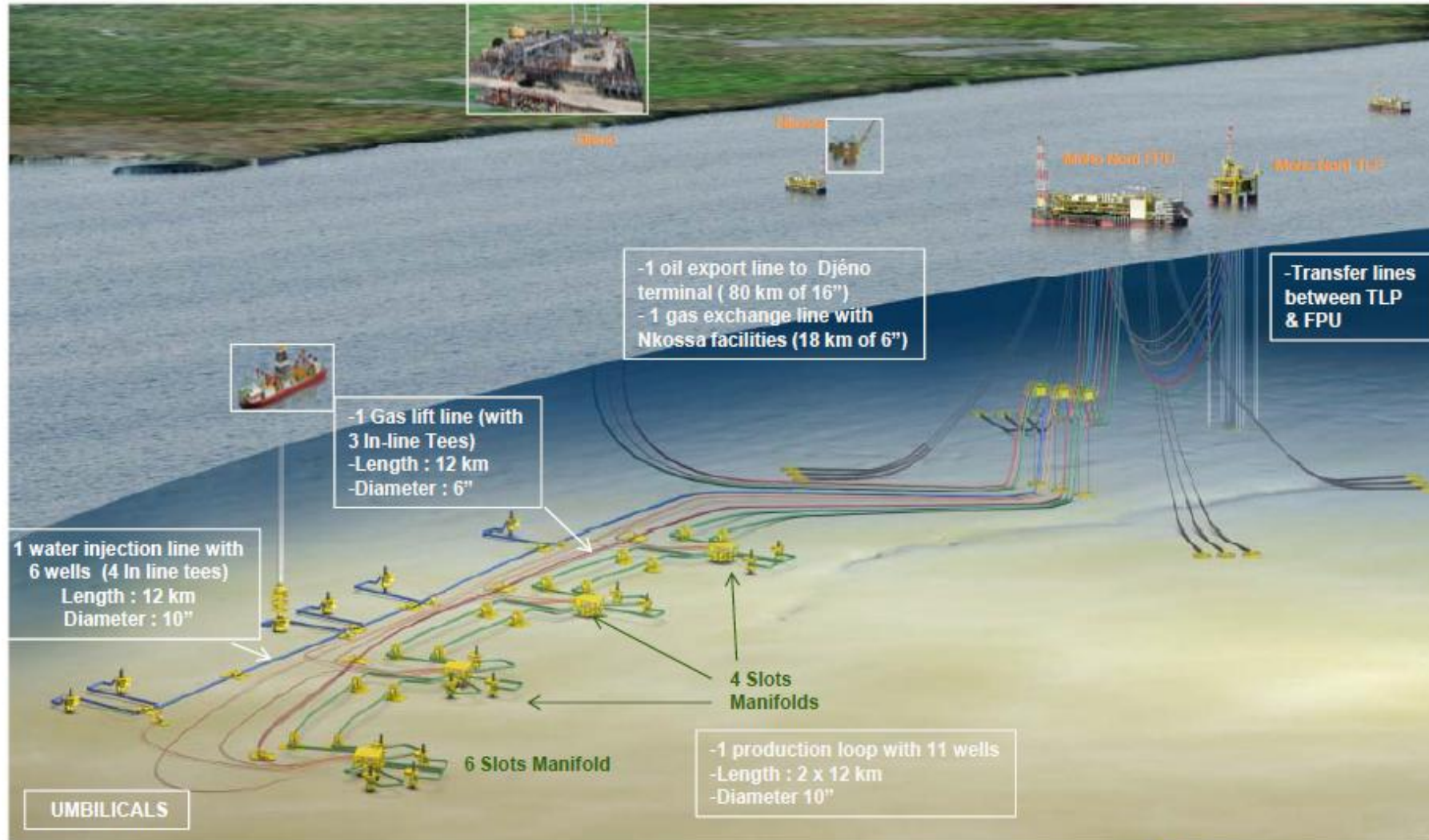
Clov Project



Clov – Multiphasic submarine pumps



Moho North Development - Congo



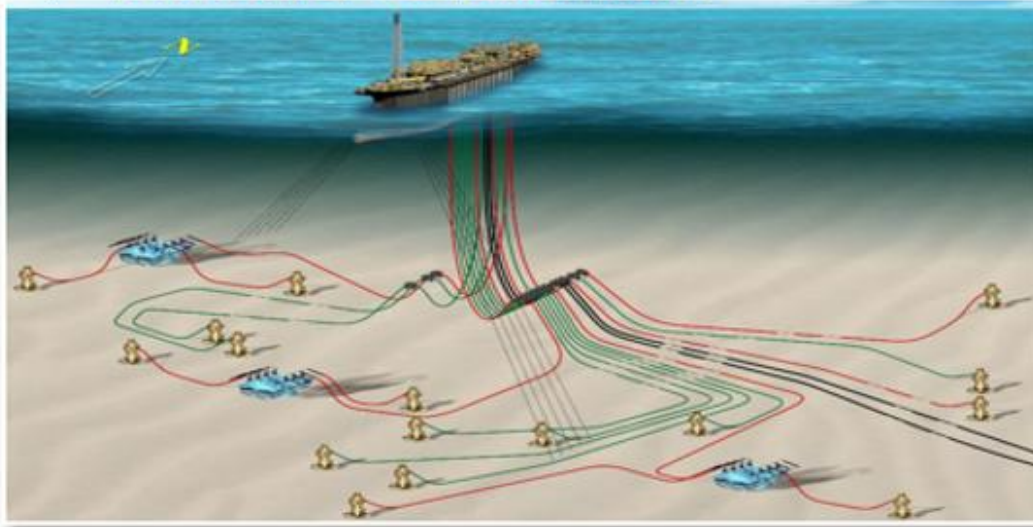
Libra Oil Field in Brazil

- ◆ The largest pre-salt oil field ever discovered in the Santos Basin
- ◆ 2000 - 2400 m water depth. 180 km off the coast of Rio de Janeiro
- ◆ Area of 1550 km²
- ◆ 8 to 12 Gb recoverable oil resources
- ◆ Estimated peak production: 1,4 Mb/d
- ◆ Outstanding challenges; 2014 budget up to 500 M\$ for 2 wells and 3D acquisition survey. Development with FPSO's. Separation, treatment of Associated Gas and CO₂.
- ◆ First Oil: 27 november 2017 (Early Production Phase)
- ◆ Consortium made up of Petrobras (40%), Total (20%), Shell (20%), CNPC (10%) and CNOOC (10%). Petrobras Operator



Libra Oil Field in Brazil

◆ NW Panel Development



4 FPSO

- Oil treatment capacity 150 kb/d
- Gas compression 12 MSm³/d
- Water injection 225 kbw/d
- Lease and Operated contract
- One FPSO to be sanctioned each year from 2017
- Offloading DP Shuttle Tankers

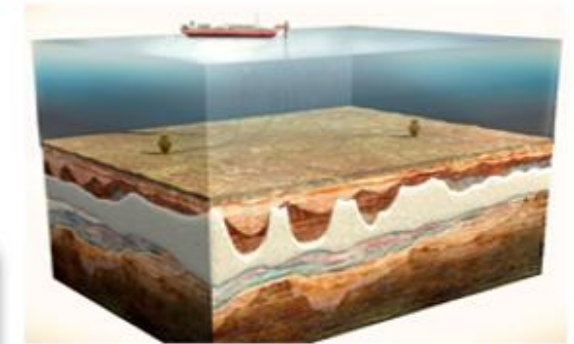
SUBSEA & WELLS:

- All wells connected to flexibles (Rigids under evaluation)
- 8 Producers & 9 Injectors (WAG) per FPSO
- Full gas reinjection

Reservoir

Water depth: 2.100 m
27° API - 44% CO₂
H₂S < 12 ppm -- GOR 430 m³/m³
Reserves: 2.9 Gb

◆ Pioneiro de Libra



1 FPSO

- Oil treatment capacity: 50 kb/d
- Gas compression: 4 MSm³/d
- No water injection
- Lease and Operated contract
 - Odebrech Teekay
 - 12 years

Milestones

- FPSO in location on May 20th 2017
- First Oil planned in November 2017



Libra Block in Brazil

17/08/2020 News

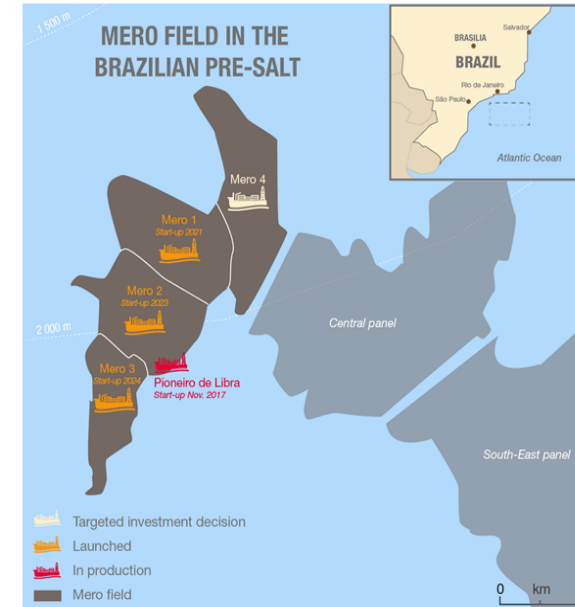
Paris – Total and its partners have taken the investment decision for the third phase of the Mero project (Libra block), located deep offshore, 180 kilometers off the coast of Rio de Janeiro, in the prolific pre-salt area of the Santos Basin.

The Mero 3 FPSO¹ will have a liquid treatment capacity of 180,000 barrels per day and is expected to start up in 2024. It follows investment decisions for Mero 1 (startup expected in 2021) and Mero 2 (startup expected in 2022) FPSOs, both of which have a liquid processing capacity of 180,000 barrels per day.

"The decision to launch Mero 3 marks a new milestone in the large-scale development of the vast oil resources of the Mero field – estimated at 3 to 4 billion barrels. It is in line with Total's growth strategy in Brazil's deep-offshore based on giant projects enabling production at competitive cost, resilient in the face of oil price volatility," said Arnaud Breuillac, President Exploration & Production at Total. "The Mero project will contribute to the Group's production from 2020 onwards, and we are targeting a production of 150,000 barrels per day in Brazil by 2025."

The Mero field has been in pre-production since 2017 with the 50,000-barrel-per-day Pioneiro de Libra FPSO. The Libra Consortium is operated by Petrobras (40%) as part of an international partnership including Total (20%), Shell Brasil (20%), CNOOC Limited (10%) and CNPC (10%). Pré-Sal Petróleo (PPSA) manages the Libra Production Sharing Contract.

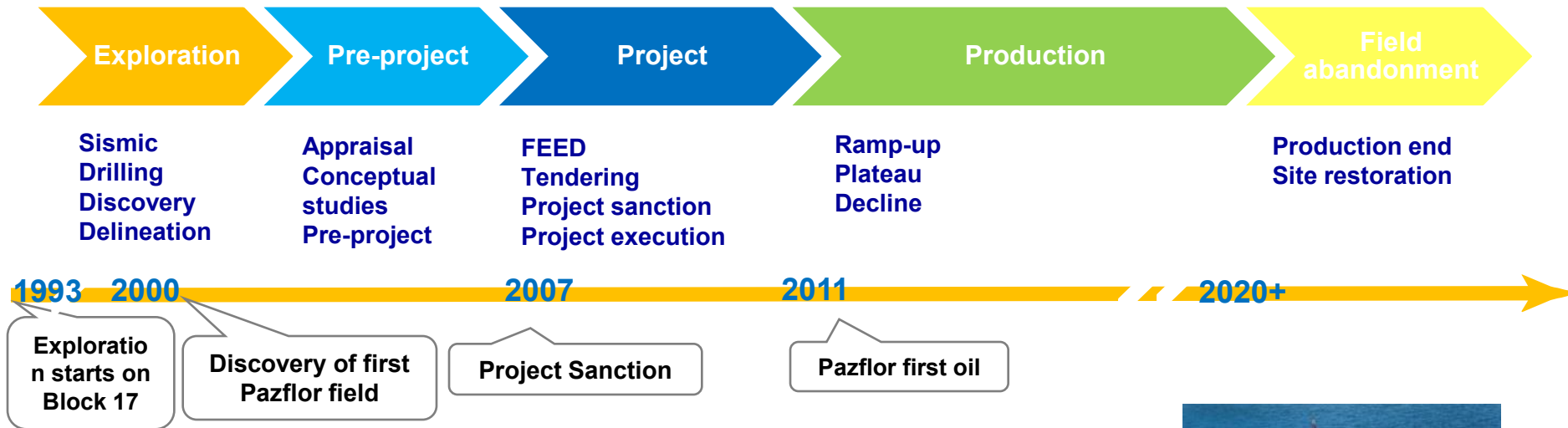
¹ Floating Production Storage and Offloading (FPSO)



Upstream Fundamentals – Long Life Cycles and Massive Investments

The upstream IOC business model

Pazflor: a 9 G\$ FPSO project from project sanction to start-up



IOC's *take on exploration risk* and fund projects : need for a very strong balance sheet until first oil.
***Production income shared* between governments and consortium partners.**



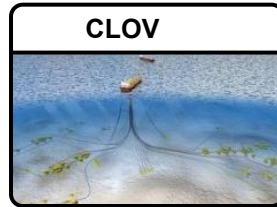
TotalEnergies: Leading deep-offshore operator – Projects 2000 - 2020



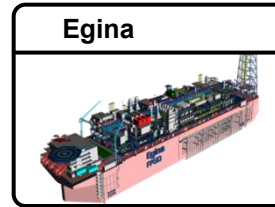
- 180 kb/d & 180 Mcf/d
- First oil Q1 2012(e)



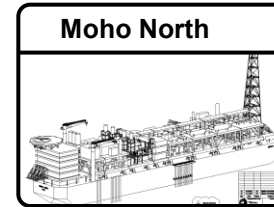
- 500 Mcf/d
- First gas 2014(e)



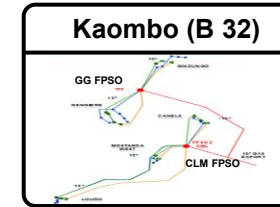
- 160 kb/d & 230 Mcf/d
- First oil 2014(e)



- 200 kb/d & 160 Mcf/d
- First oil 2016(e)



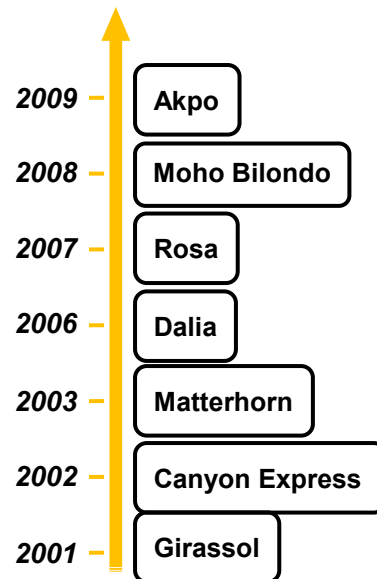
- FPU + TLPW
- 100 kb/d & 90 Mcf/d
- First oil 2016(e)



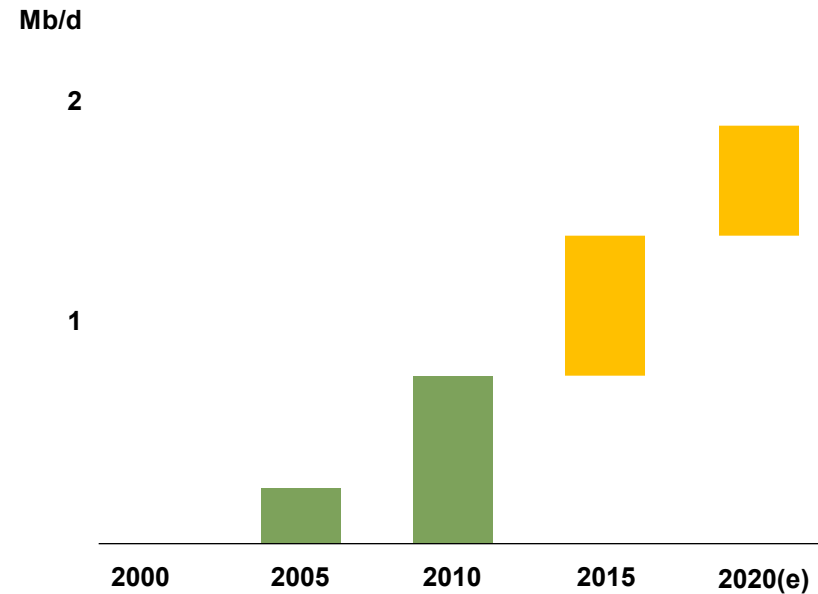
- 2 FPSOs
- 200 kb/d & 180 Mcf/d
- First oil 2016(e)



- 220 kb/d & 140 Mcf/d
- First oil Aug. 2011



Total-operated deep-offshore capacity

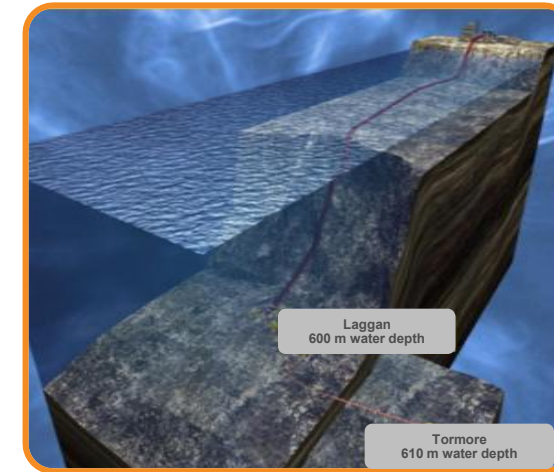


Approx. 450 wells by 2017 9 FPSOs, 2 FPUs



TotalEnergies example: Subsea innovation : lower cost, higher production

- ◆ Expertise in flow assurance technology reduces development costs
 - CLOV (Block 17, Angola) : subsea “ring” arrangement reduces length of flowlines → -11% of EPC costs
 - Kaombo (Block 32, Angola) : hybrid design reduces length of insulated flowlines → -19% of EPC costs
 - Laggan Tormore (UK) : 143 km multiphase subsea line to shore reduces costs versus dedicated floating facilities
- ◆ Subsea processing increases production
 - Pazflor (Block 17, Angola) : subsea separation + hybrid pumps allow highly viscous crudes to be produced
 - GirRI (Block 17, Angola) : high-boost multiphase pumps enhance recovery from depleted reservoir

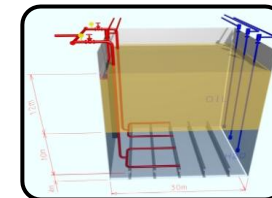
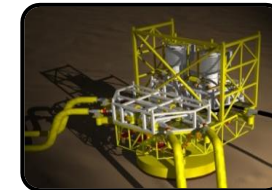
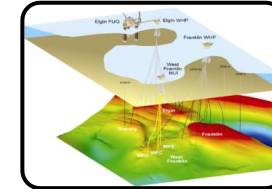
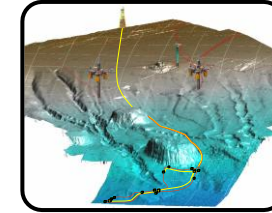


Maintaining our edge through constant innovation and rapid R&D applications



Creating value through innovative and safe designs

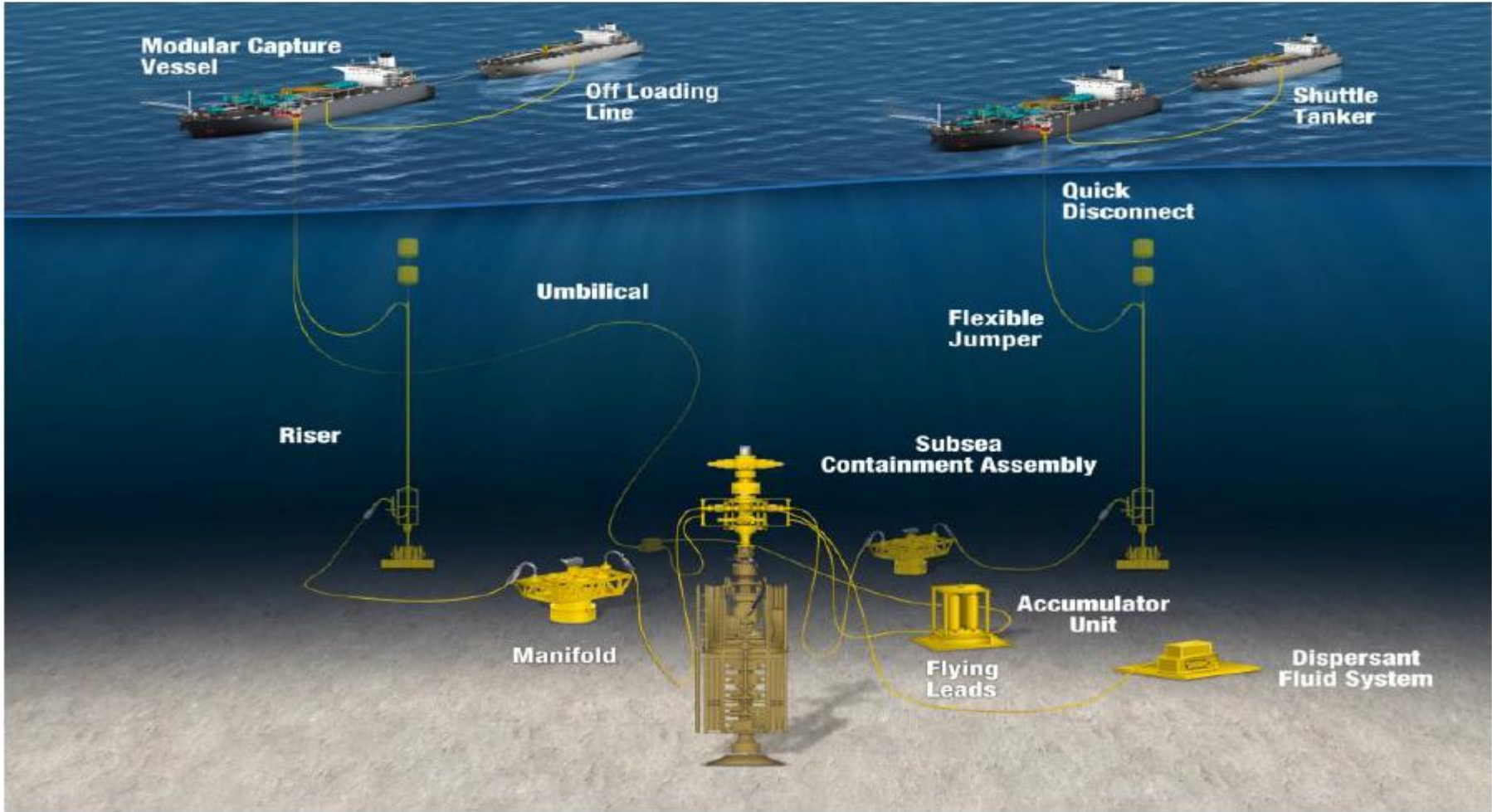
- ◆ Long-distance multi-phase transportation
 - Dunbar, Dolphin, Laggan Tormore
- ◆ HP/HT production and infill drilling
 - 1100 bars and 190°C on Elgin Franklin
 - 1150 bars and 215°C on West Franklin
- ◆ Subsea treatment, production and pumping equipment
 - Pazflor, GirRI, CLOV, Kaombo
- ◆ FPSO hulls for crude processing
 - Pazflor, Usan, CLOV : topsides weight reduction
- ◆ FLNG design (2.5 Mt/y to 4.0 Mt/y) developed based on operating experience in FPSOs and FPU's



More efficient designs for future growth



Subsea Well Control and Containment



Subsea Well Control and Containment

For the Oil Spill Response Limited (OSRL) organisation, in the framework of the Subsea Well Response Project (SWRP), Saipem has developed the Offset Installation Equipment (OIE) which manages the capping and containment of offshore wells. Equipments can be deployed down to 600 m water depth.



Source: Saipem



Services Offshore

The « Pioneering Spirit » Heerema



The World Biggest Crane Ship

Lenght: 382 m
Width: 124 m
Owner: Allseas



R & D in exploration - production

	OBJECTIVES	METHODS & TECHNIQUES
<u>GGR Techniques</u> <i>Geology Geophysics Reservoir eng.</i>	- Discover new reservoirs - Appraise discoveries - Optimize recovery	- 3D- 4D seismic - Integrate interpretations
<u>Drilling</u>	- Reduce overall costs - Reduce safety and environment risks - Control high energy wells	- M.W.D. - Slim hole drilling - Multi drain drilling - Clever completion
<u>Production</u>	- Reduce CAPEX - Produce faster - Reach (ultra) deep offshore	- Multiphase flow - Subsea production
<u>Gas</u>	- Reduce LNG chain costs - Process raw gas with high contaminant content - GTL (Gas to liquids)	- New treatment processes - New liquefaction methods - Large capacity methane carriers



Upstream trends & Costs

The situation

- Strong price volatility
- decline of conventional zones
- Technical challenges
- growing concern about environmental issues
- **Oil & Gas business role in the Energy Transition**

Exploration

- Target formations becoming smaller and more and more difficult to access
- Deep offshore, extra-heavy & unconventional HC
- Opening of new regions

Contracts and taxes

- New contracts, Joint operating companies,.....

Competition

- Privatization of national companies
- Specialized gas companies
- Creation of alliances in exploration and in R&D

Oil companies

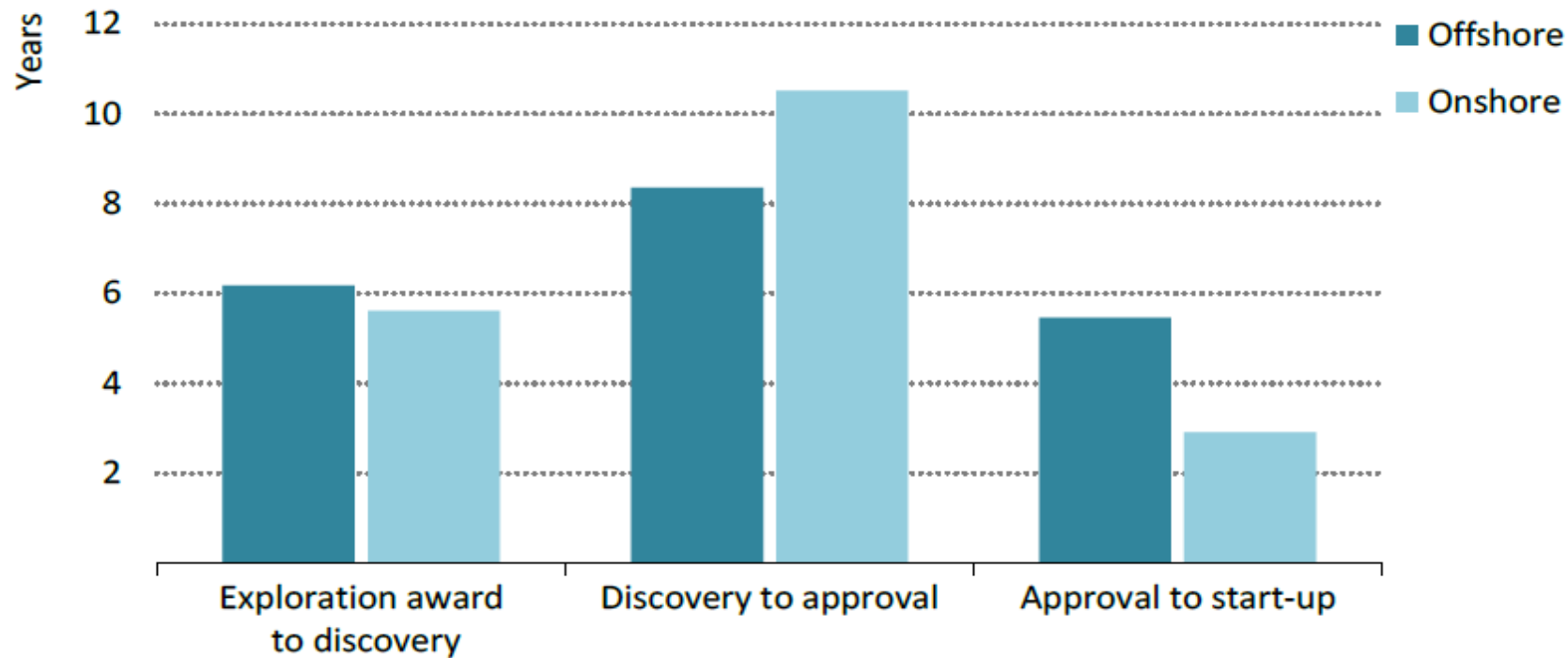
- Refocusing on core business
- Cost reductions
- Mergers

Technical services

- Mergers
- Concentration of supply
- Integrated services



Oil Business: A long process



IEA. CC BY 4.0.

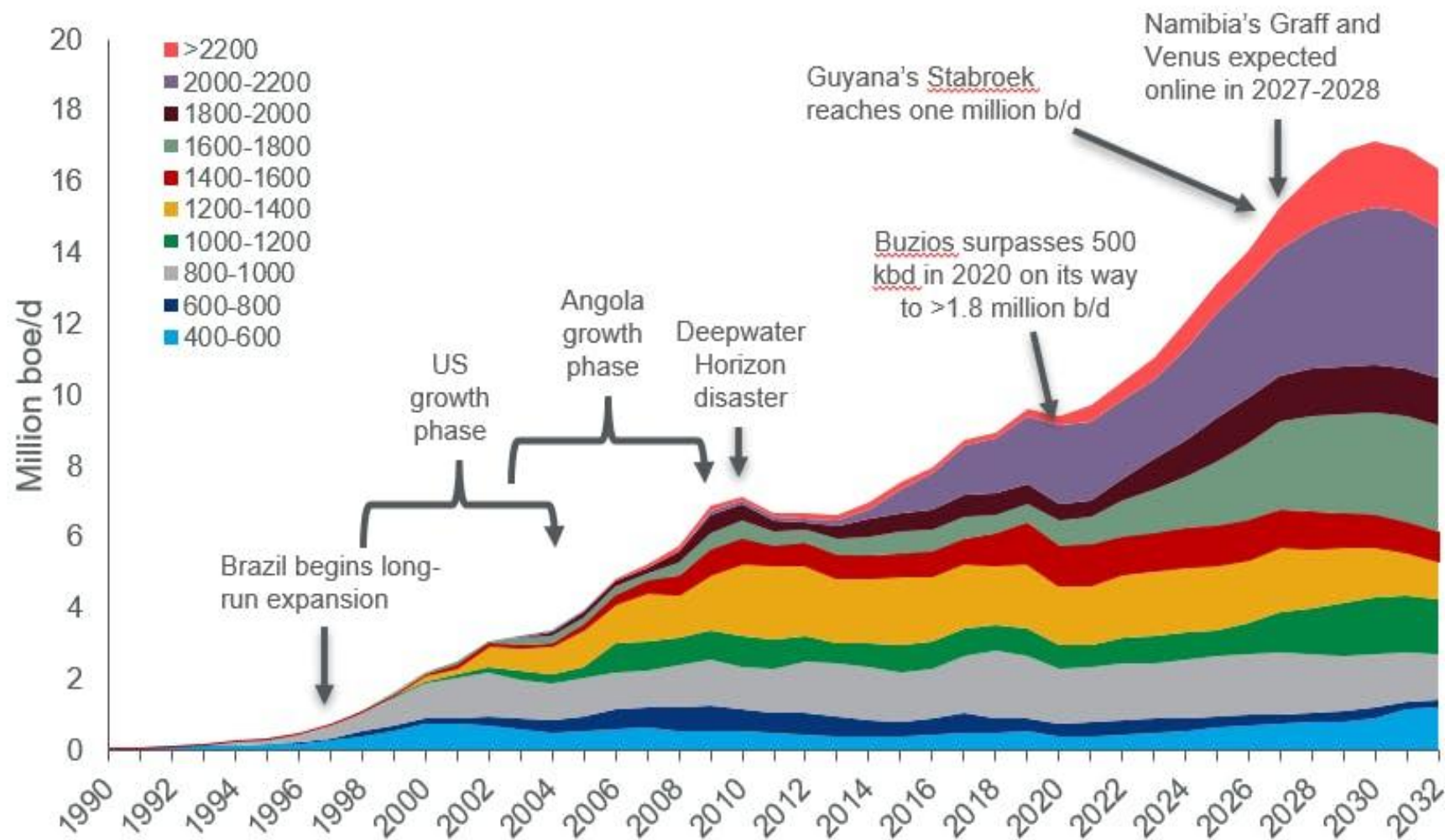
It takes around 20 years on average from the granting of an exploration licence for a new conventional project to begin production

Note: Includes projects awarded exploration licences since 1980 that started production between 2010-20, weighted by technically recoverable resources.

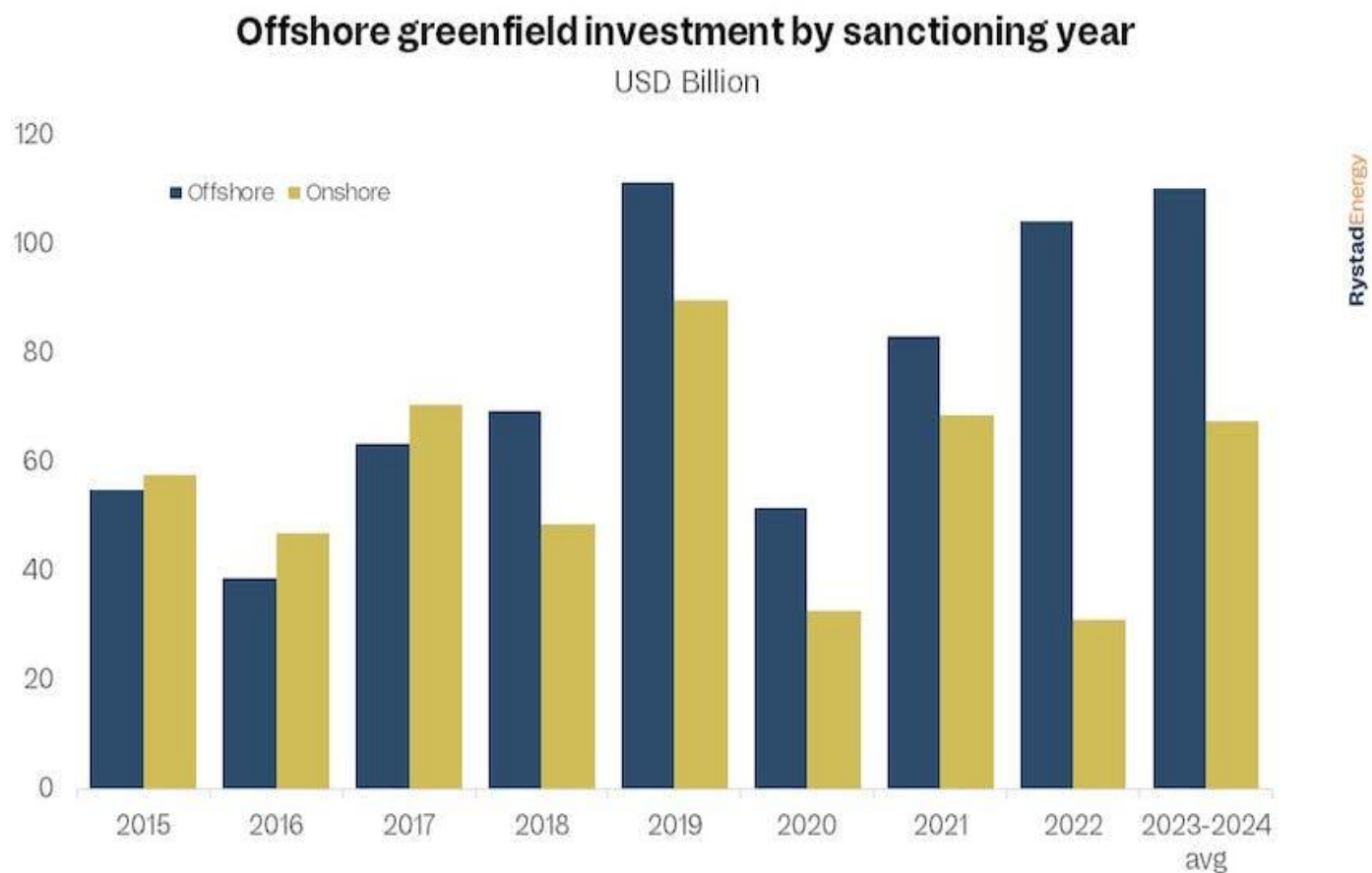
Source: IEA analysis based on Rystad Energy data.



Global deepwater production should climb to 17 MMboe/d by 2030, according to Wood Mackenzie,



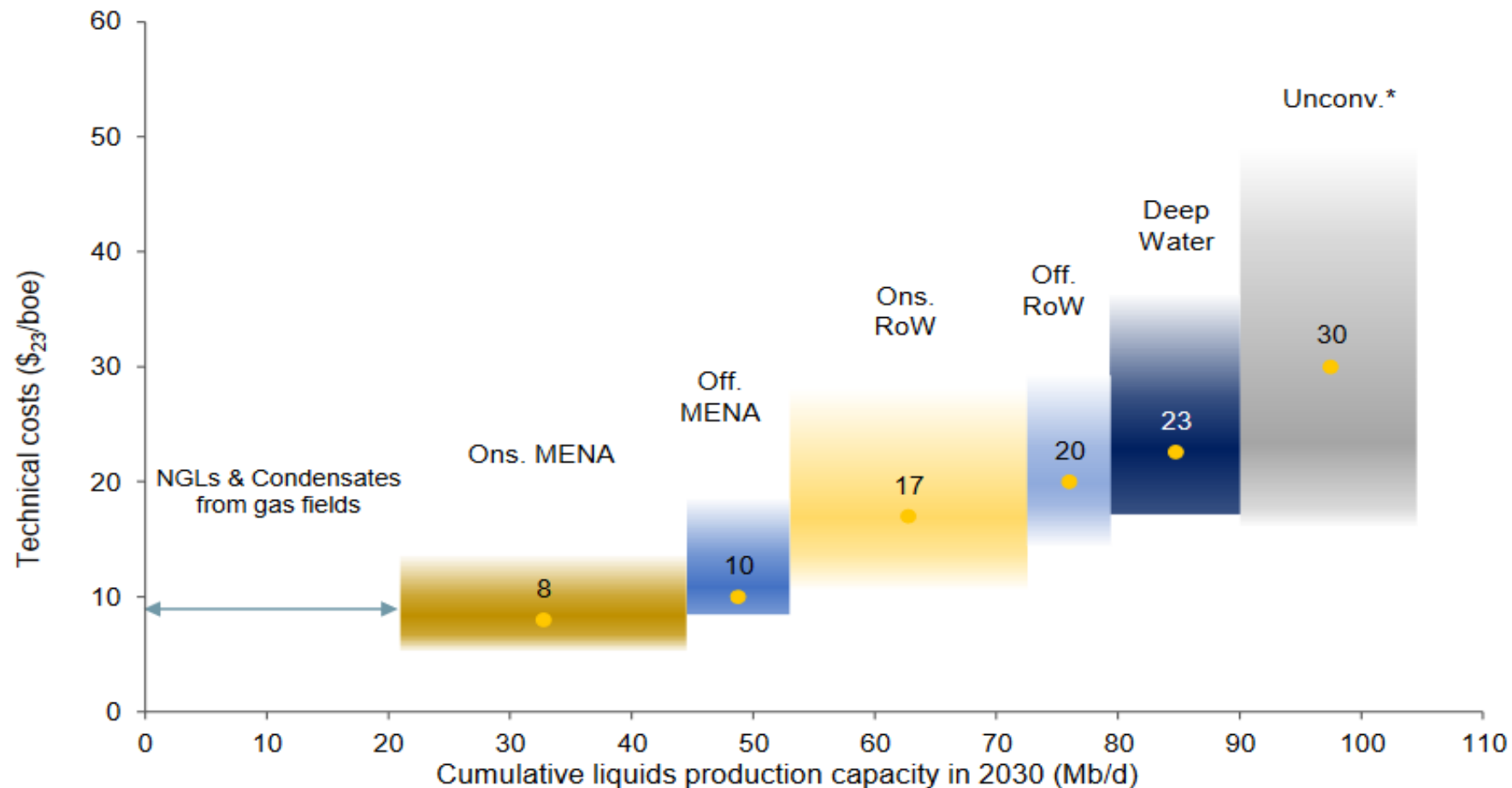
World Oil & Gas Greenfield Investments



Source: Rystad Energy's Service Market Solution, March 2023
A Rystad Energy graphic



Liquids Technical Costs by Technology



Source: TotalEnergies E&P Data Book 2023

NGLs and condensates associated to US Shale Oil are included in Unconventional liquids production capacity

RoW = Word outside Middle East

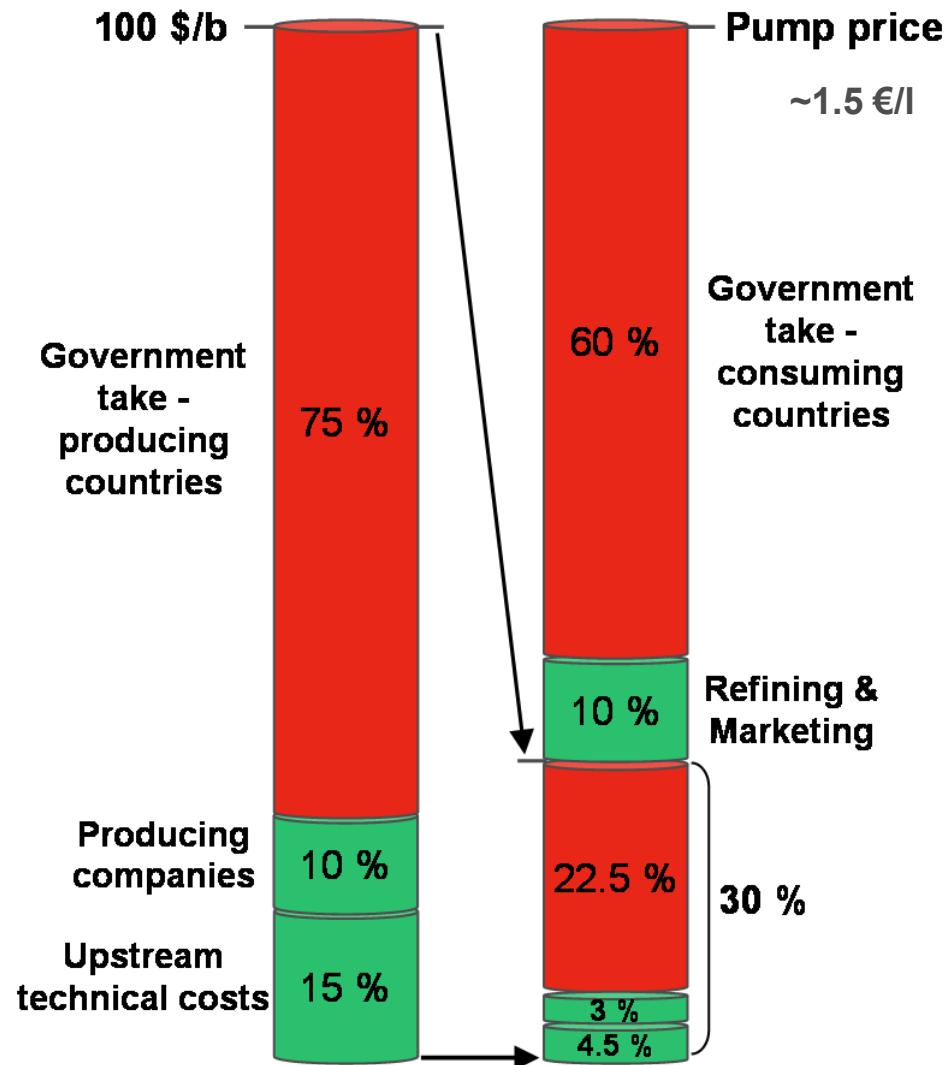
Deep Water: worldwide consideration

*Unconv: shale Oil (72%) + oil sands (28%)



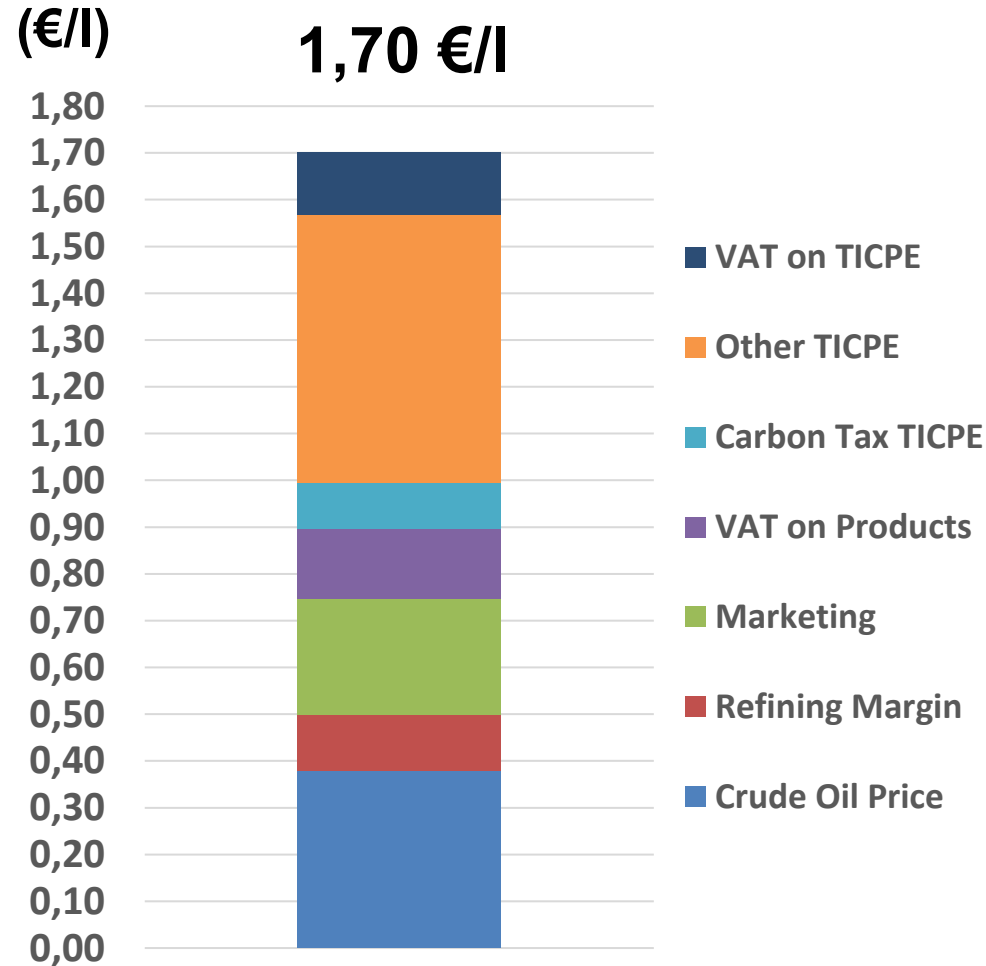
Reminder - The key paradoxes of the Oil Industry Environment 2013-2014 - Similar ratios for 2023

- ◆ At 100 \$/b crude oil, the upstream worldwide average technical costs represent 15% , while 10% are for the producing companies and around 75% for the *producing countries* « government take ».
- ◆ These 100 \$/b « crude oil cost » represent an average 30% of the pumps prices in the E.U. The other 70% consist of 60% for the *consuming countries* « government take », and 10% for downstream costs (refining and marketing).



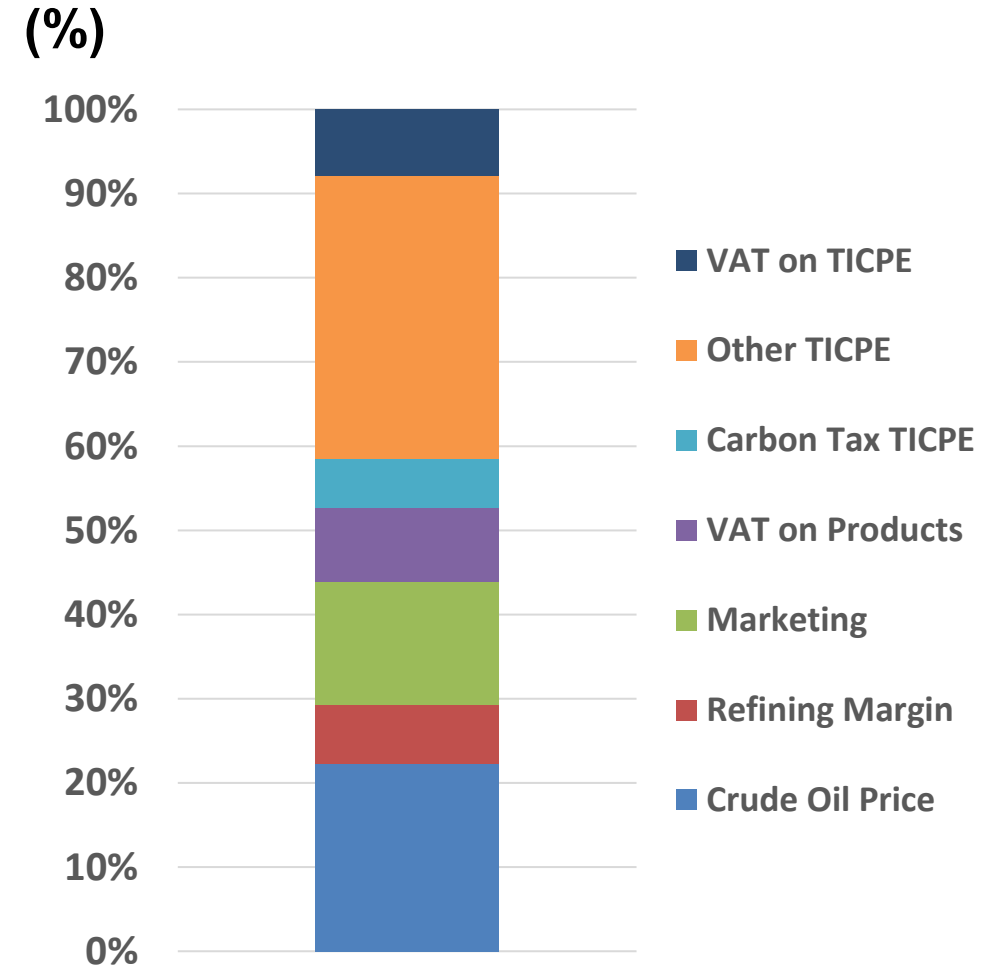
Gasoline Price SP95-E10 in France – June 2025

Downstream Taxes # 56% of the price (Not counting Upstream Taxes)



TICPE: Taxe Intérieure de Consommation
sur les Produits Energétiques

Source: ChG/Data from UFIP & INSEE

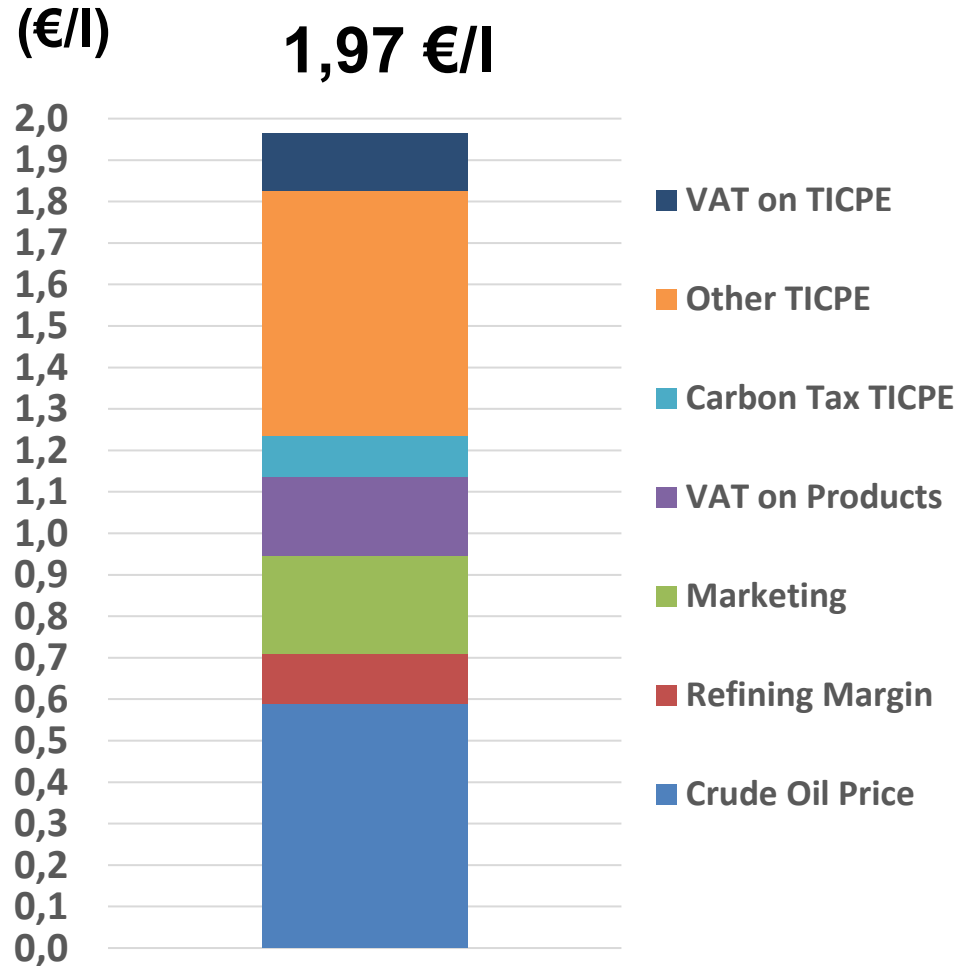


Brent Price = 65 \$/b = 0,38 €/l Exchange rate: 1 € = 1,08 \$
Carbon Tax = 44,6 €/tCO₂



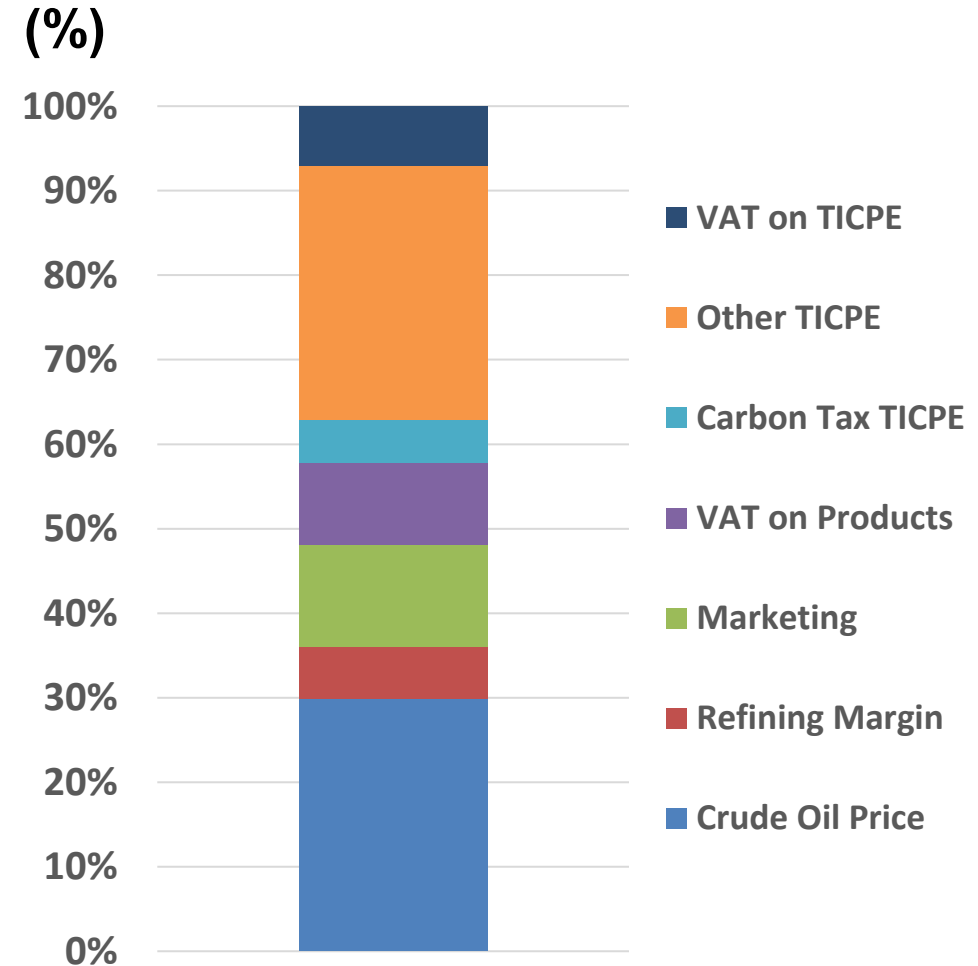
Reminder - Gasoline Price SP95-E10 in France – September 2023

Downstream Taxes # 52% of the price (Not counting Upstream Taxes)



TICPE: Taxe Intérieure de Consommation
sur les Produits Energétiques

Source: ChG/Data from UFIP & INSEE

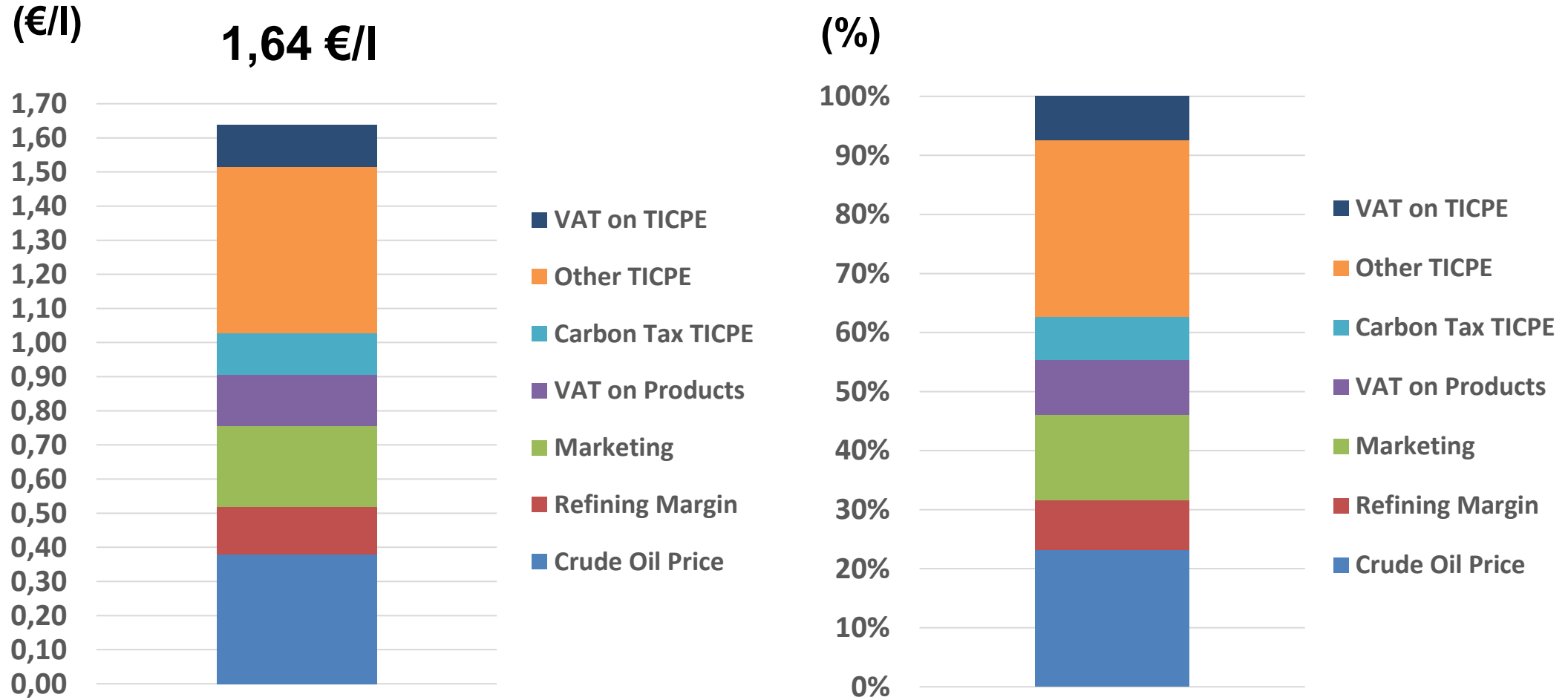


Brent Price = 101 \$/b = 0,59 €/l Exchange rate: 1 € = 1,08 \$
Carbon Tax = 44,6 €/tCO₂



Diesel Price in France – June 2025

Downstream Taxes # 53% (Not counting Upstream Taxes)



TICPE: Taxe Intérieure de Consommation sur les Produits Energétiques

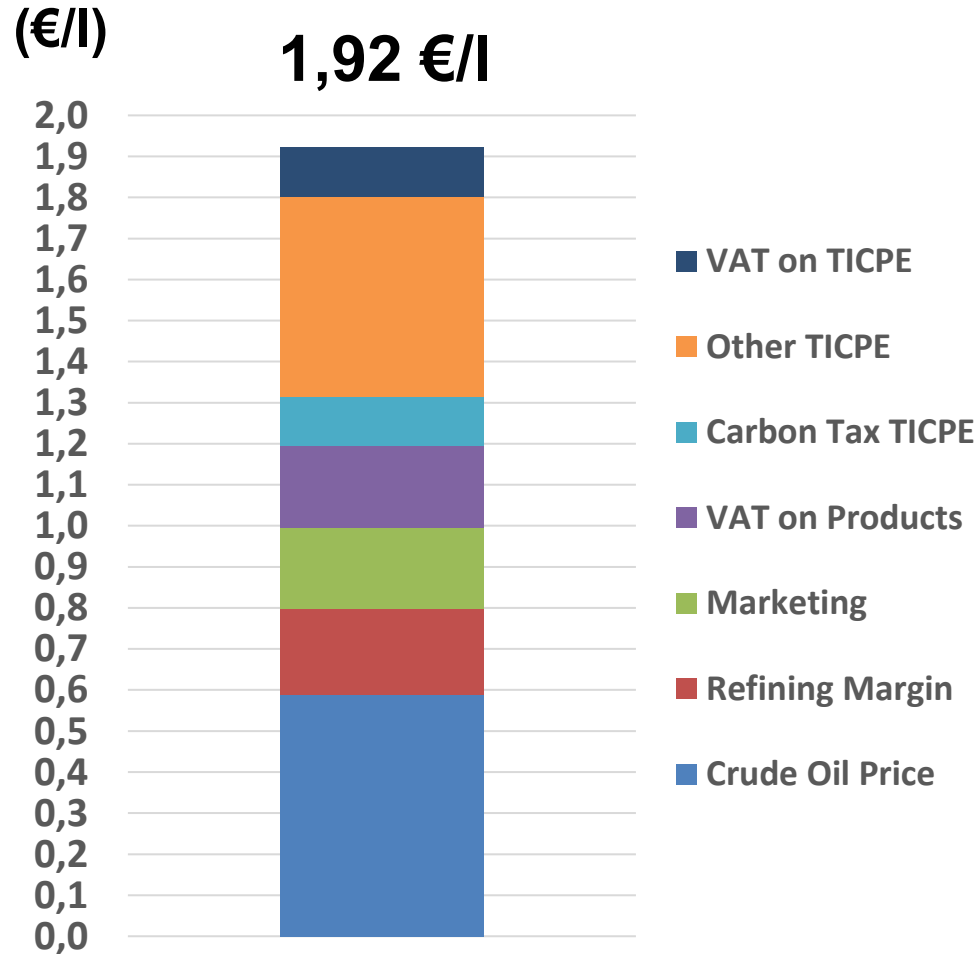
Source: ChG/Data from UFIP & INSEE

Brent Price = 65 \$/b = 0,38 €/l Exchange rate: 1 € = 1,08 \$
Carbon Tax = 44,6 €/tCO₂



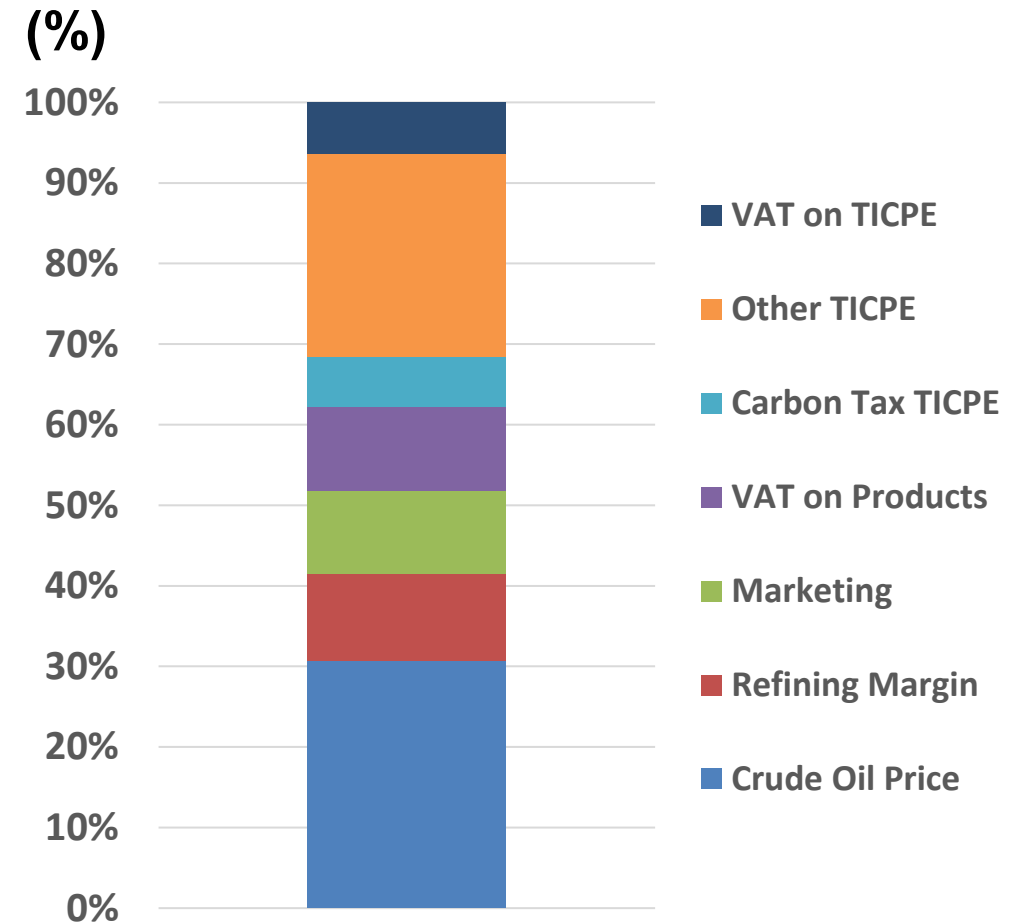
Reminder - Diesel Price in France – September 2023

Downstream Taxes # 48% (Not counting Upstream Taxes)



TICPE: Taxe Intérieure de Consommation sur les Produits Energétiques

Source: ChG/Data from UFIP & INSEE



Brent Price = 101 \$/b = 0,59 €/l Exchange rate: 1 € = 1,08 \$
Carbon Tax = 44,6 €/tCO₂

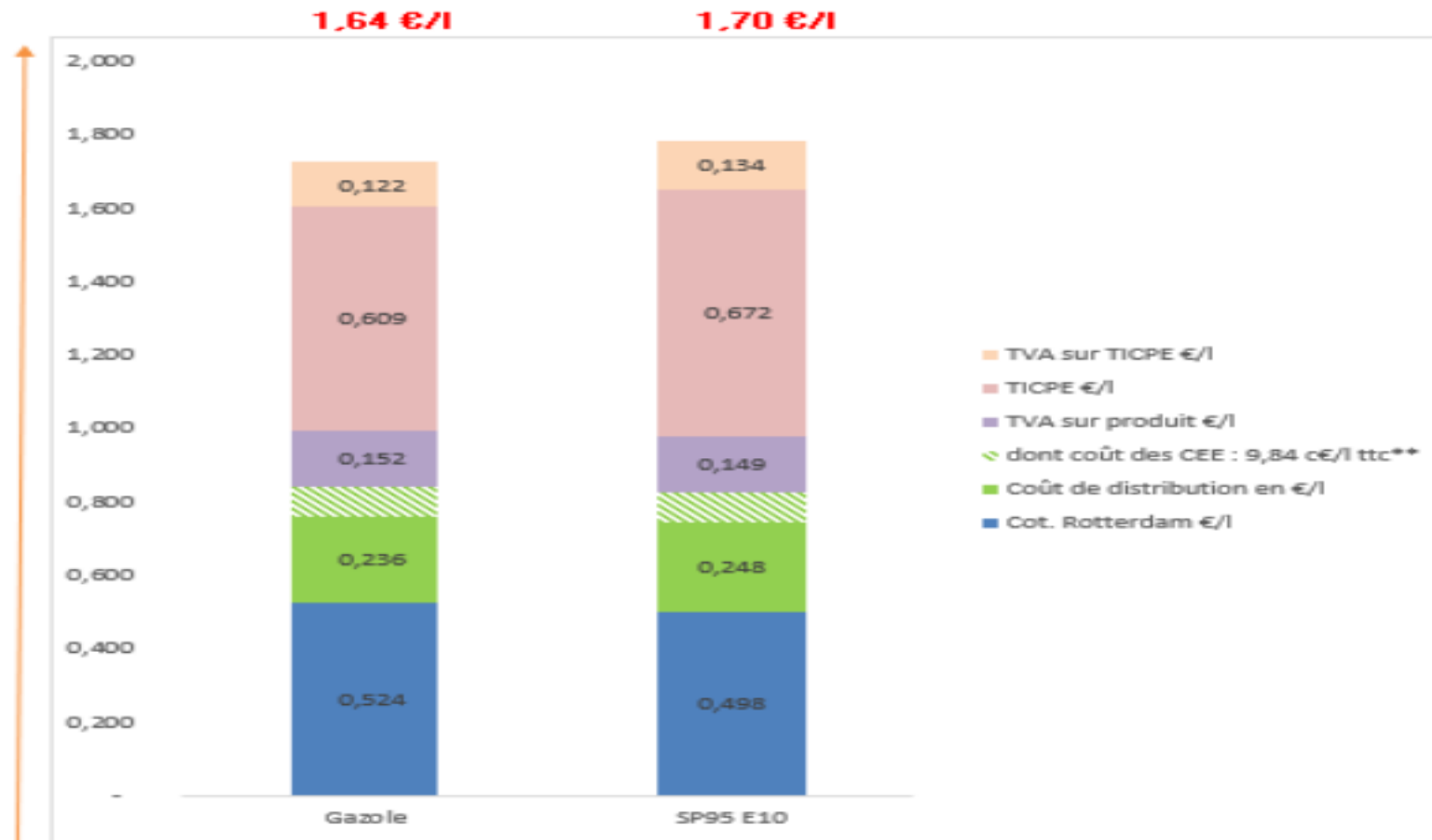


Diesel and Gasoline Prices – France June 2025

Décomposition des prix des carburants

27 JUIN 2025

Décomposition des prix des carburants (*) au 27 juin 2025

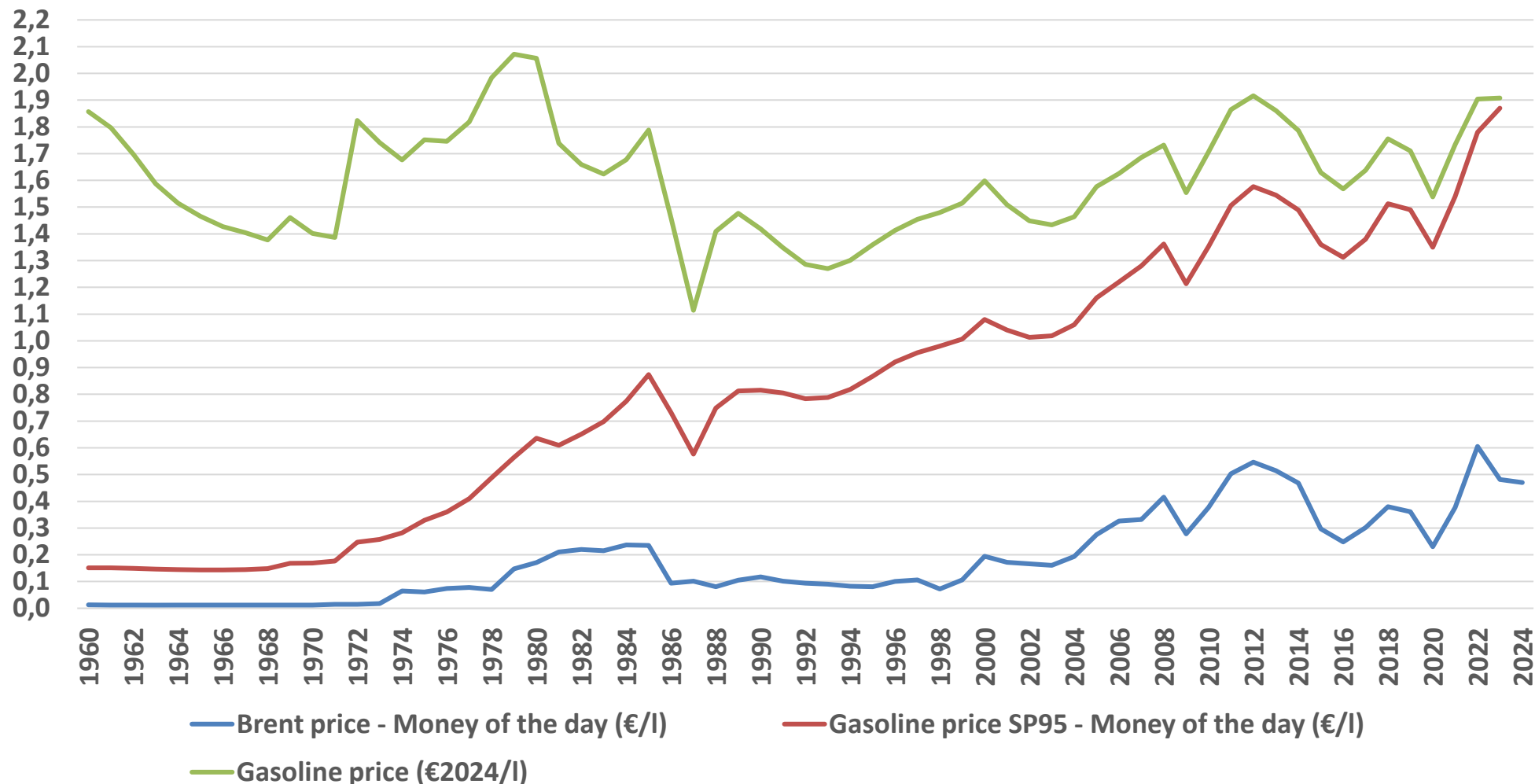


Gasoline Price in France 1960 – 2024 (Yearly average)

Picture is different when comparing current money and constant money

Excluding extreme values, Gasoline price in €2024 remains in a margin 1,3 – 1,9 €/l

(€/l)



10

Oil prices: yesterday & today



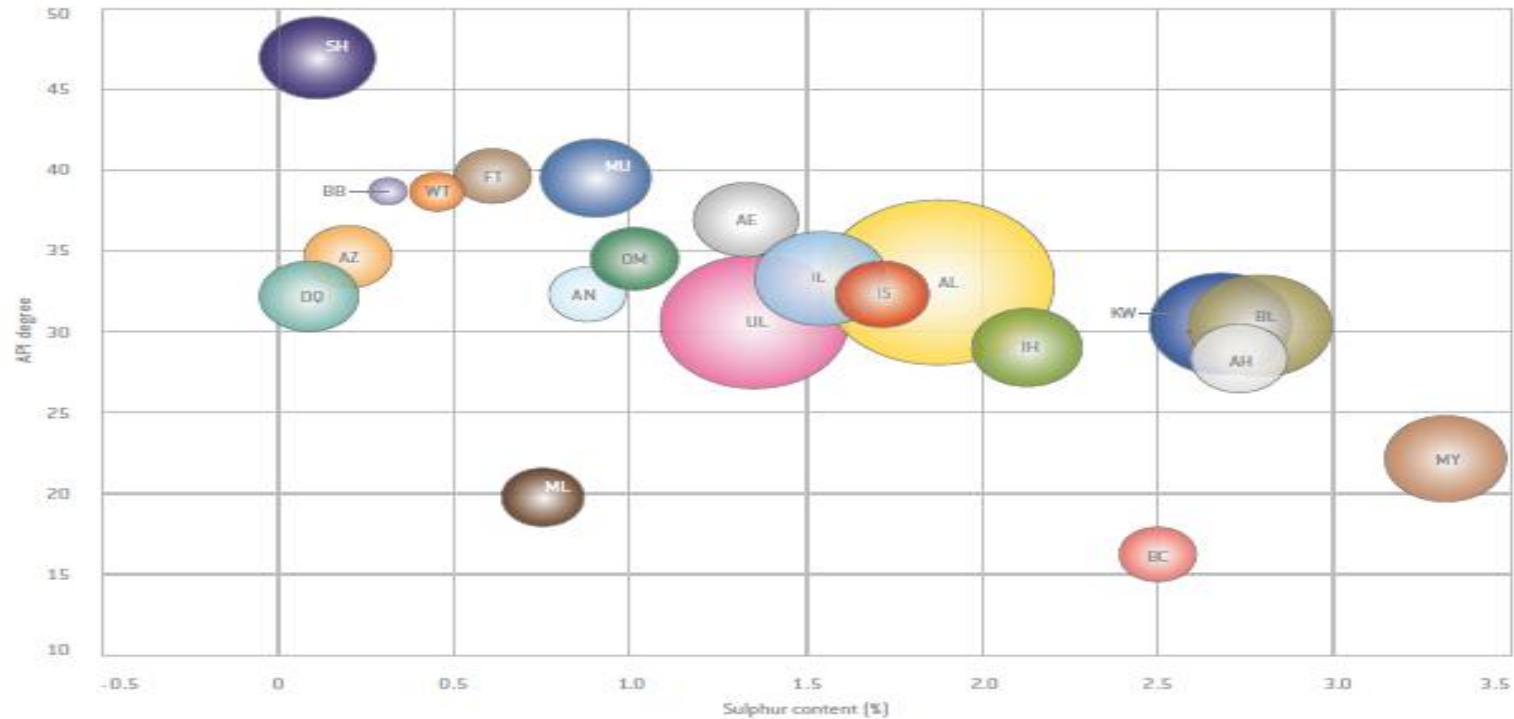
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11. The drivers for a long term oil price
12. Oil prices: various scenarios for the future
13. Oil industry stakeholders: governments, NOCs and IOCs



Quality and Volume of Crude Oil

Quality and production volume of main crudes
[thousand barrels/day]



● - 500 thousand barrels/day

- | | | | |
|--------------------------------------|--------------------------|-----------------------|-------------------------------|
| AE - Arab Extra Light (Saudi Arabia) | BC - BCF 17 (Venezuela) | IS - Isthmus (Mexico) | SH - Saharan Blend (Algeria) |
| AH - Arab Heavy (Saudi Arabia) | BL - Basrah Light (Iraq) | KW - Kuwait (Kuwait) | UL - Urals (Russia) |
| AL - Arab Light (Saudi Arabia) | DO - Daqing (China) | ML - Marlim (Brasil) | WT - West Texas Int. (U.S.A.) |
| AN - Alaskan Nth. Sl. (U.S.A.) | FT - Forties (U.K.) | MU - Murban (U.A.E.) | |
| AZ - Azeri Light (Azerbaijan) | IH - Iran Heavy (Iran) | MY - Maya (Mexico) | |
| BB - Brent Blend (U.K.) | IL - Iran Light (Iran) | OM - Oman (Oman) | |

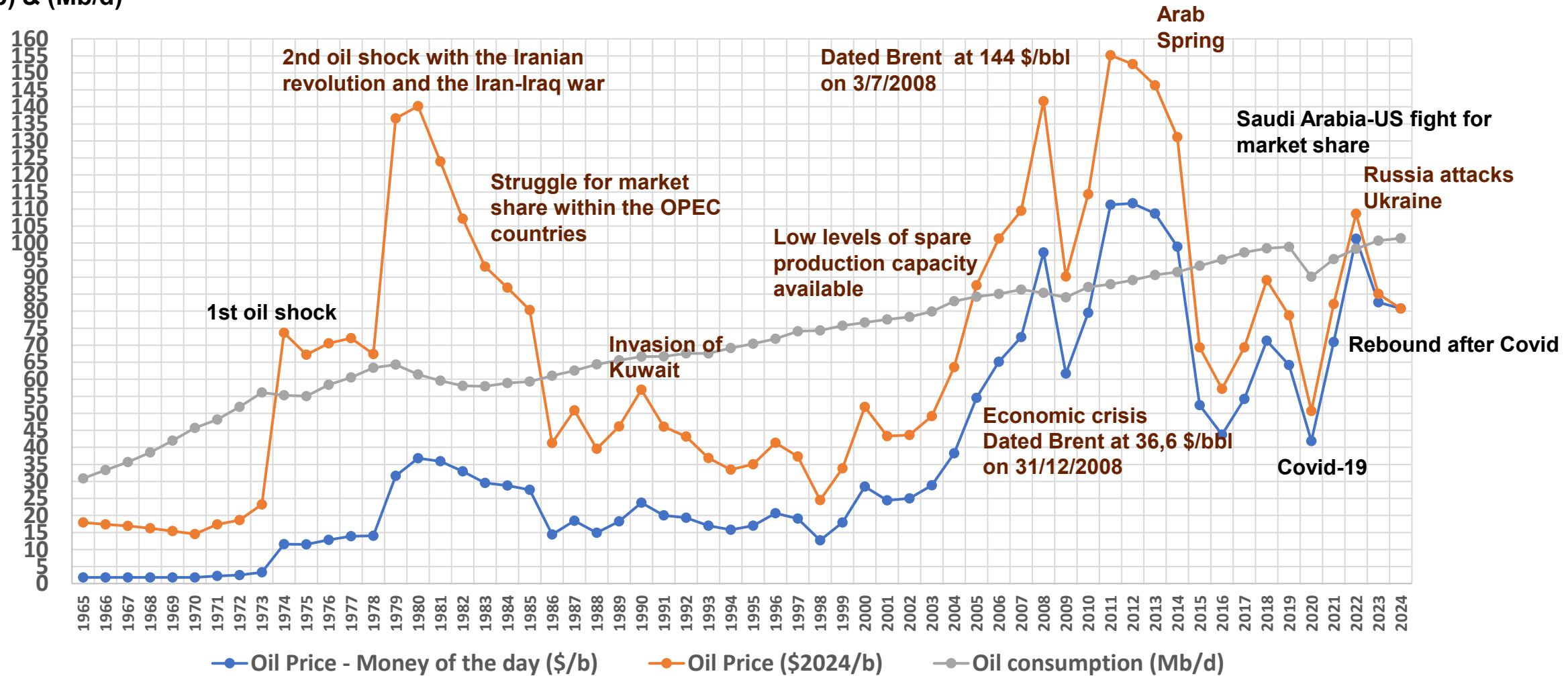
Source: ENI 2011



Crude Oil Price and Oil Consumption 1965 - 2024

(Yearly average - Prices are fluctuating within a year)

(\$/b) & (Mb/d)



Source: ChG/Data from EI Statistical Review 2025,/S&P Global Commodity Insights

Consumption Includes derivatives of Coal & Gas,...Excludes Biofuels

Oil Price: 1965-1983: Arabian Light posted at Ras Tanura

1984-2024: Brent dated

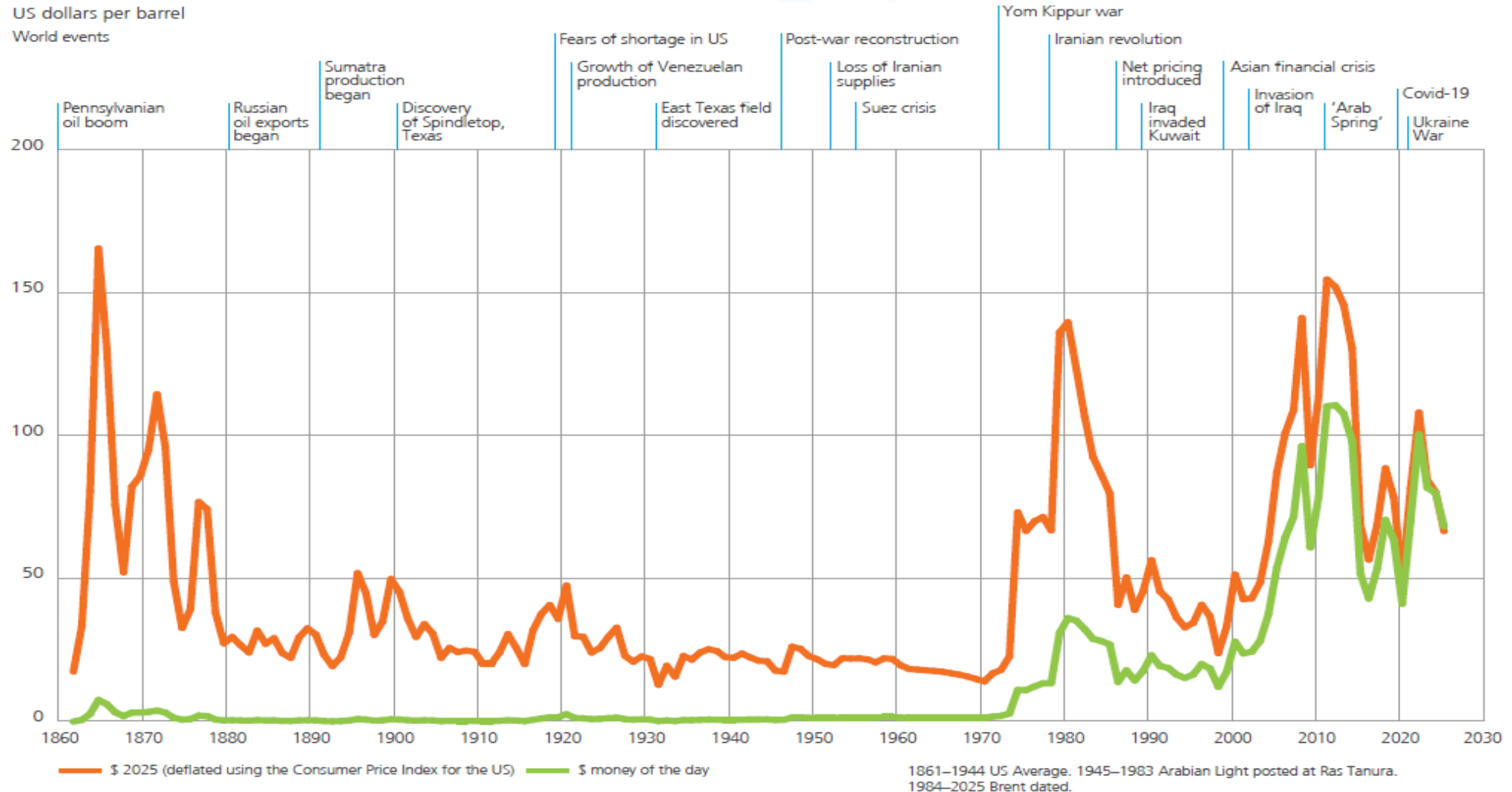
\$2024: Deflated using the US Consumer Price Index



Chart of Crude Oil Prices 1860 – 2025 by EI

Crude oil prices 1861–2025

US dollars per barrel
World events



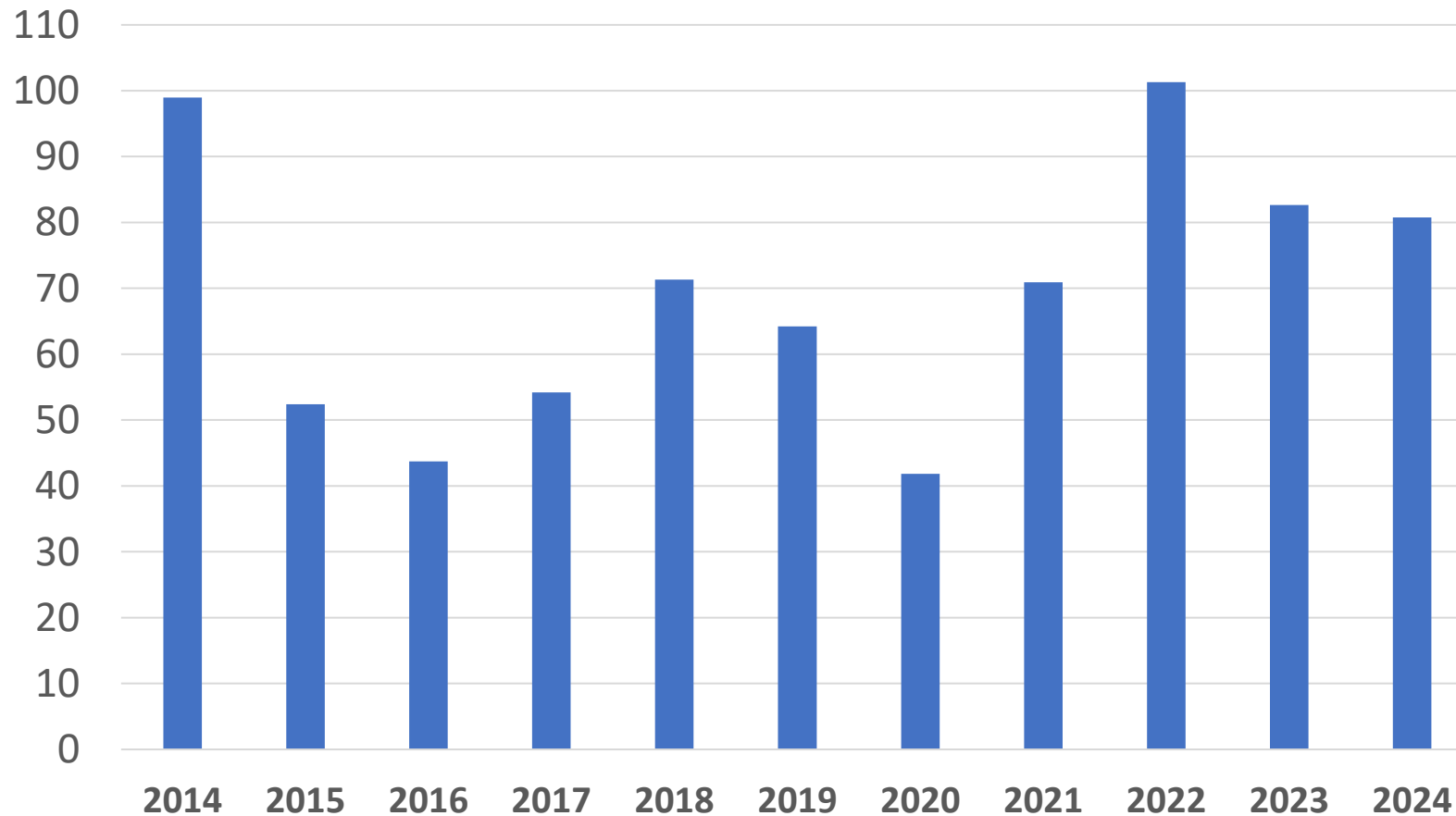
Source: EI Statistical Review 2026



Brent Price – Yearly average Zoom on period 2014 – 2024

2015/2016 Oil Price crash – Covid-19 in 2020 – Rebound in 2021/2022

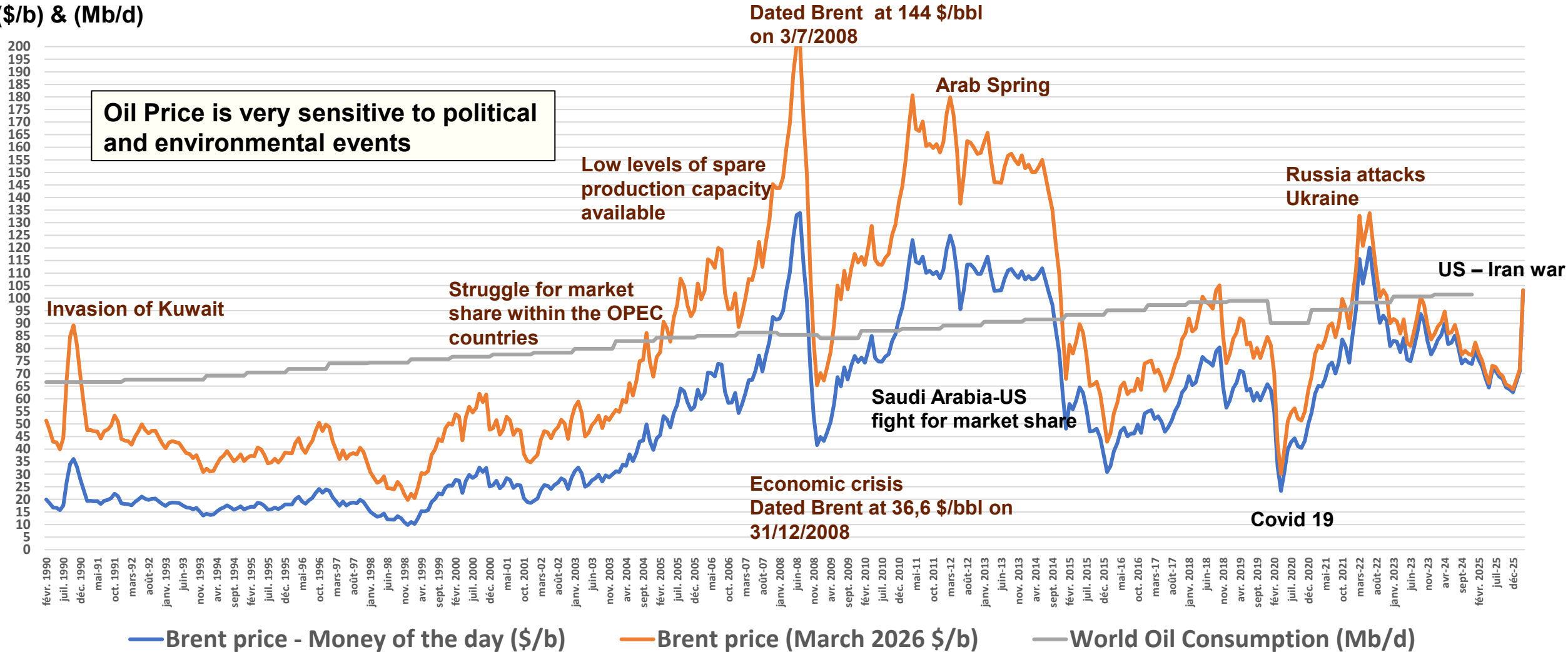
(\$/b)



Crude Oil Price and Oil Consumption since 1990 till March 2026

(Monthly Average - Prices are fluctuating within a month)

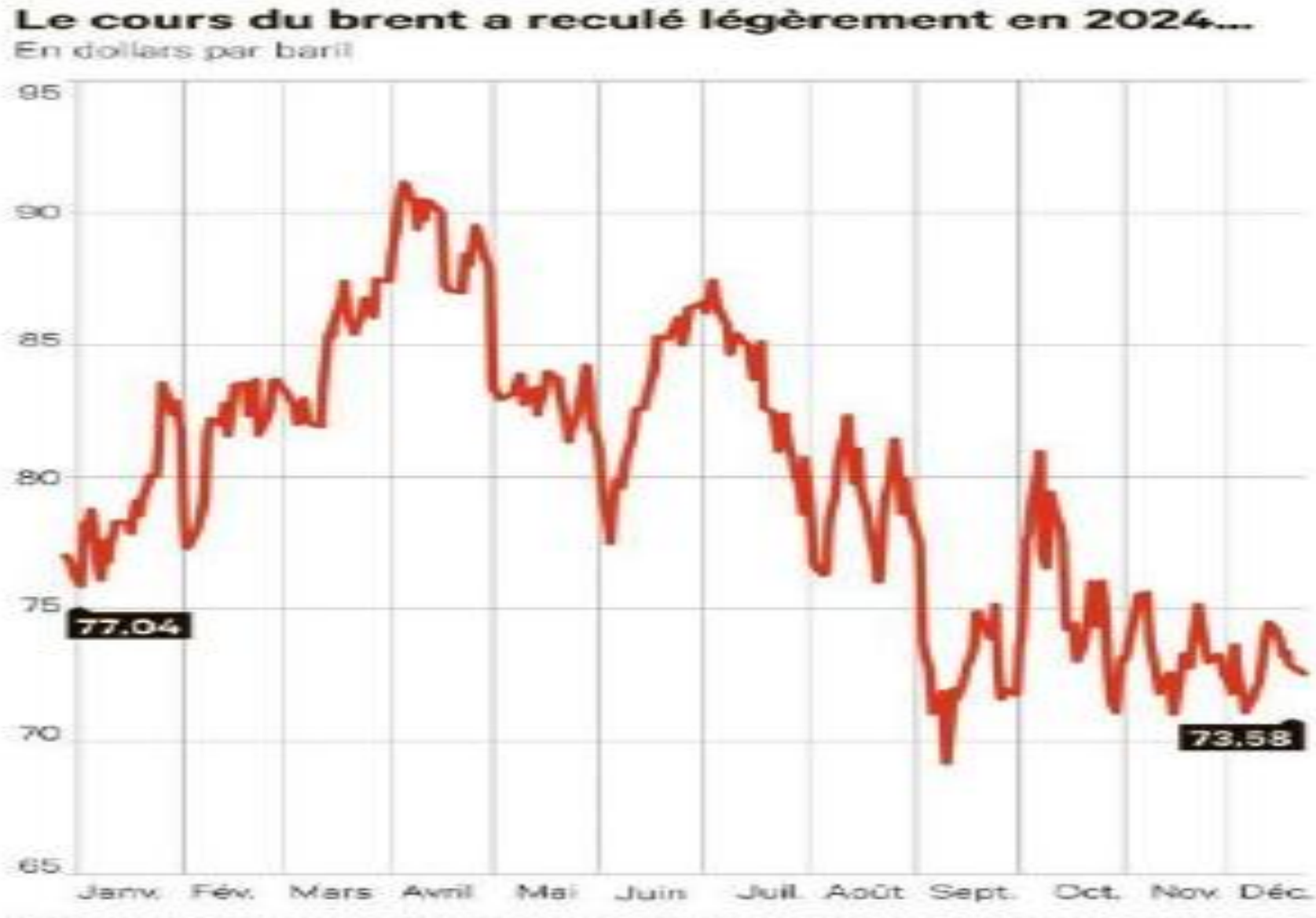
(\$/b) & (Mb/d)



Source: ChG/Price: Data from EIA Index Mundi – US CPI: Bur. of Labor Statistics
Oil Consumption: El Stat. Review 2025



Brent Oil Price in 2024



Brent Oil Price in 2025



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The drivers for a long term Oil Price



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1. Oil Industry: general considerations
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10. Oil prices: yesterday & today
11. The drivers for a long term Oil Price
12. Oil prices: various scenarios for the future
13. Oil industry stakeholders: governments, NOCs and IOCs



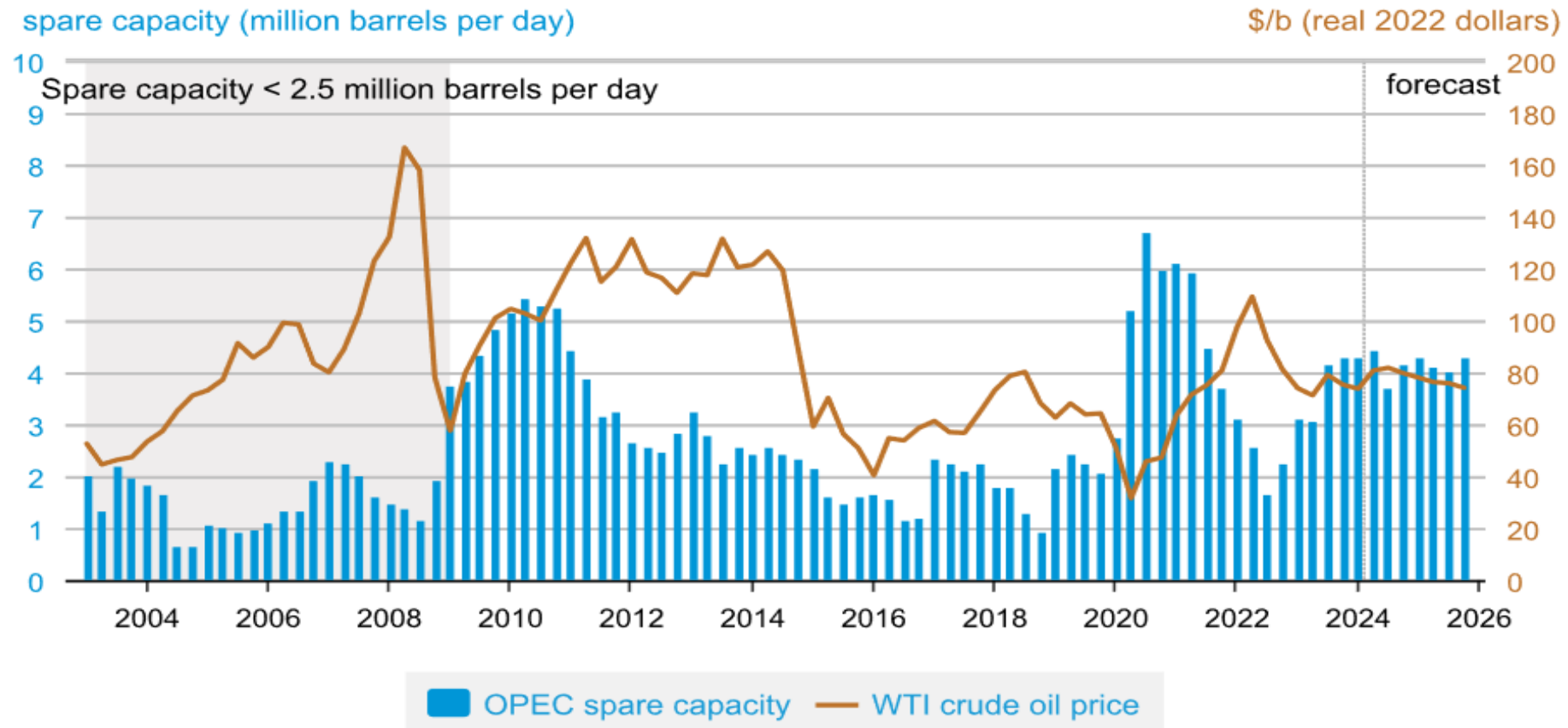
The Drivers for a **long-term** Oil Price

- Long term Demand Growth for Oil (including Impact of Energy Transition and limitation of Fossil Fuels Production to cope with Climate Change challenges)
- New Investments in Oil & Gas
- OPEC Spare Capacity
- Technical Costs for New Developments
- Break-even Oil Price for Oil Producers National Budgets
(Revenues = Price x Production)
- Stocks/Inventories (Surface: Short term, Oil fields reservoirs: Long term)



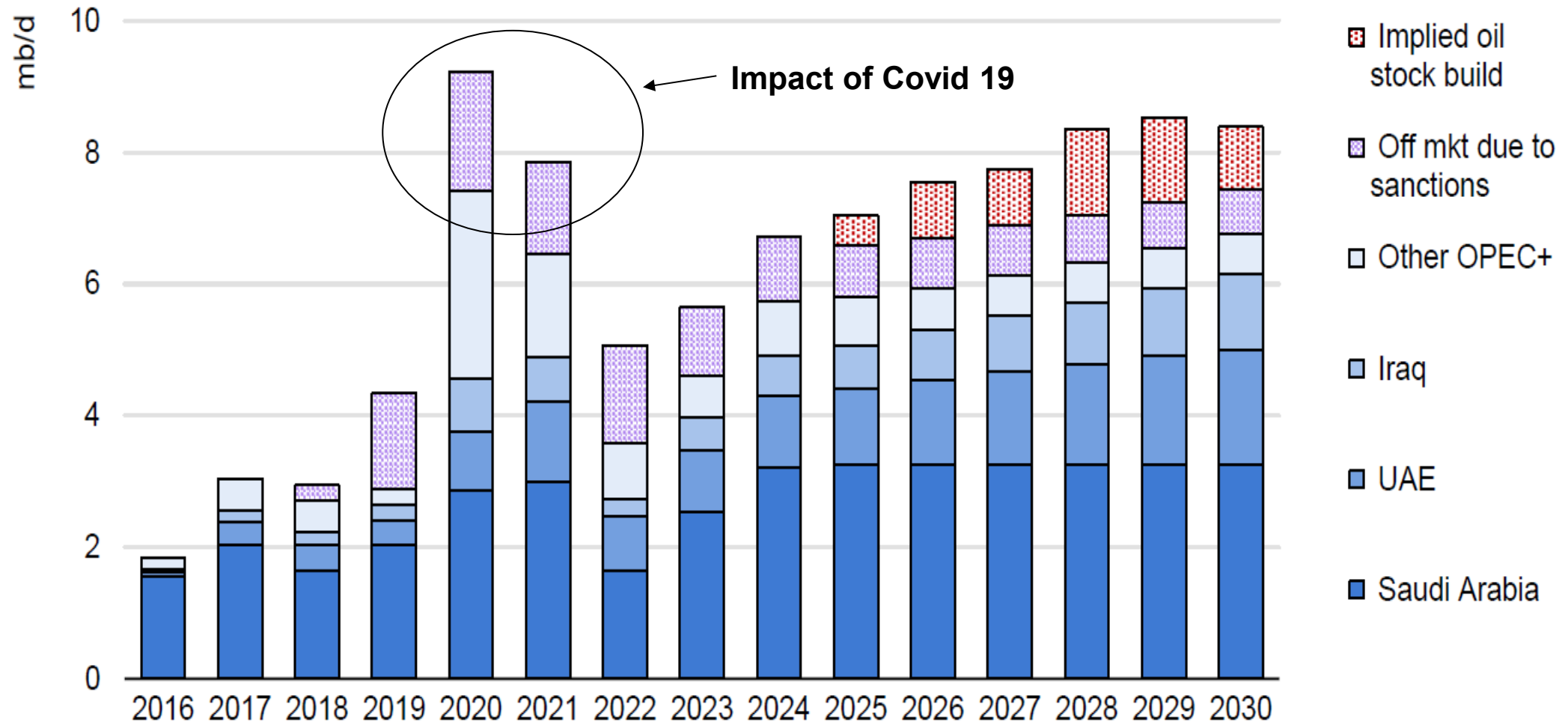
OPEC Spare Capacity and WTI Price

During 2003-2008, OPEC's spare production levels were low, limiting its ability to respond to demand and price increases



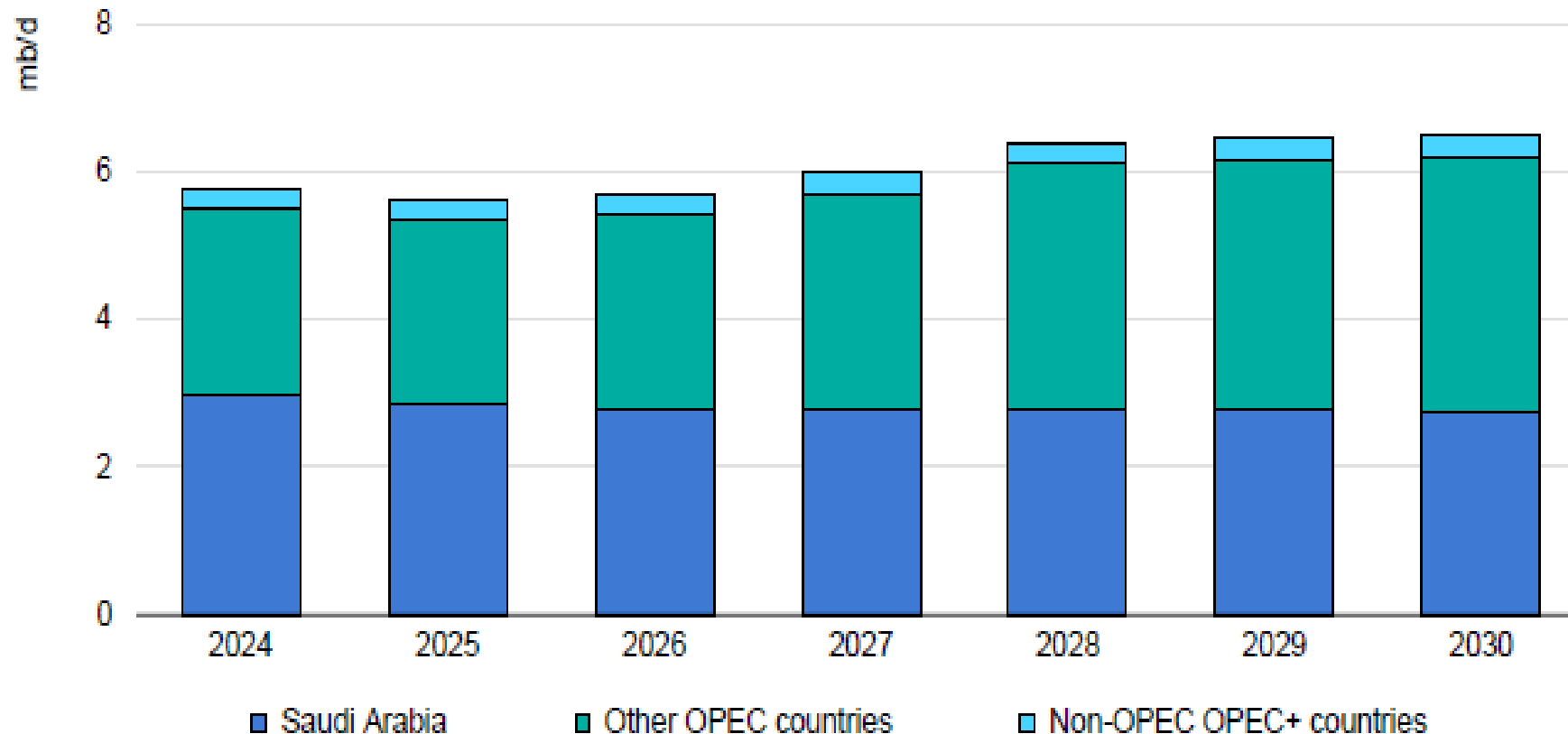
OPEC+ Spare Capacity is going to grow as from 2022

OPEC+ spare crude production capacity and implied total oil stock build, 2016-2030



OPEC+ Spare Capacity is going to grow as from 2022

OPEC+ spare crude capacity, 2024-2030

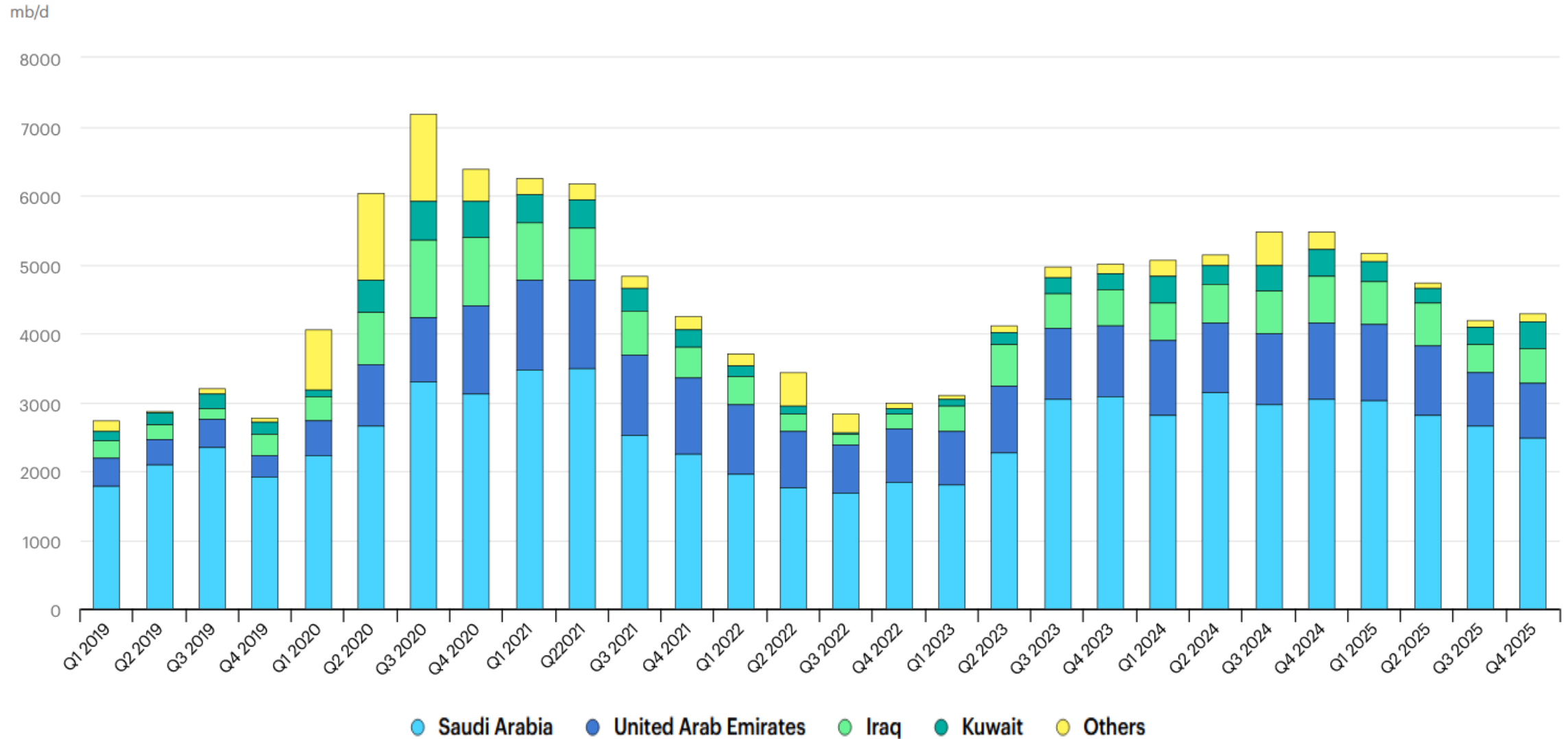


IEA. CC BY 4.0.

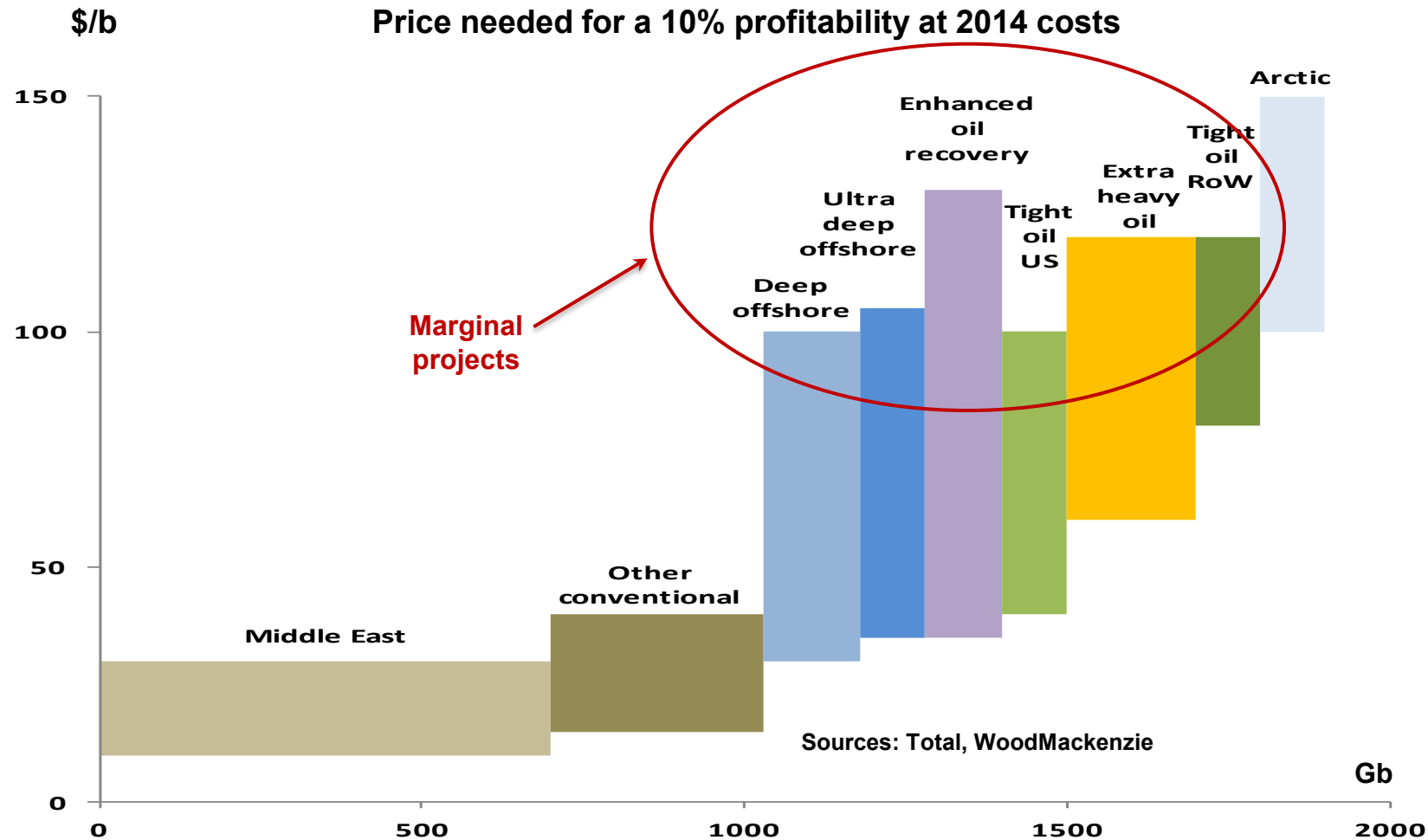
Notes: Based on OPEC+ crude supply targets effective July 2025, excluding Iran, Russia and Venezuela



OPEC Spare Capacity 2019 - 2025



Reminder - In the long term, Prices remain linked to Marginal Costs of Production



Ajustments in costs will define the new level of price



Fiscal Breakeven



Fiscal Breakeven Price

The most commonly used country-level breakeven price is the fiscal breakeven, the minimum price that a country needs to receive per barrel of crude oil sold for its government to meet its immediate spending needs and balance its budget. The fiscal breakeven metric assumes that countries will adjust both their spending and - depending on their ability to influence the global price of crude oil - their production decisions to avoid deficits and smooth public spending.

Fiscal Breakeven Prices are evaluated by several institutions and can vary from one to another.

Computed annually by the International Monetary Fund (IMF) for most OPEC+ producers, the fiscal breakeven has varied considerably for most OPEC+ members (and non-OPEC+ members Qatar and Mexico), and since 2010 has ranged from as low as 45 \$/b for Qatar, average 2000/2019 to as high 230 \$/b for Iran in 2020.



External Breakeven Price

An alternative to the fiscal breakeven is the external breakeven, which is the price a country needs to afford its imports. Just as the fiscal breakeven assumes that a government will adjust public spending in order to balance its budget, the external breakeven assumes that the wider economy will adjust its spending outflows (namely imports) to match its spending inflows (namely oil export revenues).

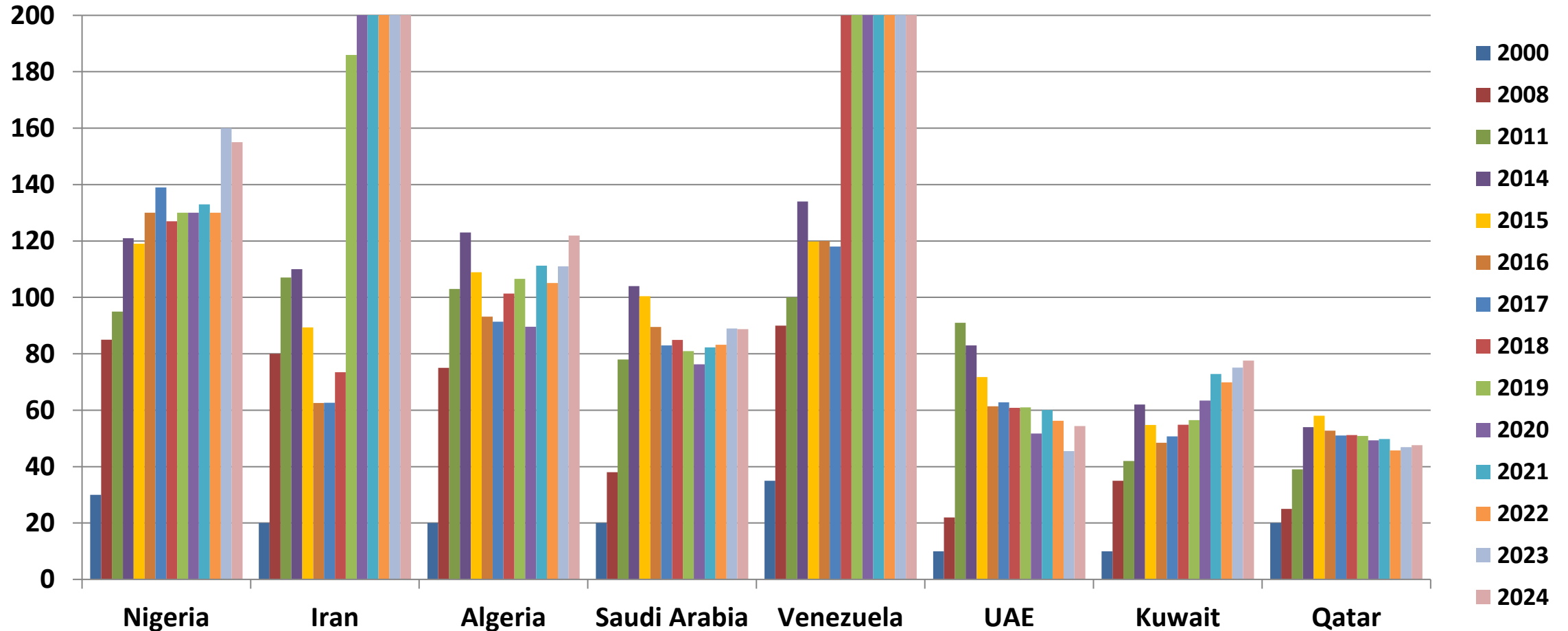
Consequently, if oil prices are higher than a country's external breakeven, that country can increase public spending or allow its currency to appreciate, while prices lower than the external breakeven suggest that the country must either reduce public spending or allow its currency to depreciate.



Different prices required by the OPEC countries to balance their budgets – Evolution 2000 – 2024 (est.)

Fiscal Breakeven price to balance budget (\$/b)

(Saudi Arabia, UAE, Kuwait & Qatar have accumulated substantial financial reserves. They can protect there public expenses for a given period of time)



Source: Ch Guérutte - Countries are ranked by population. Data from various sources, IMF, US EIA, CFR, Standard & Poors, Fitch's, IIF...Average figures, important fluctuations year per year depending upon governments financial policies, budget figures evaluated retrospectively for past years.

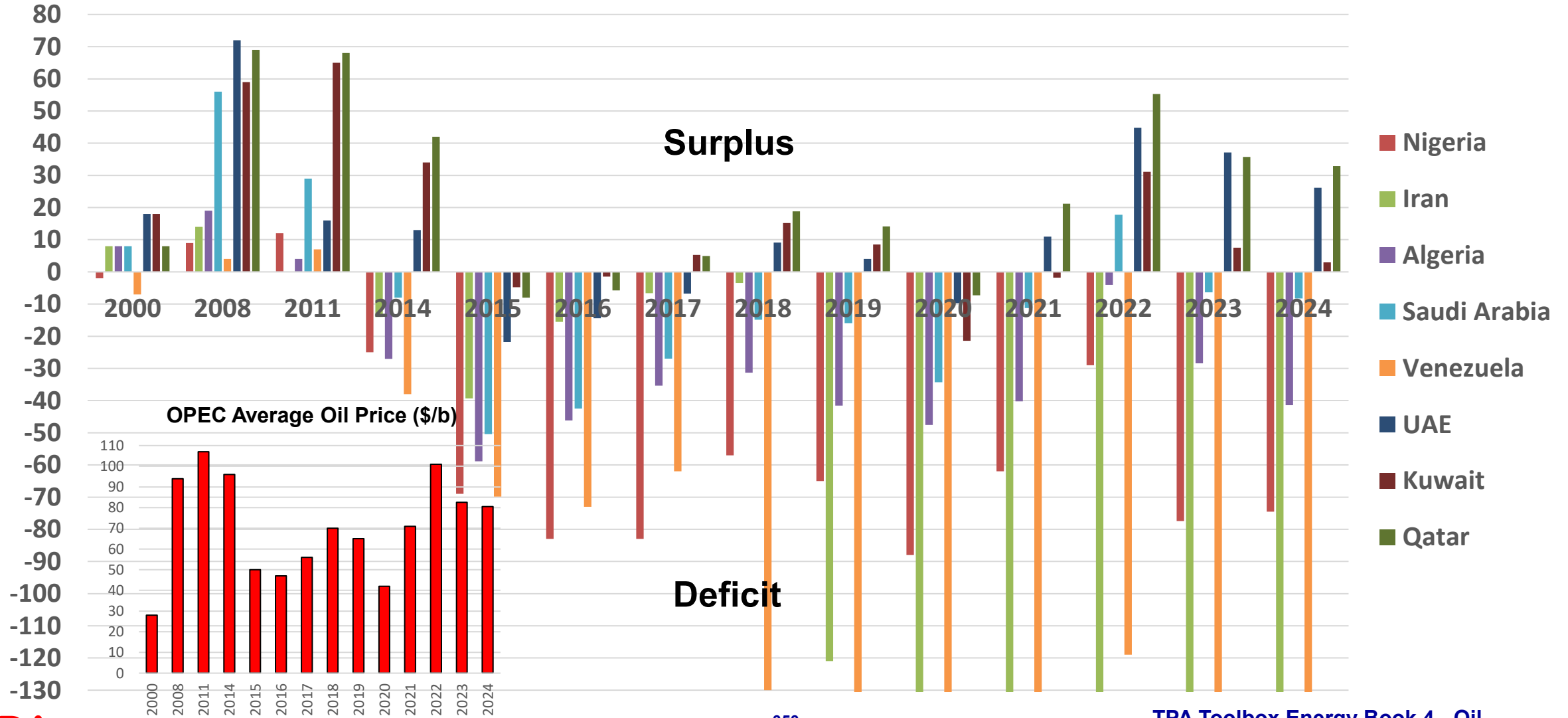
Iraq 2023: 80 \$/b Russia 2023: 116 \$/b
Lybia 2023: 66 \$/b Russia 2025: 80 \$/b



Financial and Economic challenges for OPEC countries

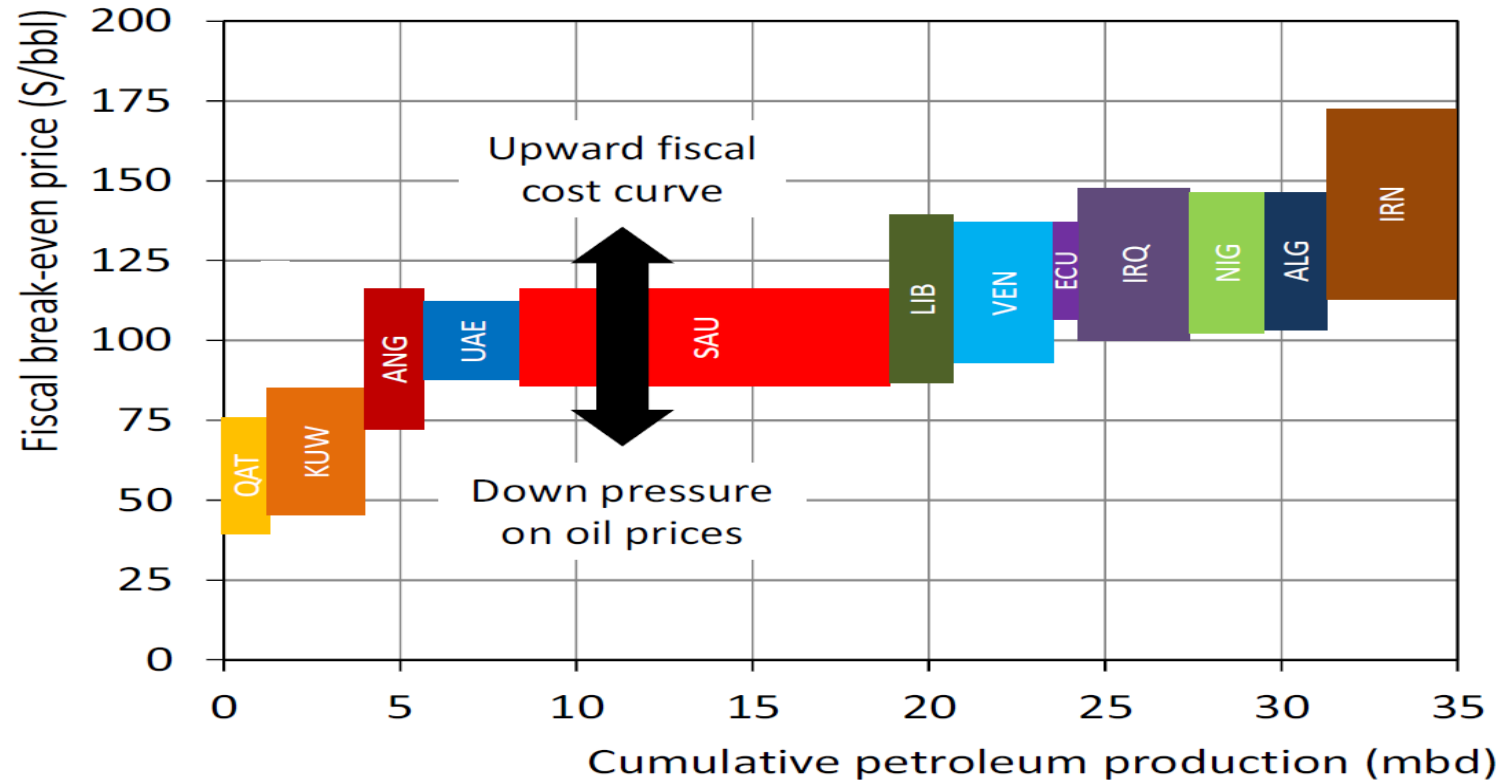
Fiscal Breakeven vs actual Oil Price – Evolution 2000 - 2024

Oil Price – Fiscal Breakeven (\$/b)



Different prices required by the OPEC countries to balance their budgets

Fiscal Break-even Price Figures may vary according to sources

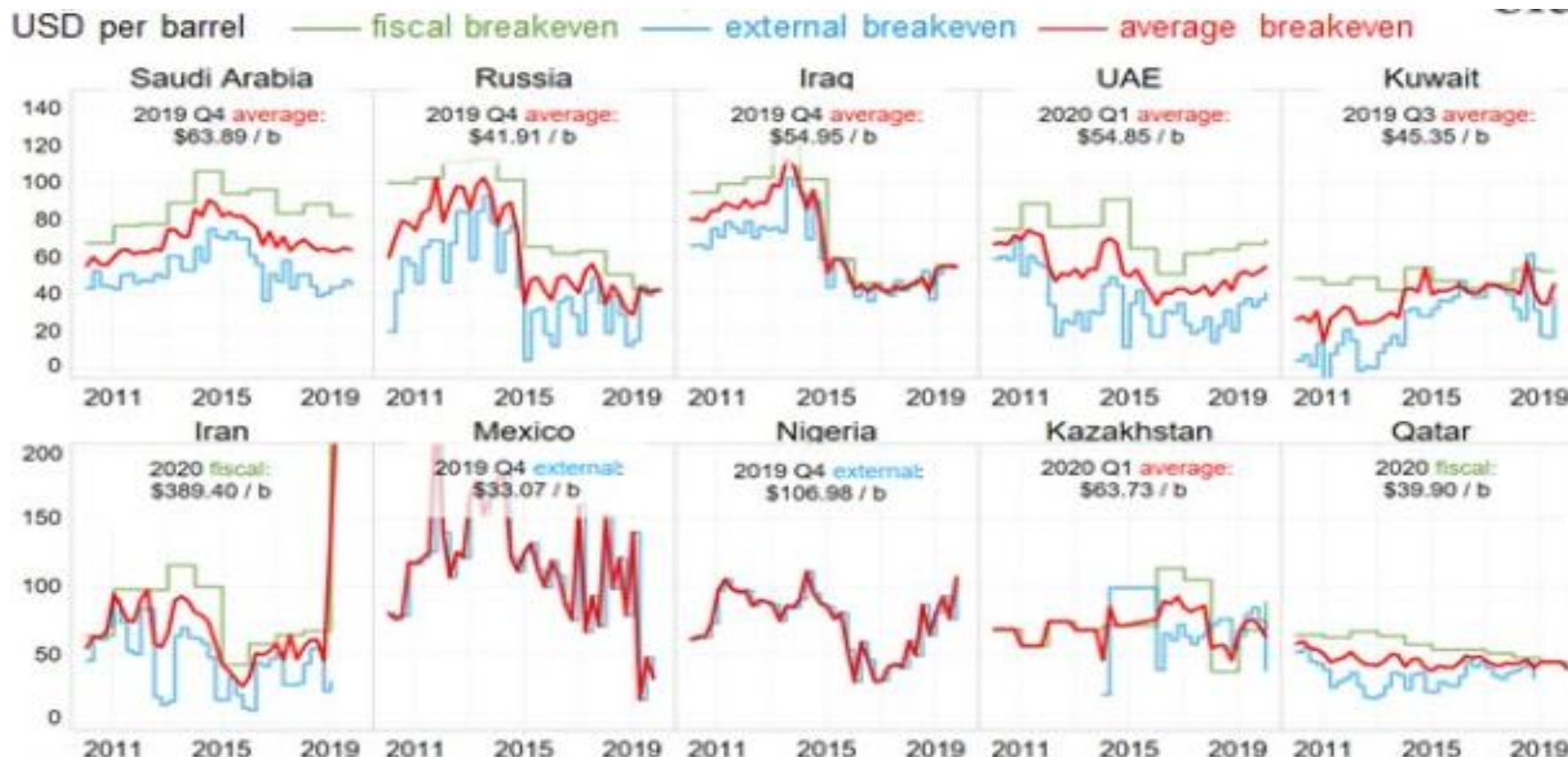


Strong budget constraints for many OPEC countries

Source: IEA, Apicorp



Different prices required by the Oil Producers to balance their budgets



Sources: U.S. Energy Information Administration. Data from the International Monetary Fund (IMF), Bloomberg, Economic Expert Group, Reuters, and the Russian Ministry of Industry and Trade.

Note: All fiscal breakevens except for Russia from the IMF. External breakevens for Russia and Qatar are calculated as inclusive of both oil and natural gas revenues. UAE = United Arab Emirates.

Strong budget constraints for many OPEC countries



The Fiscal Breakeven Oil Price

One formula



Definitions

- ◆ ***OGREV_n*** = ***Governmental Oil & Gas Revenues Year n***
- ◆ ***NONOGREV_n*** = ***Governmental Non Oil & Gas Revenues Year n***
- ◆ ***REV_n*** = ***Governmental Revenues Year n***
- ◆ ***NOCREV_n*** = ***National Company (NOC) Oil & Gas Revenues Year n***
- ◆ ***QOIL_n*** = ***Oil Production Year n***
- ◆ ***QGAS_n*** = ***Gas Production Year n***
- ◆ ***QOG_n*** = ***Hydrocarbons Production Year n***
- ◆ ***PO_n*** = ***Price of Oil Year n***
- ◆ ***PG_n*** = ***Price of Gas Year***
- ◆ ***POG_n*** = ***Weighted Price of Hydrocarbon Year n***



Definitions

- ◆ **$COST_n$** = ***NOC Costs Year n (OPEX Year n + Deprec. Year n)***
- ◆ **C_n** = ***NOC Unit Cost per barrel of oil equivalent Year n***
- ◆ **TAX_n** = ***Taxes on NOC Income Year n***
- ◆ **DEP_n** = ***NOC Depreciation, Depletion & Amortization Year n***
- ◆ **$NOCINC_n$** = ***NOC Net Income Year n***
- ◆ **DIV_n** = ***NOC Dividends Year n***
- ◆ **EXP_n** = ***Governmental Expenditures Year n***
- ◆ **$FBAL_n$** = ***Governmental Fiscal Balance Year n***
- ◆ **BEP_n** = ***Breakeven Price***



National Company Net Income

Let's consider an Oil & Gas Exporting country whose Oil & Gas activities are managed by a National Oil Company (NOC)

The Fiscal Balance for the State/Government is:

$$FBAL_n = REV_n - EXP_n$$

$$FBAL_n = OGREV_n + NONOGREV_n - EXP_n$$

Oil & Gas activities are managed by the NOC whose financial accounts are developed as follows:

$$NOCREV_n = P_{On} * Q_{On} + P_{Gn} * Q_{Gn}$$

$$NOCINC_n = NOCREV_n - COST_n - TAX_n$$



State/Government Fiscal Balance

Let's consider that the totality of the NOC Income is distributed as Dividends to the State/Government:

$$DIV_n = NOCINC_n$$

$$OGREV_n = TAX_n + DIV_n = NOCREV_n - COST_n$$

$$OGREV_n = P_{On} * Q_{On} + P_{Gn} * Q_{Gn} - COST_n$$

$$OGREV_n = P_{OGn} * Q_{OGn} - COST_n$$

$$OGREV_n = (P_{OGn} - C_n) * Q_{OGn}$$

Therefore,

$$FBAL_n = REV_n - EXP_n = OGREV_n + NONOGREV_n - EXP_n$$

$$FBAL_n = (P_{OGn} - C_n) * Q_{OGn} + NONOGREV_n - EXP_n$$



The Fiscal Break-even Price (Simplified Formula)

The Breakeven Price is the Oil/Hydrocarbon Price which balances State Revenues and Expenditures (FBAL_n = 0):



$$BEP_n = (EXP_n - NONOGREVN) / QOG_n + C_n$$

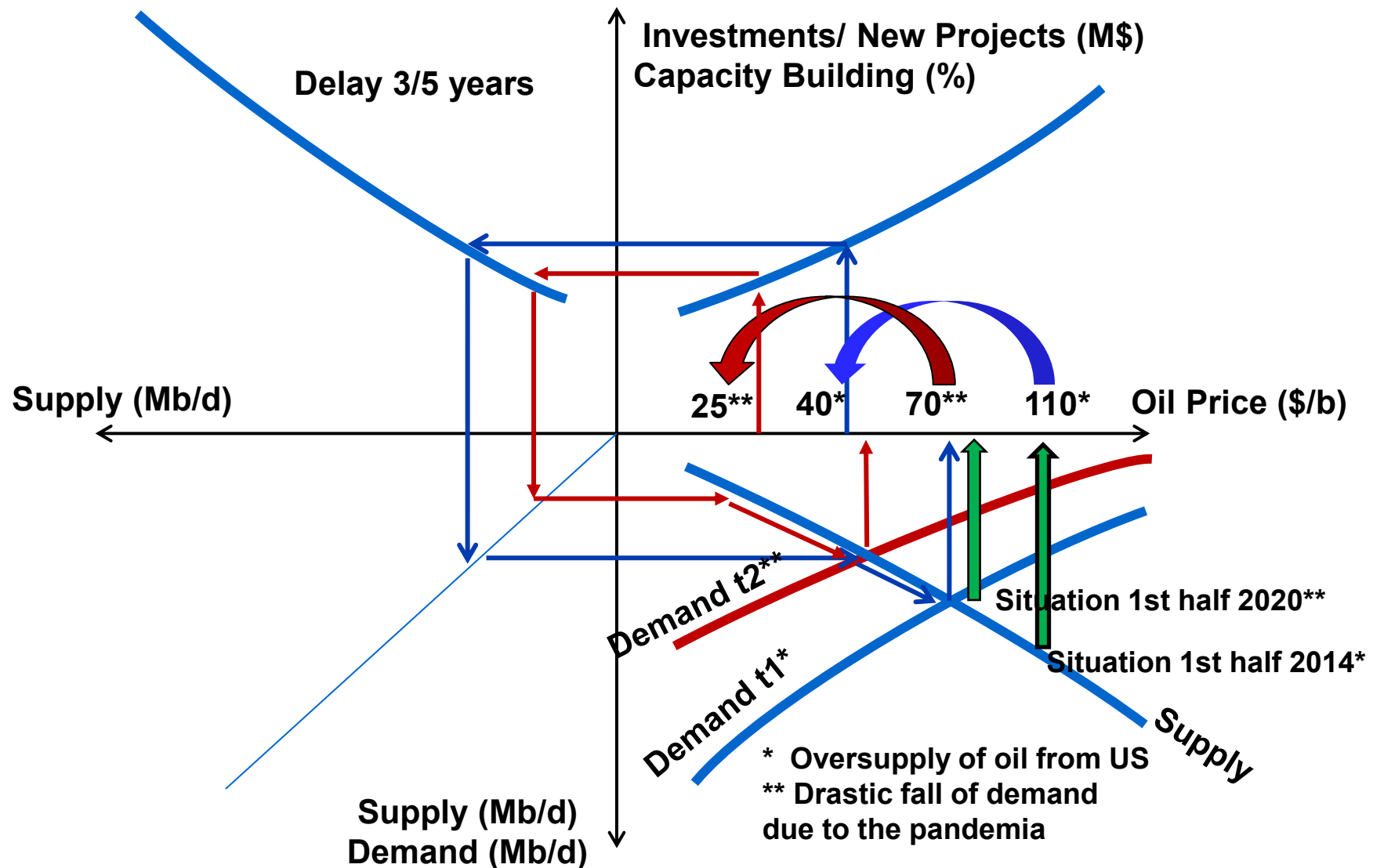


The Fundamentals of the Oil price Formation

- ◆ In a first approach, the World Oil Supply depends upon the profitability of projects and the availability of funds to finance these projects, thus for a great part depends upon the Oil Price. The greater is the Oil price, the larger are the opportunities to develop and produce new Oil fields and therefore increase Oil production.
- ◆ The World Oil Demand depends upon the final needs for the consumers. The global long term trends vary according to several factors: the demography, the standards of living evolution, but also the constraints and the relevant people perception linked to the Climate Change, the Energy Transition, the Protection of the Environment, the Societal Behaviour changes.....So, the World Oil Demand evolves timewise and can have different aspects for different periods of time.

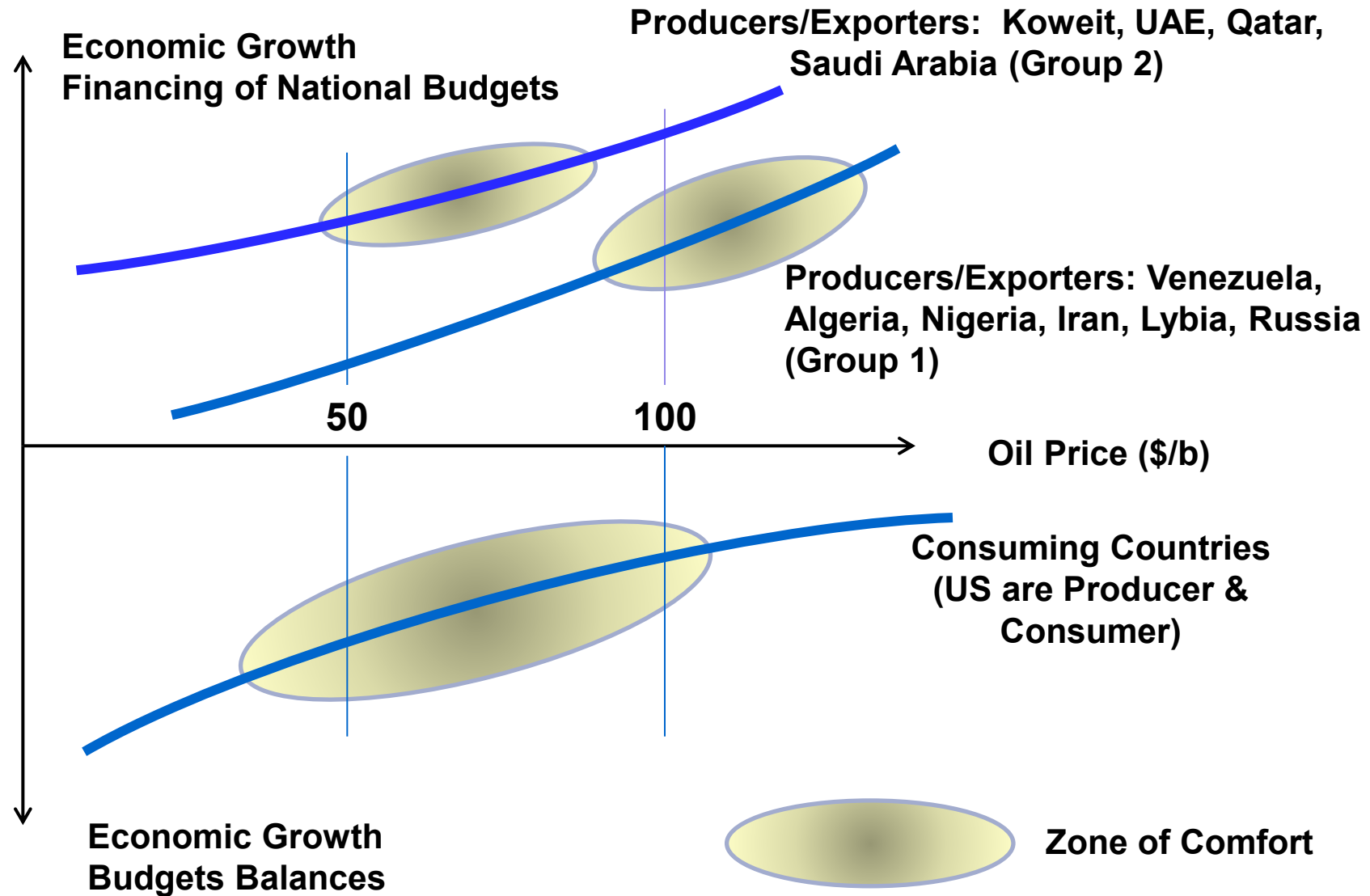


A tentative to illustrate the Oil Price Formation Post Oil crash 2014/2015 & Post Covid-19 2020



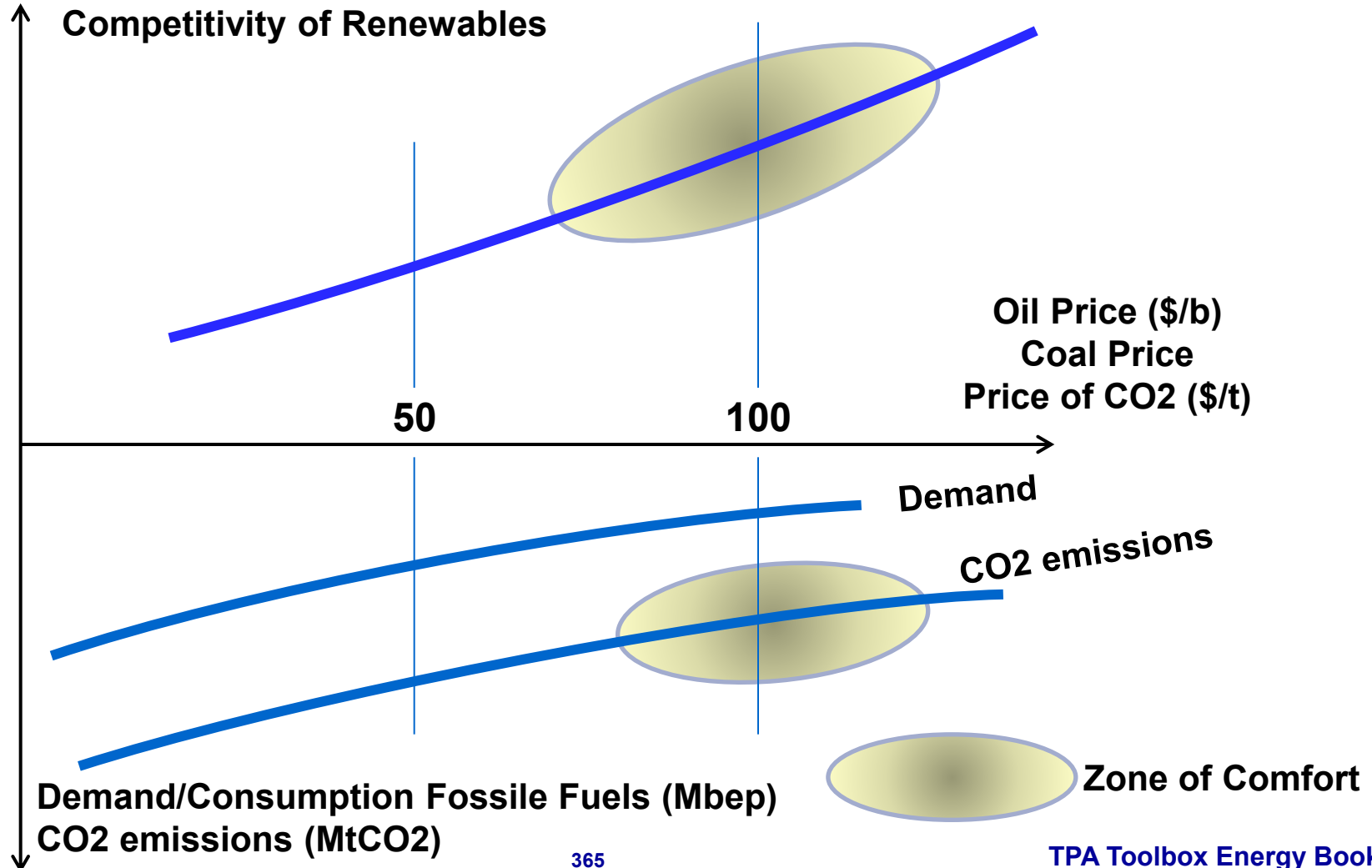
The Fundamentals of the Oil Price Formation

Positions of Oil Producers & Oil Consumers



The Fundamentals of the Oil Price Formation

Competitiveness of Renewables



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Oil prices: various scenarios for the future



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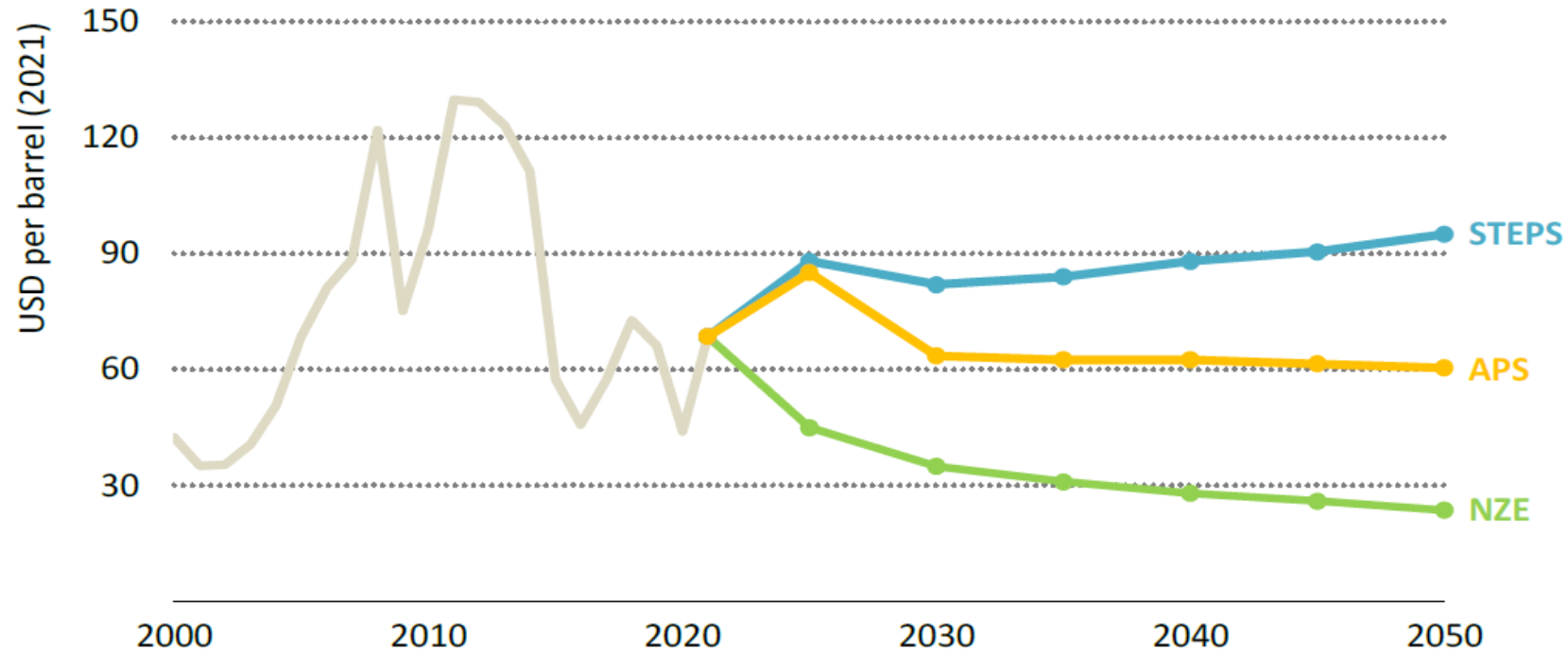


Oil Price Prediction is a perilous exercise!
See also Book 2 Energy



World Oil Prices

Reminder - IEA 2022 Scenarios



IEA. CC BY 4.0.

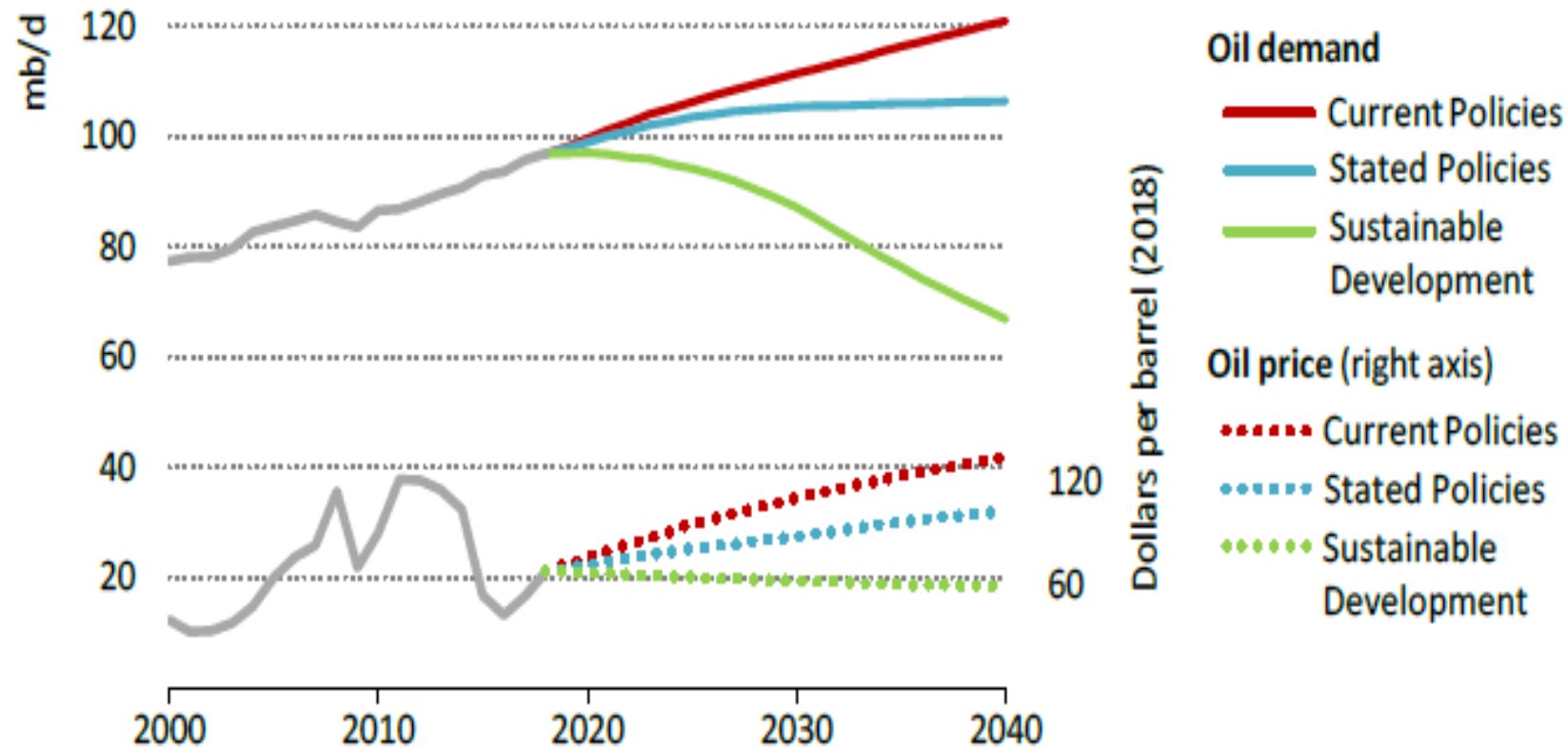
Equilibrium oil prices vary substantially by scenario, reflecting the way that policies, costs and resources affect the supply-demand balance

Note: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; NZE = Net Zero Emissions by 2050 Scenario.



World Oil Demand and Prices

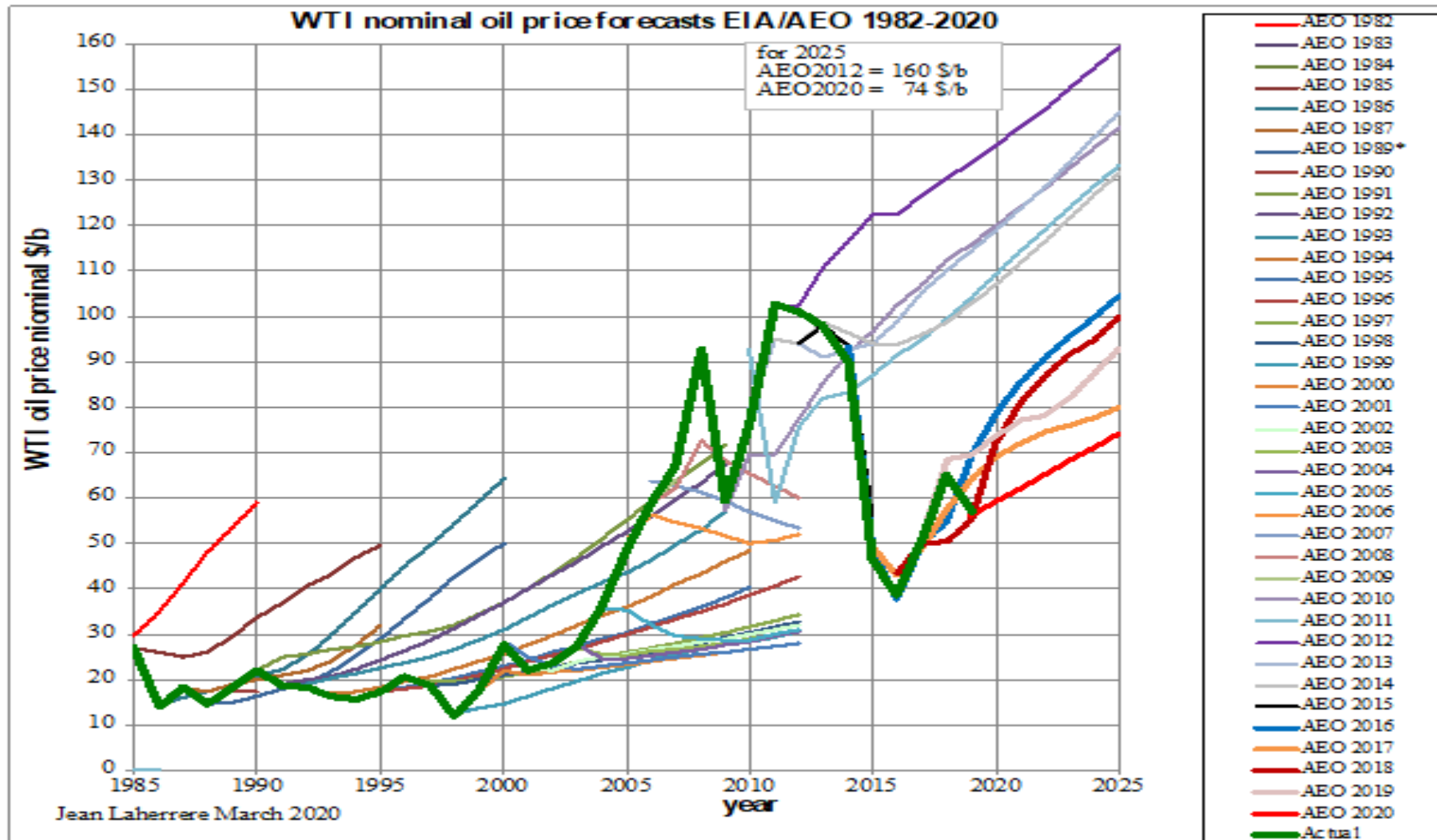
Reminder: IEA 2019 Scenarios



In the Stated Policies Scenario, demand growth slows substantially after 2025, while the Sustainable Development Scenario paints a very different picture for demand and prices

Oil prices prediction is a perilous exercise!

Oil price evolution forecasts by EIA/AEO



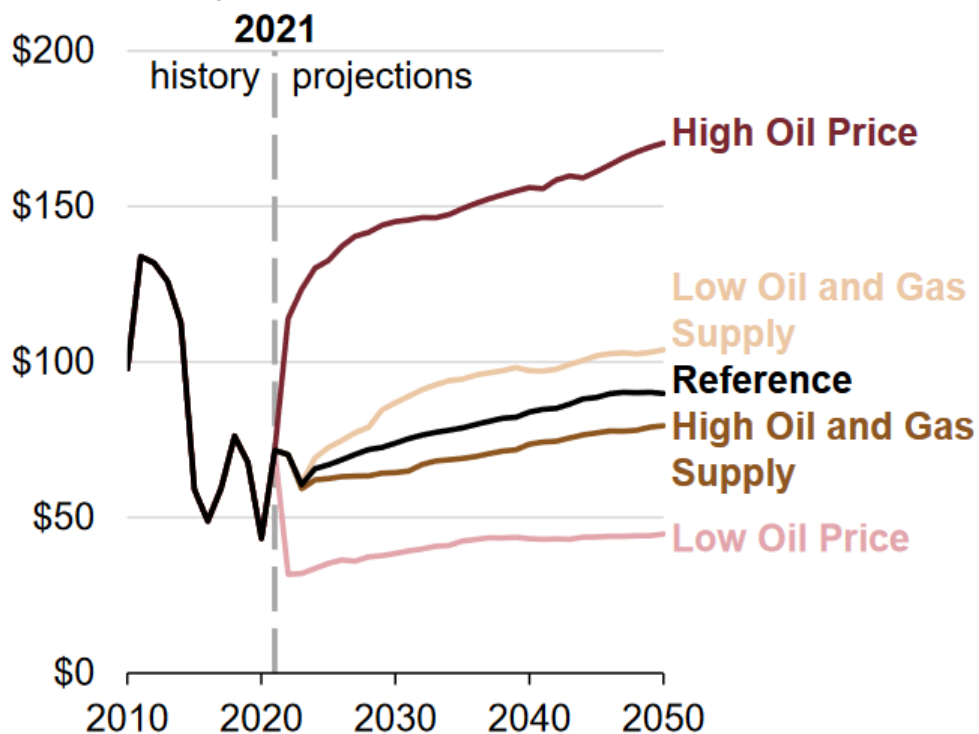
OIL & GAS PRICES – US EIA SCENARIOS 2022

Crude oil price projections and natural gas price projections

North Sea Brent crude oil price

AEO2022 side cases

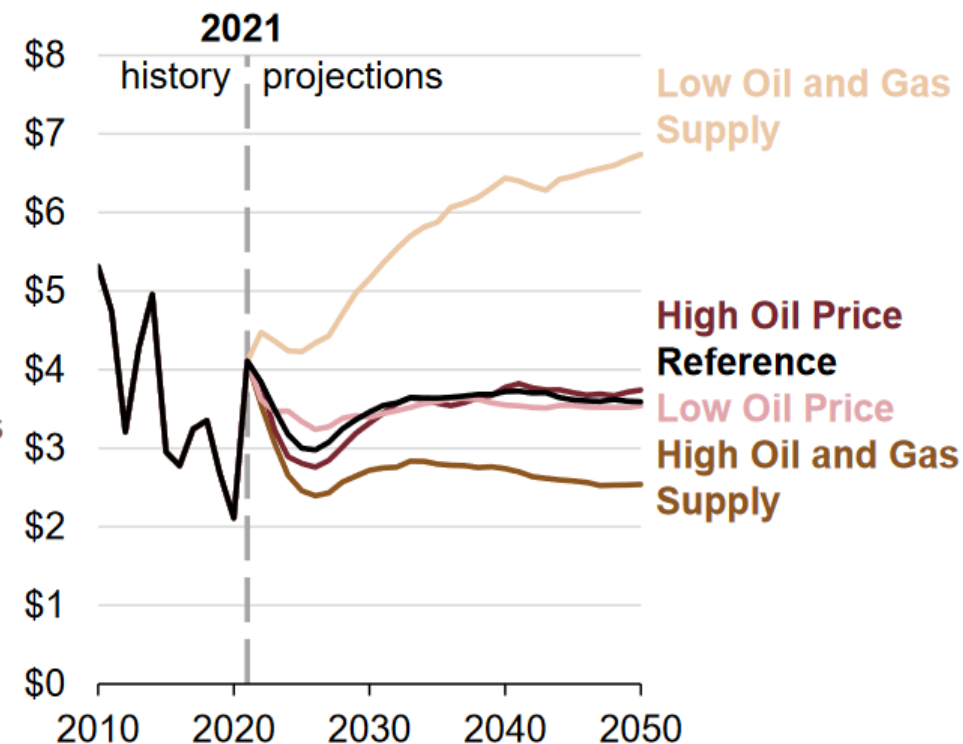
2021 dollars per barrel



Natural gas price at Henry Hub

AEO2022 side cases

2021 dollars per million British thermal units



Source: US EIA AEO 2022



Key considerations about future Oil and Energy Prices

- ◆ Higher Oil prices on the long term are probably a favourable factor:
 - To ensure stability and economic growth of oil producers, even if some of them are going to diversify their energy production.
 - To ensure energy conservation of oil importers and consumers
 - To ensure development of energy substitutes (Renewable and Nuclear)
 - To ensure development of “High Tech.” costly petroleum.
 - But the future of Oil & Gas industry is at stake in relation to the Climate Change issue and the rapid development of Renewable Energies
- ◆ The demand is guiding the market. Uncertainties on the world demand evolution have an impact. Objective of Oil & Gas Producers is to match the demand.
- ◆ While still key elements for mobility, Hydrocarbons are entering into competition with Renewable sources of Energy in the framework of Energy Transition. In this context, Carbon pricing will play a role.
- ◆ Oil prices are volatile and new oil shocks or counter-shocks with temporary higher or lower prices could occur. Environmental, geopolitical and societal upsets may have important impacts. Recent illustrations: the Covid-19 sanitary crisis, in 2022, the Invasion of Ukraine by Russia and more recently in 2026 the US-Iran war.
- ◆ Evolution of Renewable Energy production costs downwards together with other environmental considerations will also have an impact.



History doesn't like stability.....!

**A Zoom on the recent counter oil-shock
2nd Half 2014
Which consequences? What about the heavy
trends?**



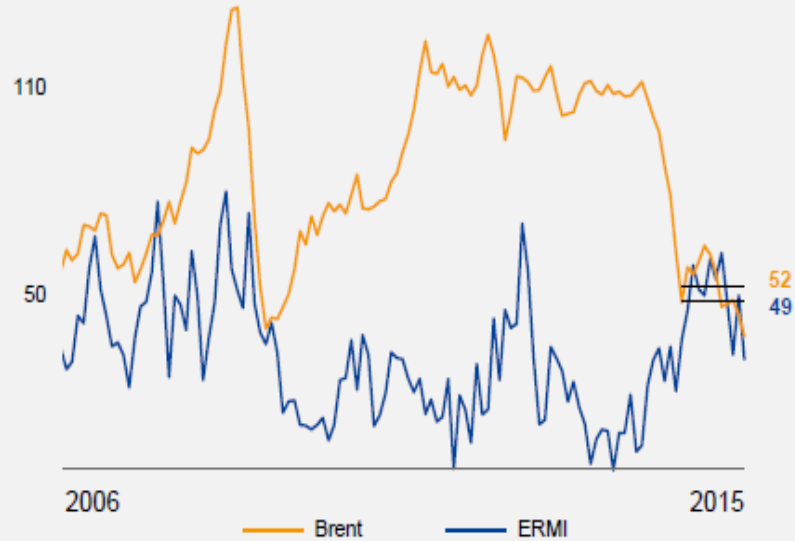
Petroleum Indicators:

2014-2015: Sharp Decrease for Oil & Gas Prices

Steep decline in commodity prices

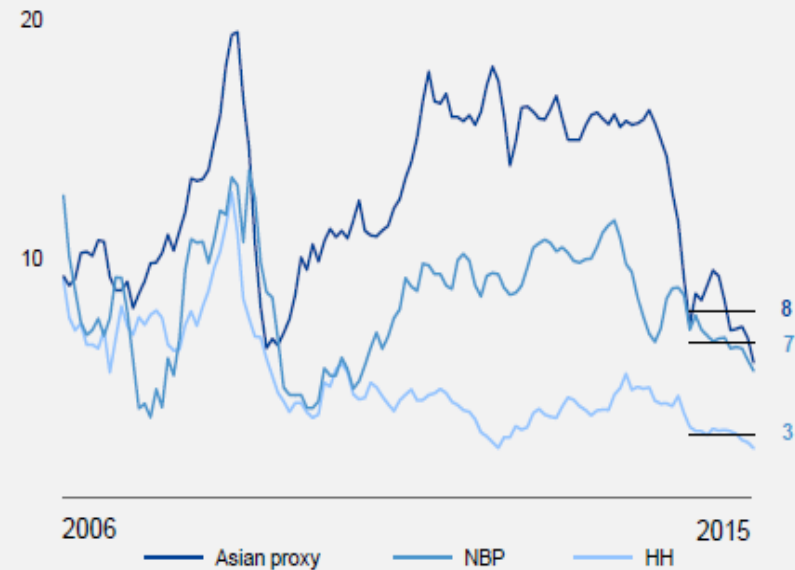
One year into the cycle

Brent (\$/b) and ERMI (\$/t)



2015 liquids realizations: -47%

Gas (\$/Mbtu)



2015 gas realizations: -33%

ERMI: European Refining Margin Indicator
NBP: National Balancing Point, HH: Henry Hub

Source: Total Results & Outlook Feb.2016



INSIDE: AN ESSAY ON THE SUBURBANISATION OF THE WORLD

The
Economist

DECEMBER 6TH-12TH 2014

economist.com

Technology Quarterly

Shinzo Abe's last chance

Boost your business with a drone

P.D. James, queen of the sleuths

Our books of the year

Sheikhs v shale

The new economics of oil



Oil price development 2nd Half 2014

Short term Consequences /Adverse Effects on selected Countries

Countries	Positive effects	Negative effects
USA	Global positive effects on the Economy. Transfert of spendings from energy consumption to other purchases.	A number of oil projects becomes non-economic. Sharp decrease in investments in the oil & gas sector.
Euro Zone	Global positive effects on the Economy. Positive impact on the consumer price index.	Risk of deflation, with an impact on salaries and wages. Cancellation of oil & gas projects (North Sea). Competitivity of renewable energies under pressure.
China	Global positive effect in relation to the oil imports burden.	Risk of failure from foreign debtors (oil exporters). Coal consumption remain a major element.
Saudi Arabia	Probable increase of market share for oil trading. Reduced competition with US oil shales (Tight oil).	Global negative effects on the Economy. Sharp increase of the budget deficit, attenuated by the high level of financial reserves (740 G\$ vs oil revenues # 250 G\$)
Venezuela		Global negative effects on the Economy (96% of export revenue come from oil). High risk of social turmoil.
Nigeria		Global negative effects on the Economy (Oil represents 60% of the Country's revenues)
Russia		Global negative effects on the Economy. Hydrocarbons represent 50% of budget revenue and more than 20% of GDP. Sharp increase of banks & enterprises' debts. Situation getting worse with the sanctions and the embargo. Ruble value down. Risk of high inflation.



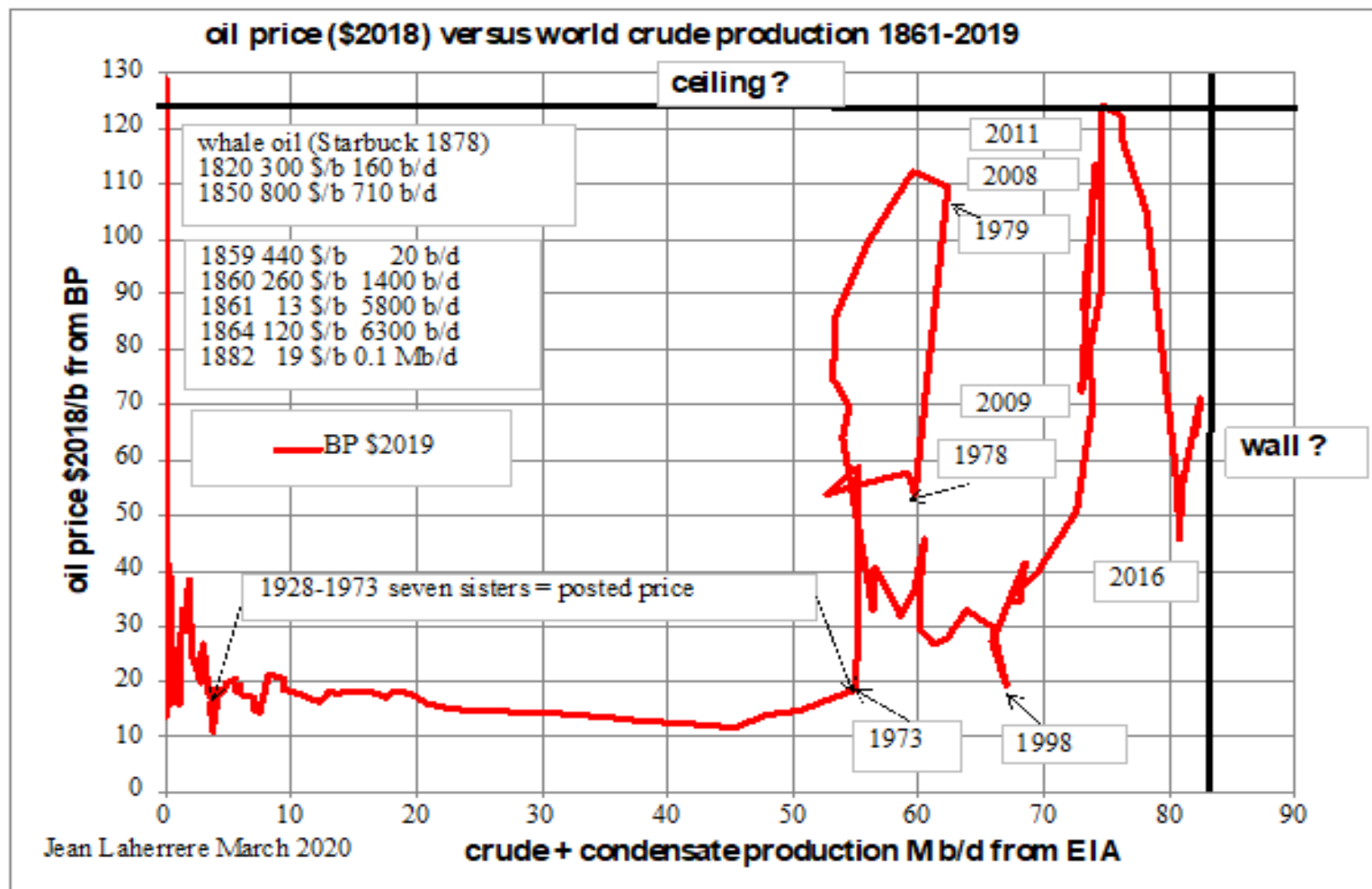
2nd Half 2014 Oil price evolution

Short term events vs heavy trends

- ◆ Due to the lack of economic growth in some regions (Europe, Japan, lower growth rate in China,...), oversupply of crude oil worldwide (impact of tight oil production in the US,...) and decrease of the oil price.
- ◆ End of November 2014, OPEC decided to maintain their production ceiling at 30 Mb/d (Saudi Arabia – 10 Mb/d- wants to keep their market share and favours the laws of the market)
- ◆ The immediate consequence was an important drop in the crude oil price down to 80/50 \$/b (-45%)
- ◆ A too low crude oil price has detrimental consequences on: energy efficiency, GHG emissions, competitiveness of renewables, development of investment to secure long term demand.
- ◆ The heavy trends regarding supply/demand together with oil producers constraints would probably rebalance the market on the medium/long term towards a higher oil price....Depending upon the future production of LTO and Shale Oil in the US.....and the political attitude of the Oil producing countries..... and the economic consequences of the Covid-19 pandemia.....



Oil Prod. & Price: A Ceiling and a Wall?



**Oil Price:
Economics &
Politics, politics, politics,.....
AND Potential World Conflicts**



Oil industry stakeholders: Governments, NOCs and IOCs



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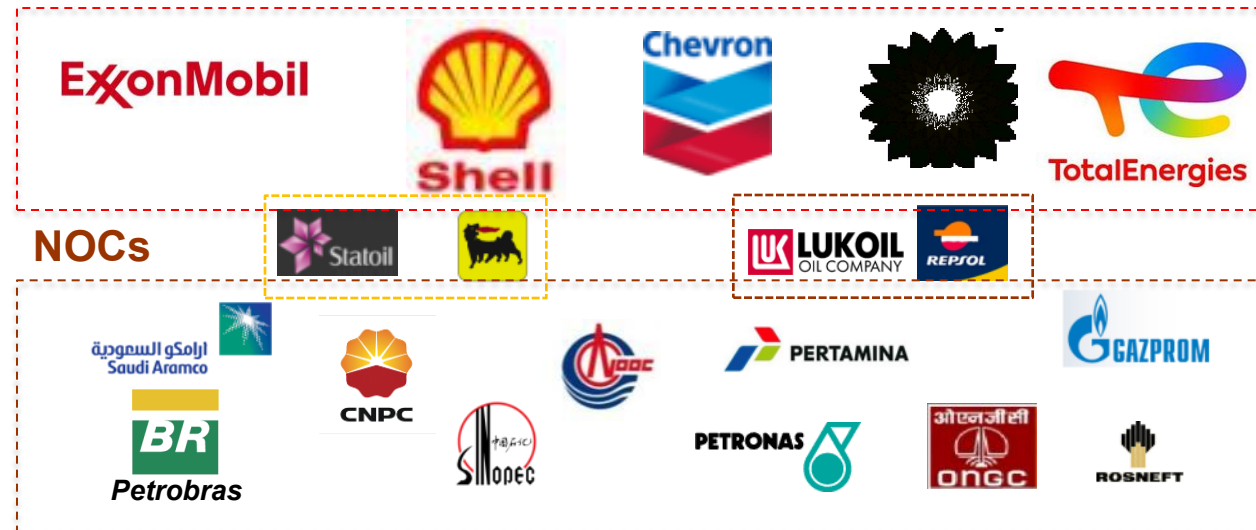
Oil & Gas and Energy sectors: the players' objectives

CONSUMER GOVERNMENTS	SUPPLY SECURITY SUPPLY DIVERSITY LOW PRICES BUT SUFFICIENT TO MAINTAIN LONG TERM SUPPLIES TAX REVENUES ENVIRONMENTAL PROTECTION COMBAT CLIMATE CHANGE - DEVELOPMENT OF ENERGY TRANSITIO PROJECTS
CONSUMERS	LOW PRICES (normally) SUPPLY AT ANY PRICE (if crisis)
OIL COMPANIES	SATISFYING DEMAND GROWTH ACCESS TO CRUDE PRICE STABILITY OR PREDICTABILITY ADEQUAT REMUNERATION OF UPSTREAM AND DOWNSTREAM INVESTMENTS DEVELOPMENT OF ENERGY TRANSITION PROJECTS
OPEC GOVERNMENTS	REASONABLE PRICES TO AVOID REPLACEMENT OF OIL BY OTHER ENERGY SOURCES AND TO FINANCE NATIONAL BUDGETS MARKET SHARE PROTECTION



An increasingly complex competitive environment

Majors A handful of global competitors...

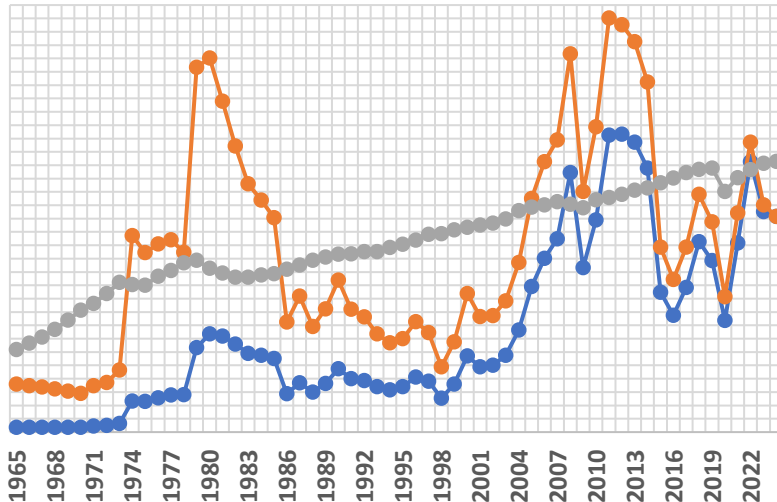
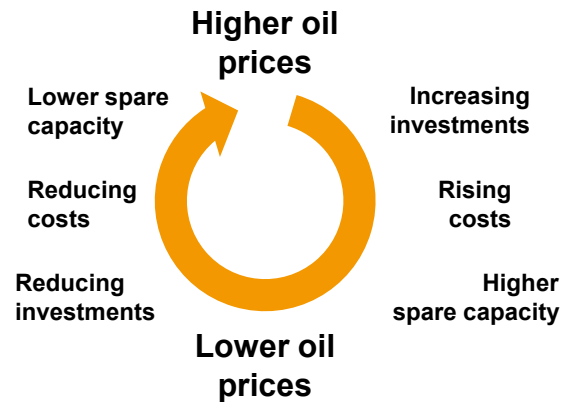


... and a myriad of specialised players in



An industry accustomed to cyclical volatility and changes due the global environmental features

Typical supply cycle



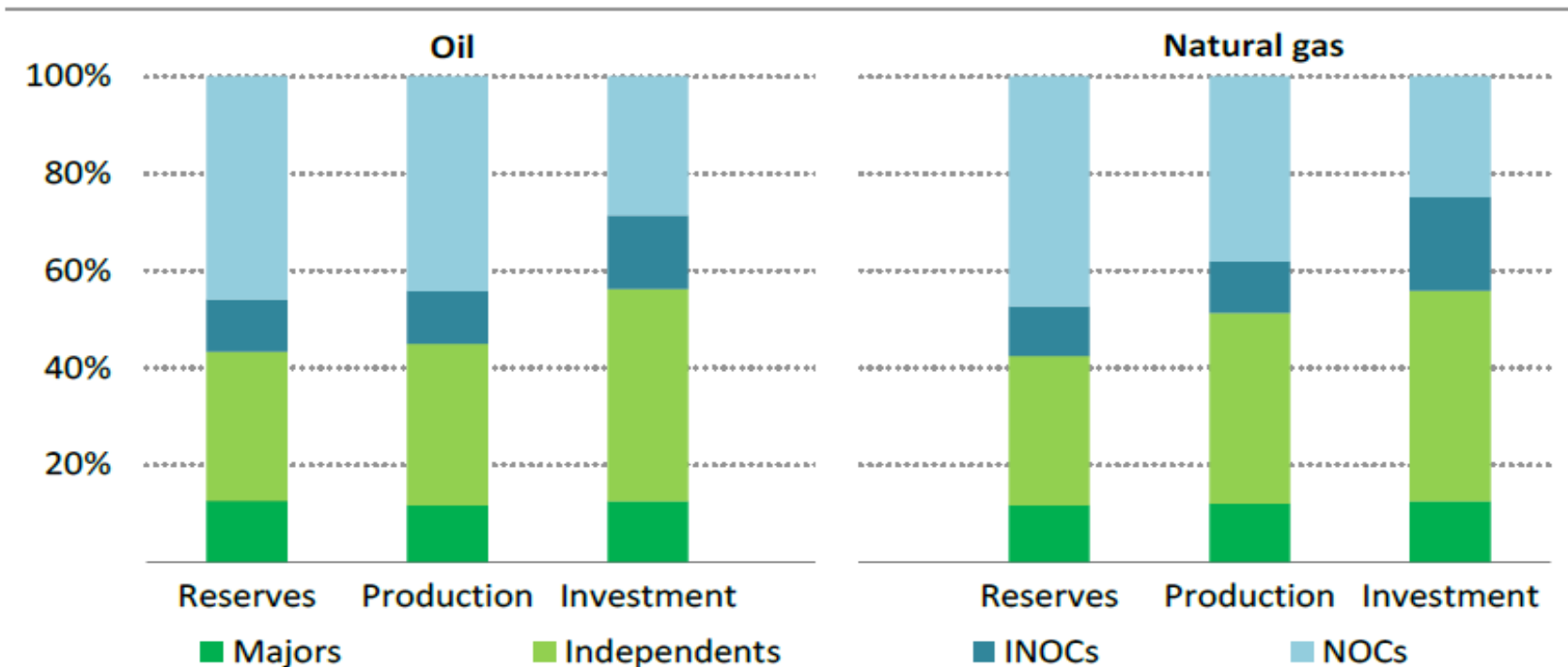
- Oil & Gas prices evolution depends on
 - Long and medium term Supply and Demand
 - Oil & Gas demand elasticity and GDP growth
 - Stocks situation
 - Innovation and improved energy efficiency
 - Geopolitical events and OPEC
- Short term industry reaction
 - Capex linked with Oil & Gas prices
 - Projects cancelled and/or delayed. Financial transactions
 - Capex and Opex optimization
 - Human Resources availability
- Oil & Gas Companies now engaged in Climate Change constraints and Energy Transition, depending upon individual strategies. Potential consequences on new exploration and development projects and their financing



Evolution of Oil & Gas Companies based on various criterias



Oil & Gas Companies ownership Reserves, Production & Investments



IEA. CC BY 4.0.

NOCs, including those with operations outside their home country, produce more than half of the world's oil and gas. The majors produce 13% of the total.

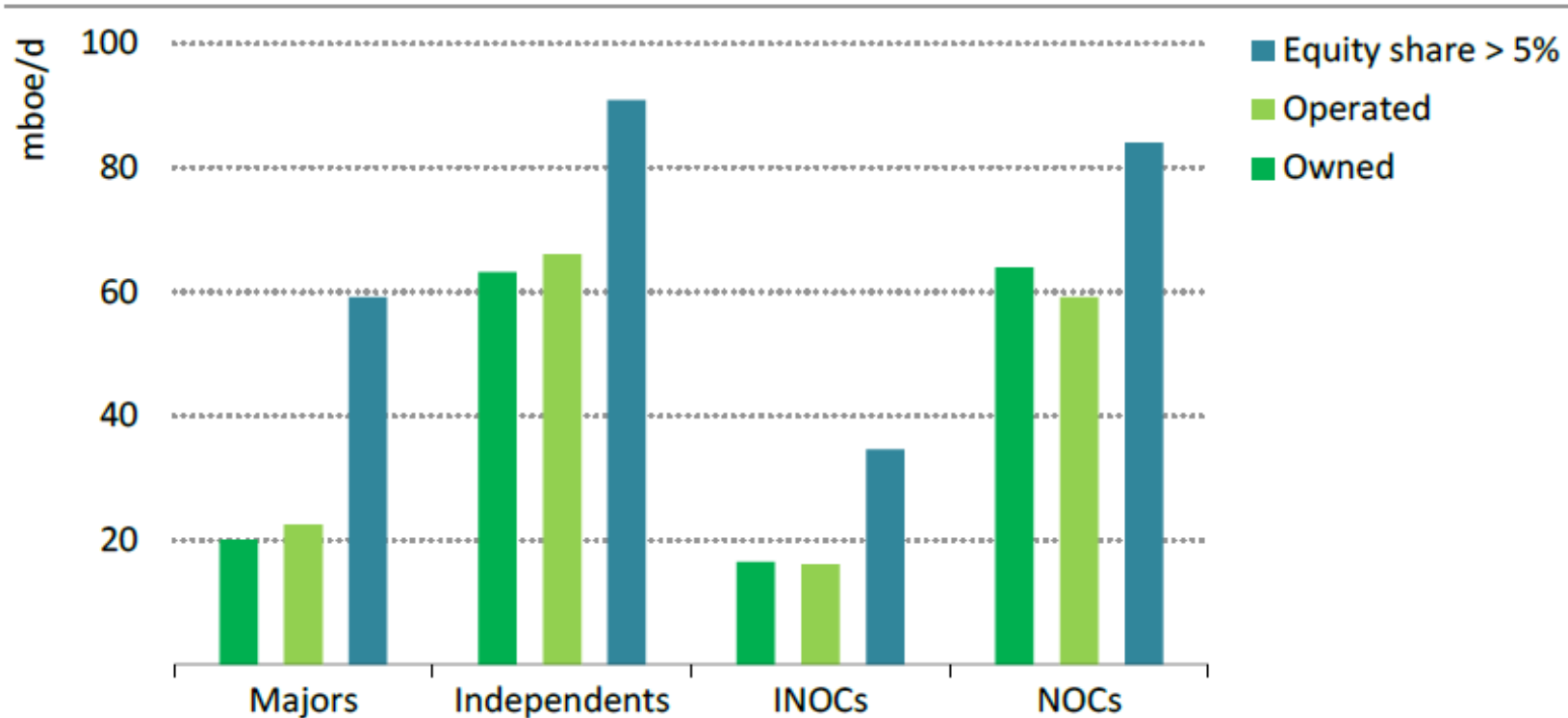
Note: INOCs = International national oil companies; NOCs = National oil companies.

Source: IEA analysis based on Rystad Energy.

Source: IEA Oil & Gas Industry in Net Zero Transitions – November 2023



Oil & Gas Companies ownership - 2022 Production



IEA. CC BY 4.0.

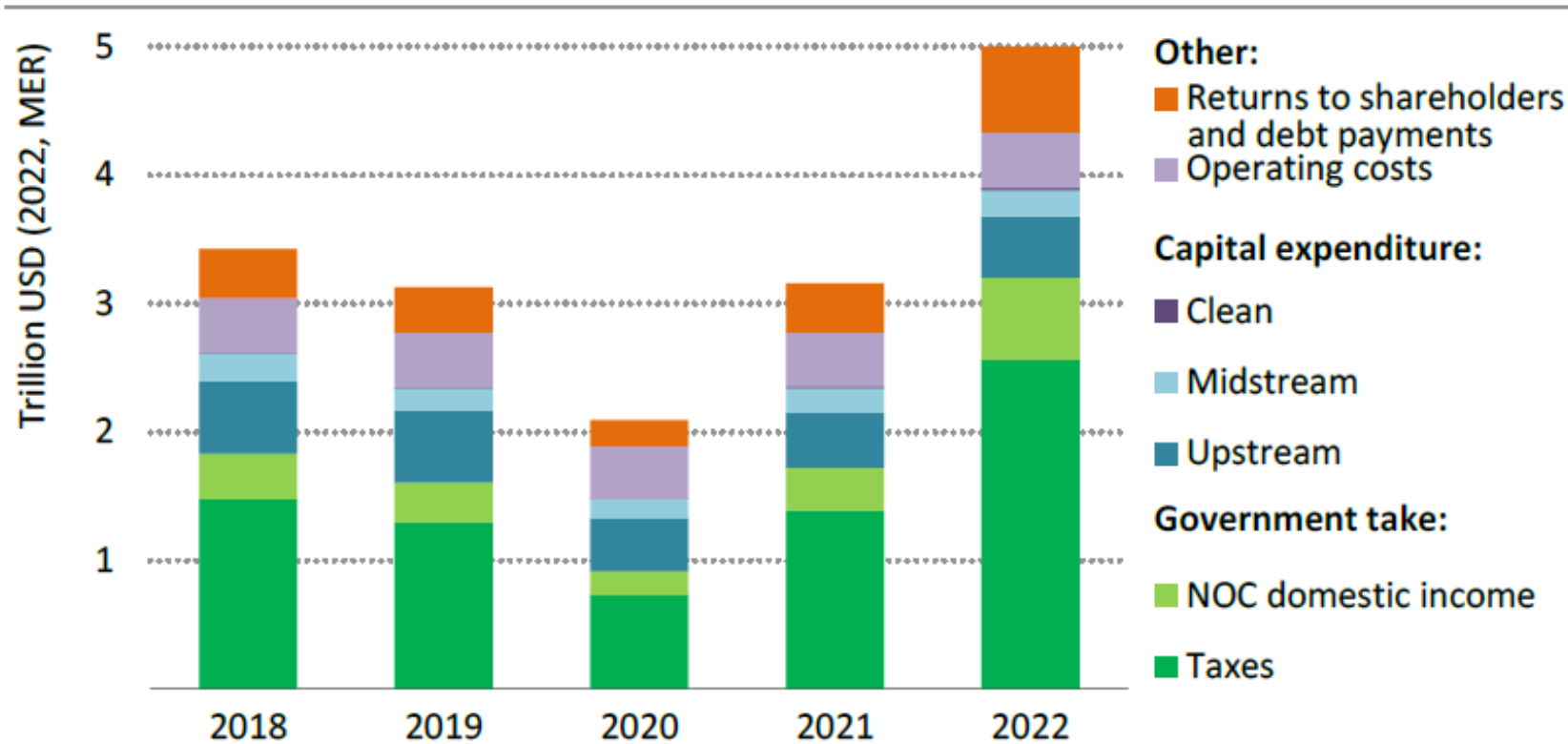
Companies' production includes oil and gas from both operated and non-operated assets, but the influence of companies can extend well beyond this.

Note: Equity share > 5% = total production from all assets in which a company holds at least a 5% share of the produced oil and gas.

Source: IEA Oil & Gas Industry in Net Zero Transitions – November 2023



Oil & Gas Companies ownership - 2022 Production



IEA. CC BY 4.0.

The oil and gas industry has generated around USD 17 trillion of revenue since 2018. Half was paid to governments and 40% was spent developing and operating oil and gas assets.

Note: NOC domestic income = National Oil Company income generated in their home country.

Source: IEA Oil & Gas Industry in Net Zero Transitions – November 2023



Oil Majors (IOC) represent are small actors compared to National Oil Companies (NOC)

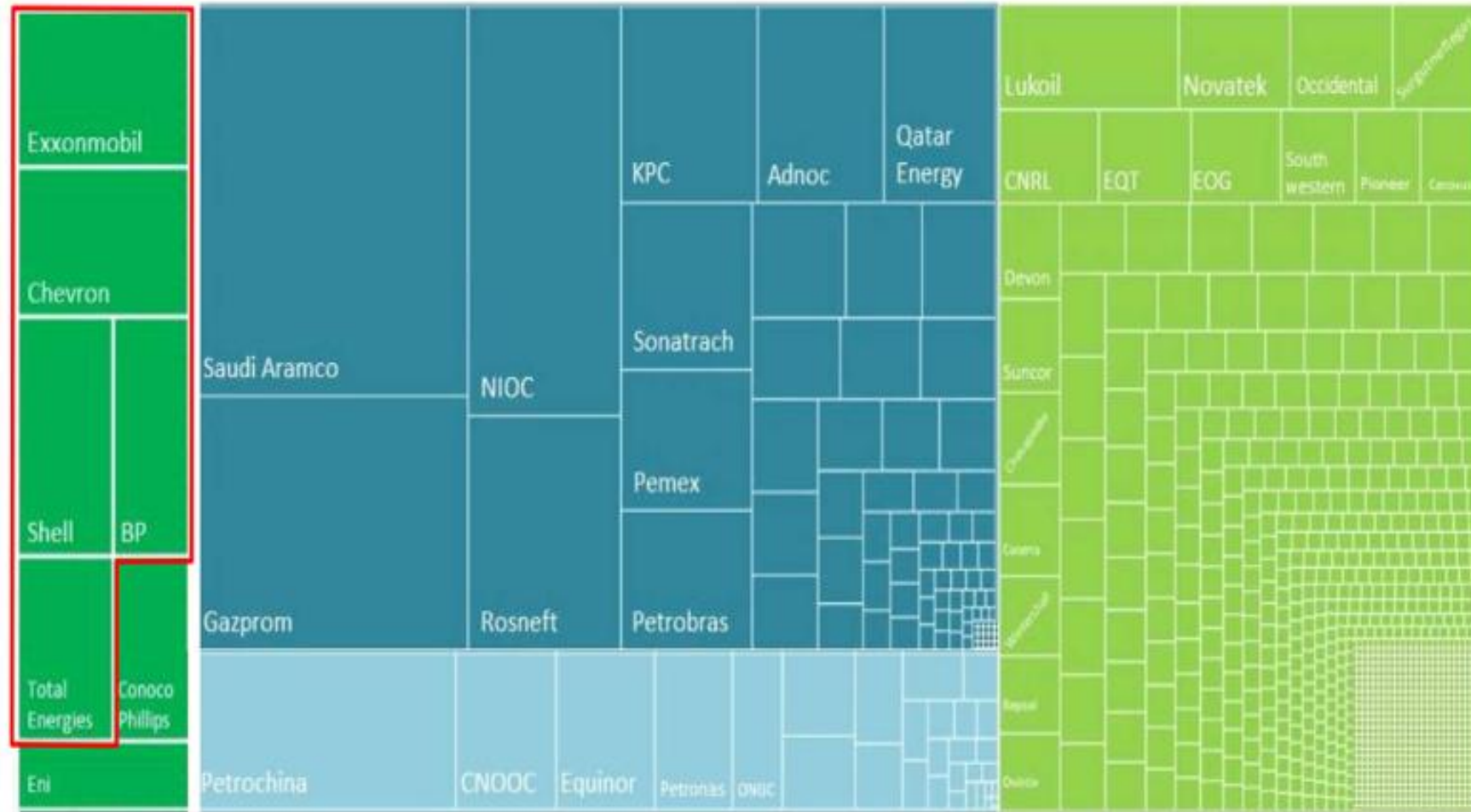


Warning:
Reserves & Resources estimates vary according to categorizations selected by the various sources.
In the following, Resources are defined either by 2P (Proven + Probable) estimates or by Commercial 2P (Proven + Probable) + Technical 2C (Contingent) estimates



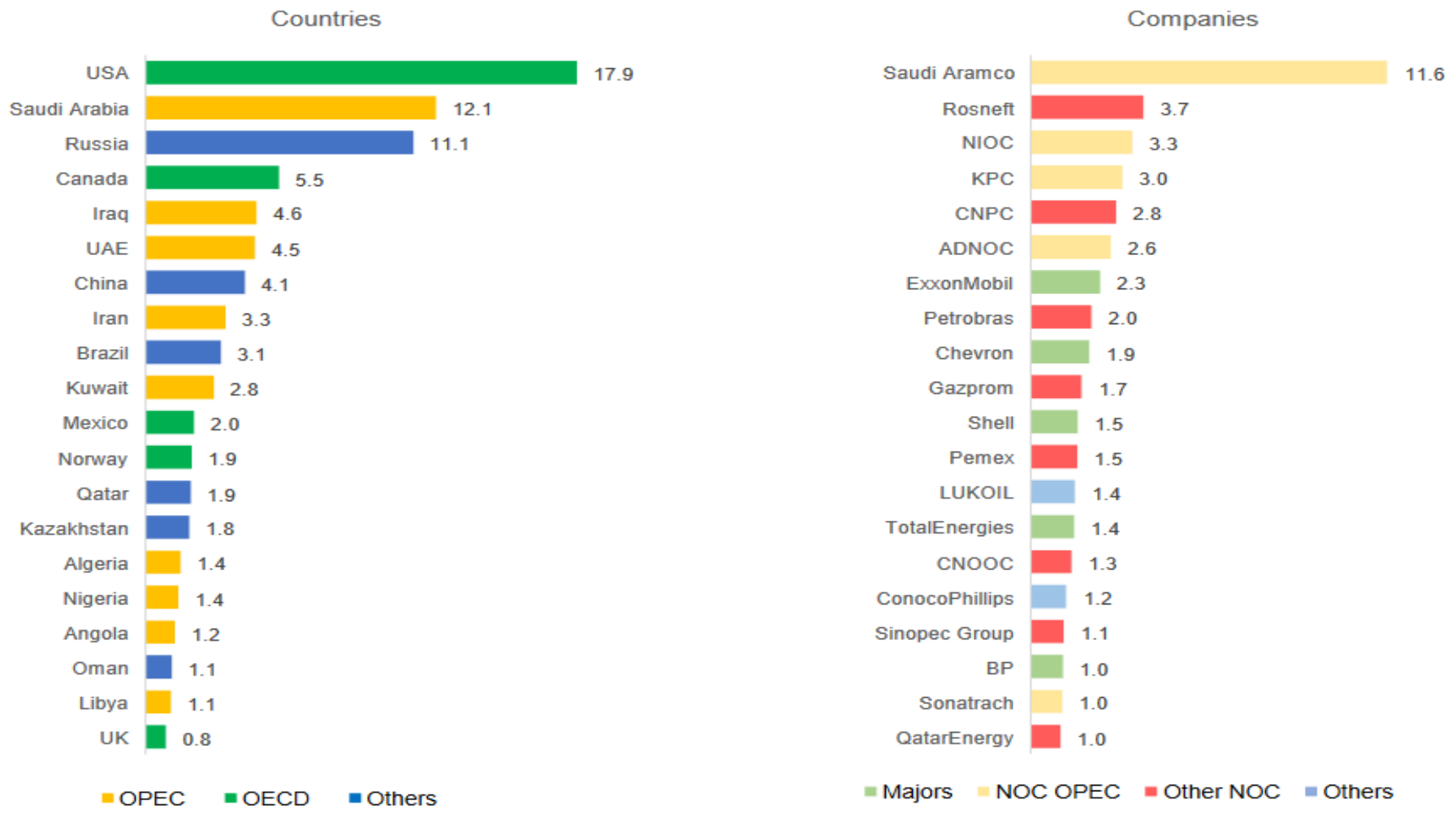
International Majors play almost a limited role in the World Oil & Gas Resources Assets - Year 2022

Global oil and gas production in 2022



International Majors play a limited role in the World Oil Production

Top 20 Liquids Production by Country & Company - Year 2022 (Mb/d)

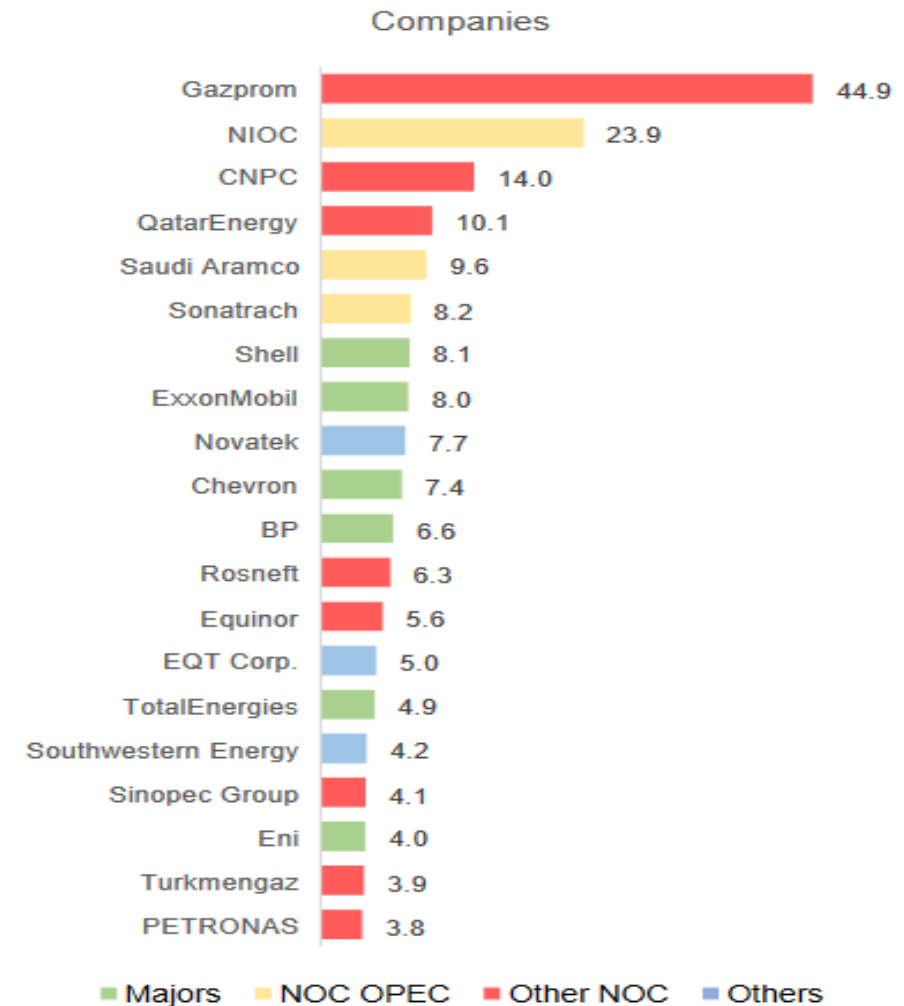
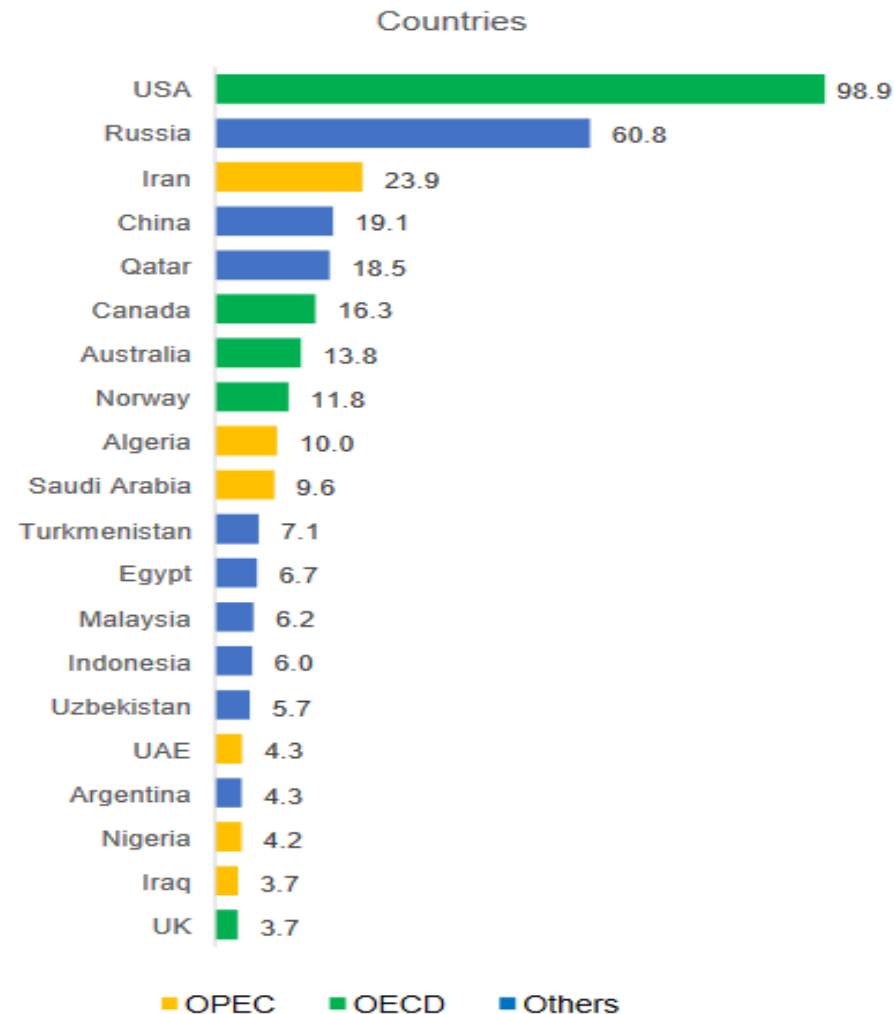


Source: TotalEnergies E&P Data Book 2023



International Majors play a limited role in the WorldGas Production

Top 20 Gas Production by Country & Company - Year 2022 (Bcf/d)

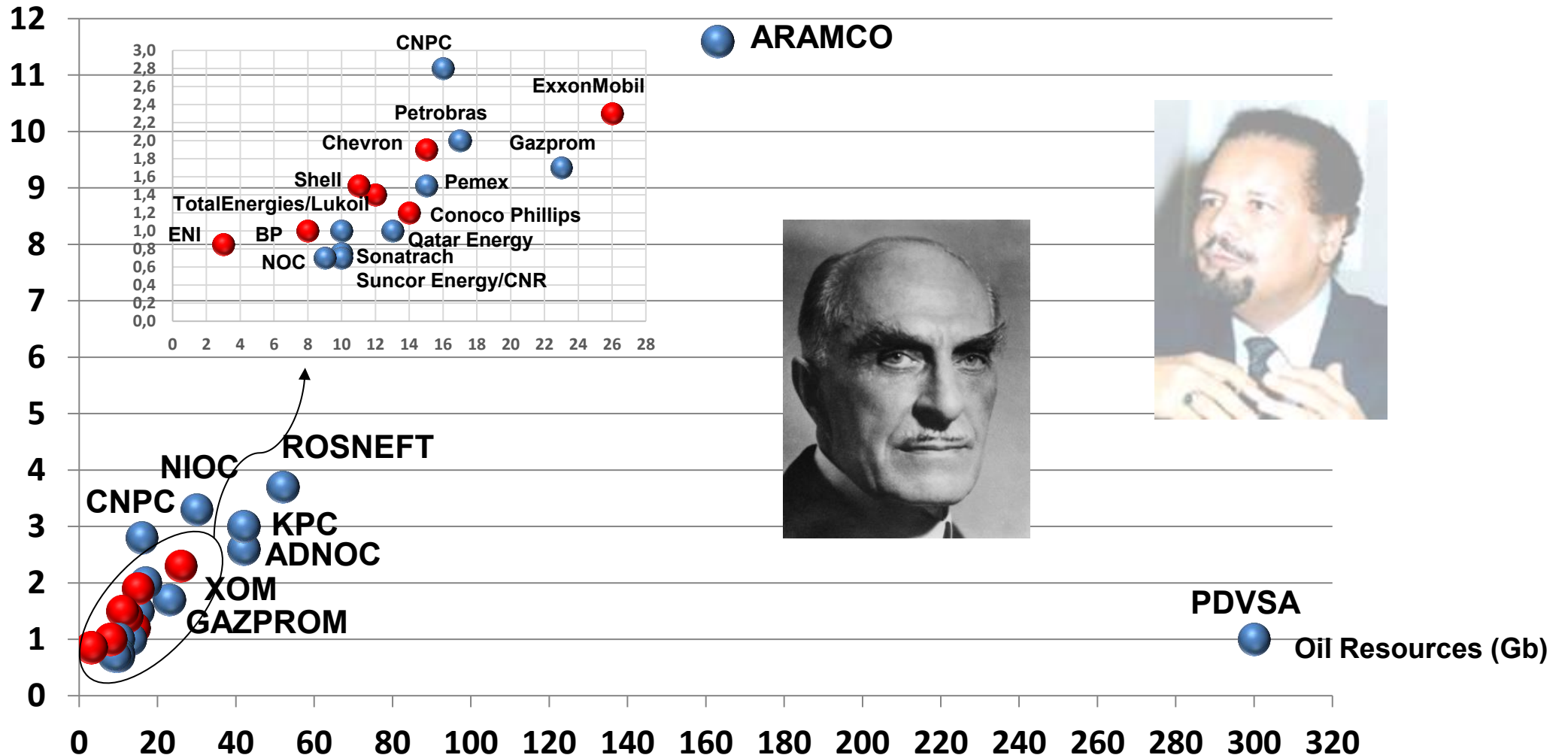


Source: TotalEnergies E&P Data Book 2023



International Majors weight # 10% in the World Oil Resources Assets- Year 2022

Oil Production (Mb/d)

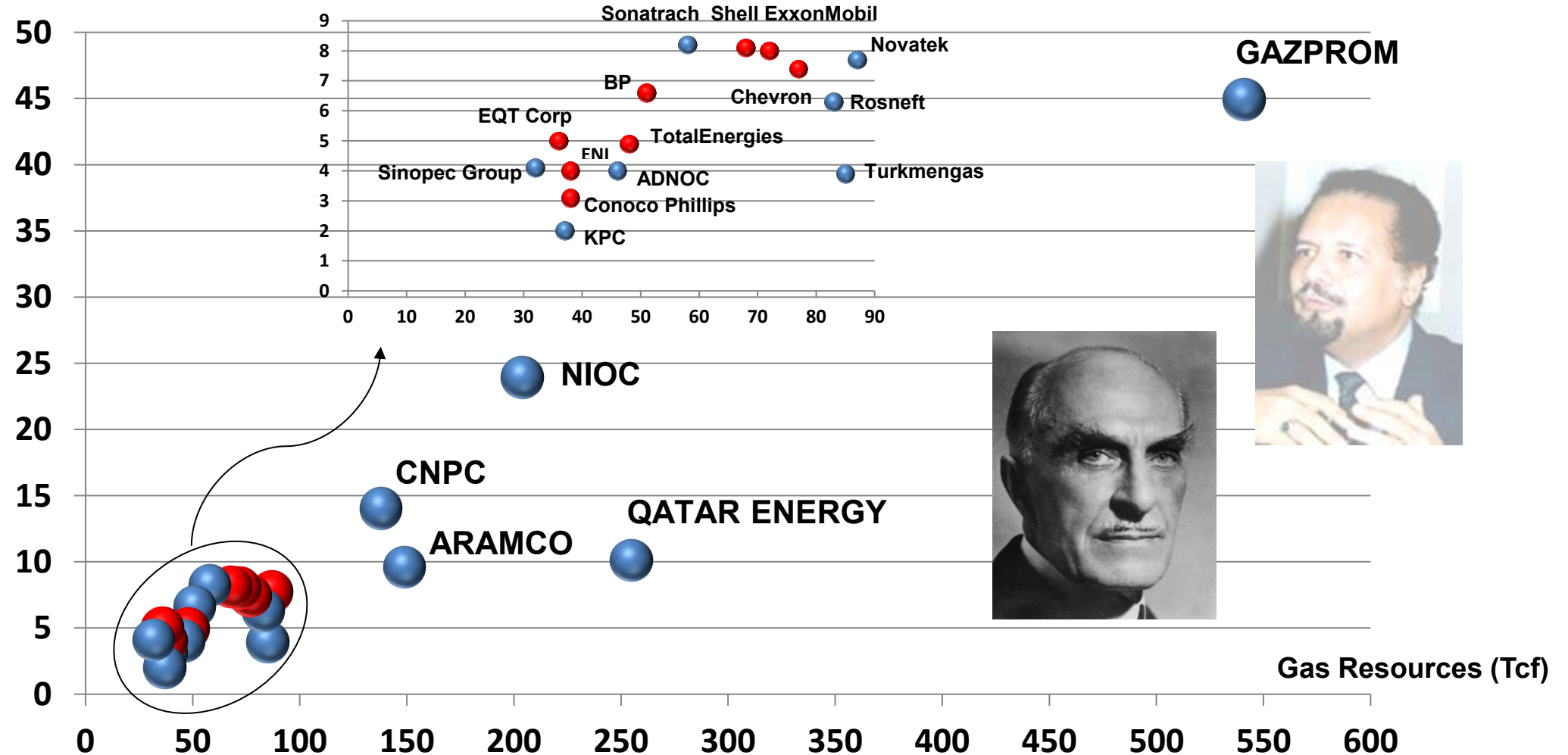


Source: ChG/Data from TotalEnergies 2023
Resources accounted as Commercial 2P & Technical 2C



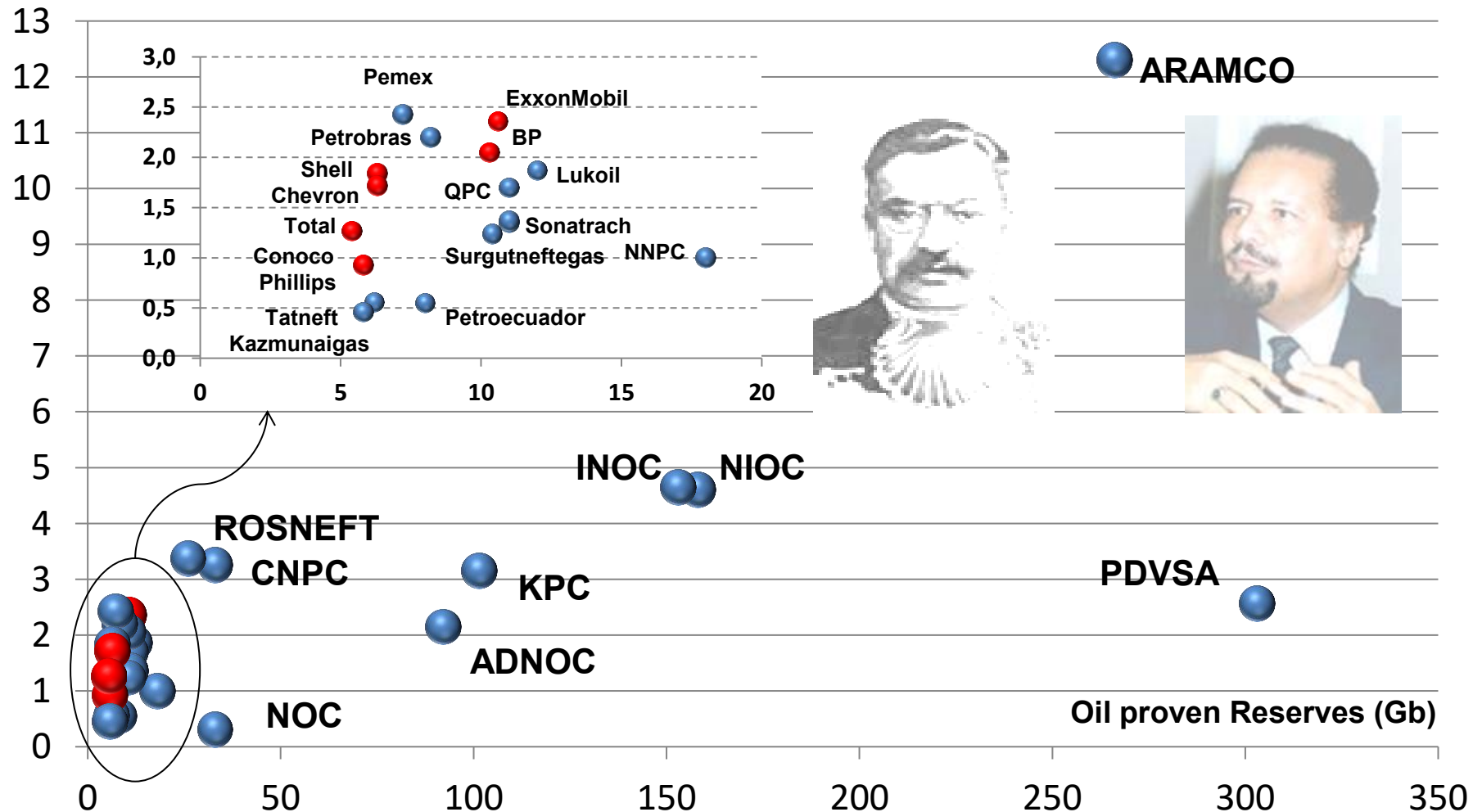
International Majors weight # 18% in the World Gas Resources Assets- Year 2022

Gas Production (Bcf/d)

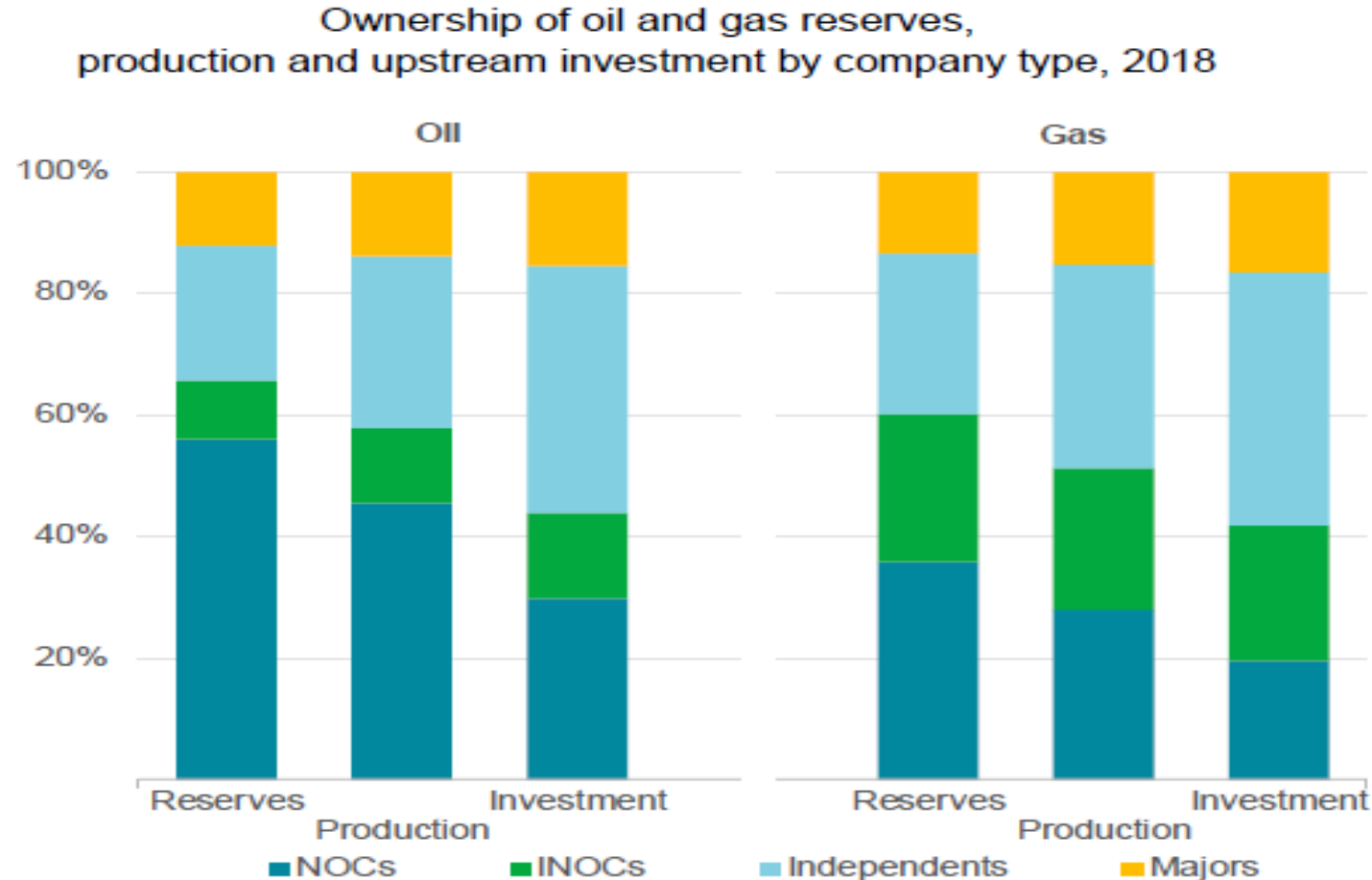


Reminder - International Majors weight only 10% in the World Oil Resources Assets* - Year 2016 - Data from PIW

Oil Production (Mb/d)



Reminder - Majors account for 10 – 15% for Oil & Gas Reserves, Production and Upstream Capex – Situation 2018

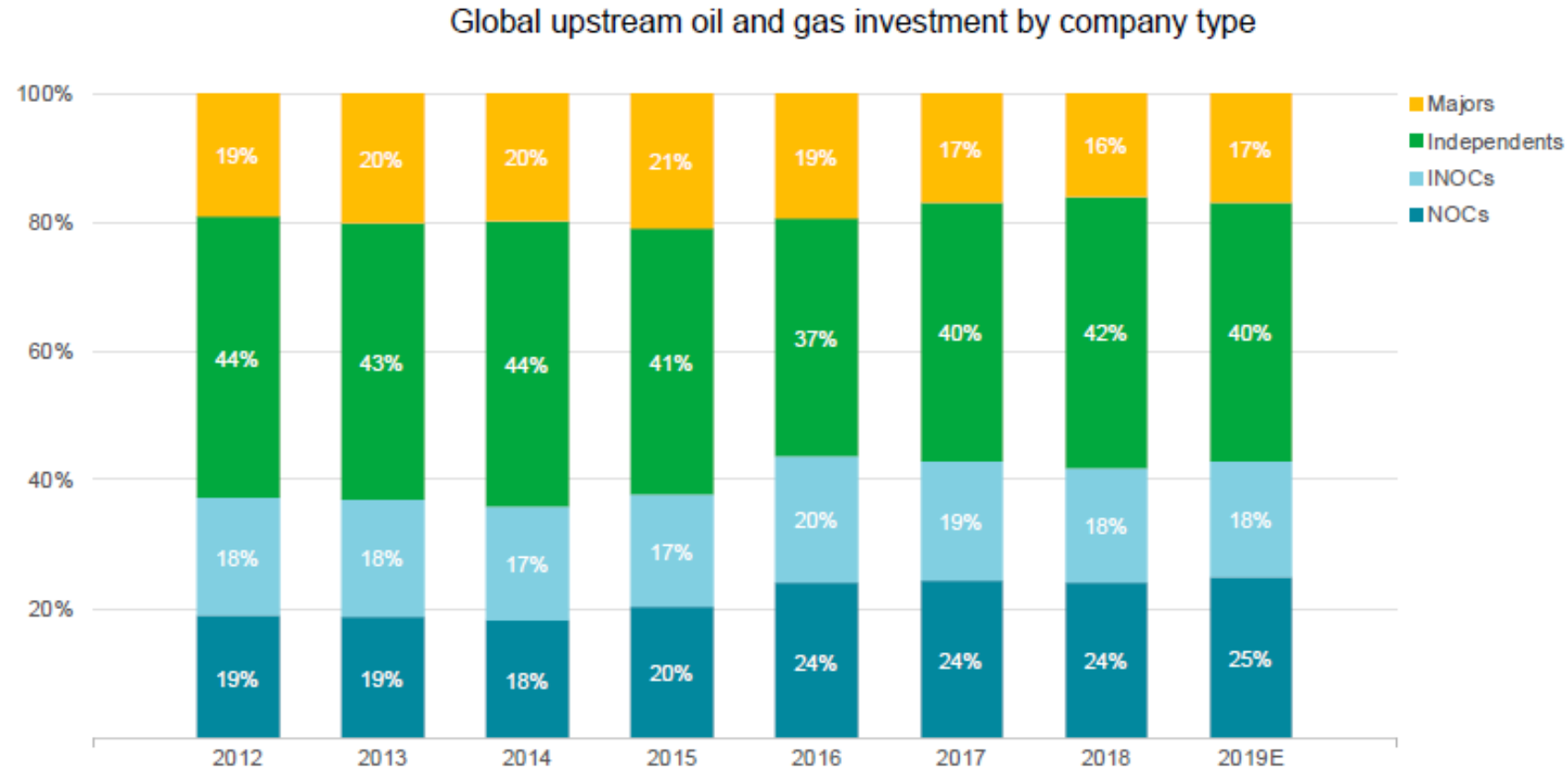


Note: NOCs = national oil companies; INOCs = international national oil companies.

Source: IEA 2019: The Oil and Industry in the Energy Transition



Reminder - The NOC's share in Upstream Capex is growing timewise 2012 - 2019



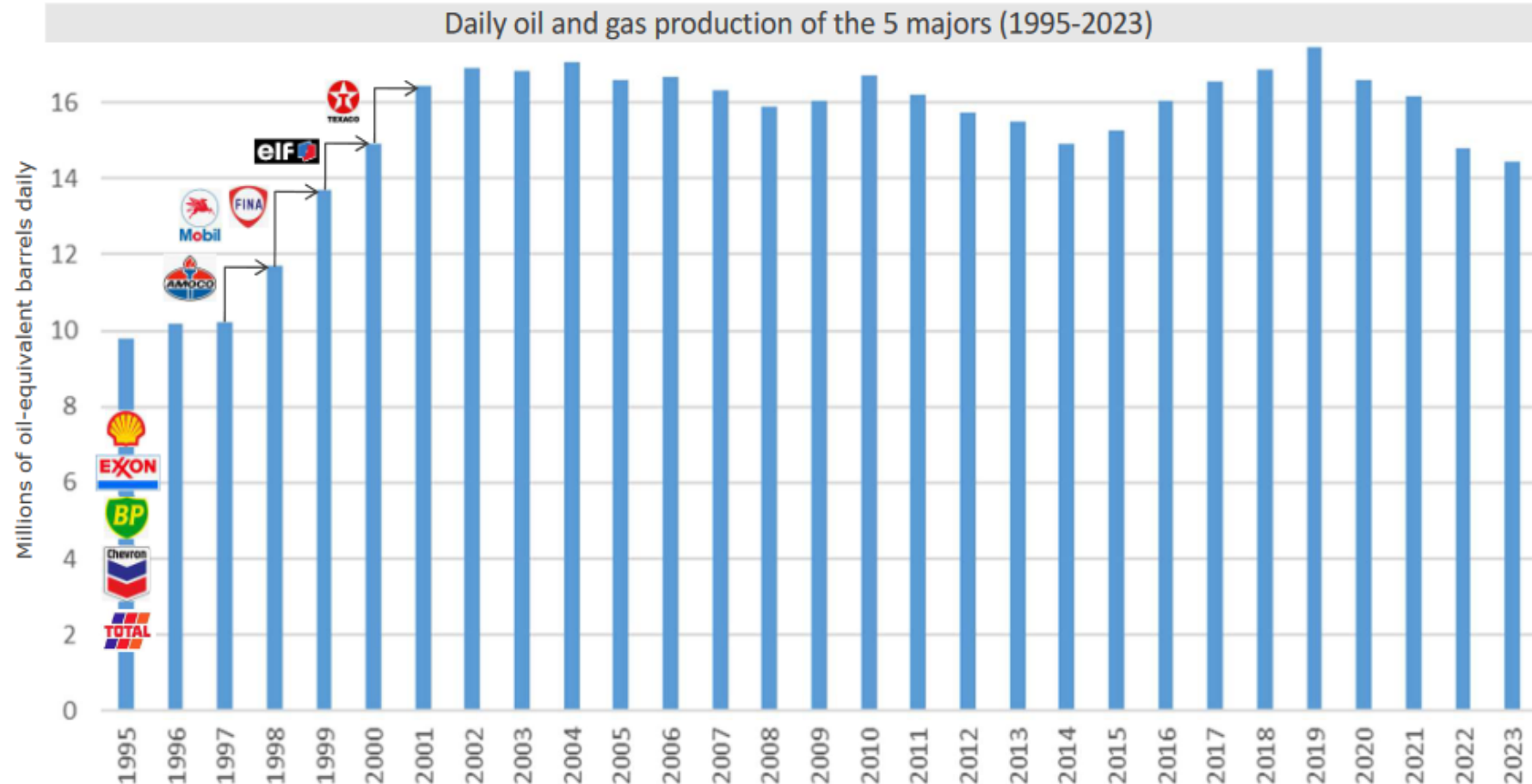
Note: Data for 2019 are IEA estimates based on company guidance, consultations with industry experts, and other sources.

Source: Analysis based on company reports and Rystad Energy (2019), UCube (database).

Source: IEA 2019: The Oil and Industry in the Energy Transition



International Majors have a limited contribution in World Oil & Gas Production # 9 – 10% in the recent past



Note:

Until 1997 BP's production only – From 1998 BPAmoco's production

Until 1998 Total's production only – In 1999 TotalFina's production – From 2000 TotalFinaElf's production

Until 1998 Exxon's production only – From 1999 ExxonMobil's production

Until 2000 Chevron's production only – From 2001 ChevronTexaco's production

Source: Vincent Faure - ASPO 2024

400

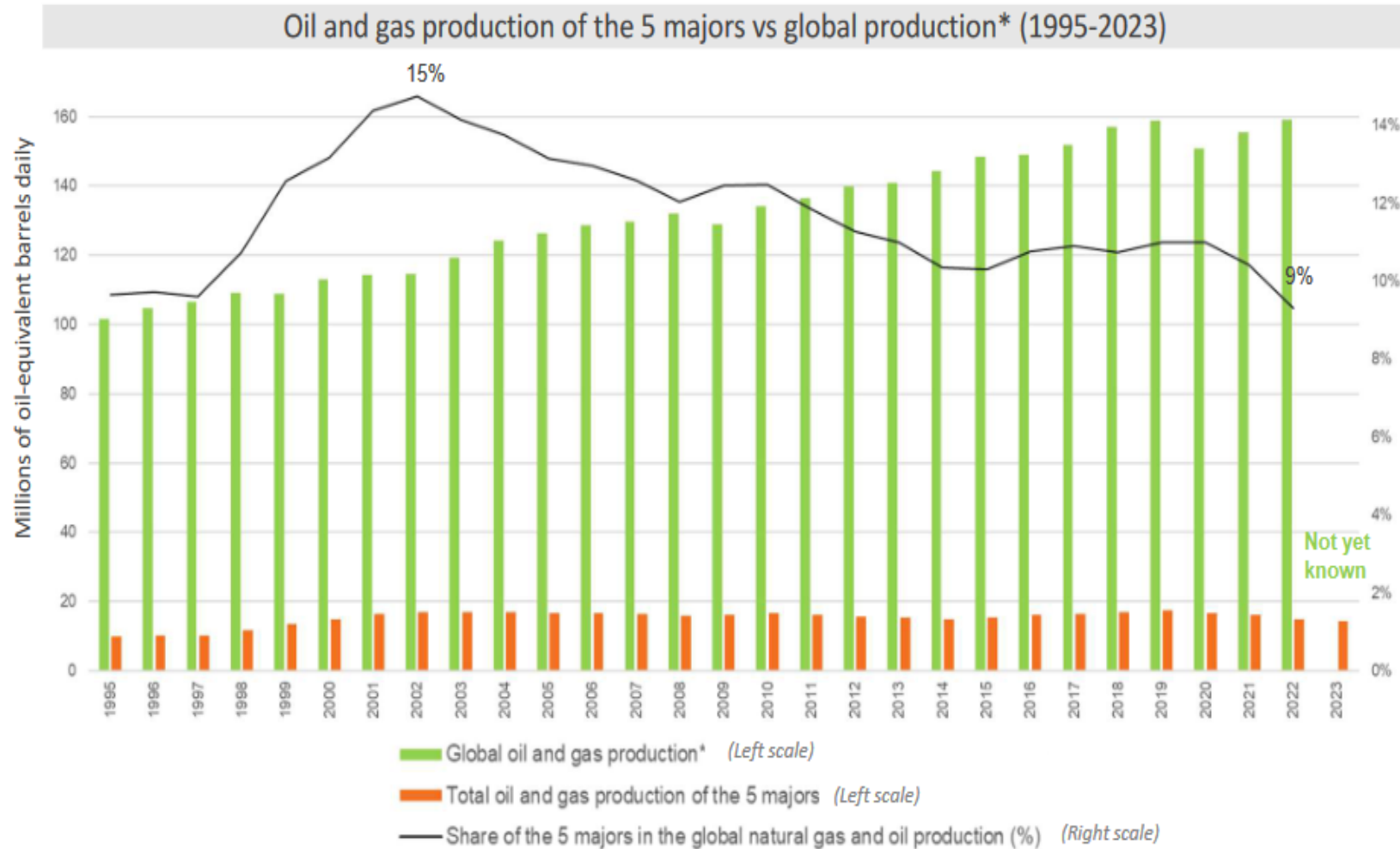


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International Majors have a limited contribution in World Oil & Gas Production # 9 – 10% in the recent past



* Source: 2023 | 72nd edition Statistical Review of World Energy from Energy Institute

Source: Vincent Faure - ASPO 2024

401

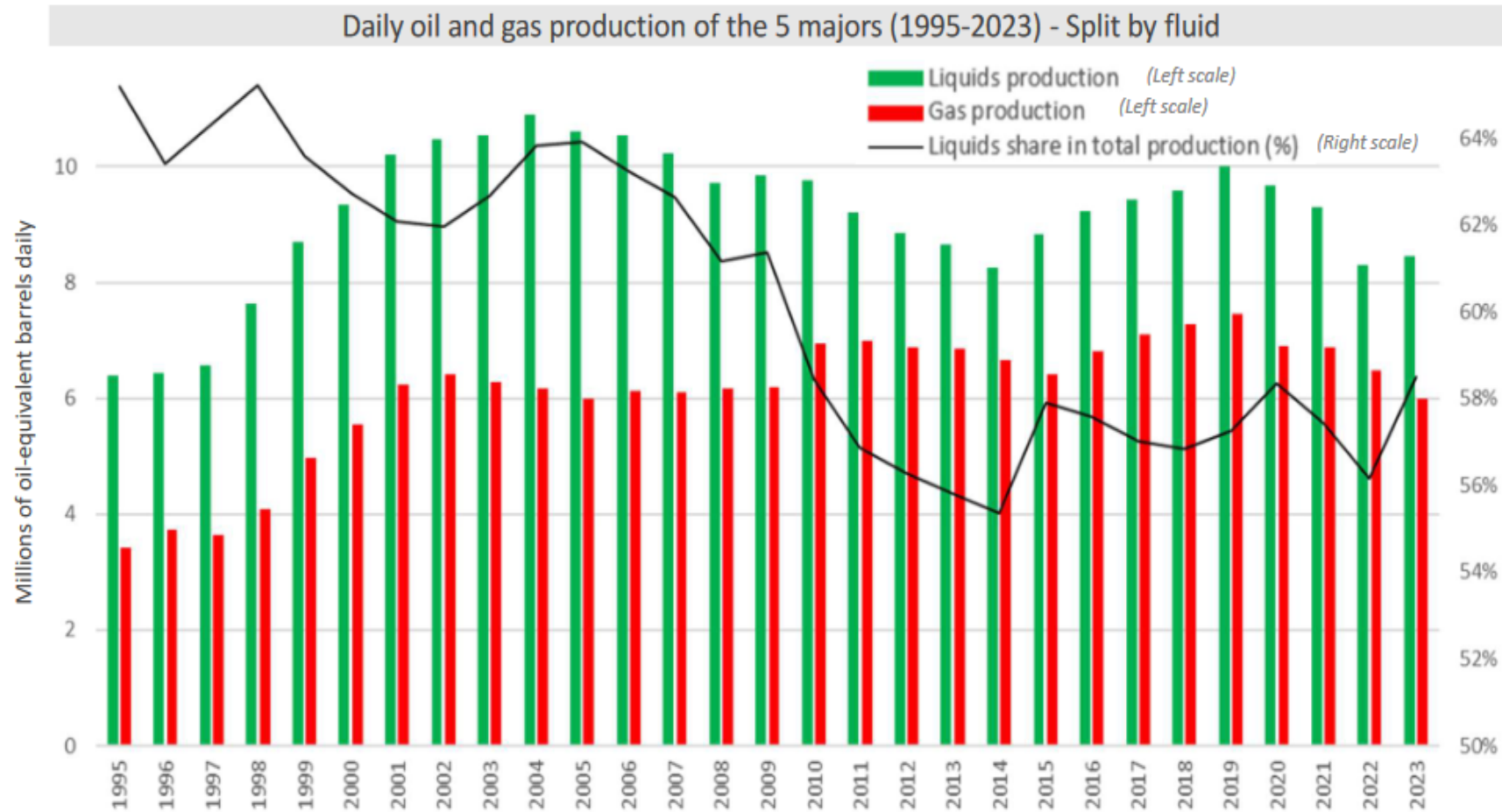


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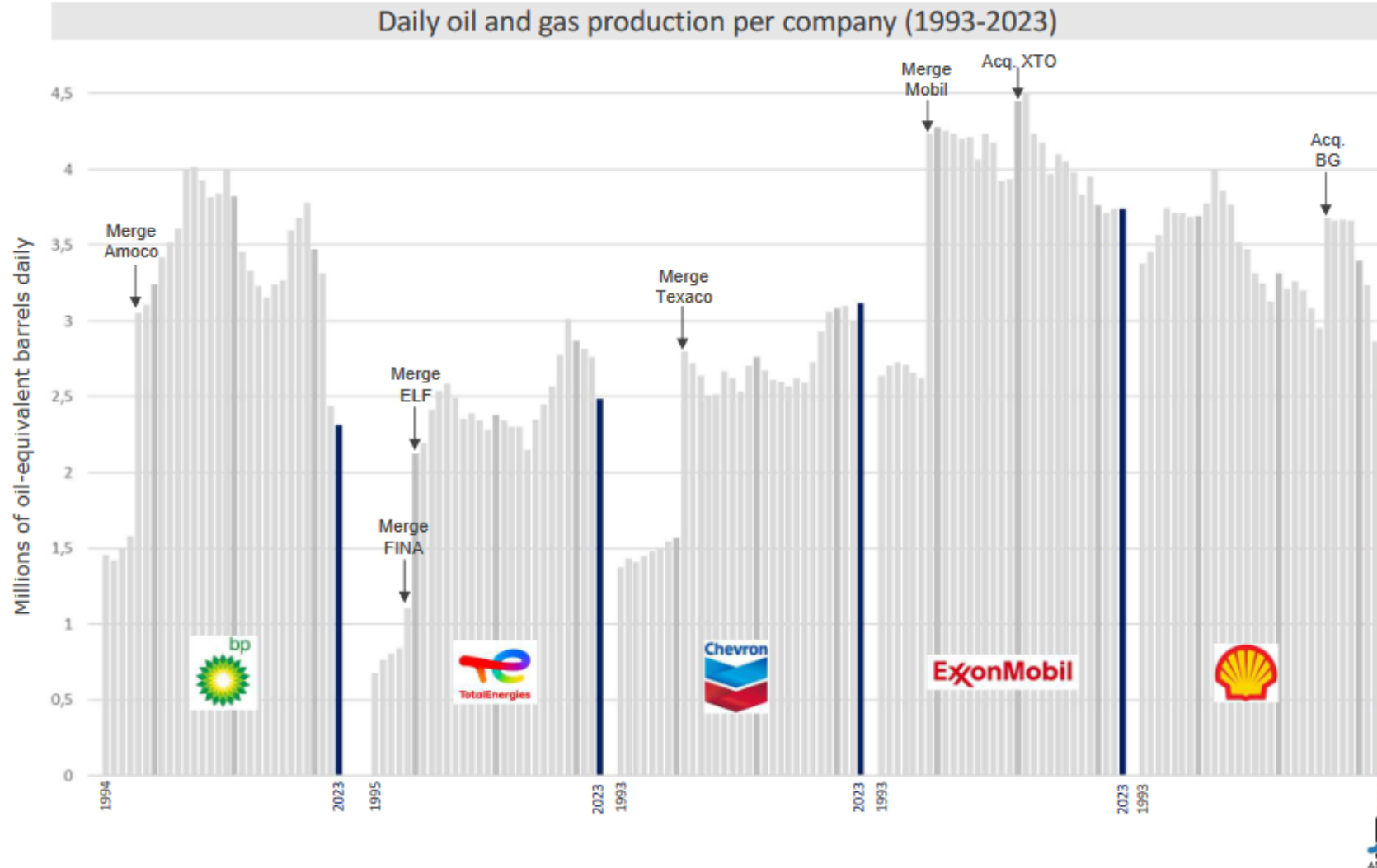
International Majors have a limited contribution in World Production of Liquids remain the majority



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International Majors Oil & Gas Production evolution with impact of M&A operations

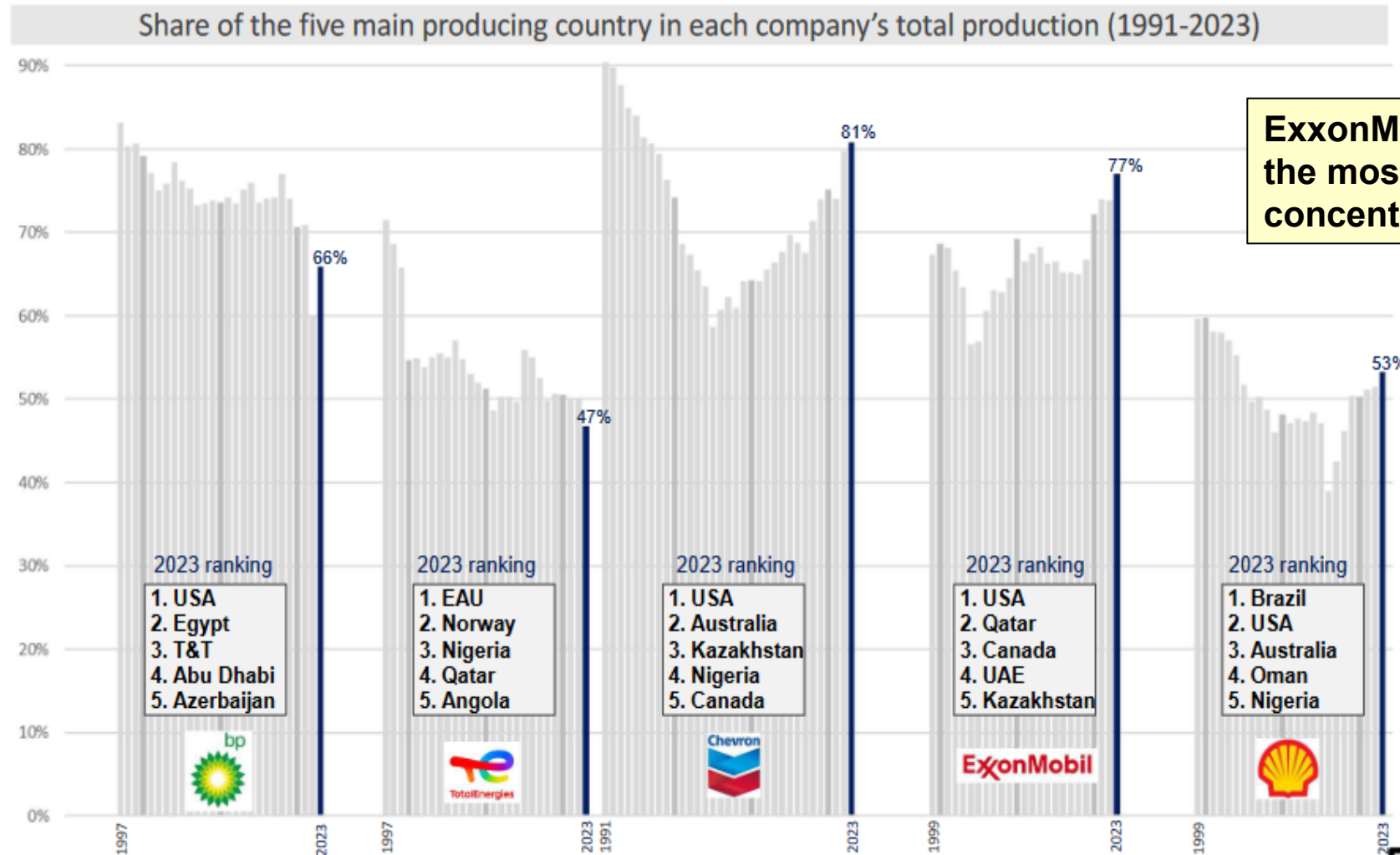


Source: Vincent Faure - ASPO 2024



International Majors Oil & Gas Production

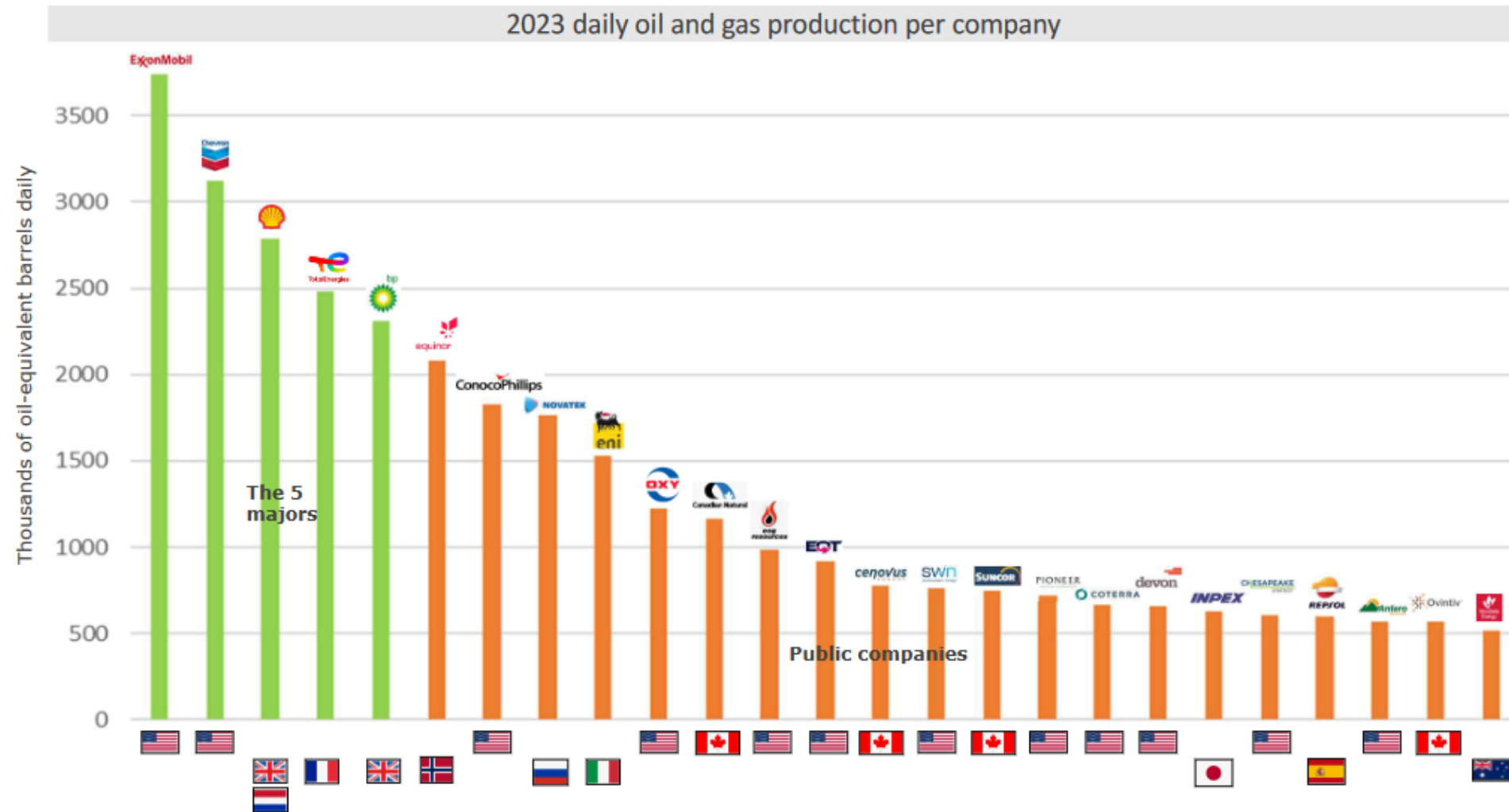
Contribution of the 5 main producing countries



ExxonMobil and Chevron are the most geographically concentrated



North American Companies are the most present in the Oil & Gas sector

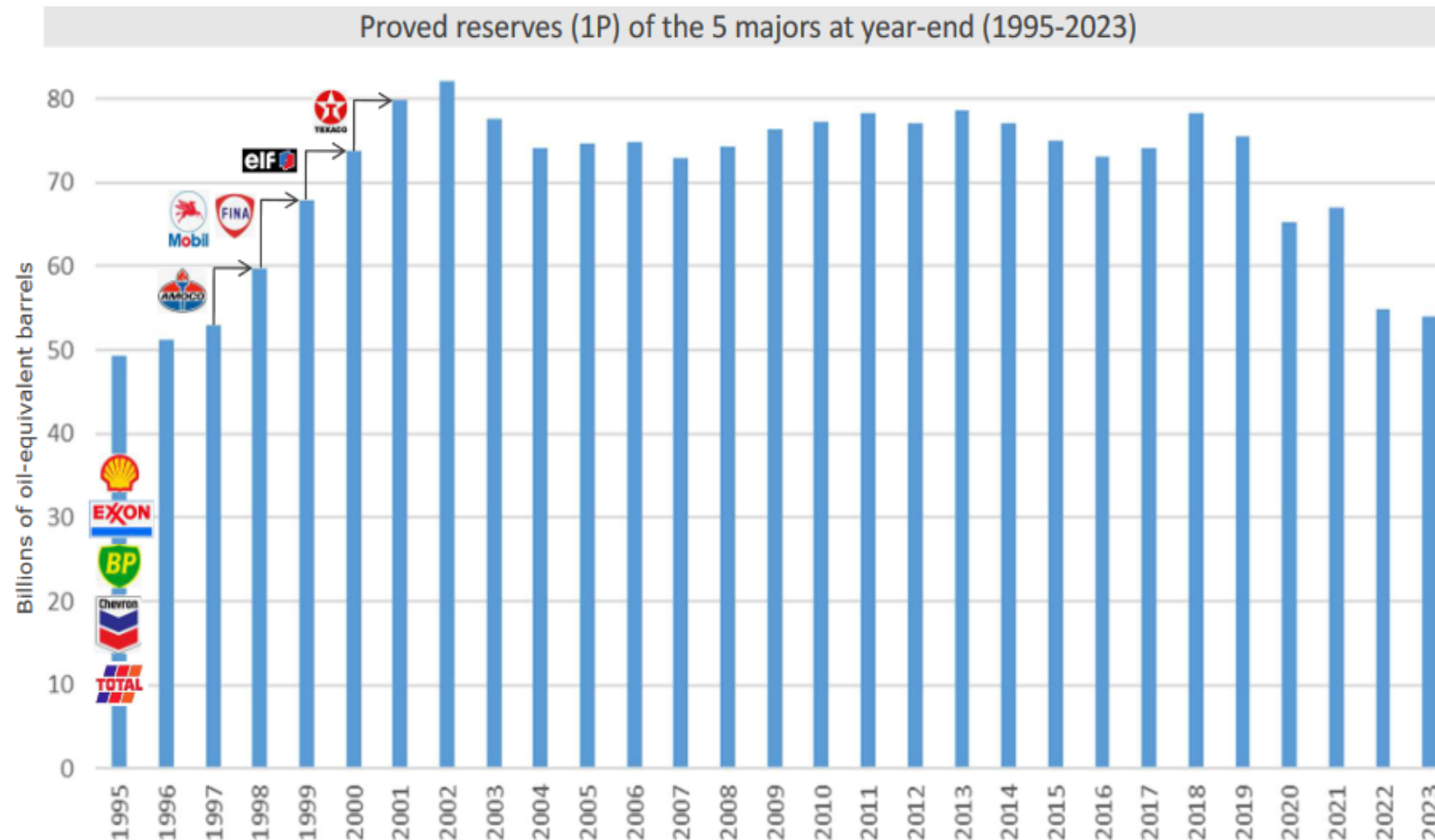


Source: Vincent Faure - ASPO 2024



International Majors Oil & Gas Proven Reserves (1P)

After decades of stability, important decline in the recent years



In 2023:
55 Gboe vs
3000 Gboe
(Total World)
= 2%

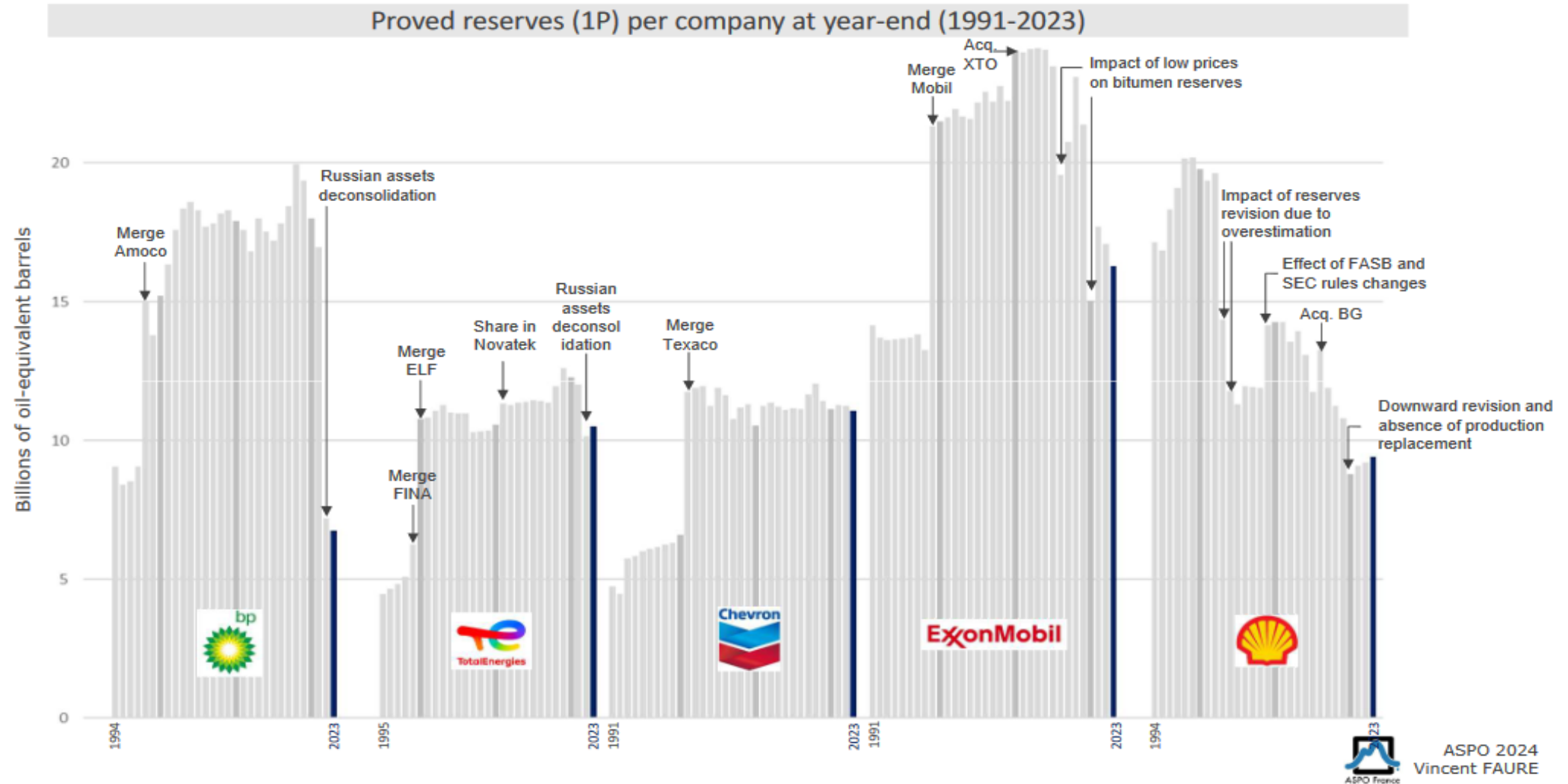
Note:

Until 1997 BP's reserves only – From 1998 BPAmoco's reserves
 Until 1998 Total's reserves only – In 1999 TotalFina's reserves – From 2000 TotalFinaElf's reserves
 Until 1998 Exxon's reserves only – From 1999 ExxonMobil's reserves
 Until 2000 Chevron's reserves only – From 2001 ChevronTexaco's reserves

Source: Vincent Faure - ASPO 2024



International Majors Oil & Gas Proven Reserves (1P) Stability for TotalEnergies and Chevron during the last decades

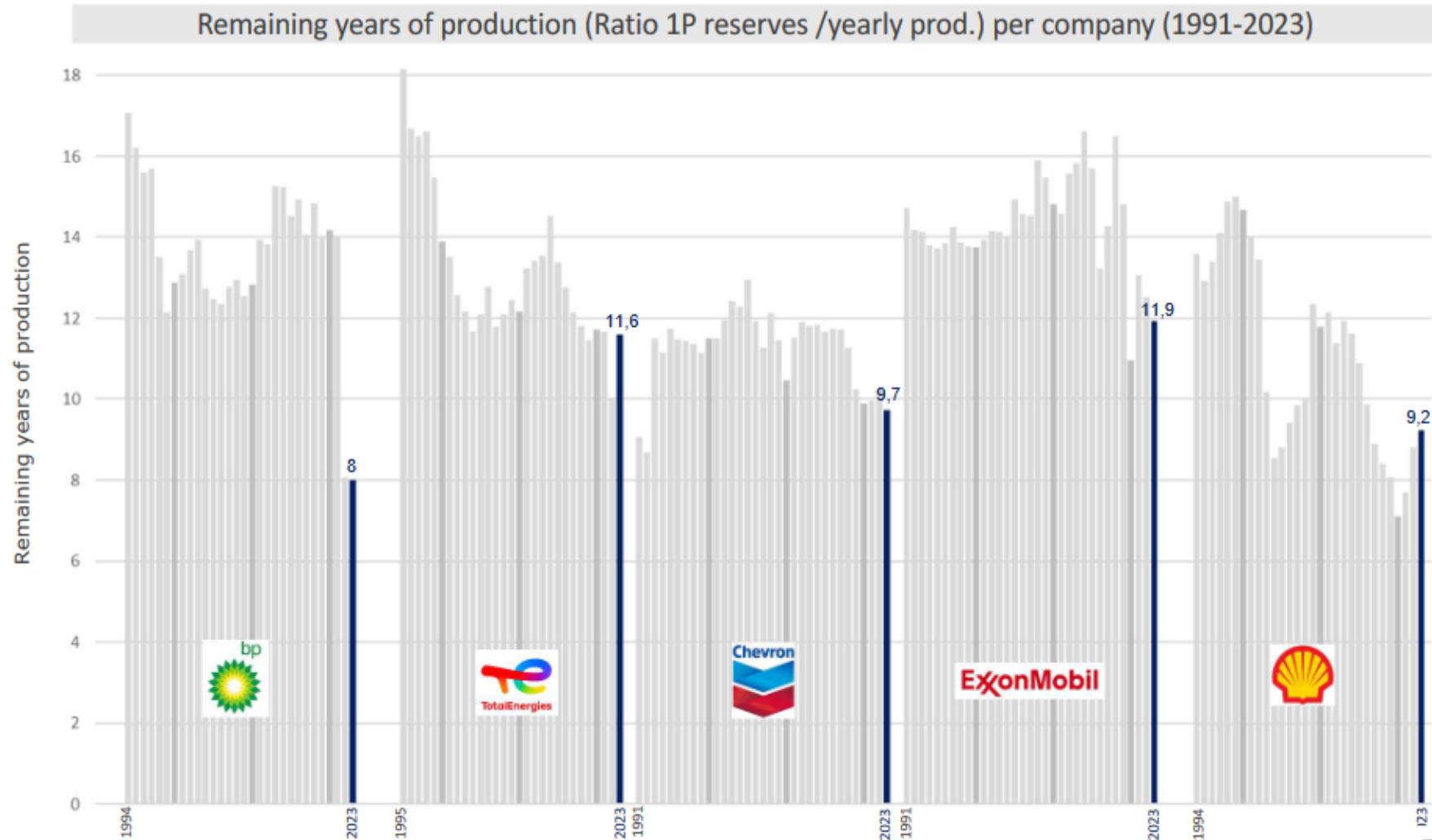


Source: Vincent Faure - ASPO 2024



International Majors Oil & Gas Proven Reserves (1P)

R/P ratio is diminishing. In 2023, between 8 and 12 years of Production

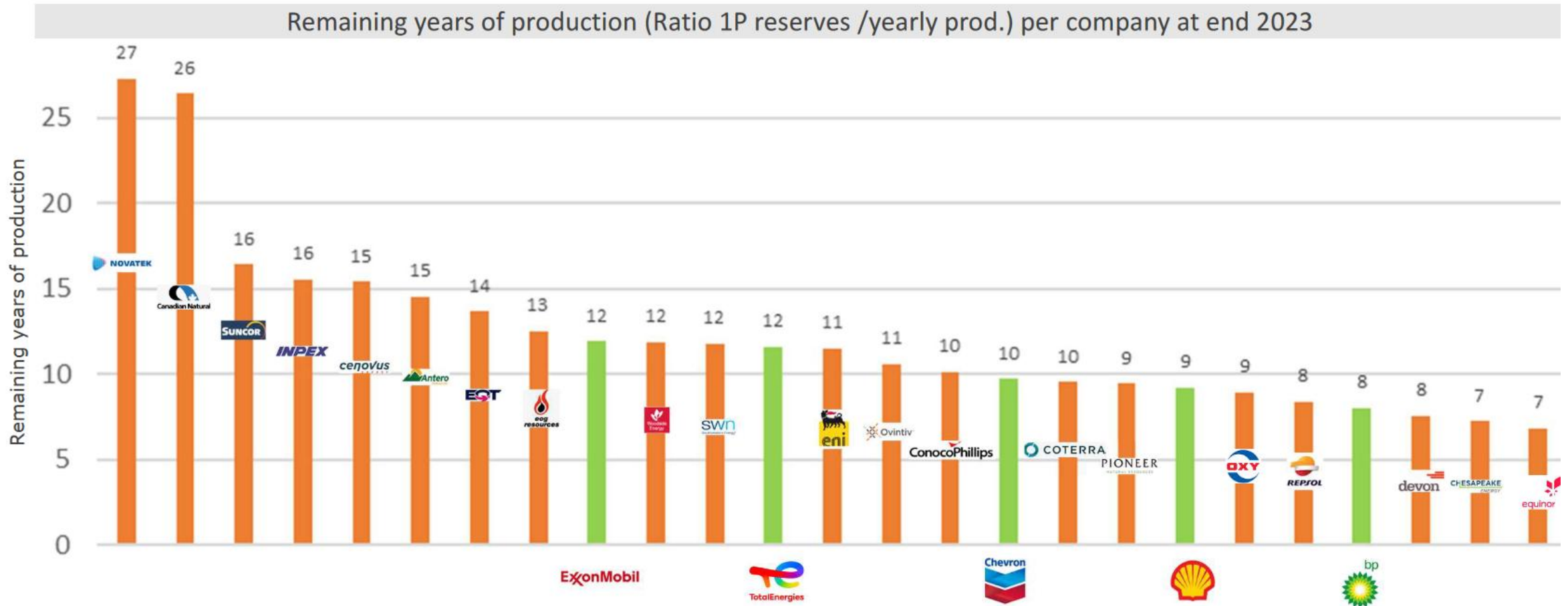


Source: Vincent Faure - ASPO 2024



25 Oil & Gas public Companies Proven Reserves (1P)

Important disparities

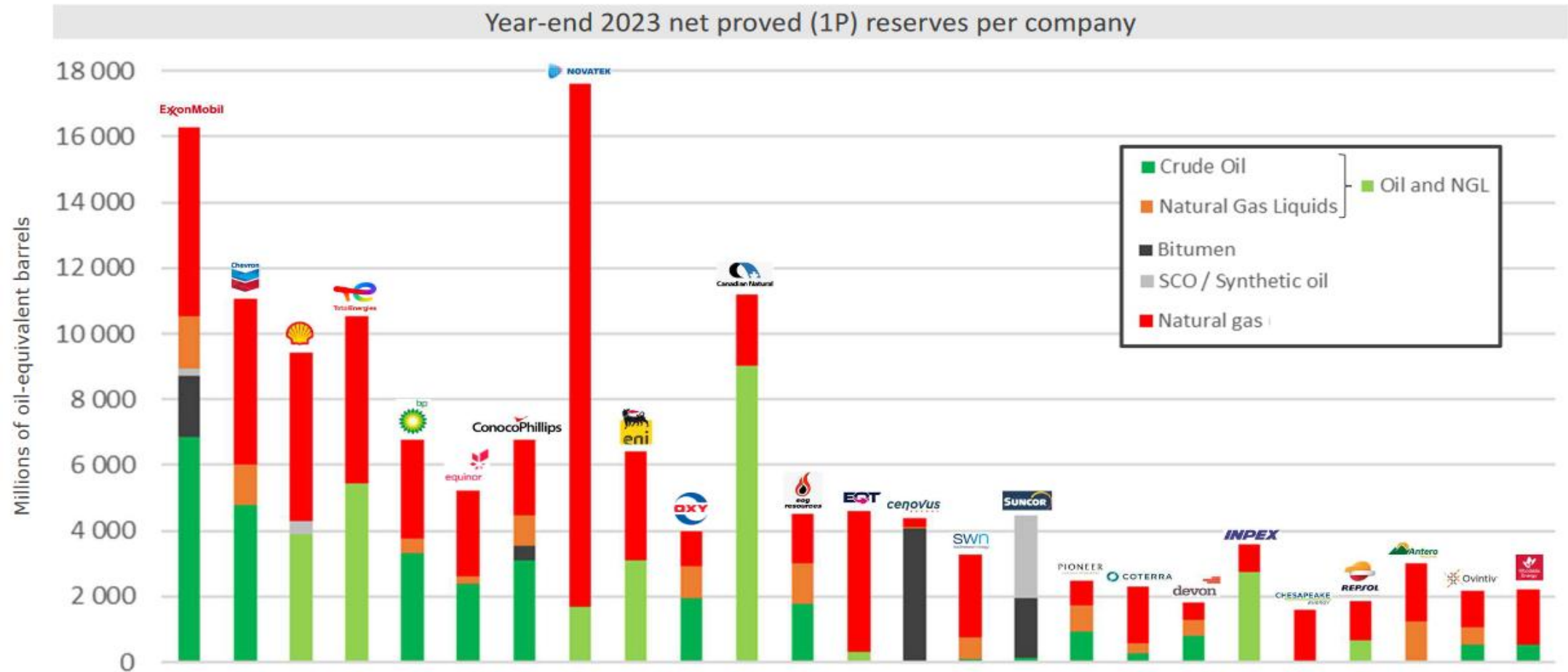


Source: Vincent Faure - ASPO 2024



25 Oil & Gas public Companies Proven Reserves (1P)

Split between Oil & Gas. In average, 50%/50%

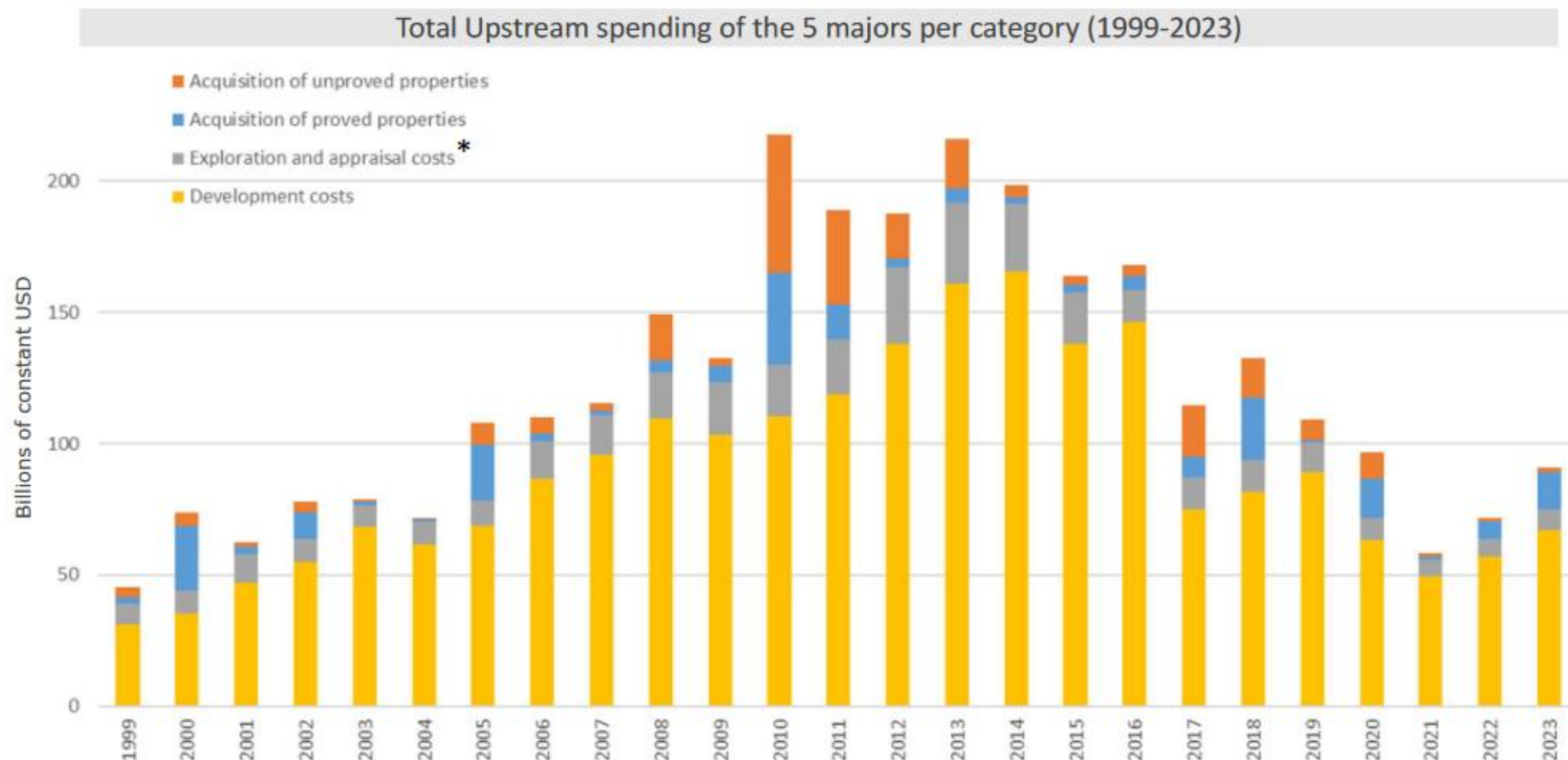


Source: Vincent Faure - ASPO 2024



International Majors Oil & Gas total Spendings including M&A

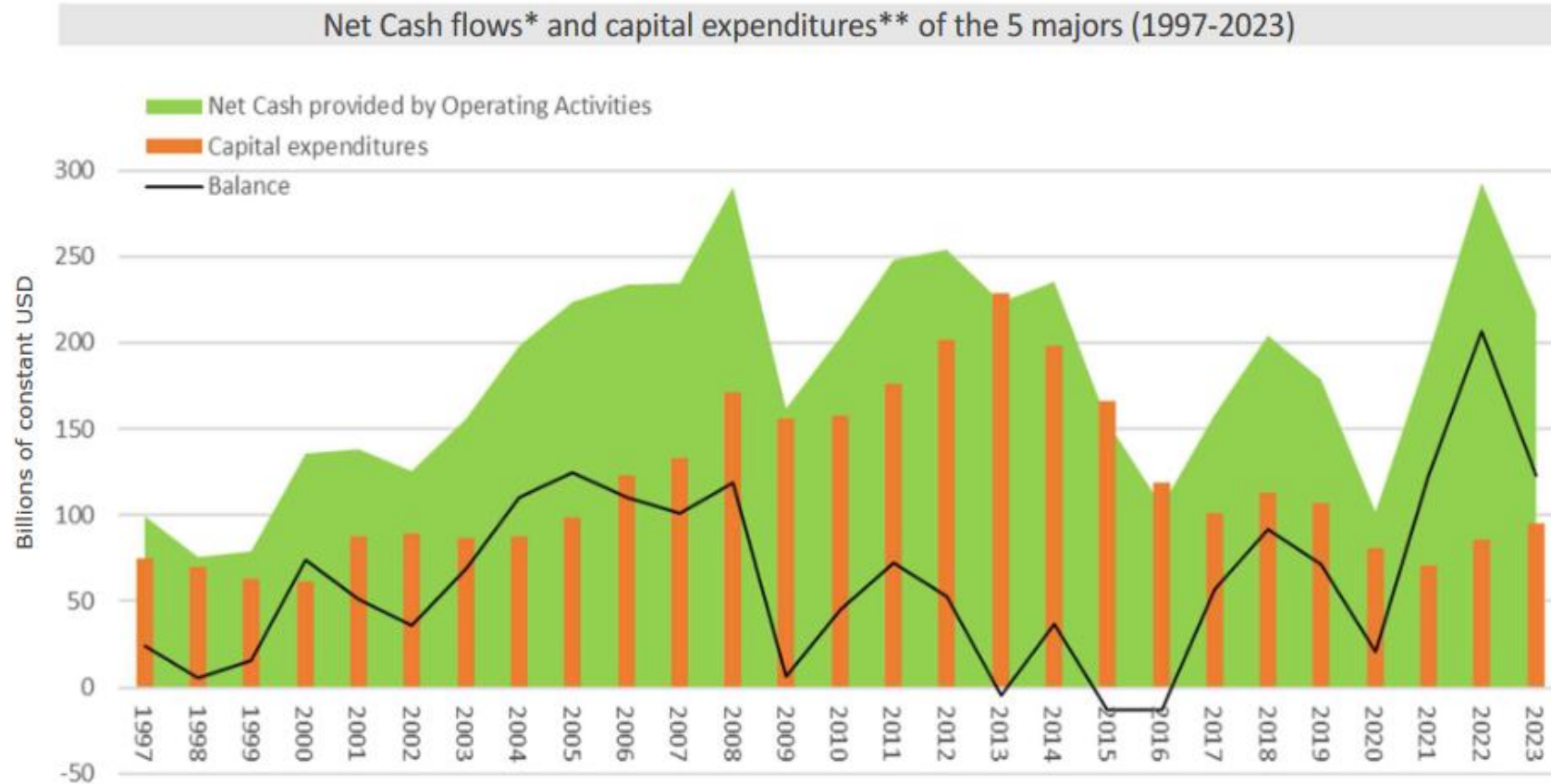
A peak of Capex in 2009 - 2014



* Includes costs incurred whether capitalized or expensed



International Majors Oil & Gas Net Cash-Flows evolution (Cst \$) 1997 - 2023



* Net Cash Flow from Operations = Cash flow after Opex, G&A, Exploration expenses, Taxes

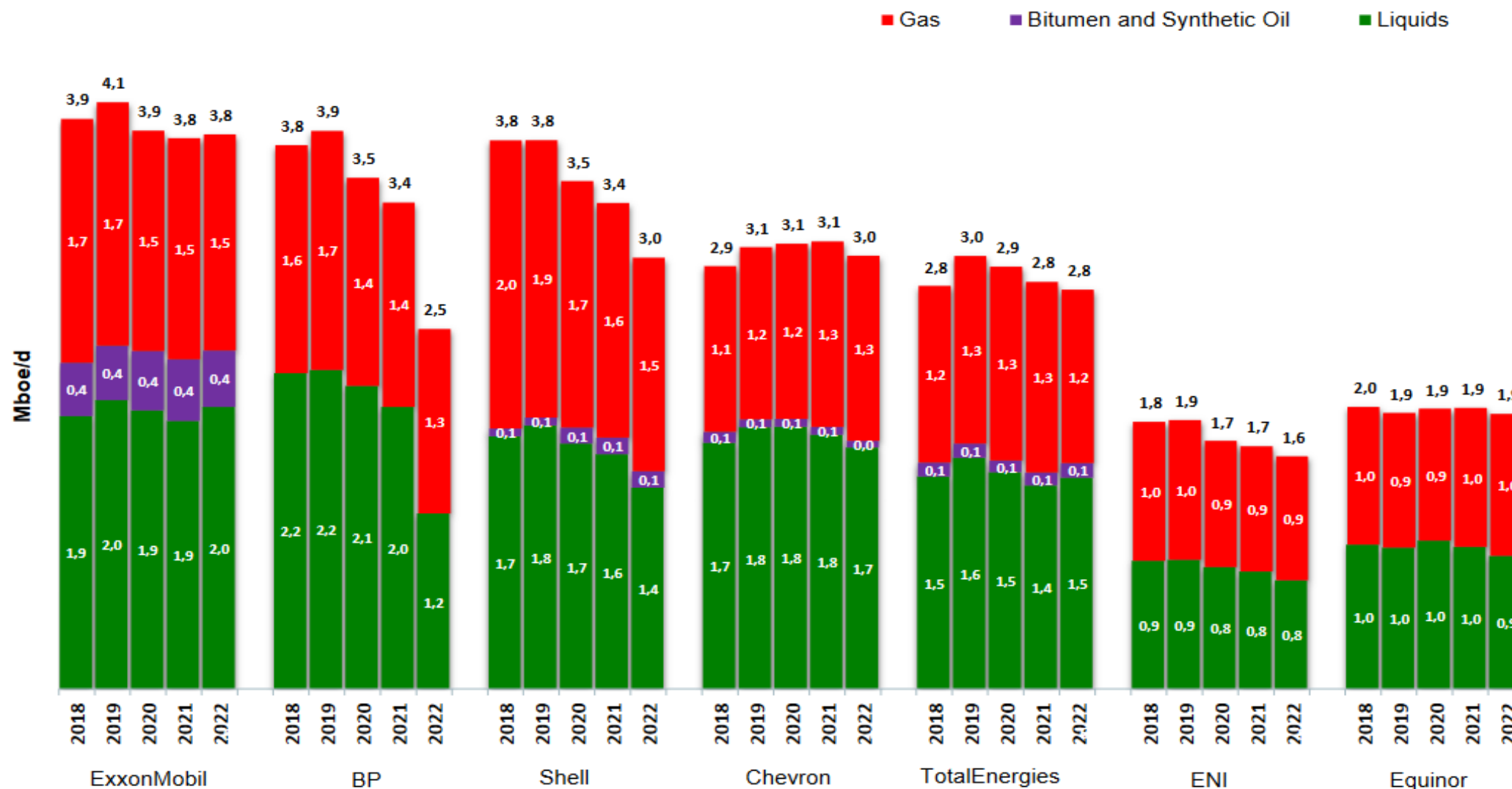
** Cash basis – Does not include cost of acquisition of businesses/companies



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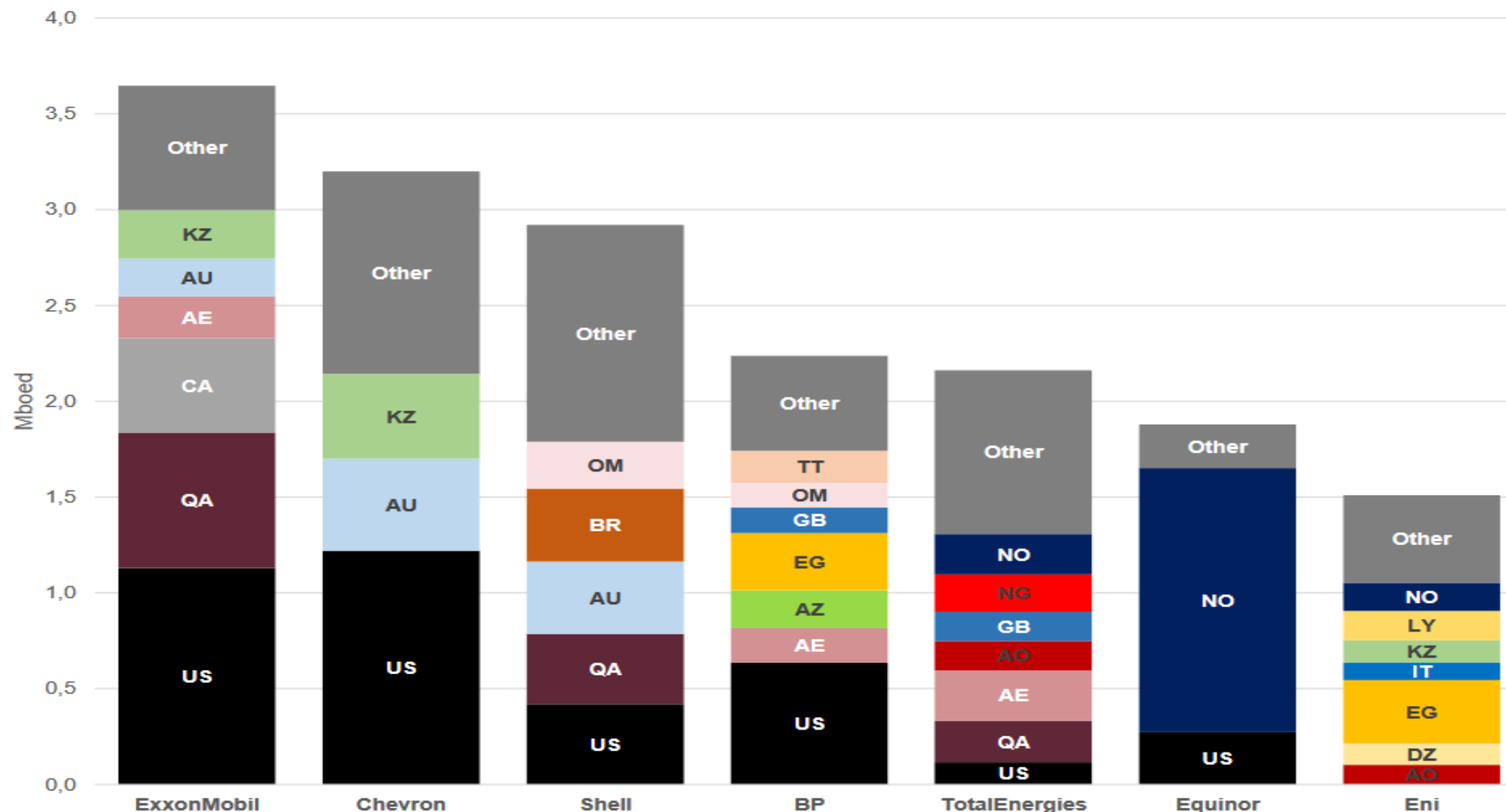
International Majors Oil & Gas Production 2018 - 2022



Source: TotalEnergies E&P Data Book 2023

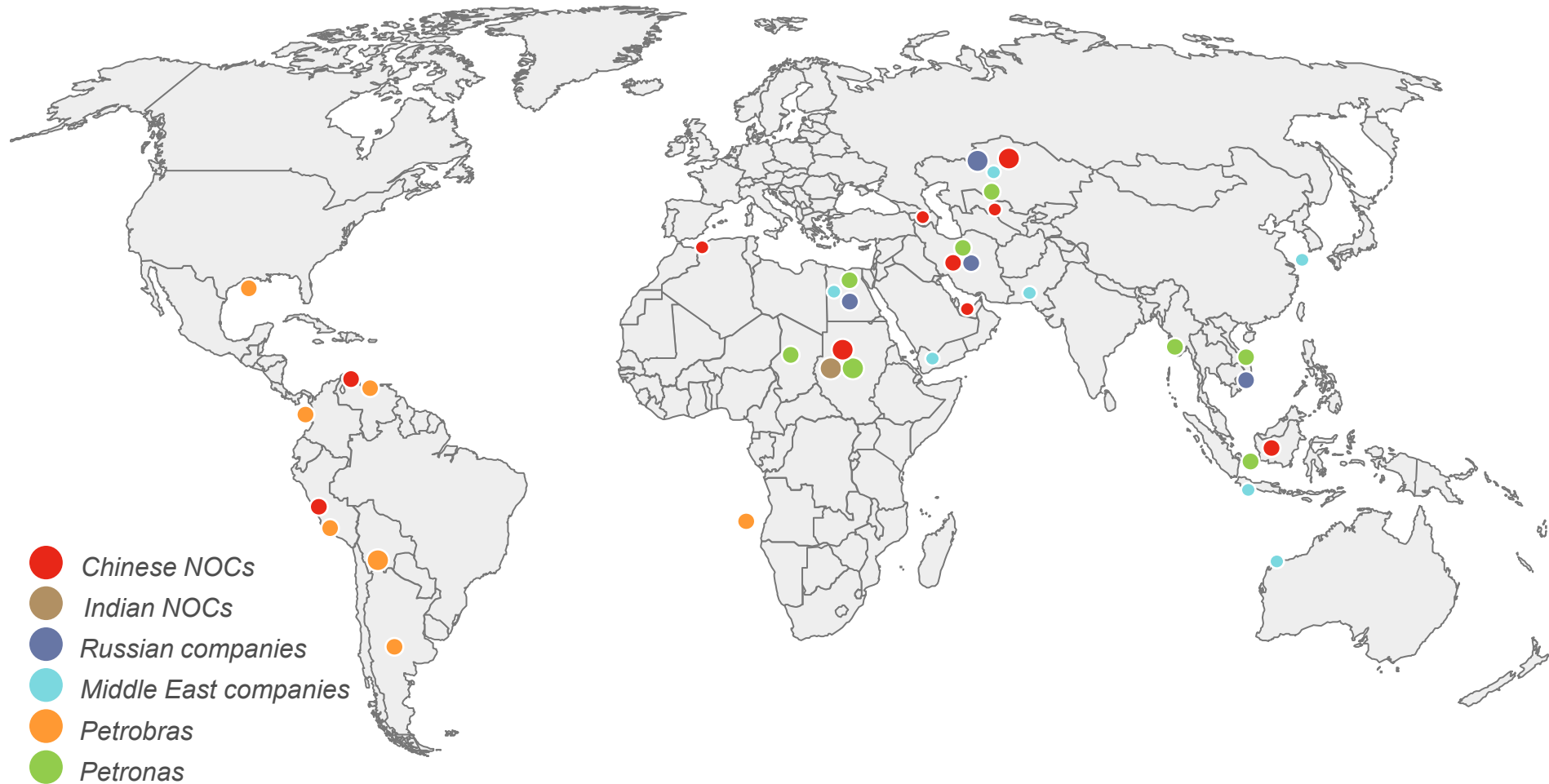


International Majors Oil & Gas Production by Countries - 2022



NOC Oil and Gas Production

2003

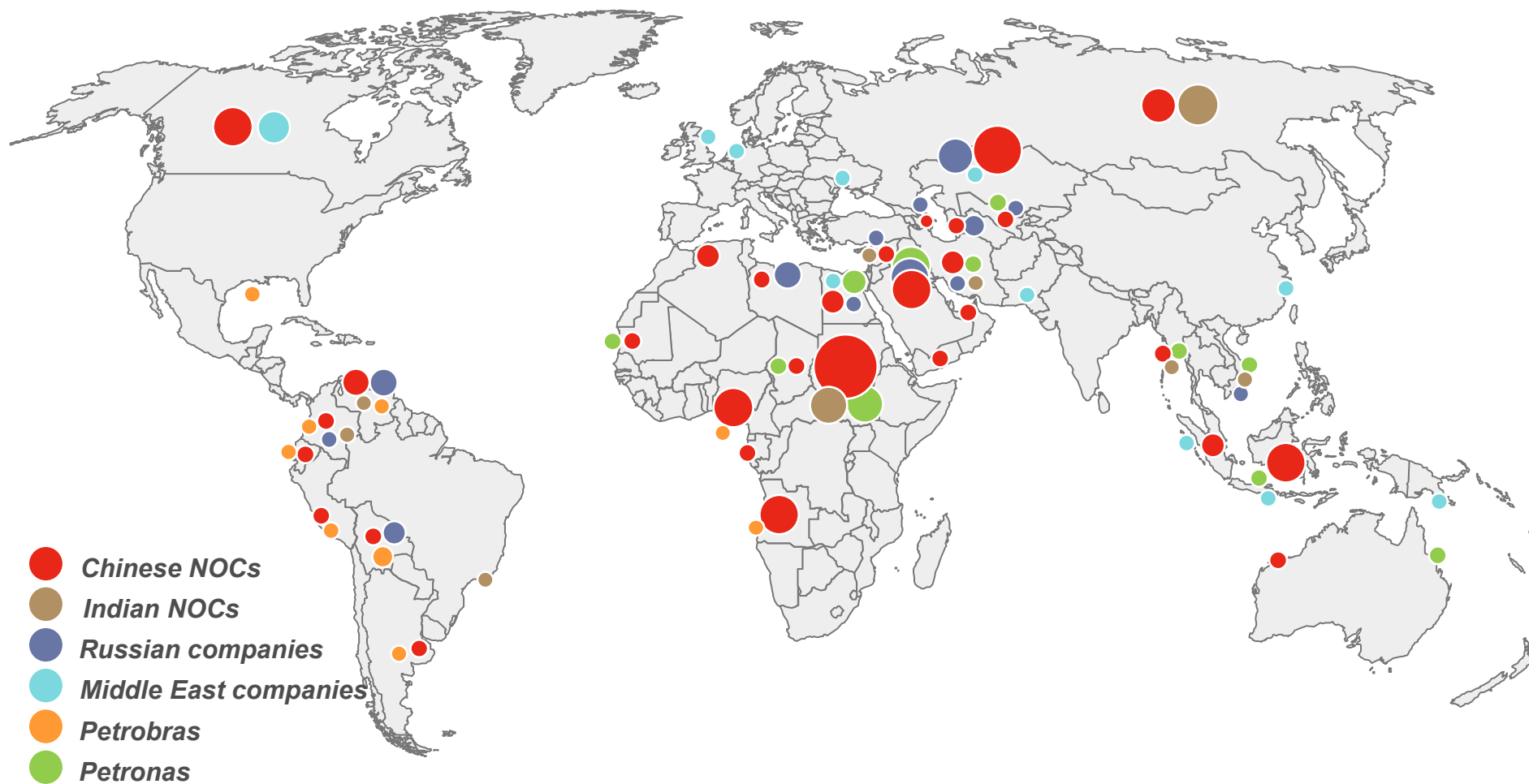


From limited foreign exposure...



NOC Oil and Gas Production

2009



... to fast expansion outside their home countries



A zoom on OPEC



OPEC

OPEC is a permanent, intergovernmental organization, established in Baghdad, Iraq, on 10-14 September 1960.

The Organization was founded by the Islamic Republic of Iran, Iraq, Kuwait, Saudi Arabia and Venezuela.

These countries were joined later by Qatar, Indonesia, Libya, the United Arab Emirates, Algeria, Nigeria, Ecuador, Gabon, Angola, Equatorial Guinea and Congo.

**During the past years, after some back and forth moves, certain countries decided to suspend their membership:
Indonesia in 2016, Qatar in 2019, Ecuador in 2020.**

The organization comprises now 13 members. Angola recently left OPEC

The organization has its headquarters in Vienna, Austria.





Organization of the Petroleum Exporting Countries

2025 OPEC Annual Statistical Bulletin

60th edition

65
YEARS

Successful past, sustainable future



OPEC

OPEC Members' facts and figures, 2024

	Algeria	Congo	Equatorial Guinea	Gabon	IR Iran	Iraq	Kuwait	Libya	Nigeria	Saudi Arabia	United Arab Emirates	Venezuela	OPEC
Population million people	46.70	6.31	1.59	2.26	86.63	46.12	4.99	6.91	227.82	35.30	11.03	33.24	508.89
Land area ¹ 1,000 sq km	2,382	342	28	268	1,648	438	18	1,760	924	2,150	84	916	10,957
GDP per capita \$	5,717	2,361	7,889	9,200	4,633	6,063	32,126	6,099	824	35,058	50,088	3,604	6,477
Nominal GDP at market prices million \$	266,979	14,893	12,544	20,774	401,357	279,641	160,238	42,159	187,627	1,237,530	552,325	119,808	3,295,875
GDP growth, real PPP %	3.5	2.6	1.9	3.1	3.5	0.3	-2.8	-0.6	3.4	1.3	3.8	5.3	2.5
Value of exports million \$	55,232	8,600	4,500	12,536	106,604	111,342	89,719	32,262	56,961	360,897	618,902	21,117	1,478,672
Value of imports million \$	54,710	6,300	3,100	5,611	86,479	90,379	61,525	21,639	58,908	317,012	546,902	15,300	1,267,863
Current account balance million \$	-3,660	1,041	711	942	9,439	8,768	46,704	2,928	17,215	-5,685	53,019	4,821	136,244
Value of petroleum exports million \$	25,815	6,338	1,784	6,000	46,776	100,972	68,886	28,697	47,322	223,372	77,655	18,372	651,990
Proven crude oil reserves million barrels	12,200	1,811	1,100	2,000	208,600	145,019	101,500	48,363	37,280	267,200	113,000	303,221	1,241,294
Natural gas reserves billion s cu m	4,504	284	40	27	33,988	3,714	1,784	730	5,979	9,727	8,210	5,511	74,498
Crude oil production 1,000 b/d	907	260	57	224	3,257	3,862	2,411	1,136	1,345	8,955	2,916	921	26,251
Natural gas marketed production million s cu m	103,966	425	6,914	477	277,611	11,073	16,325	16,411	44,322	102,894	57,820	22,586	660,823
Refinery capacity 1,000 b/d	677	21	na	25	2,237	1,266	1,451	666	1,125	3,291	1,227	2,154	14,139
Refinery throughput 1,000 b/d	703	20	na	14	1,863	789	1,235	132	248	2,591	991	335	8,921
Output of petroleum products 1,000 b/d	681	19	na	16	1,854	988	1,288	188	243	2,597	911	268	9,052
Oil demand 1,000 b/d	467	8	5	47	1,859	977	468	318	483	3,386	1,017	276	9,311
Crude oil exports ² 1,000 b/d	459	236	56	204	1,566	3,364	1,176	1,002	1,522	6,049	2,717	656	19,008
Exports of petroleum products 1,000 b/d	516	5	0	10	411	186	1,196	78	170	1,292	985	218	5,068
Imports of petroleum products 1,000 b/d	12	0	5	5	92	75	11	224	394	340	290	81	1,529
Natural gas exports million s cu m	49,087	0	4,793	0	8,967	0	0	1,296	32,860	0	4,491	0	101,494

Notes:

1. Land area figures as per official websites.
2. Crude oil exports may include lease condensates and volumes of oil in transit.

Source: OPEC ASB 2025



OPEC Member's contribution in Reserves & Production

Countries	Oil Proven Reserves At 31/12/2024 (Gb)	Production 2024 (Mb/d)	Population (Million)
Saudi Arabia	267,2	8,96	35,3
Iran	208,6	3,26	86,6
Irak	145,0	3,86	46,1
Kuwait	101,5	2,41	5,0
UEA	113,0	2,92	11,0
Total Middle East	835,3	21,41	184,0
Venezuela	303,2	0,92	33,2
Nigeria	37,3	1,35	227,8
Libya	48,4	1,14	6,9
Algeria	12,2	0,91	46,7
Equatorial Guinea	1,1	0,10	1,6
Gabon	2,0	0,22	2,3
Congo	1,8	0,26	6,3
Total OPEC	1241,3	26,25	508,9

Data from OPEC ASB 2025

* Reserves include Crude oil, gas condensate , NGLs
and Venezuela heavy oil

421

TPA Toolbox Energy Book 4 - Oil



OPEC – Population Evolution

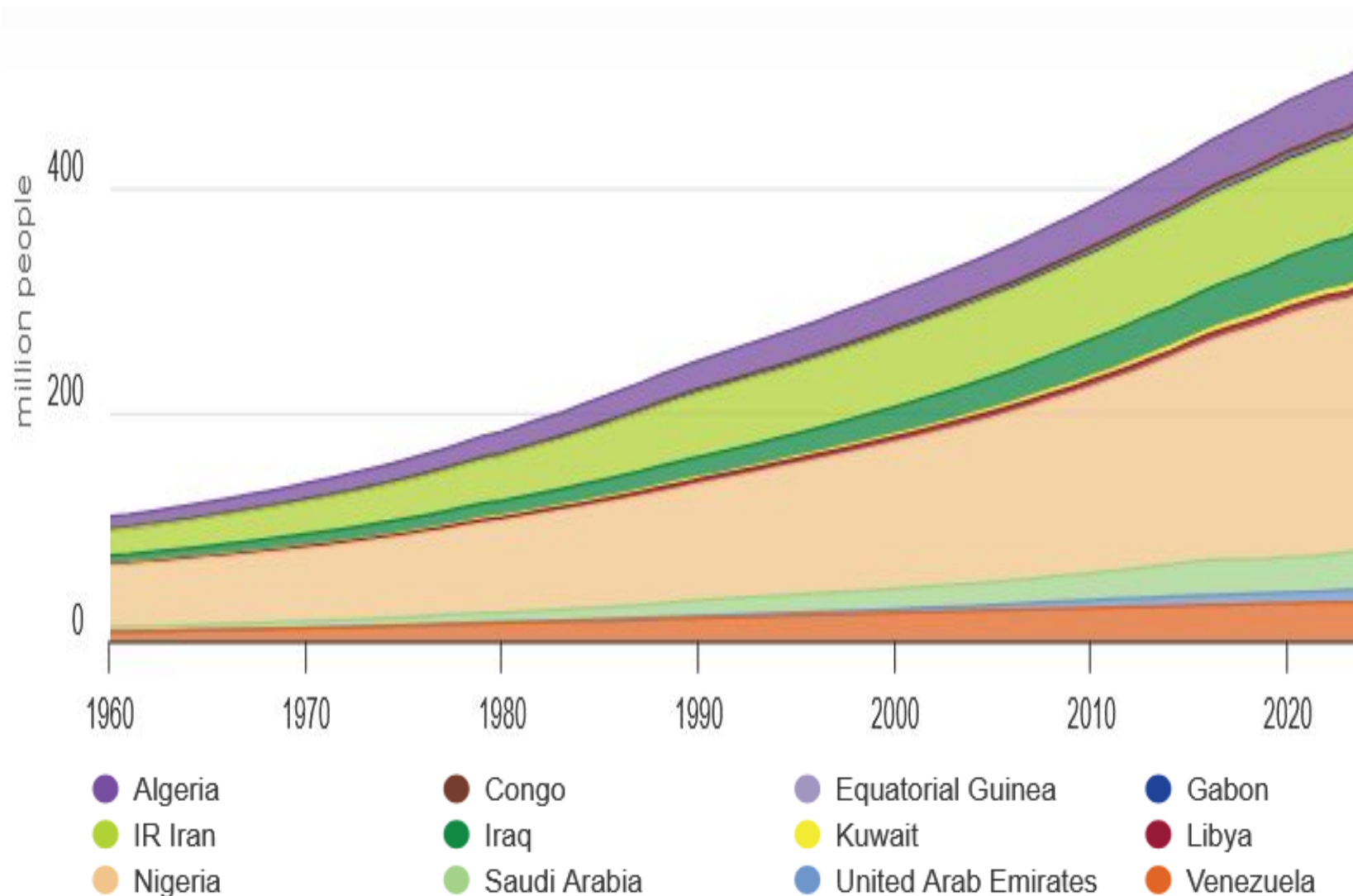
OPEC Members' population

(million people)

	2020	2021	2022	2023	2024	change 24/23
Algeria	44.244	45.024	45.800	46.344	46.700	0.356
Congo	5.702	5.836	5.970	6.138	6.309	0.171
Equatorial Guinea	1.406	1.452	1.498	1.544	1.590	0.046
Gabon	2.108	2.135	2.161	2.209	2.258	0.049
IR Iran	84.038	84.055	84.904	85.761	86.626	0.865
Iraq	40.150	41.191	42.249	43.324	46.119	2.795
Kuwait	4.671	4.628	4.737	4.860	4.988	0.128
Libya	6.644	6.710	6.777	6.845	6.913	0.068
Nigeria	213.402	218.402	221.602	222.179	227.821	5.642
Saudi Arabia	31.553	30.784	32.175	33.703	35.300	1.597
United Arab Emirates	9.449	9.789	10.242	10.642	11.027	0.385
Venezuela	32.605	32.986	33.360	33.729	33.242	-0.487
OPEC	475.972	482.992	491.475	497.278	508.892	11.615



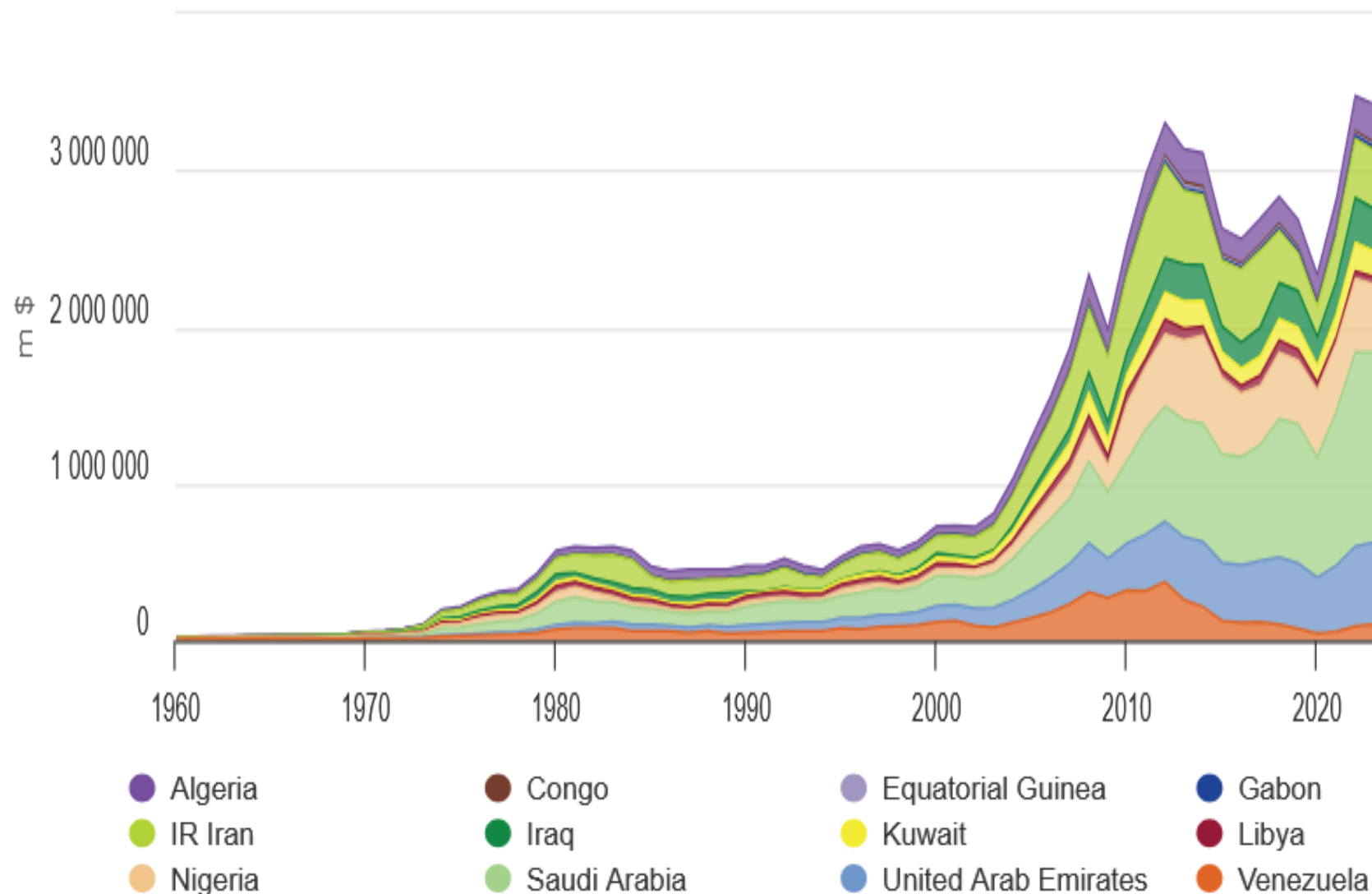
OPEC – Population Evolution



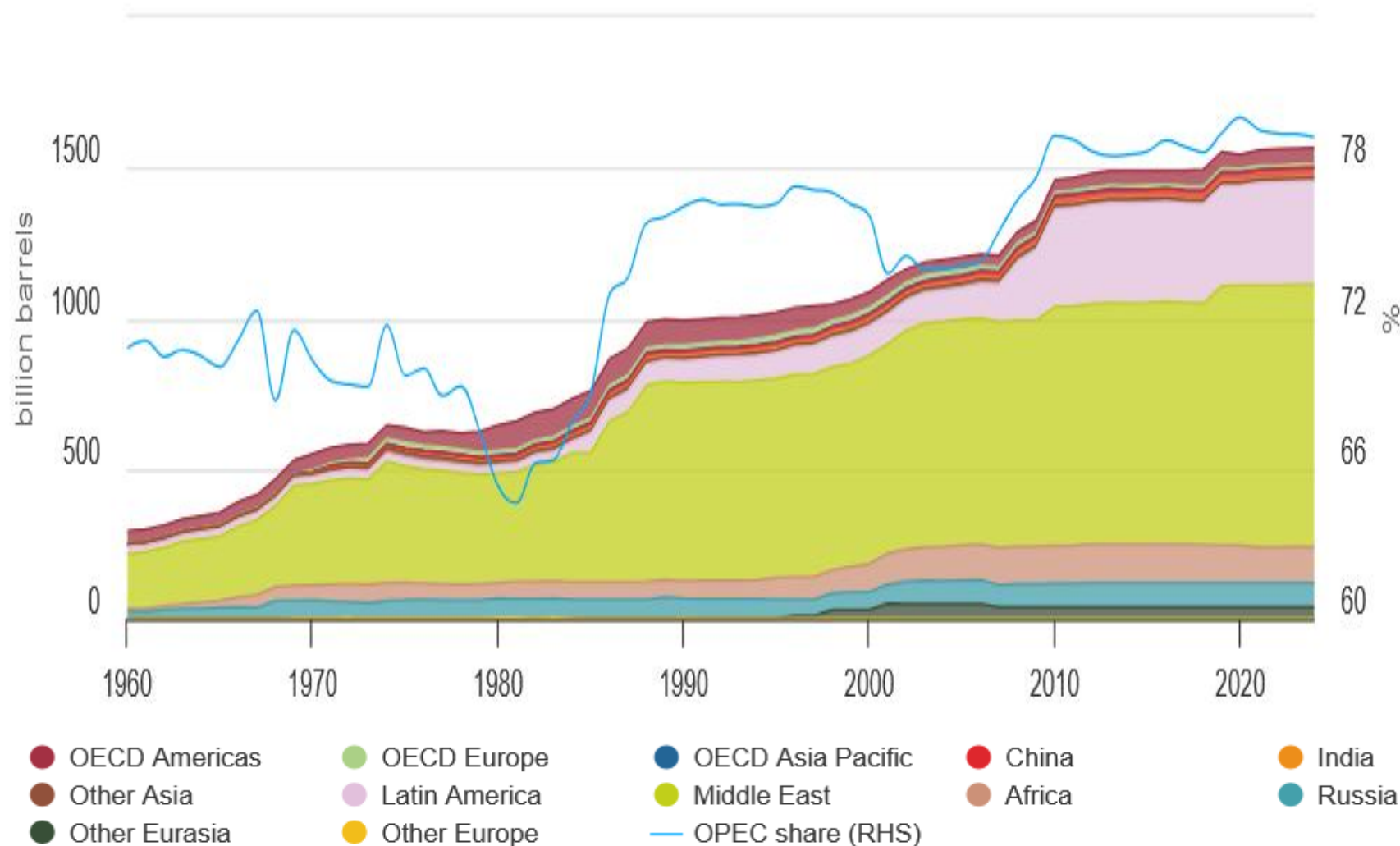
Source: OPEC ASB 2025



OPEC Members' GDP (Current Market Price)



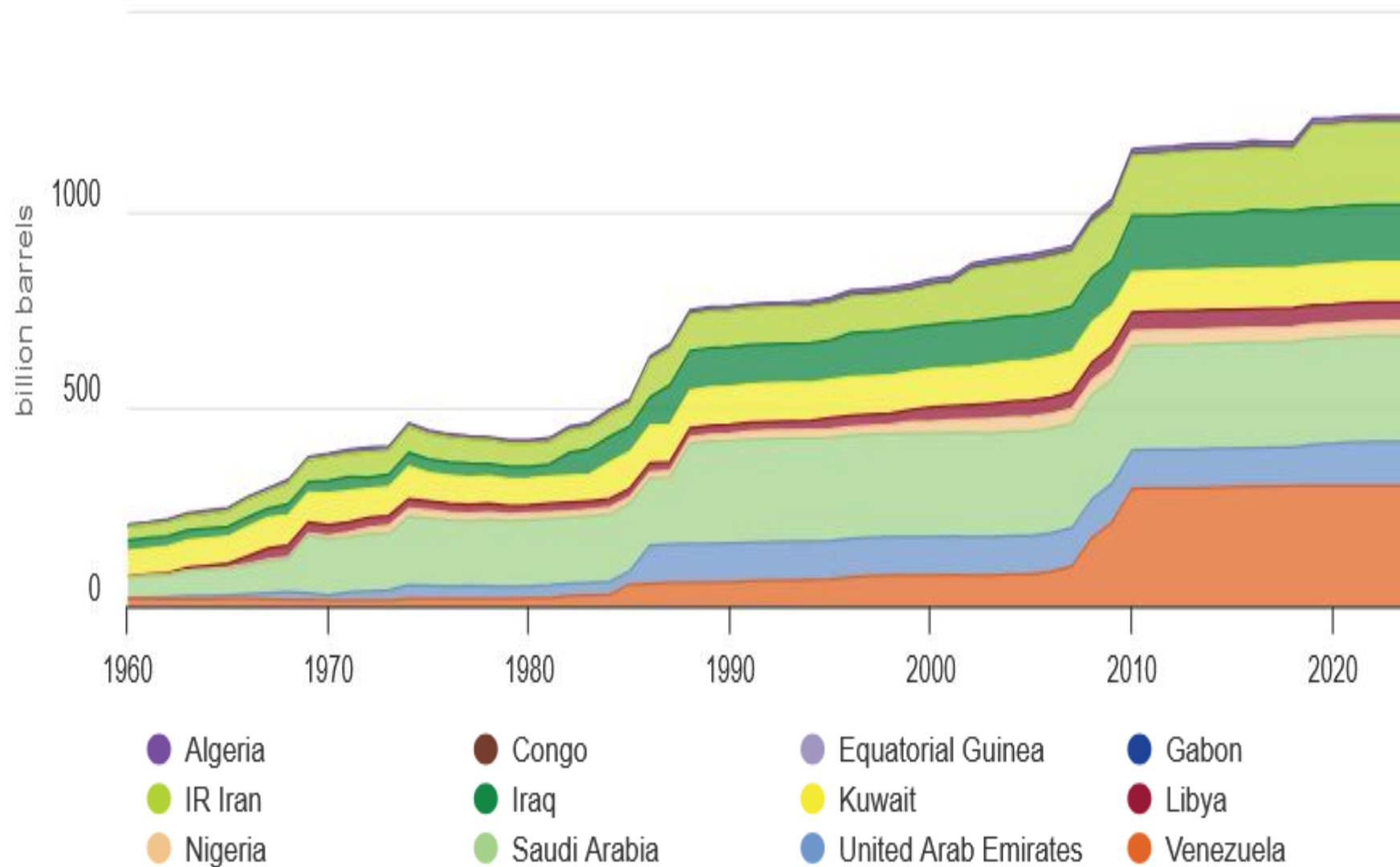
World Crude Oil Proven Reserves (Gb) and OPEC Share



Source: OPEC ASB 2025



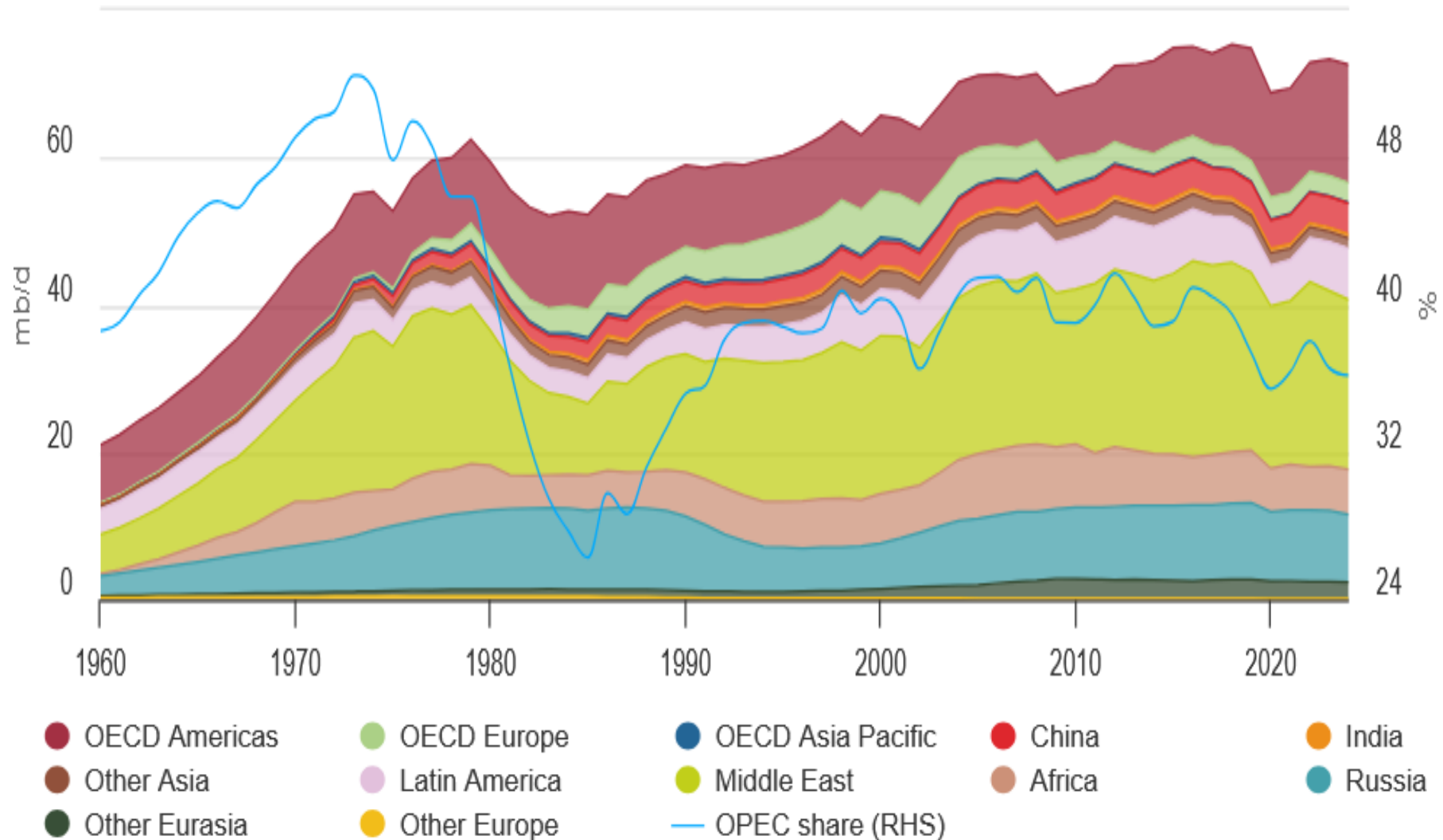
OPEC Members **Crude Oil** Proven Reserves (Gb)



Source: OPEC ASB 2025



World Crude Oil Production (Mb/d) & OPEC Share



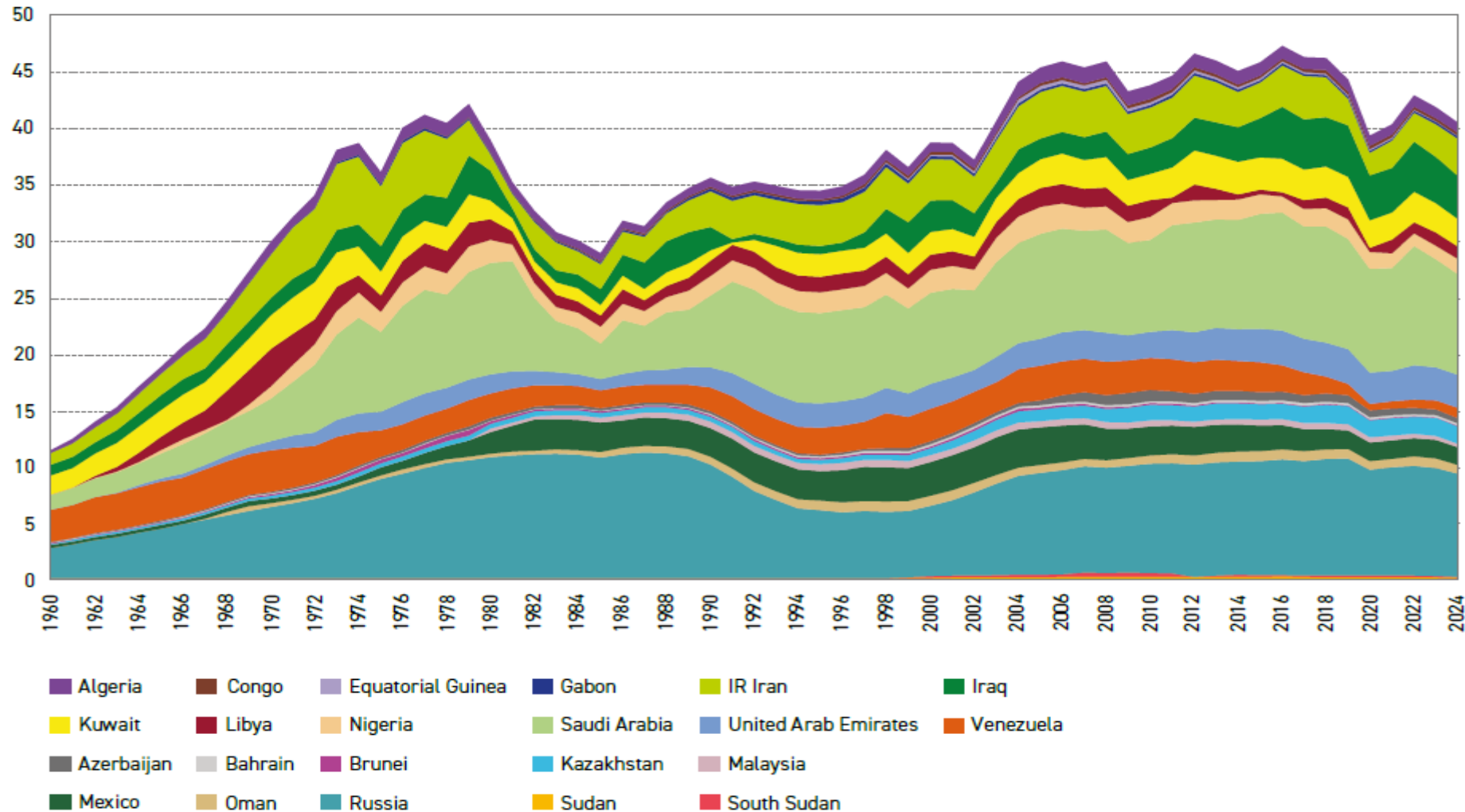
Source: OPEC ASB 2025



OPEC & non OPEC DoC Members **Crude Oil Production (Mb/d)**

Crude oil production in OPEC and non-OPEC DoC Members

(mb/d)



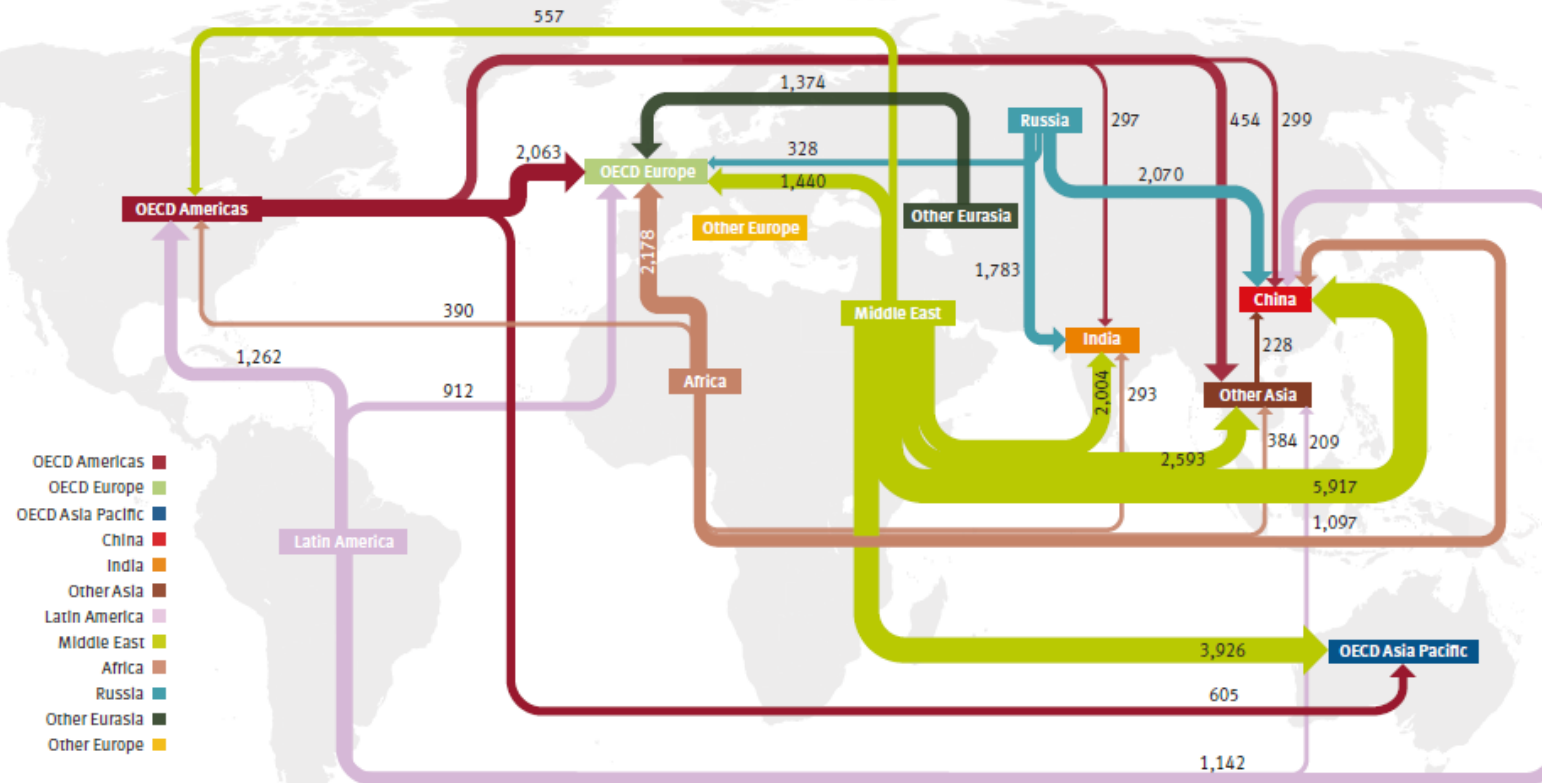
Source: OPEC ASB 2025
DoC: Declaration of Participation



OPEC Flows of Crude Oil Trade

World inter-regional trade of crude oil, 2024

(1,000 b/

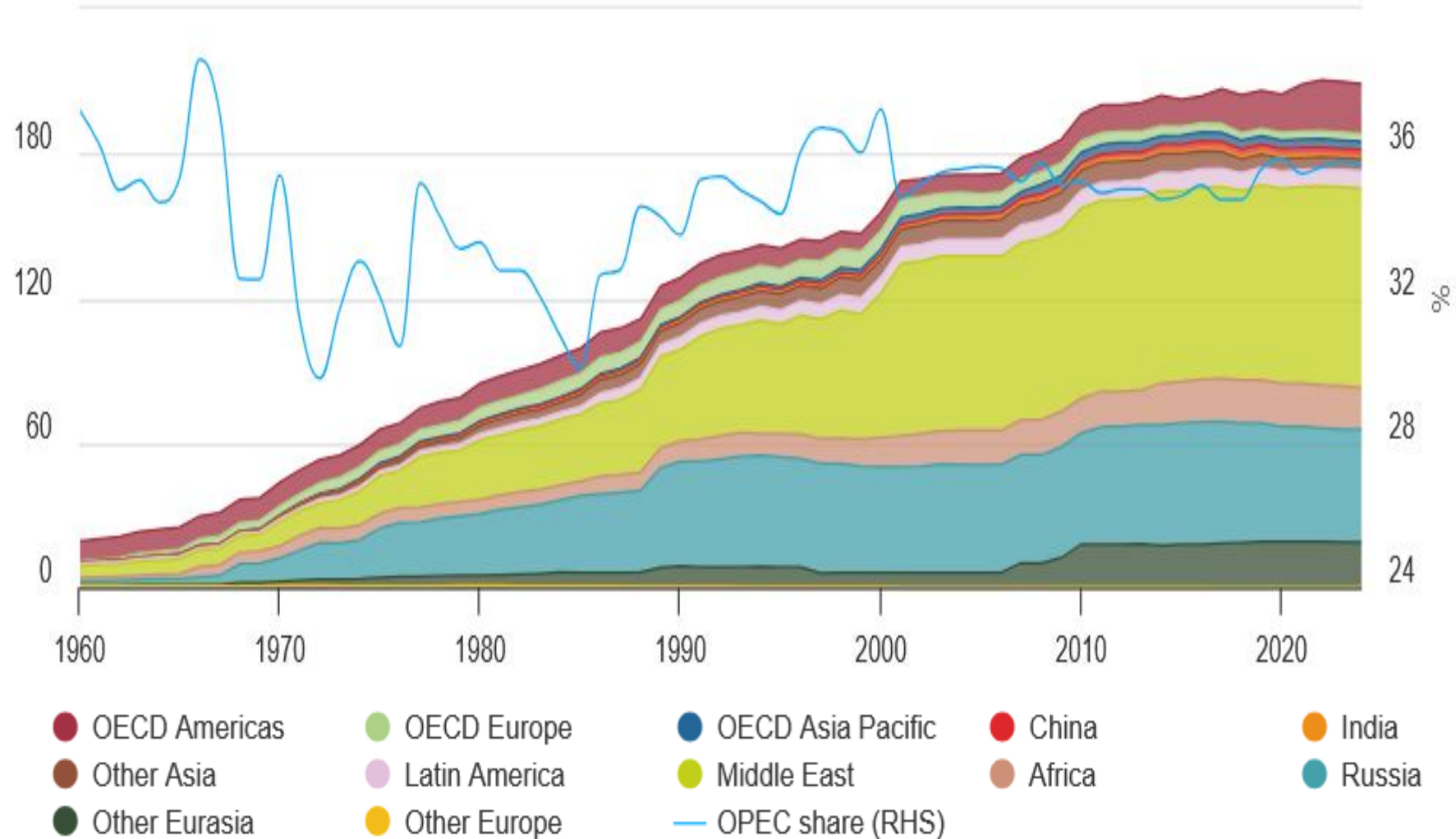


Notes:
 Excluding intraregional trade.
 Only volumes greater than 200,000 b/d are shown.
 Data may include lease condensates and volumes of oil in transit.

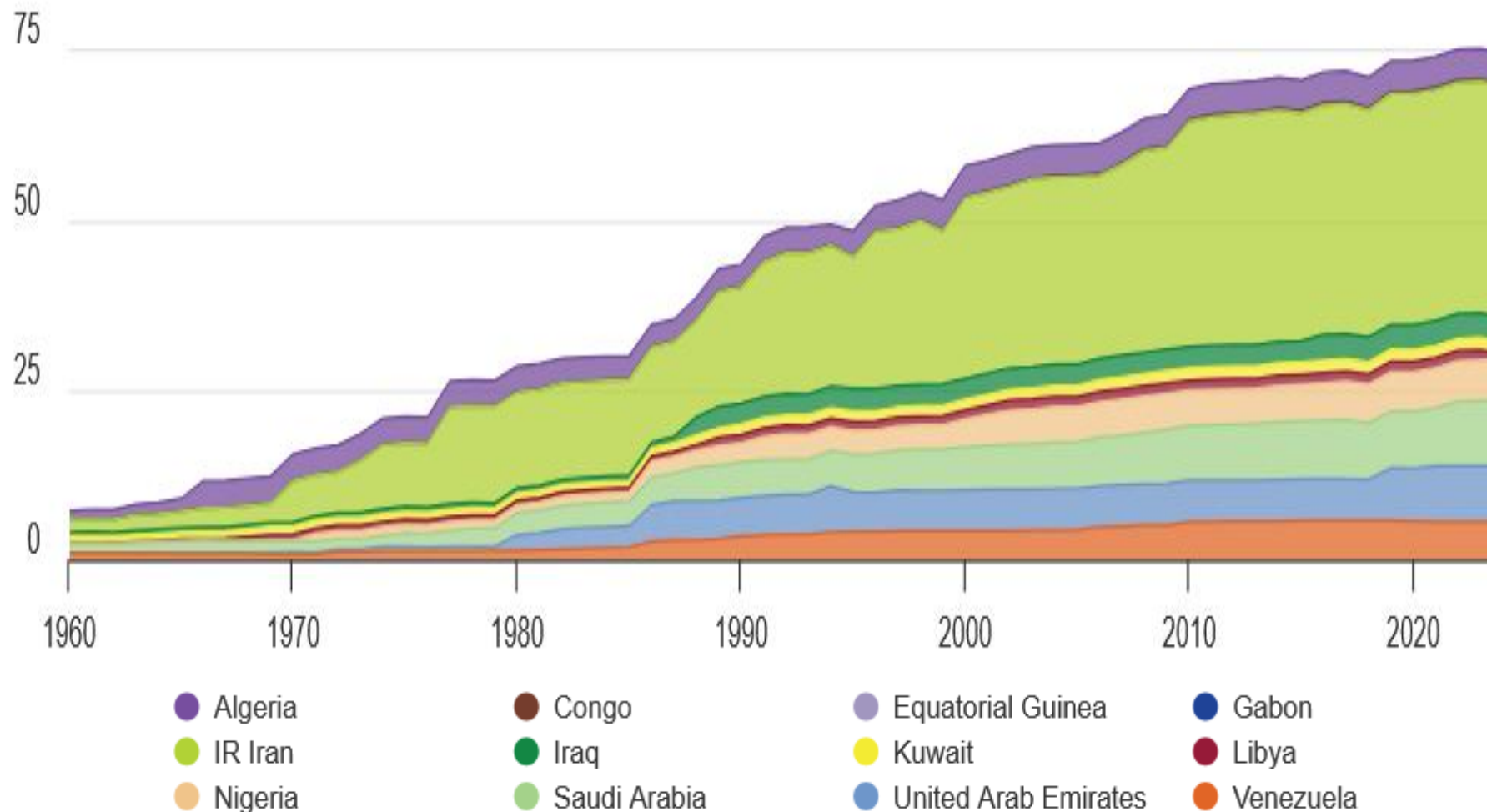
Source: OPEC ASB 2025



World Gas Proven Reserves (T.m³) & OPEC Share



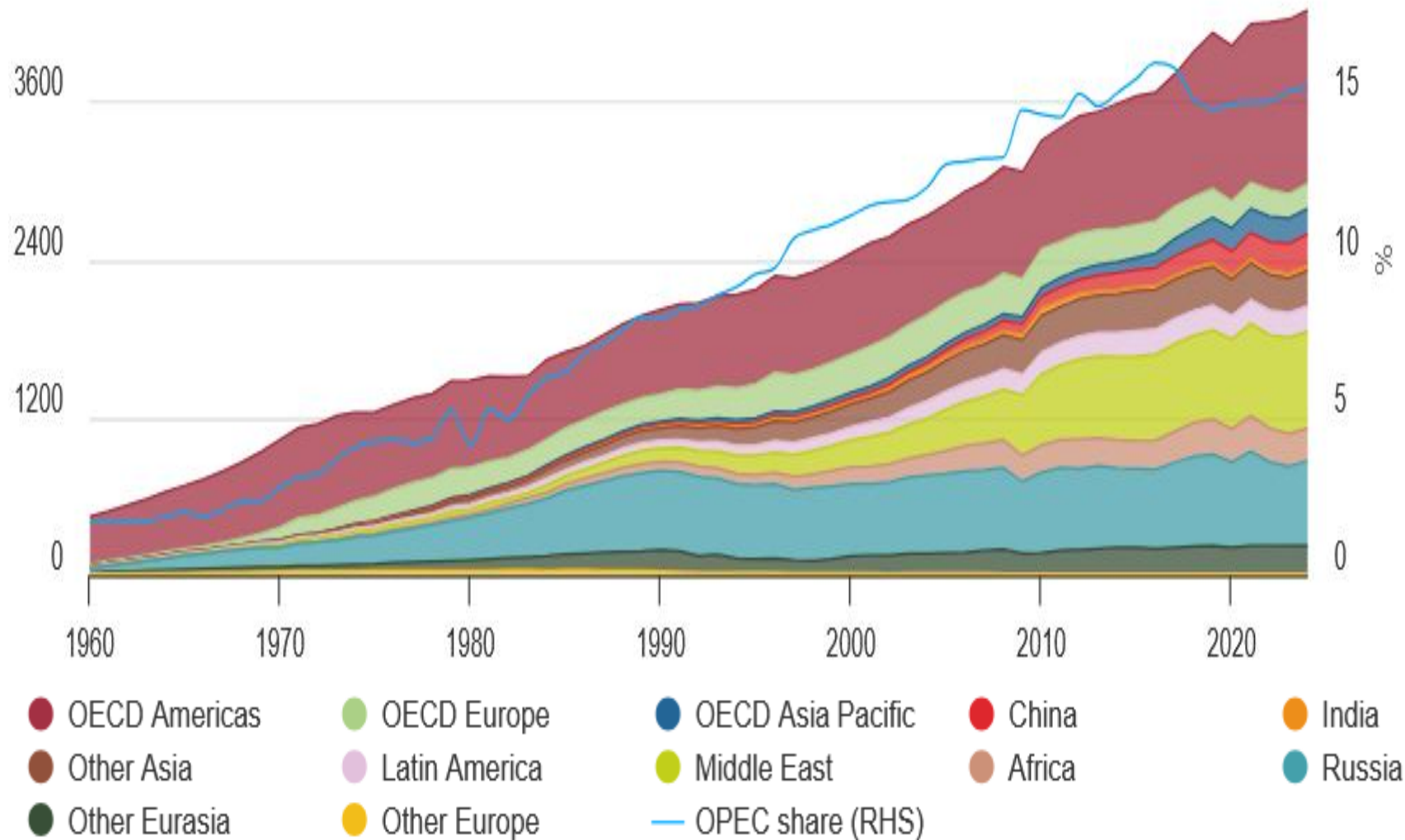
OPEC Members Gas Proven Reserves (T.m³)



Source: OPEC ASB 2025



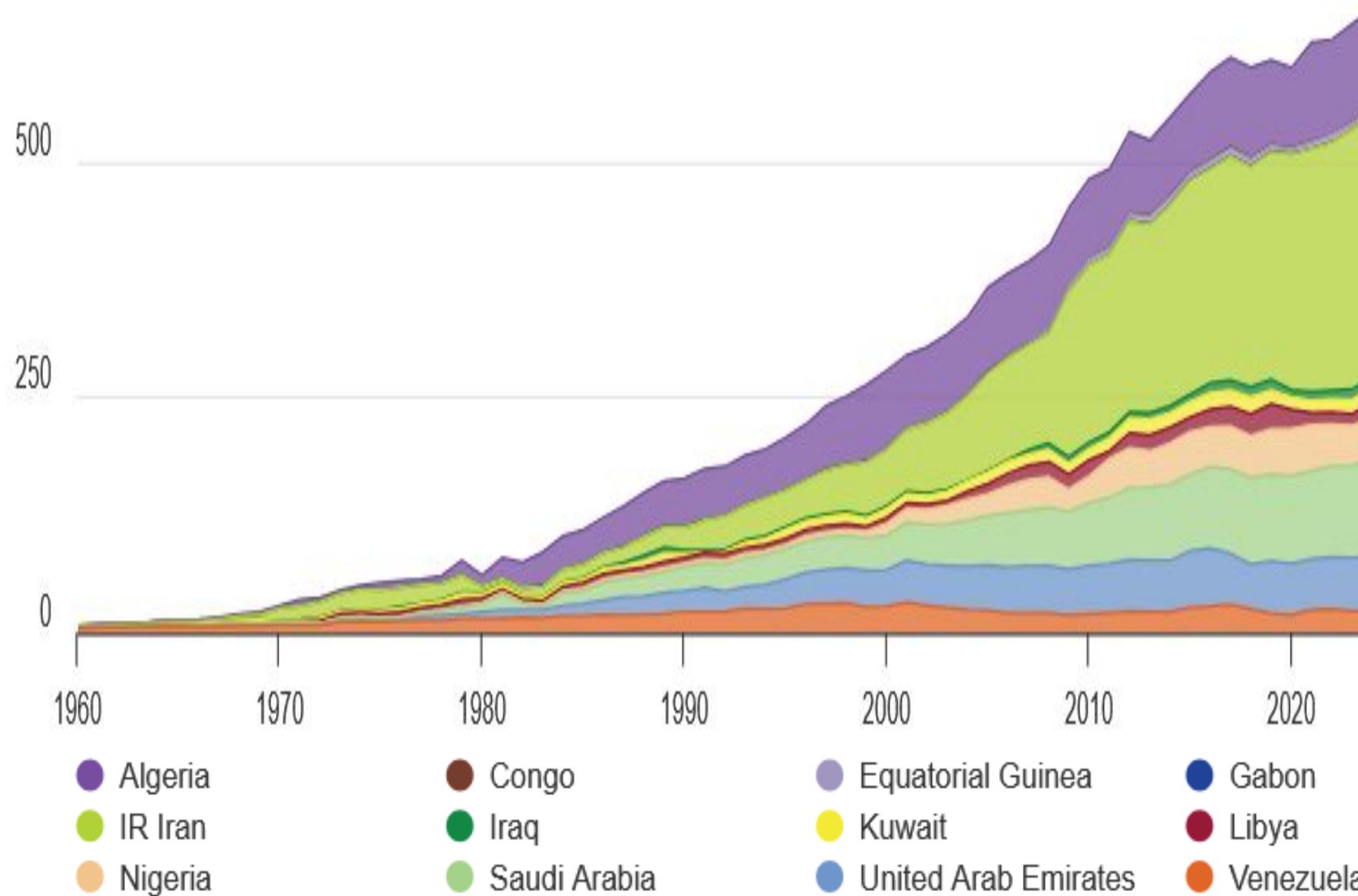
World Gas Production (G.m³) & OPEC Share



Source: OPEC ASB 2025



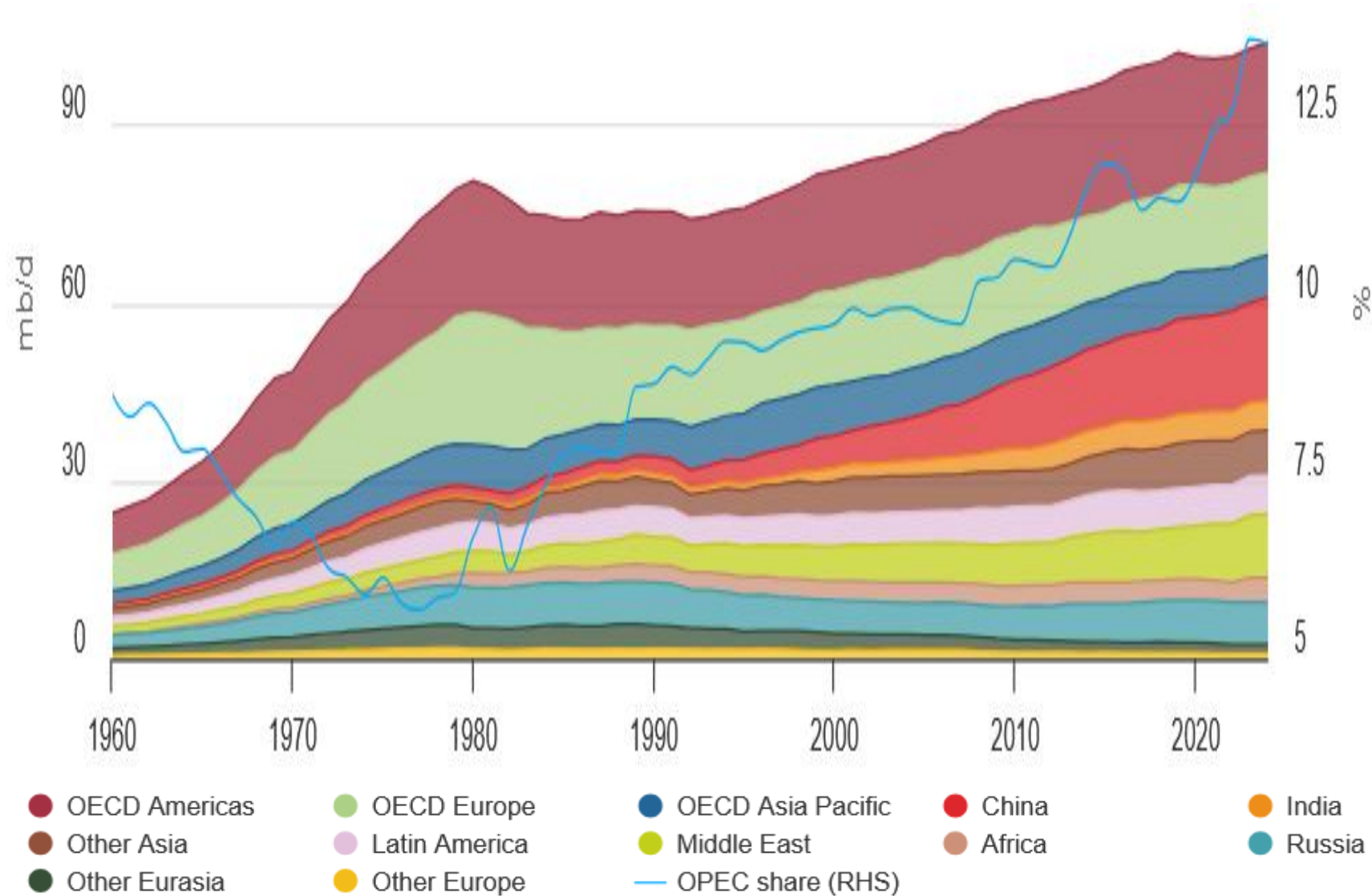
OPEC Members Gas Production (G.m³)



Source: OPEC ASB 2025



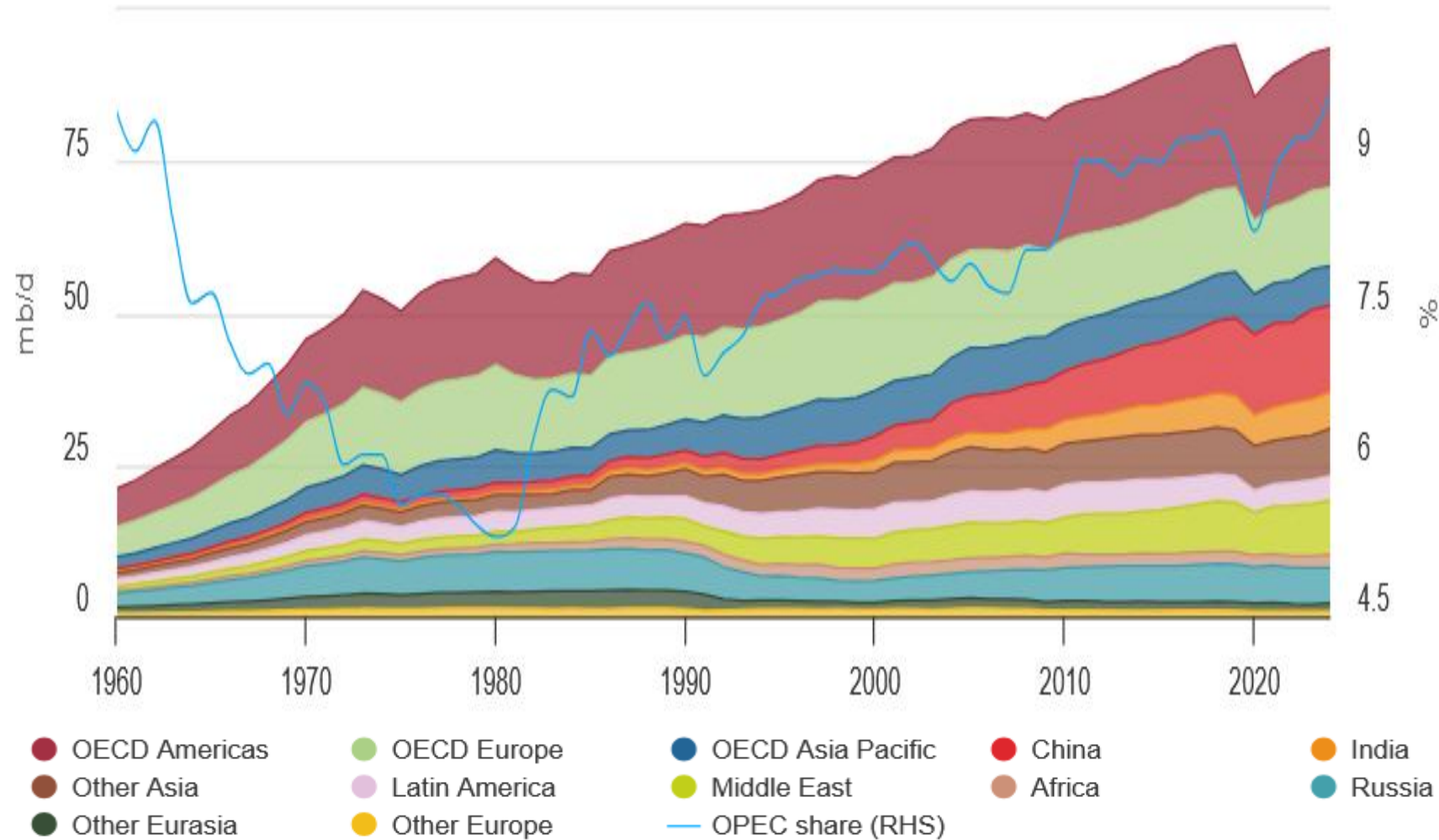
World Refinery Capacity & OPEC Share (Mb/d)



Source: OPEC ASB 2025



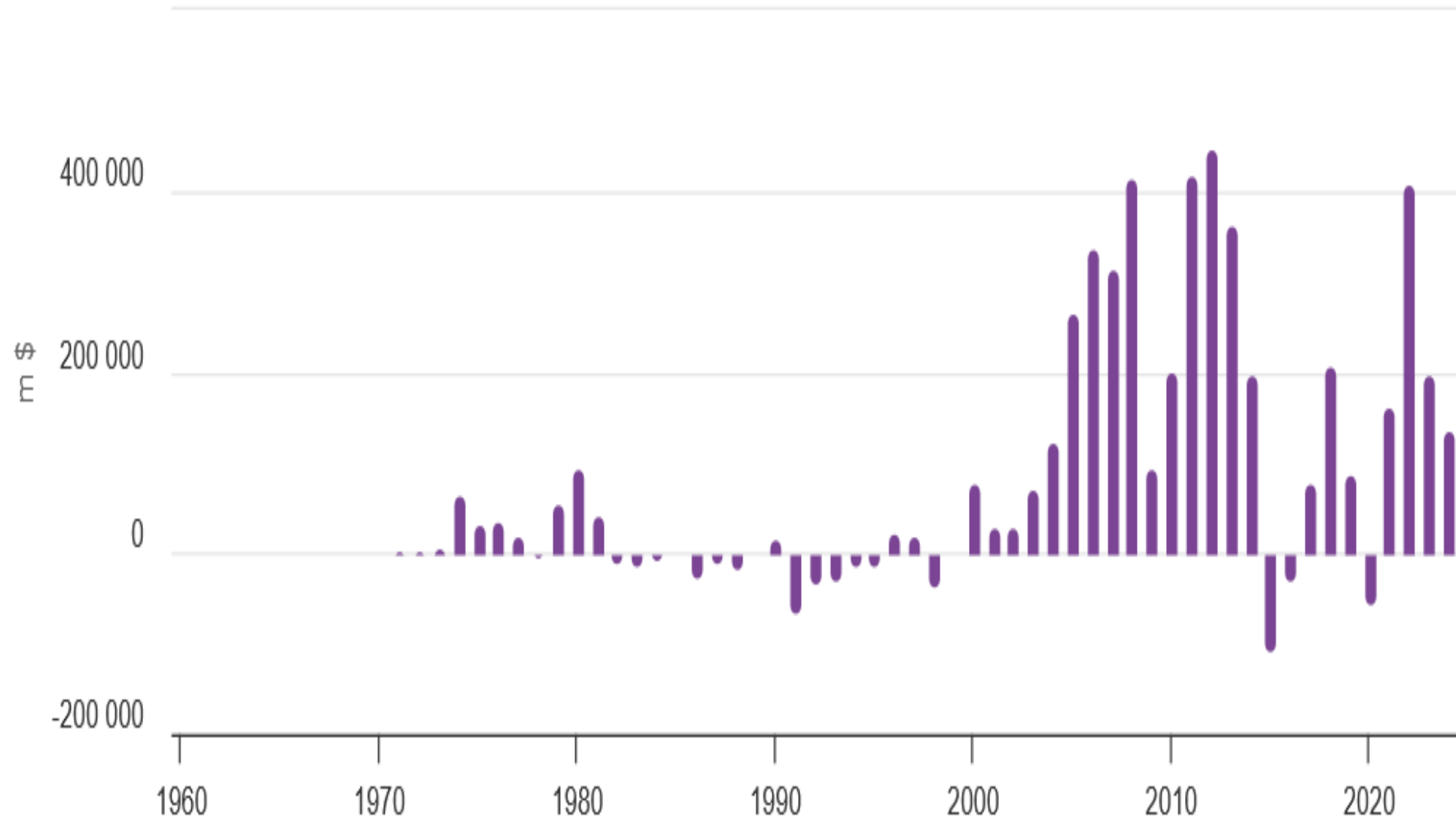
World Output of Petroleum Products (Mb/d) & OPEC Share



Source: OPEC ASB 2025



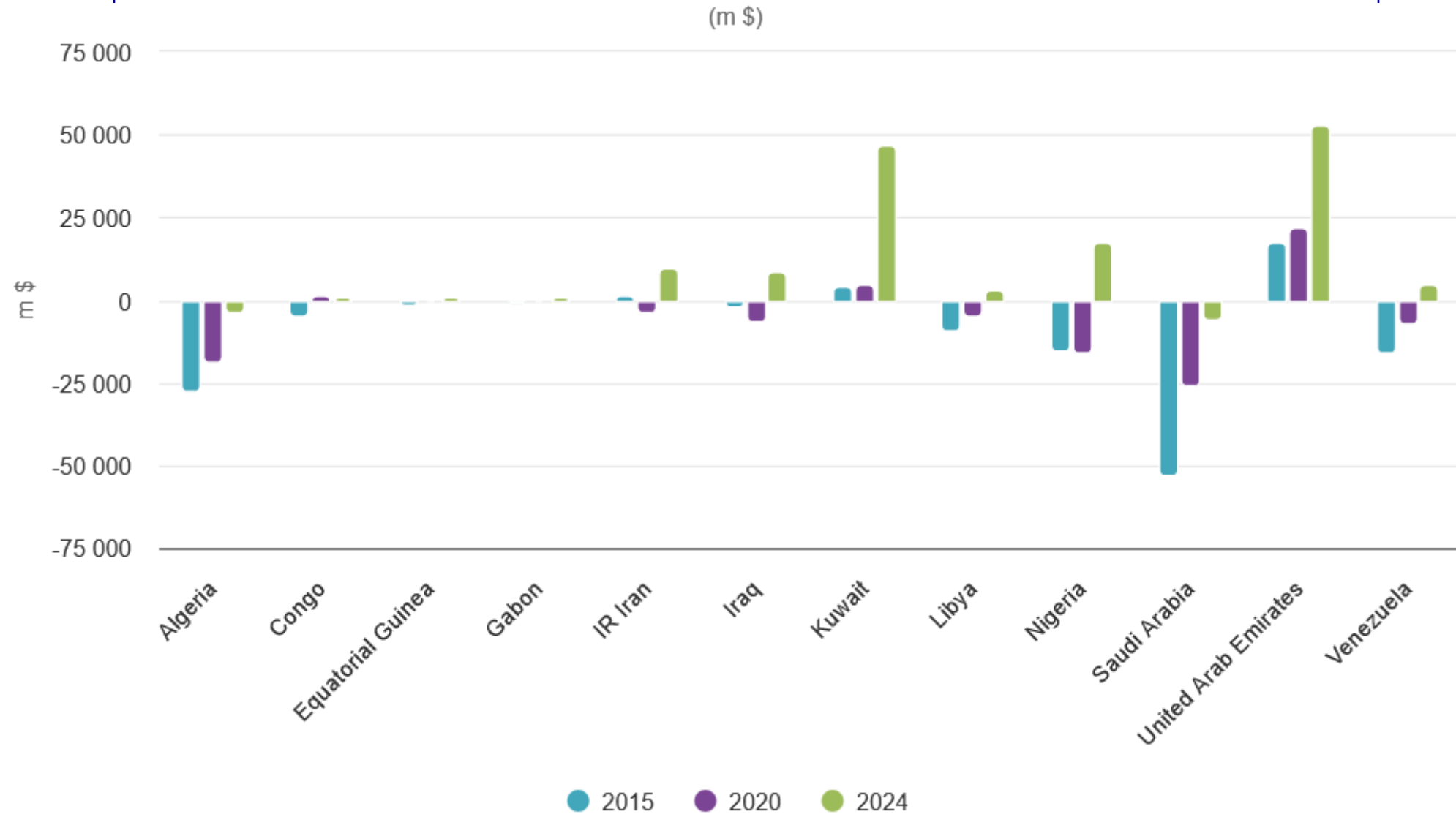
OPEC Members Current Account Balances



Source: OPEC ASB 2025



OPEC Members Current Account Balances

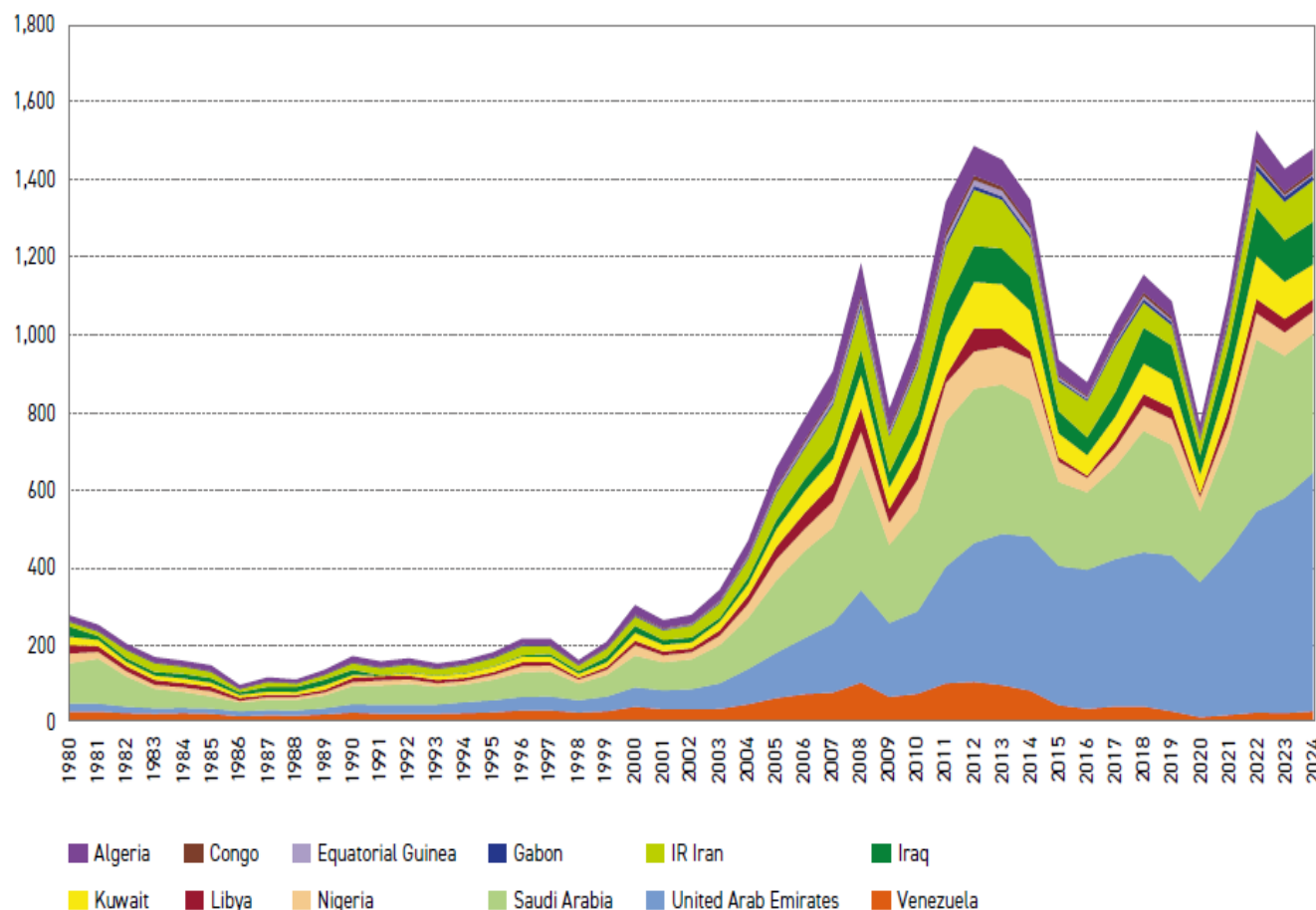


OPEC Members economic flows (2)

Exports

OPEC Members' values of exports of goods and services

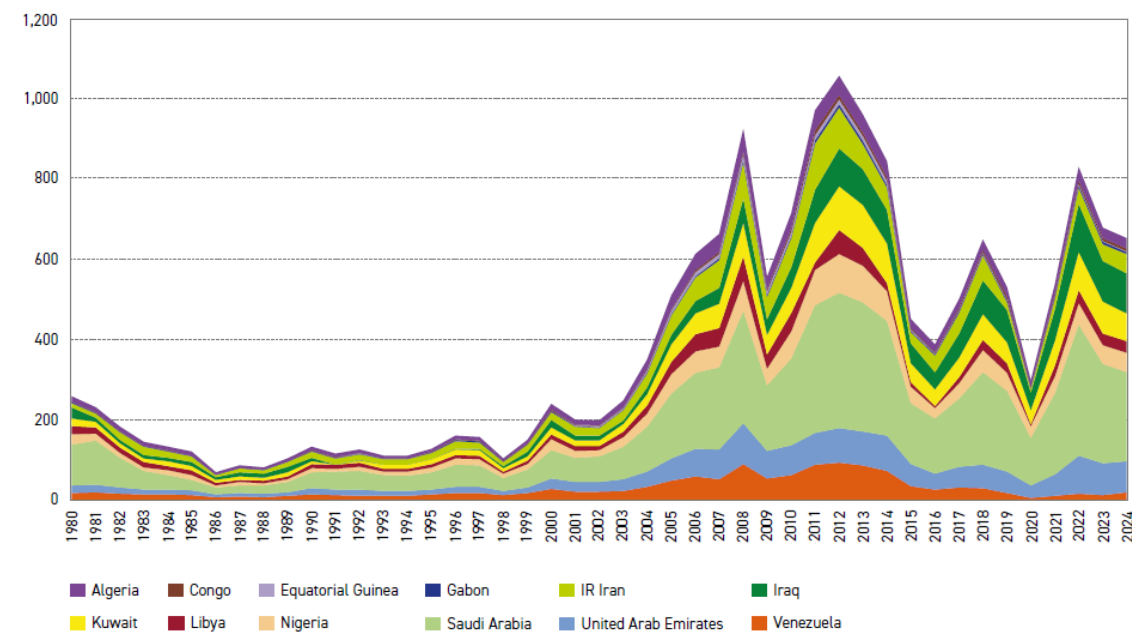
(bn \$)



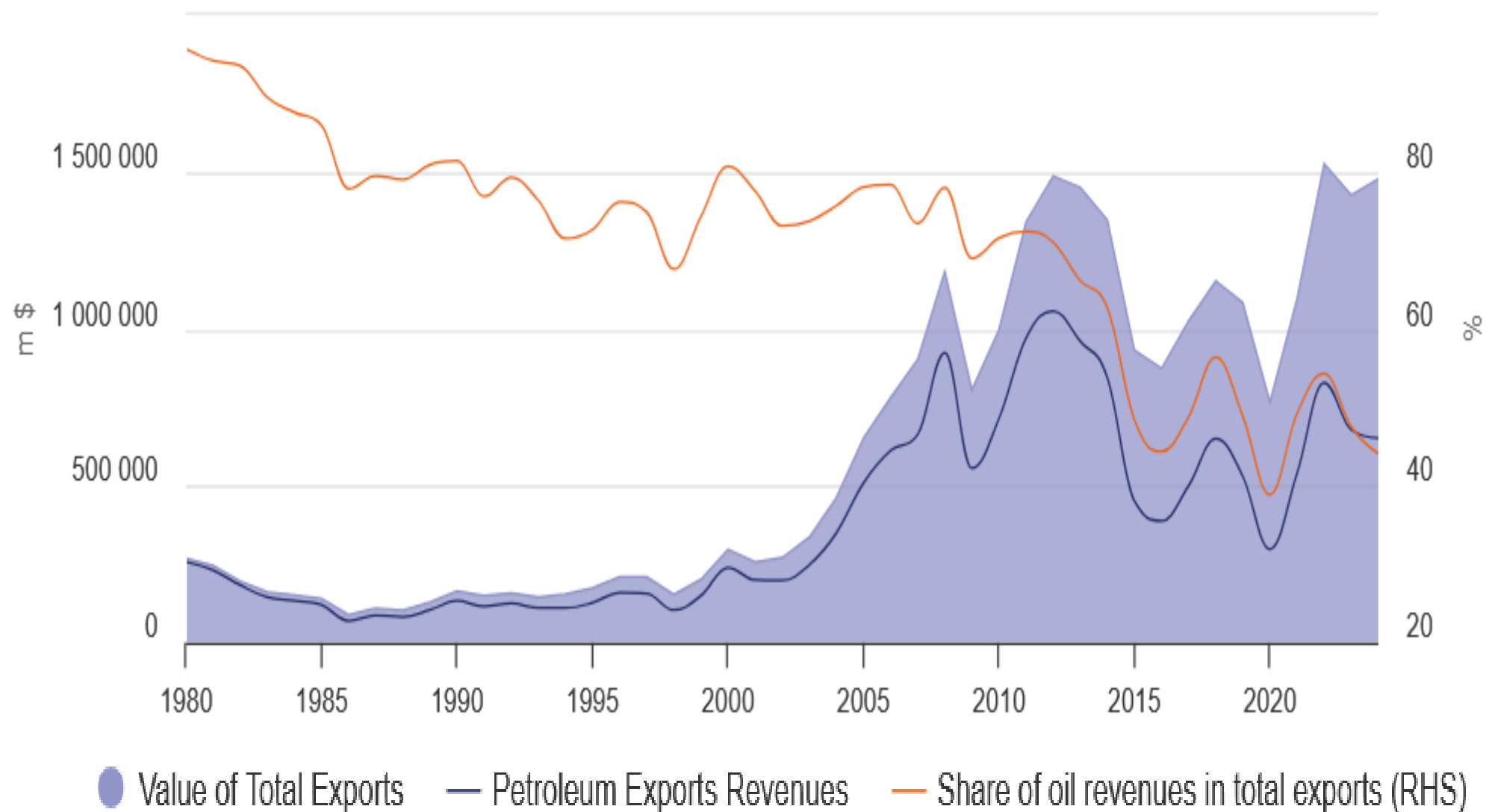
Petroleum Exports

OPEC Members' values of petroleum exports

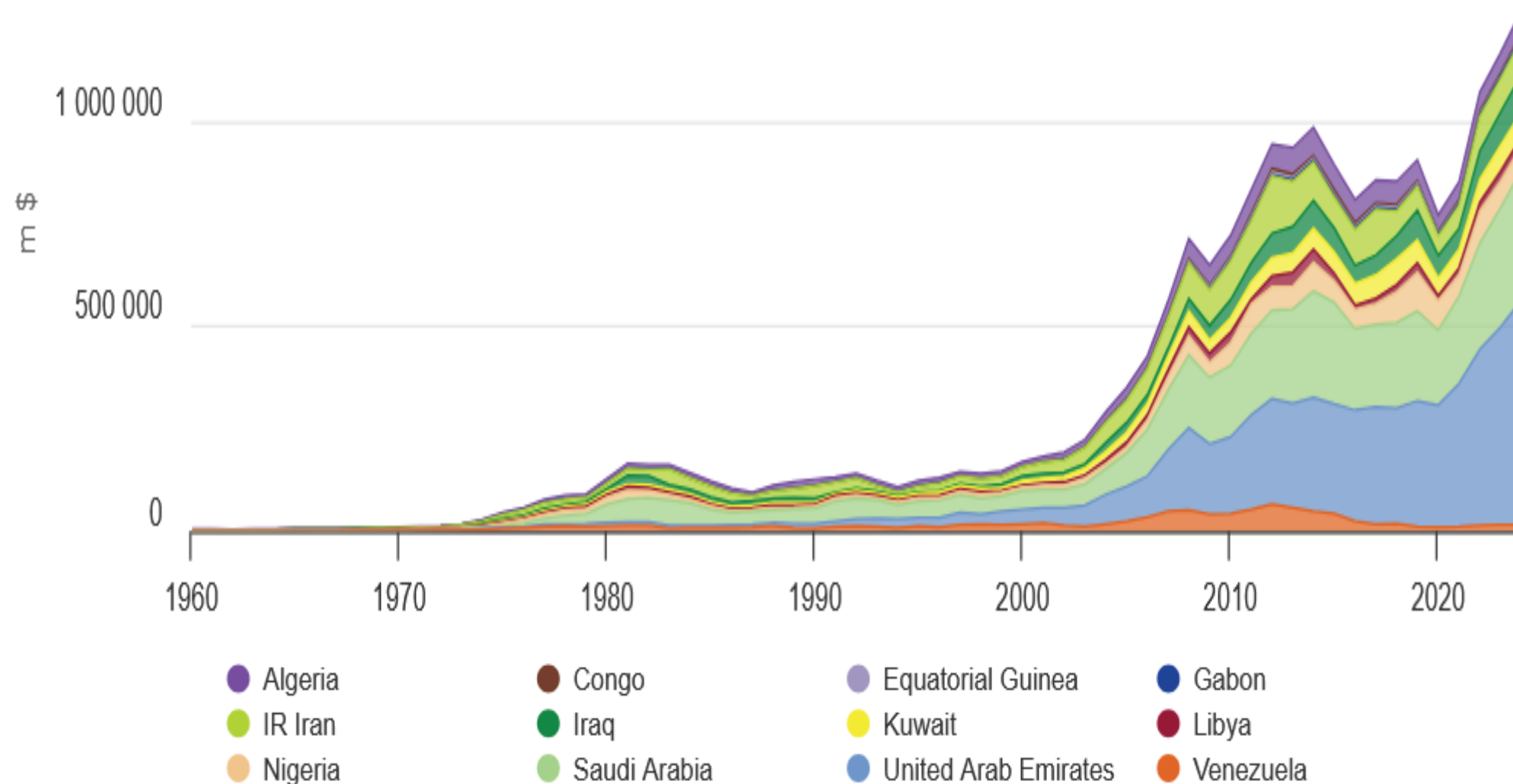
(bn \$)



OPEC Members' Oil Exports Revenues (3) vs total Exports



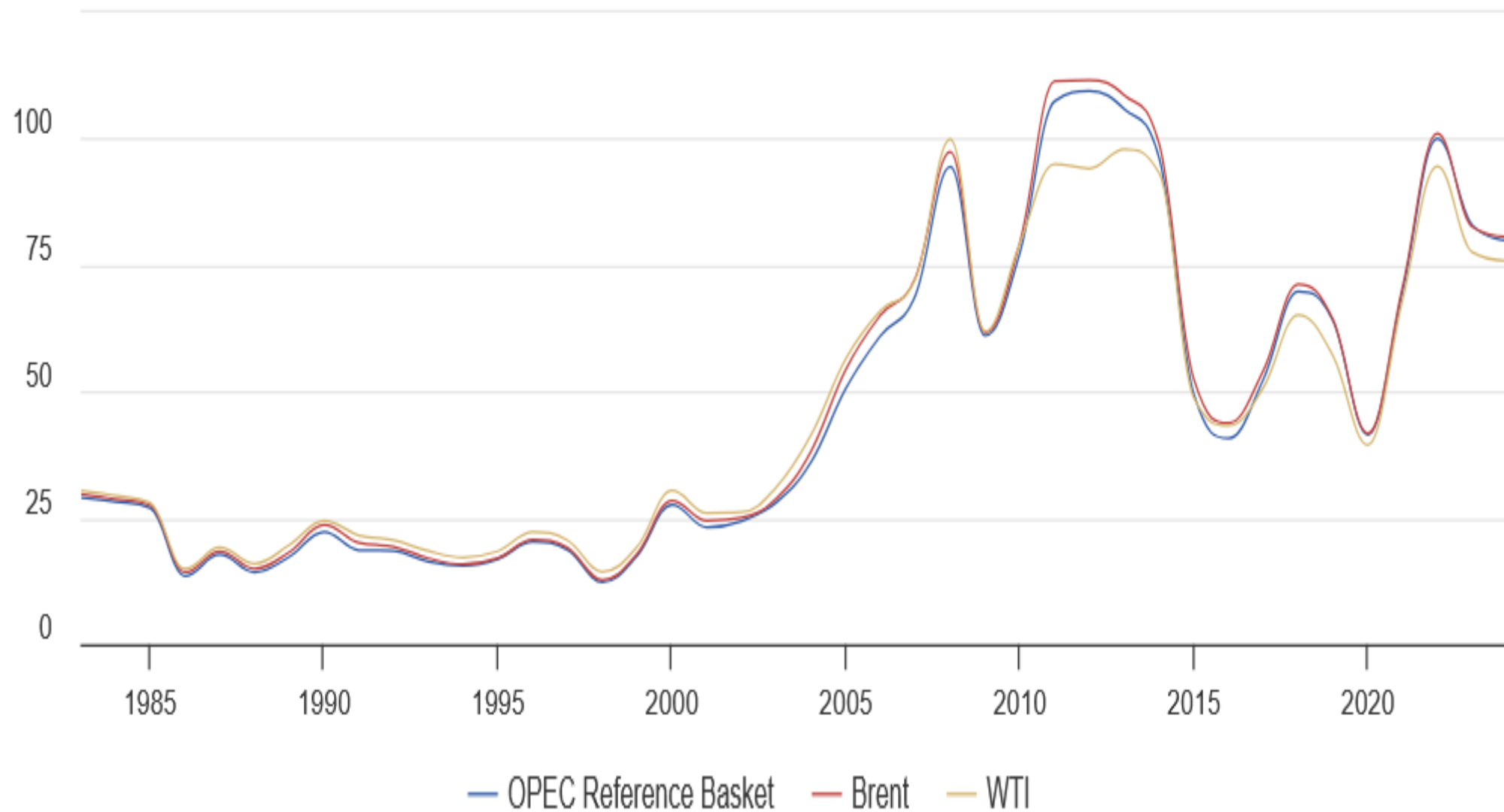
OPEC Members Imports of Goods & Services (M\$) (4)



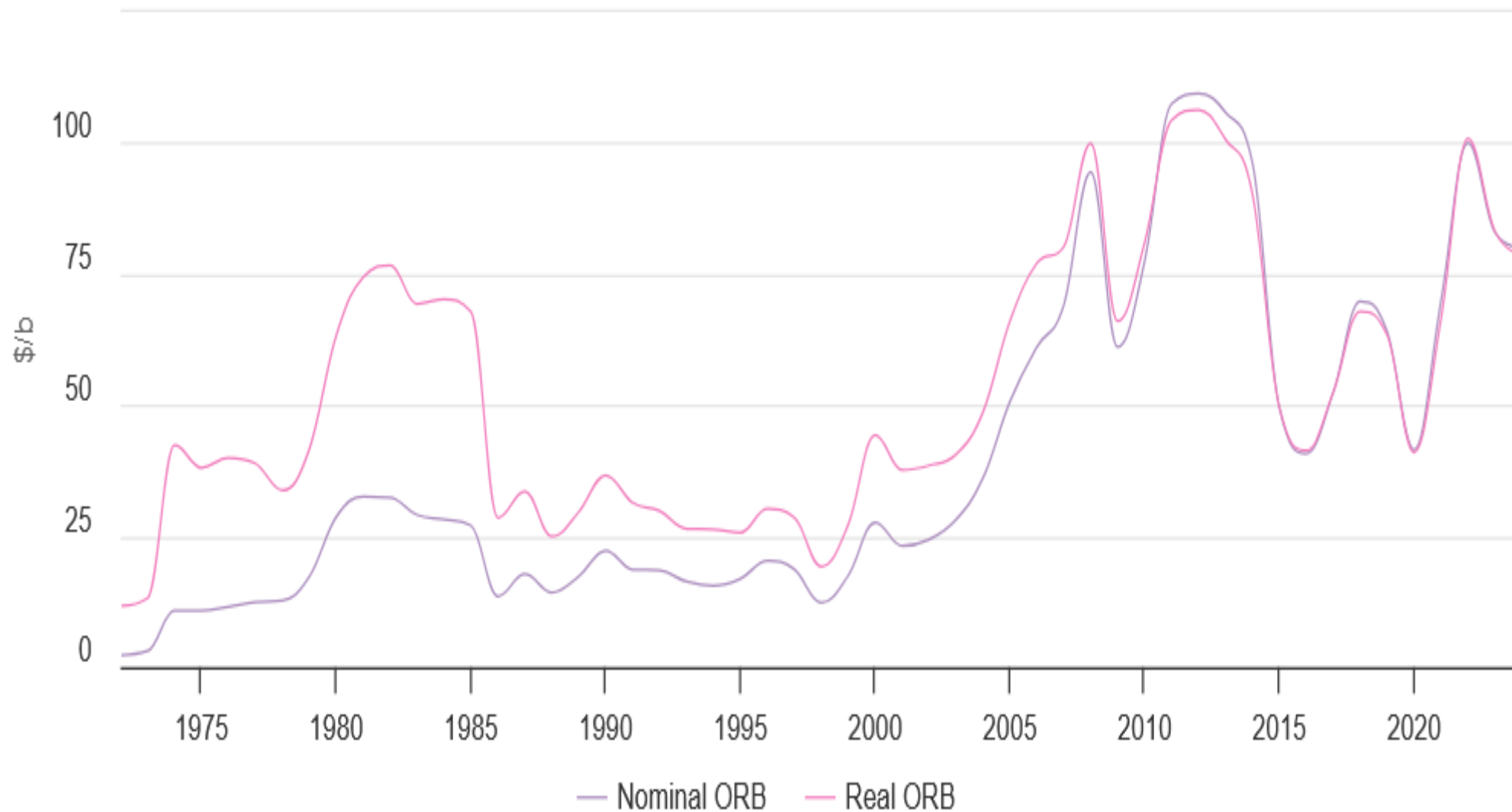
Source: OPEC ASB 2025



OPEC Reference Basket Price, Brent & WTI (\$/b)



OPEC Reference Basket Price (\$/b) & Value 2017



OPEC Economic Balance

2 examples: Saudi Arabia and Qatar

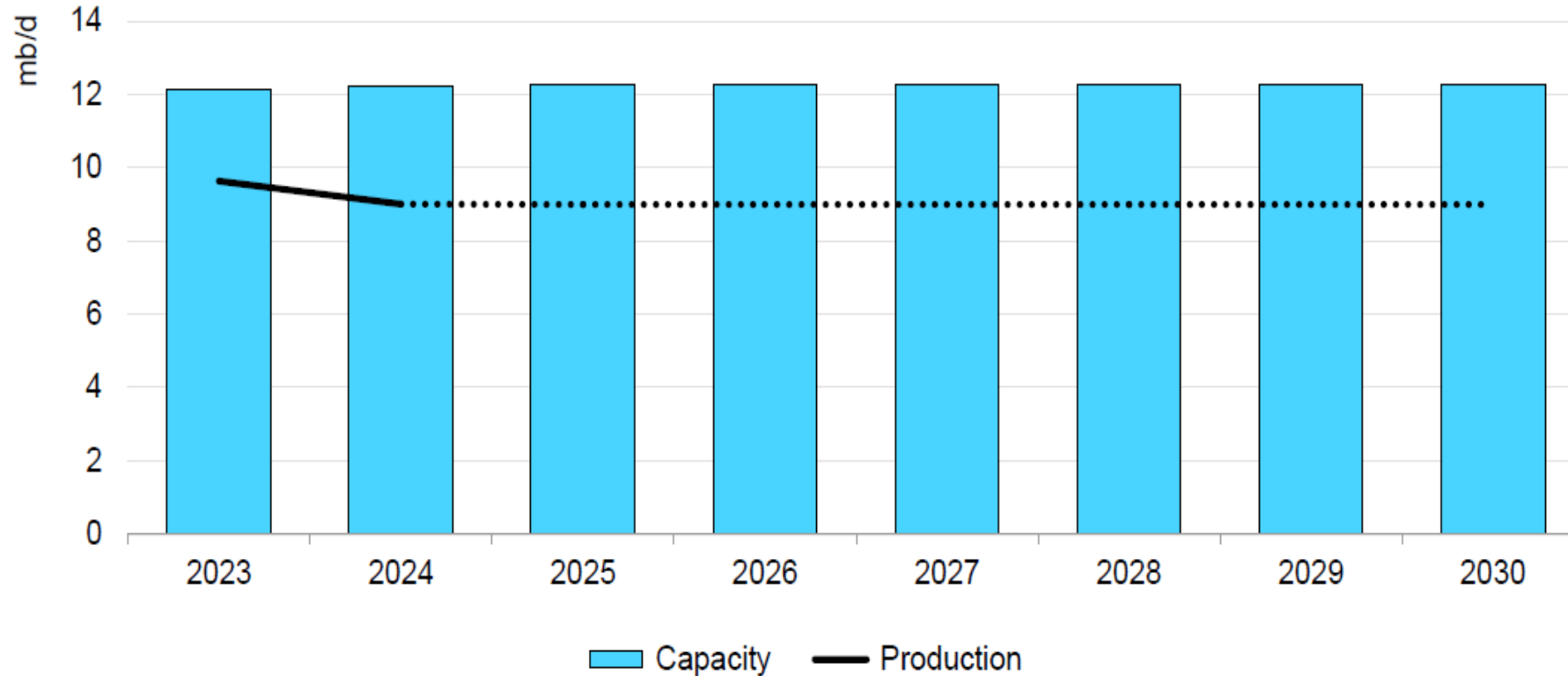


The case of Saudi Arabia



Saudi Arabia Crude Oil Capacity & Production 2023 - 2030

Saudi Arabia estimated crude oil production and capacity, 2023-2030



IEA. CC BY 4.0.

Note: Production projection based on the current OPEC+ supply deal.

Source: IEA Oil 2025



The Case of Saudi Arabia (2014 – Budget 2025)

Billion SR	Budget 2025	Estim. 2024	Real. 2023	Real. 2022	Real. 2021	Real. 2020	Real. 2019	Real. 2018	Real. 2017	Real. 2016	Real. 2015	Real. 2014
GDP nominal	4352	4091	4003	4157	3280	2625	2970	2934	2570	2420	2450	2827
Revenus	1184	1230	1212	1268	965	782	927	906	692	528	608	1044
Oil Revenus	na	758	752	857	562	413	594	611	440	329	445	913
% of Revenus	na	62	62	68	58	53	64	67	64	62	73	87
Expenditures	1285	1345	1293	1164	1039	1076	1059	1079	930	825	975	1110
Surplus/Deficit	-101	-115	-81	104	-73	-294	-133	-174	-238	-297	-367	-66
% of GDP	-2,3	-2,9	-2,0	2,5	-2,2	-11,2	-4,5	-5,9	-9,3	-12,3	-15,0	-2,3
Public Debt	1300	1199	1050	990	938	854	678	560	443	316	142	44
% of GDP	29,9	29,3	26,2	23,8	28,6	32,5	22,8	19,1	17,2	13,1	5,8	1,6
Brent price (\$/b)		81,0	83,0	100,1	69,9	41,8	64,2	71,3	54,2	43,7	52,4	99,0

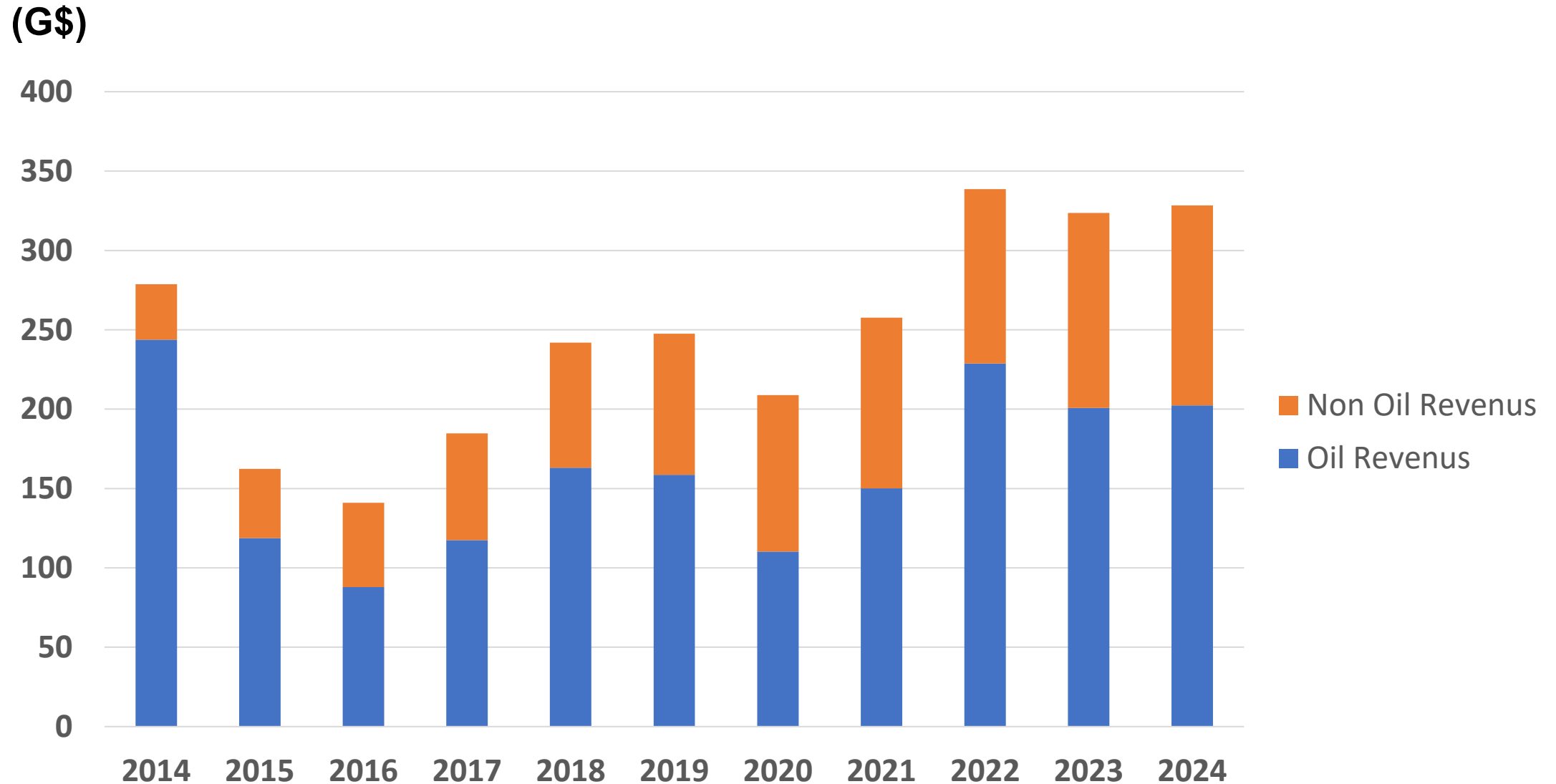


The Case of Saudi Arabia (2014 – Budget 2025)

Billion US \$	Budget 2025	Estim. 2024	Real. 2023	Real. 2022	Real. 2021	Real. 2020	Real. 2019	Real. 2018	Real. 2017	Real. 2016	Real. 2015	Real. 2014
GDP	1162	1092	1069	1110	876	701	793	783	686	646	654	755
Revenus	316	328	324	339	258	209	248	242	185	141	162	279
Oil Revenus	na	202	201	229	150	110	159	163	117	88	119	244
% of Revenus	na	62	62	68	58	53	64	67	64	62	73	87
Expenditures	343	359	345	311	277	287	283	288	248	220	260	296
Surplus/Deficit	-27	-31	-22	28	-19	-78	-36	-46	-64	-79	-98	-18
% of GDP	-2,3	-2,8	-2,0	2,5	-2,2	-11,2	-4,5	-5,9	-9,3	-12,3	-15,0	-2,3
Public Debt	347	320	280	264	250	228	181	150	118	84	38	12
% of GDP	29,9	29,3	26,2	23,8	28,6	32,5	22,8	19,1	17,2	13,1	5,8	1,6
Brent price (\$/b)		81,0	83,0	100,1	69,9	41,8	64,2	71,3	54,2	43,7	52,4	99,0

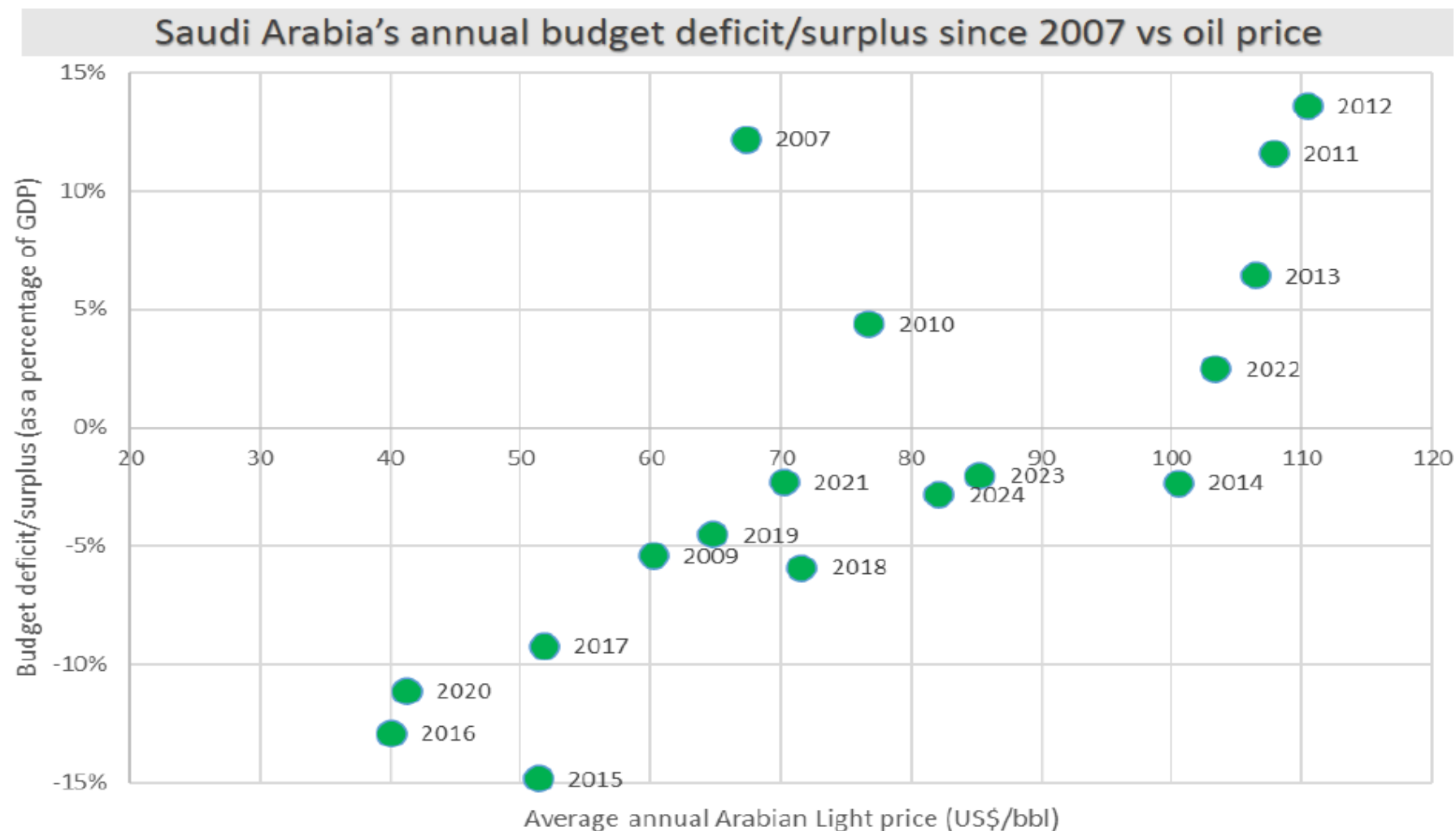


The Case of Saudi Arabia (2014 – 2024)



The Case of Saudi Arabia (Deficit-Surplus 2007 - 2024)

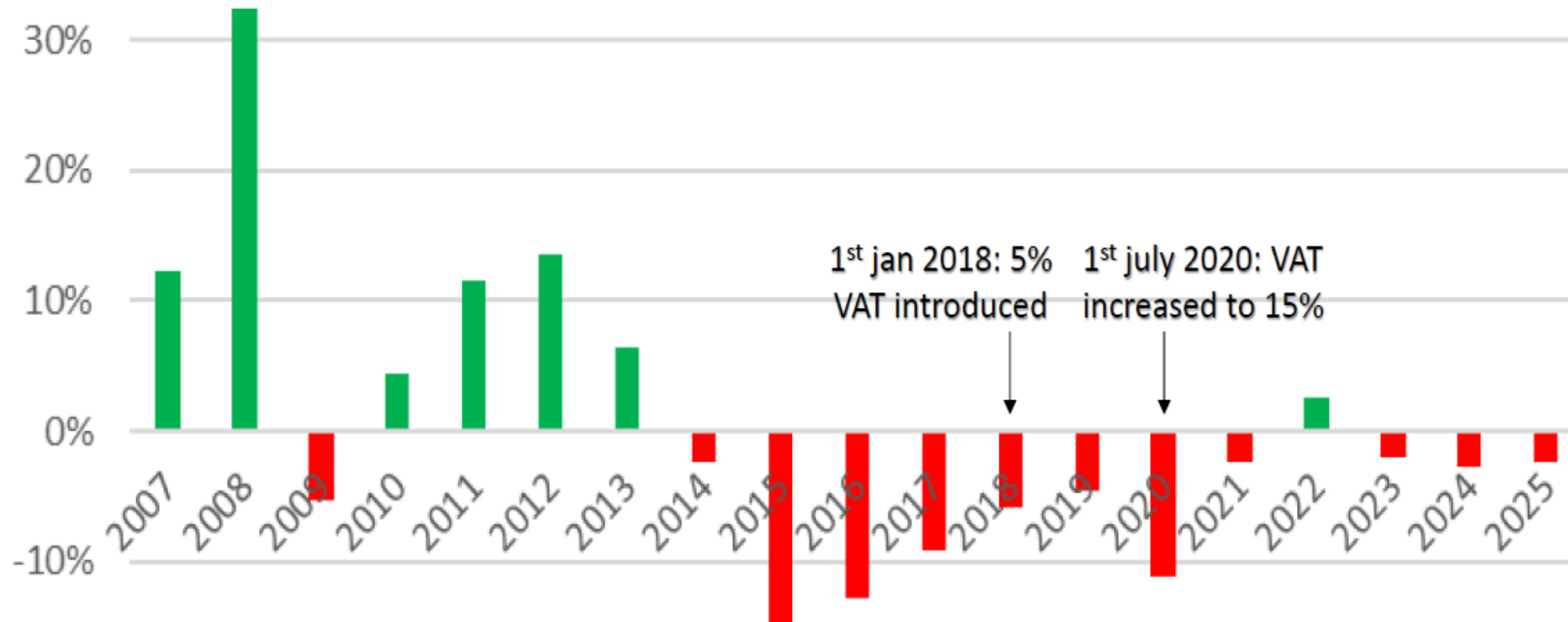
Since 2014, only one year Surplus: 2022



The Case of Saudi Arabia (Deficit-Surplus 2007 - 2024)

Since 2014, only one year Surplus: 2022

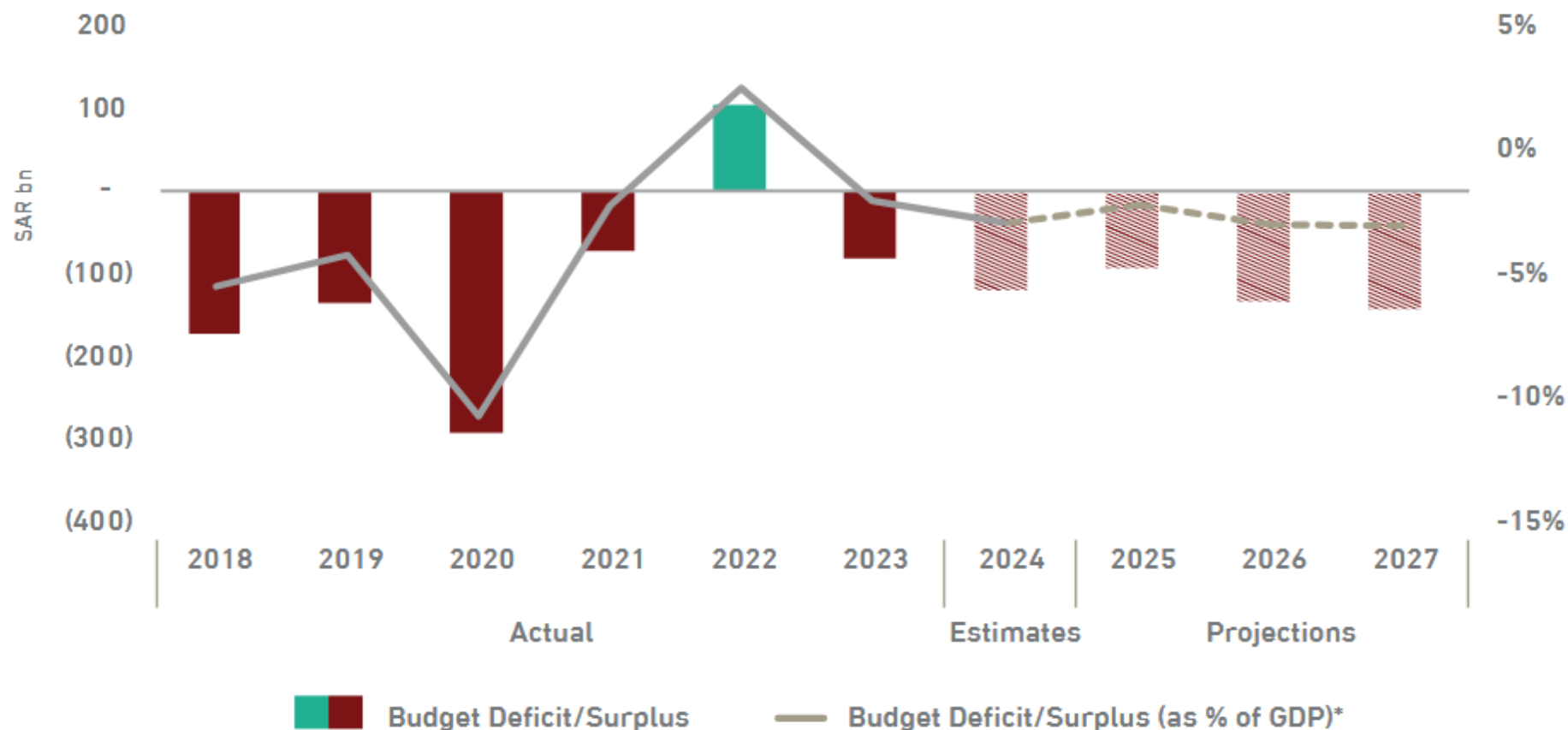
Saudi Arabia's annual budget deficit/surplus (as a percentage of GDP)



The Case of Saudi Arabia (Deficit-Surplus 2007 - 2024)

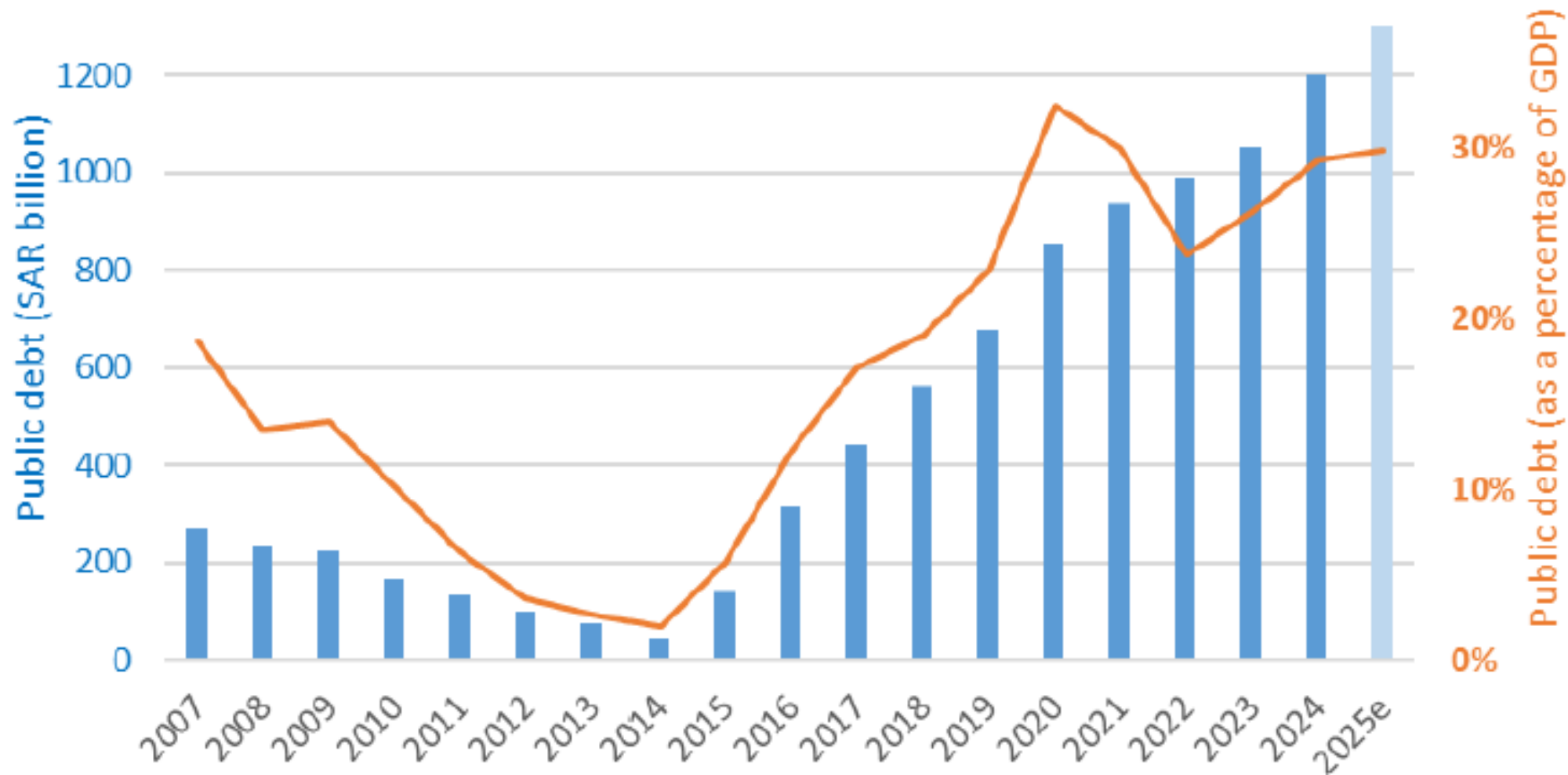
Since 2014, only one year Surplus: 2022

Budget Deficit/ Surplus



The Case of Saudi Arabia (Public Debt 2007 - 2025)

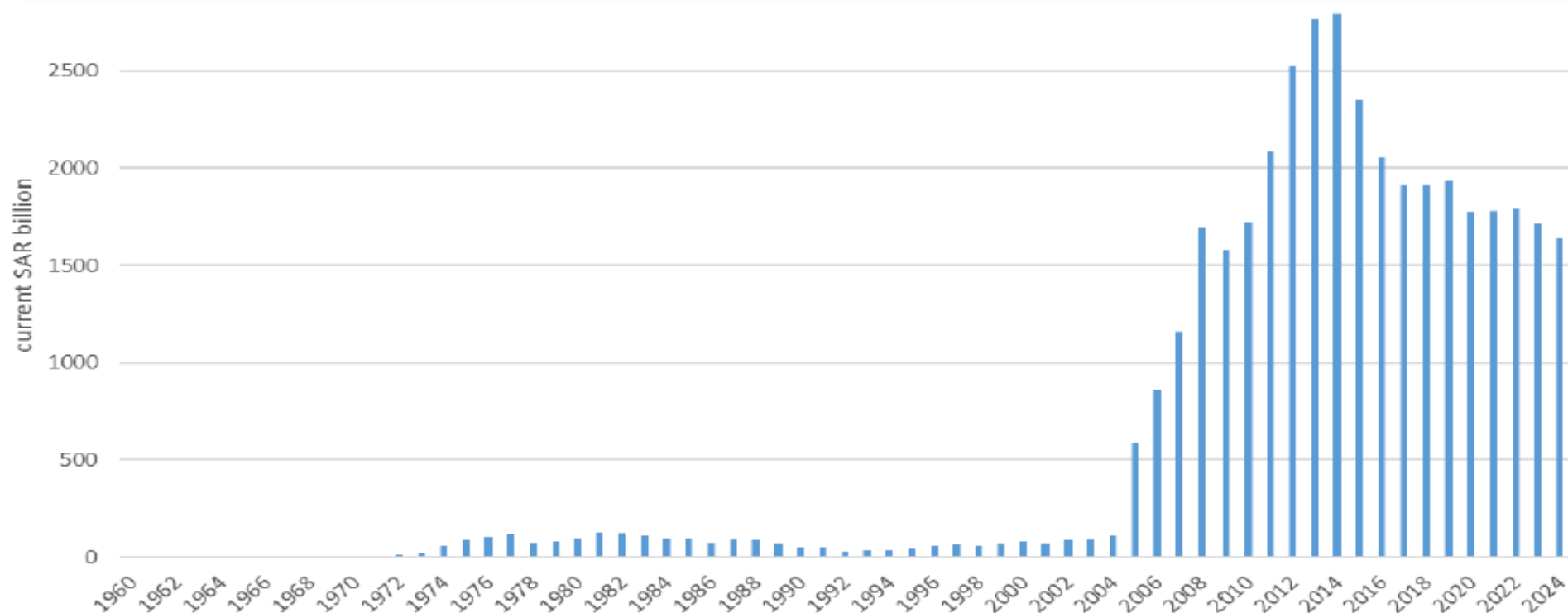
Since 2014, a regular increase



The Case of Saudi Arabia (Financial Reserves)

Since 2014, a regular decrease

KSA Total Financial Reserves (including gold, investments in foreign securities, foreign exchange reserve, etc.)



Data Source:



THE WORLD BANK



The Case of Saudi Arabia

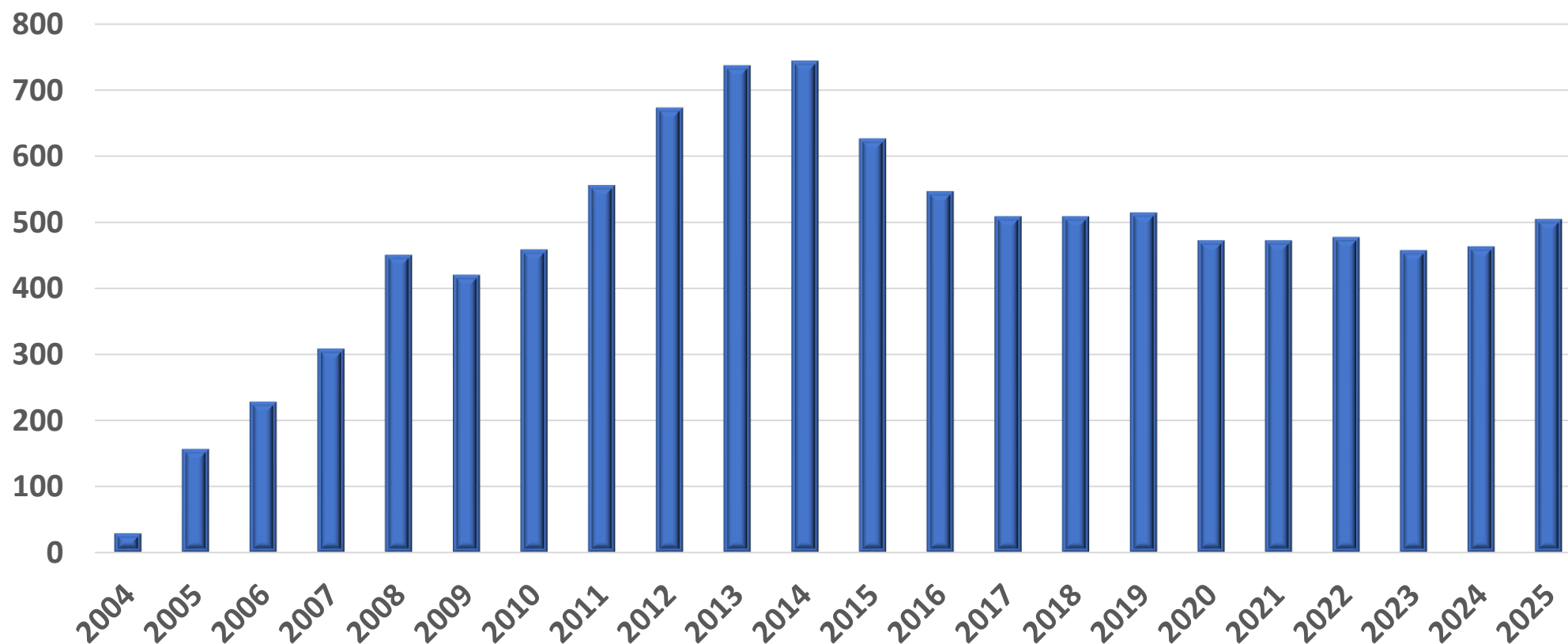
From 2014 to 2025, 240 G\$ have been drawn from SA Financial Reserves

(G\$)

GDP 2025 = 1280 G\$ # 4800 GSAR

Financial Reserves End 2014 = 744 G\$ # 2790 GSAR

Financial Reserves End 2025 = 505 G\$ # 1890 GSAR



The case of Qatar



The case of Qatar

QATAR

Qatar's economic growth remained subdued due to stagnant hydrocarbon output, while the non-hydrocarbon sector expanded under the Third National Development Strategy (NDS3), driven by education, tourism, and manufacturing. Fiscal and external balances are set to remain in surplus, with fiscal gains strengthening and external surpluses narrowing. Key risks include volatile energy prices, further escalation of geopolitical tensions and a potential slowdown in China's economy.

Population ¹ million	Poverty
3.1	..
Life expectancy at birth ² years	School enrollment ³ primary (% gross)
81.6	95.0
GDP ⁴ current US\$, billion	GDP per capita ⁵ current US\$
218.5	70854.6

Sources: WDI, MFMMod, and official data. 1/ 2024. 2/ 2022. 3/ 2022. 4/ 2024. 5/ 2024.



The case of Qatar

FIGURE 1 / Annual real GDP growth

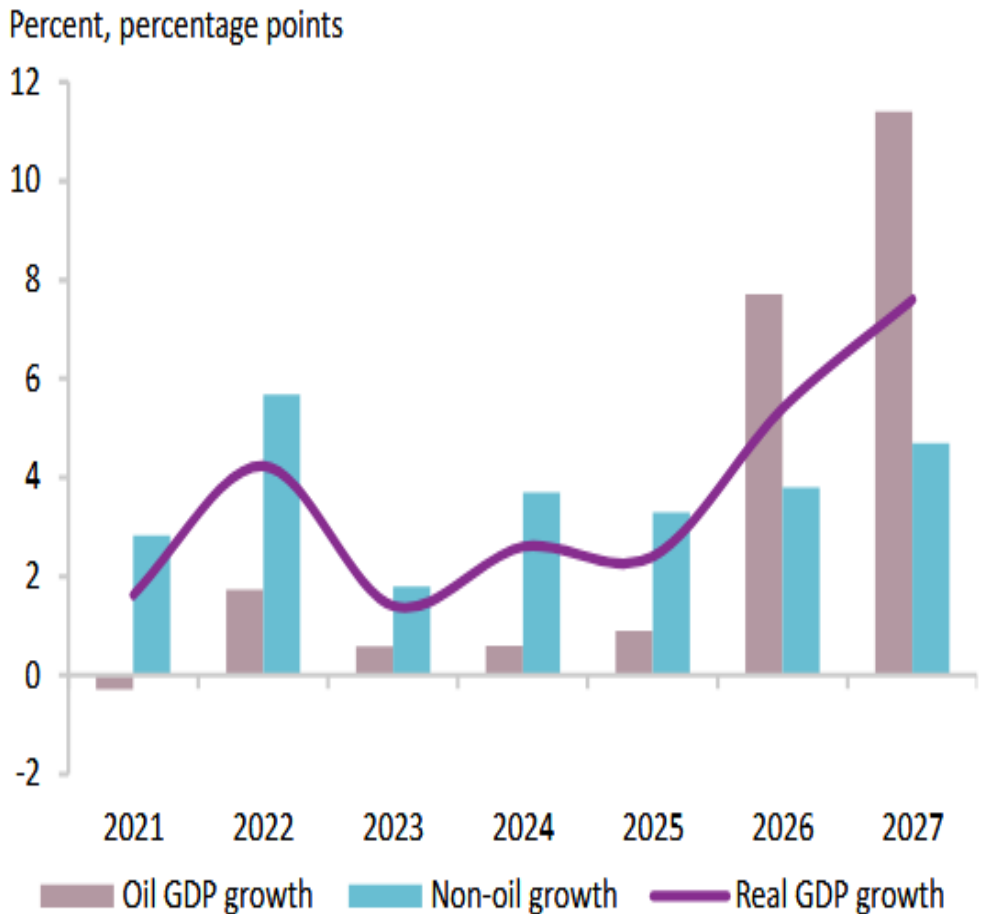
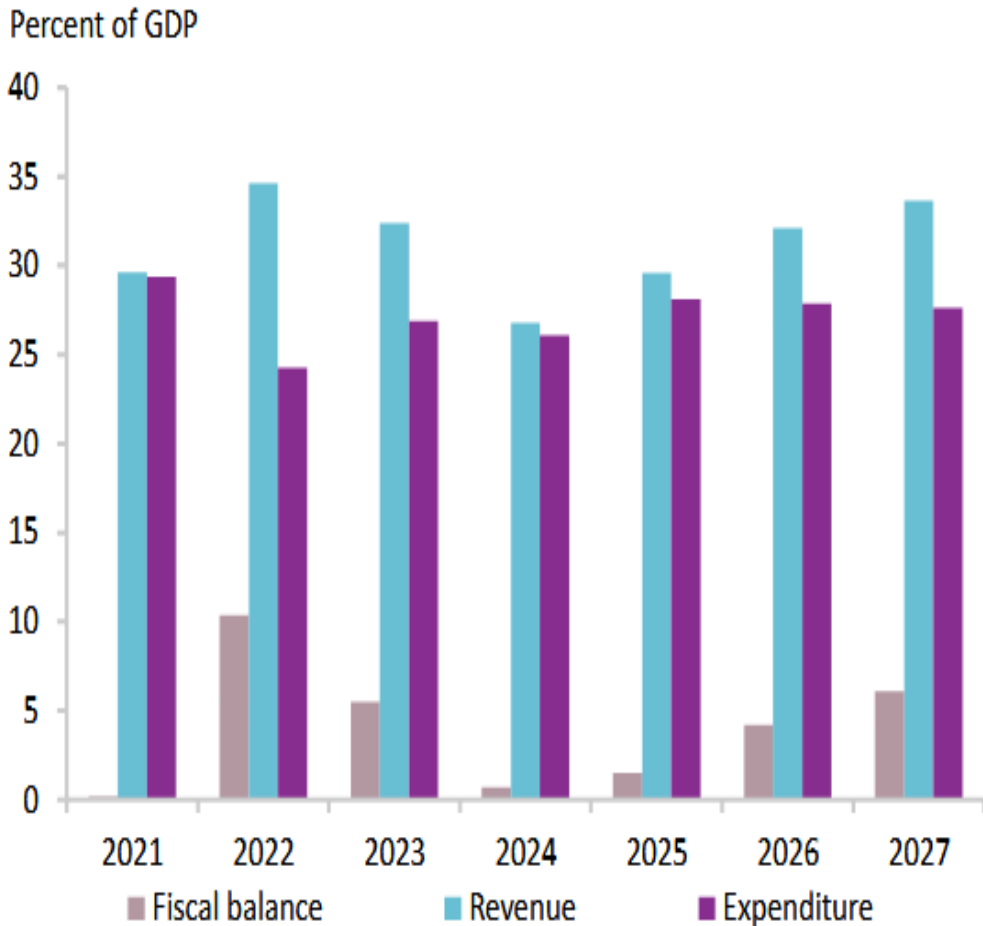


FIGURE 2 / Fiscal balance



Source: World Bank 2025



The case of Qatar

Recent history and projections

	2022	2023	2024e	2025f	2026f	2027f
Real GDP growth, at constant market prices	4.2	1.4	2.6	2.4	5.4	7.6
Private consumption	5.2	2.0	2.7	2.5	3.1	3.9
Government consumption	4.1	1.2	1.6	0.7	2.0	2.4
Gross fixed capital investment	3.1	1.4	1.9	2.1	2.4	3.2
Exports, goods and services	3.0	0.5	1.8	0.8	4.2	6.8
Imports, goods and services	6.0	3.2	3.7	3.2	3.2	3.4
Real GDP growth, at constant factor prices	4.2	1.4	2.6	2.4	5.4	7.6
Agriculture	7.7	5.4	2.5	2.4	2.9	2.9
Industry	1.7	0.3	1.5	1.8	6.0	9.0
Services	7.5	2.8	4.0	3.0	4.7	5.9
Employment rate (% of working-age population, 15 years+)	87.3	87.6	87.4	87.2	87.6	88.0
Inflation (consumer price index)	5.0	3.1	1.1	1.5	1.9	2.1
Current account balance (% of GDP)	26.8	16.9	17.4	13.1	15.5	16.2
Fiscal balance (% of GDP)	10.4	5.5	0.7	1.5	4.2	6.1
Revenues (% of GDP)	34.7	32.4	26.8	29.6	32.1	33.7
Debt (% of GDP)	42.6	44.2	40.2	38.8	38.8	34.8
Primary balance (% of GDP)	10.4	5.5	0.7	1.5	4.2	6.1
GHG emissions growth (mtCO2e)	3.4	0.8	1.7	2.4	4.8	6.4

Source: World Bank, Poverty and Economic Policy Global Departments. Emissions data sourced from CAIT and OECD.
Notes: e = estimate, f = forecast. Data in annual percent change unless indicated otherwise.

Source: World Bank 2025



Qatar Economic Outlook

2021-2023

Issue Number 13



مجلس التخطيط والإحصاء
Planning and Statistics Authority

Source: Qatar Economic Outlook January 2022



The Case of Qatar

Table 1-4: Qatar's GDP by Production, 2021 and 2023, (Annual rate of change) (%)

%	Estimate		Base scenario			Medium scenario			Optimistic scenario		
	2020	Up to Q3 2021*	2021	2022	2023	2021	2022	2023	2021	2022	2023
Real GDP (2018=100)	-3.6	1.4	1.5	1.6	0.7	1.9	2.3	1.5	2.3	2.9	1.8
Hydrocarbon GVA	-2.0	-0.8	-0.7	-0.3	-0.3	-0.2	0.0	0.0	-0.2	0.0	0.0
Non-hydrocarbon GVA	-4.5	2.9	2.9	2.8	1.3	3.3	3.7	2.4	3.9	4.7	2.9
Construction	-3.9	0.6	1.1	0.7	0.1	1.5	2.4	2.1	1.8	3.0	4.3
Manufacturing	-6.7	6.0	3.1	0.2	0.0	4.0	0.9	0.8	4.6	3.2	2.4
Service	-2.9	3.5	3.7	4.1	2.3	4.0	4.7	3.1	4.7	5.6	3.0
Source: Planning and Statistics Authority											

Source: Qatar Economic Outlook January 2022

The Case of Qatar

Table 1-5: Qatar's GDP by Expenditure (Annual rate of change %), 2021 and 2023

%	Estimate		Base scenario			Medium scenario			Optimistic scenario		
	2020	Up to Q3 2021*	2021	2022	2023	2021	2022	2023	2021	2022	2023
Real GDP 2018=100	-3.6	1.4	1.5	1.6	0.7	1.9	2.3	1.5	2.3	2.9	1.8
Private	-10.5	-6.4	-2.0	-2.0	-2.0	-1.0	-1.0	-1.0	0.0	1.0	-1.0
Government	4.4	-12.0	1.2	6.3	2.9	1.6	7.0	3.7	2.0	7.7	4.1
Gross Capital Formation	-10.4	-5.3	5.6	6.3	-0.1	5.3	8.4	-0.3	5.8	9.2	0.6
Exports, G & S	-1.5	9.7	-1.3	0.0	0.1	-0.9	0.3	0.4	-1.0	0.4	0.6
Imports, G & S	-8.9	-2.7	-0.6	5.0	-1.5	-0.8	7.1	-2.5	-0.6	8.0	-1.9
Population (million)	2.85	2.6**	2.85	2.7	2.7	2.8	2.8	2.8	2.9	2.9	2.9

Source: PSA, *for the three quarters, otherwise, for the first half of 2021**Qatar population inside the state by the end of October 2021.

Source: Qatar Economic Outlook January 2022



The Case of Qatar

Table 1-6: Qatar's budget for 2021 and 2022

QR – billion	2021 (40\$)	2022 (55\$)	Change %
Oil Revenues	121.6	154	26.6
Non-Oil Revenues	38.5	42	9.1
Total Revenue	160.1	196	22.4
Salaries and Wages	57.9	58.5	1.0
Current Expenditure	60.7	67.2	10.7
Minor Capex	4	4.6	15.0
Major Projects	72.1	74	2.6
Total Expenditure	194.7	204.3	4.9
Surplus/Deficit	34.6-	8.3-	
Source: MOF			

Source: Qatar Economic Outlook January 2022



The Case of Qatar

Table 1-7: Qatar's Fiscal and Current Accounts, 2021 and 2023

	Estimate		Base scenario			Medium scenario			Optimistic scenario		
	2020	Up-Q3-2021	2021	2022	2023	2021	2022	2023	2021	2022	2023
Overall fiscal balance (% of GDP)	-1.5	1.0	1.9	3.6	3.5	2.2	3.1	2.9	2.0	2.4	2.3
Current account balance (% of GDP)	-2.5	11.7	10.8	7.3	6.5	11.5	7.0	6.4	11.3	6.5	5.8
Exports of goods & services (US\$ bn)	70.9	73.8	98.7	99.0	94.9	100.3	99.9	95.6	100.2	99.8	95.7
Imports of goods & services (US\$ bn)	59.1	44.9	60.4	64.2	64.0	60.3	65.4	64.6	60.4	66.1	65.7
Crude oil export Price (\$/bbl)	48.3	64.2	64.2	64.1	60.7	65.4	64.1	60.7	65.4	64.1	60.7
Natural gas price (\$/mmbtu*) Japan	6.5	10.1	10.1	10.4	9.7	10.3	10.4	9.6	10.3	10.4	9.6

Source: PSA, *BTU=British Thermal Units.

Source: Qatar Economic Outlook January 2022



The Case of Qatar

Figure 2-5: Balance of Current Account and Public Finance)%(

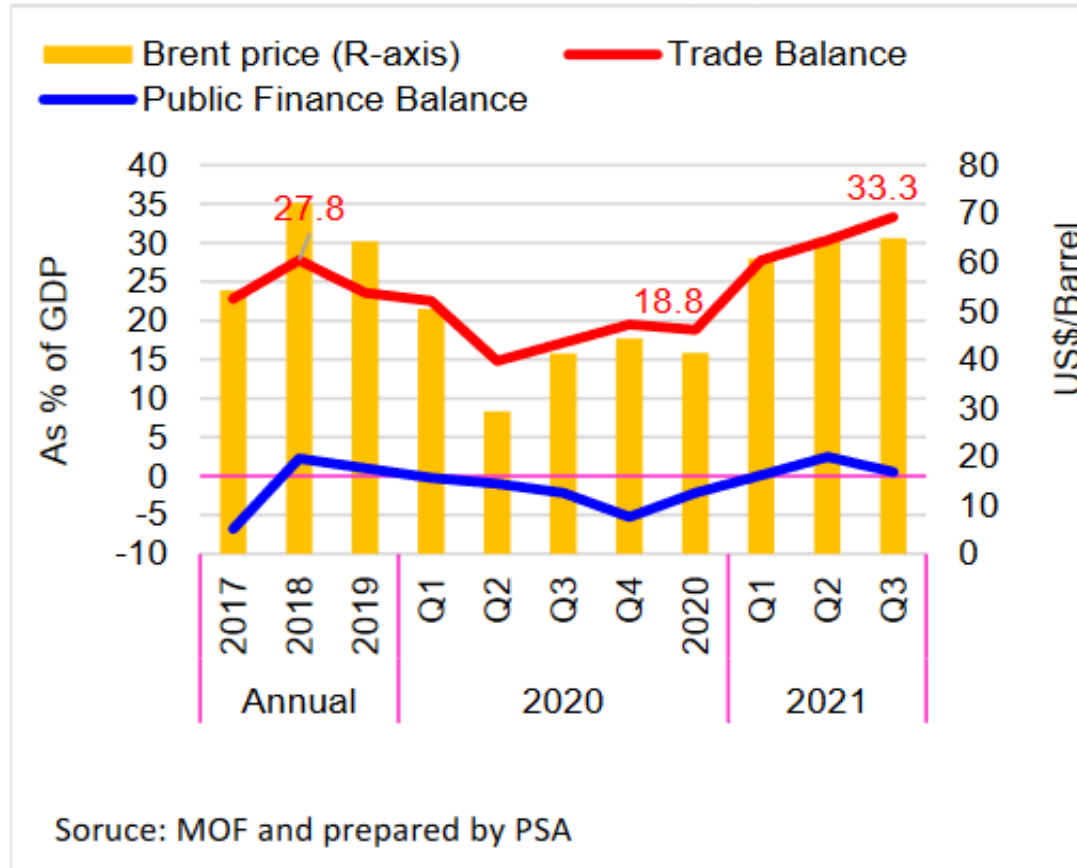
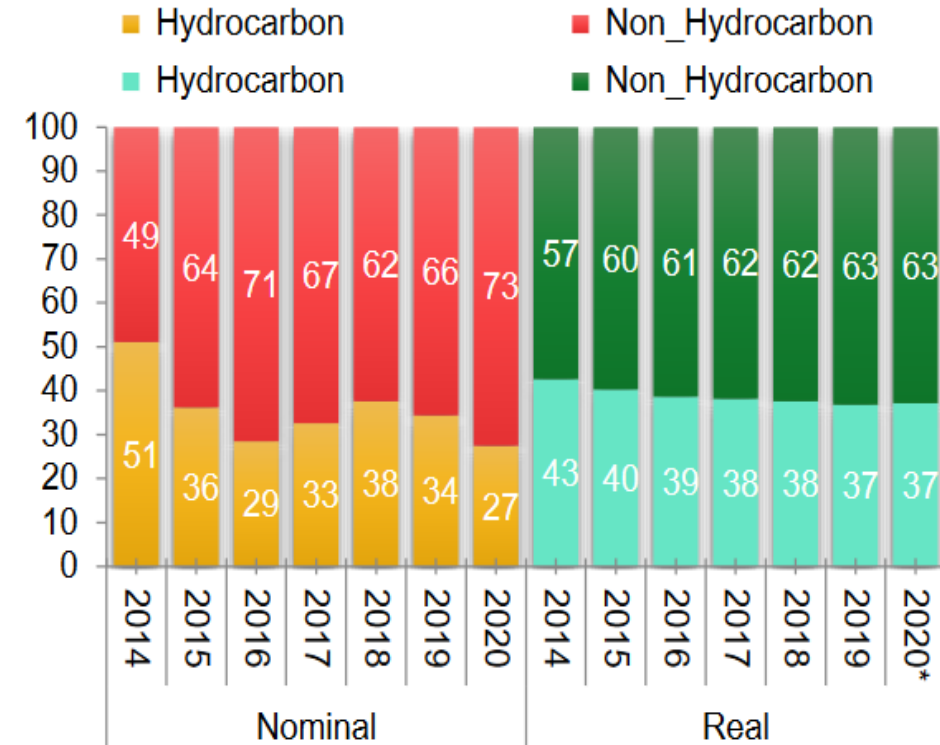


Figure 2-39: Main economic sectors as a percentage of GDP

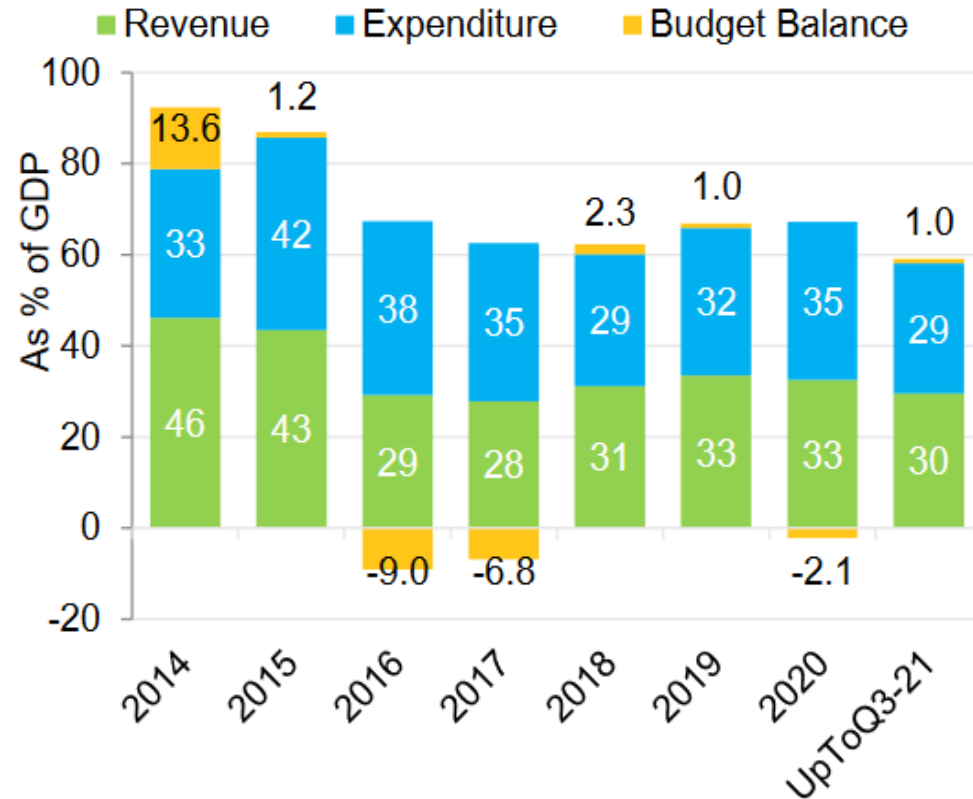


Source: Qatar Economic Outlook January 2022



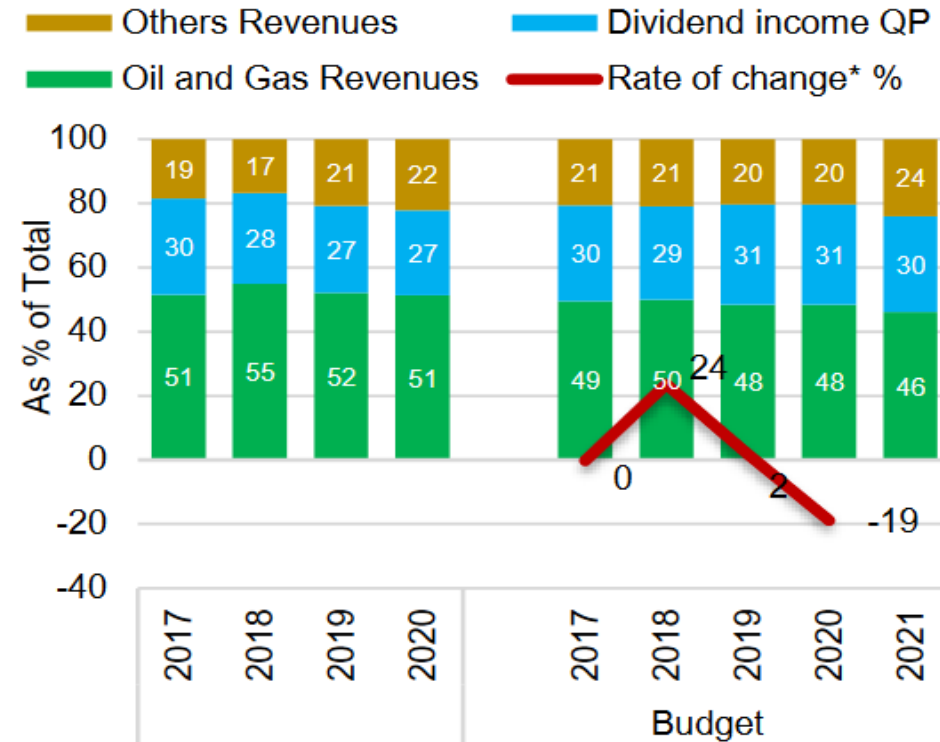
The Case of Qatar

Figure 2-43: Fiscal Balance)%(



Source: MOF and prepared by PSA

Figure 2-44: Public revenues and its components

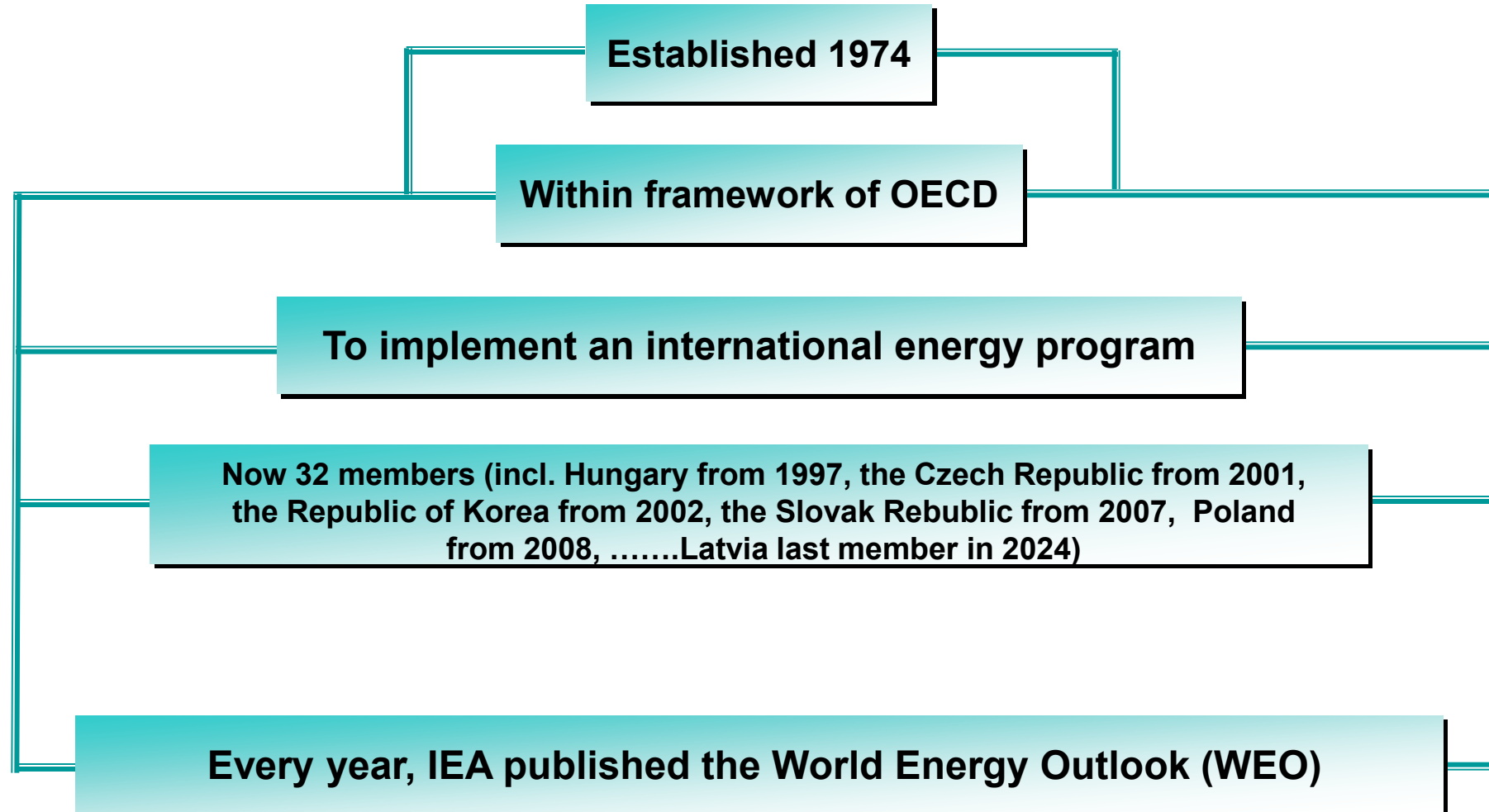


Source: MOF and analysis of PSA (*budgets compared to actual)

Source: Qatar Economic Outlook January 2022



International Energy Agency (IEA)



International Energy Agency



Signature of the Agreement Establishing the IEA, 18 November 1974.



International Energy Agency

Mission

The IEA works with governments and industry to shape a secure and sustainable energy future for all

80%

of global energy consumption

64%

of global energy production

77%

of global CO2 emissions

87%

of global clean energy investment

Membership

The IEA family is made up of 32 Member countries, 13 Association countries, and 4 Accession countries seeking IEA membership



International Energy Agency – Members Countries



Australia ●



Austria ●



Belgium ●



Canada ●



Czechia ●



Denmark ●



Estonia ●



Finland ●



France ●



Germany ●



Greece ●



Hungary ●



Ireland ●



Italy ●



Japan ●



Korea ●



Latvia ●



Lithuania ●



Luxembourg ●



Mexico ●



New Zealand ●



Norway ●



Poland ●



Portugal ●



Slovak Republic ●



Spain ●



Sweden ●



Switzerland ●



The Netherlands ●



Türkiye ●



United Kingdom ●



United States ●



International Energy Agency – Association Countries

 Argentina ○

 Brazil ○

 China ○

 Egypt ○

 India ○

 Indonesia ○

 Kenya ○

 Morocco ○

 Senegal ○

 Singapore ○

 South Africa ○

 Thailand ○

 Ukraine ○

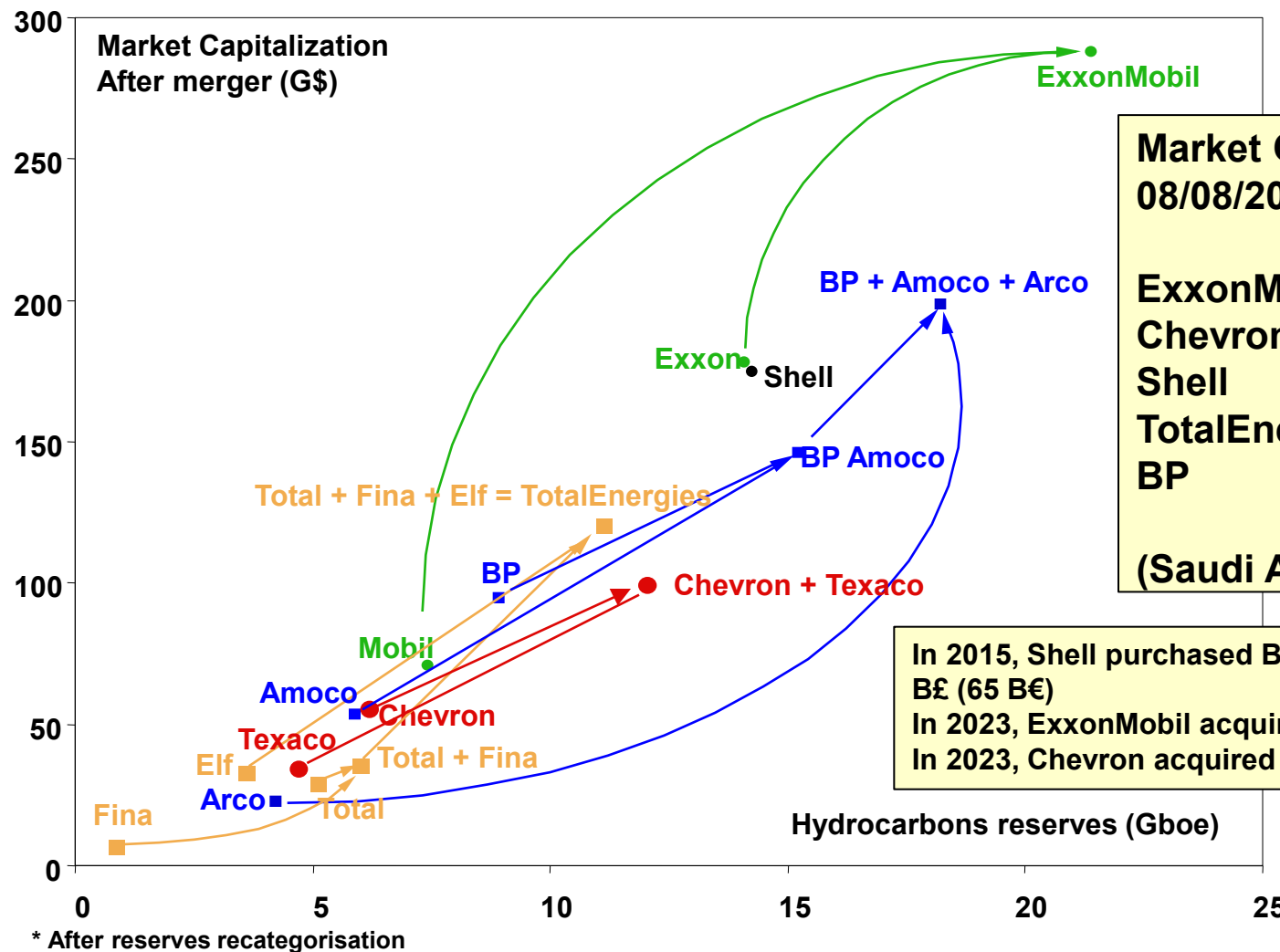


A zoom on Majors



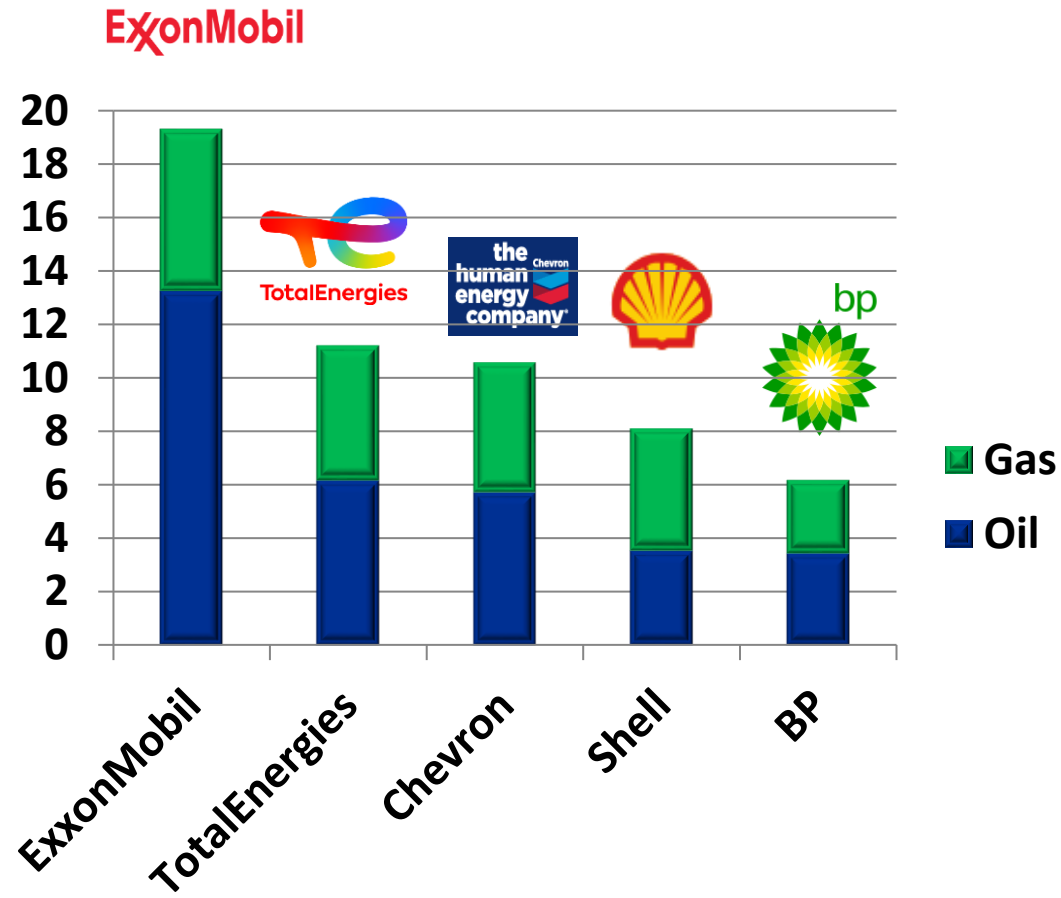
Oil Companies after mergers

(Consolidated situation after previous decade mergers)

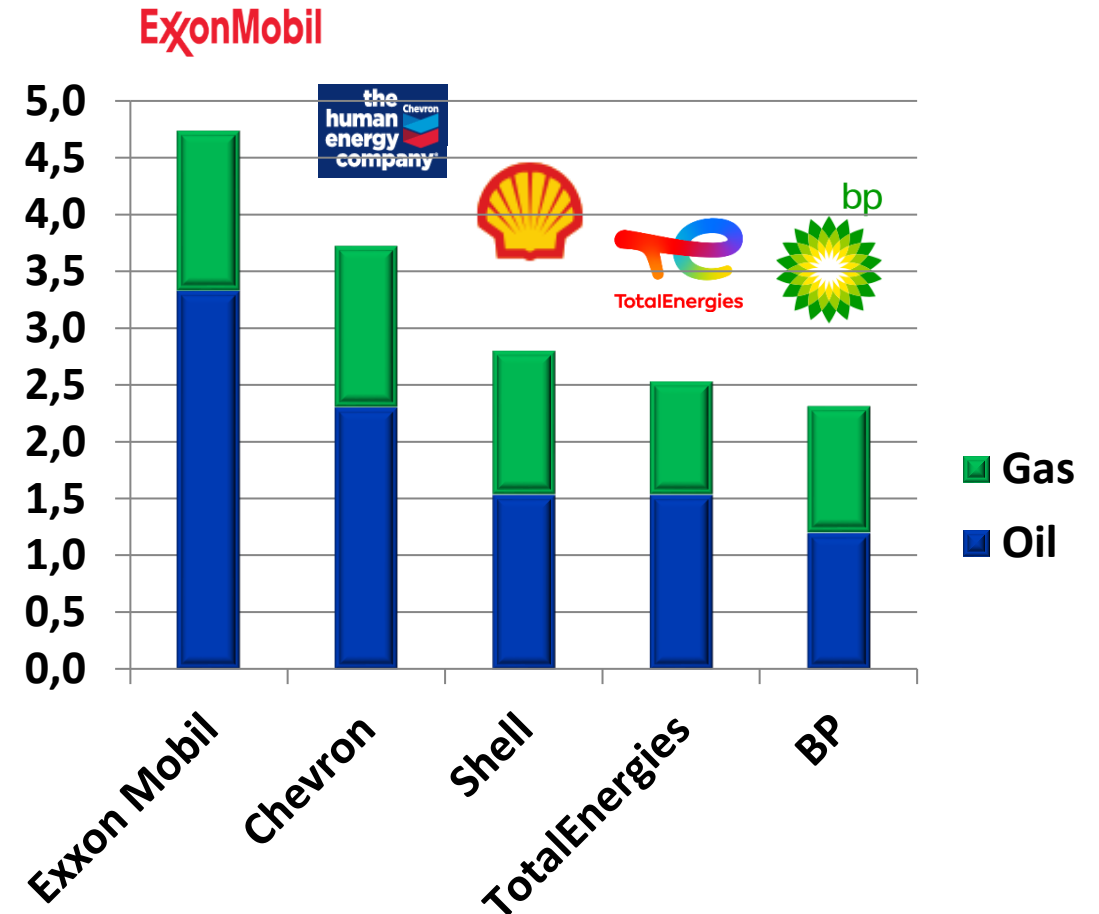


Oil & Gas Proven Reserves End 2025 and 2025 Production – Majors/IOC

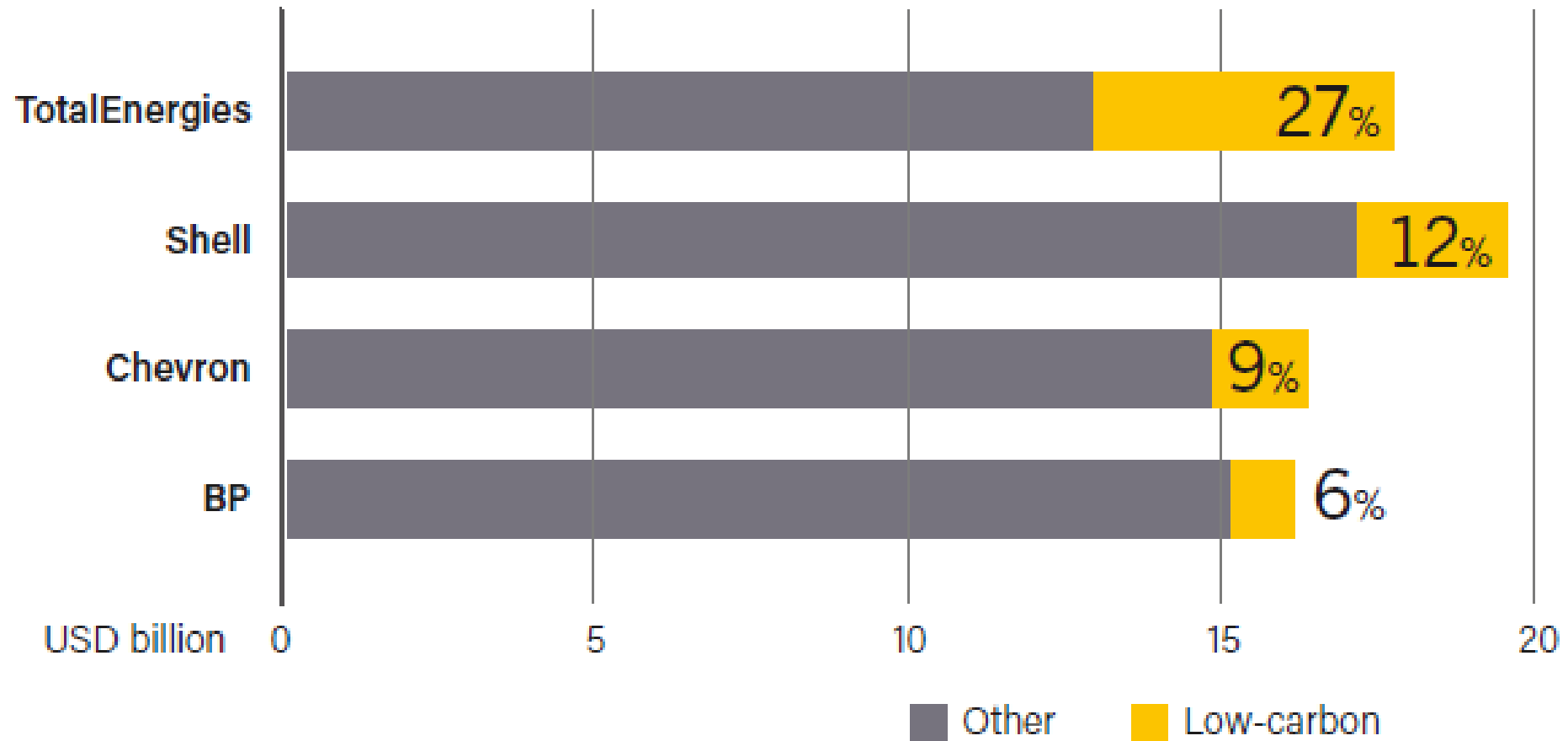
Proven Reserves (Gboe)



Production (Mboe/d)



Low-carbon & total Capex made by 4 IOC in 2024



Note: Low-carbon options are defined differently by company and may include renewable energy, carbon capture and storage, low-emission fuels and electric vehicle charging.



A Zoom on TotalEnergies (See also Book 2 Energy – Chapter 7)



2025 Strategy & Outlook

TotalEnergies, the differentiated and profitably growing energy company

September 29, 2025



TotalEnergies 2025 - Safety



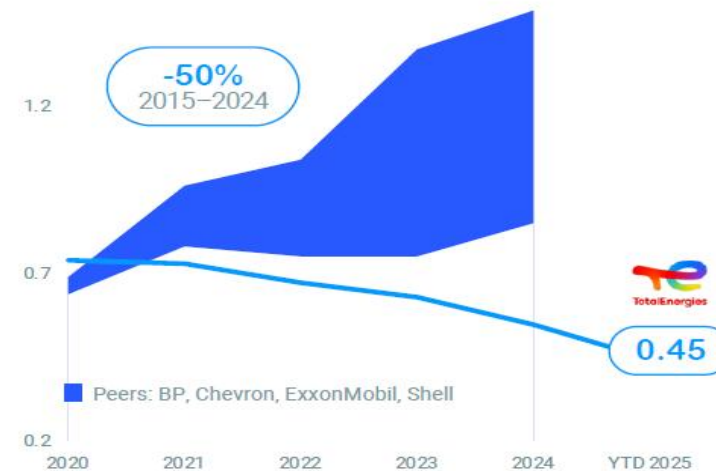
Safety

Safety in continuous improvement

Objective zero fatality

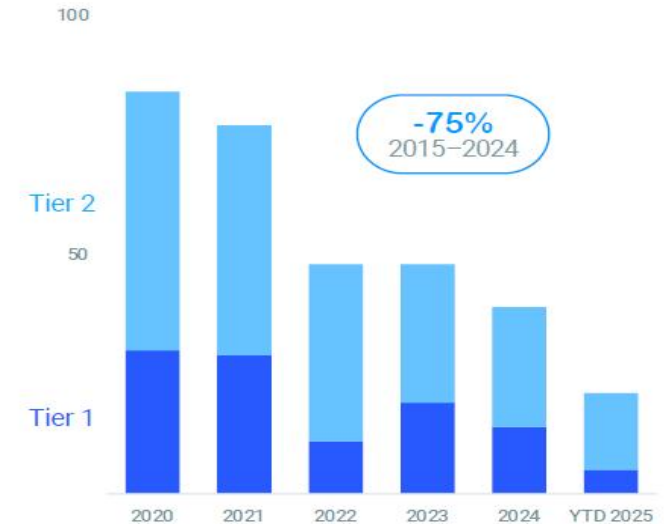


Total recordable injury rate versus peers
per million man-hours



1 fatality in 2025

Primary losses of containment*
number of incidents



* Tier 1+2, as defined in IOGP 456 (Upstream) & API 754 (Downstream)

September 2025 – Strategy and Outlook | 3

Word



TotalEnergies 2025 – Growing Energy Production

Growing energy production by 4%/y through 2030

From our two pillars: Oil & Gas and Integrated Power



Oil & Gas



- Deep low-cost, low-emissions upstream portfolio, delivering accretive growth with further optionality
- Integrated and growing diversified LNG portfolio
- Focus downstream on low-cost and high margin assets

~+3%/y
Oil & Gas production
CAGR 2024–30

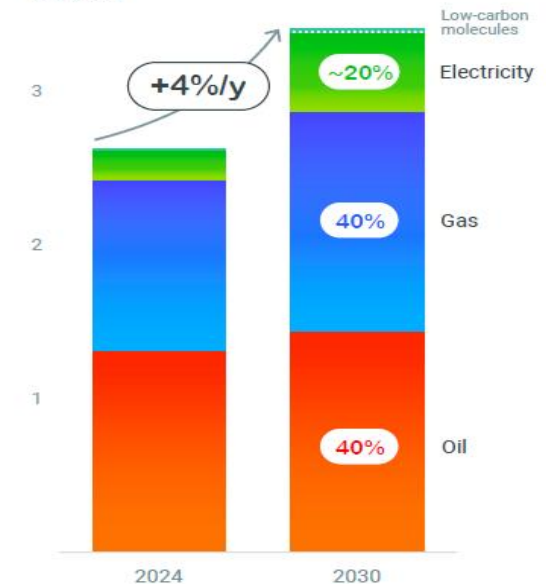
Integrated Power



- Driving value from integrated model
- Clean firm power with renewables, gas-to-power and batteries
- Focusing on key selected deregulated markets

> 100 TWh
Electricity production
2030

Energy production Mboe/d



> 3% Oil & Gas production growth in 2025 and in 2026

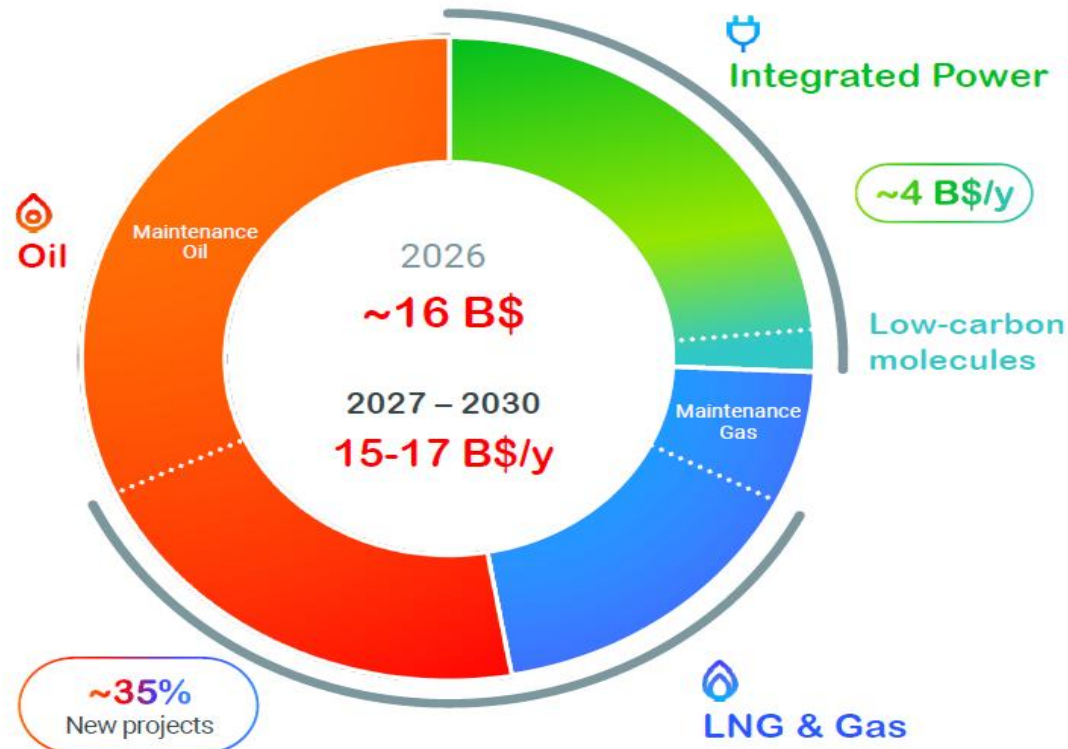
Strategy & Outlook

September 2025 – Strategy and Outlook | 10



TotalEnergies 2025 – Investments Management

Streamlining investments while delivering growth on both pillars



2026-2030

Net Capex guidance reduced by 1 B\$/y

→ **Disciplined organic investment**

- Major projects secured through FIDs and resilient to tariffs
- Focus on core growth projects in Upstream and on Integrated Power growth

→ **Balanced portfolio rotation**

- Selective acquisitions to complete integrated model (US Upstream gas and gas-to-power)
- Executing farm-down program in Renewables to recycle capital
- Disposing non-core assets

→ **Capex flexibility down to 14 B\$/y in case of very low prices**

Strategy & Outlook

Capex = organic investments + acquisitions - asset sales

September 2025 – Strategy and Outlook | 11



TotalEnergies 2025 – Investments Management

Beyond 2030: pursuing growth and value creation



Oil & Gas



Develop valuable optionality

- Namibia: progressing towards a first development
- Support LNG business growth
 - Additional phases of Mozambique LNG
 - Papua LNG
 - Exploring Canada Pacific opportunities
- Develop presence in Malaysia
 - Strategic partnership with Petronas
 - Gas supply to Malaysia LNG

Continue to explore for Oil & Gas

- ~1 B\$/y consistent exploration and appraisal effort
- Continuously reloading our exploration portfolio, like in 2025
 - High impact standalones (Niger delta)
 - Near-by opportunities (US Offshore, Congo, Suriname)
 - Frontier prospects (Algeria, Indonesia, Liberia)

Integrated Power



Sustain profitable growth

- Capture value from worldwide growing demand (AI, AC, electrification)
- Pursue development in selected markets, towards > 150 TWh in 2035

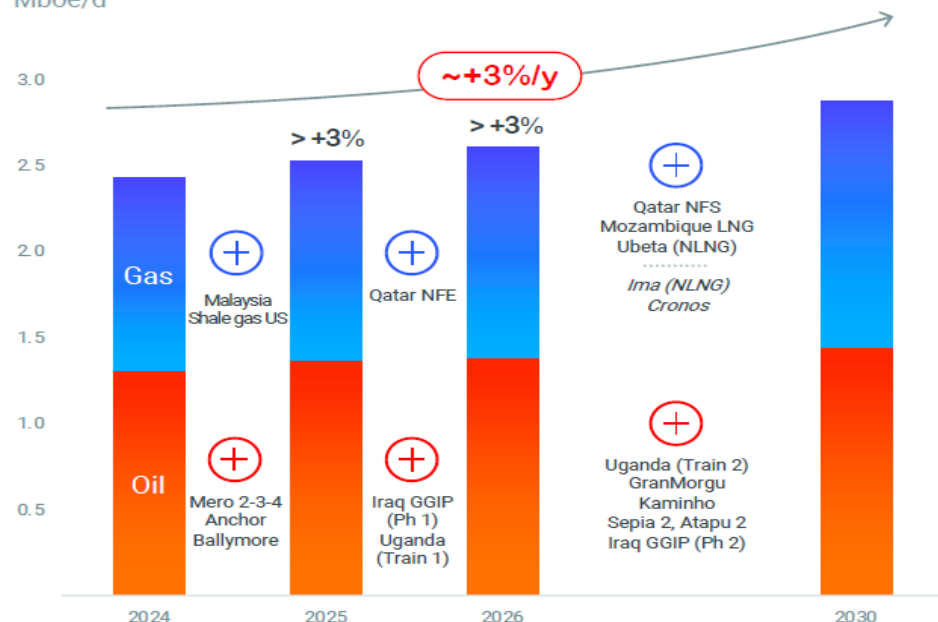


TotalEnergies 2025 – Oil & Gas Production to satisfy Demand

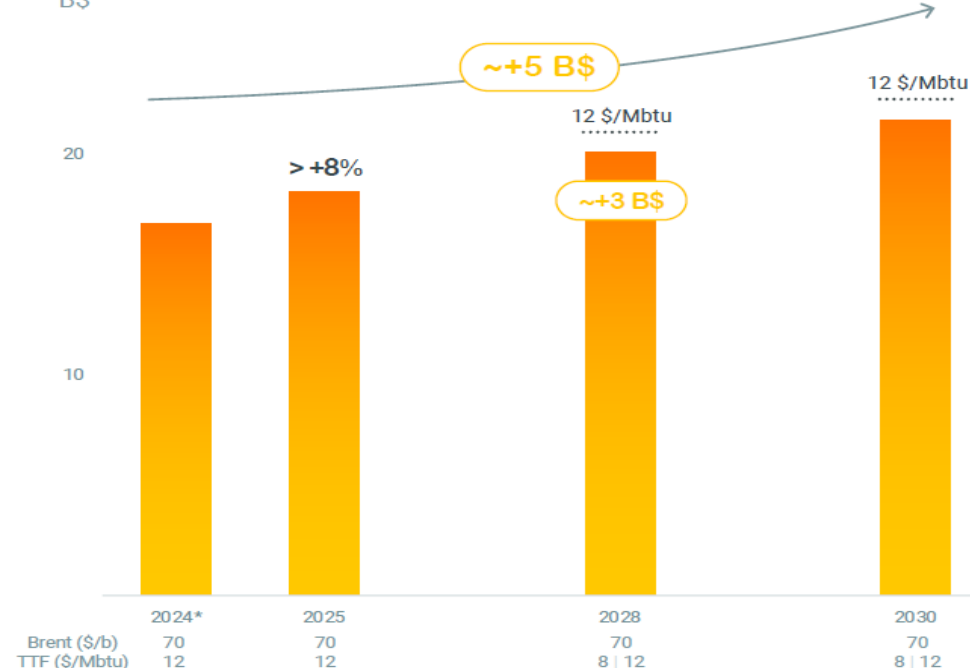
Delivering Oil & Gas production growth



SEC Production
Mboe/d



Upstream CFFO
B\$



Upstream

* 2024 Upstream CFFO restated at 70 \$/b Brent and 12 \$/Mbtu TTF

September 2025 – Strategy and Outlook | 20



TotalEnergies 2025 – Oil & Gas Portfolio optimization

Sustainable, resilient and diversified portfolio

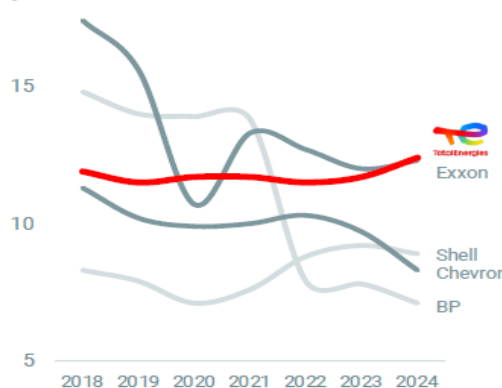


Strong reserves life

Consistent focus on portfolio longevity

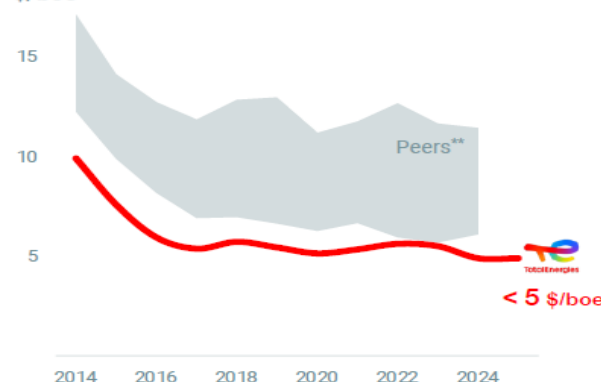
- > 12 years proved reserves
- 18 years proved + probable

Reserves Life Index years



Leadership on OPEX

Production costs*
\$/boe



Cash savings offsetting inflation

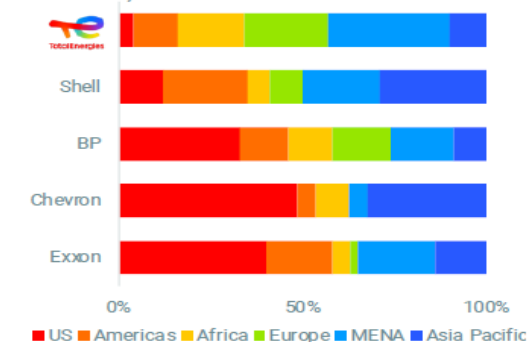
- Lean & digital deployment at scale
- Logistics & procurement synergies
- Adapting structure in mature affiliates

Diversified asset base

Large footprint with key positions

- Hedge against geopolitical, supply chain and fiscal risks
- Resilient long plateau and high-margin short plateau assets

Production geographical split % of total, 2024



Upstream

* ASC932

** Peers: Exxon, Chevron, Shell, BP

September 2025 – Strategy and Outlook | 22



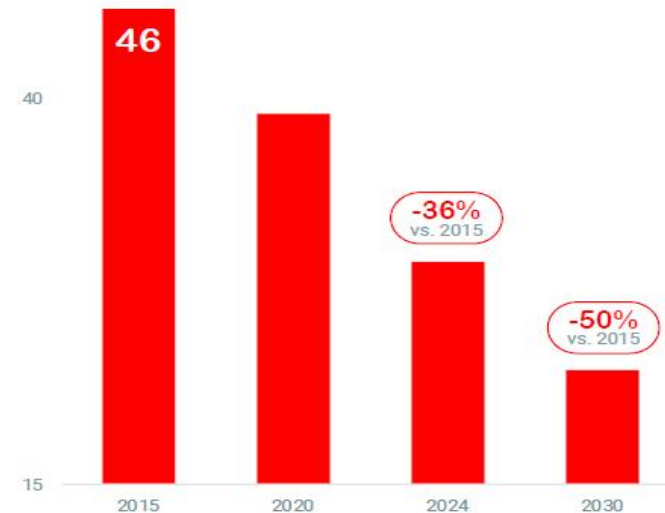
TotalEnergies 2025 – Oil & Gas with less emissions



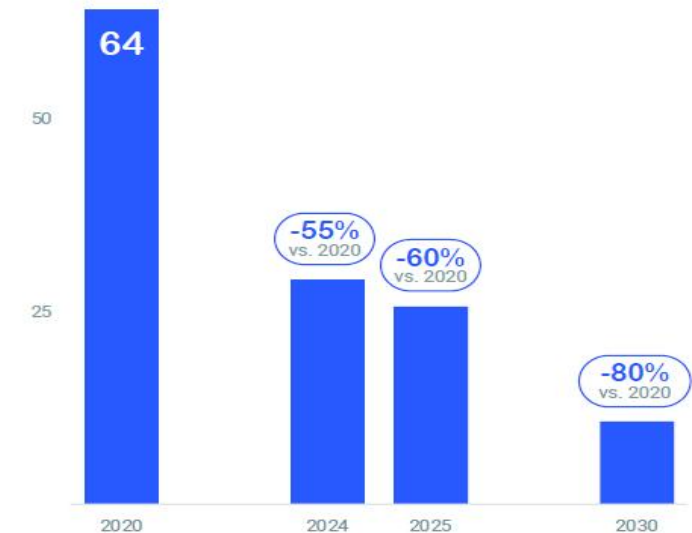
Producing Oil & Gas with less emissions



Scope 1+2 Oil & Gas*
Mt CO₂e, Operated activities



Methane emissions
kt CH₄, Operated activities



2030: -90% in flaring vs 2010, fully eliminating routine flaring**

* Oil & Gas activities, including Upstream and Downstream (not including CCGTs)
** Upstream Oil & Gas activities operated scope

Outlook (new)

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TotalEnergies 2025 – R & C adapting

R&C: pragmatically adapting to evolving markets



European R&C

**Optimizing the use of existing tool:
taking the best from our assets**

- Enhance availability
- Deliver cash savings
 - Streamlined Capex
 - Fixed costs reduction
 - Energy savings program

**Reducing petrochemicals capacity in
an oversupplied market**

- Antwerp cracker closure



Petrochemicals

Positioned to grow profitably

- Focus on advantaged feedstocks
US, Saudi Arabia
- High performing integrated platforms
- Partnerships and JVs enabling low
equity approach

Amiral in Saudi Arabia

- Capacity of 1.6 Mtpa Ethylene, mixed-
feed based on low-cost feedstock and
integrated with Satorp refinery
- Start-up expected end 2027,
50% progress as of Sept. 2025



Bio-products

**Competitively leveraging existing
refining capacity**

- Prioritize flexible coprocessing capacity
increase (Normandie, Antwerp, Leuna)
- Ramping-up production from brownfield
biorefineries (La Mède, Grandpuits)
- Securing competitive feedstock (Used
cooking oil, animal fat, intermediate crops)
- Facing customers giving priority to
affordable supply

Downstream

September 2025 – Strategy and Outlook | 29

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TotalEnergies 2025 – M & S improving margins

M&S: leveraging strengths to keep growing returns

Less volumes, more cash flow, ROACE > 20%



Rationalized retail networks

- Focusing on high market share geographies
- Disposal of peripheral subsidiaries
- Improved retail margins through non-fuel sales and loyalty cards



Profitable lubricant business

- Lubricant business driven by value over volume
- Creation of a dedicated business unit to boost profitable growth and structural savings
- Differentiation through high-end industrial applications and circular lubricants (RRBOs)



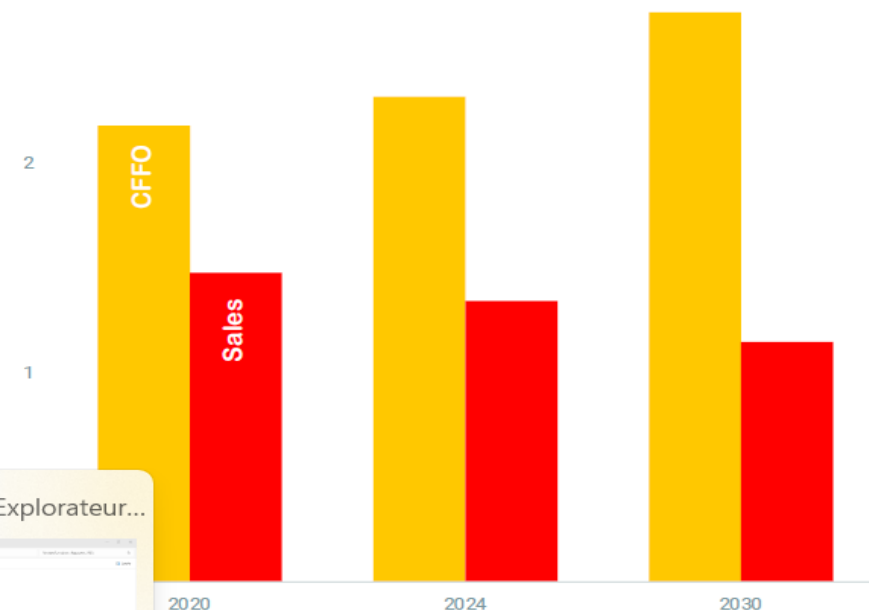
Pragmatic EV deployment

- Adapting investment to actual market penetration
- Focusing on high value charging hubs
- Streamlined Capex: low-equity applications

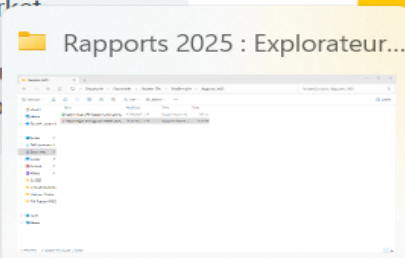
Continuously improving margins

CFFO M&S
B\$

Petroleum products sales
Mb/d



Downstream



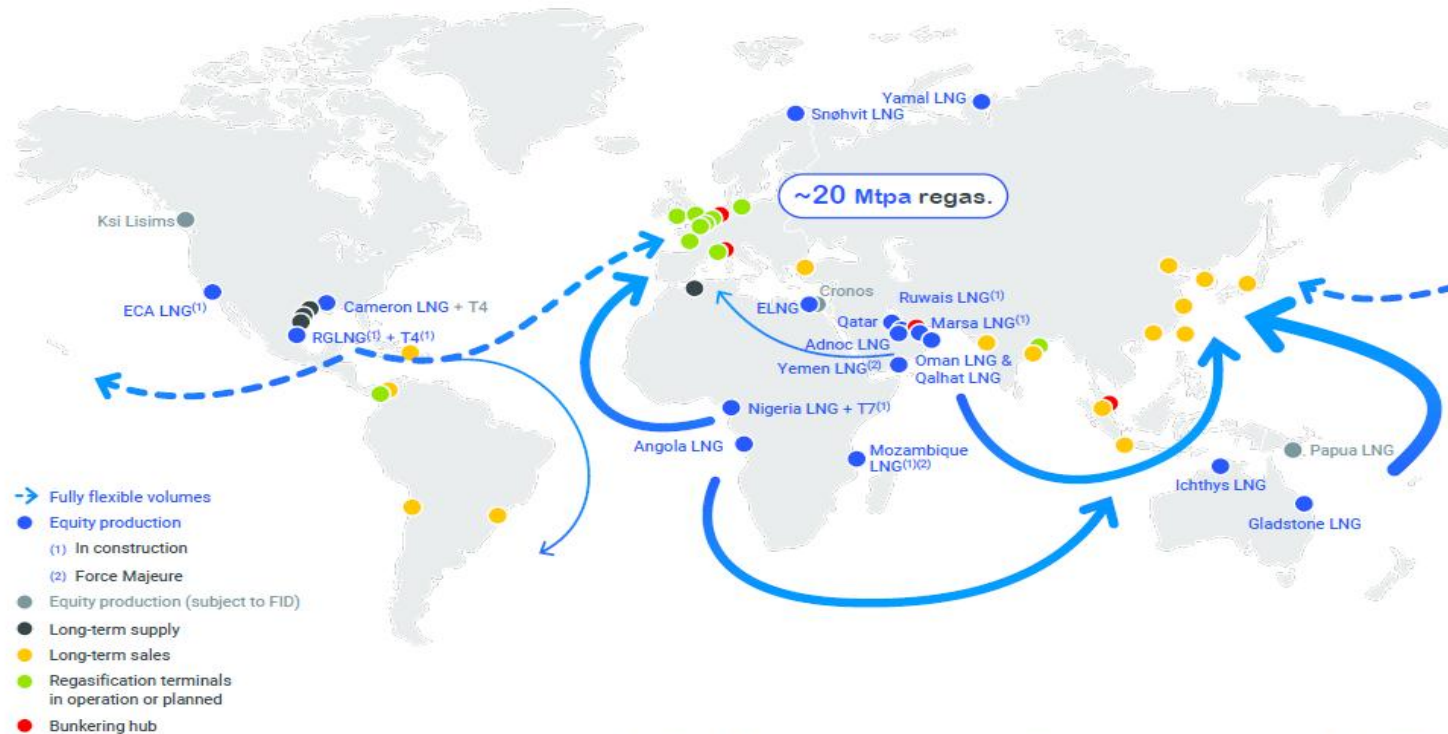
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TotalEnergies 2025 – Strong LNG Business

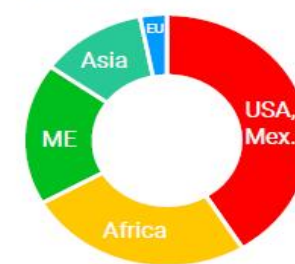
Growing a diversified and flexible LNG portfolio

Well positioned to arbitrage European and Asian LNG demand

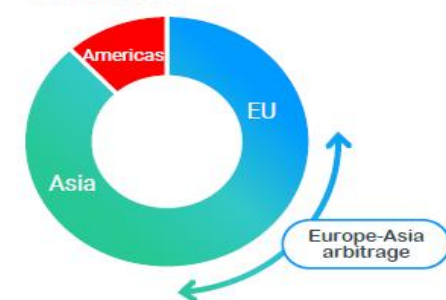


~60 Mtpa of LNG sales by 2030
+50% equity + offtake 2025-2030

Supply split by origin*
% of total, 2030



Sales split by destination*
% of total, 2030



LNG

* Excluding spot

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TotalEnergies 2025 – Developing Power Business

Sharpening focus on key deregulated markets



USA, Europe, Brazil

Key deregulated markets to scale up the integrated model

 +  +  = ~70% of TotalEnergies' power capacity and generation

USA

- Growing power demand: datacenters, industry
- CCGTs & BESS to capture price spikes from renewable intermittence and high peak demand
- Expanding corporate PPA market driving profitable renewable projects

Europe

- Growing electrification: EV penetration, heat pump
- High wholesale price driven by gas and CO₂ prices
- Gas-to-power tailwinds: coal exit, energy security focus
- CCGTs & BESS capture price volatility from renewable intermittence
Germany, UK in particular

Brazil

- Economic growth driving power demand growth
- Strong partnership with Casa dos Ventos
- Developed Clean Firm Power market, potential for flexible assets (BESS, hydro)

Oil & Gas countries

Leveraging the multi-energy model to strengthen Oil & Gas positions

- Extended value proposition and support to host countries energy transition
- Reduced emissions with on-site renewable

Selected renewable markets

Selectively targeting large-scale growing markets
India, South Africa

- Strategic partnerships with local players
- Low-Capex, high-return assets

Strategic review: monetizing all non-core assets

Integrated Power

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TotalEnergies 2025 – Strong free cash-flow

2025 CFFO sensitivities

- +2.8 B\$/y for +10 \$/b Brent
- +0.4 B\$/y for +2 \$/Mbtu TTF
- +0.5 B\$/y for +10 \$/t ERM



Investing in TotalEnergies

Strong free cash flow growth creating a large potential to grow distributions



2026-30 Cumulative CFFO B\$

< 50 \$/b
Post-dividend breakeven



Brent (\$/b) 50
TTF (\$/Mbtu) 8
ERM (\$/t) 35

~80 B\$
Free Cash Flow



Brent (\$/b) 70
TTF (\$/Mbtu) 8
ERM (\$/t) 35

> 95 B\$
Free Cash Flow
at 80 \$/b

Available for
dividend per share increase,
net debt reduction
& share buybacks

Free cash flow = CFFO – Net investments

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TotalEnergies 2026 – Sustainability & Climate

More Energy, Less Emissions

Sustainability & Climate 2026 Progress Report



Source: TotalEnergies Sustainability & Climate Progress Report 2026 – March 2026

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TPA Toolbox Energy Book 4 - Oil



TotalEnergies 2026 – Sustainability & Climate

Climate Impact of Our Strategy: Our 2025 Progress and 2026-2030 Objectives

		2015	2024	2025 Objectives	2025 Realizations	2026 Objectives	2030 Objectives
Scope 1+2 Emissions on operated activities (100%) Mt CO ₂ e	Oil&Gas Installations	vs 2015 46	- 36% 29.4		- 38% 28.4		
	CCGT	0	4.9		4.7		
	Scope 1+2 Emissions	46	34	< 37	33.1	< 34	25-30 ¹ > - 40% ¹
Methane Emissions on operated activities (100%) kt CH ₄		vs 64 kt in 2020	- 55%	- 60%	- 65%	- 70%	- 80%
			29		22,5		
Lifecycle Carbon intensity of energy products sold² (Scope 1+2+3) g CO ₂ e/MJ		73	- 16.5%	> - 17%	- 18.6%	~ - 19%	- 25%
Scope 3 (category 11) Mt CO ₂ e		410 ³	342	< 400	335		< 400

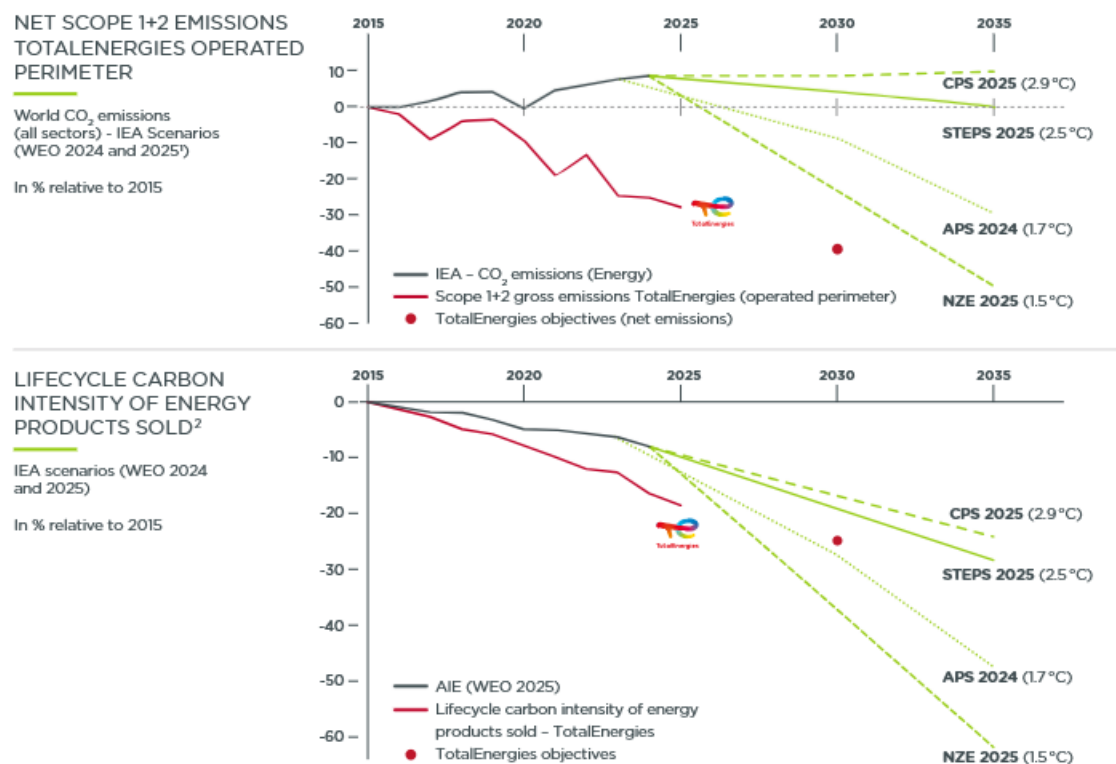
1. Net emissions, including nature-based carbon sinks from 2020. 2. Lifecycle carbon intensity of energy products sold. See Report's glossary for further details. 3. In 2015, Scope 3 category 11 was published at 410 Mt CO₂e. The Company keeps this reference to assess the evolution of its Scope 3. If the Scope 3 category 11 for 2015 had been recalculated according to the IPIECA value chain methodology (published in 2016) on the gas value chain, as introduced in data disclosures from 2021, then the Scope 3 category 11 of 2015 would have been 465 Mt CO₂e, including 344 Mt CO₂e for the oil value chain and 121 Mt CO₂e for the gas value chain.

Source: TotalEnergies Sustainability & Climate Progress Report 2026 – March 2026



TotalEnergies 2026 – Sustainability & Climate

How TotalEnergies' 2030 Objectives Compare to the IEA Scenarios



1. Based on the IEA World Energy Outlook 2024 and 2025, License CC by 4.0. Worldwide CO₂ emissions from energy combustion and industrial processes. For TotalEnergies, emissions exclude the COVID effect in 2019, 2020 and 2021, and take into account nature-based carbon sinks projects from 2030. 2. Lifecycle carbon intensity of energy products sold (refer to definitions in point 5.2.1.3 B. for more details) and evolution of the carbon intensity of world energy, calculated as the ratio of worldwide CO₂ emissions from fossil fuels (Mt CO₂) to total primary energy supply (EJ) in the IEA World Energy Outlook 2024 and 2025. The electricity production from renewable sources (wind, solar, hydro) included in these scenarios is reduced to the same fossil base, taking into account a substitution factor of 2.63 (38%) to make them comparable with the lifecycle carbon intensity of the energy products sold by TotalEnergies.

Reducing GHG emissions of the operated facilities (Scope 1+2) is key to TotalEnergies' ambition to supply more energy while curbing GHG emissions. The objective of cutting net Scope 1+2 emissions from our operated activities by 40% is consistent with the reduction targets of the European Union's "Fit for 55" program (a 37% decrease between 2015 and 2030) and the IEA's 2025 Net Zero Emissions (NZE) scenario (a 23% decrease between 2015 and 2030). TotalEnergies' targets for lowering the lifecycle carbon intensity⁽¹⁾ of energy products sold (around -19% by 2026 and -25% by 2030) put the Company on a trajectory close to the Announced Pledges Scenario (APS) in the IEA's World Energy Outlook 2024, which assumes that the States parties to the Paris Agreement fulfill all their net zero objectives.

An independent third party (Wood Mackenzie) has audited the calculations made as well as the associated trajectories for Scope 1+2 emissions and Carbon Intensity⁽¹⁾.

At the end of 2025, the NGO Transition Pathway Initiative (TPI) assessed the Company's lifecycle carbon intensity⁽¹⁾ trajectory ("Carbon Performance"⁽²⁾) and considers it as aligned with a below 2°C scenario in 2050.

(1) Lifecycle carbon intensity of energy products sold (refer to the glossary for the definition).
(2) The evaluation of TotalEnergies by the Transition Pathway Initiative (TPI) is available on TPI's website.

Source: TotalEnergies Sustainability & Climate Progress Report 2026 – March 2026



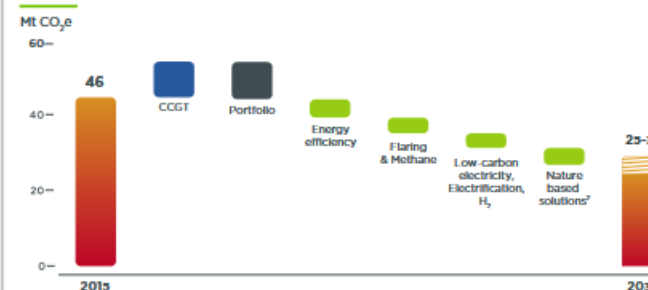
TotalEnergies 2026 – Sustainability & Climate

Reducing Our Scope 1+2 Emissions by 2030

SCOPE 1+2 EMISSIONS FROM OPERATED FACILITIES



SCOPE 1+2 FROM OPERATED FACILITIES: LEVERS TO REACH OUR -40% TARGET IN 2030¹



1. Net of nature-based carbon sinks. 2. NBS credits will be used from 2030.

The primary responsibility of TotalEnergies as a producer of fossil fuels is to reduce emissions on its facilities. In 2024, the Company launched the “Our 5 Levers for a Sustainable Change” initiative, which supports the commitment of all employees to improving energy efficiency and the use of low-carbon technologies in TotalEnergies’ operations.

Our progress in 2025

TotalEnergies is resolutely continuing to reduce emissions from its operated assets. Thus, within the scope of its oil and gas facilities⁽¹⁾, emissions from assets operated by the Company fell by 38% compared to 2015 levels. In 2025, with more than 85 GHG emissions reduction projects coming to fruition, TotalEnergies reduced its emissions by 0.7 Mt of CO₂e across its operated assets.

At the same time, emissions related to flexible power generation decreased by 0.2 Mt CO₂e due to changes in the operated portfolio and lower utilization rates of CCGTs in the United States. As a result, the Company’s overall operated emissions have decreased by 28% compared with 2015. These ongoing reduction efforts have made it possible to reduce the Scope 1+2 intensity of the Upstream Oil & Gas operated assets, from 21 kg CO₂e/boe in 2015 to less than 16 kg CO₂e/boe in 2025⁽²⁾. These results put TotalEnergies among the top performers of the industry when it comes to carbon intensity.

In support of the unchanged target of a 40% reduction in Scope 1+2 net emissions, the trajectory for the operated oil & gas segment suggests a 50% reduction in Scope 1+2 gross emissions in this sector by 2030.

Our objectives

Given the progress made towards achieving its interim targets in 2025, TotalEnergies stepped up its ambition to

reduce GHG emissions from its operated assets and has set the target for 2025 at 37 Mt CO₂e/year, compared with 38 Mt CO₂e/year previously. This target was achieved in 2025 with 33.1 Mt CO₂e/year, down 1.1 Mt CO₂e/year compared to 2024. TotalEnergies has set itself a 2026 target of GHG emissions from its operated assets at 34 Mt CO₂e/year.

TotalEnergies reaffirms its target to reduce emissions from its operated assets, which aims to reduce its net Scope 1+2 emissions⁽³⁾ by 40% by 2030 relative to 2015, after mobilizing around 5 millions credits from nature-based carbon sinks projects. This offsetting will start only from 2030 for residual emissions on the basis of a consumption of approximately 10% per year of the stock of carbon credits of the Company.

(1) Oil and gas facilities (Upstream and Downstream) do not include CCGT.

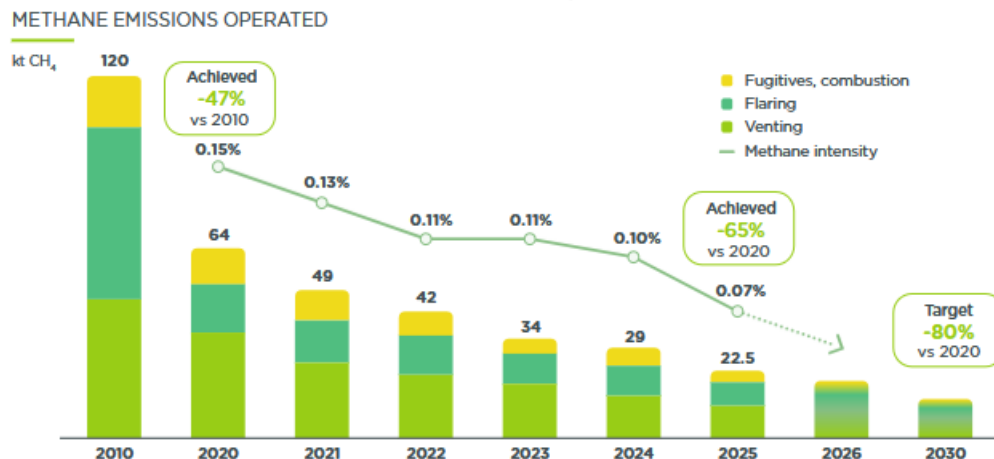
(2) Operated Oil & Gas Upstream intensity is calculated excluding LNG plants.

(3) The calculation of net emissions includes nature-based carbon sinks projects as from 2030.



TotalEnergies 2026 – Sustainability & Climate

Aiming for Zero Methane Emissions



With a warming potential 30 times greater than CO₂ and a short lifespan in the atmosphere⁽¹⁾, methane is a greenhouse gas whose rapid reduction is considered one of the most effective levers for having a short-term impact on global warming. The Global Methane Pledge, launched at COP26 and signed by more than 150 countries, aims to reduce methane emissions by 30% across all sectors (agriculture, waste, energy) by 2030 compared to 2020, and experts estimate that a reduction of this magnitude would have an impact of -0.2°C on the global average temperature by 2050⁽²⁾.

The oil and gas sector has the technologies, technical expertise and operational capabilities to act quickly on methane emissions from its operations. TotalEnergies believes that it is the sector's responsibility to reduce its methane emissions to near zero by 2030 and intends to maintain its leadership role in the industry on methane.

Progress since 2010

Between 2010 and 2020, TotalEnergies reduced methane emissions from its operated assets by nearly half. These emissions then fell from 64 kt CH₄ in 2020 to 22.5 kt CH₄ in 2025, a reduction of 65%, exceeding the target of a 60% reduction between 2020 and 2025. TotalEnergies

has set a new target of -70% in 2026 and is on track to achieve its goal of an 80% reduction by 2030 or sooner, compared to 2020. In terms of methane intensity from operated oil and gas production, TotalEnergies reached 0.07% in 2025, thereby already achieving its 2030 target of falling below the 0.1% threshold⁽³⁾.

Pioneers in methane emissions detection and measurement

In 2022, TotalEnergies deployed AUSEA⁽⁴⁾ drone technology at its upstream sites, complementing the annual leak detection and repair (LDAR) campaigns. Mounted on a drone, the ultra-lightweight dual sensor simultaneously detects methane and CO₂ with high accuracy and is now considered an international benchmark technology and one of the best drone technologies for methane detection⁽⁵⁾.

All of the Company's upstream sites are currently subject to an AUSEA detection campaign at least once a year, and TotalEnergies has shared this technology with several industry partners (including Petrobras, Socar, Sonangol, NNPC, ONGC, Oil India), and more recently in 2025 with Veolia in the waste and wastewater treatment sector. In 2025, 560 days of AUSEA operations were carried out on TotalEnergies' operated assets, nearly 100 on non-operated assets, and nearly 50 on third-party assets.

(1) Around a dozen years, compared to several hundred years for CO₂. Global warming potential of around 30 over 100 years (source: IPCC AR6)

(2) Refer to Global Methane Pledge official text

(3) Methane intensity: report to glossary

(4) Airborne Ultralight Spectrometer for Environmental Application

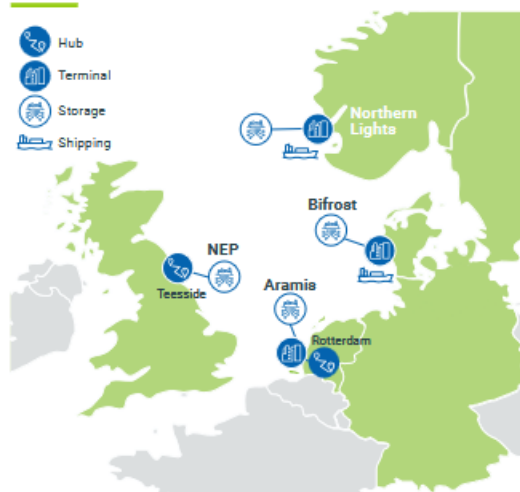
(5) Stanford & IMED study: Controlled release testing of multiple European methane measurement technologies



TotalEnergies 2026 – Sustainability & Climate

Developing Carbon Capture and Storage to Reduce Our Emissions and Those of Our Customers

CARBON STORAGE PROJECTS IN EUROPE



The IEA's NZE scenario⁽¹⁾ includes the use of CC⁽²⁾ for up to 6 Gt CO₂ per year in 2050, in order to reduce some of the emissions from residual oil and gas consumption, as well as from other industrial processes (cement, lime, steel, etc.) This capacity is more than 100 times greater than the global capture capacity currently in operation, which is around 60 Mt CO₂ per year⁽³⁾.

TotalEnergies' CCS strategy gives priority to reducing emissions of its activities, to reduce Scope 1+2 emissions from upstream Oil & Gas activities, as well as refining and

LNG plants. For example, at Snøhvit liquefaction plant in Norway, where the Company is partner alongside Equinor, around 9 Mt of native CO₂ have been stored since 2008. Similarly, the separated native CO₂ in the new NFE and NFS LNG liquefaction trains, currently under development in Qatar, will be stored by QatarEnergy. Finally, for our Ichthys LNG asset in Australia, the Company is studying a native CO₂ storage solution for start-up beyond 2030. The study of CCS solutions for its assets therefore complements the already mentioned efforts to reduce emissions, including electrification, energy efficiency and flaring reduction.

The Company also invests in CO₂ storage projects for large industrial emitters ("Storage as a Service") which can thereby reduce their Scope 1 and secure the future of their activities. TotalEnergies is investing around \$100 million per year in this business, with models that enable us to benefit from leverage. This investment will be sustained in order to contribute to the development of a gross storage capacity of 10 Mt CO₂ per year by 2030.

Europe is at the heart of this CCS strategy. TotalEnergies is an historical operator in the North Sea, with recognized operational and geological expertise in the area. The United Kingdom, Norway and the European Union have set objectives and regulations and have provided significant financial support to promote a cross-border deployment of CCS. The Company is currently developing four projects in the North Sea that will provide CO₂ storage solutions for its own assets and those of its customers. The Company has entered the United States CCS market in 2024, with a 25% stake in the Bayou Bend project in

Texas. Finally, TotalEnergies is studying the development of CO₂ storage in Malaysia, for local and regional markets, with its partners Petronas and Mitsui.

TotalEnergies is also studying the utilization of carbon in various forms (CCU), such as in reaction with renewable hydrogen, to produce fuels or synthetic methane. In particular, the Company signed an agreement for the development of the Live Oak synthetic methane production project in the United States.

(1) IEA 2025, World Energy Outlook 2025, Licence CC by 4.0.

(2) Carbon Capture & Storage.

(3) Global CCS Institute 2025, Global Status of CCS 2025 (updated on October 9, 2025)

HIGHLIGHTS

Norway

Northern Lights is the world's first merchant CO₂ transport and storage project. In 2025, the first CO₂ volumes were successfully transported by vessel from Heidelberg Materials' cement factory in Brevik, Norway, to the Northern Lights' facilities in Øygarden.

Also in 2025, TotalEnergies and its partners, Equinor and Shell, announced the Final Investment Decision (FID) of the second phase of the Northern Lights development, which will increase the project transport and storage capacity from 1.5 million to more than 5 million tons of CO₂ per year from 2028. This FID follows the signing of a 15-year commercial agreement between Northern Lights and the Swedish district energy provider, Stockholm Exergi, for the cross-border transport and storage of 900,000 tons of biogenic CO₂ emissions annually, starting in 2028.





ENTREPRISES ARE PART OF THE SOLUTION



Important Business Development Steps to build-up a MultiEnergy Company



**August 2017
Total acquired Maersk Oil
for \$7.45 billion**



Acquisition of Maersk Oil

August 2017



Acquisition of Maersk Oil

Acquiring an attractive and complementary portfolio

Adding quality assets offering growth in core areas



Mainly **conventional OECD** assets with strong growth and high margins

Complementary **international portfolio**

Significant **synergies**

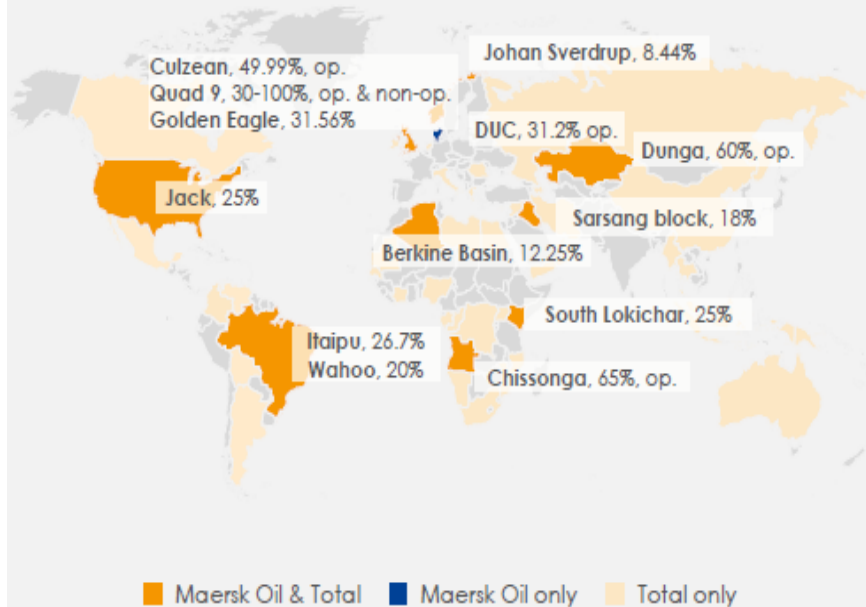
Cash flow and earnings accretive from 2018



Acquisition of Maersk Oil

Acquiring an attractive portfolio with Maersk Oil
Adding high quality assets offering growth in core areas

Main assets acquired*



* Subject to closing

~ 1 billion barrels, >85% in OECD countries

Net production of 160 kboe/d in 2018
increasing to >200 kboe/d by early 20's

Mainly liquid production with high margins
and free cash flow breakeven <30 \$/b

>1.3 B\$ CFFO at 50 \$/b in 2018 before synergies

>400 M\$ per year of synergies, incl. >200 M\$
on costs

Source: Total Investors Day September 2017



Acquisition of Maersk Oil

Share and debt deal

Closing expected early 2018*

Offer for 100% Maersk Oil's equity

**4.95 B\$ in Total shares
(97.5 million shares)**

**Total will assume 2.5 B\$ of
Maersk Oil's debt**

** Subject to regulatory approvals*

Total will obtain

- ~ **1 billion barrels** of reserves
- > **85%** in **OECD** countries

Net production of 160 kboe/d in 2018 increasing to > **200 kboe/d** by early 20's

Predominantly liquid production with **high margins** and **free cash flow breakeven < 30 \$/bbl**

> **1.3 B\$ CFFO** at 50 \$/b in 2018 before synergies

Experienced teams with strong operational skills

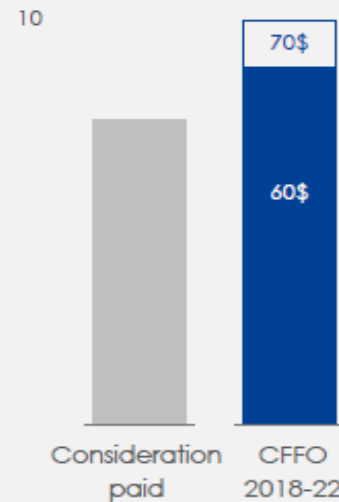
A new **long term shareholder**



Acquisition of Maersk Oil

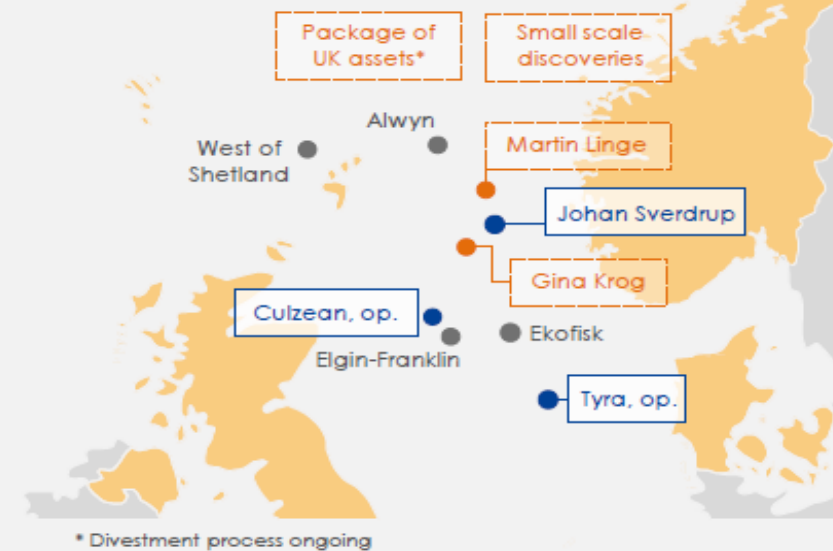
Maximizing value in the North Sea Integrating Maersk Oil assets and highgrading portfolio

Maersk Oil accretive acquisition
B\$



Divestment of high costs assets

- Main acquisitions – Tech. costs ~20 \$/boe
- Main divestments – Tech. costs > 35 \$/boe
- Key existing assets – Tech. costs < 25 \$/boe



2018 Strategy and Outlook

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Source: Total Investors Day September 2018

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TPA Toolbox Energy Book 4 - Oil



September 2019 Total acquired Anadarko African Assets



Acquisition of Anadarko Assets

Anadarko African assets, clear strategic fit

Africa, LNG



Mozambique | Area 1 | 26.5%, Op. | ~350 kboe/d

Middle East & North Africa



Algeria | Berkine Basin - Block 404A & 208 | 12.5% to 37.5%, Co-op | ~320 kboe/d

Africa, Deepwater



Ghana | Jubilee & TEN | 27% | ~140 kboe/d

* at 60 \$/b

Mozambique Area 1: one of a kind asset

- Low acquisition price < 1.5 \$/boe
- Giant high quality resources > 60 Tcf
- Sanctioned 12.8 Mt/y LNG operated project with competitive liquefaction costs ~850 \$/t
- Marketing ~90% sold under long term contracts largely oil indexed
- Launching studies on train 3&4 in 2020
- 1 B\$/y CFFO* in 2025+

Oil assets: ~700 M\$/y CFFO* on 2020-25

- **Algeria** Berkine Basin: increasing equity in long reserve asset
- **Ghana**: growing deep water asset

Exploration acreage in **South Africa**

Additional value creation by **portfolio optimization** in LNG and oil trading



Total - LNG Markets

On 13 July 2018, Total announced the acquisition of ENGIE LNG assets for an amount of 1,5 G\$:

- 16,6% in Cameron LNG in the US**
- Liquefaction capacities of 23 MT/year located in Middle-East, Australia, Russia, US**
- Long term contracts representing 28 MT/year**
- Regas capacities of 18 MT/year**
- 18 LNG vessels out of which 2 FSRU**



TotalEnergies & Renewable Energy



Total, majority Shareholder in Sunpower

SunPower, a high quality platform in solar

Leading integrated player

Solar cell and panel production



25%

World record
cell efficiency



1.3 GW

Solar modules
produced in 2015



**Wide range
of products**

Supplying all
market segments

Decentralized power generation



**#2 in US
residential**

Deploying
350-450 MW in 2016

12% market share

Power plant design, construction and operation



**>1 GW
in development**

Operating >1 GW

748 MWp Solar Star
World's largest solar
power plant

Sunpower supplier of Solar Impulse (2011)



Renewable Energy Portfolio

September 2017: New Acquisition for Total

**Total Partners With EREN Renewable Energy to
Expand Its Renewable Business**

Transaction Value = 237,5 M€

23% of EREN RE

EREN RE Activity:

Renewable Electricity Production:

Wind Energy, Solar Energy, Hydroelectricity

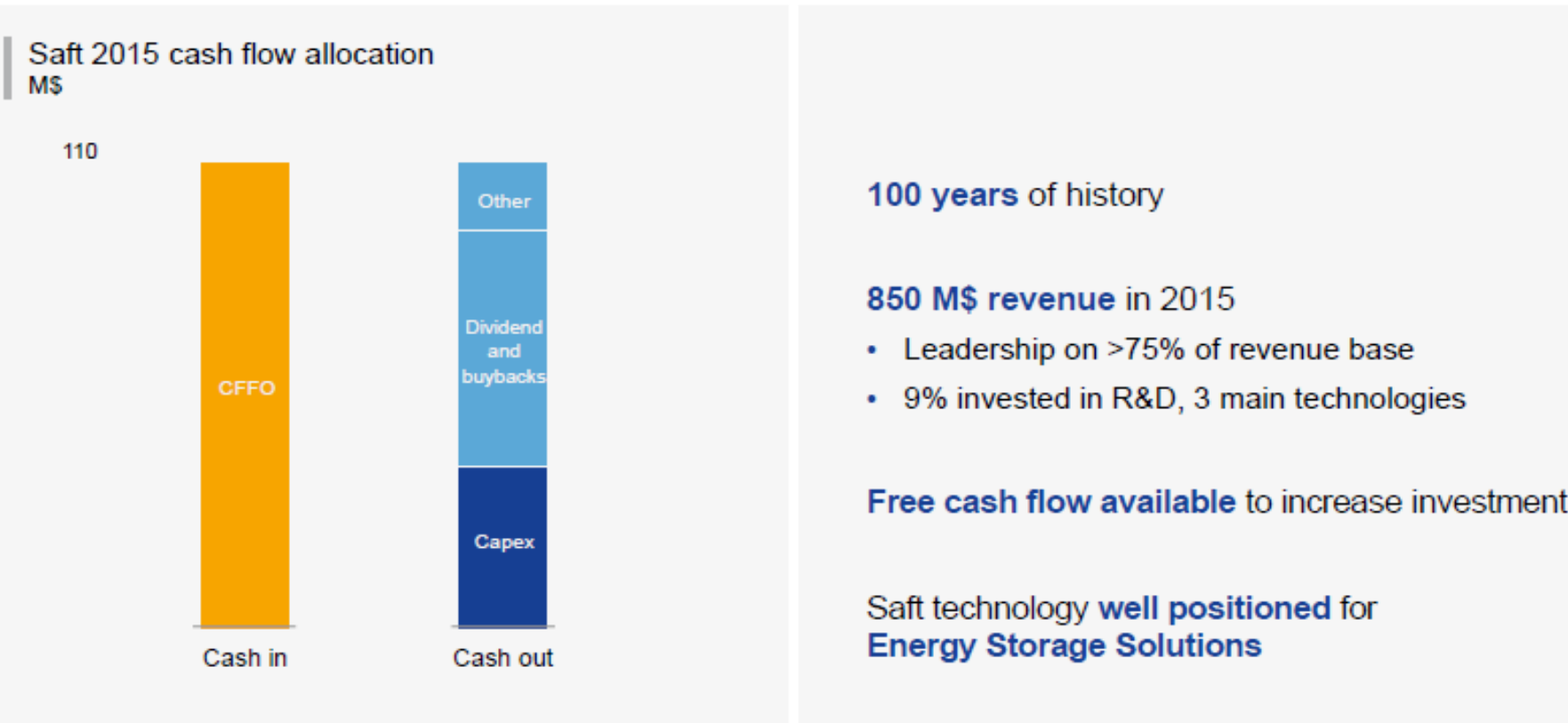
**On 26 July 2023, TotalEnergies acquired 100% of Total
EREN for 1,5 G€ (3,5 GW installed capacities +
projects portfolio of 10 GW)**



An Industrial Key: Energy Storage Acquisition of Saft (Top Range Batteries) for 950 M€

Energy storage, key to growing profitable renewables

Solid cash generation to boost future growth



Total and Renewable Energy A Rapid Development

TOTAL ET LES ÉNERGIES RENOUVELABLES



2011

SunPower rejoint Total pour former un nouveau leader mondial de l'industrie solaire.

2016

Acquisition de Saft, spécialisé dans la conception, la fabrication et la commercialisation de piles et de batteries de haute technologie pour l'industrie.

Acquisition de Lampiris, troisième fournisseur du marché résidentiel belge de gaz naturel et d'électricité renouvelable.

2017

Prise de participation dans Eren Renewable Energy, renommé Total Eren, pour accélérer la croissance dans la production d'électricité renouvelable.

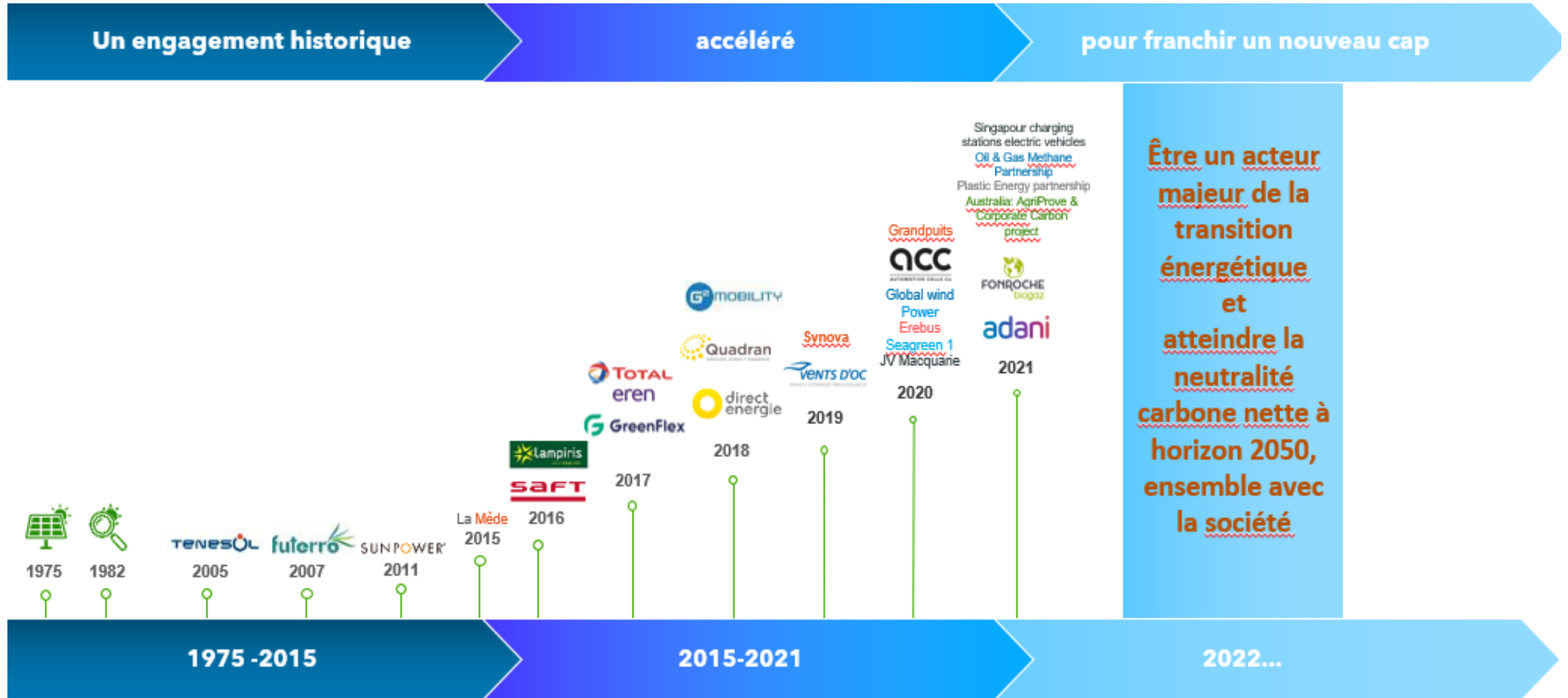
2018

Création de Total Solar, pour produire et vendre de l'énergie solaire à des clients industriels et commerciaux, ainsi qu'au réseau.

Acquisition de Direct Energie, fournisseur d'électricité français, et de sa filiale Quadran qui exploite et développe des projets d'énergies renouvelables éoliens, solaires, hydroélectriques et biogaz.

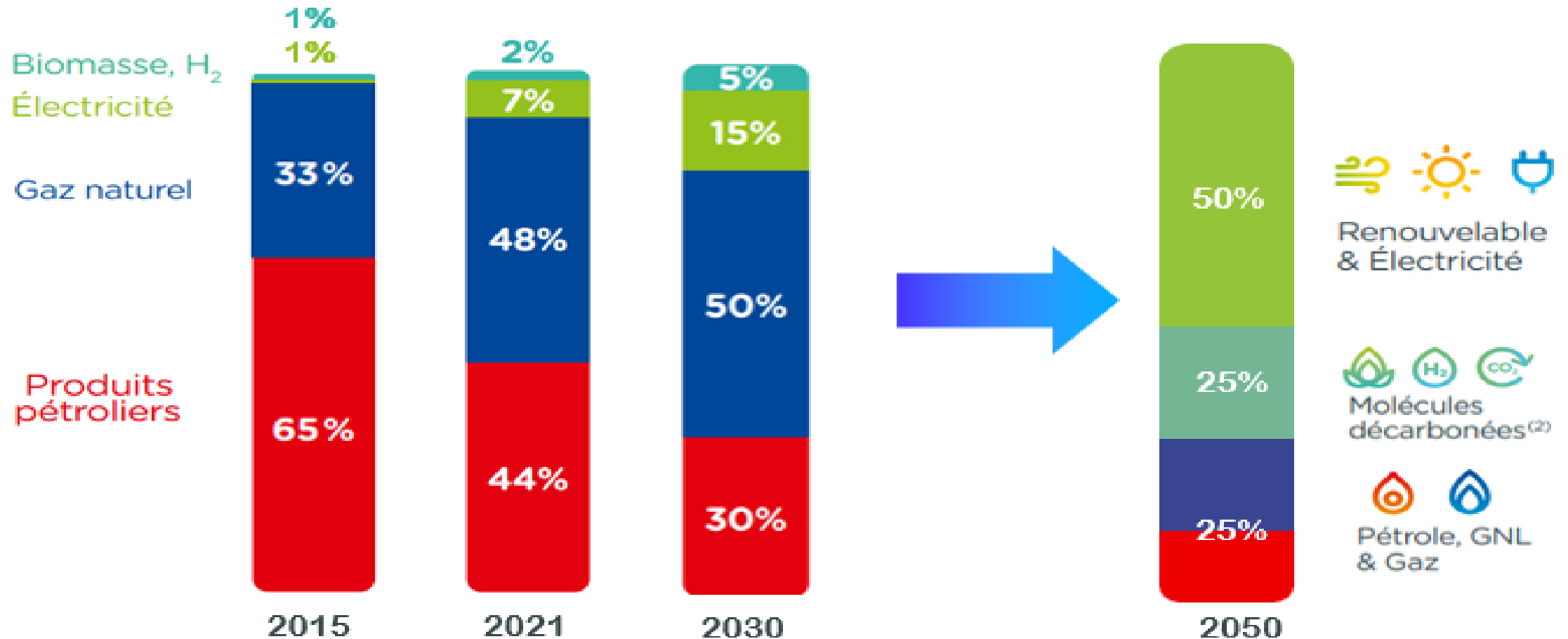


Total and Renewable Energy A Rapid Development



TotalEnergies Energy Mix Evolution

Transformation du mix énergétique



TotalEnergies among the most dynamic companies committed in Energy Transition

Investment and strategic responses to energy transitions by selected companies (illustrative, based on 2015-19 activity)

Company	Enhancing traditional oil and gas operations			Deploying CCUS		Supplying liquids and gases for energy transitions		Transitioning from fuel to “energy companies”			
	Reducing methane emissions	Reducing CO ₂ emissions	Sourcing renewable power	For centralised emissions	For EOR	Low-carbon gases	Advanced biofuels	Solar PV and wind generation	Other power generation	Electricity distribution/retail	Electrified services / efficiency
BP	●	●	◐	◐	◐	●	◐	●	◐	◐	●
Chevron	●	◐	●	●	◐	◐	◐	◐	○	○	◐
Eni	●	◐	●	◐	◐	◐	●	●	●	●	◐
ExxonMobil	●	◐	●	●	◐	◐	◐	○	○	○	○
Shell	●	●	●	●	◐	●	◐	●	●	●	●
Total	●	●	●	◐	◐	●	●	●	●	●	●
CNPC	◐	○	◐	◐	●	◐	◐	●	○	○	○
Equinor	●	●	●	●	◐	◐	◐	●	○	◐	◐
Petrobras	◐	◐	●	●	●	●	◐	◐	●	◐	○
Repsol	●	●	◐	◐	◐	◐	◐	●	●	●	◐

Notes: PV = photovoltaic. **Full circle** = growth area supported by observed strategic investments (e.g. M&A) and/or capital/operational expenditures in commercial-scale activities; **half circle** = announced strategy and/or minor investments, venture capital and/or research and development (R&D) spending; **empty circle** = limited evidence of investment activity. **For methane and CO₂ emissions**, which are not based on project and spending data, assessments reflect the presence and strength of methane reduction and emissions intensity targets, as well as evidence of their implementation, the emissions intensity trend of new investment, transparent reporting of absolute emissions and sources, and linking of executive and staff compensation to achieving goals. Power generation and efficiency investments in the Transitioning category pertain to projects destined for commercial sales (not own use). Electrified services include battery storage and EV charging. Low-carbon gases include low-carbon hydrogen and biomethane.

Total among the most dynamic companies committed in Energy Transition (Some important steps)

Affiliates/ Divisions	Activities	Year	Share	Cost (G€)	Projects location Present & future
Total Energie Développement	Solar	1972 2005	100%		
TENESOL	Solar	2005	50%		
SunPower	Solar	2011	56%	1,33	California, Chile, Italy, Australia, Japan, South Africa, ...
Saft	Batteries	2016	100%	0,95	France & international
Lampiris	Gas & Green Electricity Distribution	2016	100%	0,18	France & Belgium
EREN Renewable Energy	Hydroelectricity, solar, wind	2017	23%	0,24	Europe, Asia, Latin America, Africa 4 400 MW
Greenflex	Energy efficiency	2017	100%	na	France & Europe
Direct Energie	Gas & Electricity Low carbon Production	2018	100%	1,40	France
Total Solar Internat. (TSI)	Production & sale of solar energy Utility scale solar plants	2018	100%		Japan, South Africa, Abu Dhabi, Chile, Qatar, Spain, India.....
Total Quadran	Renewable Energy	2019	100%		France & overseas
Total Carbon Neutrality Ventures	To finance start-up developing solutions to achieve carbon neutrality	2019	100%		International Cumulated investment = 400 M\$
Total	Forests Preservation	2020	100%		100 M\$/year



Total among the most dynamic companies committed in Energy Transition (Some important steps)

Affiliates/ Divisions	Activities	Year	Share	Cost (G€)	Projects location Present & future
Blue GemWind	Wind offshore	2020	80%	na	EREBUS Project, Celtic sea, Wales, UK
TotalEnergies	Wind offshore Seagreen	2020	na		Scotland
Global Wind Power	Wind onshore via Total Quadran	2020	100%	na	France, portfolio 1000 MW
TotalEnergies	Solar Power - JV with Adani Green Energy Limited (AGEL) 3 GW & 15 GW potential portfolio	2020	50%		India
TotalEnergies	Biomethane – Acquisition of Fonroche Biogaz	2020	100%	na	Several anaerobic digestion units in France
TotalEnergies	Solar Power 5,3 GW PV with Powertis, Solarbay RenewableEnergy and Ignis	2020/21	na		Spain
TotalEnergies	Solar & Energy storage projects JV with 174 Power Global - 4 GW	2021	na		US
TotalEnergies	Floating offshore windfarm - JV with Macquarie	2021	50%		South Korea
EolMed	Floating wind project Mediterranean	2021	na	na	France
TotalEnergies	Offshore windfarm	2021	na		Taiwan
TotalEnergies	Battery storage	2021	100%		France/Dunkirk
Saft	Strategic hub for Energy Storage solut.	2021	100%		China/Zhuhai
TotalEnergies	Solar Mapper JV with Google	2021	na		



Total among the most dynamic companies committed in Energy Transition (Some important steps)

Affiliates/ Divisions	Activities	Year	Share	Cost (G€)	Projects location Present & future
TotalEnergies	Solar power PV - JV with Adani expanded	2021	50%		India/Kamuthi
TotalEnergies	Hydrogen - JV with ENGIE Masshyla project, largest green hydrogen production in France, 5tH ₂ /day by 2024	2021	na		France/La Mède
TotalEnergies	CCS – Northern Lights with Equinor & Shell 100 M\$:year devoted to CCS R&D and industrial pilot projects	2021	na		Norway
Saft	JV with Stellantis to launch large scale production of batteries for electric vehicles as from 2023	2021	100%		Europe
TotalEnergies/Saft	Pure electric refueling vehicles for aviation – Partnership with Titan Aviation & Gaussin	2021	100%		France, others
TotalEnergies	Charge points for electric vehicles – 500 service stations by 2023	2021	100%		France
TotalEnergies	Hydrogen as a fuel for trucks and buses Hydrogen fillin stations	2021	100%		Germany, Netherlands, Belgium, France
TotalEnergies	Sustainable Aviation Fuels production	2021	100%		France/Grandpuits
TotalEnergies	Natural Carbon Sink - Partnership agreement with Republic of Congo – plantation of 40000 ha of forest on the Batéké Plateau	2021	na		Congo



Total among the most dynamic companies committed in Energy Transition (Some important steps)

Affiliates/ Divisions	Activities	Year	Share	Cost (G€)	Projects location Present & future
TotalEnergies	Renewable Energy – Acquisition of 50% of Clearway Energy Group	2022	50%	na	
TotalEnergies	Acquisition of Core Solar – Utility scale solar and energy storage projects in US	2022	na		4 GW
TotalEnergies	Al Kharsaah – Solar Power plant in Qatar	2022	40%		800 MWp - Qatar
TotalEnergies	Acquisition of 50% of Clearway Energy	2022	50%		8 GW
TotalEnergies	Wind Offshore: 4 GW of projects in New-York And North Carolina	2023	na		4 GW
EREN	Acquisition of 71% of EREN – Final stake: 100% Renewables, Hydrogen	2023	100%	1,5 G€	Europe, Asia, Latin America, Africa
TotalEnergies	Acquisition of 3 start-ups: Dsflow, NASH Renewables, Time2plug – Electricity business	2023	various		France, others
TotalEnergies	Investment Agreement with Government of Kazakhstan – Mirny Onshore Wind project	2023	60%		1 GW - Zhambyl region
TotalEnergies	Inauguration of Seagreen offshore wind farm	2023	51%		1,1 GW – Scotland World deepest fixed bottom wind farm



Total among the most dynamic companies committed in Energy Transition (Some important steps)

Affiliates/ Divisions	Activities	Year	Share	Cost (G€)	Projects location Present & future
TotalEnergies	Start-up of Danish Fields, Solar Power plant in Texas	2024	50%		750 MWp - Texas - US
TotalEnergies	Acquisition of VSB (Germany) Wind, solar Energy, Battery storage	End 2024	100%	1,57 G€	Germany 2GW, projects totalling 18GW
TotalEnergies	Acquisition of SN Power, affiliate of Scatec (Norway) Hydropower projects in Africa	Mid 2024	100%		Africa, Uganda, Rwanda, Malawi
TotalEnergies	Power Purchase Agreement with Google To supply Google Data Centers for 15 years	Feb. 2026	100%		1 GW of solar capacity from Wichita/Mustang Creek - Texas
TotalEnergies	TTE & RWE selected by the Ministry of Industry and Energy to develop Centre Manche 2 Wind offshore project	Sept. 2025		4,5 G€	1,5 GW, 6TWh/year 40km off the coast of Normandy Largest Renewable Energy project in France
TotalEnergies	Power Purchase Agreement with Airbus To supply renewable electricity	Feb. 2026	100%		3,3 TWh to Airbus sites in Germany & UK



TotalEnergies among the most dynamic companies committed in Energy Transition (Some important steps)



28 May 2021: Total became TotalEnergies

Net Zero Emissions by 2050

Important Growth of Total's Gas, Power, Renewables (GRP) Division.

Power Capacity:

End 2019: 3 GW

End 2020: 7 GW

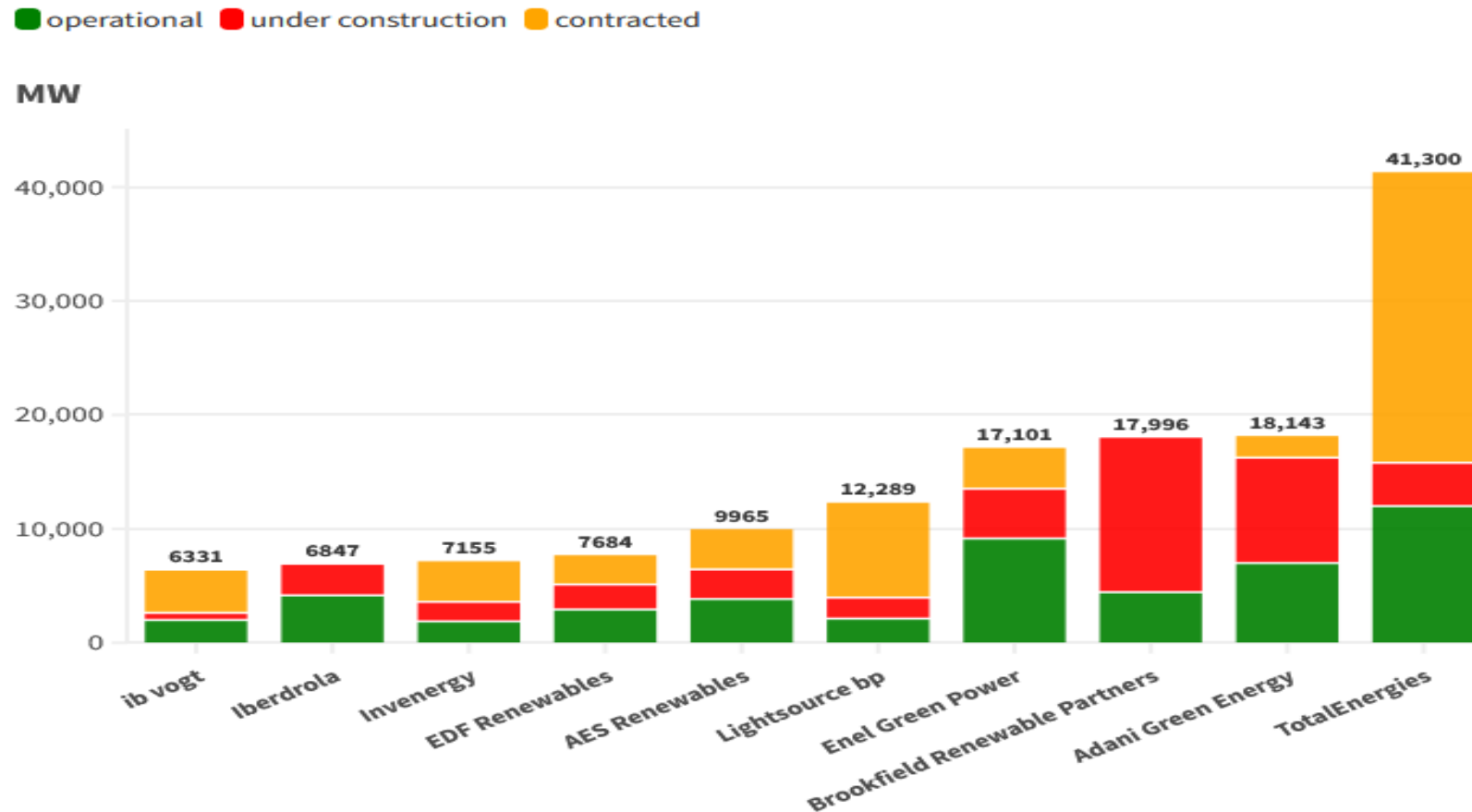
Objective 2025: 35 GW

Objective 2030: 100 GW



TotalEnergies is the top leader for utility-scale solar capacities in the World, including operational, under construction and contracted projects # 41 GW

Top 10 global utility-scale solar developers (July 2022 to June 2023)



Source: Mercom Capital Group • No data was given for Brookfield Renewable Partners' contracted capacity.



Our People are Our Main Asset



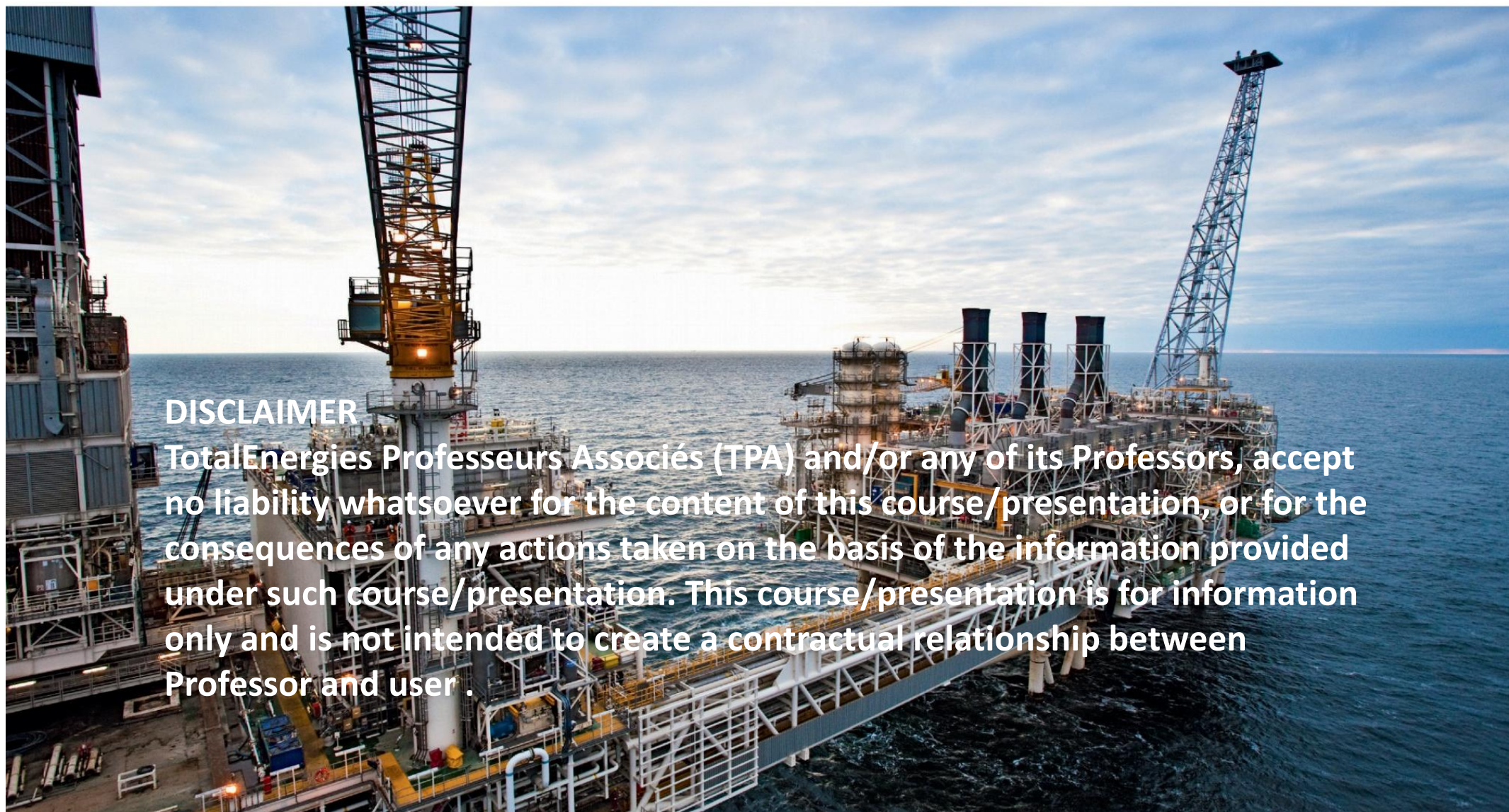
Our People are Our Main Asset



 Countries where Total is present

***International presence in 130+ countries
supported by 103 000 employees worldwide***





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Sharing Experience

