

The evolution of oil production forecasts for the World and the US by different reporting agencies: a visual summary

Table of contents

	page
-Introduction	1
-World	3
-EIA	3
-OPEC	4
-IEA	6
-ExxonMobil	14
-Shell	18
-Equinor	25
-TotalEnergies	27
-BP	30
-JHL	31
-World comparison	34
-US	37
-EIA	37
-crude oil	37
-NGPL	42
-liquids	43
-OPEC	43
-US + Canada	43
-US	44
-IEA	46
-ExxonMobil	47
-Shell	51
-Equinor	52
-Total	53
-BP	53
-JHL	55
-US liquids comparison	56
-North America comparison	57
-conclusion	59

-Introduction

It is important to have good forecasts on oil production, but the problem is that estimates of present world oil production varies from 60 Mb/d (conventional crude) to 100 Mb/d (all liquids), depending about the definition of “oil”.

IEA reported that the peak of world conventional crude production was in 2005 at 70 Mb/d. But there is no world consensus on the definition of conventional oil, excluding of course extra-heavy but also tight oil and deep waters (which depths?). Earlier definitions usually included only what we now call conventional crude oil but now we have new categories of biofuels and even refinery expansion, which have increasingly been added to crude to give “total liquids” (see Laherrere et al 2022)

In the football world, there are rules, umpires, and red cards. In the oil world, there is no rules, no umpire, and no red cards!

There are different definitions for reserves and most oil producers (listed on the US stock market) are obliged to report only the SEC definition of proven reserves which are financial to protect shareholders and banks when OPEC data are political as they fight between themselves on quotas!

In brief past data on “oil” are a mess!

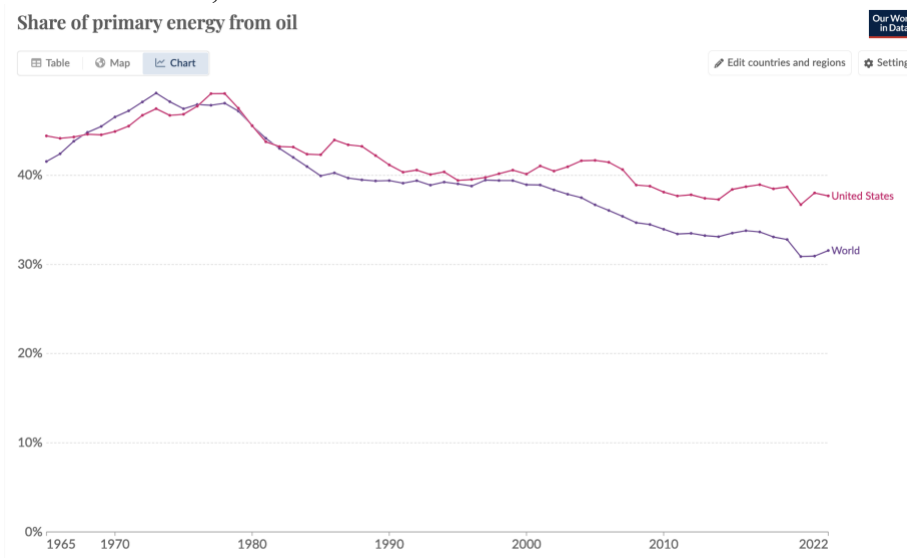
Most sources do not include the definition of their data.

Only the oil producers have the real data, but it is confidential all over the world, except in UK.

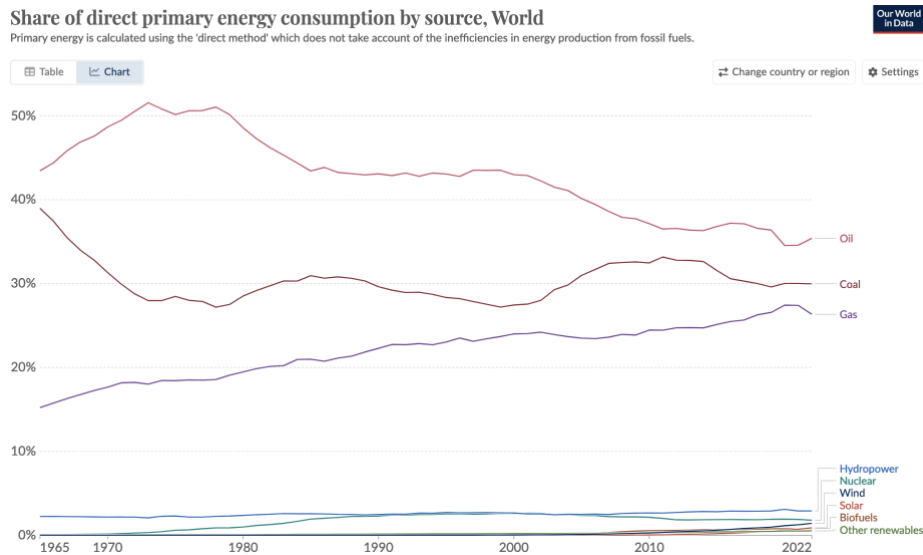
To get the real data you must buy it from scout companies such as IHS or Rystad, but even that it is not the real data because different criteria are used by different companies and countries official reports. They confuse SPE definitions for 2P reserves with Russian ABC1 definition!

The definition for continents or regions is also badly explained: North America can include from 2 to 40 countries!

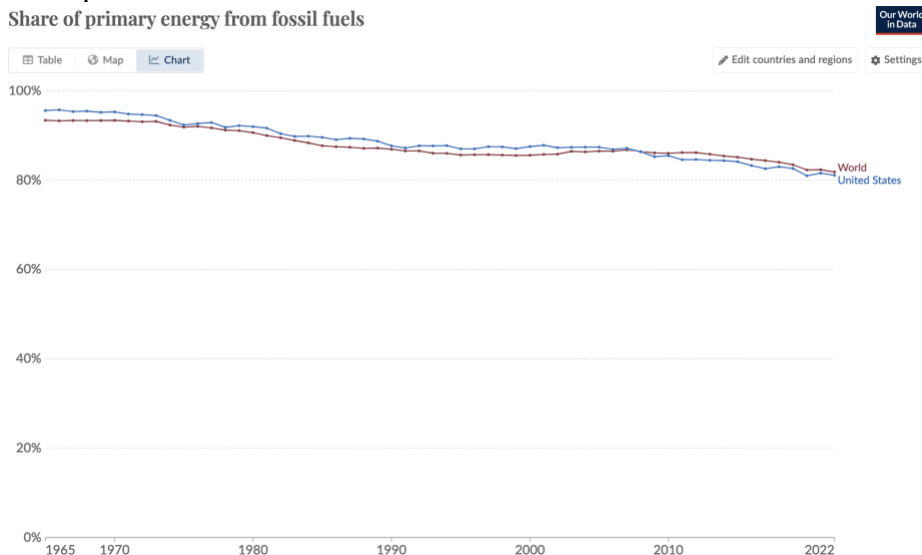
Today oil represents an important share of the world primary energy: about one third, when before the oil shock of 1973, it was about half: it is more in the US



If the share of oil declines the share of coal is about the same and the share of gas increases



Fossil fuels still represents more than 80 % for the world and same for the US



Several agencies report world oil production forecasts

-EIA with IEO international energy outlook

-IEA with WEO world energy outlook

-OPEC with WOO world oil outlook

And these forecasts are compared with oil companies forecasts as ExxonMobil, Shell, Equinor, Total, BP, and my own forecast.

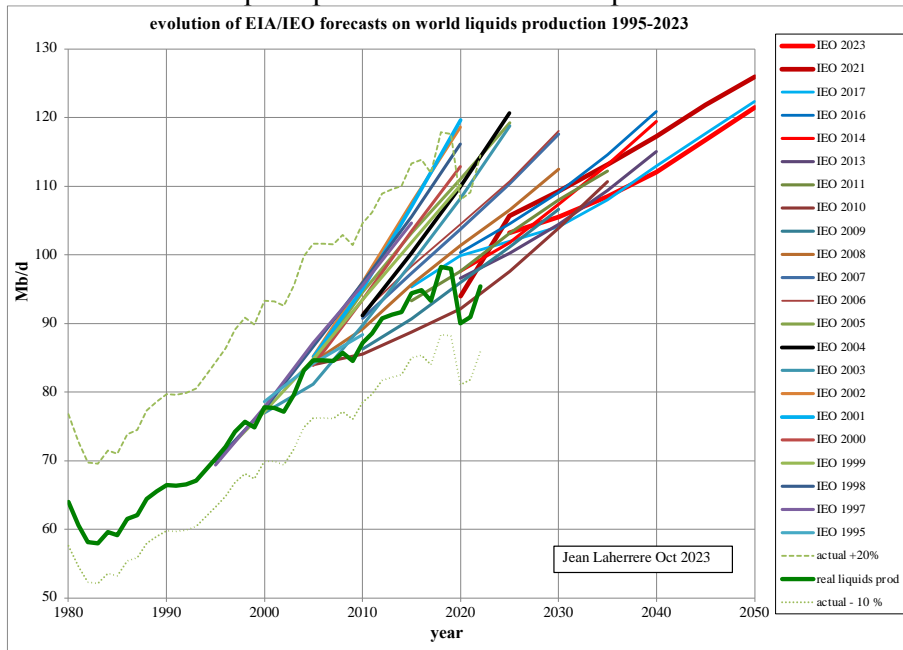
-World

-EIA = Energy Information Administration

EIA was funded in 1977 as a federal agency within the US Department of Energy and in 2020 has a staff of 359 full-time equivalent federal employees (=54 M\$ out of a total budget of 127 M\$). *The EIA Administrator does not need approval from any other DOE officer or employee for data collection, analysis, or projections. Information collected by EIA shall be available to the public upon request unless exempted from mandatory disclosure. Energy companies are required by law to provide requested information to EIA. EIA often draws a distinction between projections (i.e., estimates based on specified assumptions) and forecasts or*

predictions (i.e., best guesses about the future)
<https://crsreports.congress.gov/product/pdf/R/R46524/6>

The evolution of EIA world liquids production forecasts is plotted since 1995 to 2023

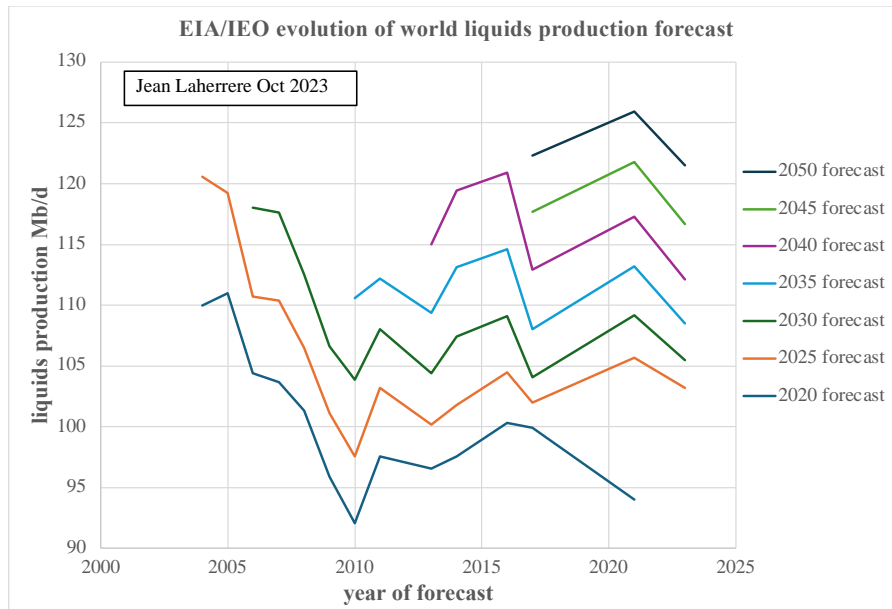


1995 forecasts for 2020 was wrong by 20%; 2004 forecast for 2022 was wrong by 20 %
EIA never forecasts peak, only increase up to 2050.

EIA past forecasts compared with the real data are in majority too optimistic!

Out of the 22 forecasts for 2019, 19 were higher than the real production

The evolution of EIA world liquids 2020 to 2050 forecasts shows up (2021) and down (2010).
 2023 forecasts are down!



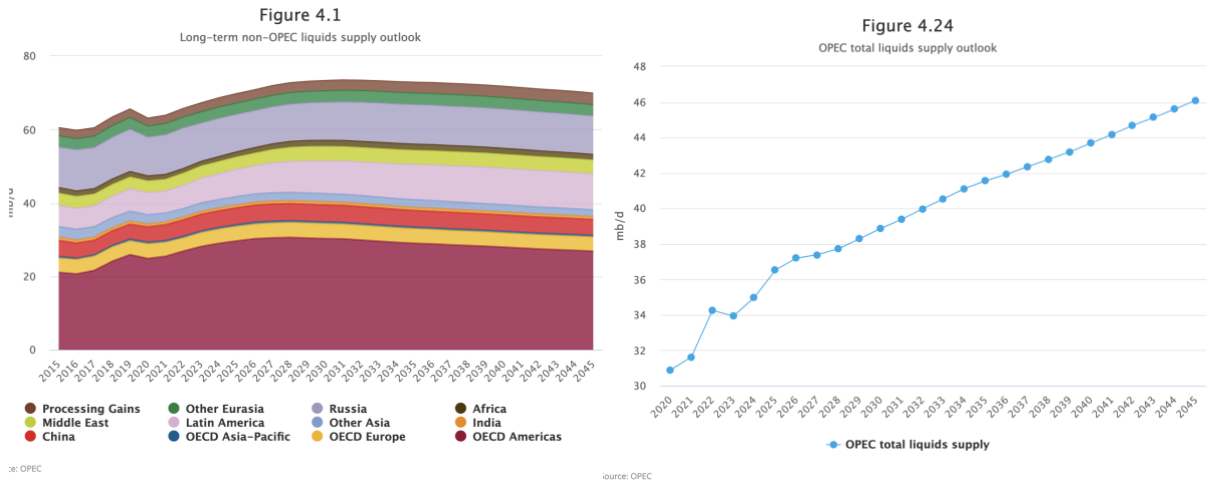
There is little correlation with WTI oil price

In the past EIA was my favorite source of oil data, but not anymore.

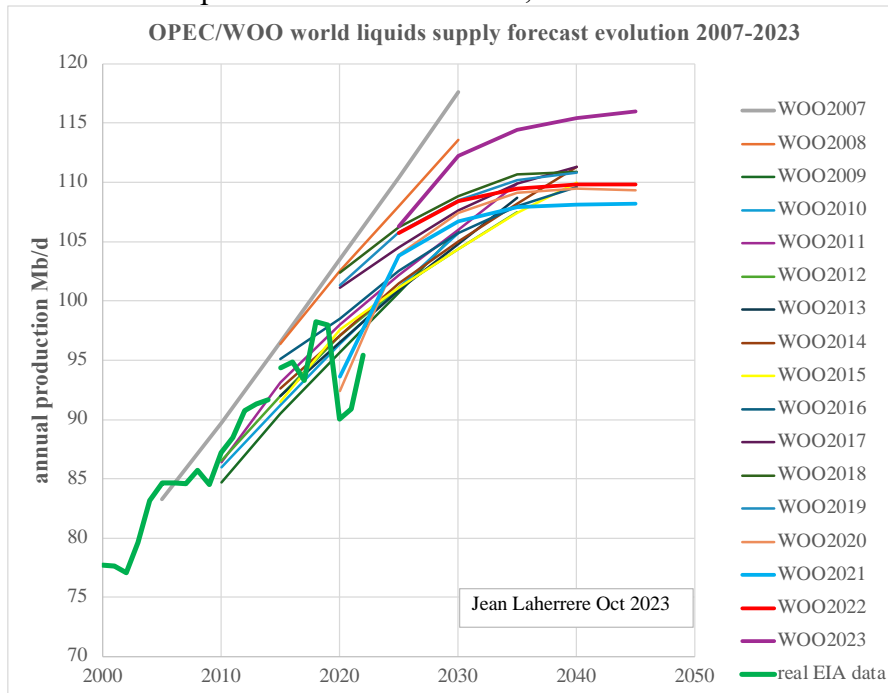
-OPEC

-world

OPEC WOO2023 displays separately non-OPEC liquids supply forecast (peak in 2030) and OPEC (peak beyond 2050 with a linear plot since 2027!)



WOO2023 is much more optimistic than WOO2022, but much less than WOO2007!



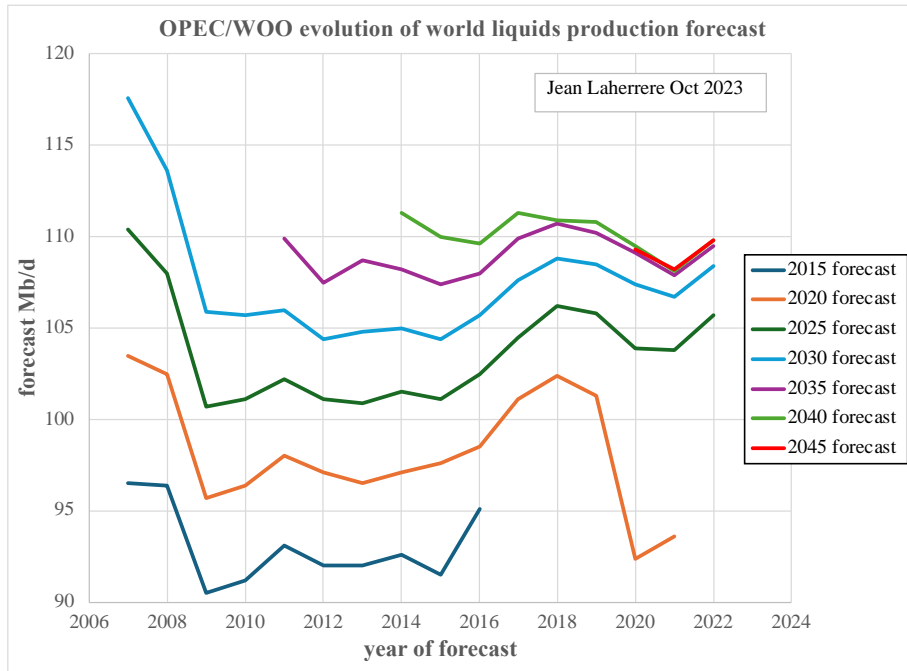
The evolution of OPEC/WOO world liquids supply displays a high in 2007 (grey), a low in 2015 (yellow), a low in 2021 (blue) and a sharp increase in 2023 (purple).

The forecast for 2020 (orange) was high in 2018 compared to real.

The forecast for 2025 (dark green) was high in 2018 and low in 2021.

The forecast for 2045 (red) was low in 2021 and high in 2023.

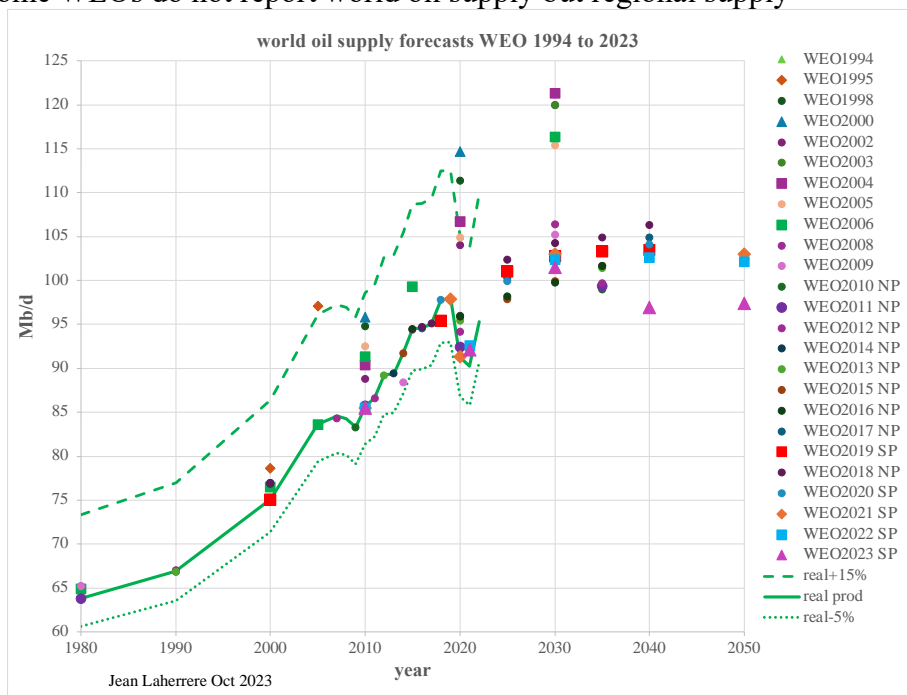
All these up and down means that the forecasters are uncertain and move from one range of uncertainty to the other range!



OPEC was pessimistic in 2009-15 and 2021, but optimistic in 2023

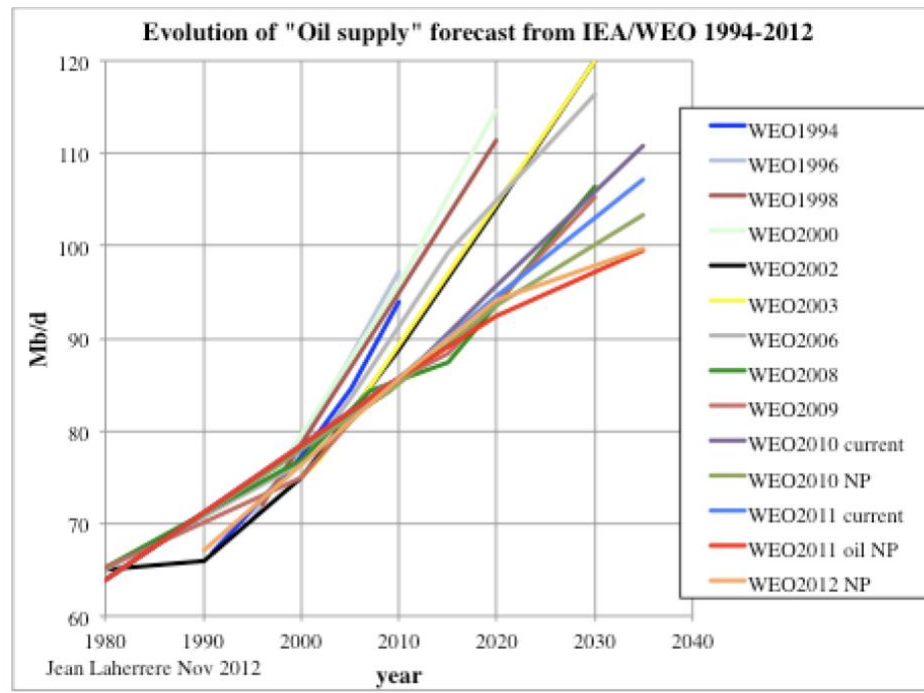
-IEA

IEA World Energy Outlook reports world oil supply (including refinery gain) in Mb/d since 1993, but some WEOs do not report world oil supply but regional supply

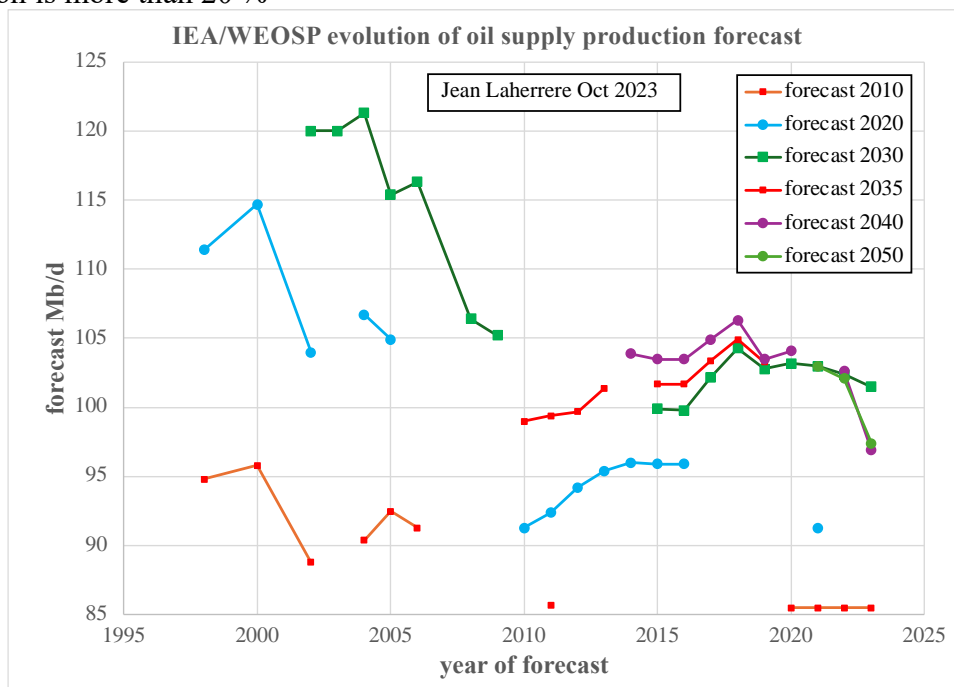


WEO-SP (stated policies) forecasts are compared with real data and some forecasts exceed real + 15%. In the past IEA NP or SP (Stated Policies) scenarios were largely too optimistic!

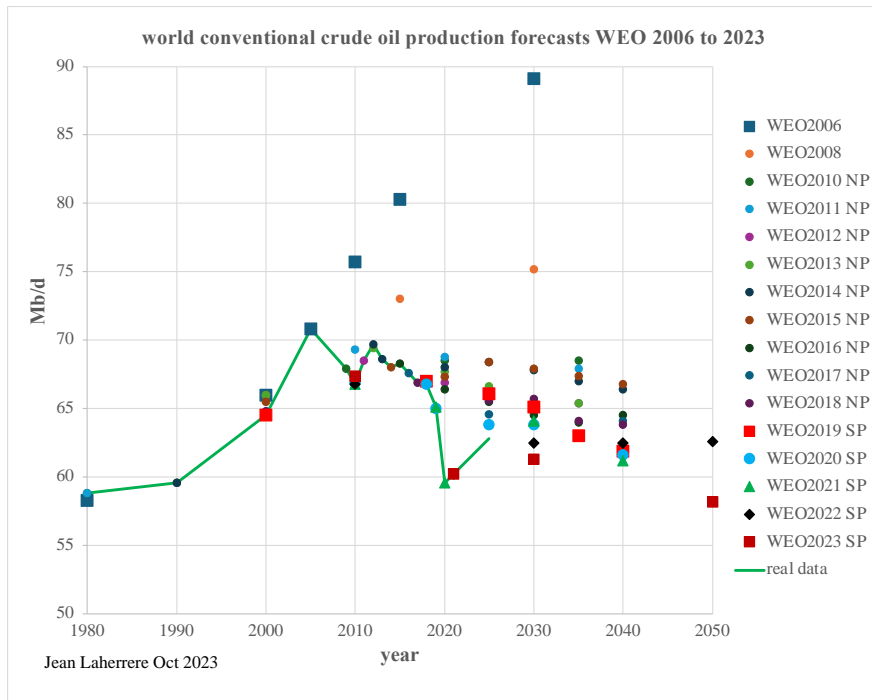
An old 2012 graph displays the early optimism of WEO, with WEO2000 forecasting more than 110 Mb/d for 2020



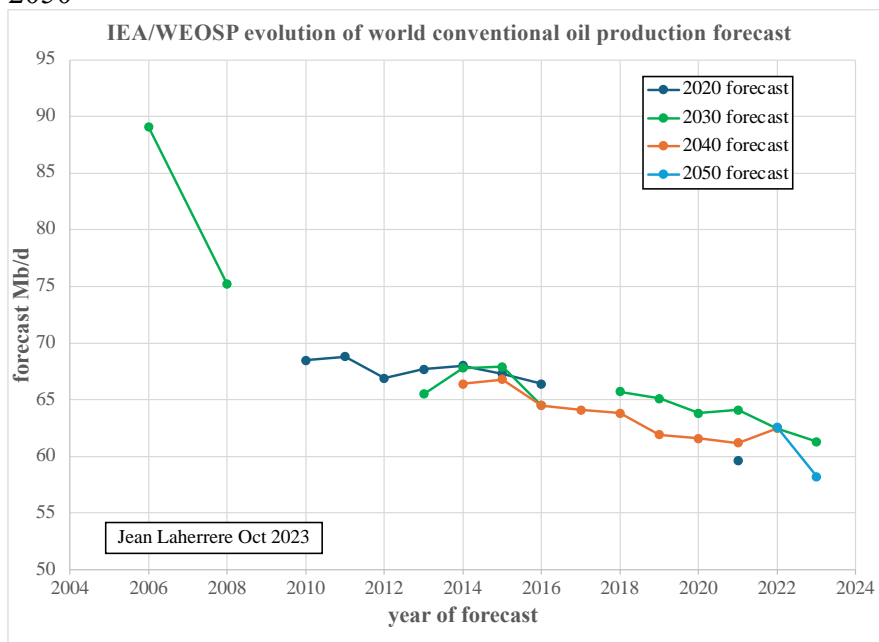
The evolution of WEO SP for oil supply is high in 2000 and 2018, low in 2010 and 2023.
The variation is more than 20 %



IEA world conventional oil production forecast is declining since 2013 to 2023



Evolution of IEA/WEO 2006 to 2023 of world conventional oil production for 2020 and beyond to 2050

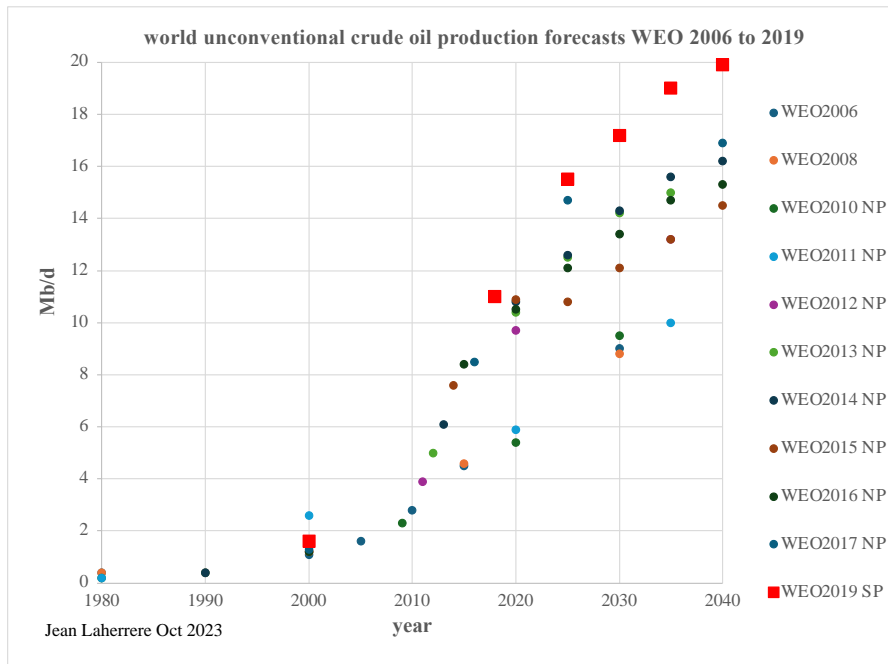


WEO2006 forecasted for 2010 conventional crude oil production at 75 Mb/d when in real it was 67 and for 2015 80 Mb/d when it was 68

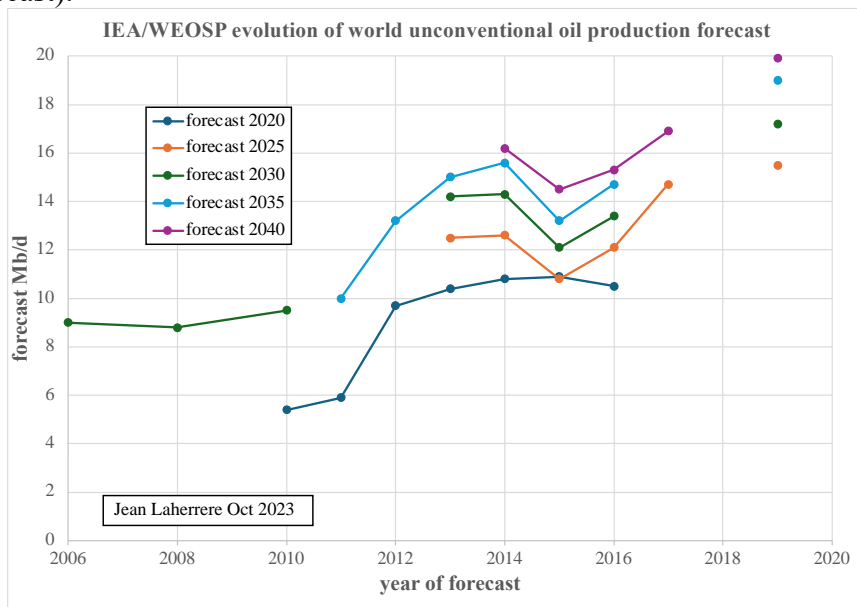
The peak of world conventional crude production was in 2005 at 70 Mb/d.

WEO forecast evolution is on decline!

IEA stopped reporting unconventional oil production in 2020 and WEO2019 forecasts unconventional crude production peak beyond 2040: quite optimistic!

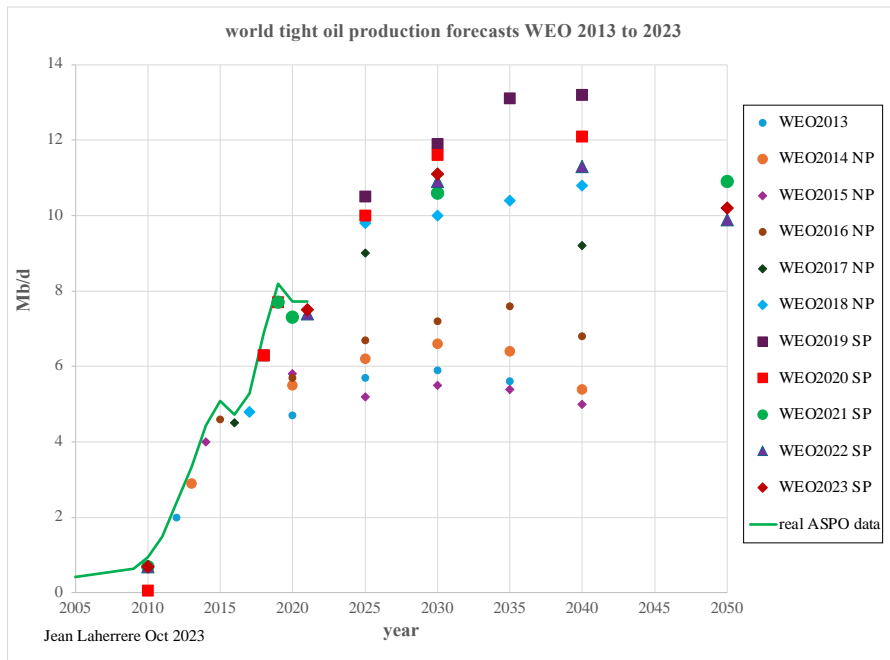


The evolution of IEA world unconventional oil production was on the increase up to 2019 (end of forecast).

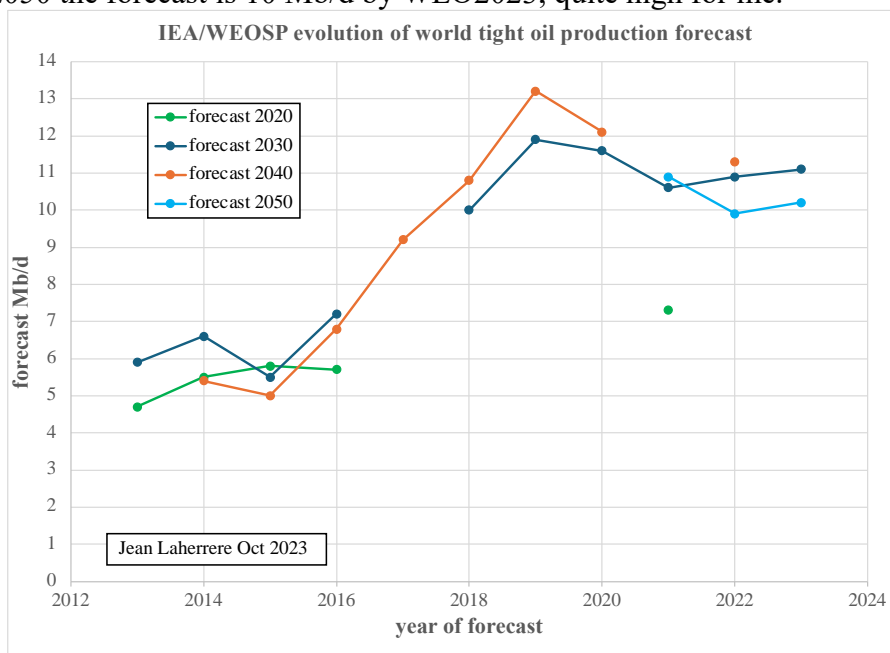


In fact, there is no world consensus on the definition of conventional oil!

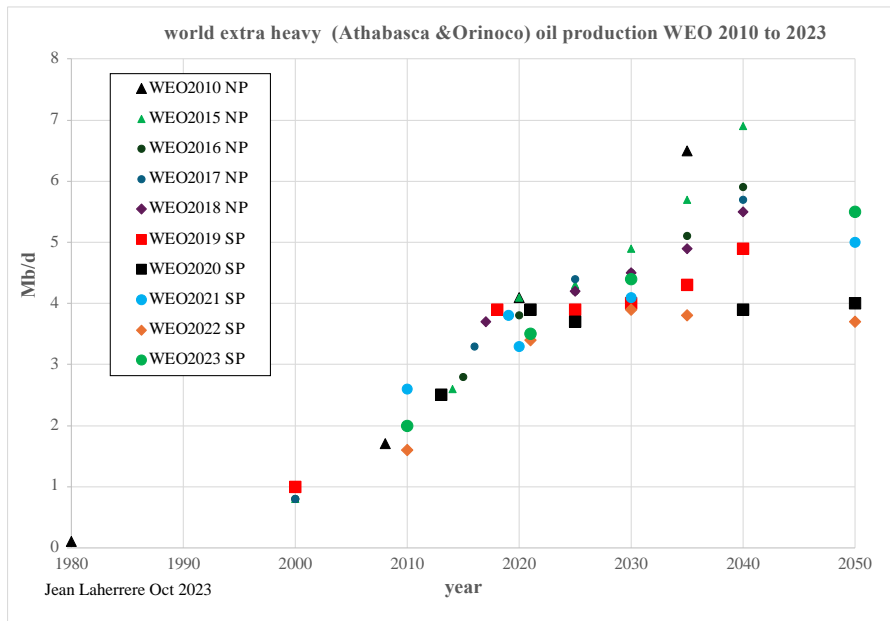
World tight oil production forecasts have widely varied



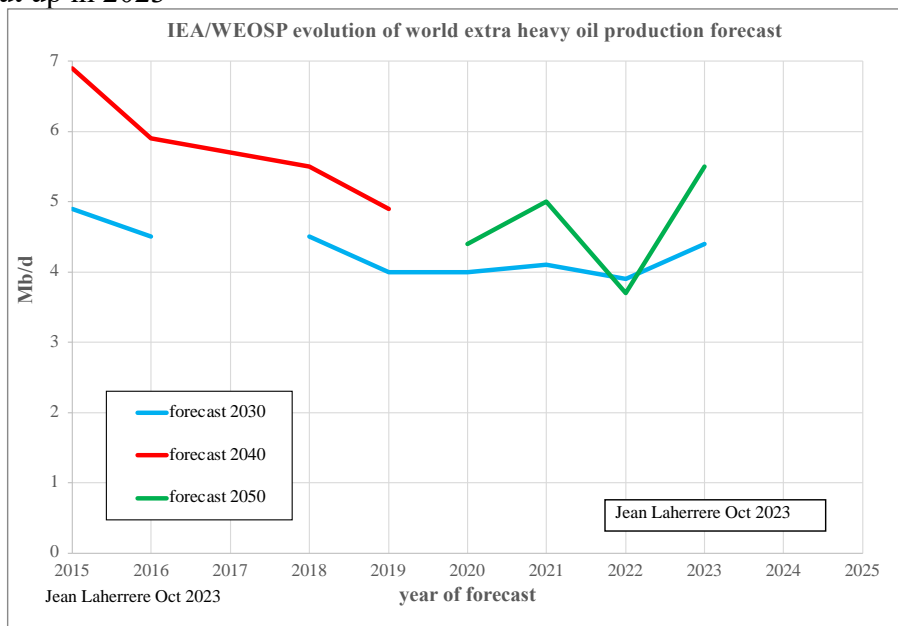
World tight oil production for 2030 (dark blue) was forecasted at 12 Mb/d in 2019, but 11 in 2023. For 2050 the forecast is 10 Mb/d by WEO2023, quite high for me.



World extra heavy production forecasts have also widely varied because political problems with Venezuela, but WEO2023 is more optimistic than WEO2022

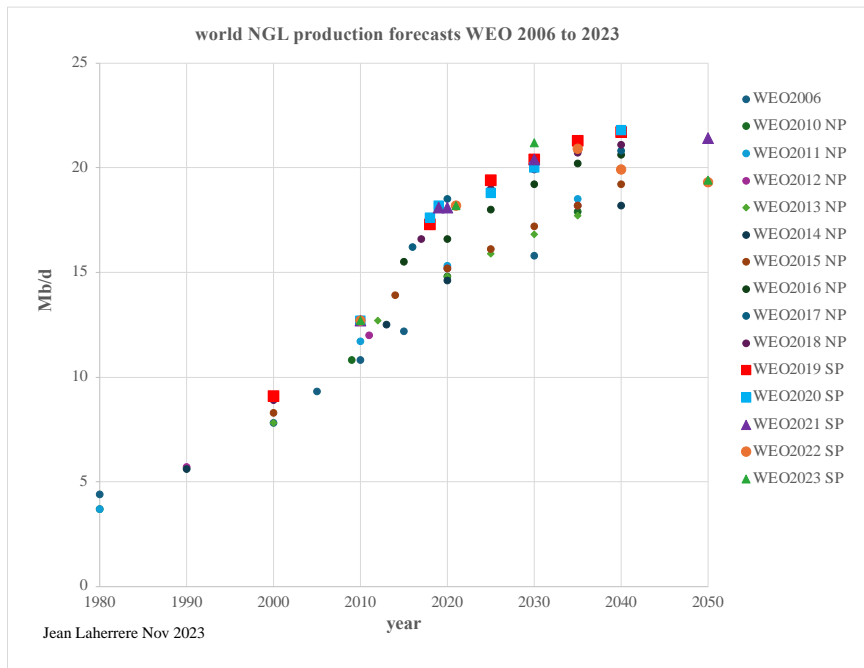


World extra heavy oil production forecast declined from 2015 to 2022 because Venezuela problems but up in 2023

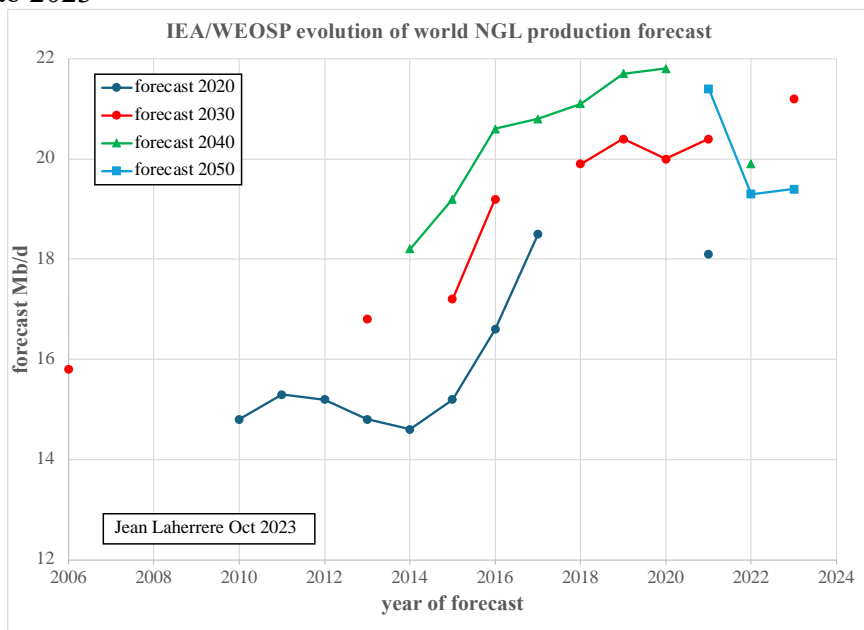


IEA was pessimistic in 2022 but more optimistic in 2023

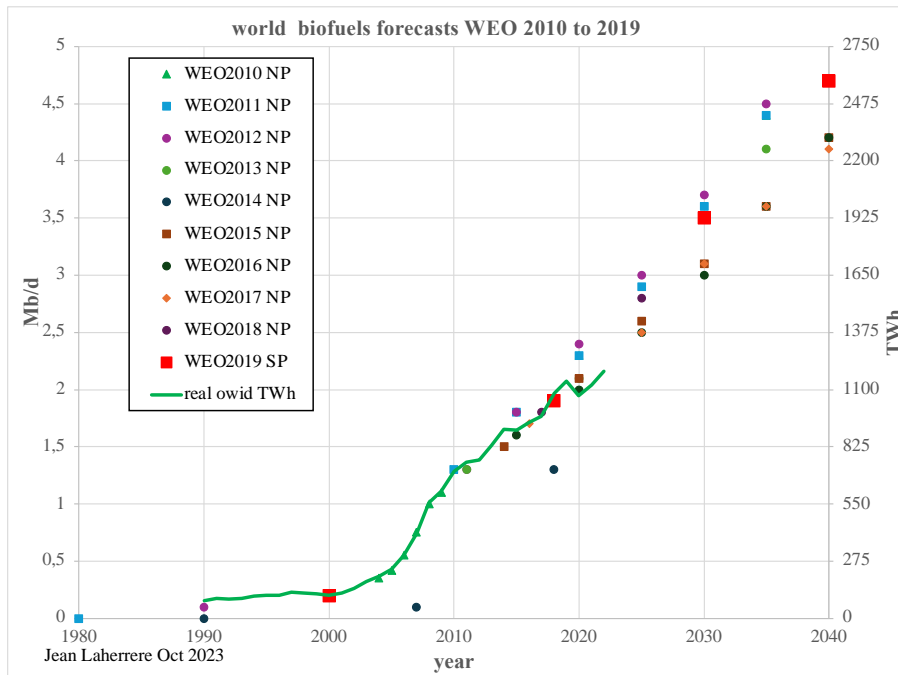
NGL production forecast will peak in 2030 for WEO2023



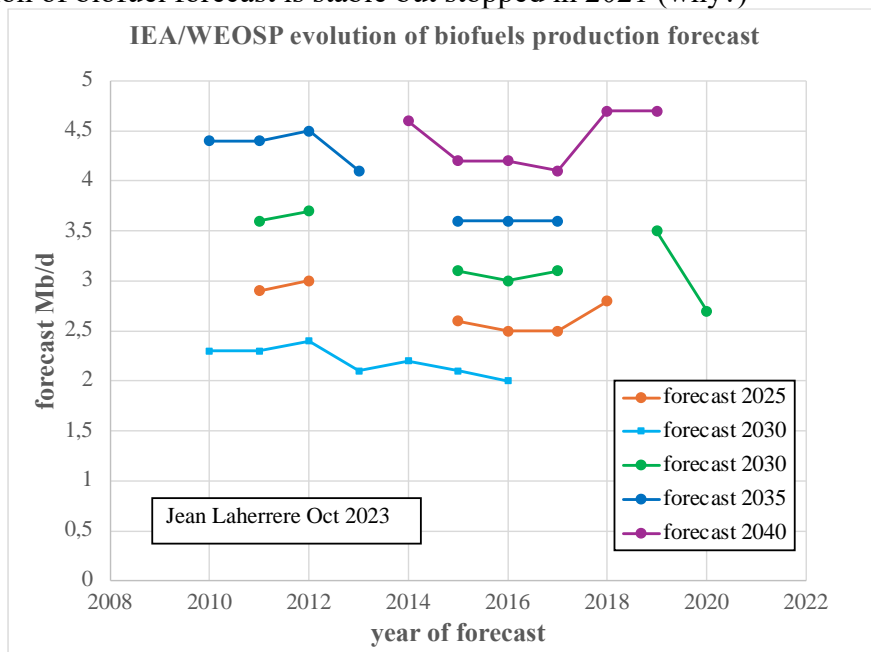
IEA NGL forecast for 2040 (green) increases from 2014 to 2020 when for 2050 it decreases from 2021 to 2023



Biofuels forecasts are increasing since WEO2010 but no forecast on recent WEO



The evolution of biofuel forecast is stable but stopped in 2021 (why?)

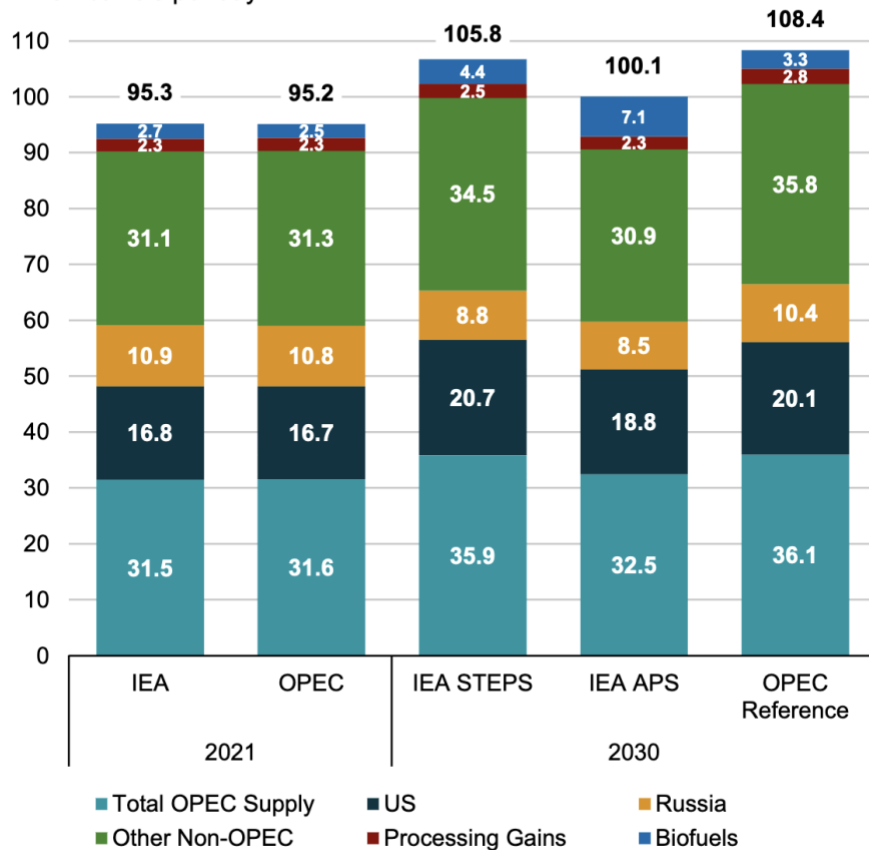


International energy forum IEF has published this comparison between IEA and OPEC for 2021 and 2030: IEA STEPS = SP and OPEC ref are not too far = 3% =within the accuracy of the data

https://www.ief.org/_resources/files/reports/outlook-comparison-report.pdf

Liquids Supply Sources by Scenario

Million barrels per day



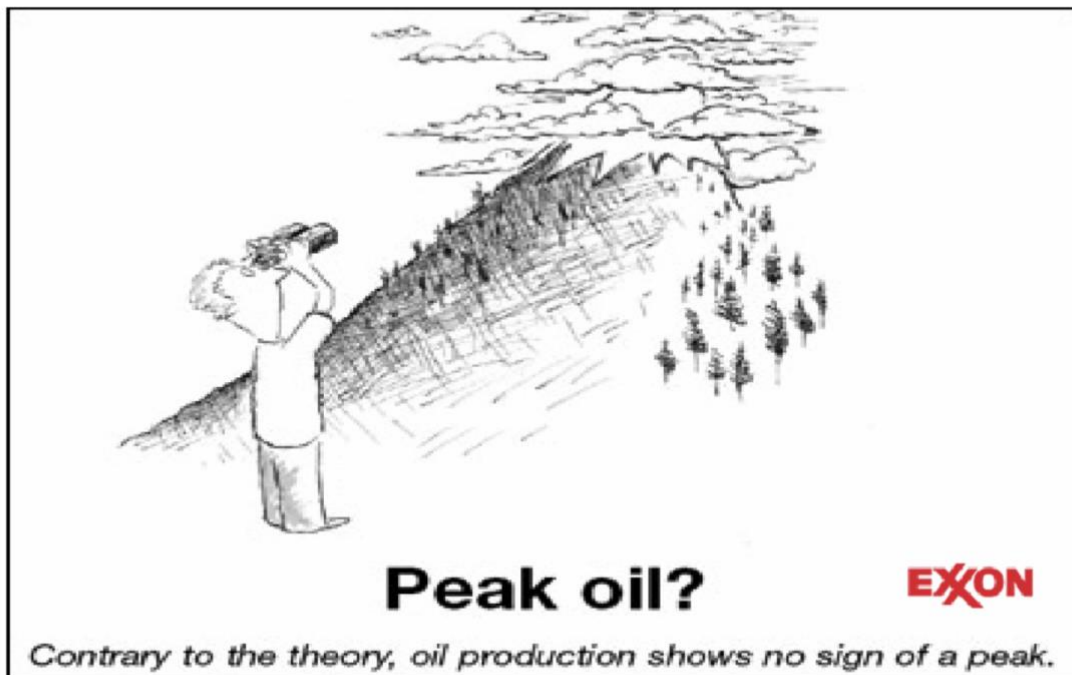
Source: IEF, IEA WEO 2022, OPEC WOO 2022

OPEC accuses IEA of vilifying oil, gas industry: https://worldoil.com/news/2023/11/28/opecc-accuses-international-energy-agency-of-vilifying-oil-gas-industry/?oly_enc_id=9685D7273256G8S

-ExxonMobil = XOM

In the past Exxon did not believe in peak oil

View from the Oil Majors: ExxonMobil

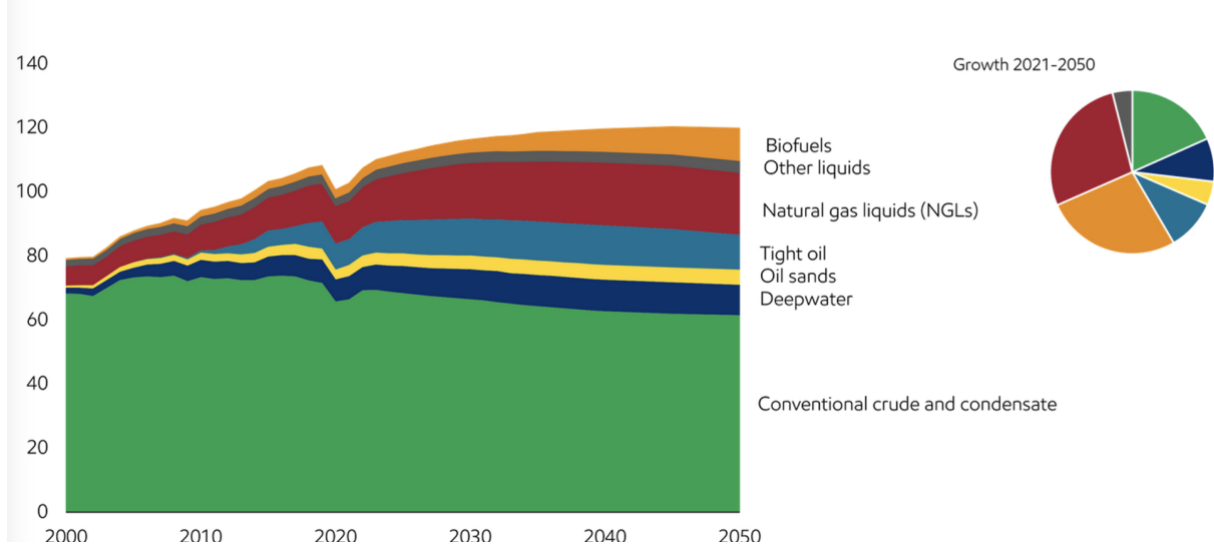


28

platts

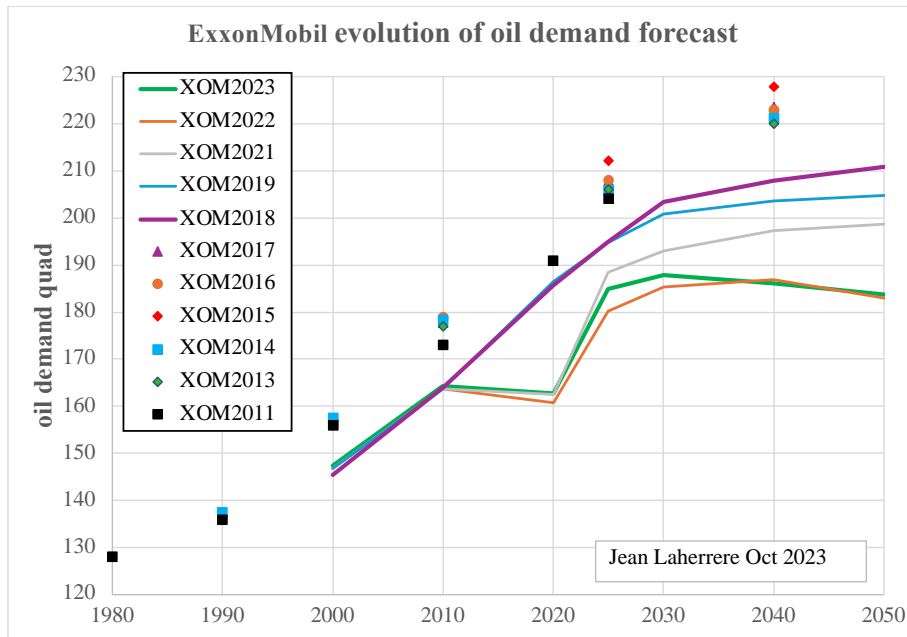
In 2023 XOM displays this graph (undated!) of global liquids supply in Mb/d

Global liquids supply by type – Million of oil-equivalent barrels per day



But the data is given not for oil supply but for oil demand

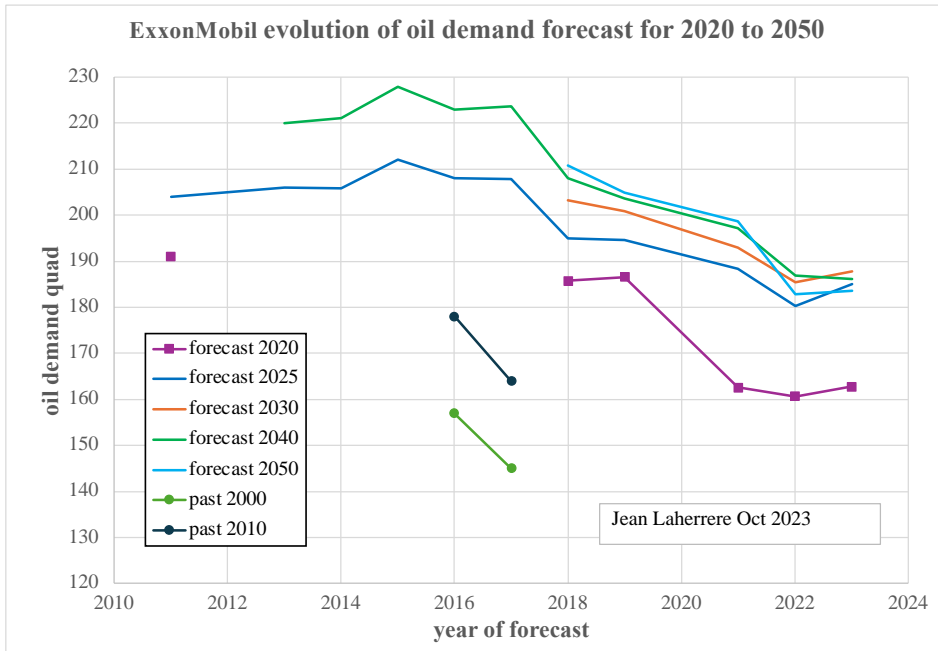
The evolution of XOM oil demand (in quads) forecasts displays a shift after 2018 losing 12 quads from 157 to 145



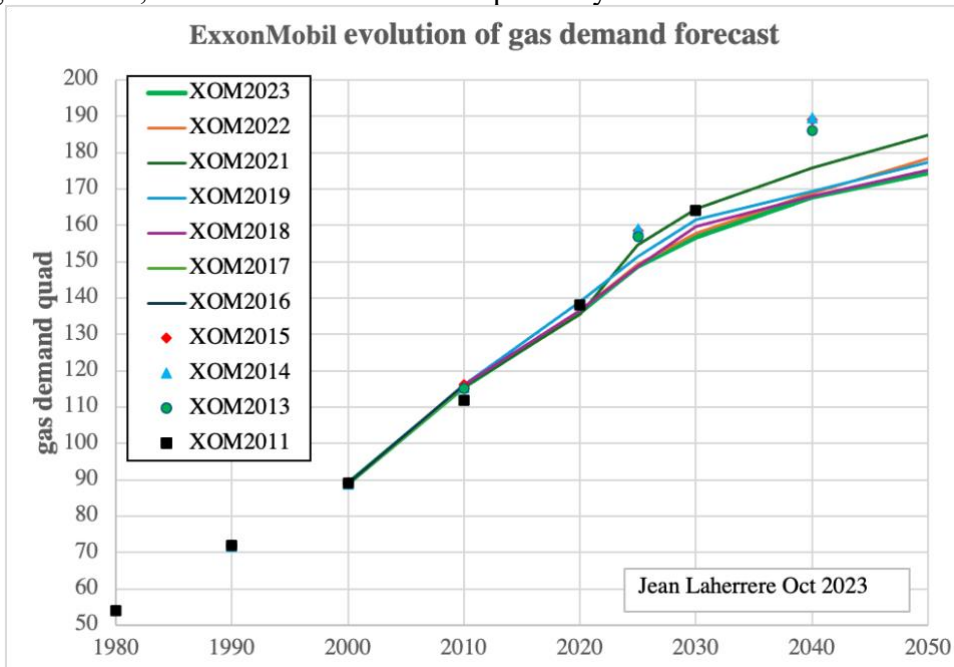
The past data of oil demand (2000 and 2010) decrease by more of 8% from 2017 to 2018, meaning that **uncertainty is higher than 8%**

2017						2018								
ExxonMobil Outlook for Energy						ExxonMobil Outlook for Energy								
Energy demand (quadrillion BTUs, unless otherwise noted)						Energy demand (quadrillion BTUs, unless otherwise noted)								
Regions	2000	2010	2015	2025	2040	Regions	2000	2010	2016	2020	2025	2030	2035	2040
World	416	527	564	634	700	World	404	515	552	579	613	643	665	681
OECD	225	230	224	225	219	OECD	218	224	218	219	220	219	216	212
Non OECD	191	298	339	408	482	Non OECD	186	292	334	360	394	423	449	469
Africa	22	30	34	43	60	Africa	22	29	33	37	42	47	53	59
Asia Pacific	126	205	234	281	322	Asia Pacific	123	202	231	250	273	290	305	315
China	47	102	120	143	153	China	46	102	118	125	135	141	146	147
India	18	28	34	48	65	India	18	27	36	41	49	56	61	66
Europe	79	81	76	74	70	Europe	77	80	75	75	73	72	70	68
European Union	72	73	68	65	60	European Union	71	72	67	66	64	62	60	58
Latin America	20	27	29	33	41	Latin America	19	25	28	30	32	34	37	40
Middle East	18	30	35	42	49	Middle East	17	28	34	37	40	44	46	48
North America	114	113	113	116	115	North America	110	109	109	110	112	114	113	111
United States	96	93	93	94	91	United States	93	91	89	90	91	92	91	89
Russia/Caspian	38	43	43	45	43	Russia/Caspian	37	42	41	41	41	41	40	40
Energy by type - World						Energy by type - World								
Primary	416	527	564	634	700	Primary	404	515	552	579	613	643	665	681
Oil	157	178	190	208	224	Oil	145	164	177	186	195	203	208	211

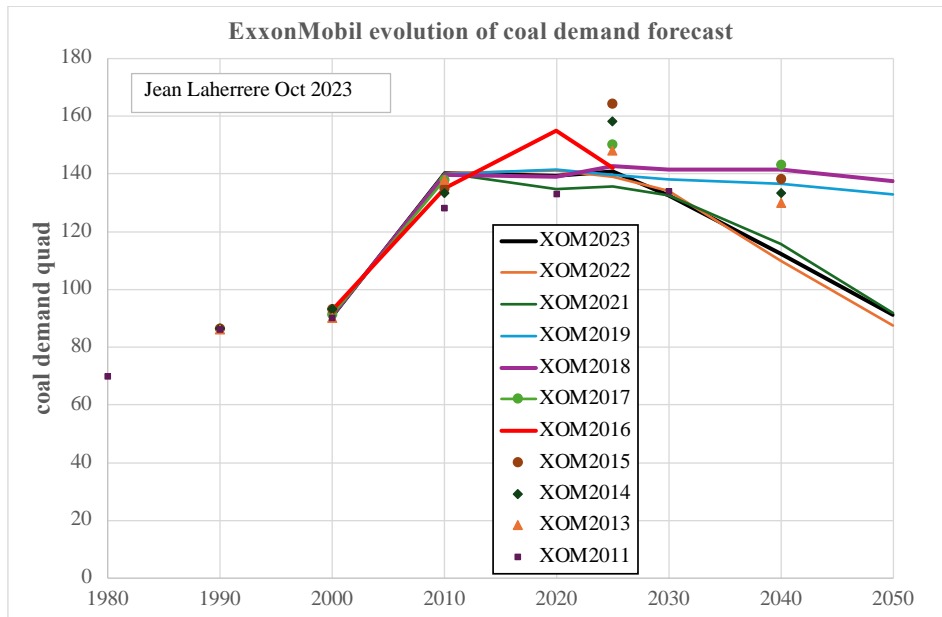
ExxonMobil was too optimistic in their oil demand forecast from 2011 to 2019



For world gas demand, ExxonMobil forecasts the peak beyond 2050



For world coal demand in 2050 ExxonMobil was optimistic in 2018, not in 2023



-Shell

In the past 50 years Shell has published energy scenarios where the wording (name of the scenarios) was more important than the data

Shell is the only (with me) to forecast oil production up to 2100.

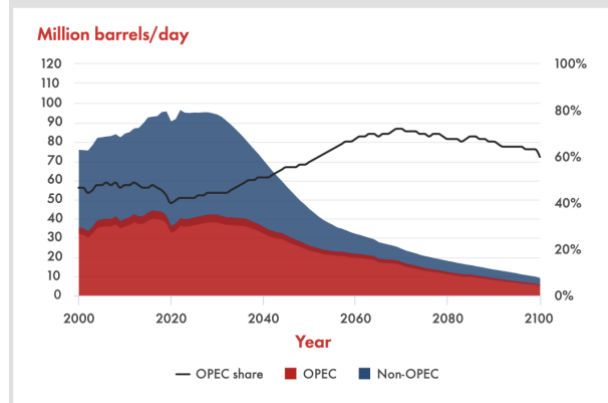
2023 Shell scenarios are Archipelagos and Sky 2050

Sky 2050 brings society rapidly to net-zero emissions

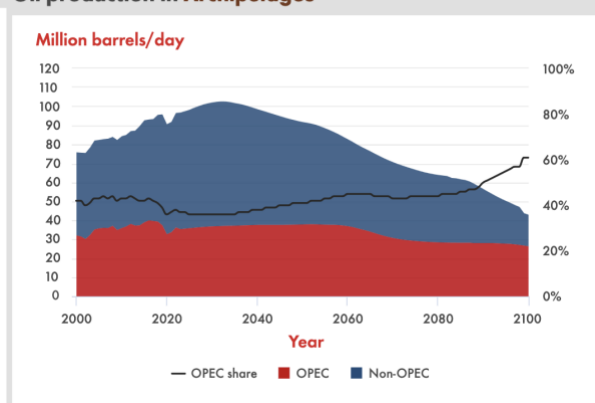
Archipelagos sees higher fossil-fuel production compared to Sky 2050,

Oil peak in 2025 for Sky 2050 and in 2035 for Archipelagos

Oil production in **Sky 2050**



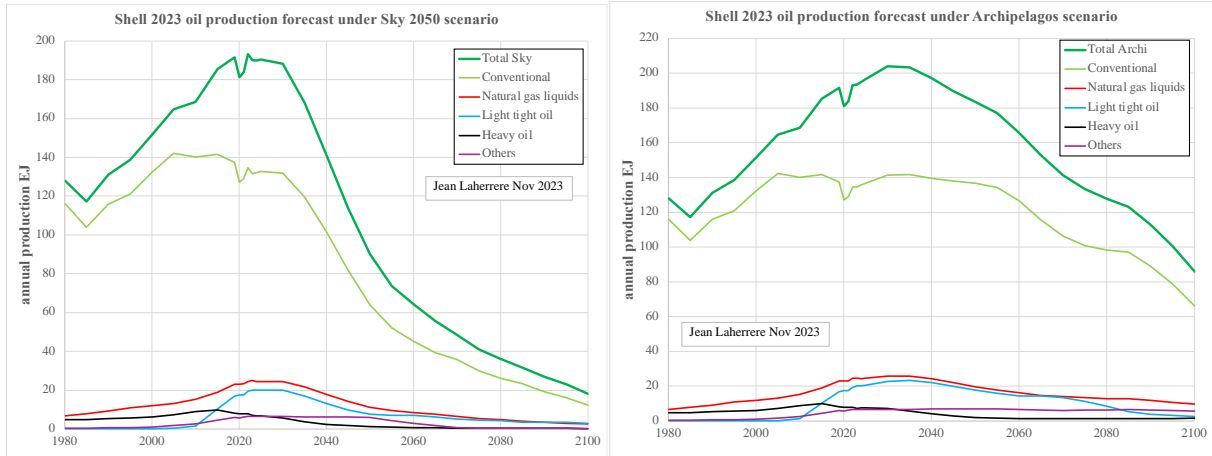
Oil production in **Archipelagos**



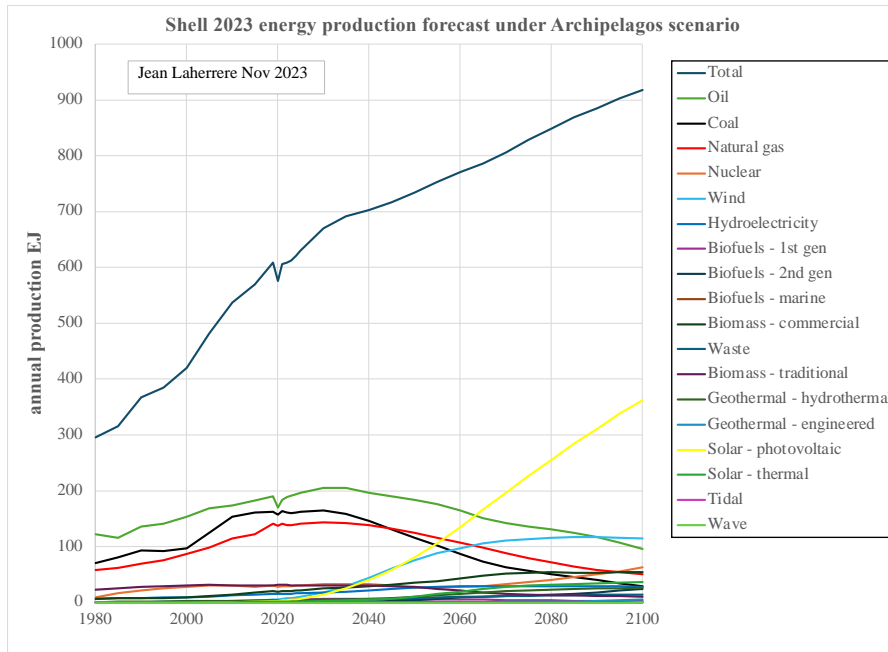
For the first time Shell provides the data in a excel file in energy EJ, providing conventional crude data (every 5 years)

For Shell world conventional crude oil peak was 2005 and 2015 at 142 EJ

Sky 2050 is wishful thinking on this oil production graph and Archipelagos is just BAU.

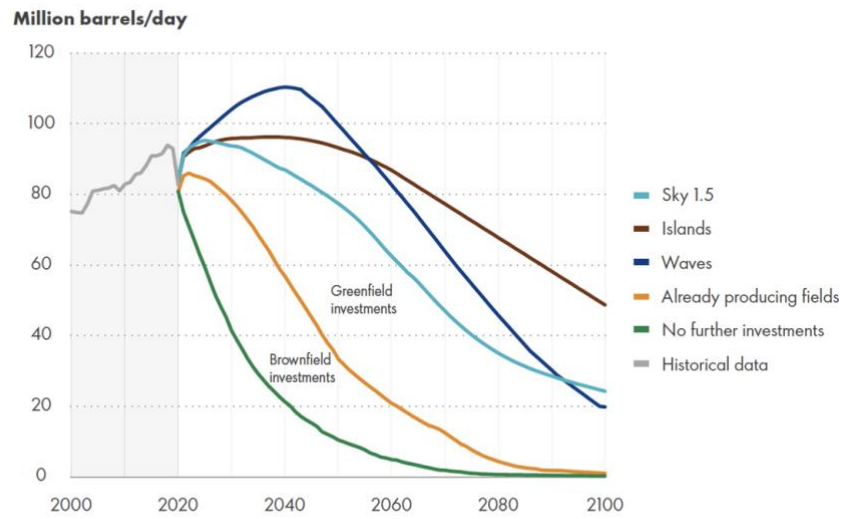


The energy production forecast up to 2100 displays that in 2065 the most important energy is the solar photovoltaic which was almost zero in 2020: it is believing in Santa Claus: wind in 2100 is more than oil



2022 Islands and waves scenarios:

Total oil* production



Source: Shell analysis based on data from Rystad Energy

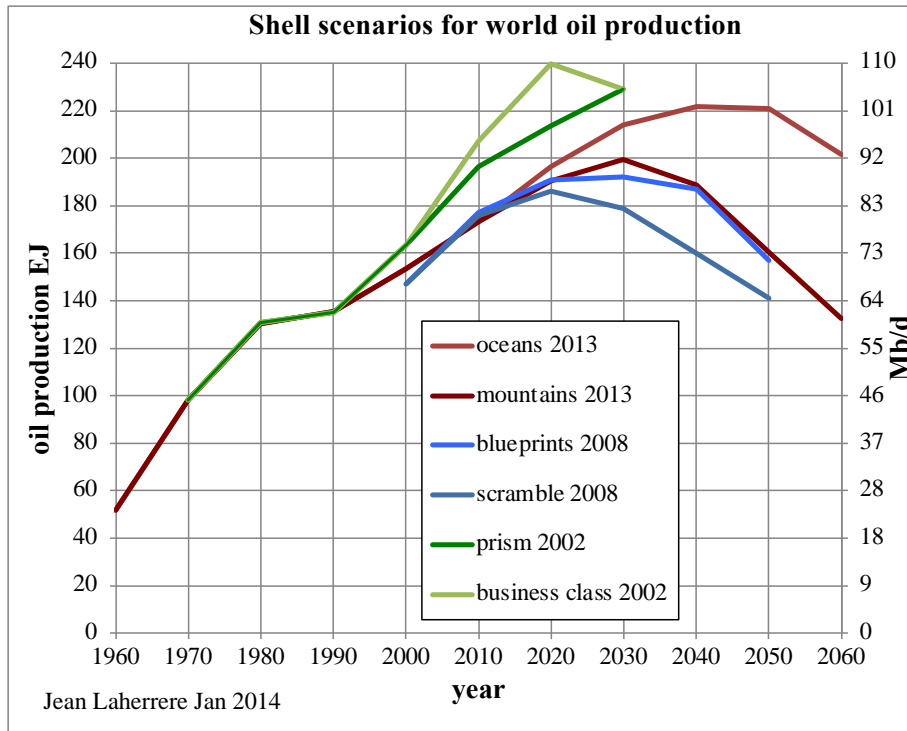
*Oil includes condensate and natural gas liquids

2014

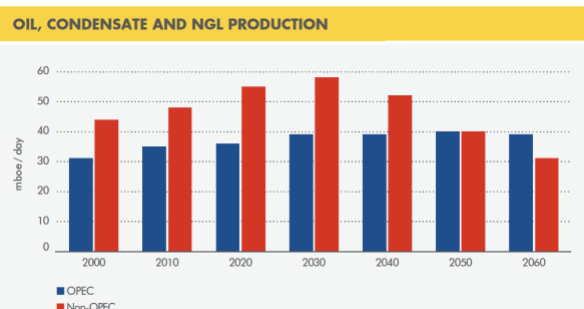
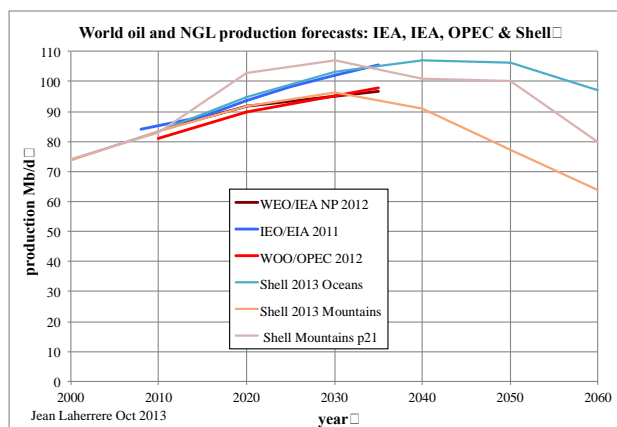
My 2014 plot of Shell forecasts shows a world oil production peak in 2040 for Mountains 2013 and in 2030 for Oceans 2013

I am lost in always new scenarios names!

2008 scenarios look too low below 90 Mb/d



2013: oil peak in 2030 for Mountains and 2040 for Oceans




MOUNTAINS TOTAL PRIMARY ENERGY – BY SOURCE


Year	Primary energy demand (EJ/year)										
	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060
Oil	52.0	98.0	130.3	135.7	153.3	173.1	190.2	199.6	188.7	160.5	132.4
Biofuels	0.0	0.0	0.1	0.3	0.5	2.5	6.6	8.6	10.0	10.2	13.5
Natural Gas	18.9	35.3	51.6	70.2	87.3	114.8	149.7	188.8	226.2	237.7	234.8
Biomass Gasified	0.0	0.0	0.0	0.0	0.2	1.3	5.4	11.5	18.2	33.9	41.7
Coal	52.2	61.6	75.9	94.2	100.1	146.2	184.8	199.0	191.4	211.8	247.0
Biomass/Waste Solids	6.6	7.7	9.8	11.6	13.3	17.1	14.0	10.5	16.3	26.3	31.9
Biomass Traditional	14.9	18.0	21.5	26.0	29.3	33.2	35.1	37.6	39.9	42.0	45.9
Nuclear	0.0	0.9	7.8	22.0	28.3	30.1	37.5	55.6	74.6	91.9	107.5
Hydro-electricity	2.6	4.2	6.2	7.8	9.5	12.4	13.2	14.7	16.7	18.7	20.7
Geothermal	0.1	0.2	0.5	1.4	2.1	2.4	4.0	6.1	9.4	14.7	30.8
Solar	0.0	0.0	0.0	0.1	0.2	0.8	3.6	11.3	19.5	32.1	51.3
Wind	0.0	0.0	0.0	0.0	0.1	1.2	3.0	5.2	11.5	21.8	34.3
Other Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total	147	226	304	369	424	535	647	749	822	902	992

OCEANS TOTAL PRIMARY ENERGY – BY SOURCE

Year	Primary energy demand (EJ/year)										
	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060
Oil	52.0	98.0	130.3	135.7	153.3	173.1	196.4	214.0	221.8	220.7	201.4
Biofuels	0.0	0.0	0.1	0.3	0.5	2.5	4.6	5.5	7.2	14.2	25.9
Natural Gas	18.9	35.3	51.6	70.2	87.3	114.8	147.9	169.2	187.3	185.6	175.4
Biomass Gasified	0.0	0.0	0.0	0.0	0.2	1.3	7.8	19.8	20.4	22.1	26.8
Coal	52.2	61.6	75.9	94.2	100.1	146.2	202.7	222.3	201.7	218.6	204.2
Biomass/Waste Solids	6.6	7.7	9.8	11.6	13.3	17.1	18.7	14.1	15.5	17.7	21.4
Biomass Traditional	14.9	18.0	21.5	26.0	29.3	33.2	28.9	26.9	24.2	24.3	22.5
Nuclear	0.0	0.9	7.8	22.0	28.3	30.1	33.3	42.1	47.2	52.4	54.7
Hydro-electricity	2.6	4.2	6.2	7.8	9.5	12.4	13.5	14.8	16.8	18.7	20.6
Geothermal	0.1	0.2	0.5	1.4	2.1	2.4	5.1	9.7	18.9	26.4	34.1
Solar	0.0	0.0	0.0	0.1	0.2	0.8	4.4	25.2	70.1	132.6	209.6
Wind	0.0	0.0	0.0	0.0	0.1	1.2	4.7	13.2	24.7	42.4	59.3
Other Renewables	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
Total	147	226	304	369	424	535	668	777	856	976	1056

2008 oil peak: 2020 for Scramble and 2030 for Blueprints

 Scramble	2000	2010	2020	2030	2040	2050
	EJ per year					
Oil	147	176	186	179	160	141
Gas	88	110	133	134	124	108
Coal	97	144	199	210	246	263
Nuclear	28	31	34	36	38	43
Biomass	44	48	59	92	106	131
Solar	0	0	2	26	62	94
Wind	0	2	9	18	27	36
Other Renewables	13	19	28	38	51	65
Total primary energy	417	531	650	734	815	880

 Blueprints	2000	2010	2020	2030	2040	2050
	EJ per year					
Oil	147	177	191	192	187	157
Gas	88	109	139	143	135	122
Coal	97	137	172	186	202	208
Nuclear	28	30	30	34	41	50
Biomass	44	50	52	59	54	57
Solar	0	1	7	22	42	74
Wind	0	1	9	17	28	39
Other Renewables	13	18	29	40	50	62
Total primary energy	417	524	628	692	738	769

2007

Low trust globalization

Flags

Open doors

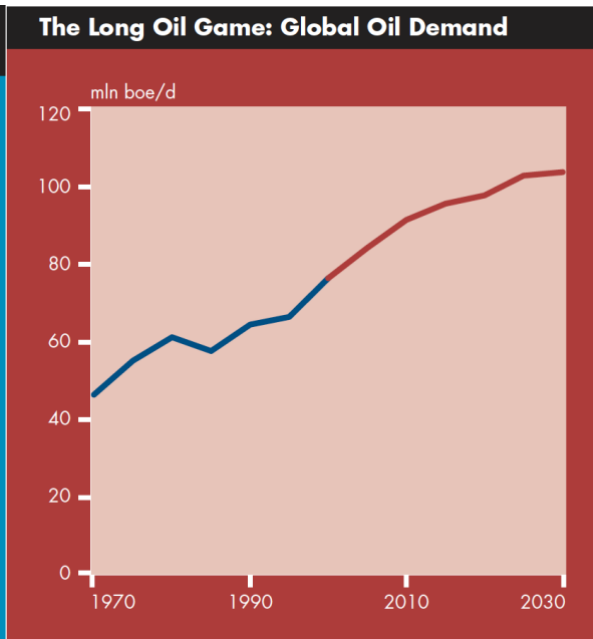
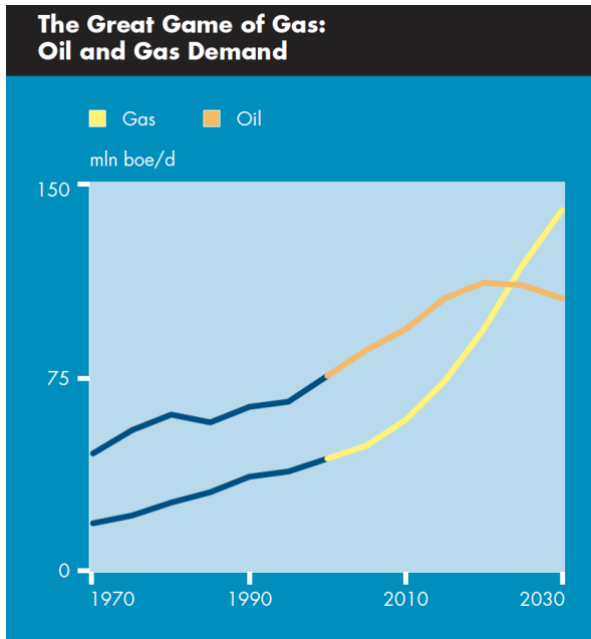
2002

Business class

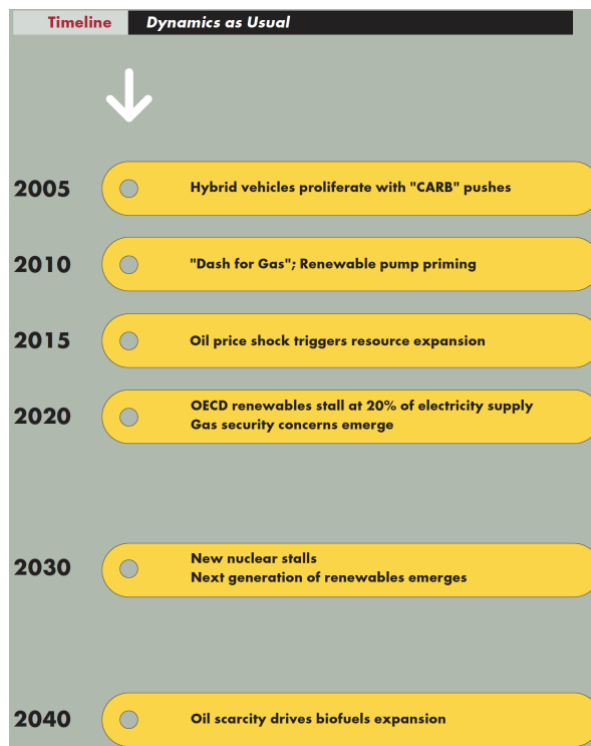
Oil peak in 2025

Prism

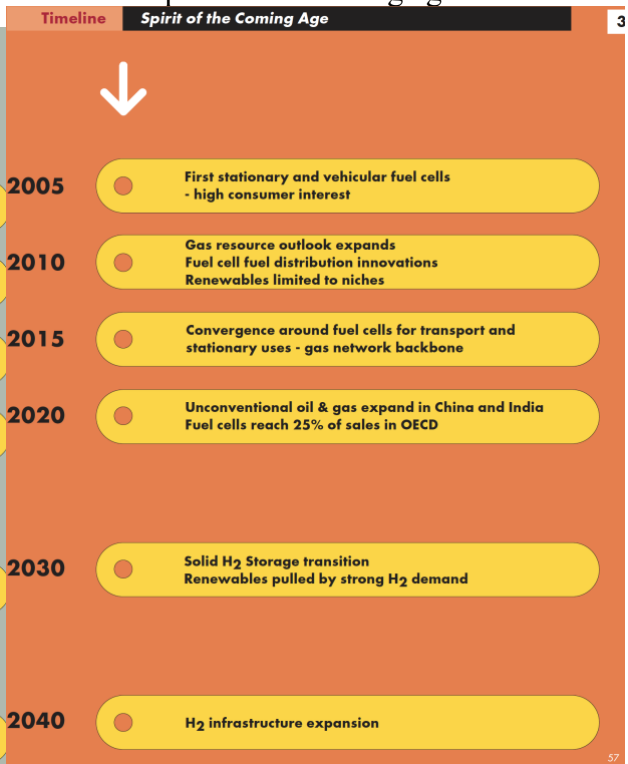
oil peak beyond 2030



2001
“Dynamics as usual”



“The spirit of the coming age”



Oil peak in 2025 for “Spirit of the coming age” and beyond 2050 for “Dynamics as usual”

Summary quantification (exajoules)*							
	1975	2000	2025	2050	1975-2000	2000-2025	2025-2050
Population (billion)	4	6	8	9	1.5%	1.0%	0.6%
GDP (trillion 2000 \$ PPP)	23	49	108	196	3.1%	3.2%	2.4%
Dynamics as Usual							
Primary Energy	256	407	640	852	1.9%	1.8%	1.2%
Oil	117	159	210	229	1.2%	1.1%	0.3%
Coal	70	93	128	118	1.1%	1.3%	-0.3%
Coal CH ₄ /H ₂	0	0	4	16	-	-	5.8%
Natural Gas	47	93	167	177	2.7%	2.4%	0.2%
Nuclear	4	29	35	32	8.1%	0.8%	-0.4%
Hydro	17	30	41	39	2.4%	1.3%	-0.3%
Biofuels	0	0	5	52	-	10.2%	10.1%
Other Renewables	0	4	50	191	8.7%	11.2%	5.5%
Spirit of the Coming Age							
Primary Energy	256	407	750	1217	1.9%	2.5%	2.0%
Oil	117	159	233	185	1.2%	1.6%	-0.9%
Coal	70	93	150	119	1.1%	1.9%	-0.9%
Coal CH ₄ /H ₂	0	0	6	97	-	-	11.6%
Natural Gas	47	93	220	396	2.7%	3.5%	2.4%
Nuclear	4	29	46	84	8.1%	1.9%	2.4%
Hydro	17	30	49	64	2.4%	2.0%	1.1%
Biofuels	0	0	7	108	-	11.8%	11.8%
Other Renewables	0	4	38	164	8.7%	9.9%	6.0%

* Nuclear, hydro, wind, solar and wave expressed as thermal equivalents

1995

TINA and the Learning Scenarios

Stretching the social fabric

'No Business as Usual'

The learning scenarios

Two possible futures

Just Do It!

Libertarianism and the angry fringes

The US – how to *Just Do It!*

From atoms to bits

'Bubbles of value' and other business challenges

大我 - Da Wo ('Big Me')

The Asian century

Straining the social fabric

Positioning in Asia as an Asian company
and other business challenges

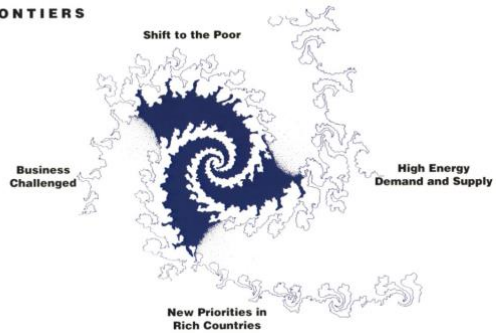
Being Asian

1992

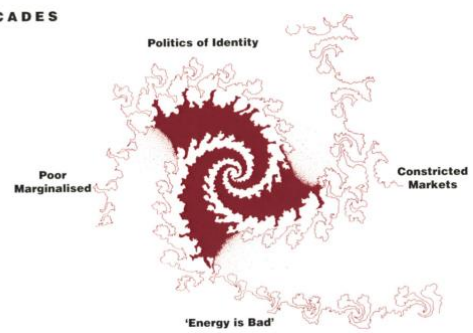
New frontiers

Barricades

2. NEW FRONTIERS



3. BARRICADES



Importance of the names of scenarios:

- New Frontiers and Barricades 1992
- Scramble and Blueprints
- Low trust globalization, Flags and Open doors 2007
- Oceans and Mountains
- Islands, Waves and Sky
- Dynamics as usual and Spirit of the coming age
- People and Connections

Title looks more important than value!

Words more important than data!

-Equinor (Statoil before 2018)

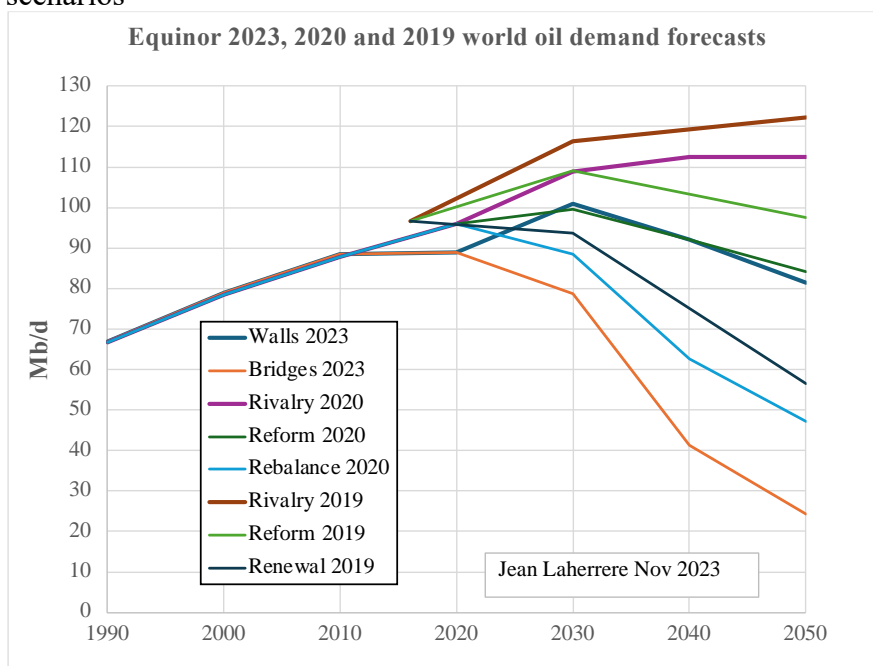
As Shell, Equinor uses exotic names for scenarios

2023 = Walls and Bridges, 2020 = Rivalry, Reform, Rebalance, 2019 = Rivalry, Reform, Renewal

It should be better to use realistic name as most likely or business as usual.

But in 2011 Statoil energy perspectives forecasts only one scenario, but 3 scenarios in 2017

The most optimistic scenarios as Walls 2023 and Rivalry 2020 and 2019 are declining as the 2050 forecast decreases from 122 Mb/d in 2019 down to 81 Mb/d in 2023, large decrease due to different scenarios

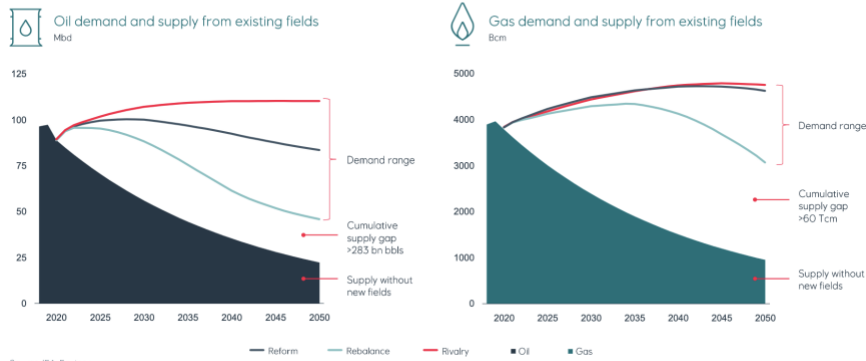


2021 scenarios Rivalry, Reform and Rebalance



Wide outcome space for oil and gas demand

Large oil and gas investments in all scenarios, although significantly less in Rebalance

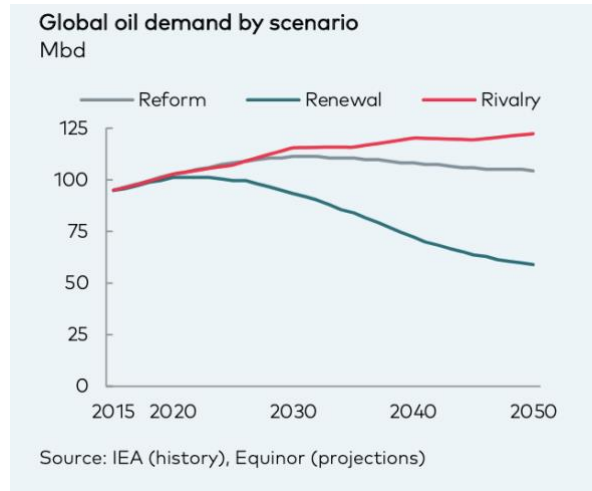


Source: IEA, Equinor

17 | Energy Perspectives 2021

Open

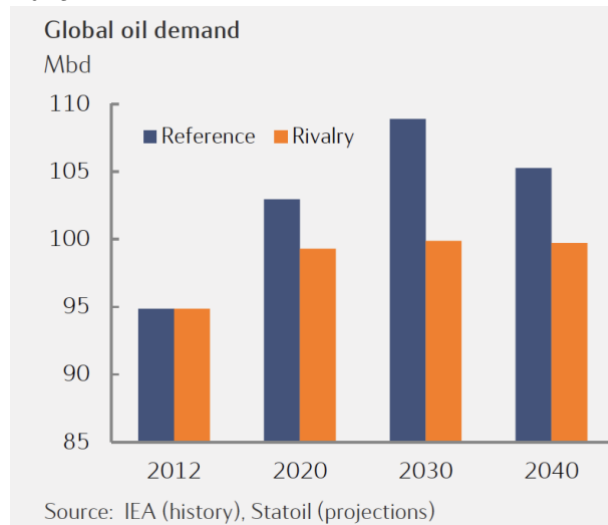
2018= 3 scenarios



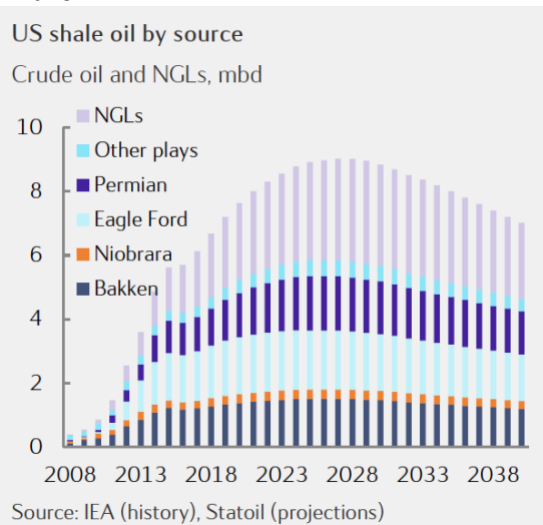
2016 = 3 scenarios



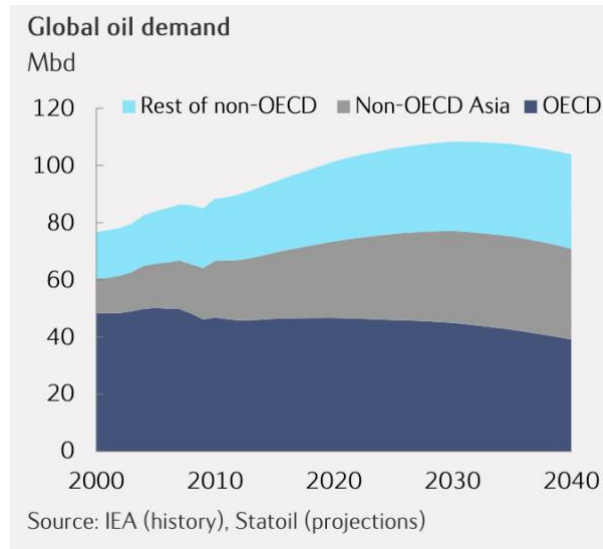
2015 two scenarios



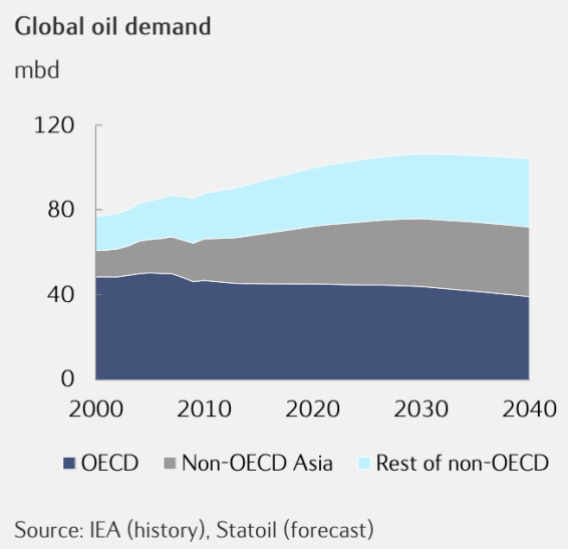
2015 for the US shale oil



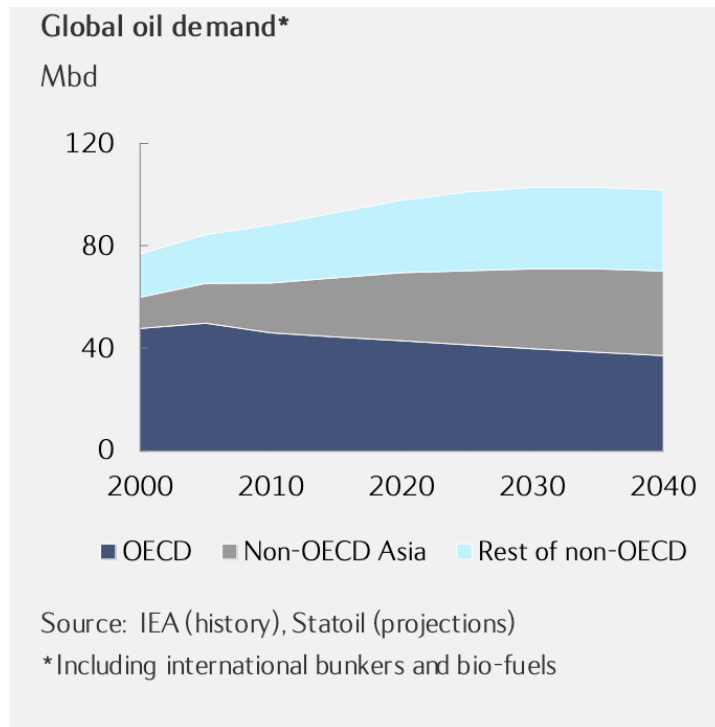
2014 one scenario for oil demand



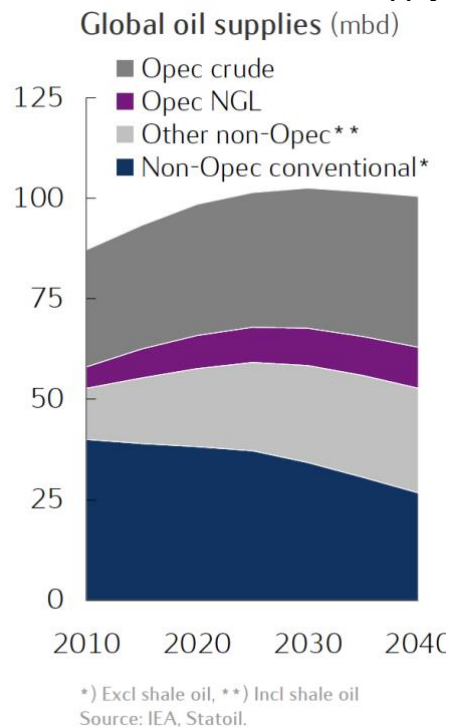
2013 one scenario for oil demand



2012 one scenario for oil demand



2011 one scenario for oil supply

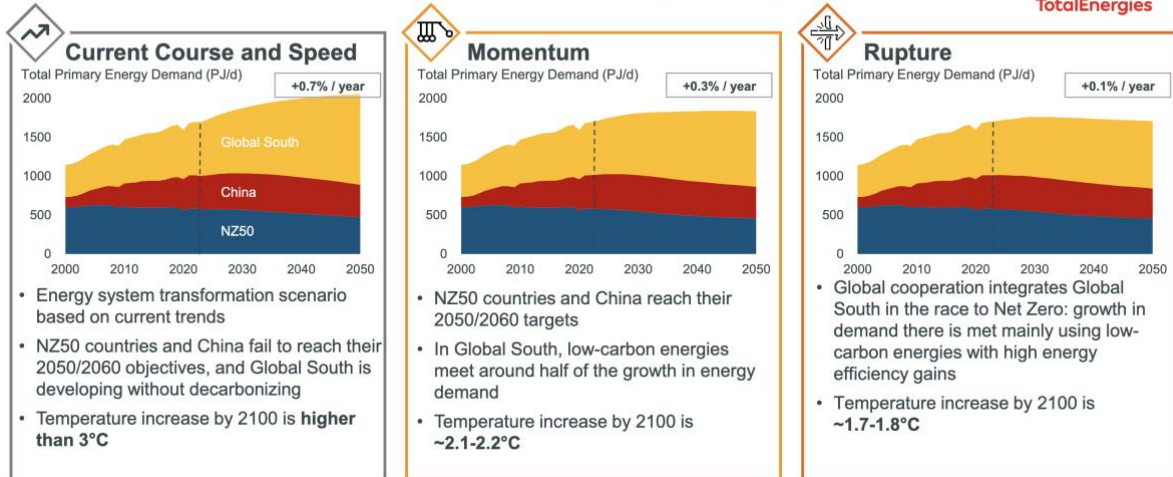


-Totalenergies

2023 Totalenergies energy outlook uses 3 scenarios with different energy growth:
Current course = 0.7%/a, Momentum = 0.3%/a and Rupture = 0.1%/a

Three possible scenarios in 2050

Population 9.5 billion in 2050, economic growth 2.8% / year until 2050



2022 Total energy outlook uses only 2 scenarios: Momentum and Rupture

Key features of our 2022 scenarios



Momentum: accelerating the ramp-up of greener molecules and electrons

GDP growth : +3.0%/yr
Energy growth: +0.4%/yr

- Starts with higher fossil fuels demand and higher emissions – so **more efforts needed**
- Transport revolution** under way: massive road electrification for Light and Heavy Duty Vehicles; increased Sustainable Liquid Fuels (incl. SAF) ambitions for marine and aviation
- Speeding up **end-use electrification** with strong growth in REN deployments
- Natural gas** keeping strong role as key transition energy in power and industry, much less in mobility
- Biofuels and biogas** penetrating selected segments
- H₂ potential** confirmed with ramp up after 2030
- High **polymer recycling** objectives

Rupture: how to reach well-below 2°C

GDP growth : +3.0%/yr
Energy growth: +0.2%/yr

Necessary dissemination at scale of decarbonization drivers to all emerging economies

- Speeding up energy switch to reduce emission and increase **energy efficiency**
- Further development of **electricity & renewables**
- Extension of road transport revolution with higher ZEV* penetration worldwide**
- Higher penetration of **new energy carriers** (clean H₂ in industry & transport, e-fuels, biofuels and biogas...)

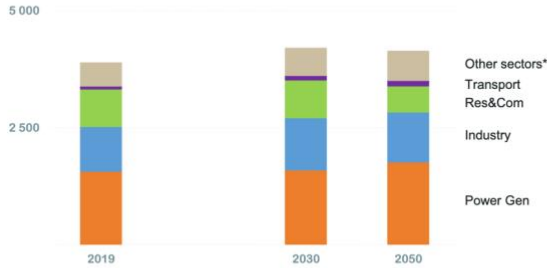
Momentum is very pessimistic compared with Shell Archipelagos

World Oil & Natural Gas

Natural gas key for energy transition; oil starts decreasing after 2030

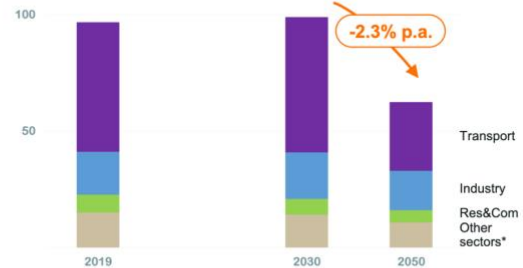


Natural gas demand by sector, excluding gas for Blue H₂ (Momentum)
Bcm



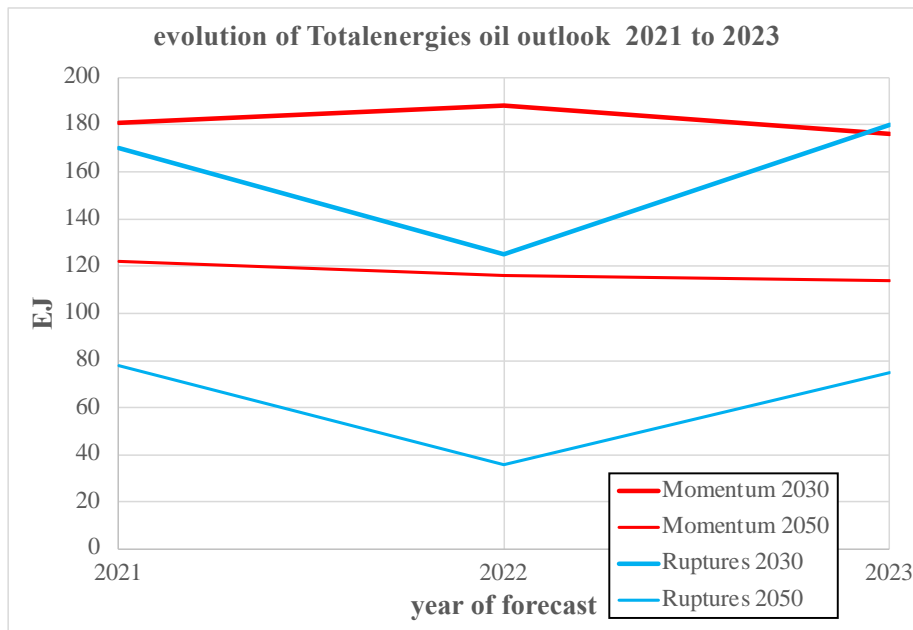
- Natural gas is a key transition fuel, growing by +0.2% p.a. to 2050, with a plateau from the 2030's
- Natural gas to displace coal in Power and Industry
- Gas use in transport remains mainly focused on Marine

Oil demand by sector (Momentum)
Mb/d

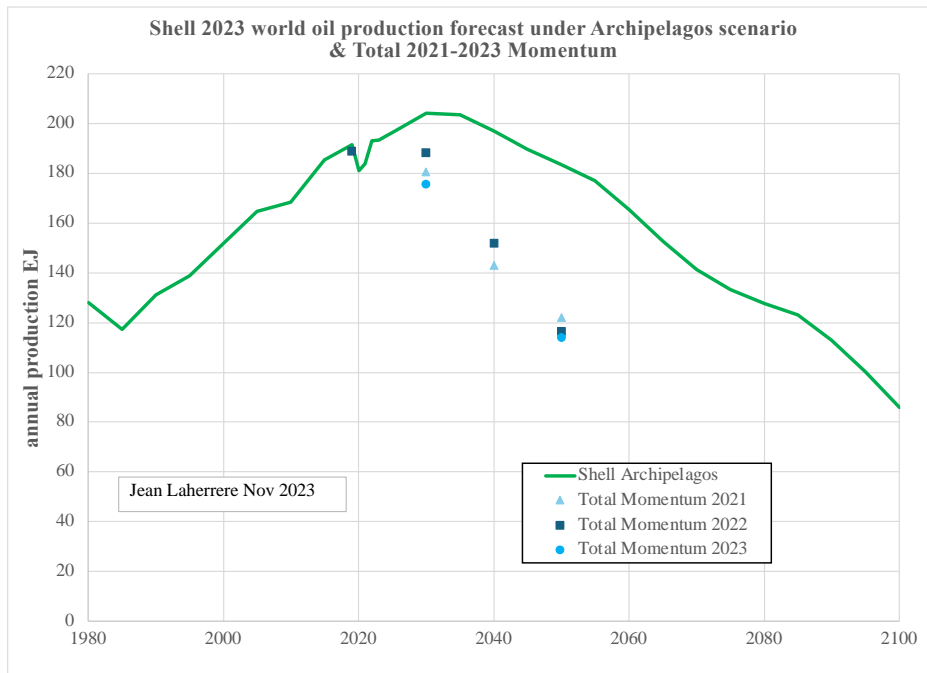


- Slight oil demand increase until early 2030
- Decrease post-2030 slower than the natural decline of producing oil fields, requiring continued investment

The evolution of Total forecasts displays a low in 2022 for Rupture, but 2023 similar with 2021.

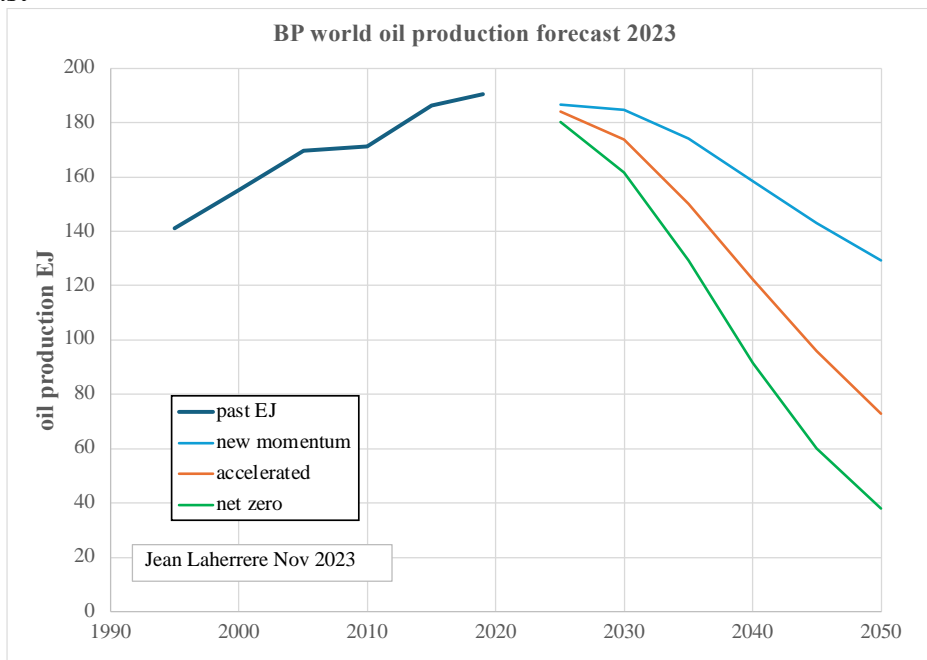


Total Momentum 2023 oil scenarios are compared with Shell 2023 Archipelagos: Total is much more pessimistic!

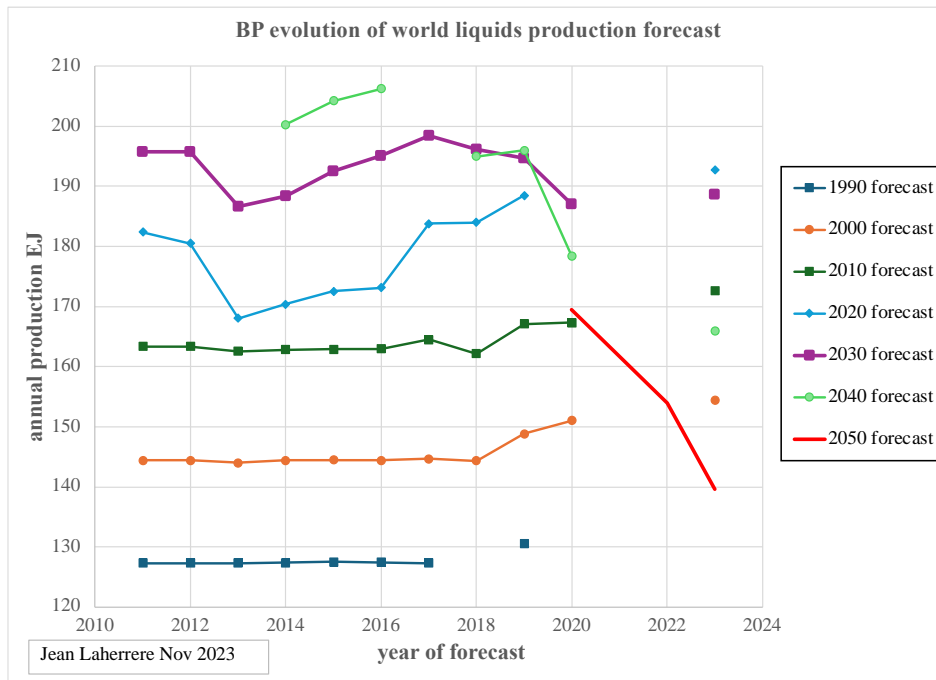


-BP

BP reports energy outlook since 2011 and moves from one scenario to 3 to cover zero emissions forecast and from Mb/d to EJ 2023 forecast

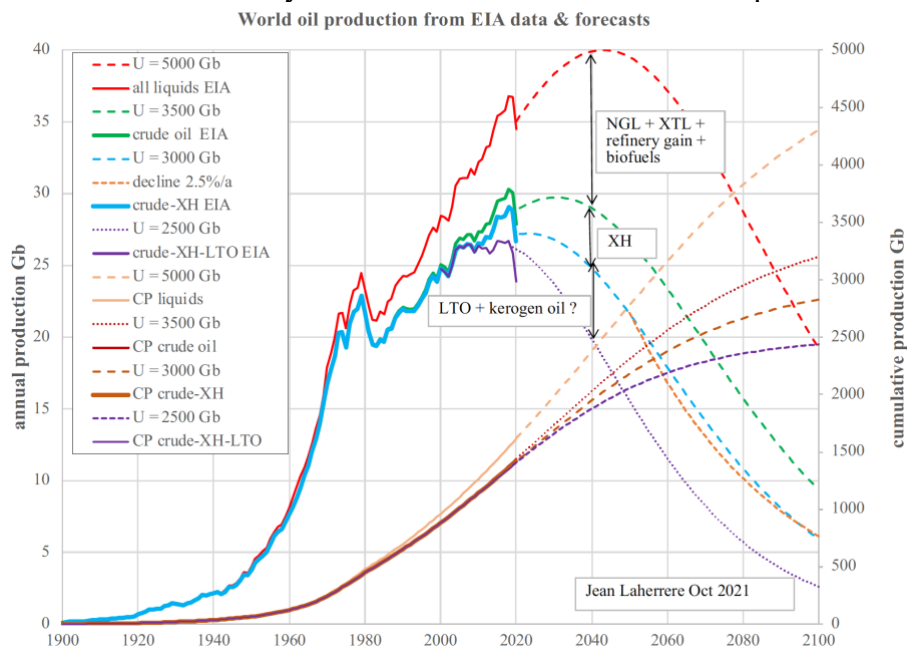


The 2030 forecast (purple) evolution since 2011 was low in 2013, high in 2017, when the 2040 (green) & 2050 (red) forecast are falling sharply since 2046

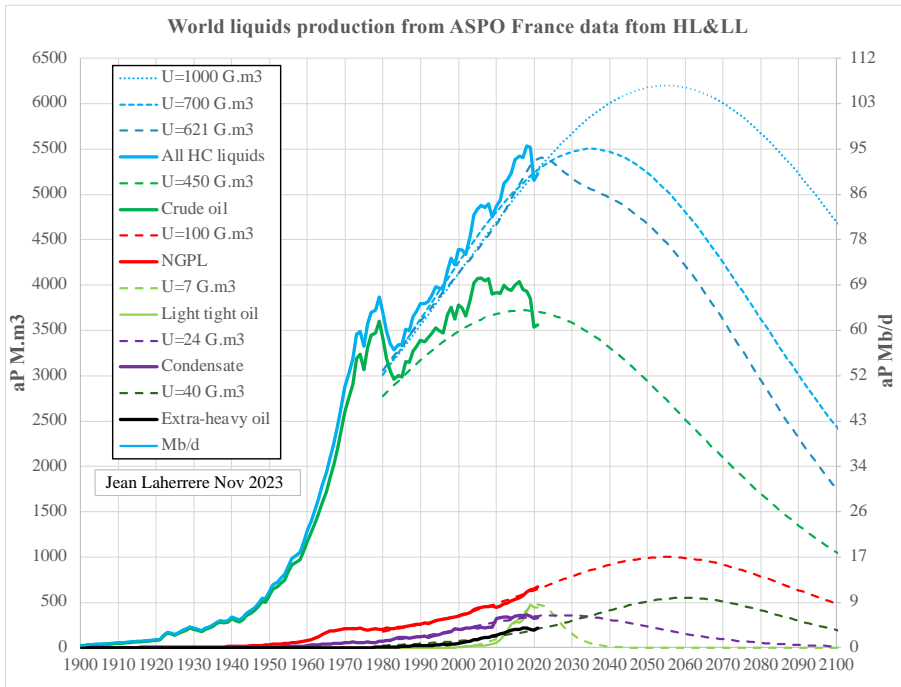


-JHL

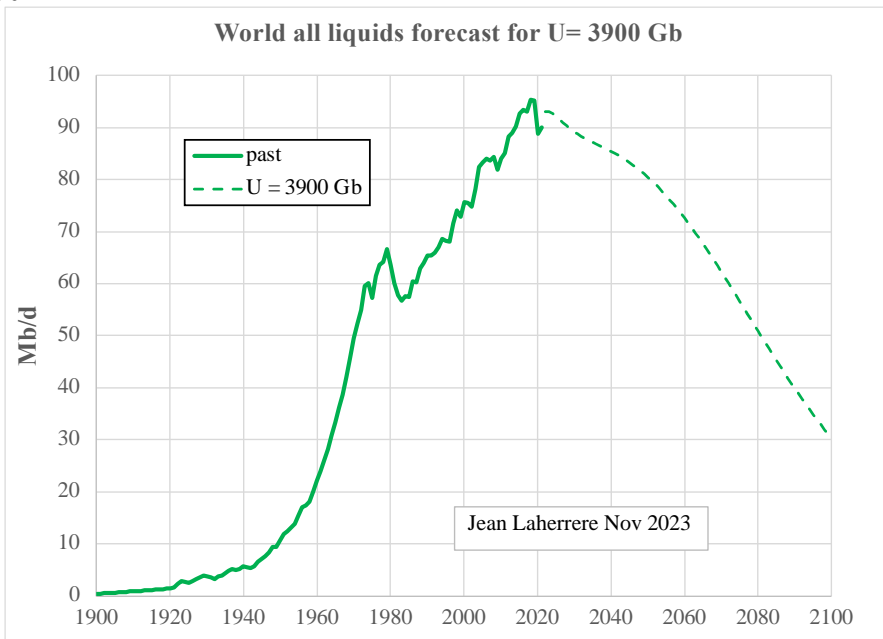
My 2021 forecast based on widely rounded ultimates from HL technique was rather optimistic



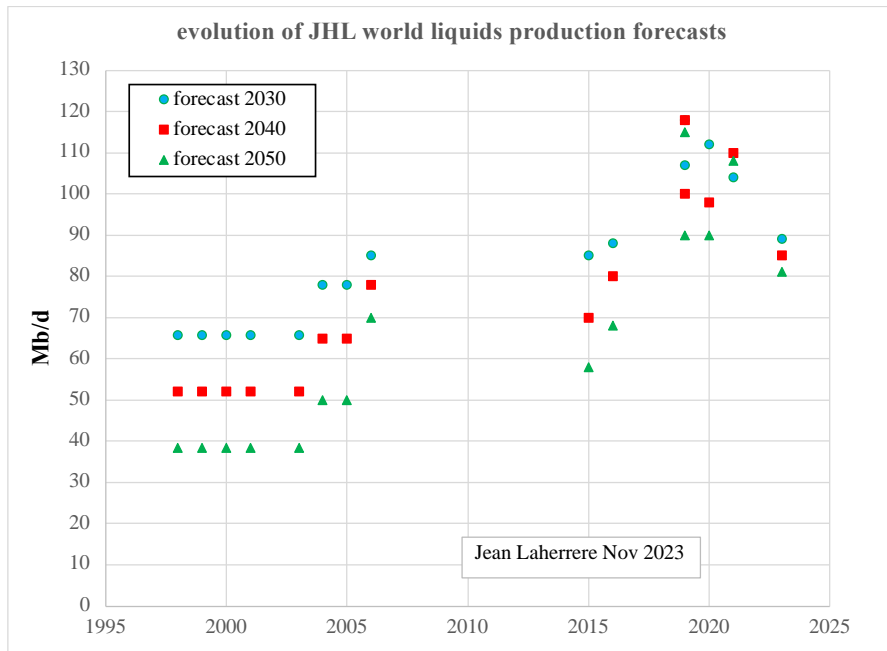
My 2023 forecast based on LH and LL (log linearization) of each product is more pessimistic: crude production has peaked, NGL will peak in 2050, condensate now, tight oil in 2024 and extra-heavy in 2060



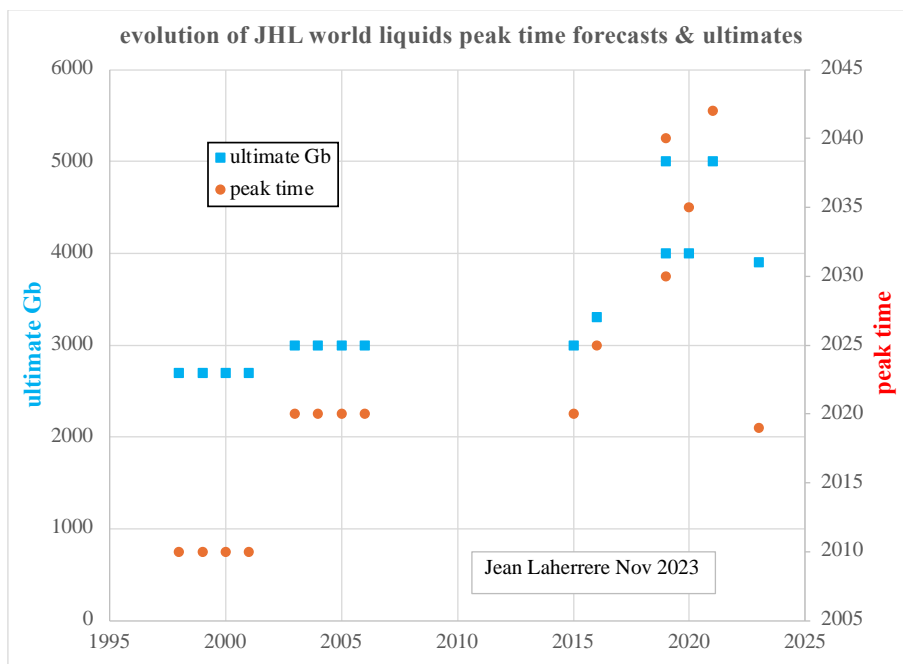
The best guess is the sum of crude + condensate + NGPL + LTO + XH with an ultimate of 621 G.m3 = 3900 Gb

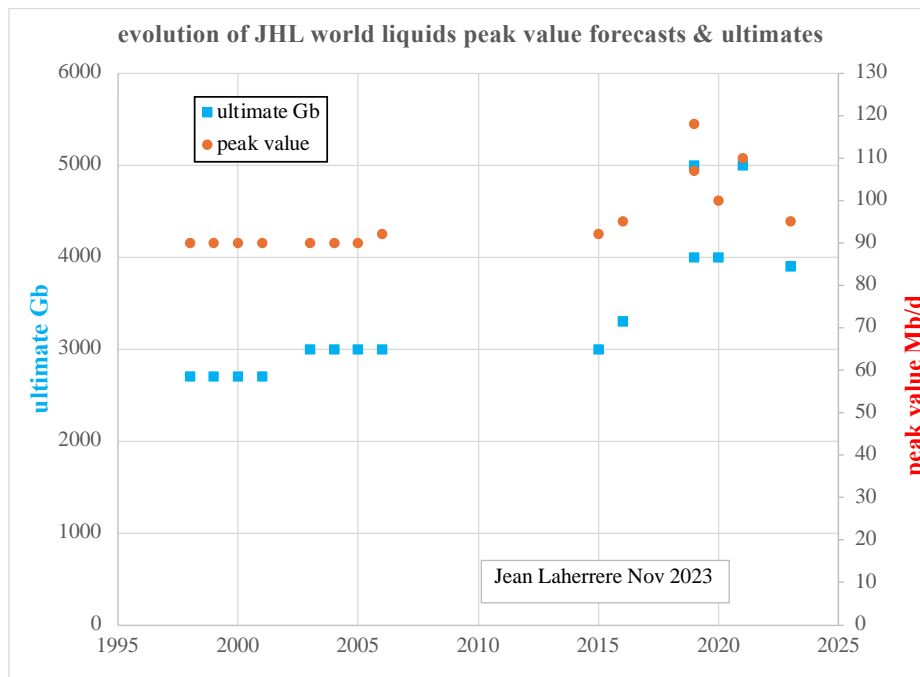


Evolution of JHL world liquids forecasts sees a peak in my 2019 forecast with a sharp decline in 2023



Same for the evolution of liquids peak time: my liquids peak is down in 2023 to 2019, when in 2021 the peak was in 2045: quite a change! But in 2005 my peak was in 2020. I was too optimistic on NGL because recently NG giants still discovered against very few oil giants.





If is obvious that my forecasts have fluctuated largely for the last 20 years, mainly due with the arrival of LTO with sophisticated fracking and very long horizontal lengths.

Nobody in 2005 forecasted such LTO burst.

My ultimate estimates wide variation means that I try to adjust my techniques to new data.

But LTO production is mainly concentrated in the US with 7.6 Mb/d in 2019 when 8.2 in the world with Canada, China, and Argentina.

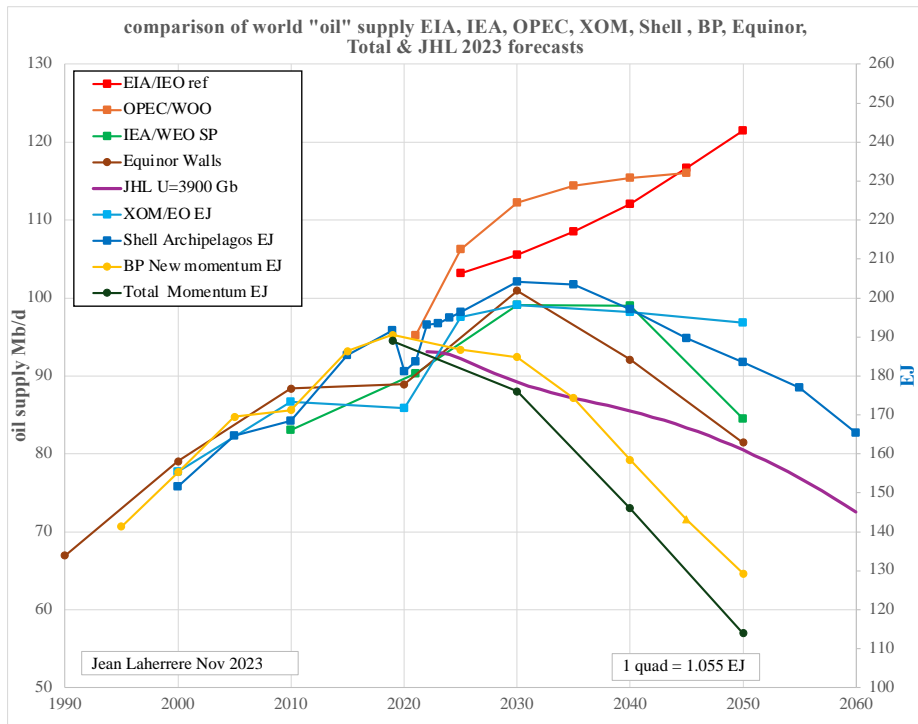
EIA published a very optimistic report in 2013 where within the United States indicate technically recoverable resources of 345 billion barrels of world shale oil resources and 7 299 trillion cubic feet of world shale gas resources and outside the US. 287 Gb and 6 684 Tcf

In fact, LTO production outside US is small because in US landowners own the oil and sell their rights to oil producers, accepting all the nuisances of production and fracking (hundreds of trucks) because landowners receive a lot of money from oil producers. Outside the US, oil belongs to government and landowners do not get any money from the tight oil production, so they do not accept any nuisance but NIMBY = not in my back yard.

The best example was the refusal by the local population in 2016 in Algeria at Ain Salah of any shale gas production in the middle of the Sahara Desert!

-world comparison

World oil supply 2023 forecasts are compared



EIA forecasts world liquids production peak beyond 2050 when XOM, Shell & Equinor in 2030, IEA 2035, but BP & Total as myself in 2019

In the past EIA has never forecasted a peak: it is against its belief, as if growth is forever in a finite world!

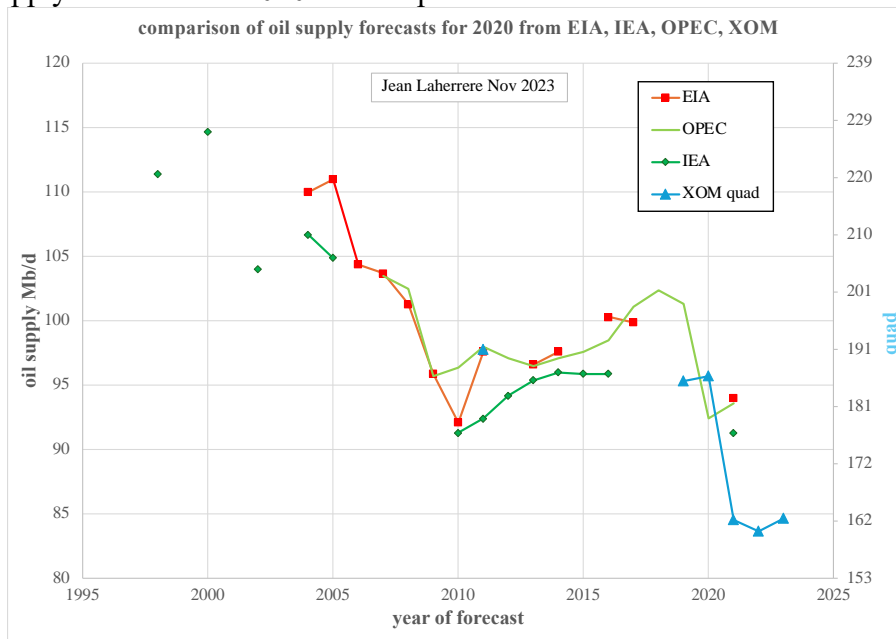
Total Momentum forecast is very pessimistic for 2040 and 2050, but BP is not too far.

My forecast is pessimistic for 2030, less for 2050

Equinor, ExxonMobil, Shell and IEA are in the middle

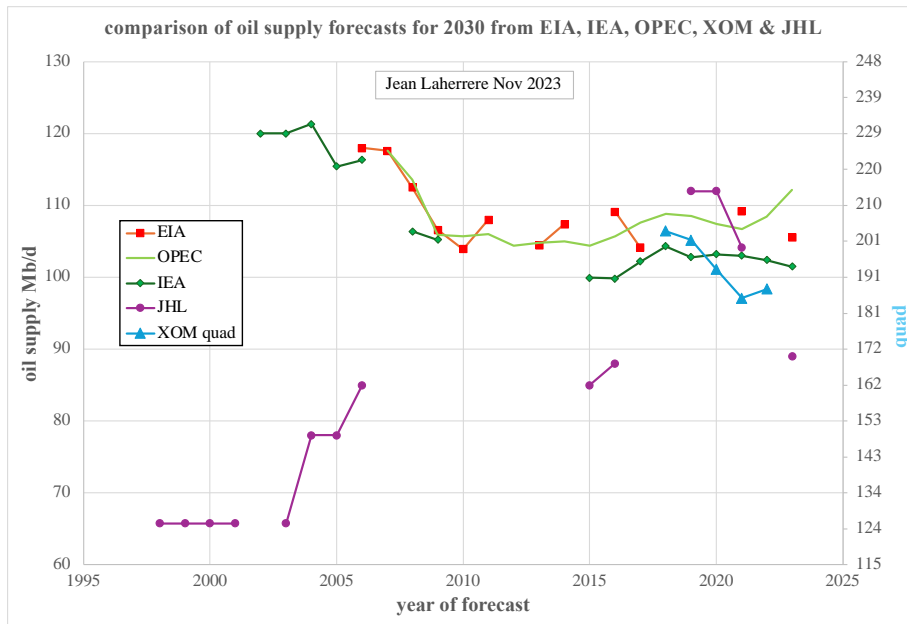
Last EIA believes in Santa Claus, but OPEC is close with a peak beyond 2045!

World oil supply forecasts for 2020 are compared:



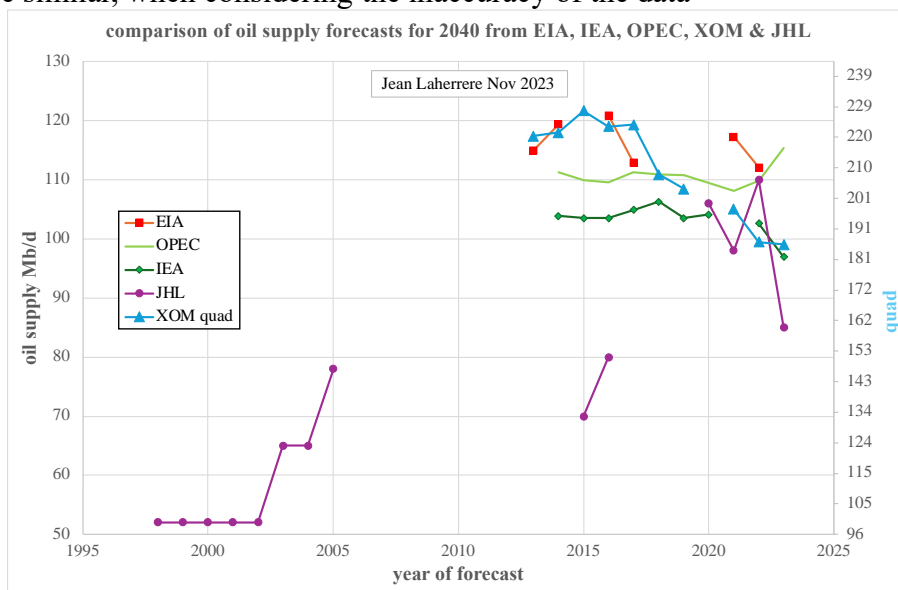
Same behavior with general decline and low in 2010 and high 2018

World oil supply forecasts for 2030 are compared:



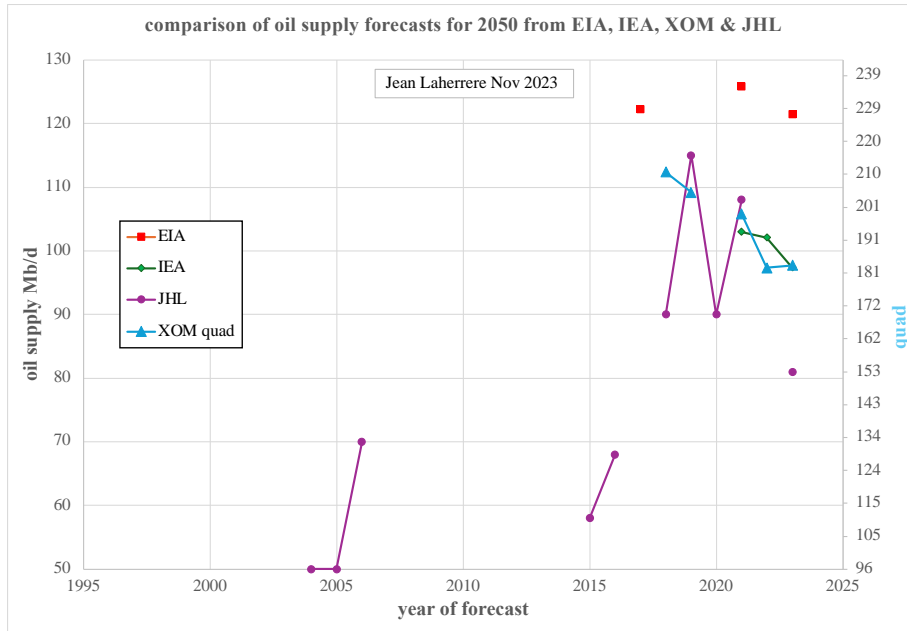
My old forecasts before the burst of LTO of 2008 were too low: I was too pessimistic, to counter the optimism of agencies: there is a kind of symmetry. In 2021 I was within others, but in 2023 pessimistic compared to others

World oil supply forecasts for 2040 are compared: same story before 2020 but today all forecasts are similar, when considering the inaccuracy of the data



World oil supply forecasts for 2050 are compared, but OPEC forecasts stop at 2045: since 2017 decline for all except OPEC

For the last years of forecasts since 2018, 2050 forecasts decline to the present value of 100 Mb/d, but EIA forecasts are too high over 120 Mb/d!



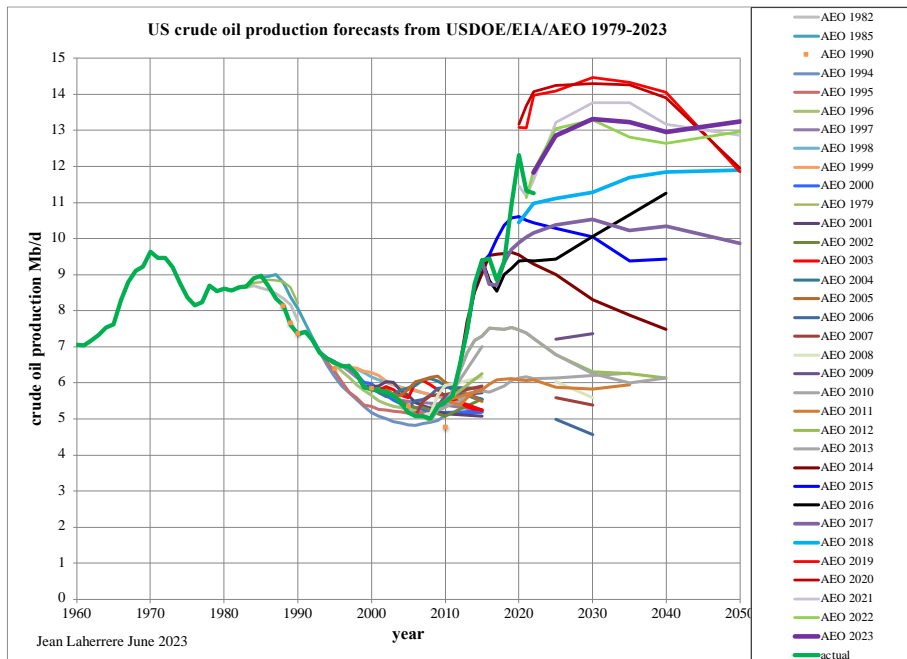
-US production forecasts

-EIA

The U.S. Energy Information Administration provides a long-term outlook for energy supply, demand, and prices in its Annual Energy Outlook (AEO). This outlook is centered on the Reference case, which is not a prediction of what will happen, but rather a modeled projection of what might happen given certain assumptions and methodologies

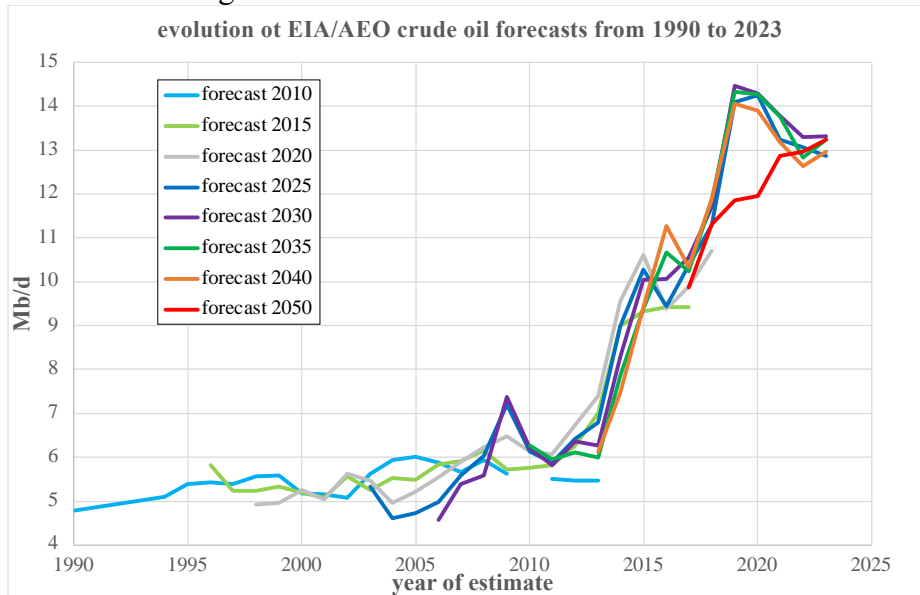
-crude oil

EIA did not forecast the LTO burst which started in 2010 until 2013 and forecasts the peak in 2030

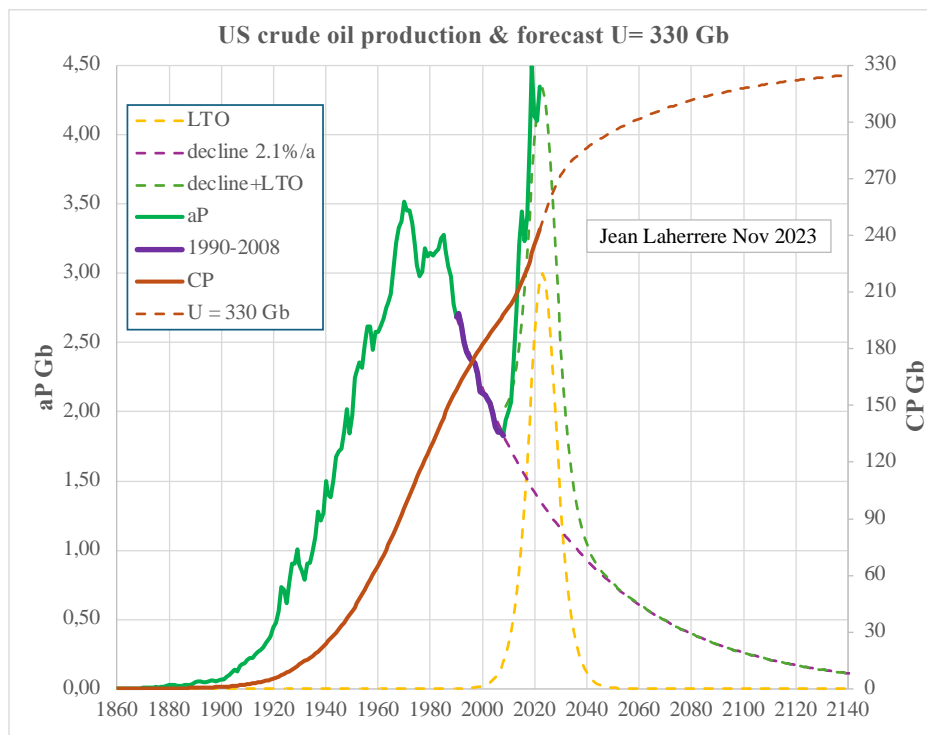


AEO2011 forecasted US crude oil production for 2020 at 6 Mb/d when the real value is 12 Mb/d = double!

The peak in 2030 is declining since 2019



EIA US crude oil production data is plotted and the period 1990-2008 (purple) is extrapolated with a decline of 2.1 % per annum, it is assumed to be the crude less LTO, then a Hubbert curve with a peak in 2024 is added. The total cumulative production has an ultimate of 330 Gb



In previous papers, I mentioned that EIA reports 3 different US oil production data from 3 different sites, asking “where is the boss?” after that Adam Sieminski was fired by Trump when elected.

source a: prod data <https://www.eia.gov/petroleum/drilling>

source b: reserves data including production data

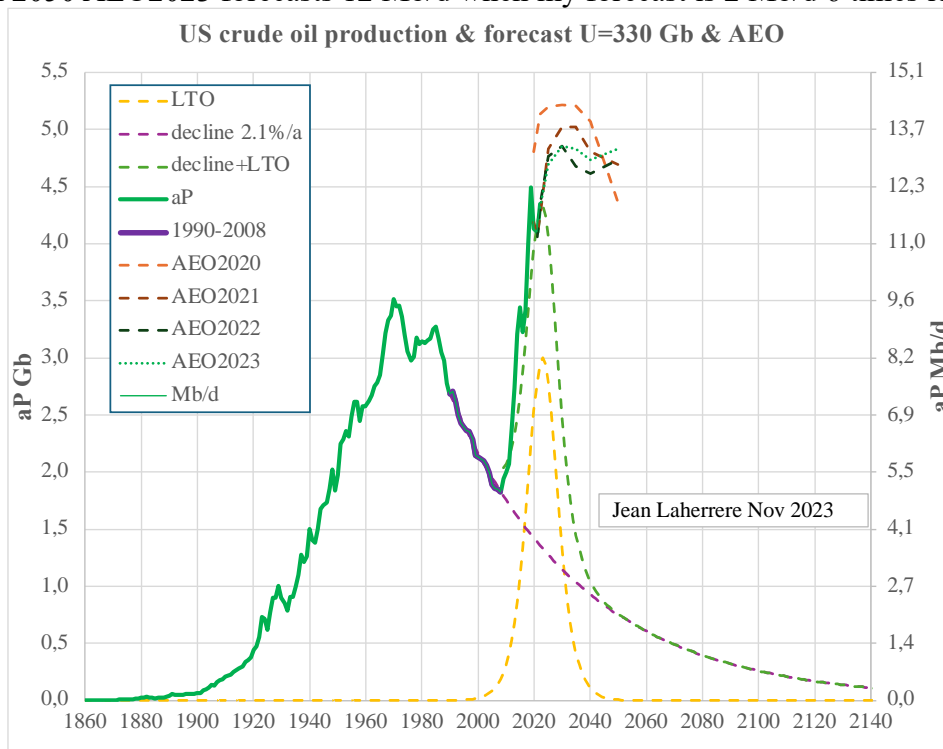
<https://www.eia.gov/naturalgas/crudeoilreserves/>

source c: energy explained <https://www.eia.gov/energyexplained/oil-and-petroleum-products/data/US-tight-oil-production>

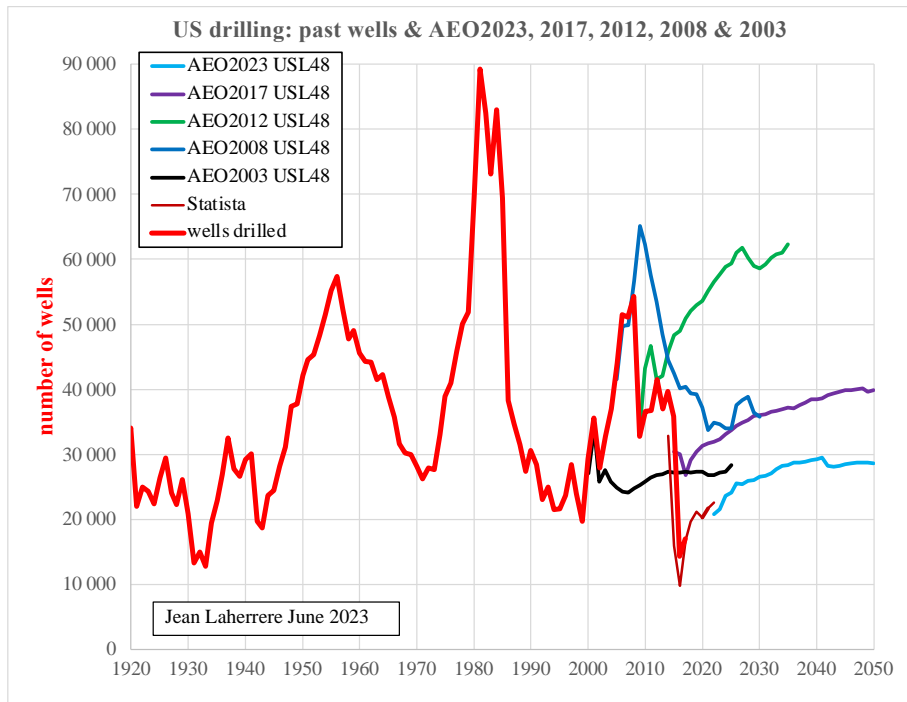
It means that EIA data is not reliable: EIA does not report real data since 2015 but estimates under the Form EIA-914.

*With the expanded Form EIA-914 survey, EIA collects data **from a sample of less than 500 out of 13,000 currently active operators** of oil and natural gas wells. These operators account for about 90% of crude oil, lease condensate, and natural gas production in the Lower 48 states and a significant share of the total oil and natural gas production in each of the 15 states and the federal Gulf of Mexico for which data are individually collected*
 The old method was estimated by EIA to have an uncertainty of 200 000 b/d for the USL48, but what is the uncertainty of EIA-914?

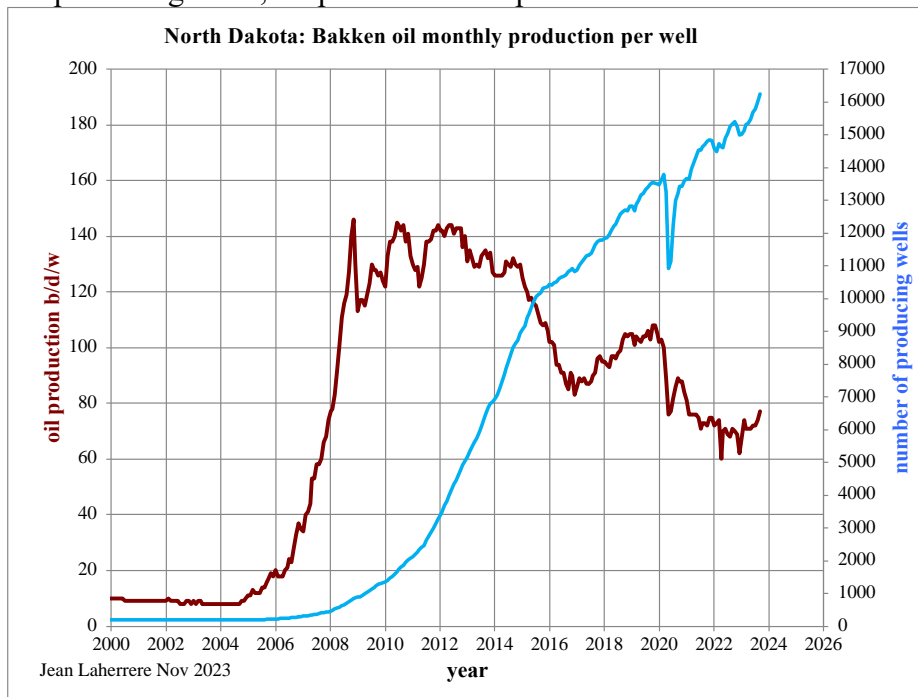
The 330 Gb future production is compared with EIA AEO 2020 to 2023: the difference is amazing: in 2050 AEO2023 forecasts 12 Mb/d when my forecast is 2 Mb/d 6 times less!



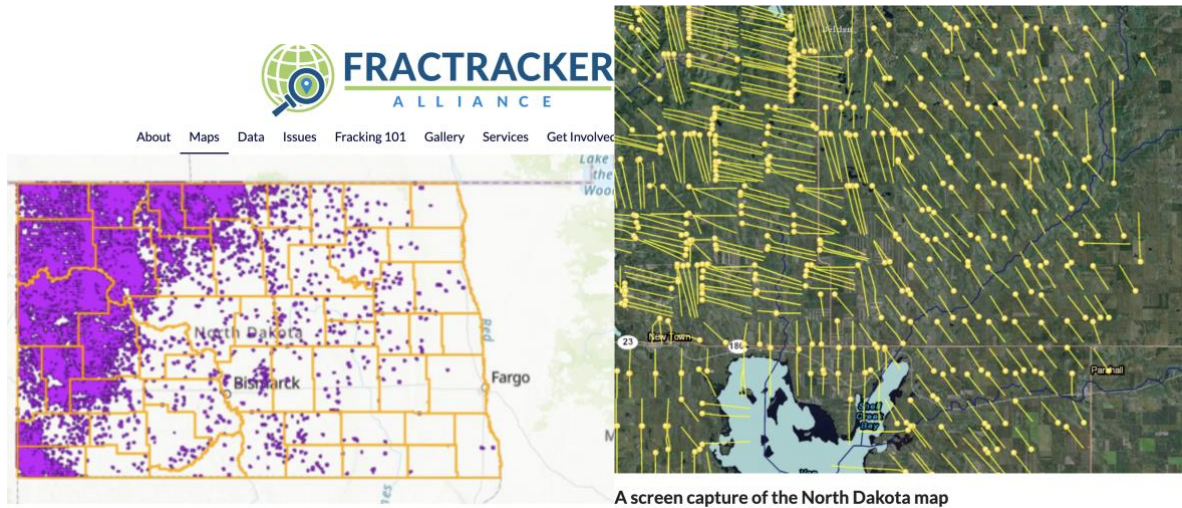
EIA/AEO2023 forecasts 30 000 wells drilled on USL48 in 2050; the past AEO forecasts in USL48 future drilling (AEO2003 to AEO2023) were poor compared with real data: AEO2012 (green curve in next graph) for 2020 forecasted 55 000 wells against 20 000 in real. AEO2023 forecasts the peak of US crude production beyond 2050: EIA believes in Santa Claus! Already most of the LTO locations are full and problems between parent wells and child wells



However, Bakken monthly oil production per well in North Dakota is presently increasing as the numbers of producing wells, despite that the map of the wells looks almost full

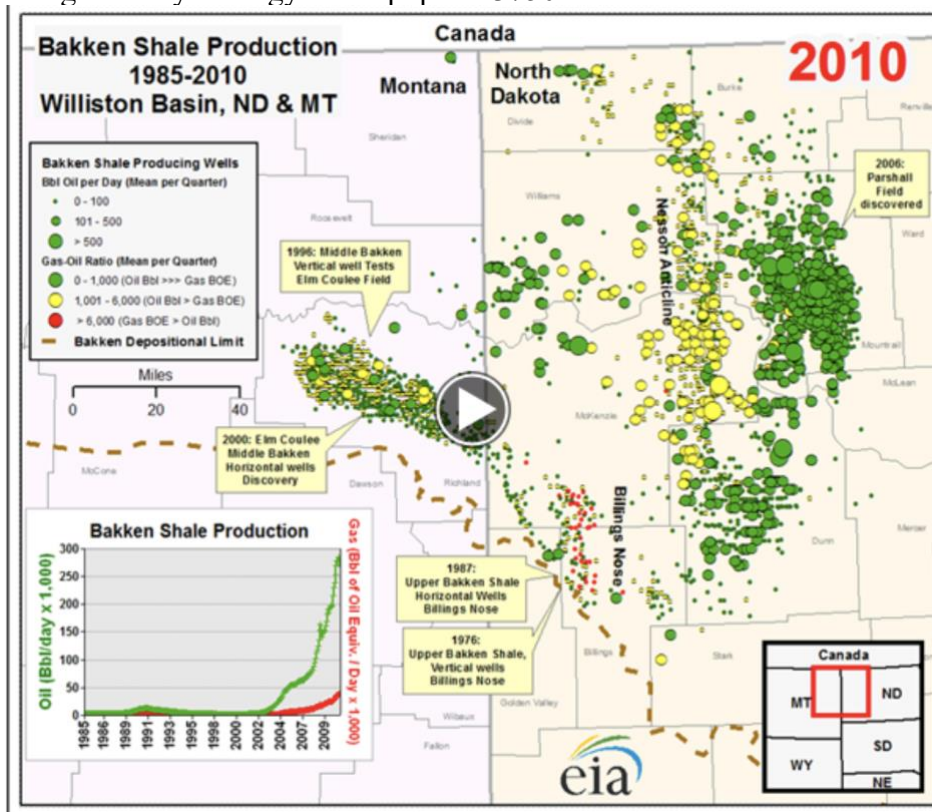


This map from FracTracker displays the producing wells: few locations left today for new wells in the economic zone, except in the lake!

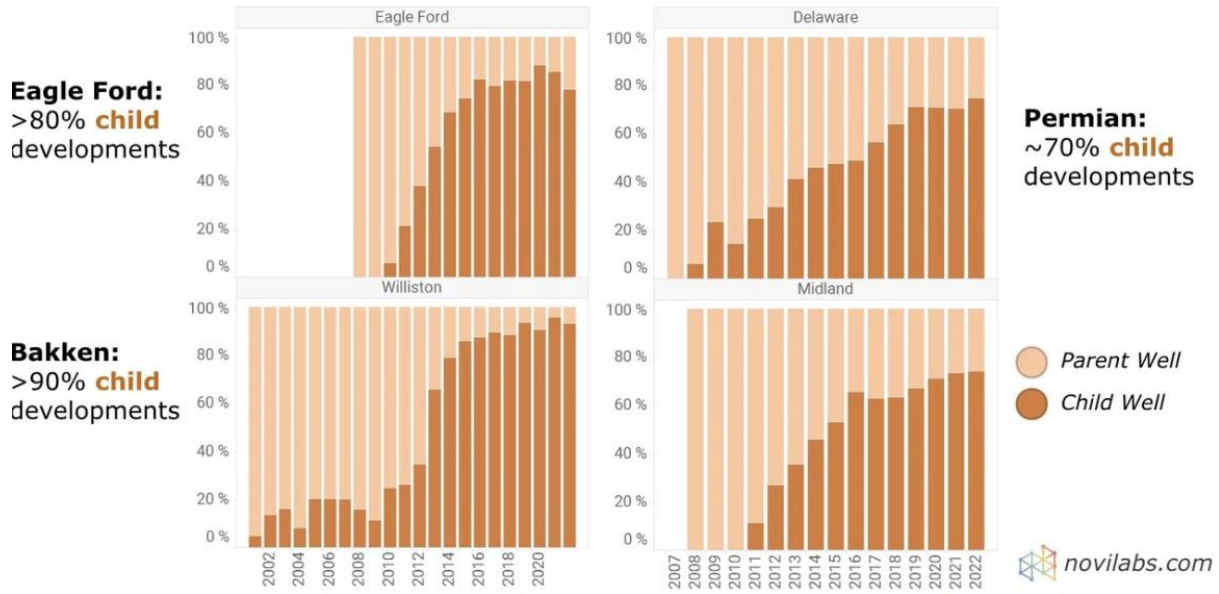


A screen capture of the North Dakota map

EIA displayed the Bakken map annually from 1985 to 2010
<https://www.eia.gov/todayinenergy/detail.php?id=3750>

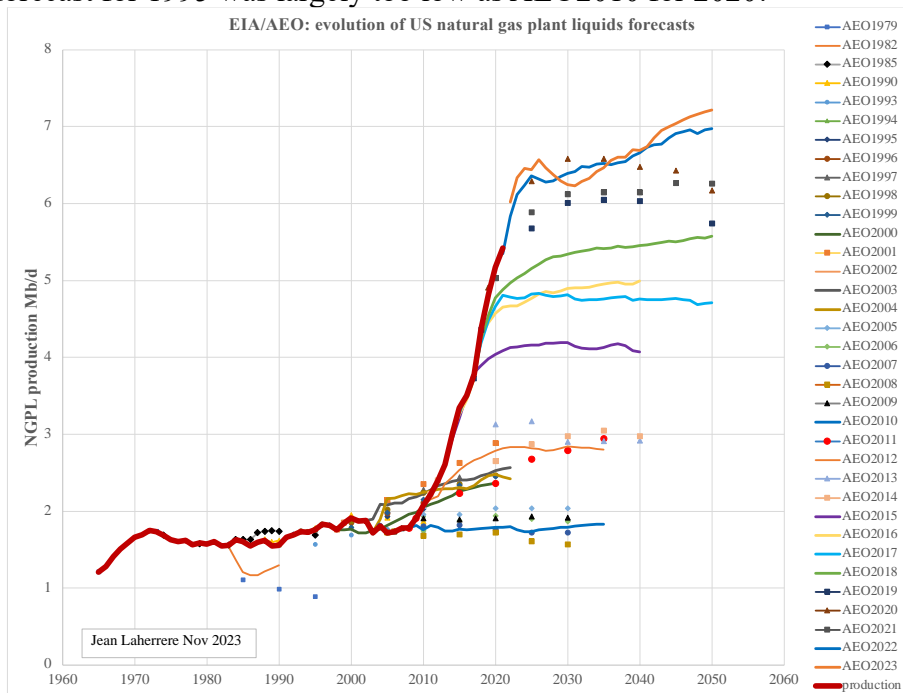


A new paper by Novi displays the importance of the parent-child well dynamic where in Bakken >90% of wells coming in line being child wells

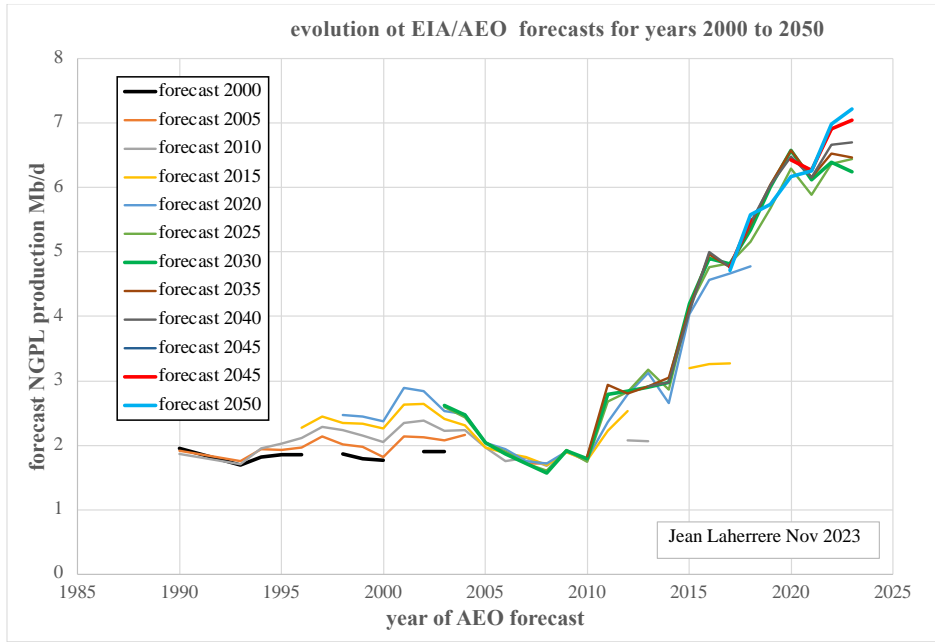


-NGPL

AEO1979 forecast for 1995 was largely too low as AEO2010 for 2020!

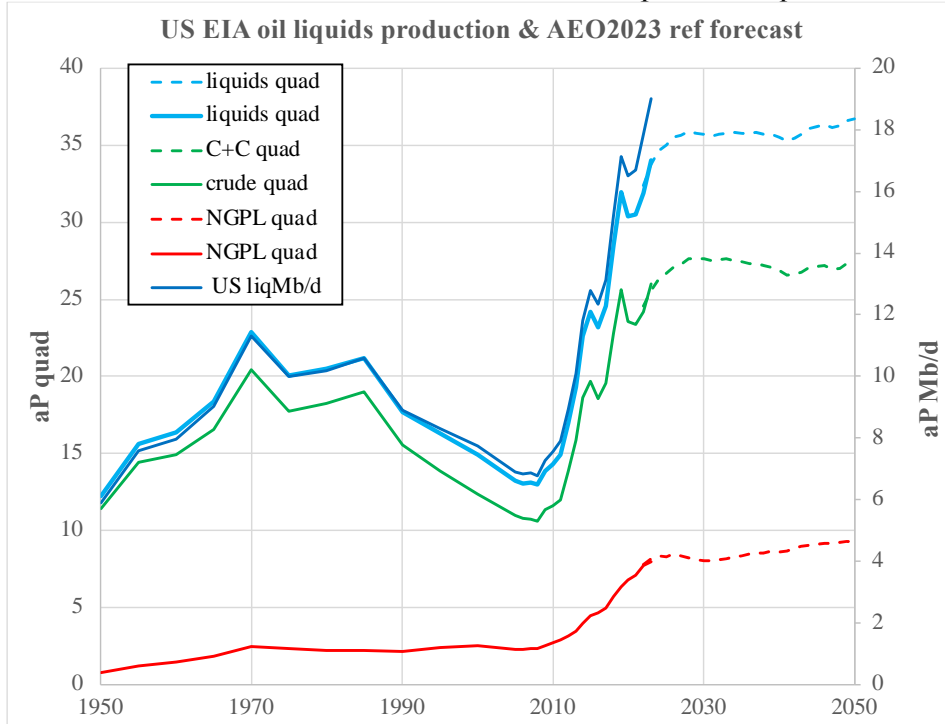


EIA was too pessimistic on NGPL forecasts
 AEO NGPL forecasts vary little



-liquids

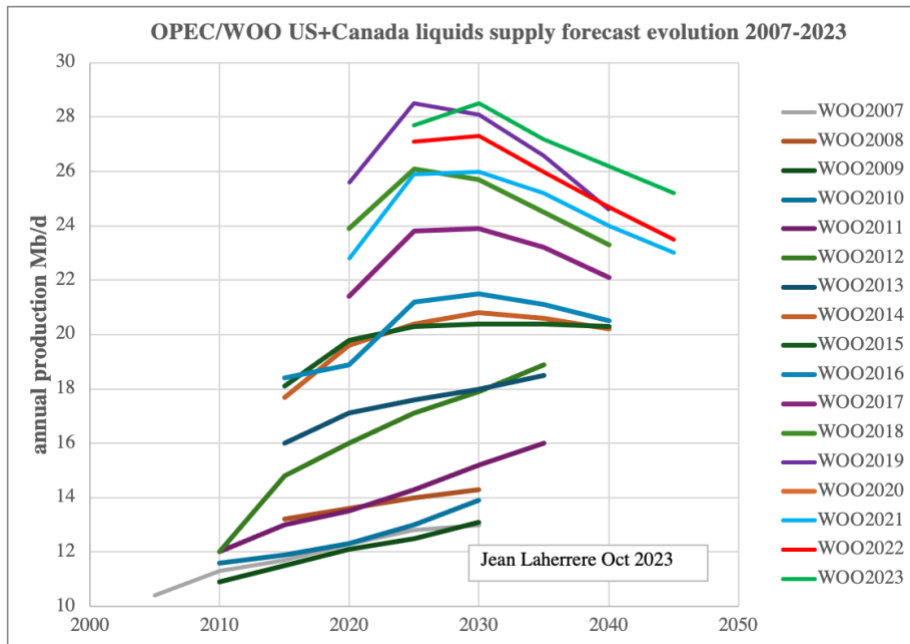
EIA crude & condensate, NGPL and AEO 2023 forecasts are plotted in quad and Mb/d



Oil peak is beyond 2010 for EIA; I doubt as LTO will decline soon!

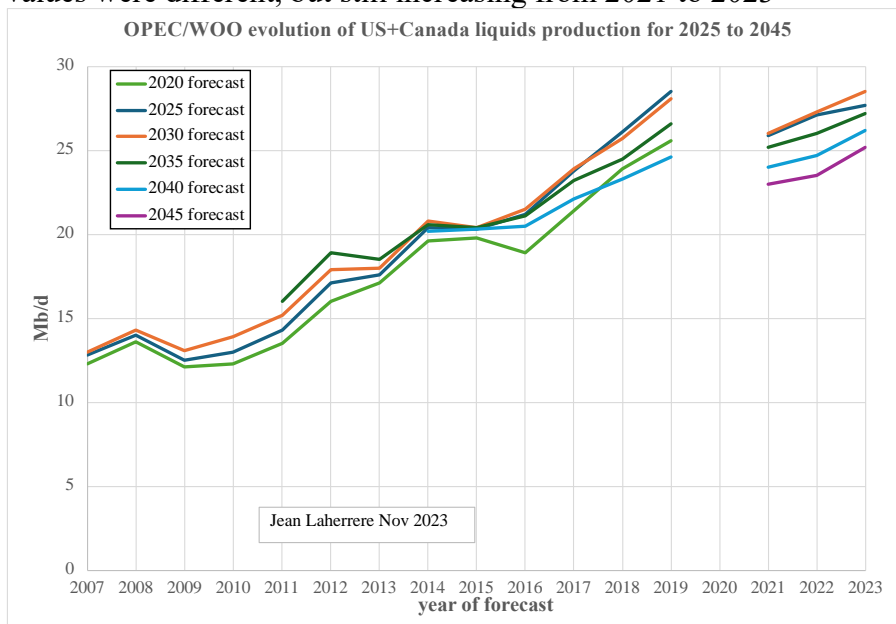
-OPEC

-US + Canada



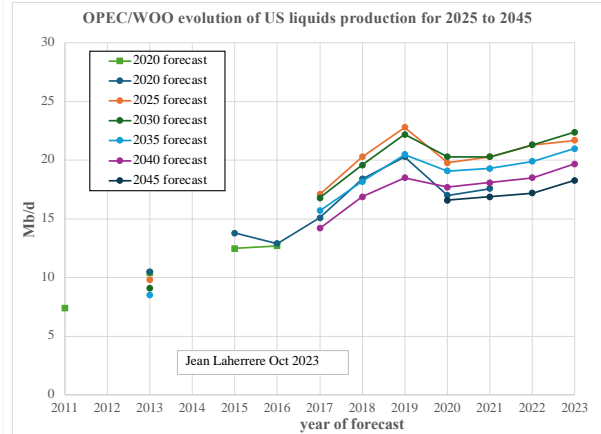
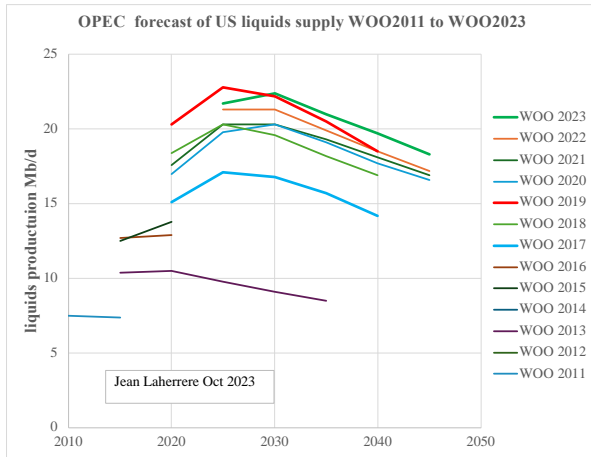
In 2023 OPEC forecasts a peak in US + Canada liquids supply in 2030, before it was in 2025

US + Canada liquids forecasts increase since 2007 to 2019 and after a no report in 2020 the values were different, but still increasing from 2021 to 2023

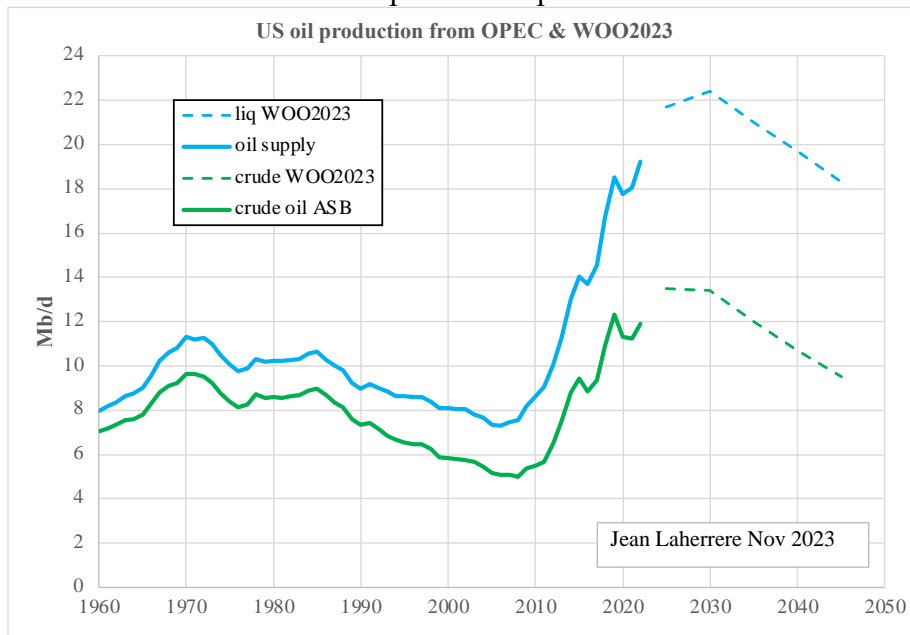


-US

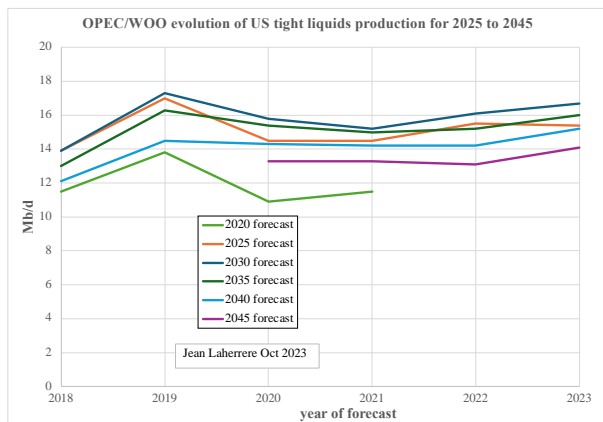
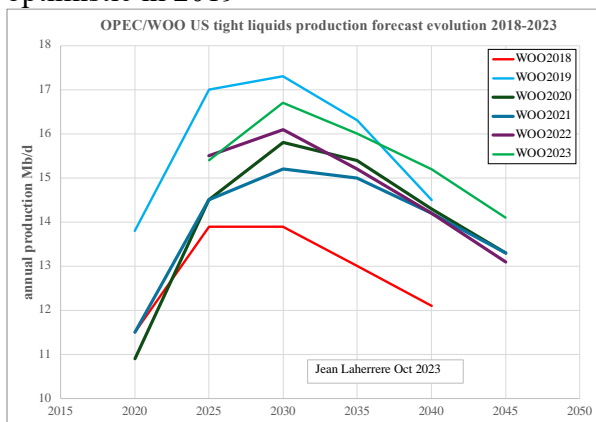
US liquids supply forecast: peak in 2030, but the forecast evolution increases since 2011 to 2019 and then rather stable



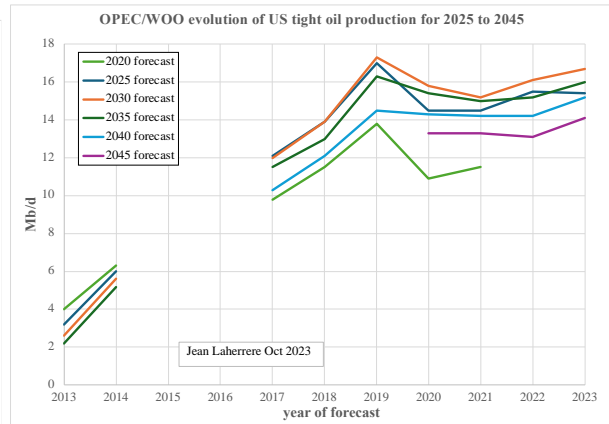
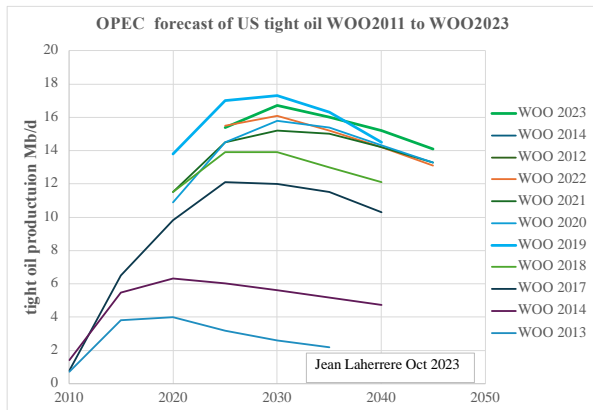
WOO2023 forecasts US oil and crude oil production peak in 2030



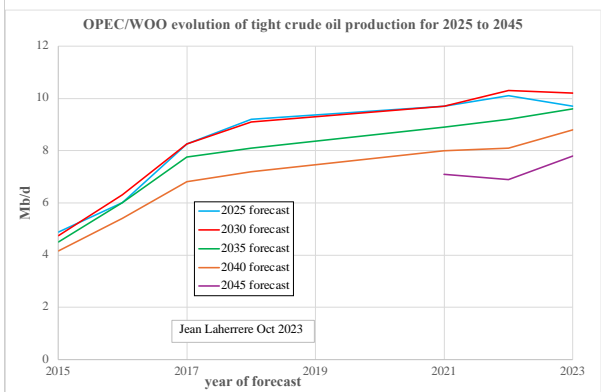
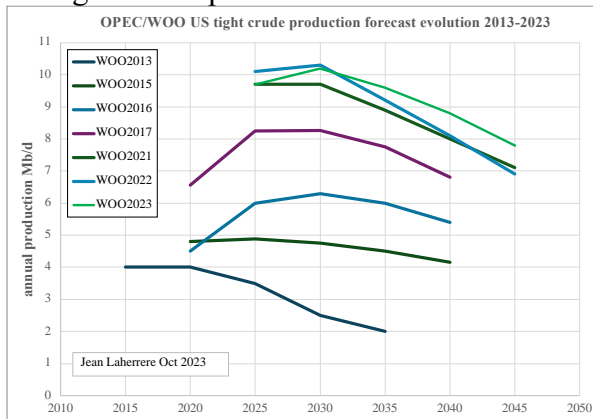
US forecasts tight liquids peak in 2030; the evolution since 2018 is rather stable with the most optimistic in 2019



US tight oil forecast: peak in 2030 and the forecast evolution increases sharply from 2013 to 2019, stable after.



US tight crude: peak in 2030 with an increasing forecast from 2015 to 2023



WOO 2023 on US total liquids supply

Figure 4.5 US total liquids supply outlook

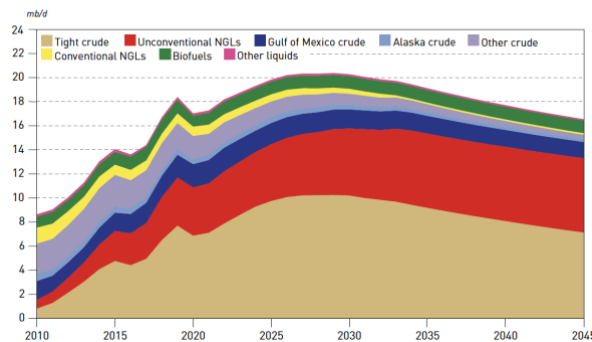
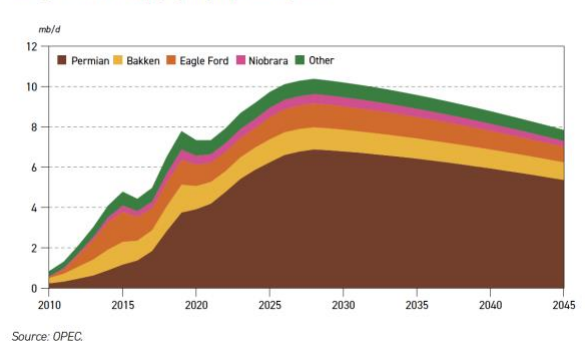


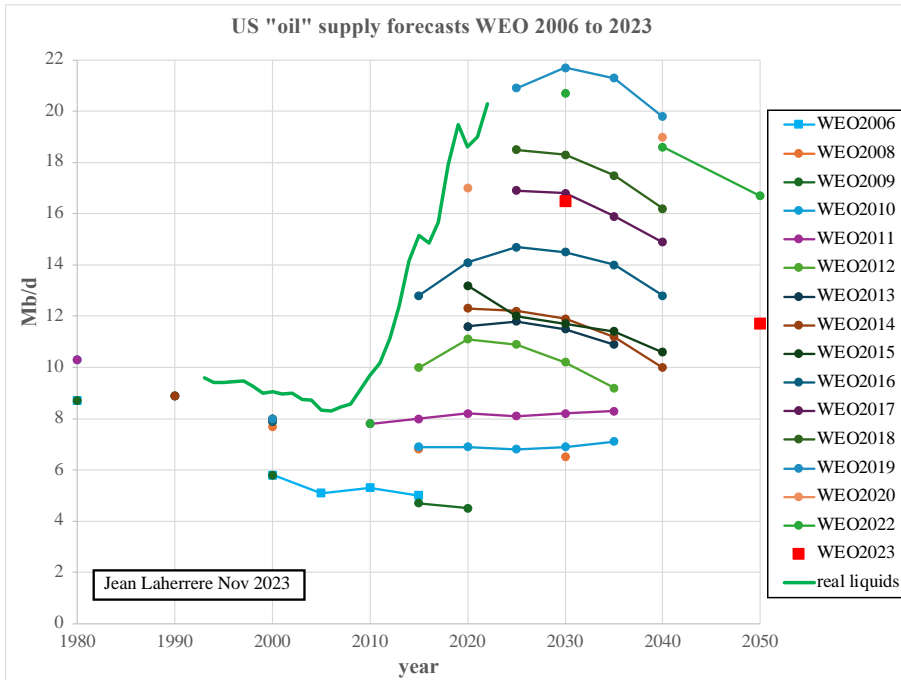
Figure 4.21 US tight crude oil supply by major producing basin



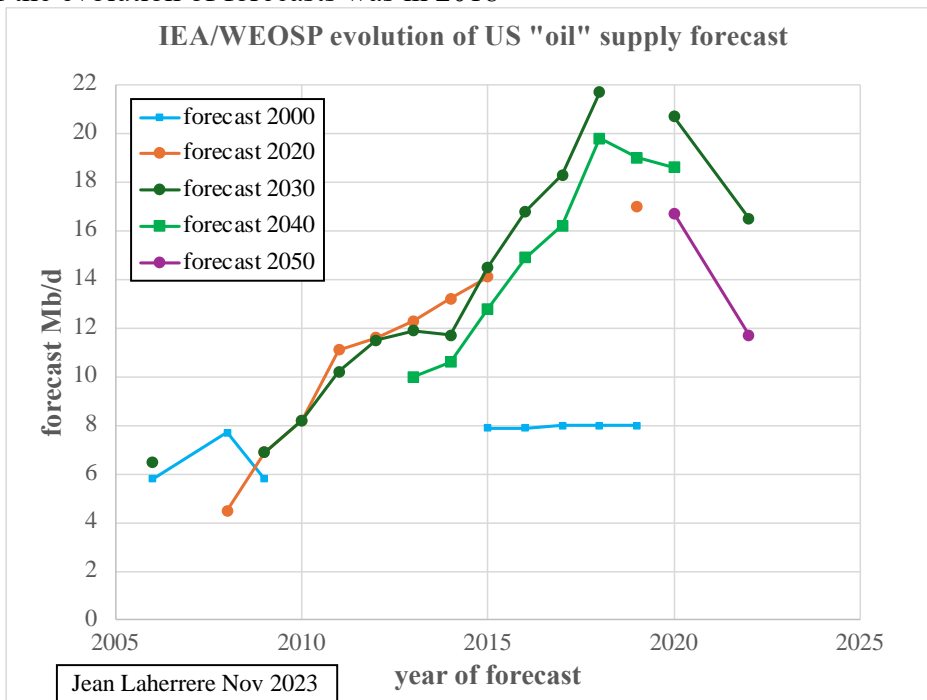
OPEC WOO2023 forecasts a slow decline for US tight oil production when US LTO real data shows a strong decline per well, needing more new wells (about 30 000 wells per year) to be drilled and completed when the room for new locations seems short!

-IEA

There is uncertainty about the definition of oil being all liquids in volume, but including or not biofuels and refinery gain



WEO2023 forecasts a sharp decline in 2030 and 2050
 The peak of the evolution of forecasts was in 2018

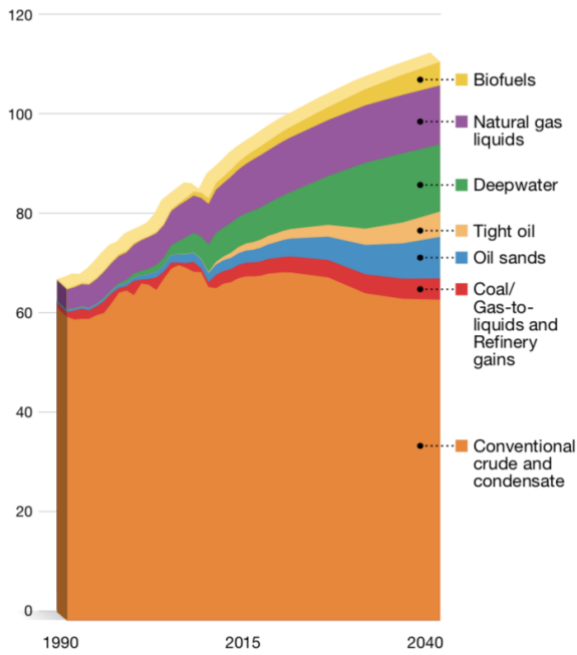


-ExxonMobil liquids supply forecasts:
 The evolution of XOM forecasts on world
 Edition 2012

Edition 2013

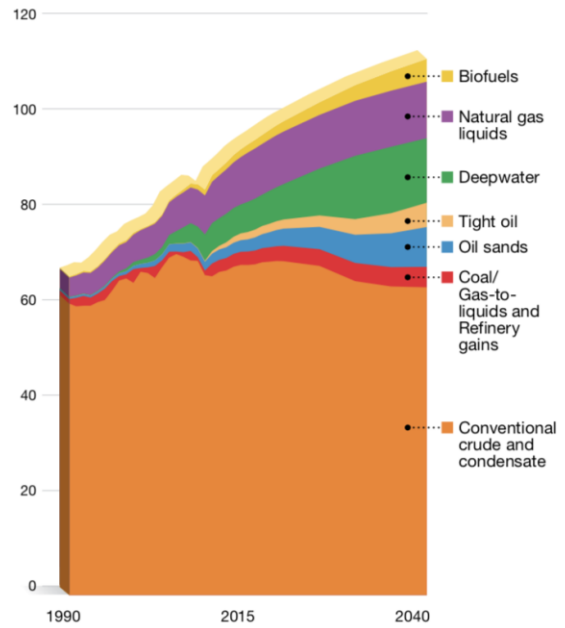
Liquids supply by type

Millions of oil-equivalent barrels per day



Liquids supply by type

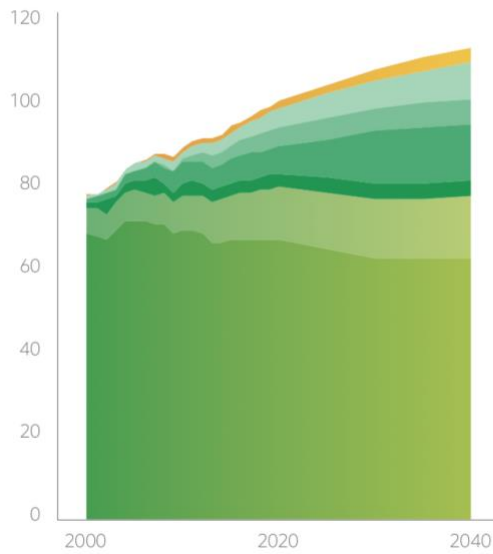
Millions of oil-equivalent barrels per day



Edition 2014

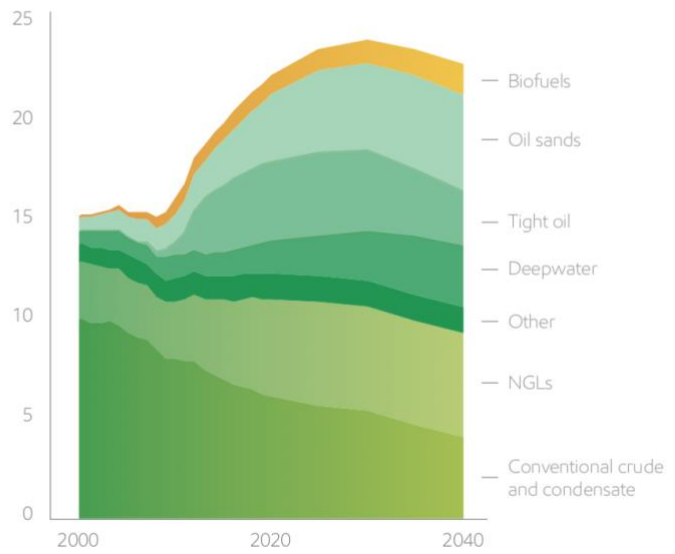
Global liquids supply by type

Millions of oil-equivalent barrels per day



North America liquids supply by type

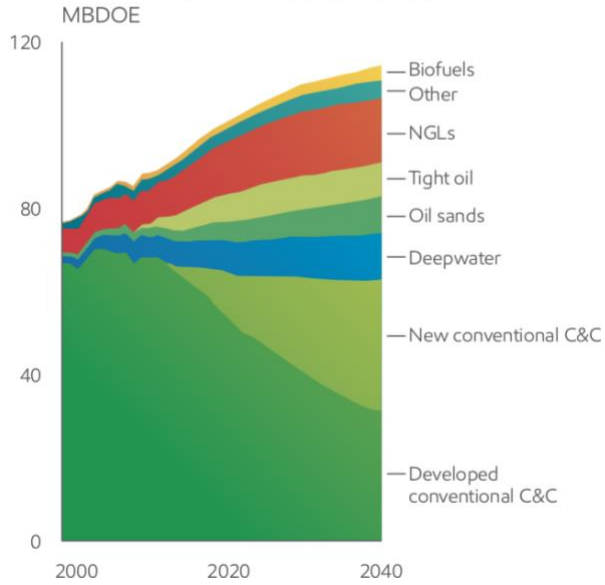
Millions of oil-equivalent barrels per day



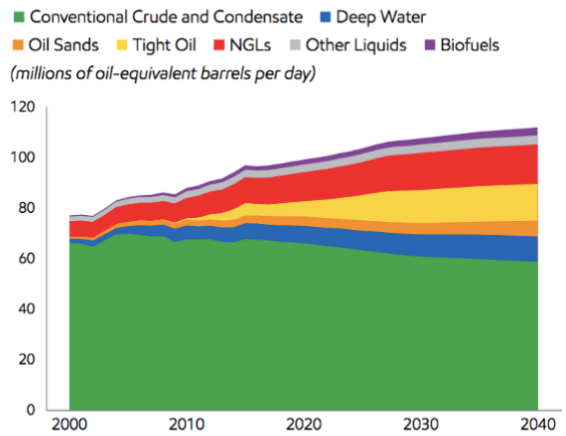
Edition 2015

Edition 2016

World liquids supply by type

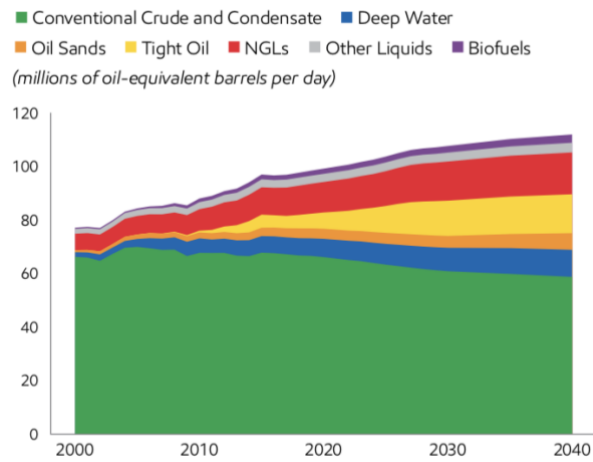


Global Liquids Supply by Type



Source: ExxonMobil, 2017 *The Outlook for Energy: A View to 2040*

Edition 2017

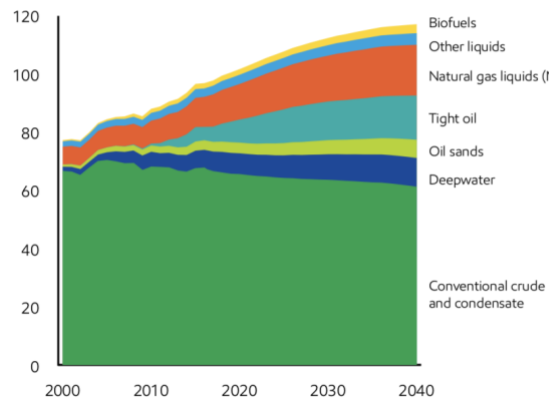


Source: ExxonMobil, 2017 *The Outlook for Energy: A View to 2040*

Edition 2018

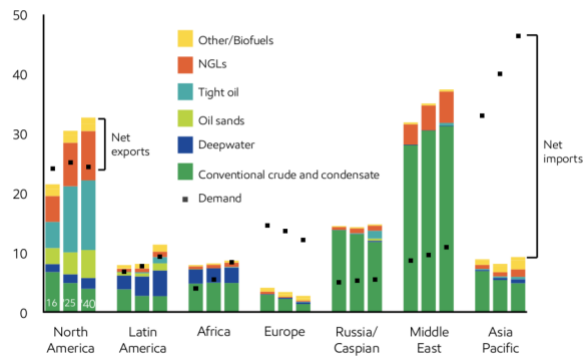
Liquids supply highlights technology gains

Global liquids supply by type – MBDOE



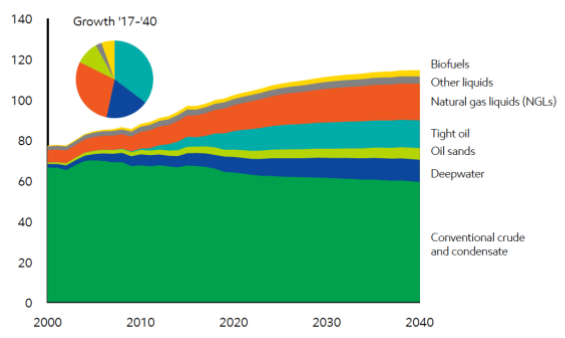
Liquids supply highlights regional diversity

By region and sector – MBDOE

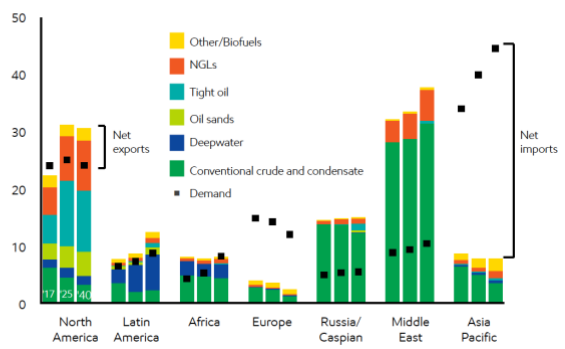


Edition 2019

Liquids supply highlights the need for investment
Global liquids supply by type – MBDOE

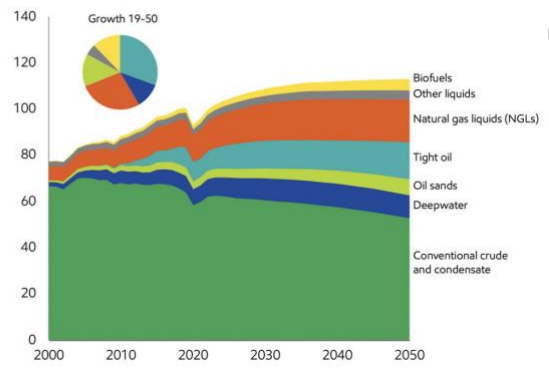


Liquids supply highlights regional diversity
By region and type – MBDOE

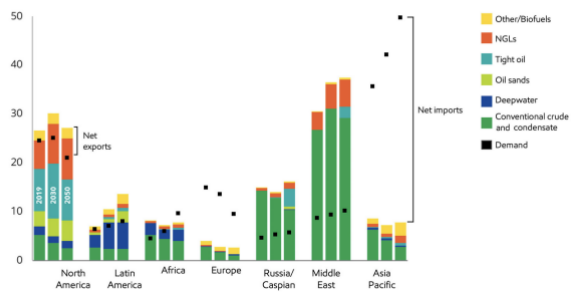


Edition 2021

Global liquids supply by type – MBDOE



By region and type – MBDOE



ExxonMobil stopped reporting such production forecast, showing in 2023 only energy demand, no more energy production but more renewable!

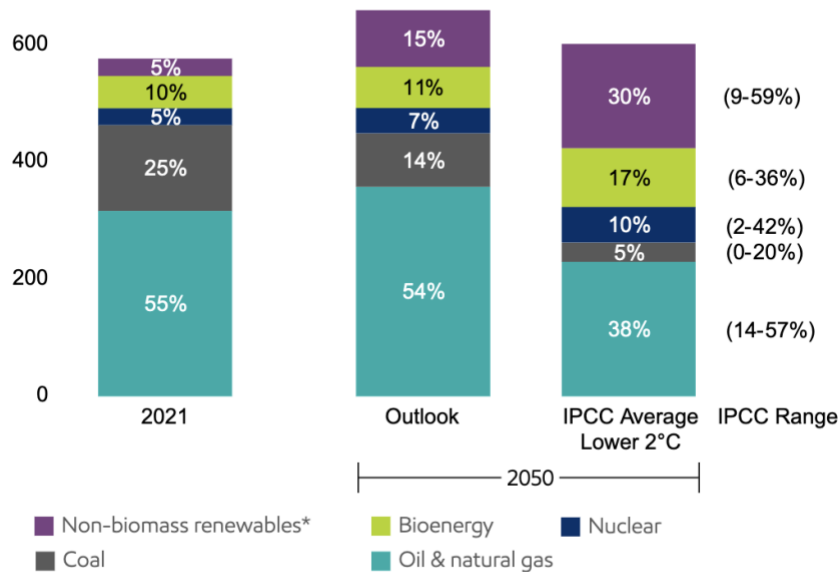
It is today bad to speak about production, only about demand if added with a net zero emission scenario! Everyone should be politically correct in blaming oil production, without blaming oil demand!

ExxonMobil forecasts in 2050 a decline in % of fossil fuels

Global energy mix

Quadrillion Btu

800



* Includes hydro, wind, solar, and geothermal

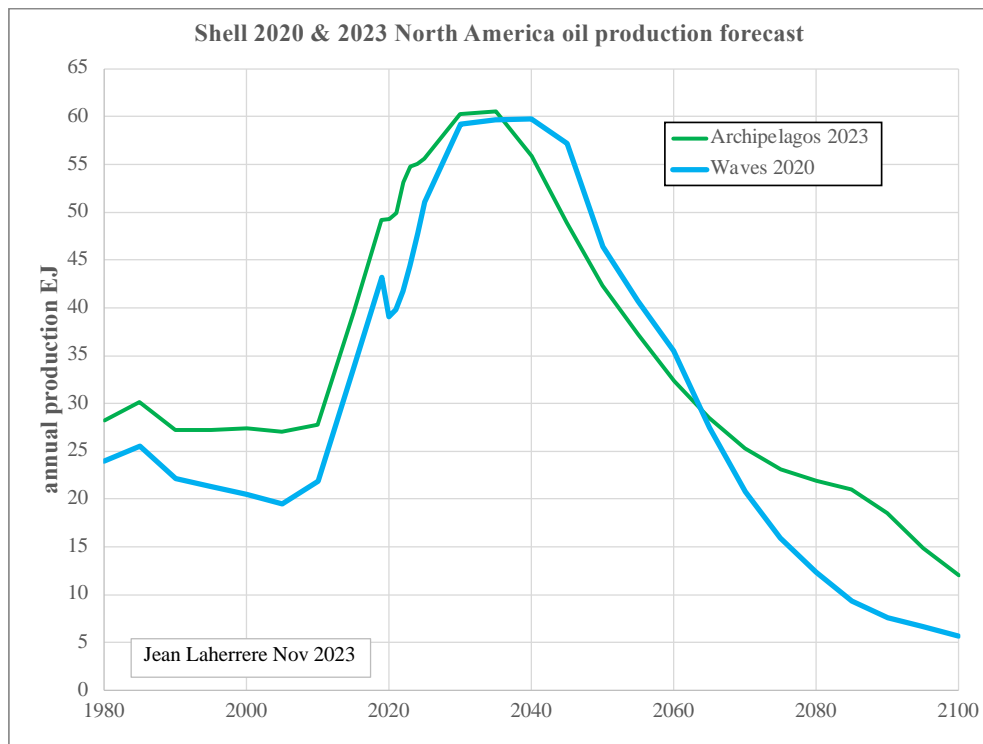
Source: IPCC: AR6 Scenarios Database hosted by IIASA release 1.0 average IPCC C3: "Likely below 2°C" scenarios; ExxonMobil analysis

I am afraid that tomorrow production forecast graphs will be replaced only by images of people

-Shell

Shell highest forecast is plotted for 2023 and 2020 in EJ and it is surprising to find a significant discrepancy in the past data before 2019 and the explanation is that Shell has changed the conversion rate being 5 GJ/b in 2023 but 5.465 GJ/b (crazy 4 significant digits) in 2020. It is amazing to find such mistake within Shell!

North America is defined as continent by Shell in 2023 with 39 countries: US, Canada, Mexico, Central America, Caribbean Islands and Trinidad and Tobago (?), when in 2000 there is no definition. But as standard region North America includes only US, Canada, Mexico ; Greenland and Saint Pierre & Miquelon = 5 countries!



Oil peak is forecasted to occur in 2025

Shell glossary

MMBtu million British thermal units

Mtpa million tonnes per annum

Why MM and M for million? MM is wrong

Shell should respect the metric system where million is mega or M, and not MM used in the US

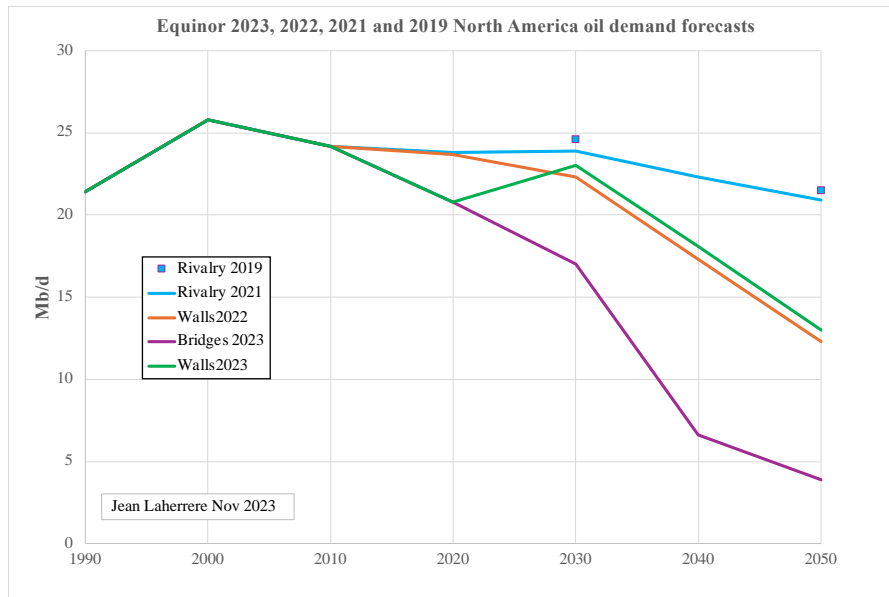
Every countries except US and Liberia (5% of the world population) buy gasoline or diesel by liter, meaning that 95 % of the world uses the metric system known as SI = International System of units created in 1960 where thousand $10^3 = k$ (kilo), million $10^6 = M$ (mega), billion $10^9 = G$ (giga), $10^{12} = T$ (tera), $10^{15} = P$ (peta), $10^{18} = E$ (exa).

Mega means great, giga giant, tera monster; to go beyond tera the SI experts (CGPM) in 1975 found that tera= 10^{12} could be transformed in $10^3 * 4$ and 4 = tetra (4 in Greek) which is tera after removing one letter, so the next $10^{15} =$ peta being penta (5 in Greek) after removing one letter, $10^{18} =$ hexa (6 in Greek) being exa after removing a letter, so EJ = 10^{18} joule

In 1991 to go beyond were introduced zetta (10^{21}) and yocto (10^{27}) and in 2022 ronna (10^{27}) and quetta (10^{30})

-Equinor

Equinor reports only oil demand forecast for North America, nothing on oil production



Equinor glossary has some strange definitions:

b/d for barrels per day but Bbl for barrel

Why b and Bbl for barrel?

b or bbl are not a SI unit, IEA defines bbl in glossary-of-energy-units, but uses b in the monthly oil market report

Km for kilometre instead of km, as K = unit of Kelvin = thermodynamic temperature

Mboe for thousand barrels of oil equivalent instead of kboe

Mcm for thousand cubic meters instead of kcm

Mmdbl for million barrels instead of Mbbl

Mmtpa for million tonnes per annum instead of Mt/a (t is metric)

mtpa for million tonnes per annum instead of Mt/a

Wikipedia The metric system was introduced in Norway in 1875, with Norway being one of the original signatories of the meter convention.

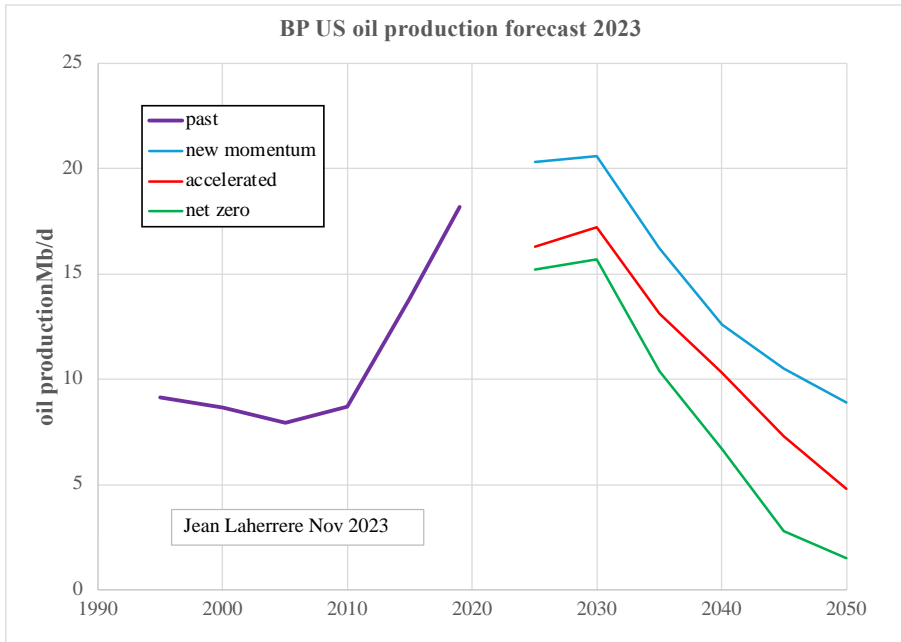
Equinor should respect the metric system which is the law in Norway

-Totalenergies

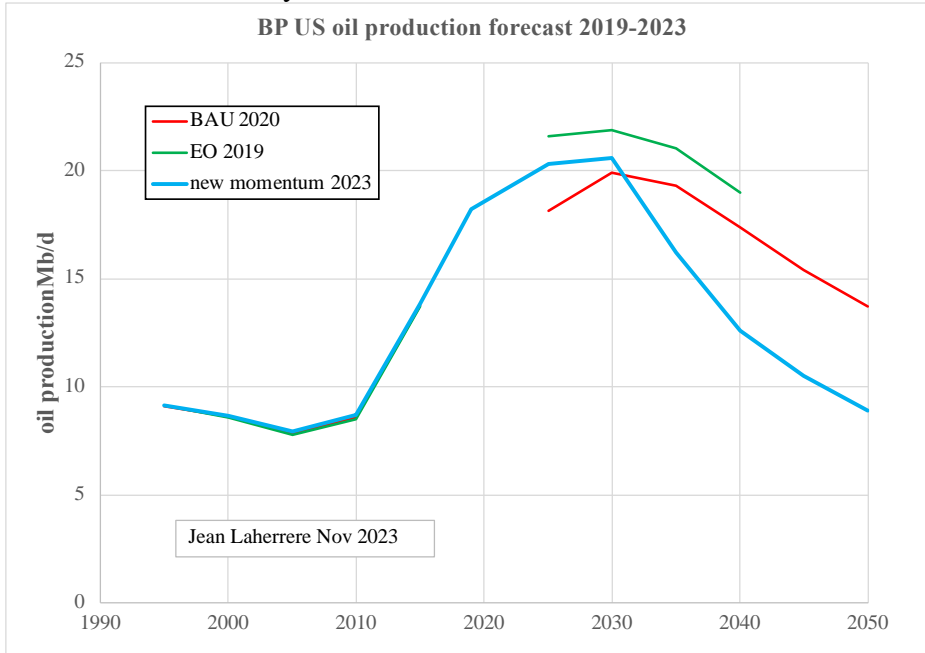
No forecast on US production

-BP

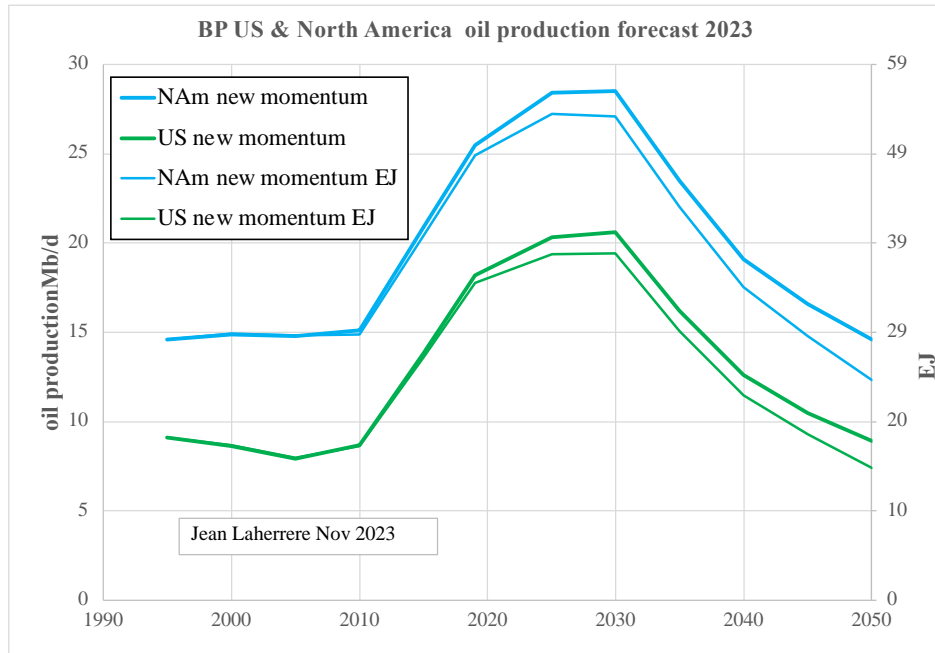
BP in 2023 forecasts US oil production peak in 2030, with a sharp decline beyond, as the 2010-2020 rise.



BP 2030 peak forecast was already on their 2019 scenario



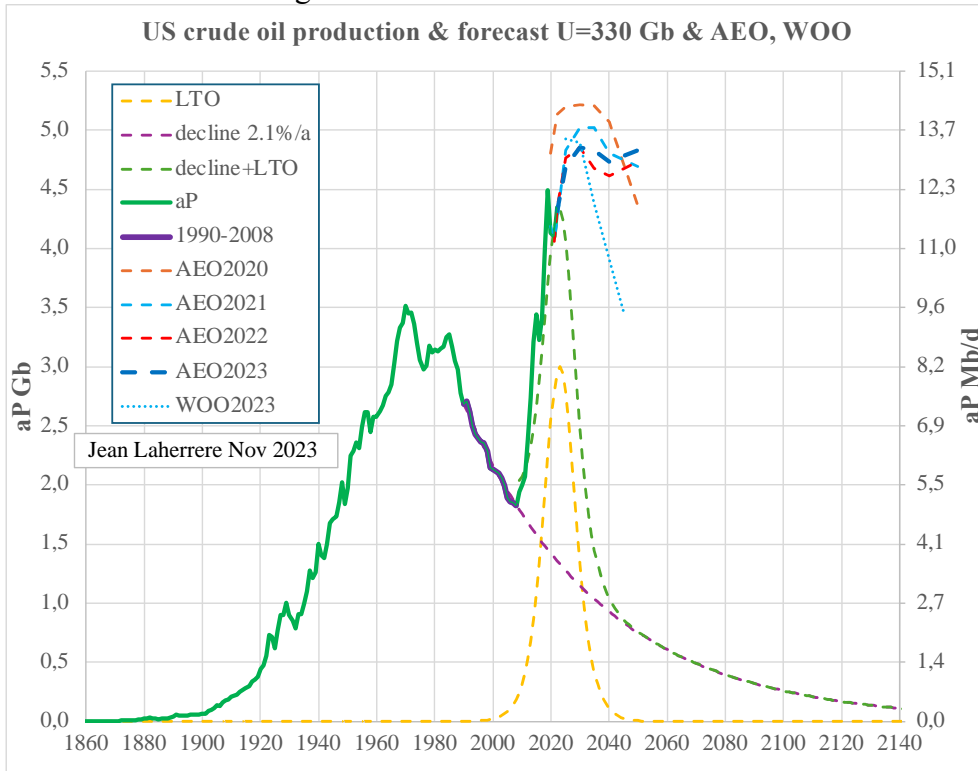
BP 2023 forecast for US and North America in Mb/d and EJ, they are very similar



-JHL

My forecast for US crude oil production is based on a decline of 2.1%/a of period 1990-2008 plus a LTO Hubbert curve with a peak at 3 Gb in 2024

My forecast for 2040 is 3 Mb/d against 13 Mb/d for AEO2023 and 11 Mb/d for WOO2023

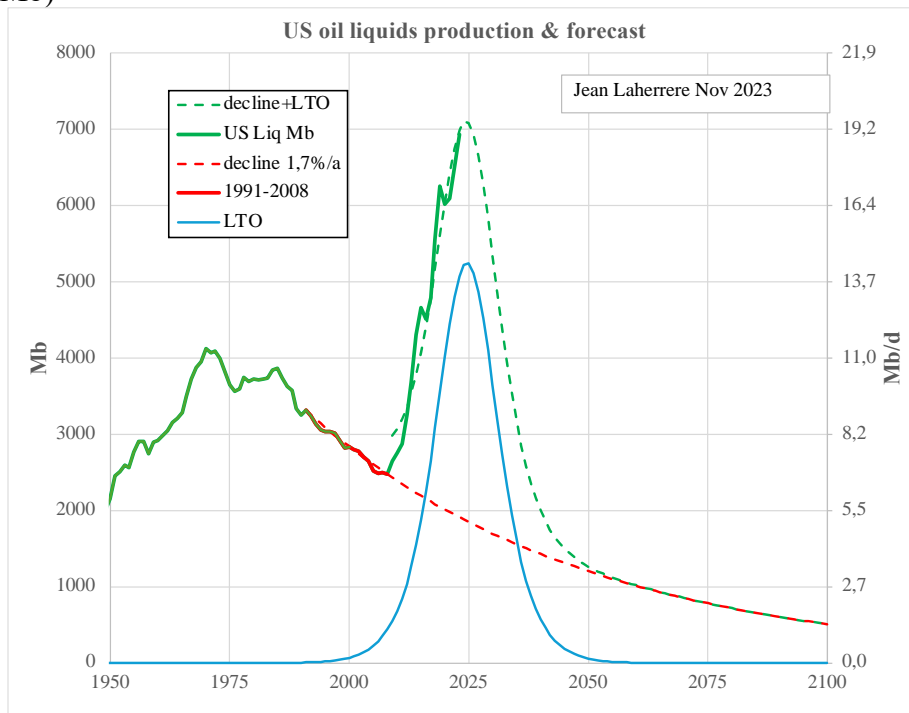


My crude oil peak is 2024 against 2025 for OPEC and beyond 2050 for EIA

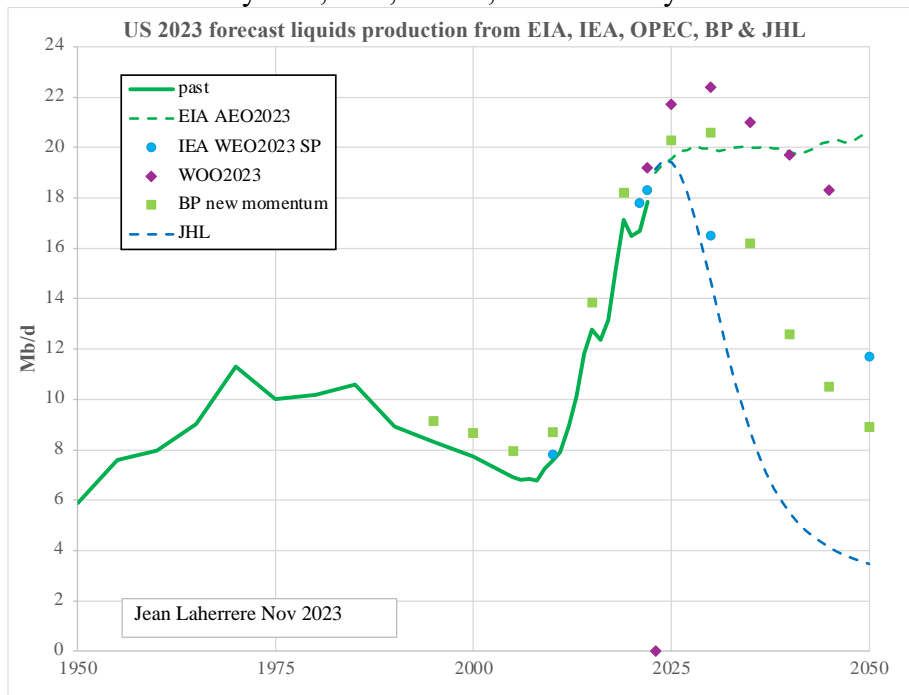
EIA today optimism is amazing!

-US liquids comparison

My forecast of US liquids production is based on the decline for the period 1991-2008 of 1,7%/a going forward for liquids excluding LTO (red curve) with a LTO Hubbert curve (peak 2024 5250 Mb)



The comparison of forecasts by EIA, IEA, OPEC, and BP as myself



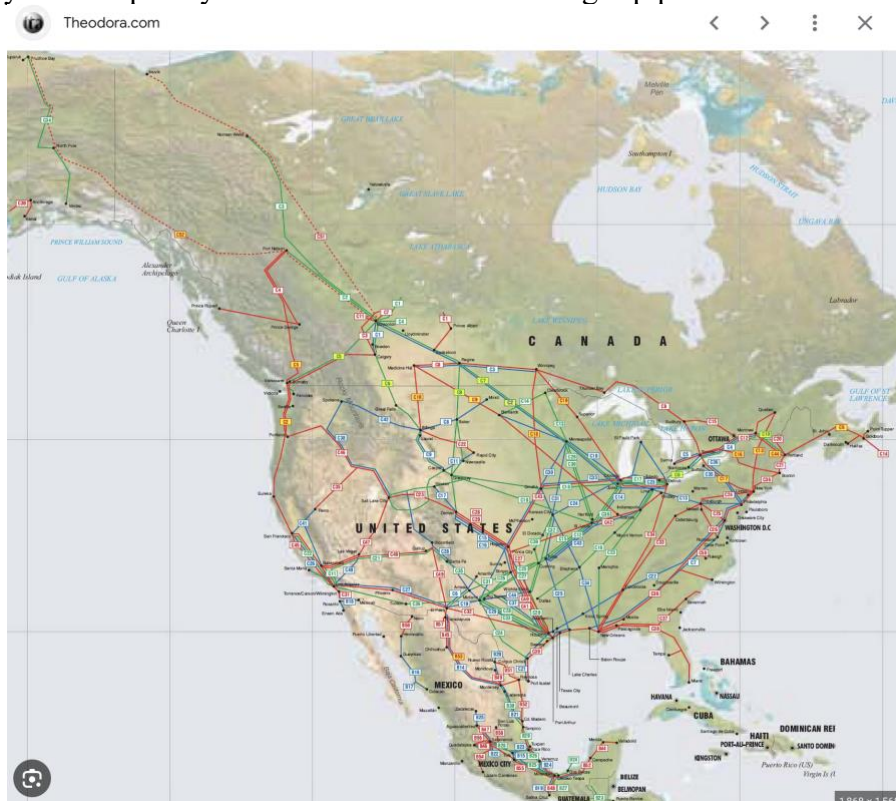
EIA forecasts US liquids production peak beyond 2050 when IEA forecasts peak around 2025, BP in 2030 as OPEC.

The difference between liquids production represents biofuels and other liquids when the past is only crude + NGL

My forecast in 2050 is the most pessimistic followed by BP, IEA, and OPEC: EIA is out limit!

-North America oil production forecasts comparison

North America definition varies with sources, but it should include US, Canada, and Mexico, because they are completely interconnected with oil and gas pipelines



Different definitions are

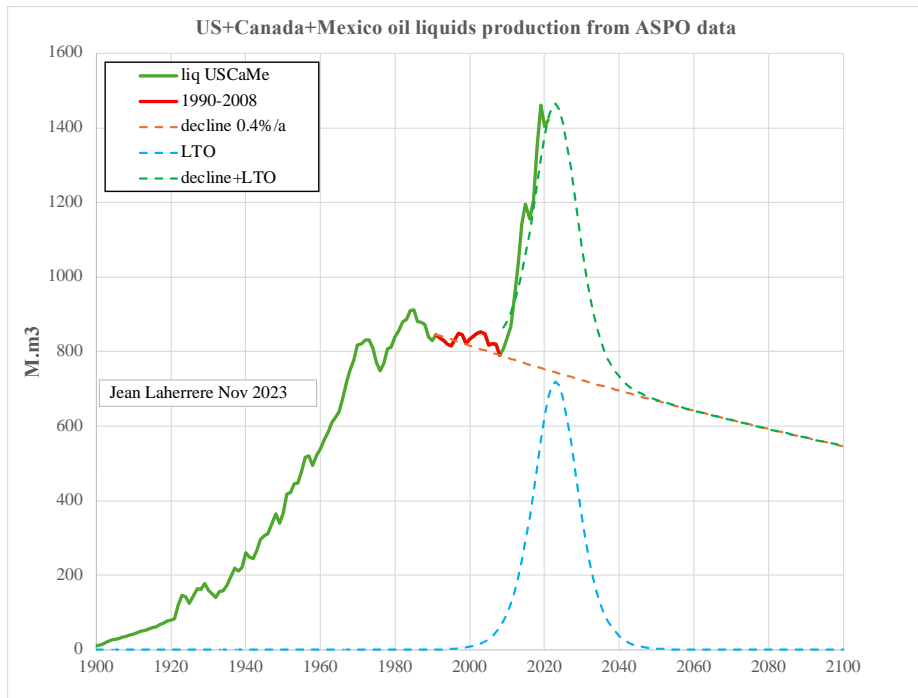
-US, Canada, Greenland, Mexico, and Central America

-US, Mexico, Canada, Guatemala, Haiti, Dominican Republic, and Cuba

Shell include 39 countries including Trinidad!

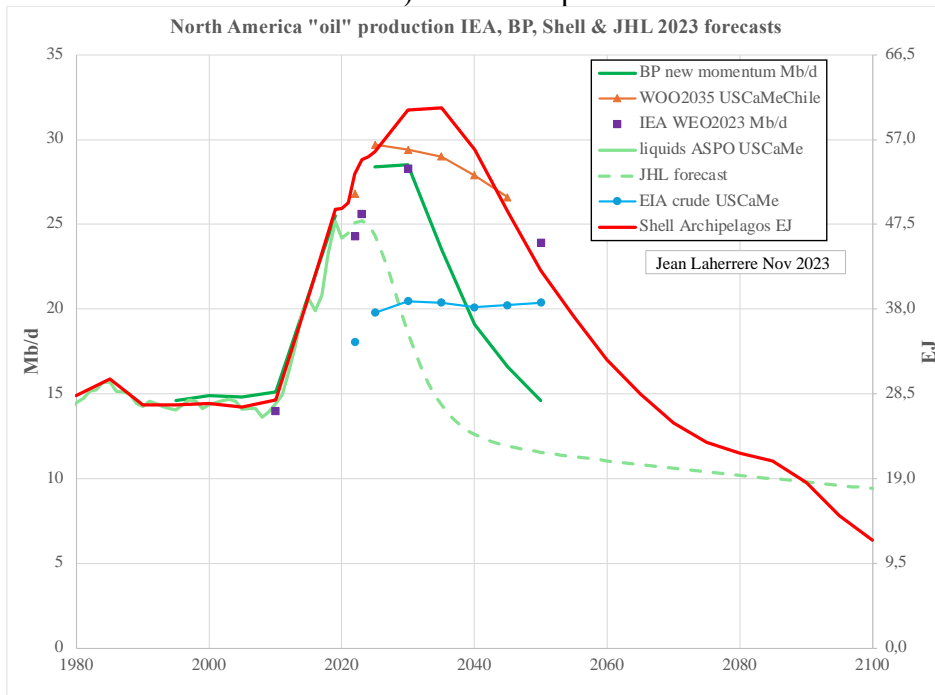
ASPO France data includes only US and Canada, Mexico needs to be added: it is wrong

ASPO France data on US +Canada + Mexico oil production: as above the oil liquids data from 1990 to 2008 is extrapolated with a decline of 0.4%/a and a LTO Hubbert curve is added to obtain the future liquids production. The decline is quite low because the Canadian oilsands huge reserves



Only data for Northern America are reported by BP (3 countries = US, Canada & Mexico) and Shell (39 or 4 countries?). IEA for US + Canada + Mexico + Chile (grouped with Mexico?). EIA/IEO2023 report only crude oil production in G2 by region (G3 other liquids is only for the world)

ASPO France data US + Canada + Mexico) forecast is plotted under JHL



JHL “oil” peak is 2024 when BP is 2030 and Shell 2035; peak values are different, but the slopes of the decline are about the same. OPEC peak is 2025.

As usual, EIA does not forecast any crude oil peak before 2050

-Conclusion

Information agencies seldom report oil forecast comparison with other sources or past estimates

My forecast comparison is based on the likely policies, ignoring zero emissions scenarios.

Every agency or major companies forecast a peak in the oil production before 2045, except EIA and OPEC: the peak time range is huge: 2019 to beyond 2050.

Liquids production peak is forecasted in 2019 for BP, Total and me, 2030 for XOM, Shell & Equinor, 2035 for IEA

Most of forecasts are for oil supply, but recently the shift is for oil demand, more politically correct and the addition of zero carbon net emissions scenarios, despite that these scenarios are based on the capture of CO₂ (needing 1 GJ/tCO₂) based on huge unavailable energy consumption.

Zero CO₂ net emissions in 2050 are a lie based on the capture of CO₂, as world primary energy will peak around 2050 (at 750 EJ) and energy will lack to capture all anthropic CO₂!