

# THE EUROPEAN UNION CAN EXPECT TO SUFFER OIL DEPLETION BY 2030

– A PRUDENTIAL PROSPECTIVE ANALYSIS –

AN ANALYSIS BASED ON EXCLUSIVE DATA, CONDUCTED BY THE THINK TANK  
*THE SHIFT PROJECT*, SUGGESTS THAT MOST OF CURRENT OIL SUPPLY  
SOURCES TO THE EUROPEAN UNION MAY DECLINE BY 2030.



## ABSTRACT

The likely decline, by 2030, in the production capacity of those countries that currently supply more than half of the oil consumed by the European Union (EU) could lead to severe constraints on EU supplies.

From 2019 to 2030, the total volume produced by the EU's current oil providers is likely to shrink by up to nearly 8%, according to an analysis featuring a level of detail unavailable so far in any public study; the report is mostly based on estimates of future global crude oil production capacity provided by a Norwegian market intelligence agency, Rystad Energy. The highest potential rates of this decline would exceed the decline rate of oil consumption in the European Union since 2010 (notwithstanding, the EU currently imports more crude oil than China or the United States).

The combined production of Russia and all former USSR countries, which together account for more than 40% of the EU's oil supply, seems to have entered a systematic decline in 2019. Africa's oil production (more than 10% of EU supplies) appears set to decline at least until 2030.

The production growth expected by Rystad is highly dependent on the development of new oil prospects whose technical and economic potential remains to be assessed, or on hypothetical future discoveries. As a result, a significant share of the expected growth trends is more uncertain than the expected decline, which is induced by the well-known and precisely measured evolution of existing "mature" production.

Two factors increase this risk concerning future EU supplies:

- firstly, the extreme volatility of crude oil prices observed during the last decade, which makes investing in oil projects more complex and more risky,
- secondly, the strong growth in demand expected from Asia and Africa, while the production of both continents should decline, according to Rystad and the International Energy Agency.

While severe constraints on global oil production are likely to affect directly or indirectly the EU over the coming decade, such shrinkage seems unavoidable beyond 2030.

This challenge of limited global oil resources may be viewed as the "broom wagon" of environmental policies: if climate policies fail to be implemented at the right pace, then we will all be swept by the "broom wagon" of the decreasing availability of crude. However, such constraints will not allow us to thwart global warming. Global warming and "peak oil" are in no way exclusive: here are two natural hazards that pile up on each other.

As a result, peak oil is an additional compelling reason for designing a world without oil, and stop relying on global economic growth, which remains so far largely correlated with oil consumption.

"Peak oil" is a major yet largely undocumented issue that has not yet received the attention it deserves.

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# I- Introduction

## 1- Background

The International Energy Agency 2018 annual report identifies the potential risk of a global oil “supply crunch” by 2025, resulting from a persistent deficit in new conventional oil exploration and development projects (oil extracted from conventional geological reservoirs<sup>1</sup>).

The International Energy Agency's World Energy Outlook 2018 Executive Summary defines this risk as follows:

*« The risk of a supply crunch looms largest in oil. The average level of new conventional crude oil project approvals over the last three years is only half the amount necessary to balance the market out to 2025, given the demand outlook in the New Policies Scenario. US tight oil is unlikely to pick up the slack on its own. Our projections already incorporate a doubling in US tight oil from today to 2025, but it would need to more than triple in order to offset a continued absence of new conventional projects. »<sup>2</sup>*

The growth in oil demand expected in 2018 by the International Energy Agency (IEA) under the “New Policies” Scenario was less than 1% per year until 2025, significantly lower than the trend that has prevailed in the previous period. Tight oil, considered by the IEA to be essential in order to “pick up the slack” in conventional oil, experienced a growth rate exceeding 20% in 2018. Inversely, the IEA confirmed that conventional crude oil had reached its historic peak in 2008, at 69 million barrels per day (Mb/d), and has since declined by 2.5 Mb/d<sup>3</sup>.

According to IEA, conventional oil, which still accounts for over two-thirds of the global liquid fuel production, has irreversibly passed its peak, in the context of two major tendencies:

- Unprecedented mediocrity, in recent years, in the annual volumes of discoveries of this predominant form of liquid fuel, after several decades of chronic decline (*Figure 1*)<sup>4</sup>
- Despite Research and Development investments in hydrocarbon production being much higher in the 2010 decade than ever before (*Figure 2*); these investments were largely maintained after the sudden collapse of the market in 2014-2015, owing to the significant contraction in subcontractors' rates<sup>5</sup>.

<sup>1</sup> As opposed to “non conventional” oil, such as “shale oil” (tight oil), exploited by hydraulic fracturing and oil sands. Offshore oil, a highly technical source of production, is nevertheless considered as conventional oil because it is drilled from conventional geological reservoirs.

<sup>2</sup> International Energy Agency, *World Energy Outlook 2018*, p. 28.

<sup>3</sup> *Ibid.*, p. 142.

<sup>4</sup> See for example: “IHS Markit: Conventional oil, gas discoveries at 70-year low”, *Oil&Gas Journal*, 2 October 2019.

<sup>5</sup> International Energy Agency, *World Energy Investment 2019*, p. 83. See also: Emmanuel HACHE, Pierre HACQUARD, Marine SIMOËN, “Is the oil industry able to support a world that consumes 105 million barrels of oil per day in 2025?”, *Oil and Gas Science and Technology Journal*, 74, 88, 2019 : “In 2018, investments in the upstream sector were still 40% lower than those observed in 2014. Most of this contraction is due to lower investment volumes. However, companies also benefit from a favourable price environment from their suppliers under pressure. Adjusted to current upstream costs, it still represents a 12% lower investment compared to the 2014 peak.”

Figure 1.

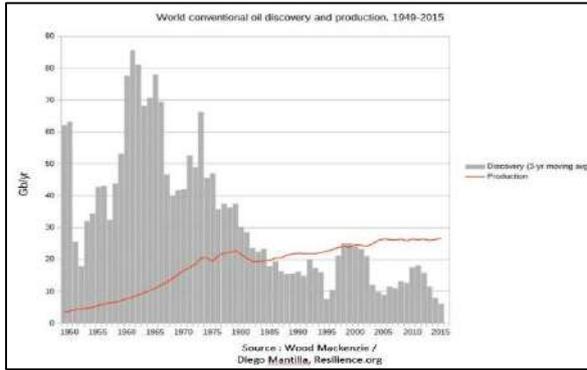
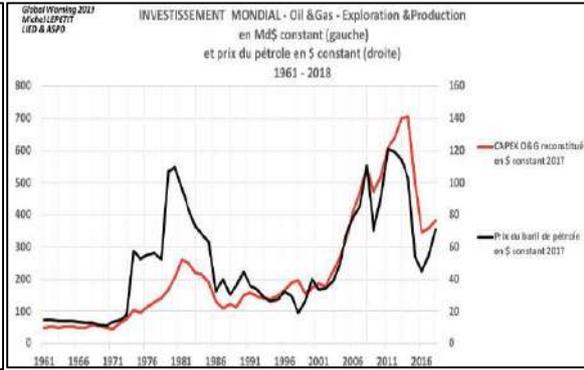


Figure 2.

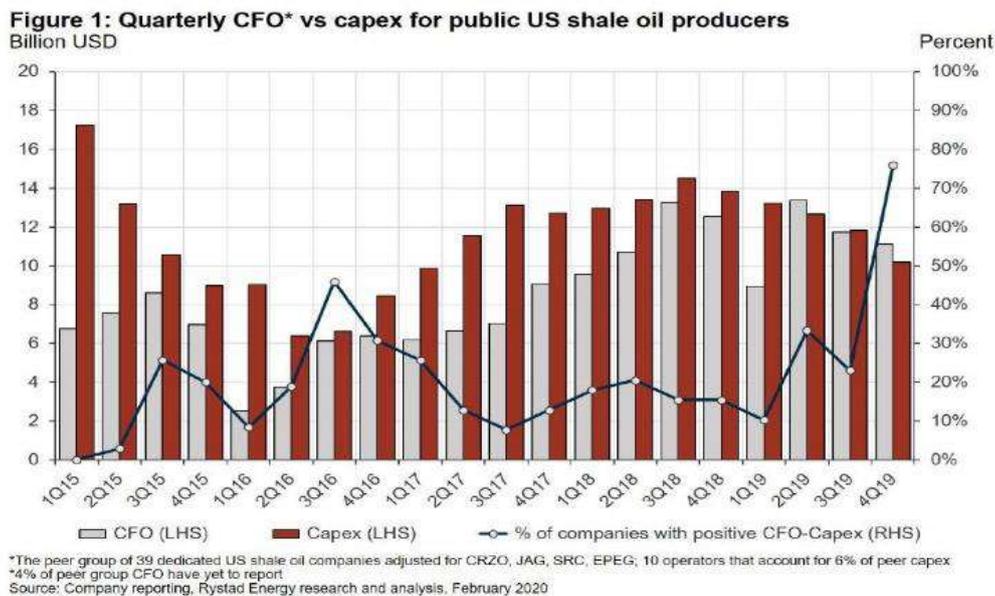


The risk of a “supply crunch” by 2025, as described by IEA at the end of 2018, seems to have worsened considerably since then:

- In a first step, since mid-2019, due to the brisk slowdown of the tight oil boom<sup>6</sup> in the United States, resulting in particular from high levels of debt and an enduring problem of negative cash flow in the sector; by the end of 2019, this issue seemed to be about to be resolved only at the cost of reduced investment in future production (Figure 3);
- In a second step, since the beginning of 2020, due to the unprecedented freeze on numerous investment projects caused by the collapse of oil prices, in the wake of the COVID-19 crisis, and the price war initiated by Russia and Saudi Arabia.

Figure 3.

Rystad Energy, March 2020<sup>7</sup>



<sup>6</sup> Oil extracted by hydraulic fracturing of tight reservoirs, also referred to as *shale oil*.

<sup>7</sup> Rystad Energy, “US shale operators find sublime balance between spending and cash flow”, 2 March 2020.

## 2- Challenge

The uncertainty surrounding the immediate and medium-term outlook for global crude oil production requires careful consideration, given the major economic and geopolitical risks it entails; meanwhile, it appears that, globally, no climate policy sufficiently sustained to trigger a significant decline in crude oil demand has been launched.

The economic and geopolitical risk is especially high for the EU, which:

- is the world's largest importer of crude oil, currently ahead of China and the United States<sup>8</sup>,
- has no significant domestic oil resources, as opposed to China and the USA<sup>9</sup>,
- buys its crude oil mainly from countries whose production is largely mature or already on the decline.

## 3- Scope of analysis, characteristics of the main source

Given the context and the challenge as above mentioned, ***The Shift Project* conducted a prudential analysis of the risk related to the security of future oil supplies to the European Union, based on a synthetic database provided by the oil industry**, and not merely on publicly available reports, such as those produced by IEA, whose assumptions are rarely spelled out.

*The Shift Project* has purchased licence to access one of the three authoritative databases on the state of global liquid fuel production: this database, produced by the Norwegian company Rystad Energy, serves as the standard reference for the industry, as well as for IEA (although the Agency does not reveal its sources in detail).

**The production forecasts provided by Rystad Energy** are based on their own projections, generally designed on a field-by-field basis, concerning the status of the resources (total amount of oil that can presumably be drilled) and reserves of these fields, proven (recoverable with certainty) or probable (having more than 50% chance of being recovered). In particular, these estimates take into account current production and level of investment. Although these forecasts are cross-checked and consolidated in various ways, they involve a certain level of uncertainty that is hard to assess, since quite a few companies and producing countries fail to publish detailed results concerning their resources and reserves.<sup>10</sup> Rystad Energy only collects data and tries to assess its value. For the user of their data, the process remains essentially opaque.

The projections that serve as a basis for our analysis are dated 6 June 2020. They incorporate the investment cuts announced by the oil industry since the onset of the COVID-19 crisis, involving a significant drop in production prospects expected by numerous countries over the coming decade. On

<sup>8</sup> Subtracting production and consumption from the EU compared to that from China and the United States, BP, *Statistical Review of World Energy 2020*.

<sup>9</sup> Due to Brexit. North Sea oil, mainly exploited by Norway and the United Kingdom, is a very largely mature source of production.

<sup>10</sup> See sections 2- a. and 2- b.

the other hand, they assume that the major Persian Gulf producers and US tight oil producers should be able to make up for most of the shortfall caused by the crisis. This year, the volume of new conventional oil projects approved is expected to be the lowest in 40 years, and investment in tight oil could be almost halved<sup>11</sup>. However, Rystad also expects global oil demand to catch up its pre-crisis levels in the autumn<sup>12</sup>, and crude oil prices to reach approximately USD70 per barrel from 2022 onwards, after which they should keep going up slowly with no volatility.

Rystad projects that the loss of future production capacity due to reductions in investment resulting from the crisis will amount to 6 Mb/d by 2025 (compared to a global demand at around 100 Mb/d before the crises, and expected to reach 105 Mb/d in 2025). Rystad presumes that the main Persian Gulf producers should be able to increase their output to make up for 3 to 4 Mb/d lost, and that the remaining amounts will likely be covered by the development of tight oil, under the condition that the price per barrel peaks above 70 dollars<sup>13</sup>.

The scenario of tight oil production growth designed by Rystad in June 2020, remains roughly in line with a doubling of production over the period 2017 – 2025 forecasted in 2018 by the IEA. This Rystad scenario thus remains largely inferior to the multiplication by a factor of three, deemed necessary by the IEA in 2018 in order to prevent the risk of a “supply crunch” by 2025<sup>14</sup> by compensating for the “*persistent lack of new conventional projects*”.

The dearth of new conventional projects persists in 2020, and the degree of uncertainty as to the completion of future investments is brought to a peak by the COVID-19 crisis.

**The analysis that follows is of prudential nature:** our goal is to circumscribe a risk, not to forecast the future.

We deliberately focussed on the “half-empty glass”, i.e. on the situation of decline of current mature production, whereas most analyses are essentially focused:

- either on the “half-full glass” (boom of non-conventional oils, esp. tight oil),
- or on the slowing pace of emptying the glass (the “peak demand” theme, which to this day remains hypothetical on a global scale).

This prudential approach appears all the more necessary since the public source of reference on future global crude oil production, IEA – an offshoot of OECD whose primary mission historically has been to shield oil-consuming countries from supply problems – has in the past published numerous forecasts that have consistently proved to be distinctly optimistic as compared with actual trends (*Figure 4*).

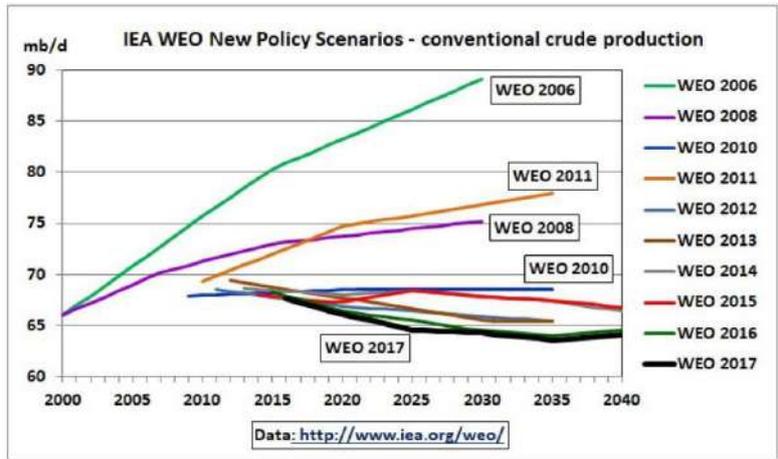
<sup>11</sup> Rystad Energy, “Global investment slowdown set to hike oil prices and cause undersupply of 5 million bpd in 2025”, 4 mai 2020.

<sup>12</sup> Rystad Energy, *Covid-19 Report - 14 May 2020*.

<sup>13</sup> Rystad Energy, “Global investment slowdown set to hike oil prices and cause undersupply of 5 million bpd in 2025”, *op. cit.*; Rystad Energy, UCube Change Record June 2020.

<sup>14</sup> International Energy Agency, *World Energy Outlook 2018*, *op. cit.*, p. 28, see also table 3.3 p. 145.

Figure 4.



Gathered by Michel Lepetit

This analysis is preliminary; we feel that it points to the emergence of a major risk. This review marks the launch of an in-depth analysis aimed at delineating this risk as comprehensively as possible.

## II- Prudential analysis of European Union oil supply prospects by 2030<sup>15</sup>

### 1- *The Big Picture*: the “easy oil” season is over

- **Peak Conventional Oil passed in 2008**
- **Nature and magnitude of current production decline**
- **Leading role of American tight oil and giant conventional oil fields in the Persian Gulf**

It appears that the new conventional oil projects that would be required, according to the IEA, if we are to avoid a global oil “supply crunch” by 2025, are not about to be implemented; likewise, global tight oil production does not seem to be in a position to double from its 2017 level, let alone triple, as expected by the IEA.

*Figures 5, 6, and 7* display the trends in global liquid fossil fuel production from 2000 to 2030, as predicted by Rystad from 2020 onwards.

*Figure 5* makes a distinction between conventional oil and all non-conventional oil types. It confirms that conventional oil production peaked in 2008: it shows a decline of -4.4% from 2008 to 2019, and expects a further decline of -0.9% for the 2019 - 2030 period. Given the limited amplitude of these variations, this trend can also be depicted as an undulating plateau from 2004 to 2018, followed by a second, slightly lower, undulating plateau from 2019 onwards.

In any case, it is to be expected that production will never exceed its 2008 peak level again, including beyond 2030, according to both Rystad and the IEA.

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<sup>15</sup> Unless otherwise stated, the figures and graphs shown below were taken from the Rystad Energy database in May 2020. They relate to the production in barrels per day of liquid fossil fuel, defined as the sum of the production of crude oil, condensates, natural gas liquids and refinery gains. They are expressed in thousands of standard barrels per day (Kbbl/d) in the graphs from the Rystad database, or in millions of barrels per day in the text of the analysis (Mb/d).

Liquid agrofuels are not discussed here. Rystad Energy estimates that their production should keep growing at the same rate as since 2010, rising from around 3 Mb/d in 2019 to 3.5 Mb/d in 2030.

Figure 5.

**World liquid fossil fuel production, 2000 – 2030, conventional and unconventional**  
 (“other liquids”: refinery gains)

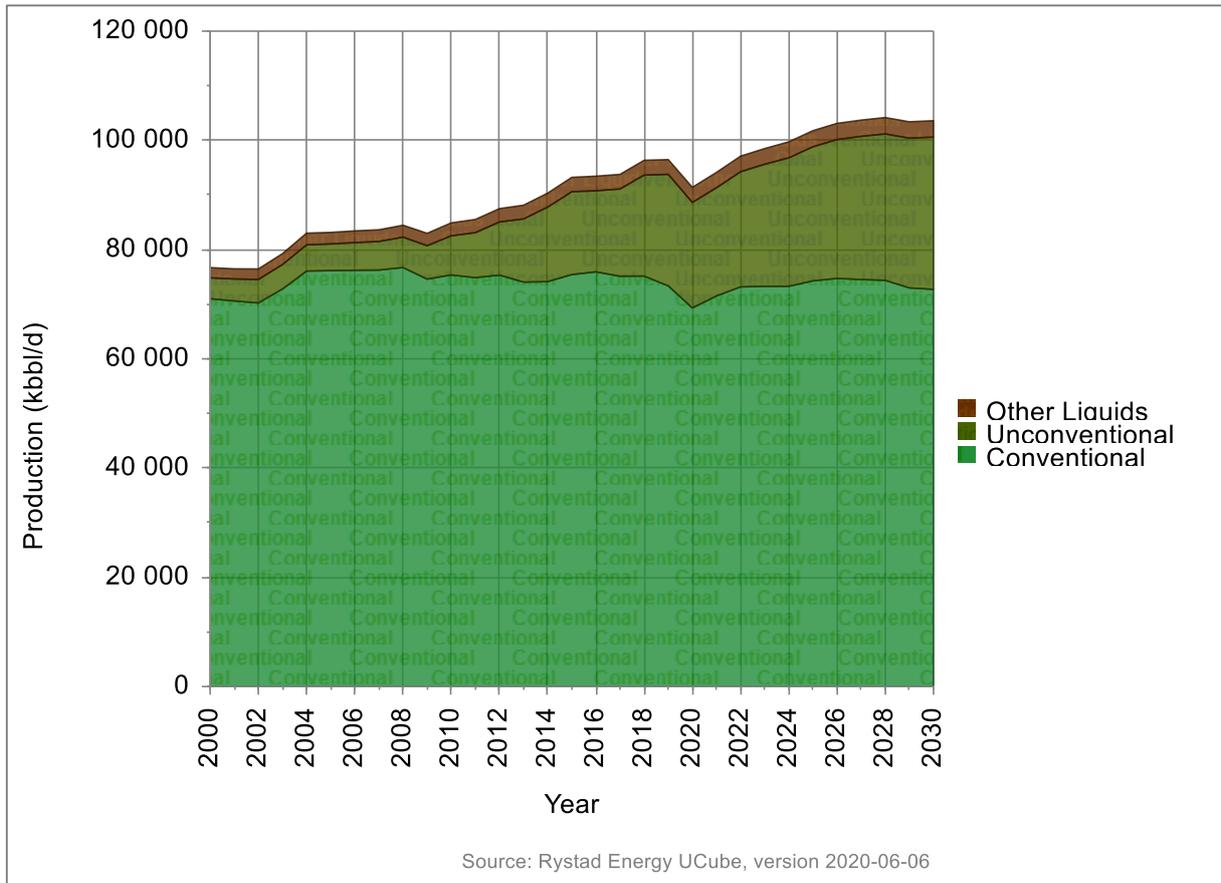


Figure 6 reveals that tight oil and liquids from “shale gas” (unconventional gas) wells should provide for the entire expected production growth from all unconventional oils over the 2019 - 2030 period<sup>16</sup>.

<sup>16</sup> According to Rystad Energy, other forms of unconventional oil should remain marginal by 2030: Canadian oil sands production is expected to grow strongly but remain comparatively limited, while extra-heavy oil extraction is expected to decline steeply in Venezuela and elsewhere.

Figure 6.

**World liquid fossil fuel production, 2000 – 2030, conventional and unconventional categories**

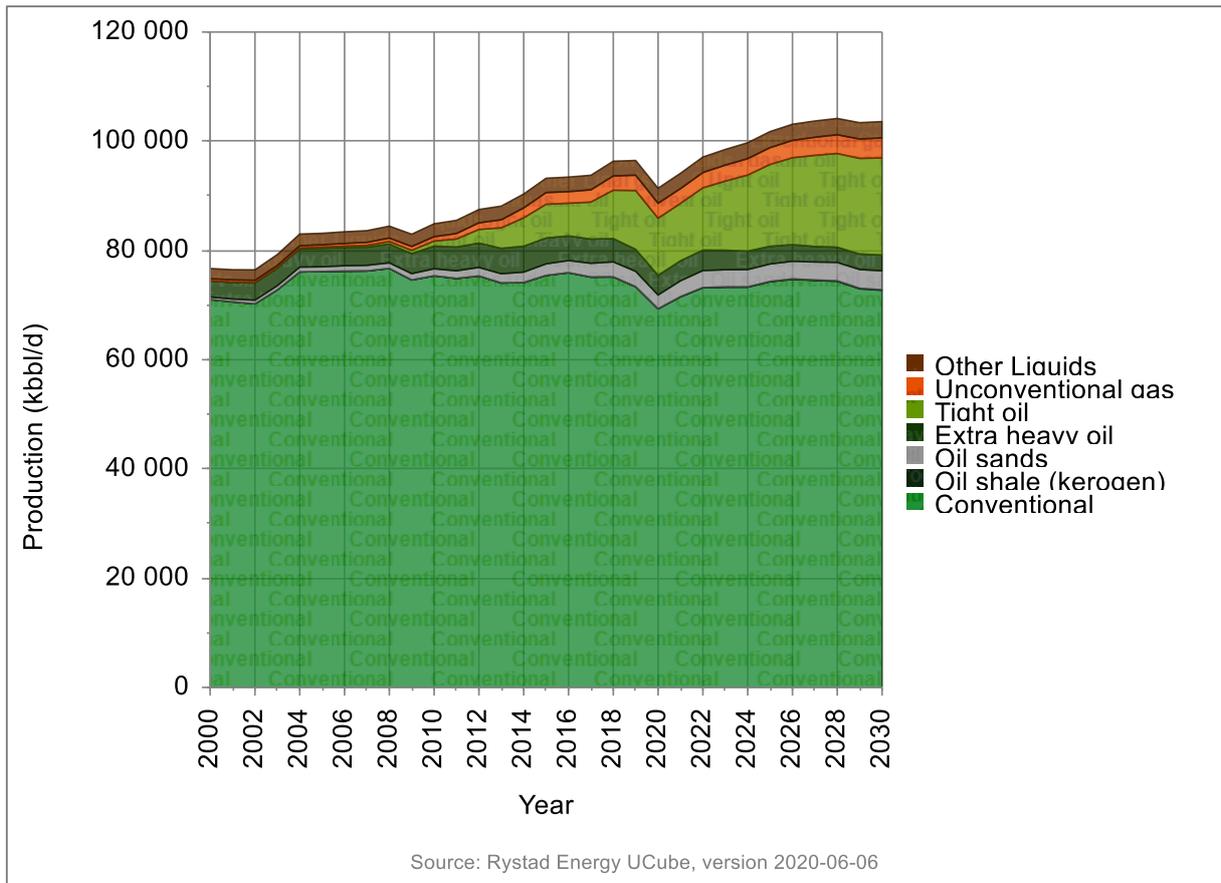


Figure 7 displays the evolution of global production by maturity degree of extraction sources: almost a half of the current production (47,8% or 46,1Mb/d, in 2019) stems from so-called “mature” sources, i.e. oil fields that have already started to decline, having already produced more than half of their estimated long-term recoverable reserves, based on the plausible evolution of various future technical and economic parameters.

Figure 7.

**World liquid fossil fuel production, 2000 – 2030  
by life cycle category**

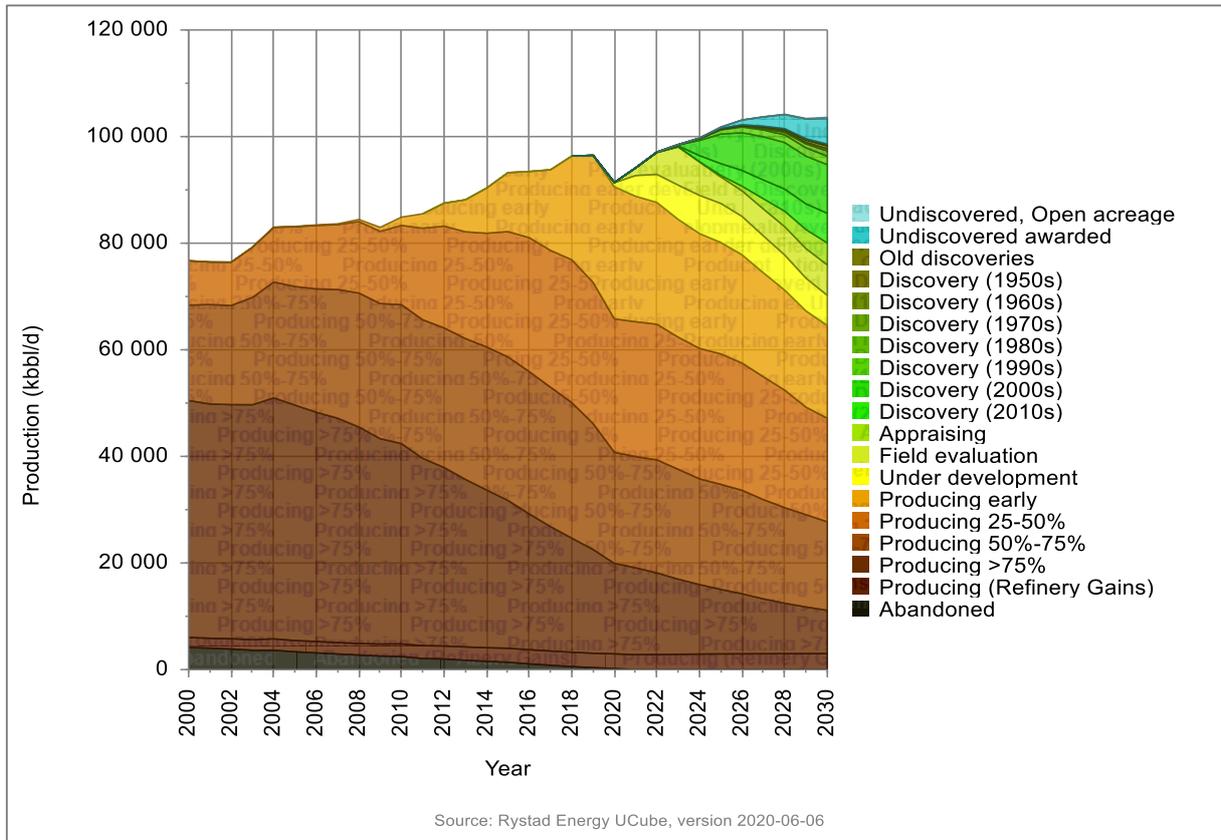


Figure 7 also reveals that, only to maintain production at its 2019 level (96.5 Mb/d), one-third of the current (2019) production will need to be substituted by 2030. This decline in current production that needs to be made up for over the next ten years is 31.7 Mb/d, equivalent to the current combined production capacities of the United States, Saudi Arabia and Russia, the world's three largest producers<sup>17</sup>.

If we are to reach the total production level of 103.6 Mb/d expected for 2030<sup>18</sup>, nearly a quarter of this (23.6 Mb/d) will have to be obtained from past discoveries (green) or from possible future discoveries (blue). The actual development potential of these discoveries is by nature problematic, both from an economic and a geological perspective. From 2023 onwards, the ability to maintain production depends on the actual development of past discoveries and, from 2026 onwards, it depends on the development of possible future discoveries.

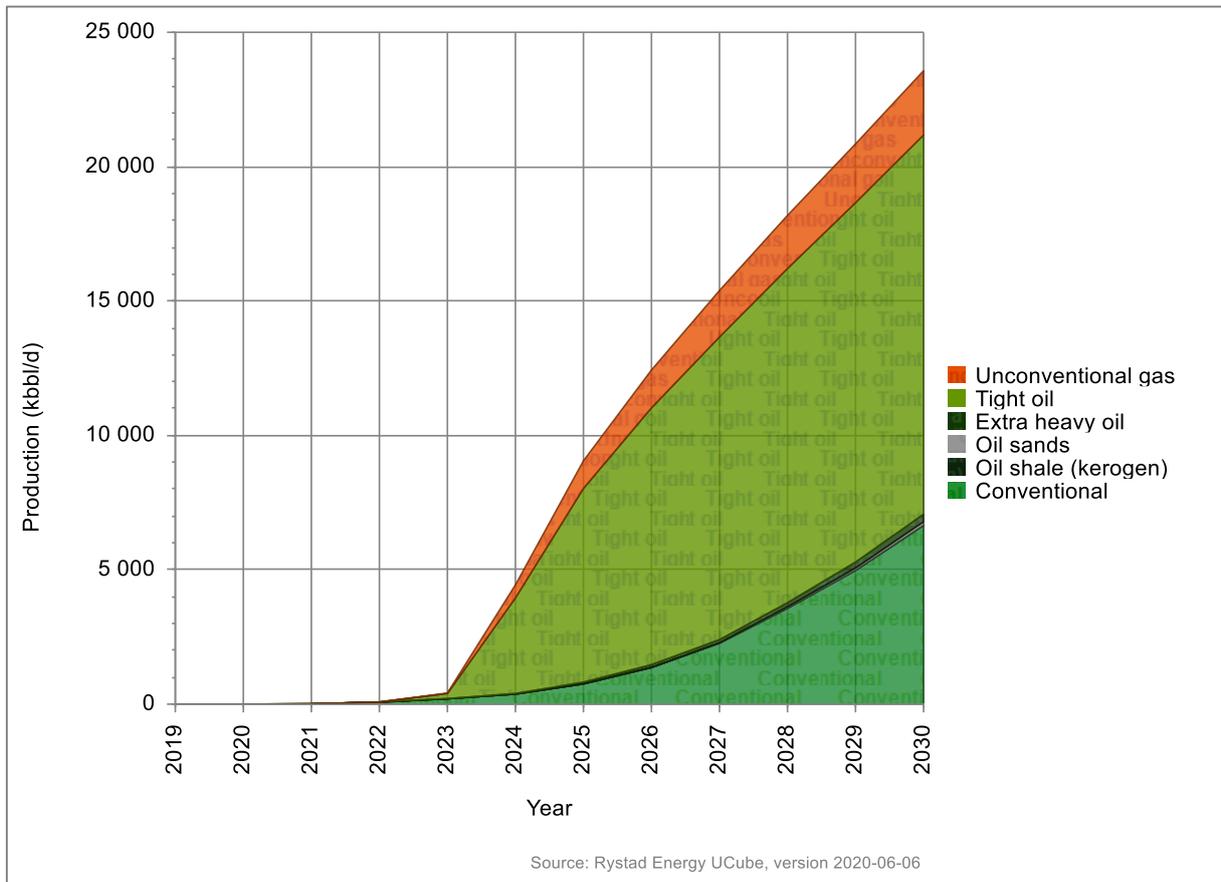
Of these conjectural 23.6 Mb/d of new production capacity, 70% will have to be provided by tight oil or natural gas liquids from unconventional gas wells: *figure 8*.

<sup>17</sup> Production of crude oil, excluding condensates, natural gas liquids and processing gains.

<sup>18</sup> The “New Stated Policies” scenario published by the IEA in its annual report in November 2019, before the COVID-19 crisis, stated a slightly higher figure of 102.8 MMb/d.

Figure 8.

**World new production from discoveries not appraised yet or from undiscovered reserves, 2019 - 2030  
by conventional and unconventional category**



This prospect for the development of tight oil and liquids from shale gas wells could be hampered:

- if other significant episodes like the US tight oil boom persistently fail to occur,
- if the business model of the US tight oil sector does not improve sustainably,
- or if this restructuring was achieved at the cost of a slowdown in investment (trend observed in 2019),
- or if, for any reason, the number of new wells actually drilled and “fractured” were to decline significantly (as has been the case since March 2020),
- or, finally, as some indicators suggest<sup>19</sup>, if “sweet spots” (highly productive zones) were to become scarcer in the United States, making it impossible to compensate for the rapid decline in producing wells, which is a characteristic feature of reservoirs allowing the retrieval of tight oil and shale gas.

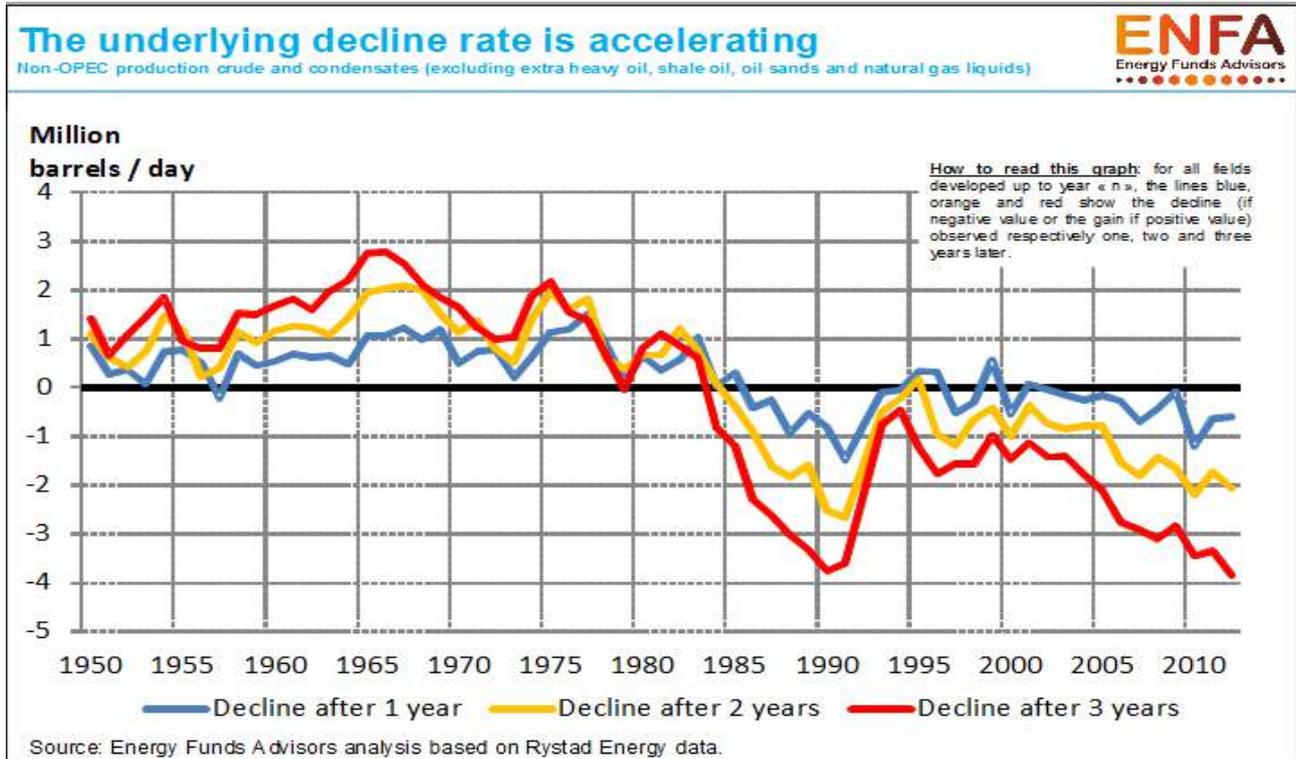
Since conventional oil peaked in 2008, the race on the treadmill of declining current production has become inevitable.

<sup>19</sup> See for example: Platts, S&P Global, “Feature: US shale oil productivity growth expected to slow in some basins”, 10 January 2020.

This “treadmill effect” is a recent trend in the history of the oil industry. It represents a symptom of the “end of easy oil<sup>20</sup>”, to quote an expression made famous in 1998 by the Mobil’s CEO on the occasion of the merge with Exxon.

Until the 1990s, production growth could be secured by oil wells already in operation. In other words, a halt in investment in the development of new wells would not trigger a production slump (Figure 9).

Figure 9.



Olivier Rech for Energy Funds Advisors, 2012

The “treadmill effect” is also visible when stacking global production by the date new wells come on stream (Figure 10).

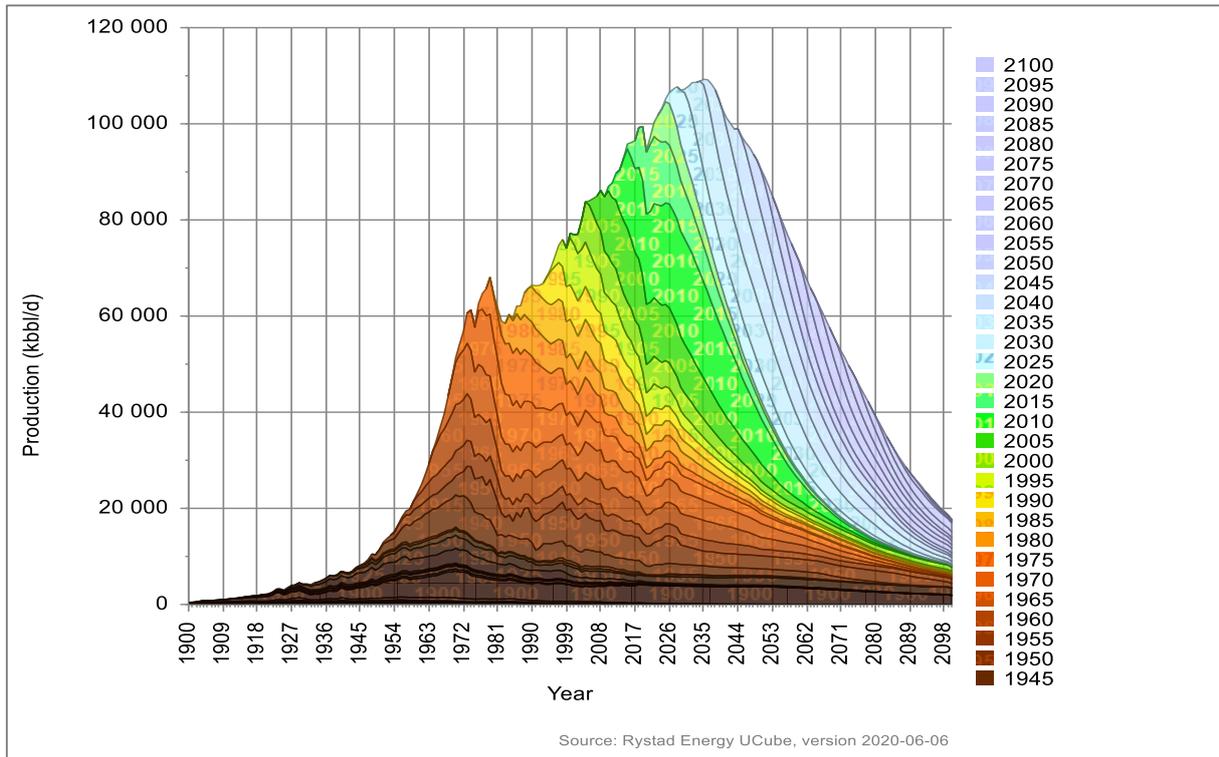
It results in a kind of heap that becomes increasingly difficult to raise by adding new layers, i.e. new sources of production, as the slope of decline in past production becomes ever steeper.

According to Rystad, this treadmill race to maintain current production will be lost and the heap will collapse from 2035 onwards, with the global peak oil being passed in that year, including all forms of liquid fuels, at around 109 Mb/d (Figure 10). It can be considered that the world economy has been approaching this peak since at least 2008, when the peak of conventional oil was passed.

<sup>20</sup> Matthieu AUZANNEAU, *Or noir, la grande histoire du pétrole*, La Découverte, 2015, p. 543 (*Oil, Power, & War*, Chelsea Green Publishing, 2018).

Figure 10.

**World liquid fuel production 1900 – 2100  
by five years start-up period**



This treadmill effect is made even stronger by the nature of recent discoveries.

Consistently, these new discoveries involve ever-smaller conventional oil fields, or fields that are difficult to access and require more infrastructure to develop. Since 2000, new production start-ups feature a prevailing share of deep offshore fields, oil sands and smaller conventional fields, as well as tight oil from 2010 onwards.

For different but converging reasons, smaller fields, offshore fields and particularly tight oil and shale gas wells tend to start declining earlier and more steeply<sup>21</sup> than the “elephants”, the giant conventional oil fields that were mostly discovered and brought on stream in the middle of the 20<sup>th</sup> century. In the case of tight oil and shale gas, production generally starts to drop several weeks or months after hydraulic fracturation (although the cumulative amounts of the “production tails” of mature wells, and the “refracking” of those wells partly compensate for this major trend).

According to various sources of analysis, including Rystad, the future development of production relies mostly on increasing the extraction from giant conventional oil fields of the Persian Gulf, along with a new start of the tight oil boom. The fall in crude oil prices since 2014-2015 has strongly weakened the interest of oil companies in deep offshore oil, oil sands, and generally in all difficult sources requiring a long cycle

<sup>21</sup> See in particular: Richard G. MILLER, Steven R. SORRELL, *The future of oil supply*, Philosophical Transactions of the Royal Society A, janvier 2014, volume 372 ; HSBC Global Research, *Global oil supply - Will mature field declines drive the next supply crunch?*, septembre 2016.

of return on investment. This state of affairs has just been exacerbated by the COVID-19 crisis, according to Rystad, among others<sup>22</sup>.

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Regarding its future oil supply, Europe, currently the world's largest importer of crude oil ahead of China and the United States, is facing a game that will most likely be played out more and more in the Persian Gulf and the United States, two zones recently marked by significant risks, respectively geopolitical and economic risks.

Figure 11 illustrates the decline expected by Rystad in global production, except in the Middle East and North America. Figure 12 highlights the share of “mature” production that is in jeopardy (dark brown: producing > 50%) in global production excluding the Middle East and North America.

Figure 11

**World liquid fossil fuel production by continent without Middle-East and North America**

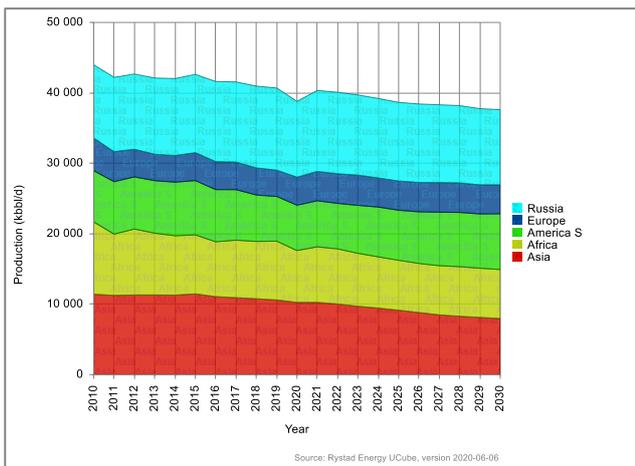
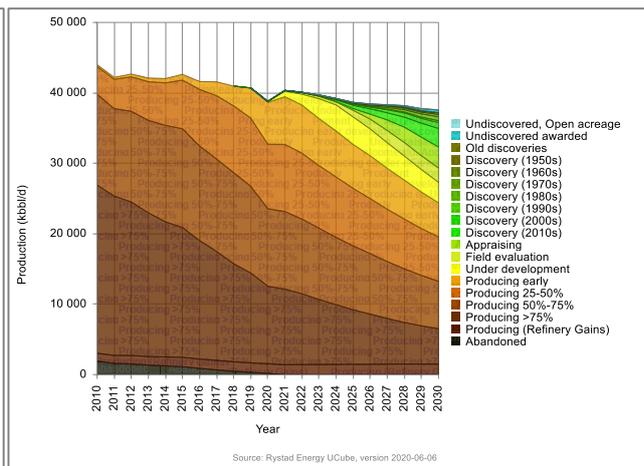


Figure 12.

**World liquid fossil fuel production by life cycle category without Middle-East and North America**



## 2- General framework, parameters and categories of analysis

### a. General framework of analysis

The situation of global oil production can be compared to a bathtub that empties on one side and has to be constantly refilled on the other. The emptying bathtub represents the reserves that are extracted and consumed over time. For production to be sustained, it is imperative to constantly replace the extracted reserves, either through the discovery of new resources or by improving the extraction from existing fields (increasing the “recovery rate of existing resources”).

<sup>22</sup> Rystad Energy, “Global investment slowdown set to hike oil prices and cause undersupply of 5 million bpd in 2025”, *op. cit.*

The oil industry constantly monitors the maximum speed at which the bathtub would empty if nothing was done. This is the “natural decline rate of existing production”. It measures the slope of production evolution, if all investments in maintaining this production were to be stopped (pumping equipment and “stimulation” of production using the “Improved Oil Recovery” methods).

The natural decline rate of existing production is the fundamental benchmark for oil company strategies. It can be compared to a central bank's policy rate for the financial sector. This natural rate of decline varies depending on the nature and the maturity of the relevant field. Sometimes, the pressure that is naturally present in a newly opened conventional oil field may allow the production of this field to be maintained or even increased without requiring additional investment. At the other end of the spectrum, a tight oil well typically displays a sharp decline shortly after it is started, regardless of the investments.

So-called “mature” fields (fields that have already yielded more than 50% of all the exploitable reserves, or “ultimate reserves”) will inevitably decline in the medium to long term, depending mainly on the volume of these ultimate reserves: the larger fields usually decline more slowly<sup>23</sup>.

So-called “camel-back” scenarios may occur, mostly at the scale of large oil producing areas: when production reaches a first peak and extraction starts to decrease, oil operators may decide to boost their investment effort, sometimes resulting in a second production surge. This may be about to happen in the North Sea, today in Norwegian waters and perhaps, by 2030, in UK waters.

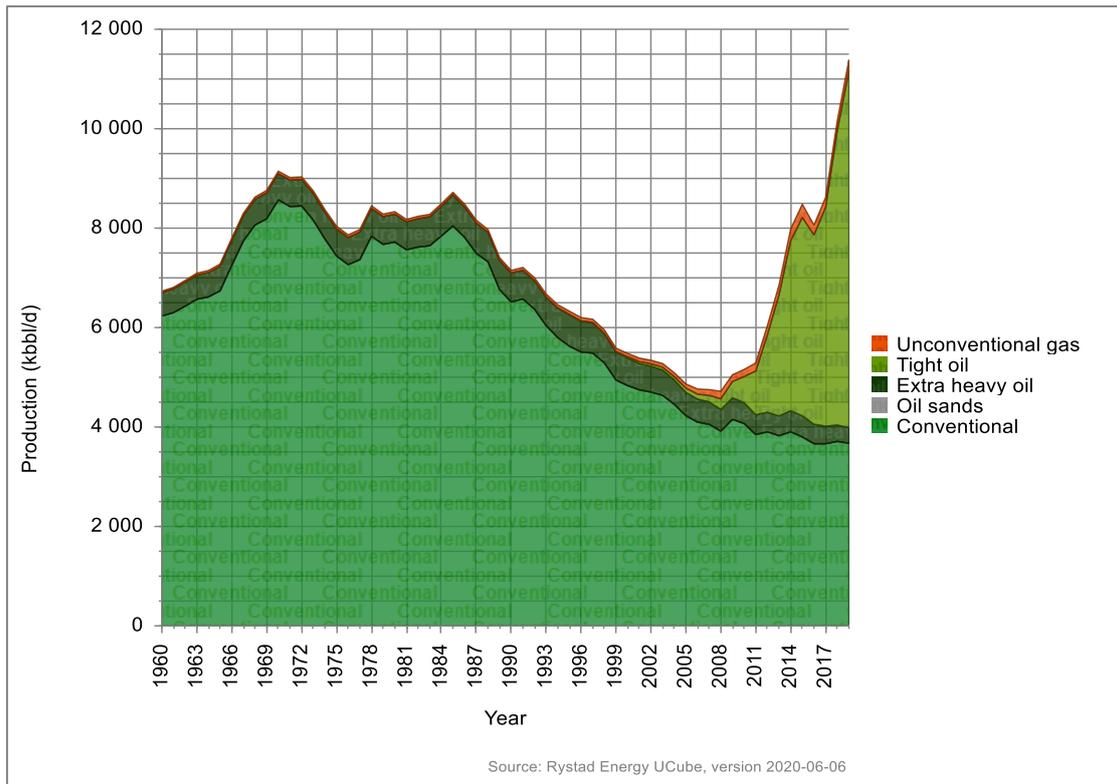
However, during this “camel-back” period, it has rarely been seen that the production from an oil play rises above the initial peak level. The most famous counter-example is the boom of tight oil, which required not only a massive investment surge, but also a shift in the operation mode of wells and even in the very nature of the resources being extracted. As a result of this boom, crude oil production has since 2018 been well above the peak of conventional crude oil reached by the United States in 1970, despite the continued decline of conventional crude oil (see Figure 13).

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<sup>23</sup> See previous section.

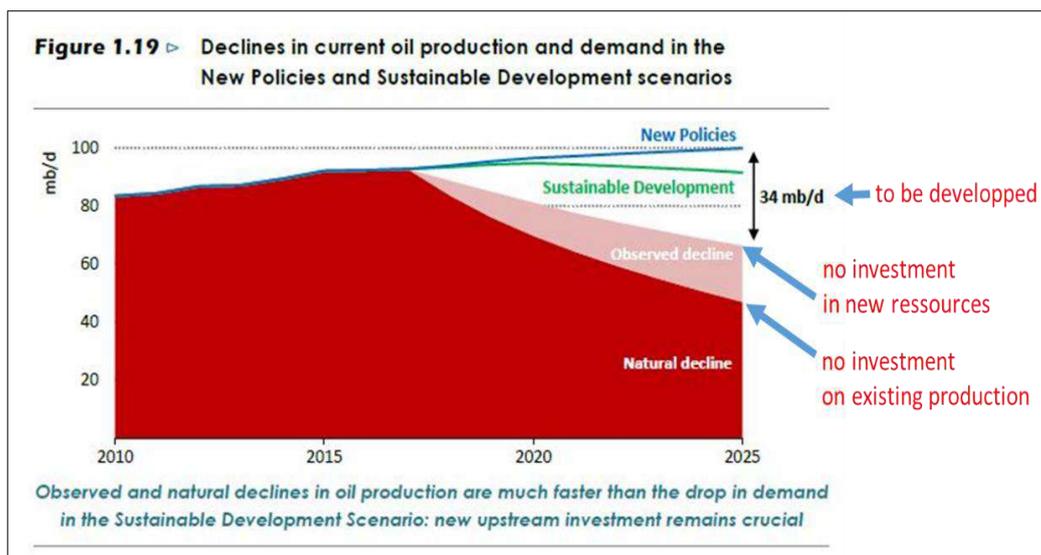
Figure 13.

United States crude oil production by unconventional category, 1960-2019



However, the more the production of an oil play depends on “mature” fields, the greater the problem posed by the natural decline in existing production. *Figure 14* illustrates the current magnitude of the decline in existing production. It shows the same order of magnitude as shown in *Figure 7*.

Figure 14.



International Energy Agency, *World Energy Outlook 2018 (The Shift Project)*

## b. Analysis parameters

The ability to increase, maintain or slow the decline of an oil play depends on a set of economic parameters, within the boundaries drawn by technical and geological limits on the one hand, and by political and geopolitical constraints on the other.

### i. Economic, technical and geological parameters

Depending on its economic conditions (security of contracts, crude oil prices, state of demand, etc.), a producer or group of producers will be able to more or less maximise the potential of a resource. This potential is bounded immediately by the state of the art of the industry, and ultimately by the state of the resource at a given time (volume of ultimate reserves, physical properties, maturity of the exploitation).

Economic conditions are constantly changing, often in ways that are abrupt and difficult to predict. A high barrel price, which is favourable to operators, is difficult to maintain over time, particularly because it tends to induce recession for demand<sup>24</sup>.

As regards conventional oil, under favourable economic conditions, the recovery rate for existing resources is typically around 35%. Under optimal economic conditions and with highly favourable physical properties, the current state of the art will sometimes allow a recovery rate above 50%. The technical capabilities usually progress incrementally and rather slowly, within the limits set by various absolute physical constraints. There may sometimes be unexpected breakthroughs; in the case of hydraulic fracturing, the large-scale implementation of the technological breakthrough requires very propitious economic conditions (e.g, the first phase of the tight oil boom, from 2010 to 2014, benefited from a barrel at over USD100).

### ii. Political and geopolitical parameters

Depending on the political and geopolitical situation in a given country or region, the ability of oil operators to optimise their level of production can be significantly impaired.

One of the main factors of political degradation is the fact that oil producing countries frequently need to capture a substantial share of oil revenues in order to finance the State's activities, to "buy social peace", to distribute part of the money to a network of cronies or to pay for corruption. When larger parts of the production become mature, this windfall is bound to decrease, and the alternative between investing in maintaining production and redistributing the windfall for political purposes can lead to a catastrophic vicious circle. This was recently the case in Venezuela. To some extent, this was probably also the case in Syria, where in the 2000s a rapid decline in extraction was followed by a sharp reduction in subsidy policies<sup>25</sup>. This may also have been the case in Yemen (*Figures 15, 16 and 17*).

<sup>24</sup> We will get back to this aspect at the end of the analysis: see section II- 3- b. i.

<sup>25</sup> This hypothesis is insufficiently substantiated at present, given the lack of research on the topic, but is cogently put forward here: Nafeez AHMED, "Peak oil", climate change and pipeline geopolitics driving Syria conflict", *The Guardian*, 13 May 2013.

This type of vicious circle may occur in all producing countries with largely mature production, especially those with a large population, where the stability of institutions depends heavily on oil revenues. In this respect, the case of Algeria, and oil producing countries in the Gulf of Guinea, of Mexico, Iran and Russia, appear as major sources of concern (we shall come back to this later).

Figure 15.  
Venezuela crude oil production, 1980 – 2019  
by life cycle category

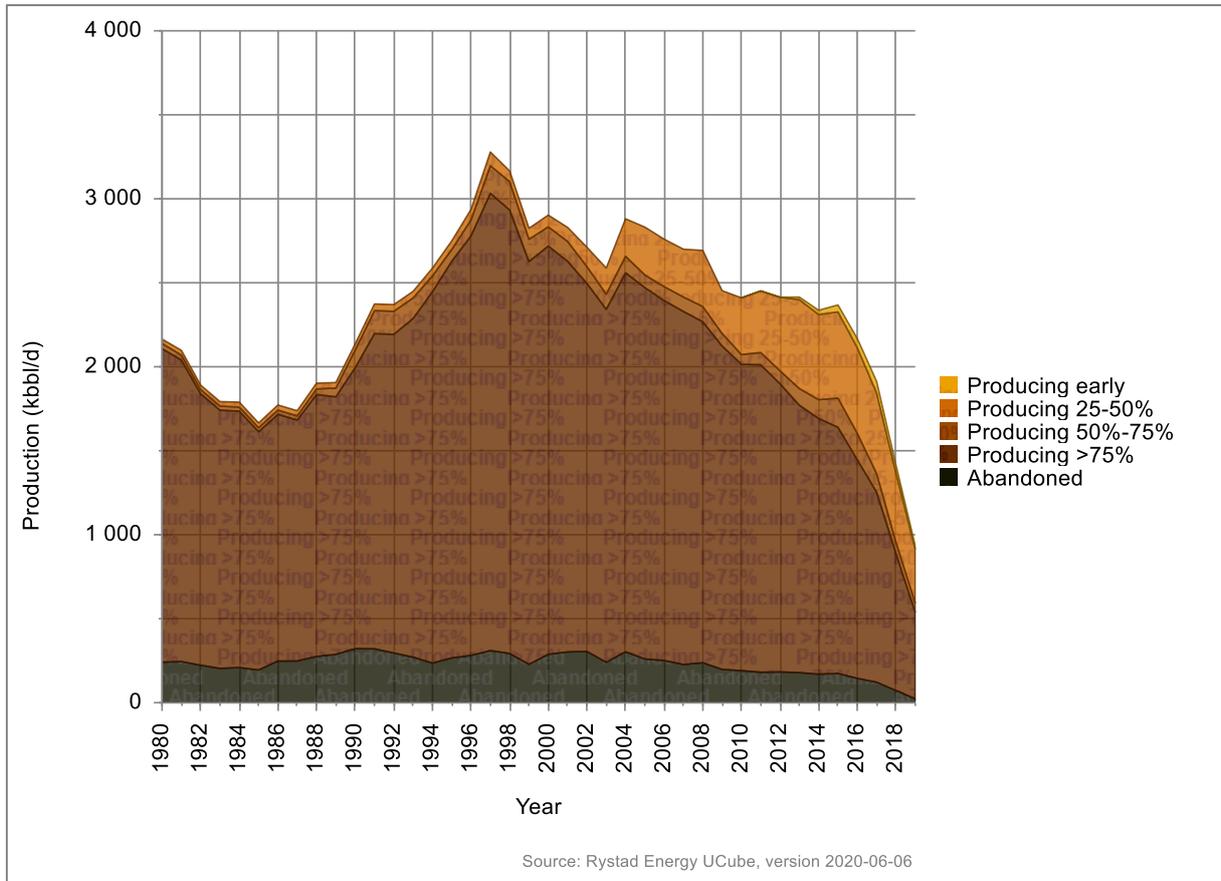


Figure 16.

Syria crude oil production, 1980 – 2019  
by life cycle category

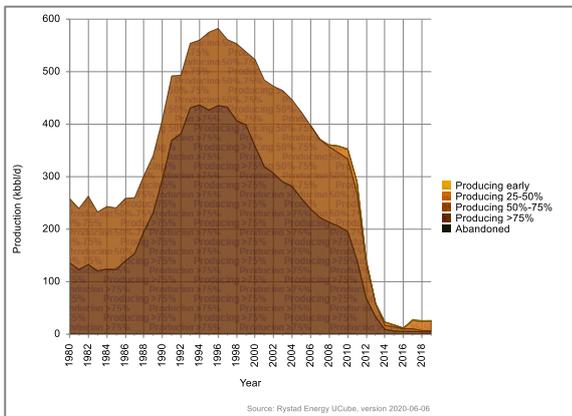
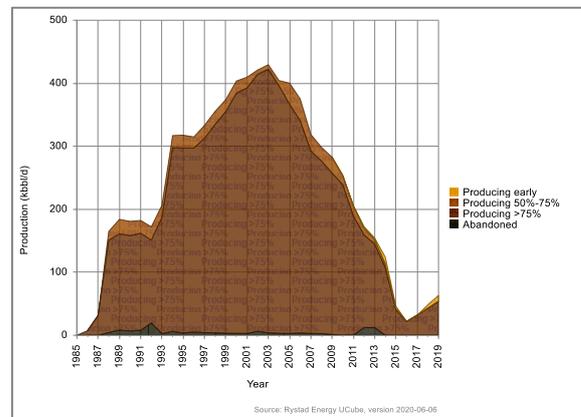


Figure 17.

Yemen crude oil production, 1980 – 2019  
by life cycle category



### c. Categories of Analysis used in Rystad Energy's Production Scenarios

Rystad Energy designs reference prospective scenarios for thousands of oil fields, updated with information provided by a large global network of experts, using models that integrate a set of detailed, adjustable parameters outlining the geological, technical and economic conditions. These parameters are weighted according to specific political and geopolitical constraints. Rystad provides a rating of its confidence level in its own production forecasts. This depends mainly on the management policy of the crude oil reserve implemented by the relevant country (in particular, state-owned companies tend to be less transparent).

We have categorised Rystad scenarios up to 2030 for the main oil suppliers of the European Union (EU) according to the parameter groups described in the previous section:

- moderate to strong production growth – *uncertain* (United States, Canada, Brazil, etc.);
- low (Mexico) to moderate (Norway, United Kingdom) production growth – *uncertain*;
- low production growth – *highly uncertain* (Libya, Iran);
- robust production growth – (Iraq)
- robust, stable production (Saudi Arabia, Kuwait);
- decline – *moderate to steep* (Russia, Kazakhstan, Nigeria, Azerbaijan, Algeria, Angola, etc.).

#### i. Moderate to strong production growth – *uncertain*

The strong growth in the output of liquid fossil fuels from these countries expected by Rystad over the 2019 - 2030 period will have to be secured exclusively by the development of previously discovered resources whose production potential has not yet been appraised or evaluated as of June 2020, or by hypothetical future new discoveries.

A large part of the current production of these countries is mature (> 30% of the total in 2019).

Main countries concerned, according to their share of EU supplies in 2018:

- United States (*figure 18*);
- Canada (*figure 19*);
- Brazil (*figure 20*).

Figure 18.

**US liquid fossil fuel production, 2010 – 2030,  
by life cycle category**

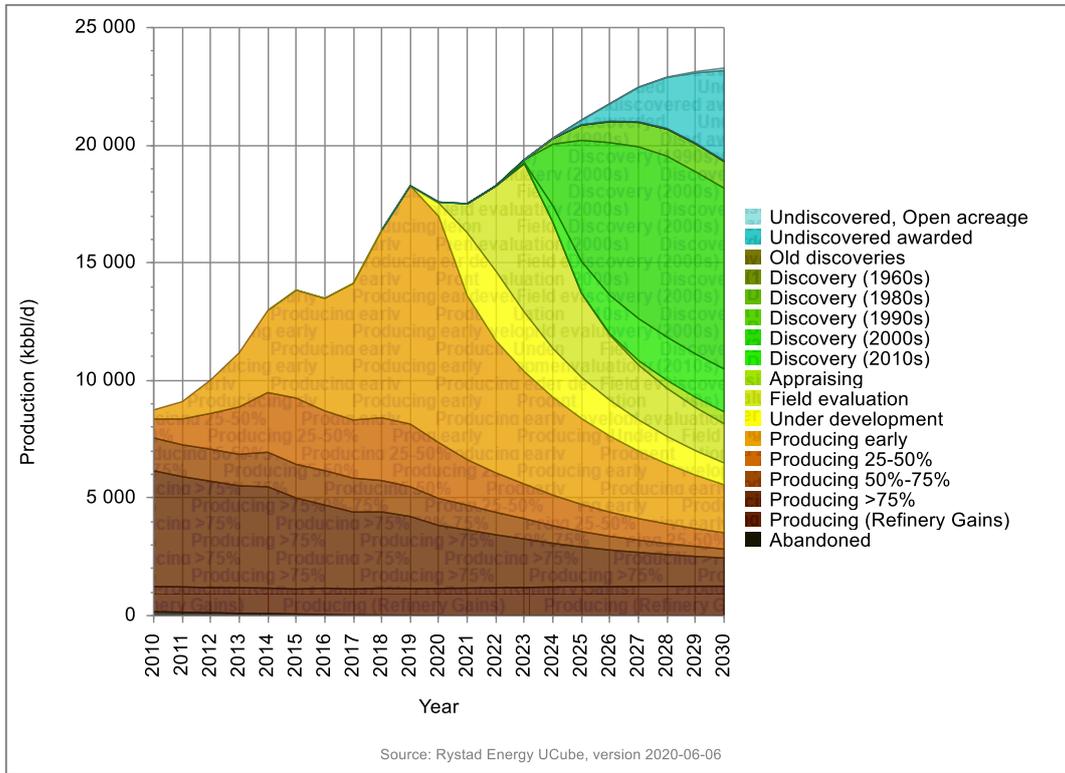


Figure 19.

**Canada liquid fossil fuel production, 2010 – 2030,  
by life cycle category**

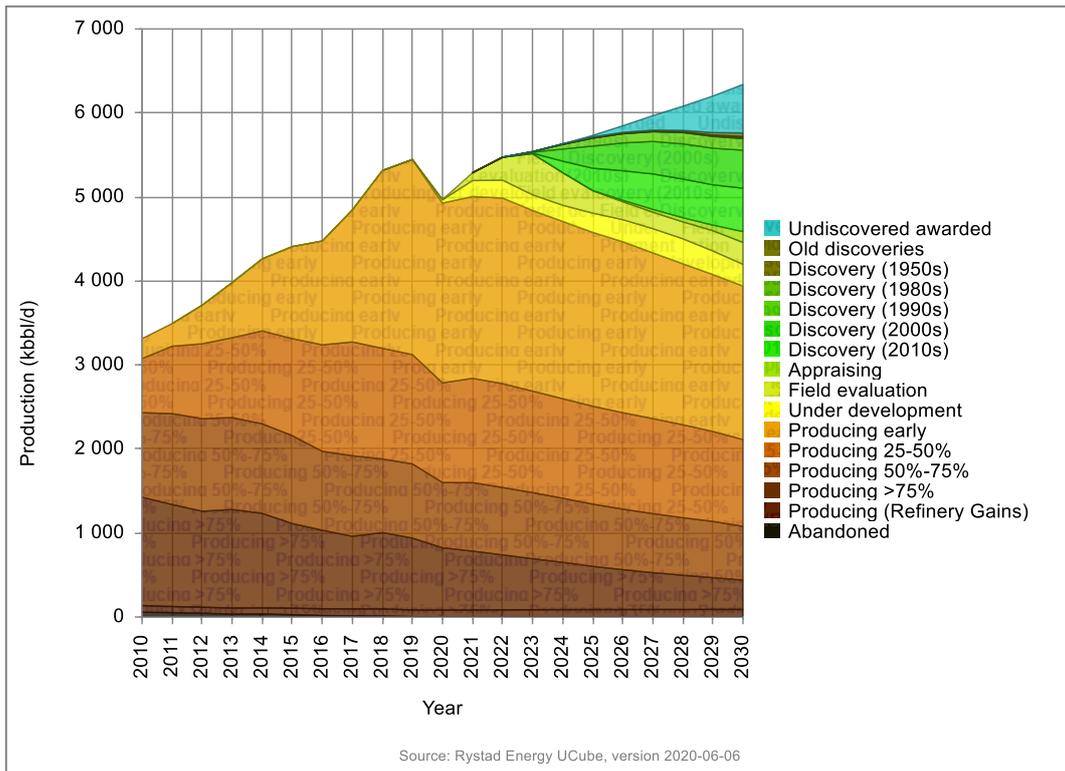
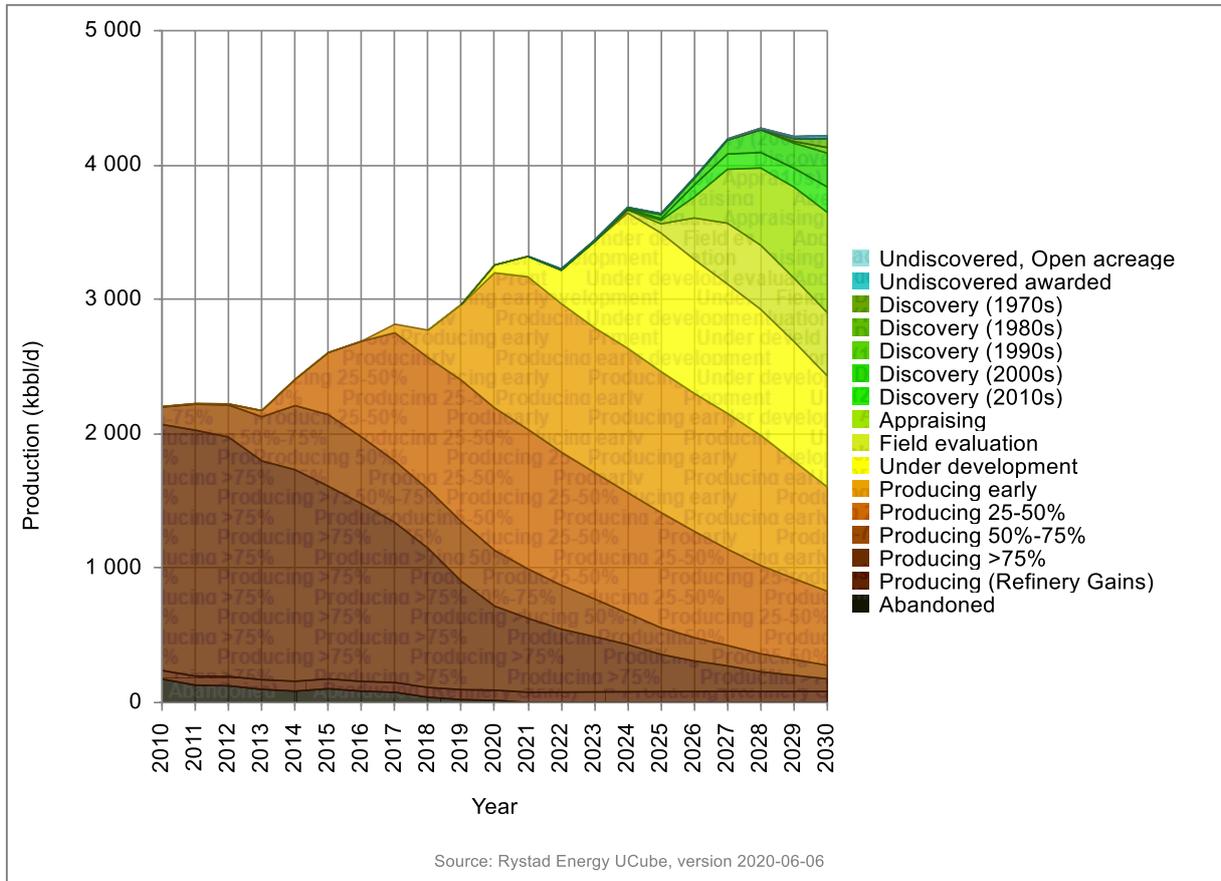


Figure 20.

**Brazil liquid fossil fuel production, 2010 – 2030  
by life cycle category**



**ii. Low to moderate production growth – uncertain**

The relatively moderate production growth in these countries over the 2019 - 2030 period will have to be secured exclusively by developing new sources not yet fully evaluated, or by new discovering new sources.

The vast majority of these countries' current production is mature (> 75% of the total in 2019).

Countries concerned:

- Norway (figure 21);
- United Kingdom (figure 22).
- Mexico (figure 23)

Figure 21.

**Norway liquid fossil fuel production, 2010 – 2030  
by life cycle category**

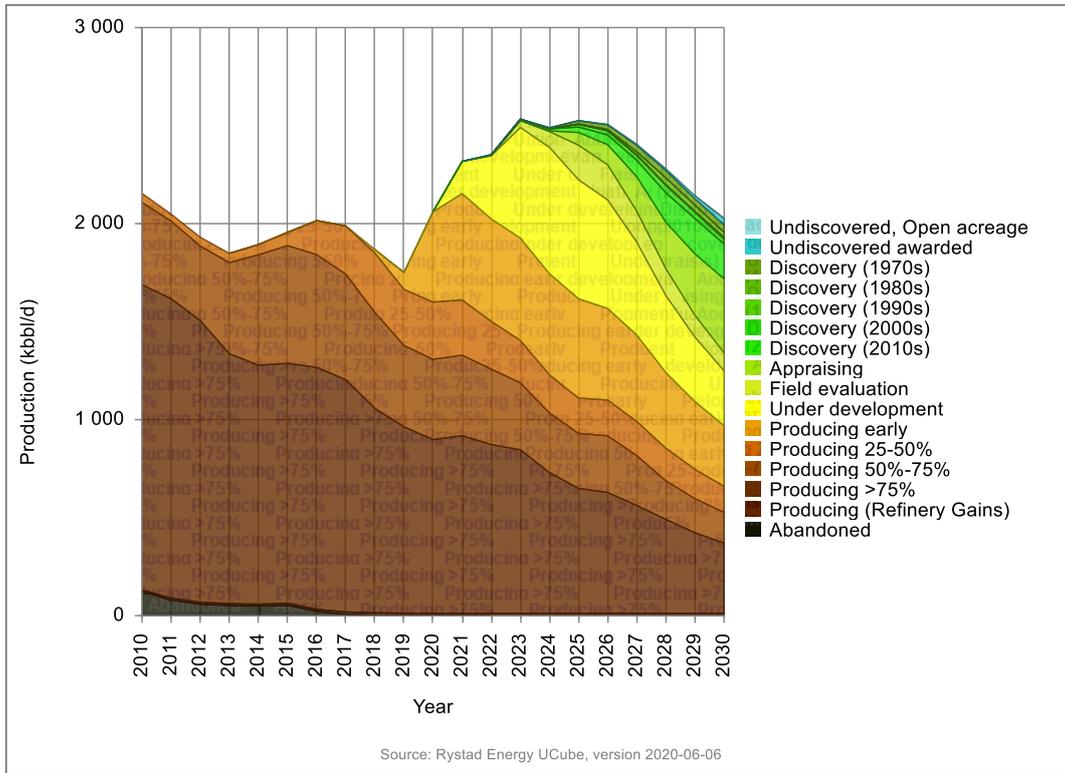
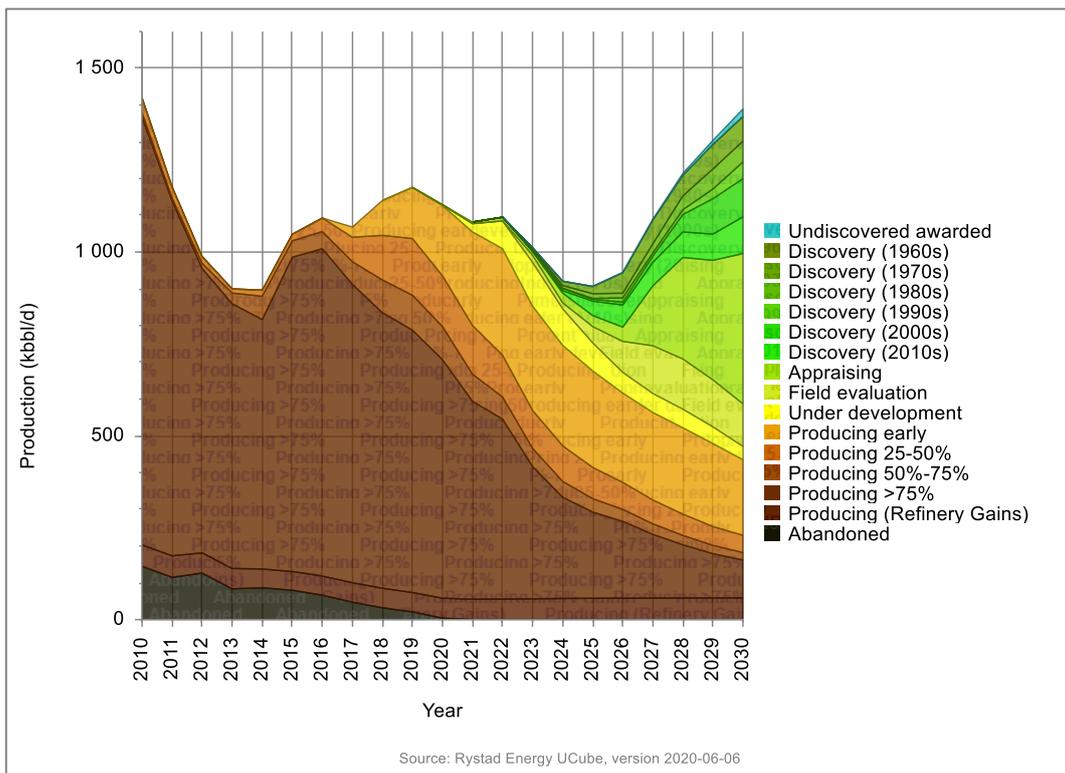


Figure 22.

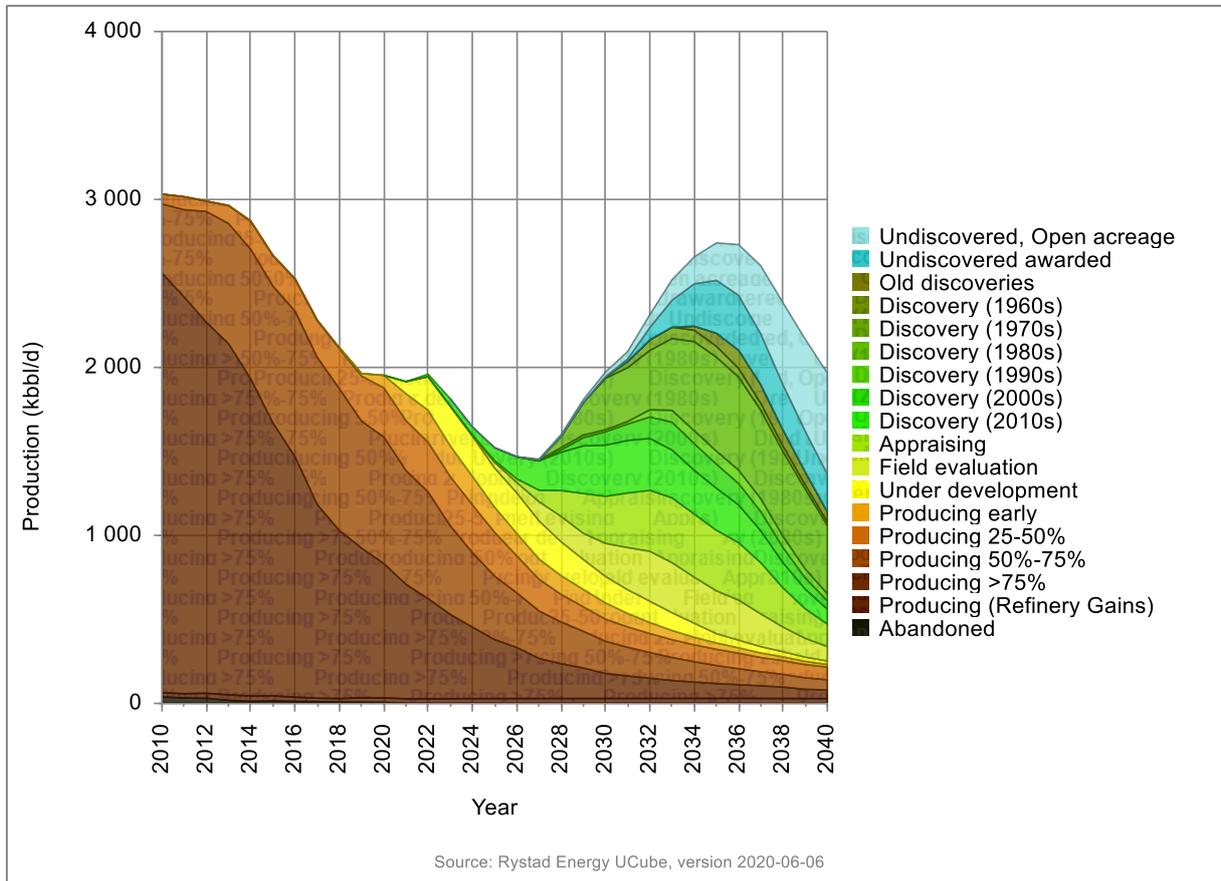
**UK liquid fossil fuel production, 2010 – 2030  
by life cycle category**



Finally, provided that it finds a situation conducive to its ambitious investment plan in *offshore* resources at the end of the COVID-19 crisis, **Mexico** should see a new production surge from 2027 onwards, thus putting a halt to the steady decline since 2003 (*figure 23*).

Figure 23.

**Mexico liquid fossil fuel production, 2000 – 2040  
by life cycle category**



iii. Low production growth – highly uncertain

The weak production growth expected in these countries, that are facing serious political and geopolitical issues, happens in the context of a decline in mature fields, which account for at least nearly half of the total production capacity in 2019. The development of the hydrocarbon resources of Libya and Iran - like all Persian Gulf and North African countries - took off in the second half of the 20<sup>th</sup> century.

Like all the Persian Gulf and North African countries reviewed in this and subsequent sections, over the coming decade, Libya and Iran are expected to face a notable drop in existing production, more or less impending and sharp.

This decline in current production can only be made up for by the development – wherever available – of resources that were mostly identified long ago, but whose exploitation has generally been postponed

due to their poor quality (heavy and/or sour oils, fragmented fields that are difficult to tap). Assessing the probabilities of this type of development is difficult and beyond the scope of our analysis.

A development of tight oil or other forms of non-conventional oil cannot be ruled out, and is indeed often under study. However, this development remains conjectural to date.

Countries concerned, in this category:

- Libya (figure 24);
- Iran (figure 25).

Figure 24.

**Libya liquid fossil fuel production, 2000 – 2030, by life cycle category**

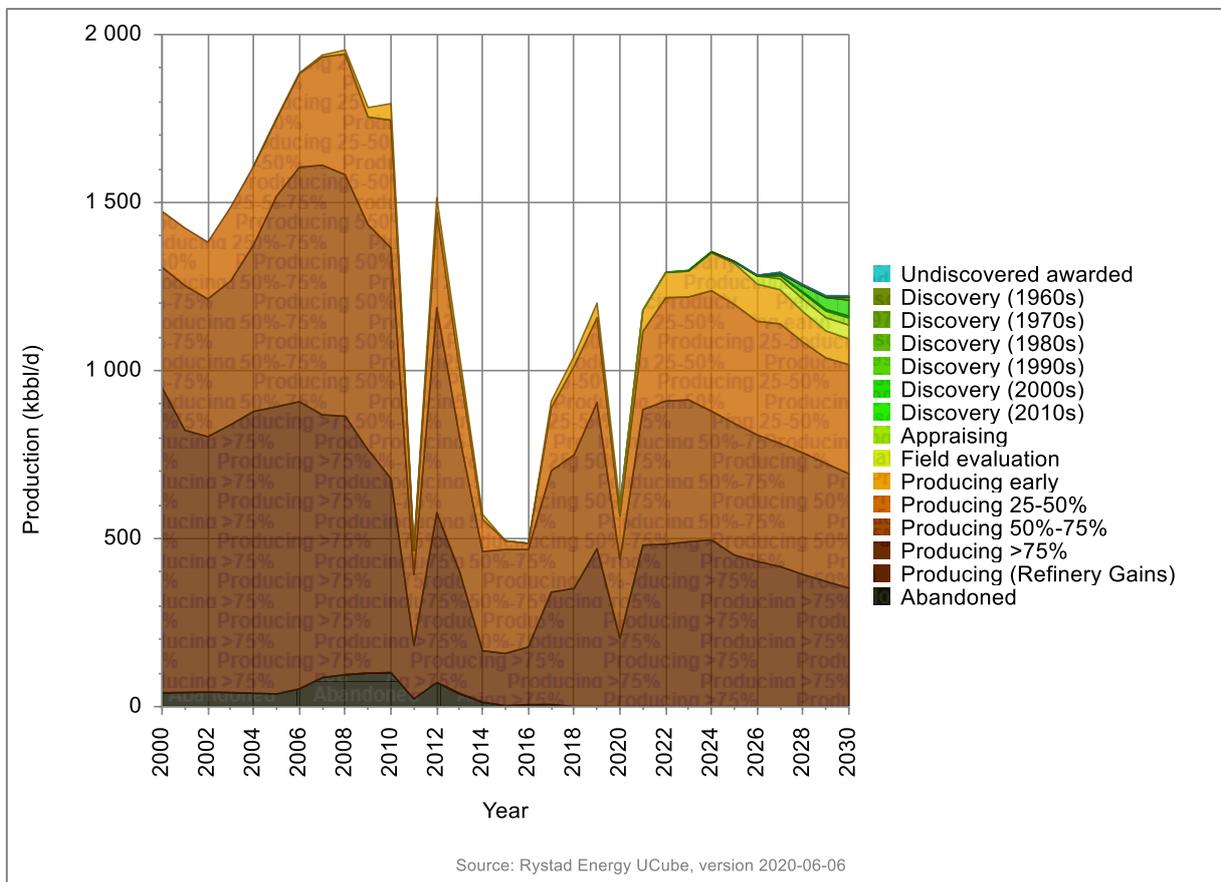
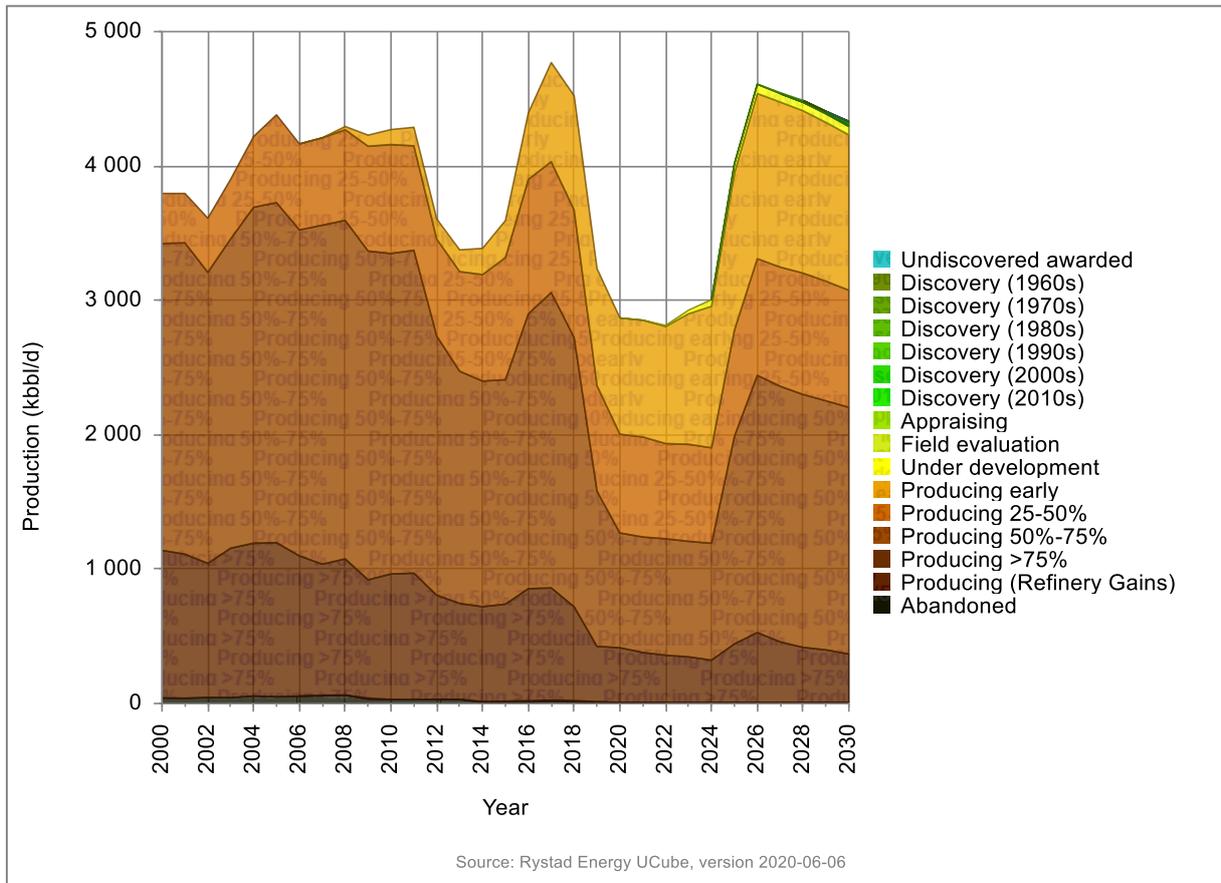


Figure 25.

Iran liquid fossil fuel production, 2000 – 2030, by life cycle category



iv. Robust production growth – (Iraq)

Like other major Persian Gulf countries, Iraq still has massive reserves of conventional oil. The appalling political and geopolitical situation that has plagued Iraq for more than a generation, now benefits its oil industry, as Iraq's reserves have been spared for a quarter of a century by conventional wars, civil wars and embargo.

A unique case among Middle Eastern producers, Iraq also enjoys a low share of mature reserves (13% in 2019, according to Rystad).

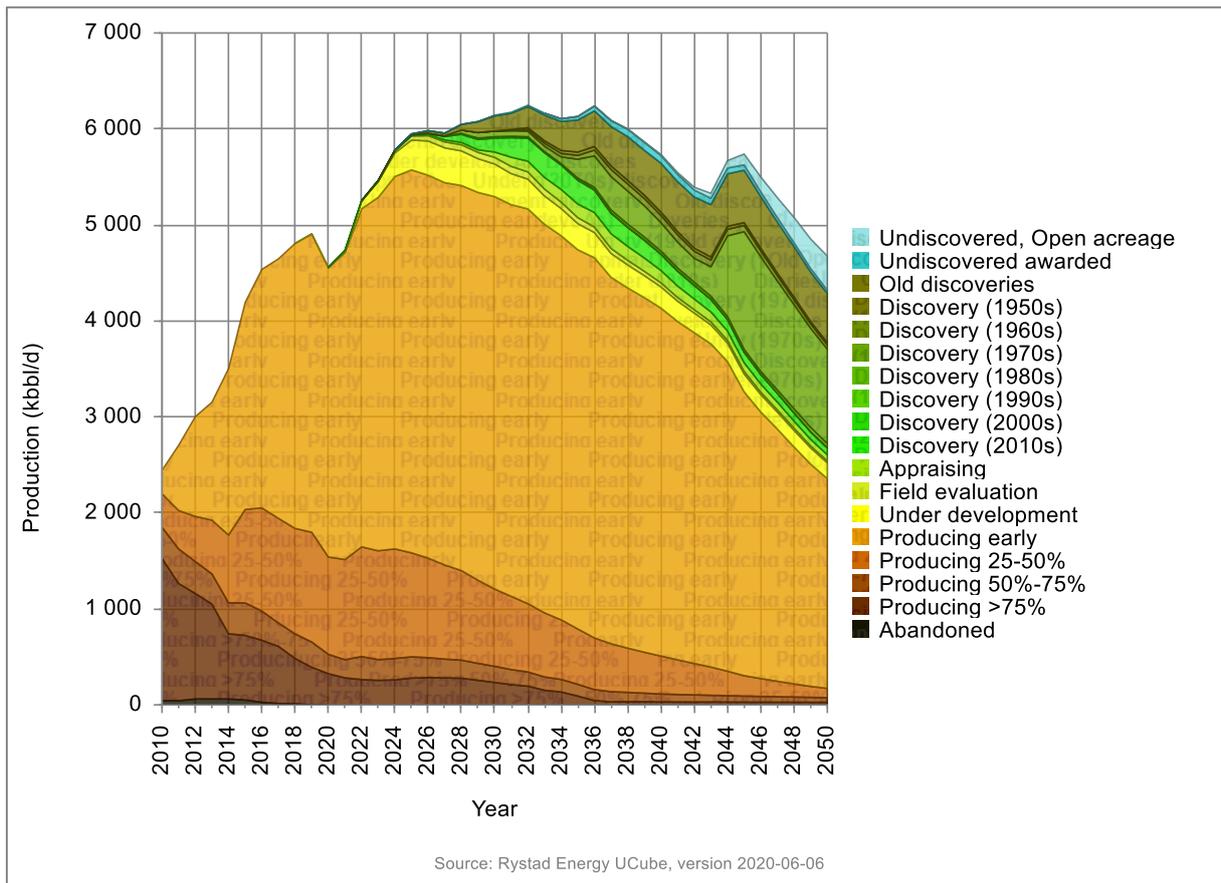
However, once again, the profile expected by Rystad displays an incipient declining trend in total existing production during the decade, driven by a more or less extensive decline in mature reserves - the same trend as highlighted in the previous section, applying to all Persian Gulf and North African countries.

In the case of Iraq, this downturn is expected in 2025, according to Rystad (Figure 26).

In the following graphs, we chose year 2050 as a timeframe. While such option is increasingly speculative as we progress through time, it helps us to grasp the scale and inescapable nature of the issue of mature production (despite potential “redevelopments”, which are usually marginal in scale).

Figure 26.

**Iraq liquid fossil fuel production, 2010 – 2050  
by life cycle category**



**v. Robust, stable production**

Saudi Arabia, and to a lesser extent Kuwait, both enjoy huge reserves of conventional oil that can be recovered at low cost. Rystad predicts that the production capacities of these countries will be maintained over the decade.

A quarter of Saudi Arabia's production is mature. This rate is up to 60% in the case of Kuwait. Due to the size of their reserves, these two state-owned producers can – and indeed do – manage the maximum production plateau over the long term.

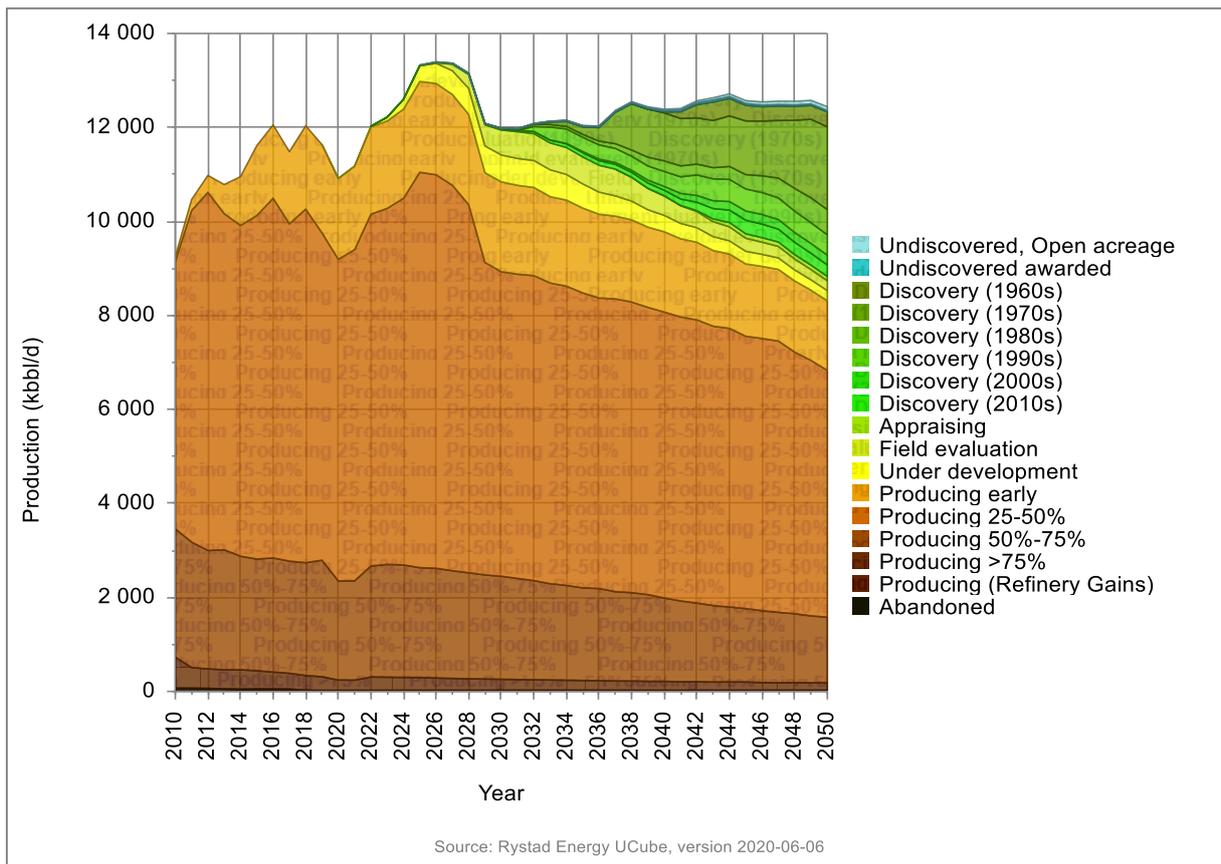
Here too, the first signs of a decline in current production may occur over the decade, driven by the decline in mature reserves. According to Rystad, this trend is expected to start in 2023 in the case of Kuwait (Figure 29), and from 2025 onwards in the case of Saudi Arabia (Figure 27).

The long-anticipated decline in mature production from Saudi Arabia's Ghawar oil field, the world's largest field, is expected to occur during the following year, 2026, when Ghawar should reach its historical peak of 5.9 Mb/d and then go into steep decline (*Figure 28*). This peak of the Ghawar field would cause Saudi Arabia's production to also peak in 2026. However, according to Rystad, thanks to the development of new resources, this peak would not automatically trigger a decline in Saudi production, which would settle on an undulating plateau for several decades.

Saudi Arabia's so-called '2P' technical reserves (proven and probable) were of the order of 188 billion barrels according to Rystad<sup>26</sup>, compared with nearly 300 billion according to the official amount declared by the country. Such gap is found in many producing countries (see section III-4-, figure 58).

Figure 27.

**Saudi Arabia liquid fossil fuel production, 2010 – 2050  
by life cycle category**



<sup>26</sup> Rystad Energy, "Rystad Energy's annual review of world oil resources: Recoverable oil loses 282 billion barrels as Covid-19 hastens peak oil", 17 juin 2020.

Figure 28.

**Ghawar liquid fossil fuel production, 1950 – 2050**

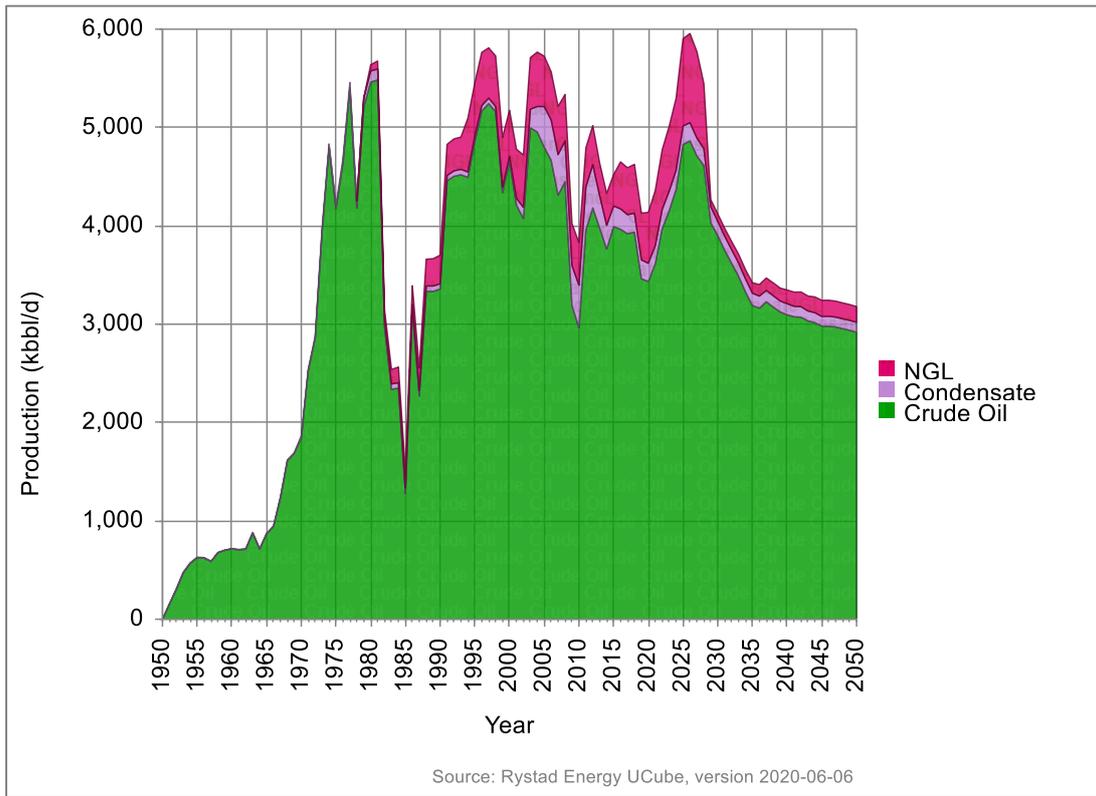
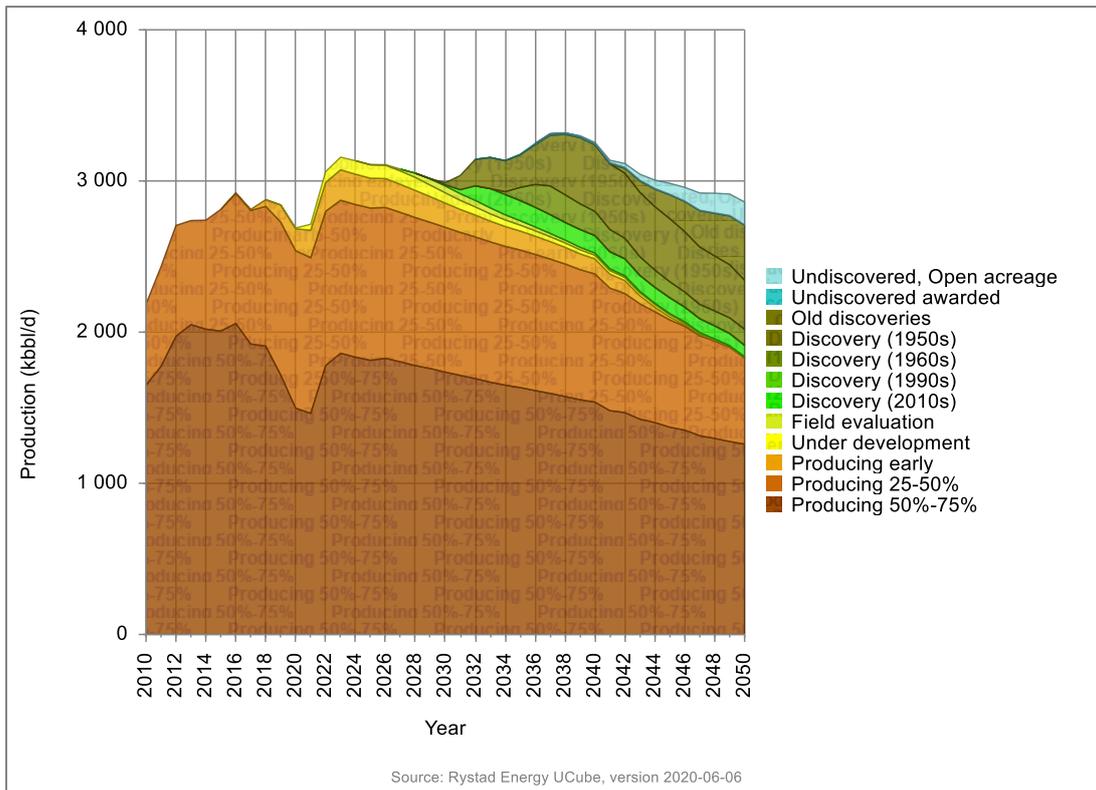


Figure 29.

**Kuwait liquid fossil fuel production, 2010 – 2050  
by life cycle category**



## vi. Declines – moderate to steep

The last category of analysis of EU's main suppliers is made up of countries for which Rystad expects only a decline in output throughout the coming decade.

In the case of the main suppliers, the expected decline rates over the 2019 - 2030 period range from -7% for Kazakhstan to -31% for Nigeria. Some much smaller producers, such as the former French colonies of Gabon and Congo-Brazzaville, would be on their way to a drop of over 45% in their extractions over the decade.

The current production of all countries in this category is mostly mature, and the remaining exploitable reserves appear to be proportionally insufficient to fully or even partially compensate for this decline by 2030. The development of new, untapped resources would only be able to slow down (Algeria, - 13%) or practically halt temporarily the decline (as in the case of Nigeria and Angola, which would nonetheless see their extractions drop by around 30% over the 2019 - 2030 period).

All the countries for which Rystad Energy expects a decline have been assigned to the same category (although, as we shall see, this category includes rather contrasting situations).

This choice is based on four reasons:

- Broadly, even if output were to be higher than Rystad's forecast, the projected declines are steep enough to make it very unlikely that countries in this category would still achieve output growth by 2030, compared to 2019;
- More fundamentally, over this timeframe, it is doubtful that any unexpected event likely to significantly increase the envisaged production levels will occur, firstly because Rystad pays great attention to the investment trends in existing or new fields, and secondly because the development of a new conventional oil field typically takes 6 to 10 years (an interval that is especially irreducible in the case of deep offshore, which now accounts for most of the major new wells)<sup>27</sup>;
- Above all, the fact that the output of the countries in this category is old and mostly mature makes significant surprises most unlikely for two reasons: firstly, as the geology of these countries is well known, the chances for new discoveries are slim, and secondly, the best-known factor in this geology is precisely the state of maturity of current production;
- lastly, as this analysis is of a prudential nature, the production decline of the countries in this category should be considered as a whole, as the initial assumption for the risk we intend to assess.

Rystad assumes that **Russia** has reached its production peak in 2019 at 11.67 Mb/d (Figures 30, 31 and 32) and expects the decline in Russian production to reach 10.9% between 2019 and 2030.

<sup>27</sup> A boom in non-conventional oil resources would probably take at require at least five years to reach a significant level. While there are currently pilot projects for tight oil, particularly in Russia and Algeria, and although, before slipping into political crisis, Venezuela had prospects for the development of its huge extra-heavy oil reserves, Such a boom remains hypothetical today for the countries in this category, such a boom remains hypothetical for the countries in this category,

In the early 2010s, IEA suggested that a decline in Russian oil might begin before 2020. Russia managed to push back this fatal moment through a sustained industrial effort, which has been particularly successful in areas of Russian territory that were still undeveloped: in Arctic Russia and, even more so, in Eastern Siberia. However, since 2018, Moscow has repeatedly presented the prospect of a peak by 2021 as highly probable<sup>28</sup>.

Russia is by far the largest supplier of crude oil to the European Union. Along with the United States and Saudi Arabia, it is currently one of the world's three largest producers (and one of the two oldest, apart with the United States).

The long-term timeframes chosen for the following graphs show the scale of the challenge posed by the maturity of Russian production, a problem that the Kremlin identified long ago.<sup>29</sup> The geology of Russia (along with the state secrets involved, to a certain extent, in the data pertaining to Russian raw material resources) may still provide some surprising developments, in Eastern Siberia, in the Arctic Ocean or in tight oil resources.

So far, the expected drop in Russian production is mostly related to a steady decline since 2006 in the fields of Western Siberia, the country's main oil-producing region. This downward trend is compounded with the resumption of decline of the old Volga-Ural area since 2014. Rystad suggests that the significant development of reserves in Arctic Russia and Eastern Siberia should not be enough to “refill the tank” (*Figure 31*). Despite the existence of a number of pilot projects, a significant development of tight oil by 2030 remains hypothetical.

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<sup>28</sup> “Russia is Only 3 Years Away From Peak Oil, Energy Minister Warns”, *The Moscow Times*, September 24, 2018; Nastassia ASTRASHEUSKAYA, “Russia makes its oil reserves work harder as output declines”, *The Financial Times*, November 12, 2019

<sup>29</sup> Hydrocarbons are both Russia's primary source of foreign currency and an essential factor in the stability of the regime in place. As this regime was able to settle decisively by regaining control of the Russian oil industry, its dignitaries know that the petroleum geostrategy of the Reagan administration was one of the decisive contributors to the fall of the Soviet Union, cf. Matthieu AUZANNEAU, *Or Noir, la grande histoire du pétrole*, op. cit., p. 455 and sq.

Figure 30.

**Russia liquid fossil fuel production, 1970 - 2050  
by life cycle category**

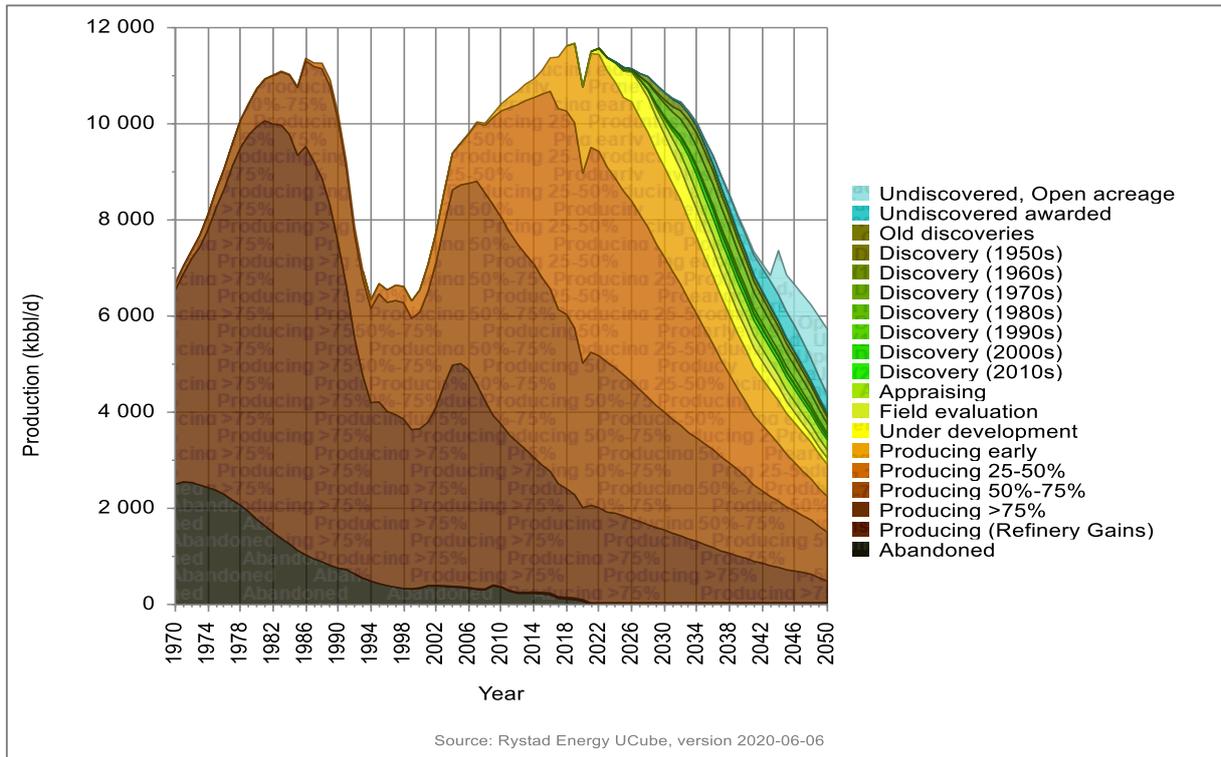
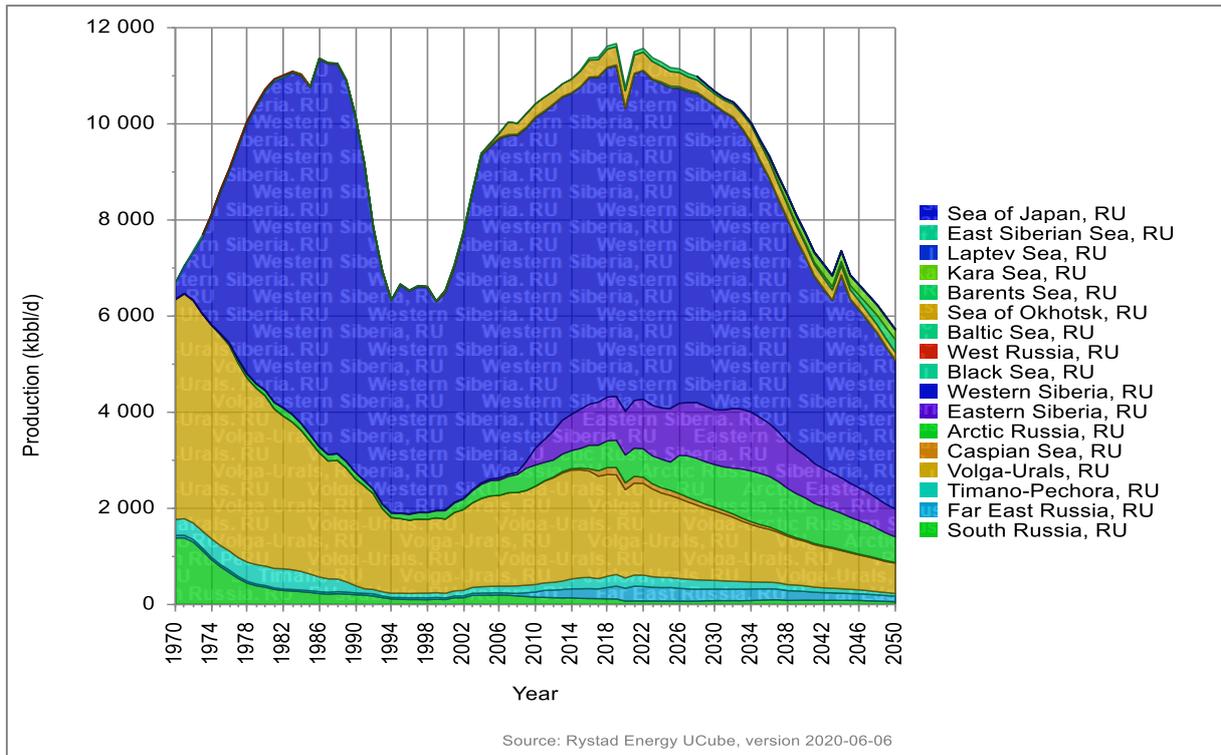


Figure 31.

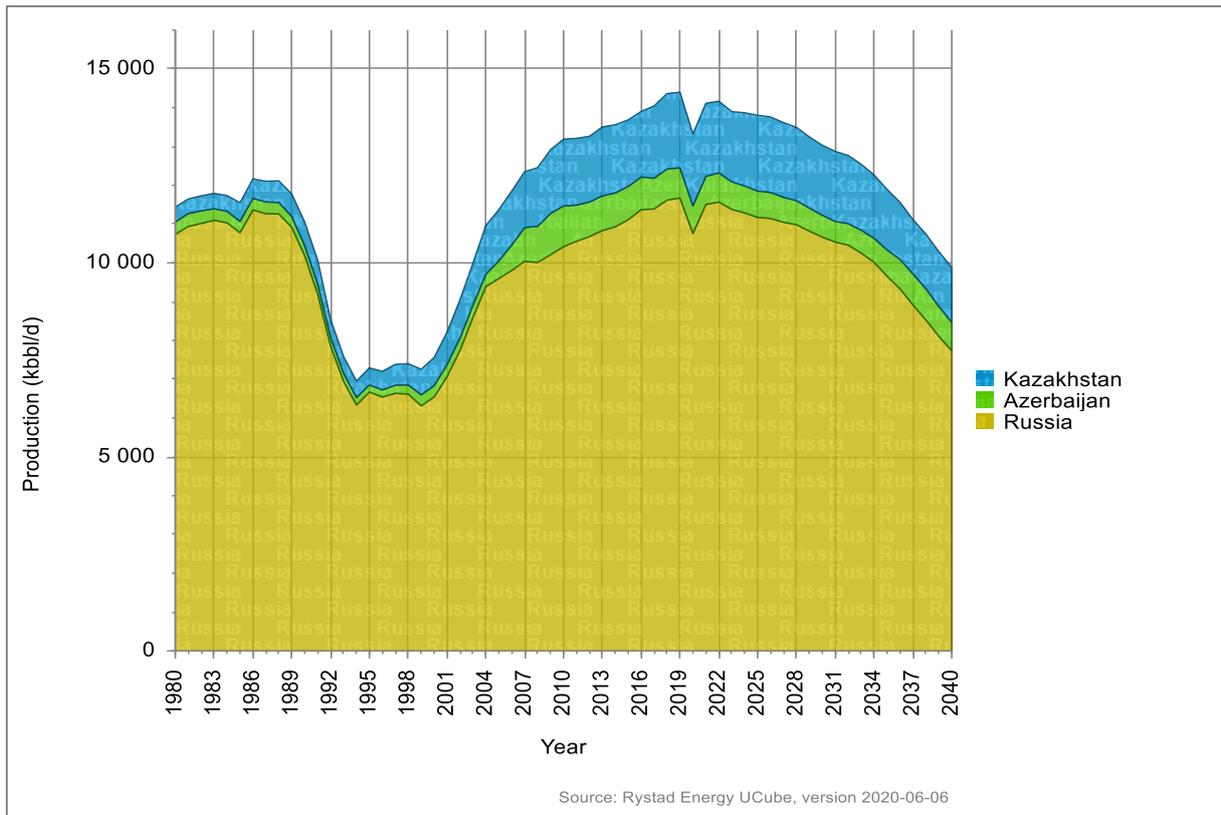
**Russia liquid fossil fuel production, 1970 - 2050  
by producing regions**



According to Rystad, in the ex-Soviet Union, overall oil production is expected to decline dramatically over the current decade and the following ones. Russia's oil production decline from 2019 onwards is cumulating with that of Azerbaijan, which started in 2009, and should be made more severe by the projected depletion of Kazakhstan's reserves from 2025 onwards (Figure 32).

Figure 32.

**Russia, Kazakhstan & Azerbaijan  
liquid fossil fuel production, 1980 - 2040**



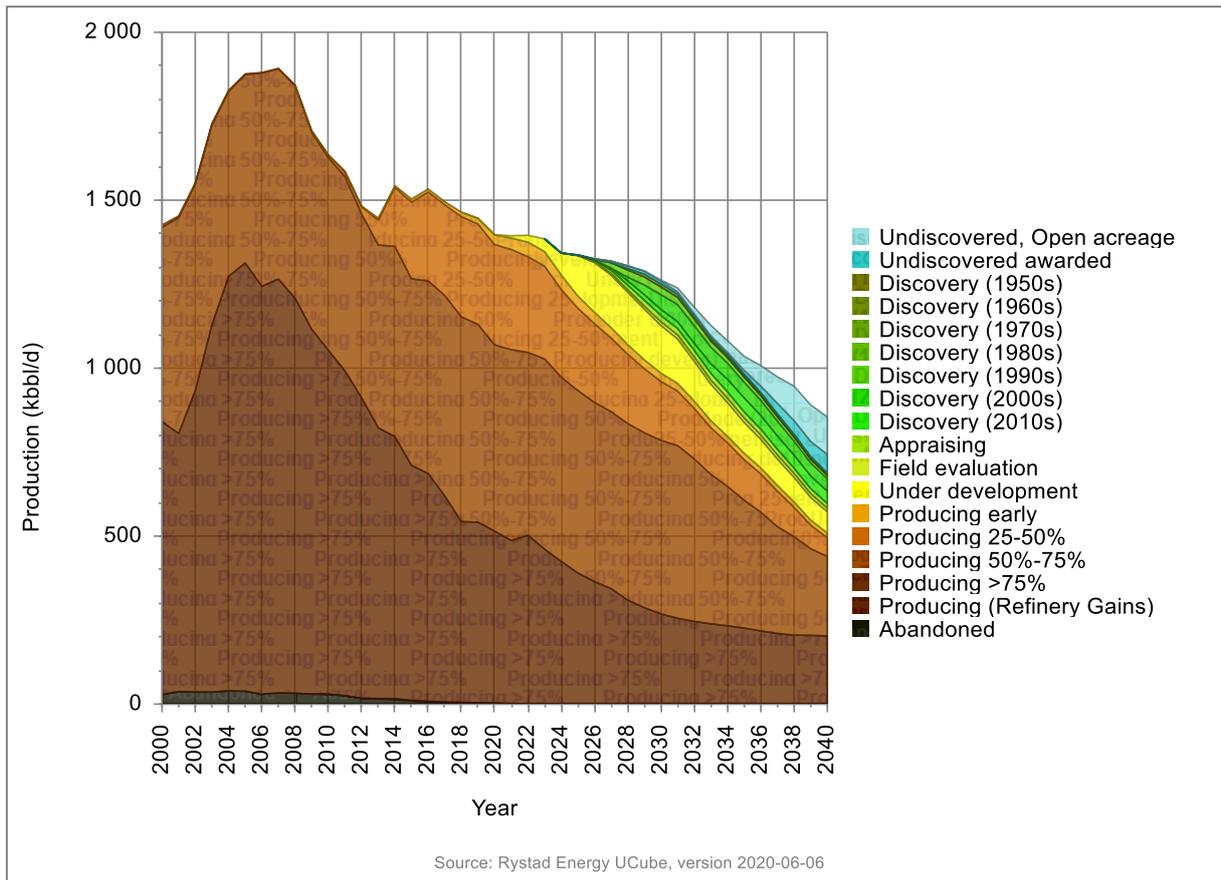
In 2018, according to the most recent consolidated data provided by Eurostat, oil producers in the former Soviet Union, still largely under Moscow's rule, supplied as much as 42% of European Union's oil.

**Algeria**, an important oil supplier for Southern Europe and specifically for France, displays a situation similar to that of Russia: a mostly mature production, with currently few prospects likely to make up for its decline. However, the situation seems even more problematic in the case of Algeria, as national production has already been experiencing a decline since 2007, with a 23.6% drop over the 2007 – 2019 period, and a predicted persisting decline of around 13% over the 2019 – 2030 period, according to Rystad (Figure 33).

Due to this situation, Algeria faces a severe risk of instability, at the political, economic, and social levels, just like Russia and most countries where oil production seems doomed to decline.

Figure 33.

**Algeria liquid fossil fuel production, 2000 - 2040  
by life cycle category**

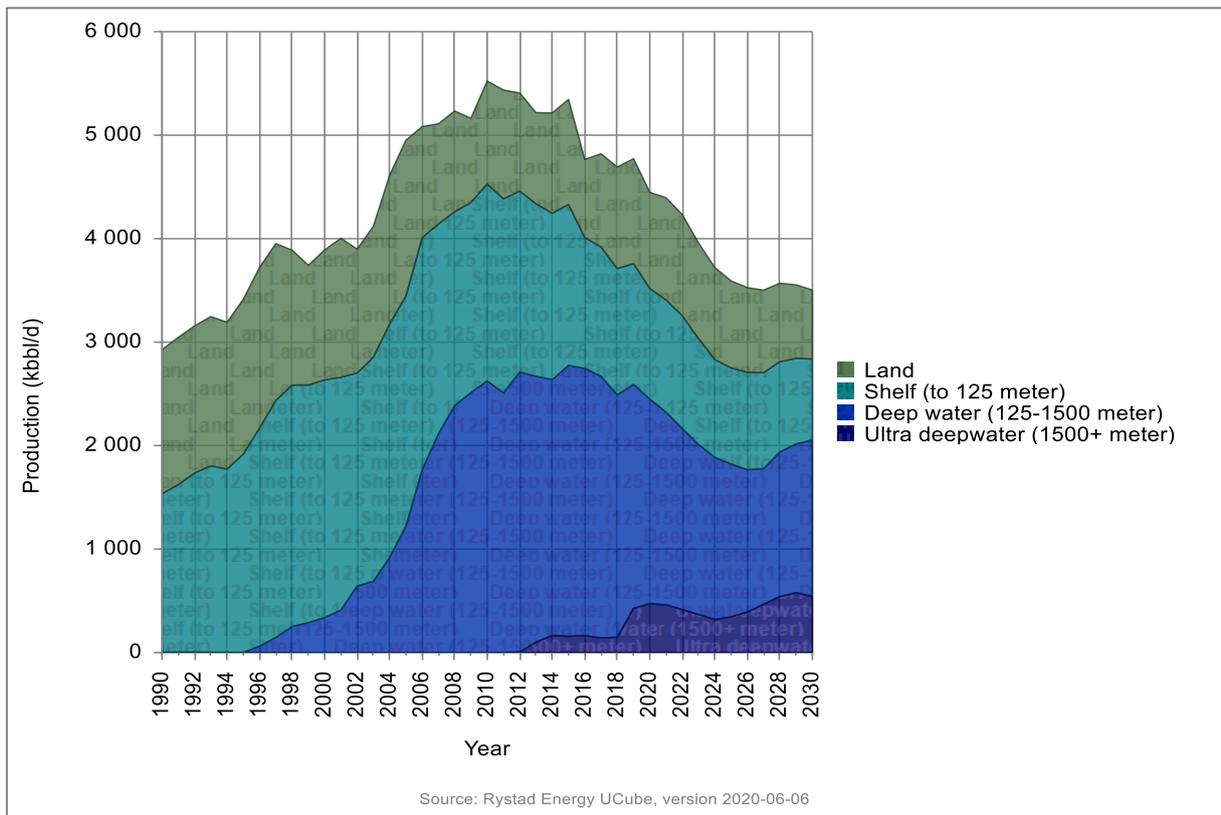


In the Gulf of Guinea, all the main current suppliers to the EU – Nigeria, Angola, but also the former French colonies of Gabon and Congo-Brazzaville, the latter having reached a peak in 2019<sup>30</sup> – are doomed to a more or less steep drop in production over the 2019 – 2030 period, according to Rystad (Figures 34 to 38).

Offshore fields now account for a vast majority of West African production (figure 34), dependent on crude reserves that are increasingly technical and costly to develop. Historically, offshore production has often shown stronger growth followed by steeper declines than its onshore counterparts, as operators are eager to recoup massive initial investments<sup>31</sup>. This appears to be underway in Angola, where the rapid decline since 2015 might be halted from 2024 onwards by the development of new deep-water reserves (Figure 36).

Figure 34.

**West Africa liquid fossil fuel production, 1990 - 2030  
by water depth**



<sup>30</sup> As in the case of Algeria, the prospect of declining foreign currency resources in Nigeria, Angola or even Congo-Brazzaville is worrying given the potential instability of these countries already marked by long episodes of civil war – in the case of Congo-Brazzaville, the conflict in the 1990s was closely linked to disputes over French networks of occult political funding, cf. Matthieu AUZANNEAU, *Or Noir, la grande histoire du pétrole*, op. cit., p. 509 and sq.

<sup>31</sup> A typical example is the sharp increase in UK extraction in the North Sea from 1974 (in the aftermath of the first oil shock) until 1999, followed by an equally rapid decline in the 2000s.

Figure 35.

**Nigeria liquid fossil fuel production, 2010 – 2040  
by life cycle category**

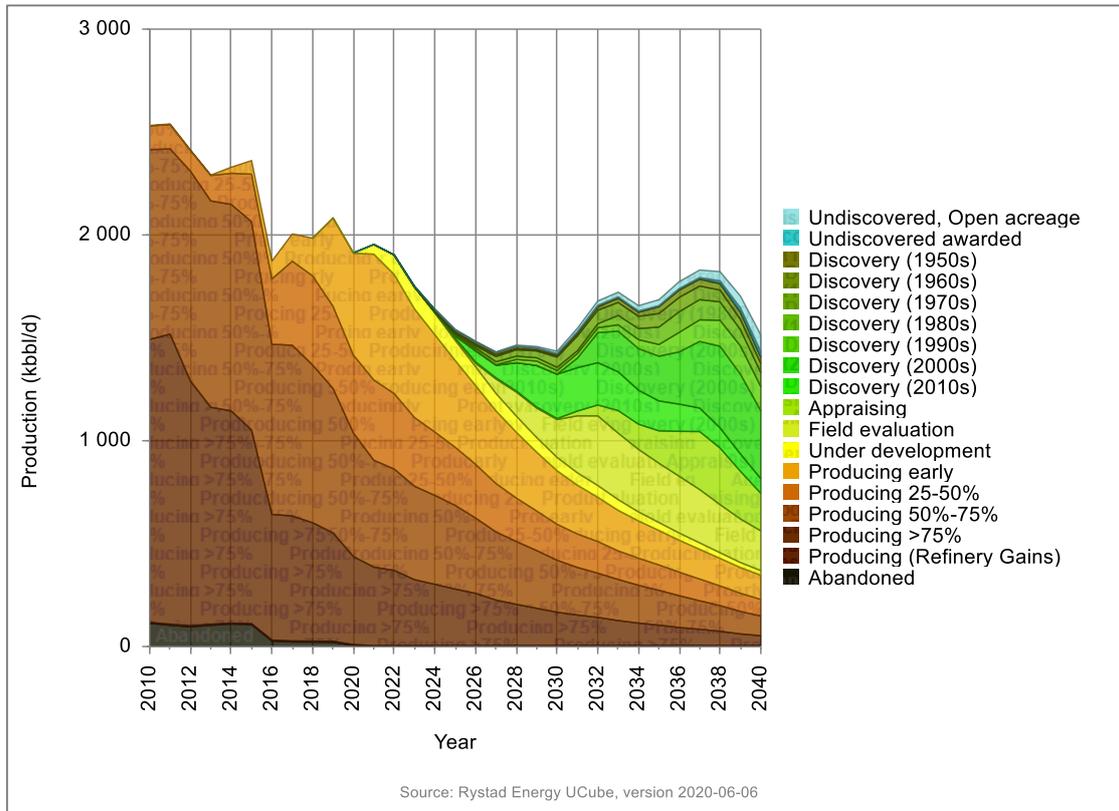


Figure 36.

**Angola liquid fossil fuel production, 1980 - 2040  
by water depth**

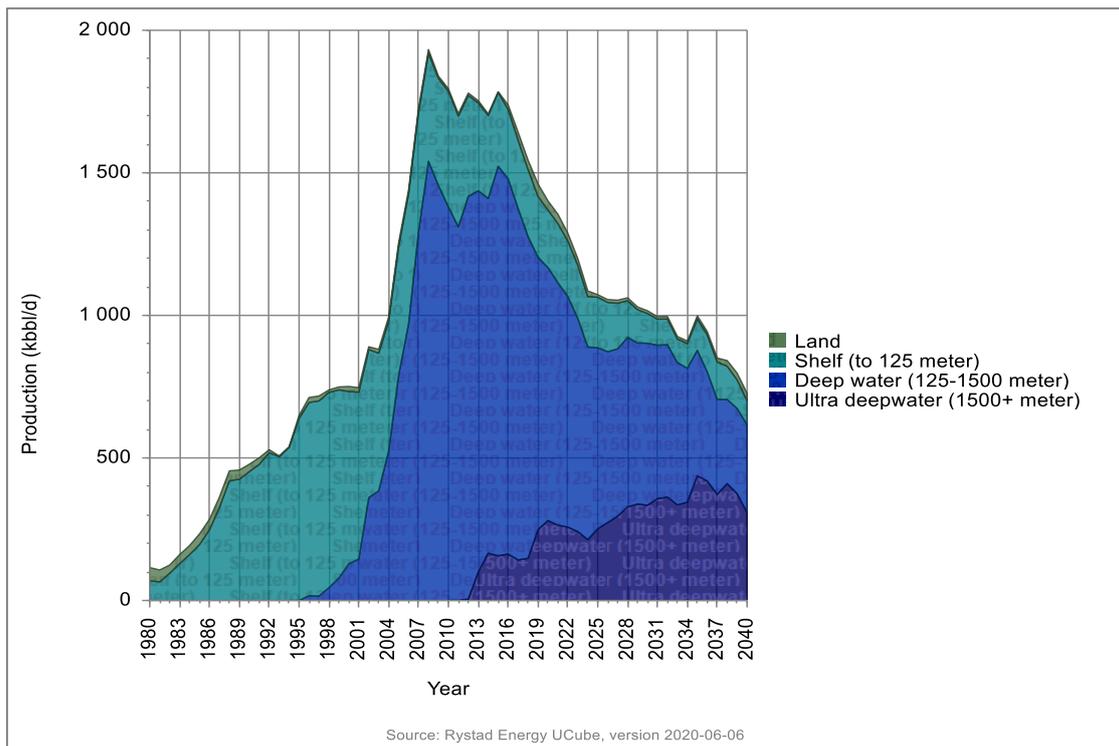


Figure 37.

**Gabon liquid fossil fuel production, 2010 – 2040  
by life cycle category**

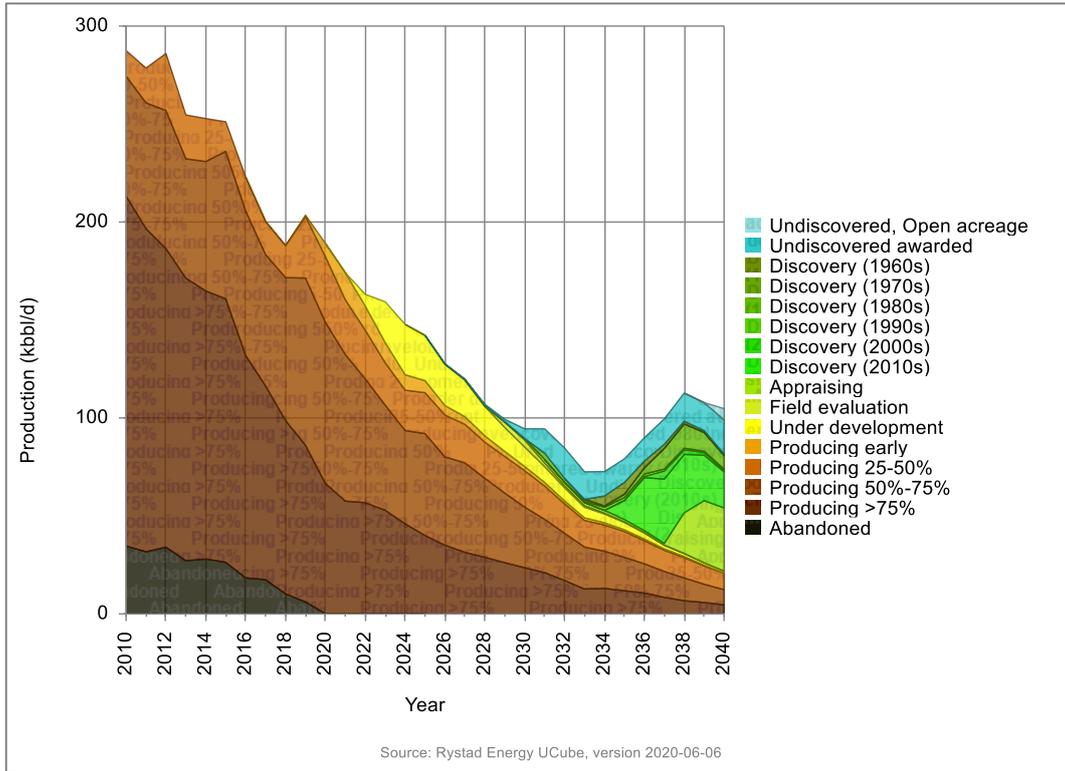
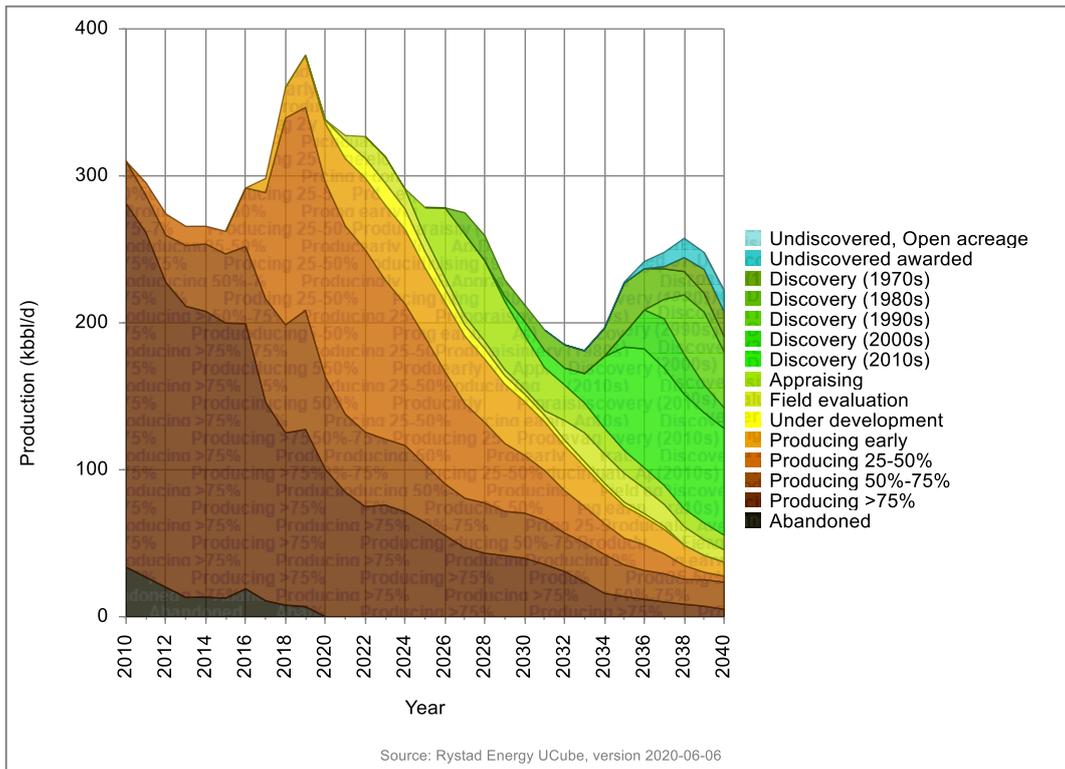


Figure 38.

**Congo-Brazzaville liquid fossil fuel production, 2010 – 2040  
by life cycle category**



### 3- Analysis

#### a. Possible decline by 1% to nearly 8% of EU's current oil supply sources between 2019 and 2030, all other things being equal

For this analysis, we have weighted the evolution of the production of the main countries supplying the European Union with liquid fossil fuel, according to the weight (in tons) of each of these countries in the overall supply of crude oil and petroleum products to the EU in 2018<sup>32</sup>.

The combined total output of all these major EU suppliers accounted for more than three-quarters of total global production in 2019.

From one year to the next, the shares of each supplier country fluctuate within a limited range, both for the EU as a whole and for each individual Member State. In fact, the distribution of import sources for a given country is highly structured and constrained both by geographical proximity and by historical relationships – chosen or imposed – between suppliers and customers. For example, roughly three-quarters of the oil consumed in Poland comes from Russia (generally speaking, Eastern Europe is highly dependent on crude oil extracted in Russia and Kazakhstan).

Over the last decade, the most striking development is obviously the introduction of American tight oil on the European market (see *Figure 39* for the cases of Germany and France). However, the United States still holds a limited position on the EU market: 2 % of supplies in 2018<sup>33</sup>, probably around 4-5% in 2019<sup>34</sup>, and probably far less in 2020<sup>35</sup>. This is primarily explained by the fact that the United States, the world's largest oil consumer, remains a massive importer of crude oil (around 4 Mb/d of net imports in 2019<sup>36</sup>, i.e. slightly less than the equivalent of the total production of Canada, its first foreign supplier).

On the other hand, at any given point, the shares held by the different supply sources vary greatly between individual EU Member States. *Figure 39* compares the sources for Germany and France<sup>37</sup>. Germany remains highly dependent on Russian oil, and imports very little crude from Algeria, whereas France is a major client of Algeria. While buying much less from Russia than Germany, it imports a substantial part of its crude oil from former USSR countries taken together.

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<sup>32</sup> As of June 2020, year 2018 is the most recent year for which Eurostat provides consolidated data on crude oil and petroleum products, in tons, by country of origin, for the EU as a whole.

As the level of global oil production was practically even between 2018 and 2019, the extrapolation from the shares of EU source countries for 2019 gives the same results as those provided by the historical data for the whole of the EU currently available for 2018, but not beyond.

This extrapolation overlooks the only two major changes in world production between 2018 and 2019: Compared to the reality of market shares in the EU in 2019, it probably overestimates slightly the share of Saudi Arabia's supplies (due to Saudi Arabia's policy of limited production reduction in 2019), and underestimates the impact of sustained strong production growth in the United States (this, however, is limited in view of the distribution of EU supplies, as North American oil still has a low market share in Europe).

<sup>33</sup> *Idem*. See also *figure 38* for Germany and France.

<sup>34</sup> *Idem*. For 2018 and for the United States, the consolidated values in tonnes for all petroleum products give shares in supplies significantly lower than the data in barrels and for crude oil alone\*.

<sup>35</sup> Given the collapse of production and investment in the United States during the COVID-19 crisis; in May 2020, American imports were increasing sharply, in particular from Saudi Arabia, cf. Derek BROWER, Anjli RAVAL, "US crude imports surge as Saudi oil armada arrives", *Financial Times*, May 28, 2020.

<sup>36</sup> US Energy information administration (EIA).

<sup>37</sup> Eurostat data available for 2019 in barrels of crude oil, by country, by oil region and / or by type of crude oil (data not available in May 2020 for 2019 in consolidated form, for the whole of the EU, in tons and for raw and refined products, see note 21).

Figure 39.

**Ex-USSR major oil producing countries, Algeria & US's  
shares of Germany & France supplies**  
(Eurostat, 2020)

<b>Oil supply %age by source country</b> (Eurostat - The Shift Project)		<b>RUSSIA</b>	<b>KAZAKHSTAN</b>	<b>AZERBAIJAN</b>	<b>ex-USSR</b>	<b>ALGERIA</b>	<b>US</b>
<b>Germany</b>	2015	40%	9%	7%	56%	4%	1%
	2018	35%	10%	3%	48%	1%	5%
	2019	29%	8%	3%	40%	1%	6%
<b>France</b>	2015	8%	15%	7%	29%	8%	0%
	2018	14%	16%	2%	32%	10%	3%
	2019	12%	15%	3%	30%	12%	8%

Figure 40 summarizes the extrapolation, over the 2019 – 2030 period, of the future production profiles of the main EU supplier countries expected by Rystad Energy, classified along the categories presented in the previous section, based on the weight of each country in EU supplies in 2018.

In particular, Figure 40 shows that more than half of the EU's supply sources in 2018 are expected to experience a production decline between 2019 and 2030.

Figure 40.

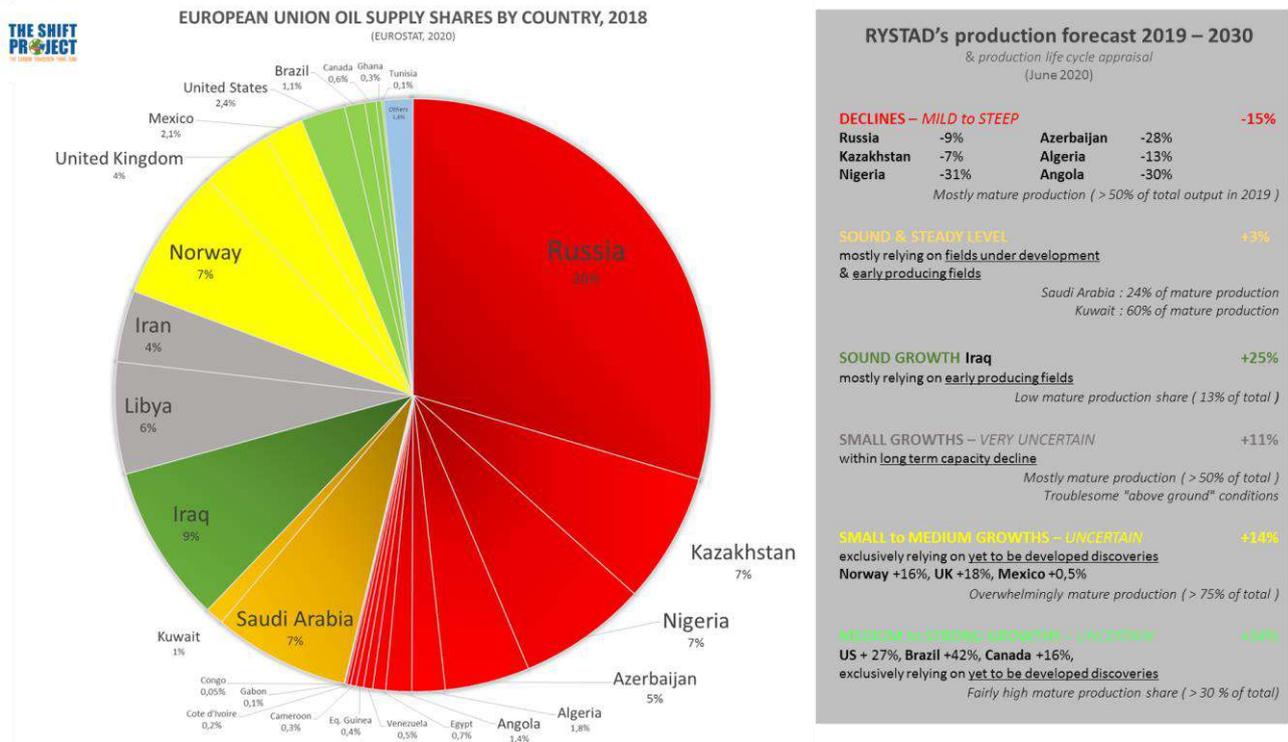


Figure 41 details the year-by-year evolution of the production profiles of each of the main EU supplier countries, weighted on the basis of their contribution to supply in 2018.

Figure 42 summarizes this evolution for the years 2019 and 2030 only and by categories of analysis.

Figure 42 shows three slopes of trend development between 2019 and 2030 for EU's main sources of supply in 2018, other things being equal:

- Trend 1: slope of decline if all Rystad Energy's predictions come true;
- Trend 2: slope of decline if uncertain growth trends are neutralized (null growth in output of all countries in these two categories);
- Trend 3: slope of decline if all uncertain and highly uncertain growth trends are neutralized.

Figure 41.

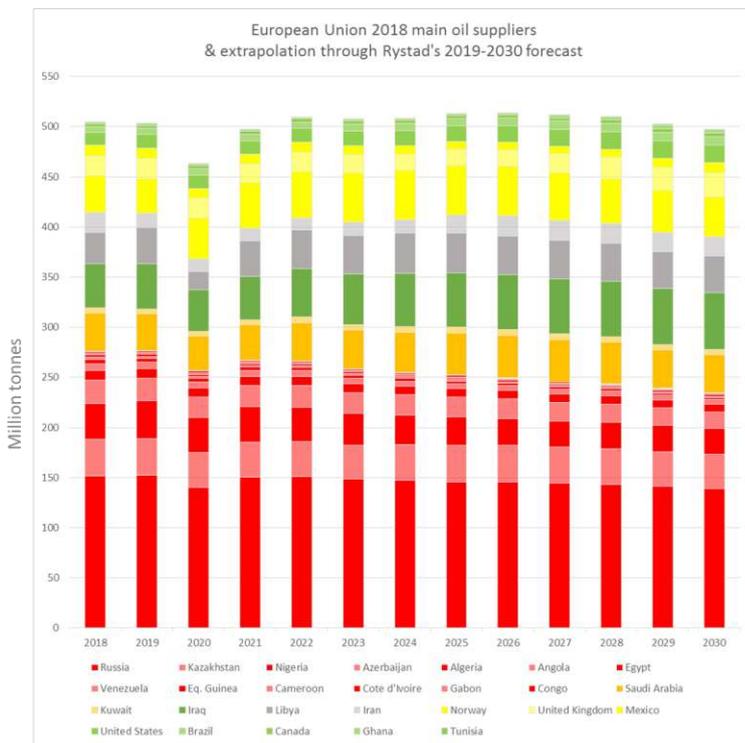
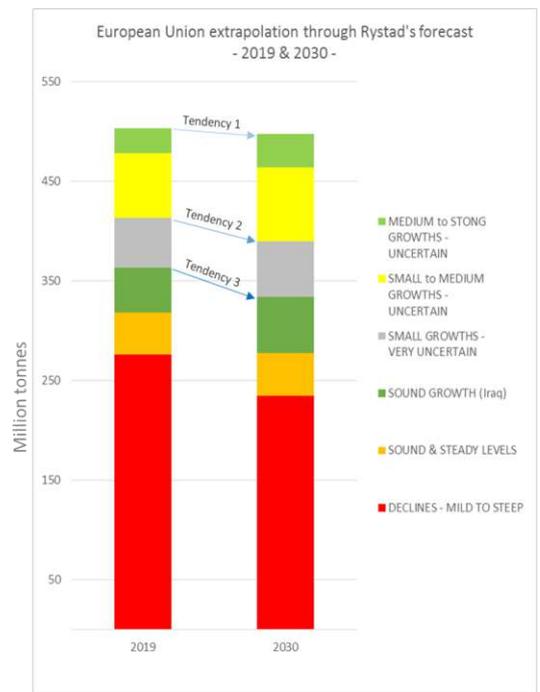


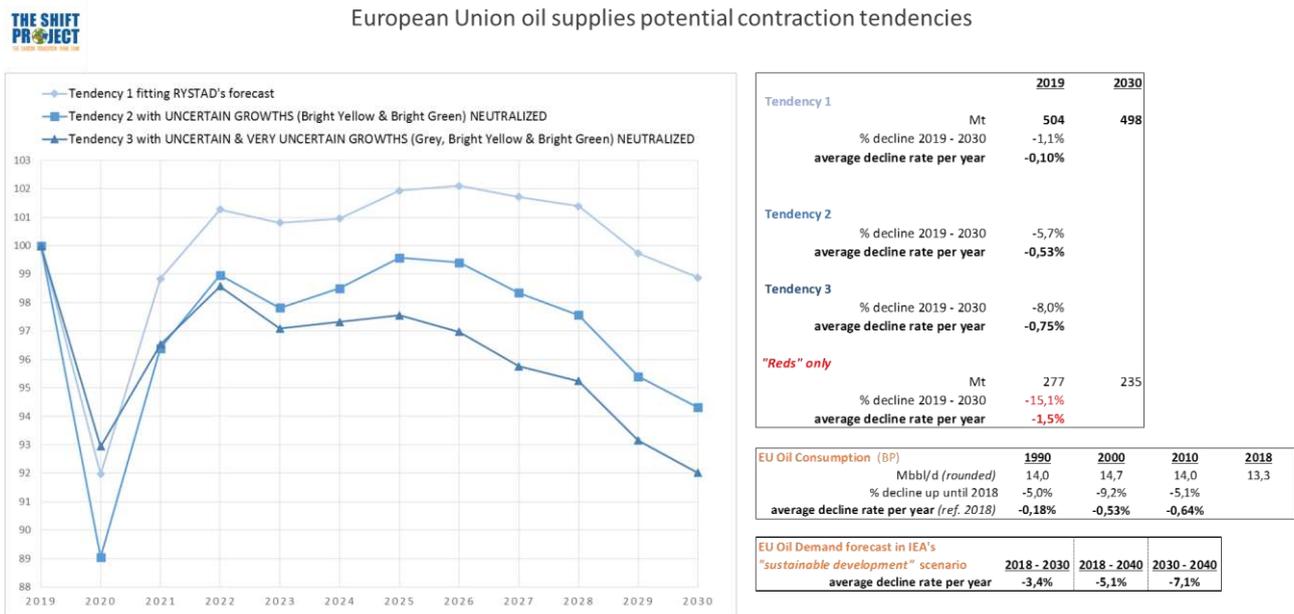
Figure 42.



These declining trends, other things being equal, are described in *Figure 43*, and compared to:

- the annual decline rate of oil consumption in the EU over the past decades ;
- the annual decline rate in oil consumption in the EU required to meet the commitments made under the 2015 Paris climate agreement, according to the “sustainable development” scenario of the IEA.

Figure 43.



The above reported trends lead to a contraction, all other things being equal, of all major EU supply sources in the range of 1 to almost 8% over the 2019-2030 period.

Trend 1, which strictly extrapolates the production profiles expected by Rystad, gives a very limited annual decline rate (- 0,10 %) that is slightly lower than the rate of decline in consumption (- 0,18 %) observed in the European Union since 1990.

Barring any new unexpected technical or geological event on a scale comparable to the *tight oil* boom since 2010, *Trend 1* can be considered as a *best-case scenario*, in the context of future prices imagined by Rystad Energy (see next section).

A contraction in EU supplies exceeding *trend 1* is to be feared if anything fails to happen along the lines of this best-case scenario, i.e. if part of the planned development in the country categories with uncertain growth prospects fails to happen, or if the fall in extractions in the category of countries facing an inevitable decline is sharper than expected.

If the uncertain and highly uncertain growth patterns do not come true, then *trend 3* displays a rate of decline (- 0,75 %) that is faster than the decline in consumption over the last decade, which is the most sustained ever observed in the European Union (- 0,64 %).

Reality will likely fit somewhere between these two trends, all other things being equal. The main other parameters that are not equal depend on the fungibility of supply sources and the evolution of solvent demand (*see following section*)

\*\*\*

The significant decline in oil consumption in the EU since 2010 was mainly achieved through energy efficiency gains and relatively easy substitution in transport and construction, as well as through a limited upswing in industrial activities versus the pre-2008 crisis period, a relative stagnation in the volume of freight transport by road, and a continued decline in some of the most hydrocarbon-intensive industries.

Maintaining this rate of decline over the next decade will be difficult.

Nevertheless, the targets stated by the EU, regarding both climate policies and energy transition, are relatively ambitious. Integrating these objectives, IEA forecasts a decline rate of 1.9% per year until 2030<sup>38</sup>, well beyond the expected evolution of supplier countries in the category of moderate to steep declines (see "*Reds*" only, figure 43). However, the oil exit targets announced in the EU, notably by Germany and France, have so far been systematically missed by far.

In order to comply with the climate objectives of the 2015 Paris Agreement, the decrease in oil consumption in the European Union should be around -3,4% per year until 2030, and above 5% per year by 2040<sup>39</sup>.

Thus, should the countries fail to implement climate policies at the proper pace, they will most likely be overtaken by the "broom wagon" of peak oil<sup>40</sup>.

<sup>38</sup> International Energy Agency, *World Energy Outlook 2019*, cf. table 3.2, p. 134, "*Stated Policies*" scenario; table reproduced in figure 46.

<sup>39</sup> *Ibid.*, "*Sustainable development*" scenario; see also The Shift Project, "COP22 | Global emissions: - 5% per year now, or... impossible later ", November 18, 2016

<sup>40</sup> We will come back to this observation in the following part ("*A larger picture*"), as well as in the conclusion.

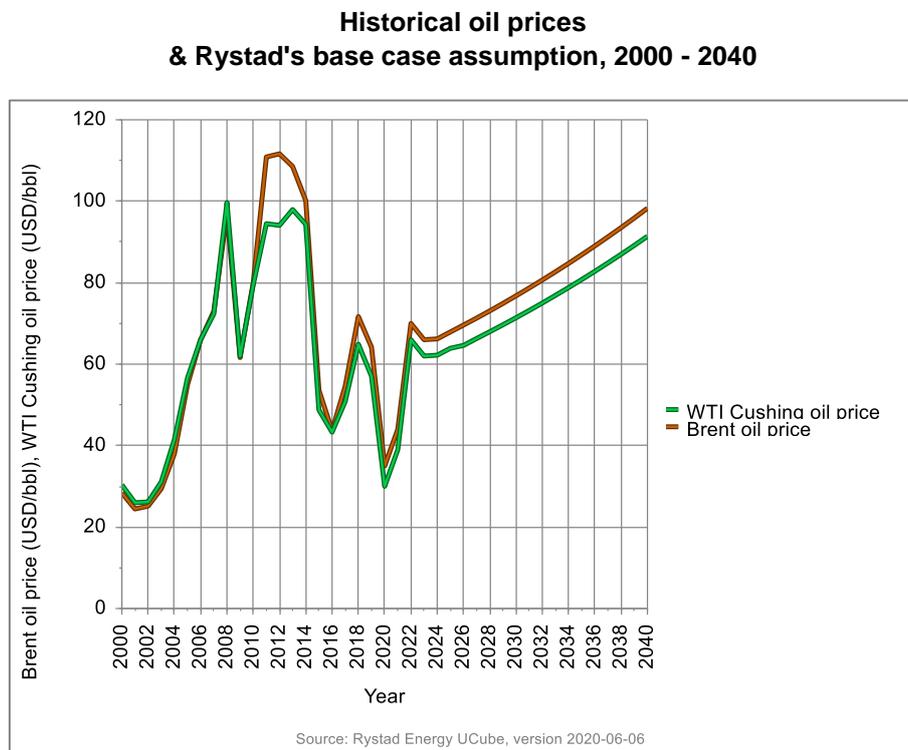
## b. A risk aggravated by plausible price volatility and by strong growth in demand from emerging countries

### i. Crude oil price stability, demand solvency: a delicate balance

Price evolution assumptions are of course crucial in economic scenarios: this applies not only to price levels, but also to their degree of volatility.

As noted in the introduction, Rystad anticipates a steady rise in barrel prices after the COVID-19 crisis. The rise should be strong from 2021, up to 70 dollars in 2022, then steady until 2030, approaching USD80 at that date (Figure 44).

Figure 44



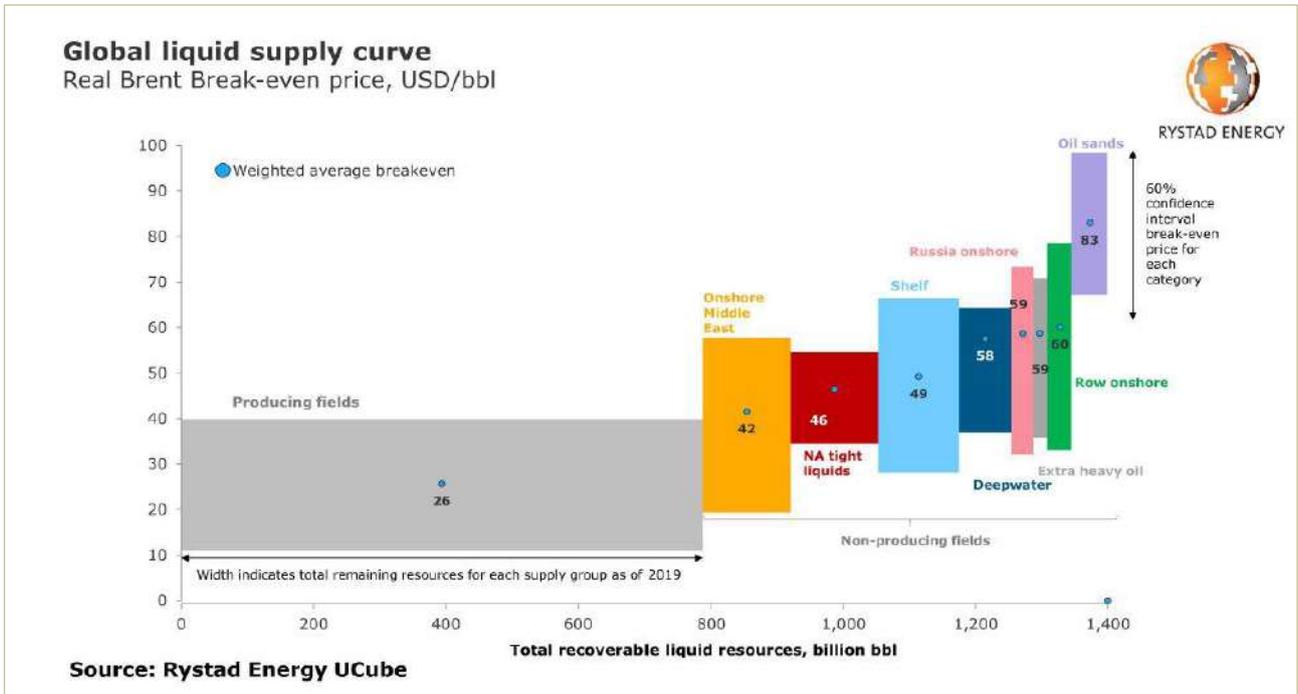
This situation of both rising and low-volatility prices is the best case for securing the long-term investment policies that are required for heavy industries. This is certainly not the configuration that has prevailed since the 2008 crisis (a year also marked by the passing of the peak of conventional oil).

In the context of high volatility over the past few years, the speed with which tight oil wells can be brought on stream (a few months, whereas several years are needed for conventional oil wells) has contributed to the emergence of this new form of non-conventional oil. The short duration of investment cycles which is specific to tight oil was a major reason why, from 2018 onwards, American majors Exxon and Chevron joined this sector; these companies are also facing serious difficulties in securing their investments, mainly because of the volatility (and therefore the unpredictability) of the price of crude oil.

The volatility of prices has, on the other hand, worked against investments in other non-conventional forms of oil, notably Canadian oil sands, and in the most technical conventional oils, particularly deep offshore.

Based on the break-even prices estimated by Rystad Energy for 2019, the expected price evolution over the next decade should in principle allow “getting everyone back on track” (Figure 45).

Figure 45.



Rystad Energy displays a high confidence level (significantly more so than the IEA) in the geological and economic potential of tight oil. However, the extreme volatility of crude oil prices since 2008 – still amplified by the COVID-19 crisis – and its negative impact on investment policies, prompts us to regard with caution any assumption of steadily increasing prices until 2030.

The unprecedented level of uncertainty that characterizes the state of demand supports the opposite assumption of a persisting volatility.

In fact, this uncertainty is in no way (not yet?) due to a global “peak demand”, which has hardly begun in Western Europe and Japan, and which still depends, among other things, on a possible significant rise in the use of electric cars. Such uncertainty primarily relates to the solvency of global oil demand when prices per barrel rise.

In the United States, since 1945, 10 out of 11 episodes of recession were preceded by a surge in oil prices<sup>41</sup>. The 2008 crisis coincided with the peak of an unprecedented surge in crude prices in the previous years (a symptom of the beginning of the end of "easy oil")<sup>42</sup>. The "quantitative easing" monetary policies implemented as a result of the crisis mainly caused an explosion in outstanding debt; yet one of its side effects was undoubtedly to give a crucial boost to the tight oil boom, which requires massive amounts of borrowed capital (see *Figure 3*).

When the US central bank started restricting its quantitative easing policy in 2014, it triggered a collapse in oil prices and in the prices of all major commodities. Such a development, the other way round this time, highlights the importance of the question of demand solvency, as in this case demand is less able to rely on the crutch of a particularly accommodating monetary policy<sup>43</sup>.

After the COVID-19 crisis, this same question will re-emerge<sup>44</sup>: how to achieve the delicate balance between decently high and stable crude oil price levels, enabling oil companies to make up for the current production decline, and the potentially recessive impact of high oil prices, leading to a chronic instability of prices?

Such a balance is likely to become still more difficult to achieve: the burden of the debt is heavier than ever before, thereby increasing the risk of more erratic economic events, and vicious circles such as debt deflation.

It is hard to run on a treadmill when the stride is irregular.

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<sup>41</sup> James D. HAMILTON, "Historical oil shocks", *Routledge Handbook of Major Events in economic History*, Routledge, 2013, p. 239-265

<sup>42</sup> There may be a link, explored in various publications, between the bursting of the *subprime* bubble and the previous historic boom in crude prices: firstly because of constraints exerted on the budget of low-income households in the United States by the prices of gasoline and fuel oil; secondly, and perhaps above all, through the crushing between 2004 and 2006 of the *spread* between stable American mortgage rates and the increase in the Fed's key interest rate, decided in the name of an inflationary risk induced by an increase in the price of a barrel of a scale and a duration never seen before.

<sup>43</sup> The limitation, then in October 2014 the termination of the third phase of *quantitative easing* by the American Federal Reserve played on the strong rise of the dollar against most other major currencies from June 2014. This rise in the dollar coincides with the simultaneous slip in prices for oil and many other commodities generally quoted in dollars. In many major economies outside the United States, the appreciation of the dollar has led to an increase in supply costs, and therefore to a downward pressure on the demand for oil and other essential commodities, as well only on their derivative products and major dependent services.

<sup>44</sup> To illustrate the currently extremely high level of uncertainty affecting the price evolution forecasts, one can mention an analysis published in March 2020 by J.P. Morgan, claiming that the barrel price could reach USD190 in 2025, due to a persistent lack of investment over the last years, and to the potential supply shortfall that would ensue. Such unprecedented levels have already been forecast before and after the 2008 crisis, but have never been reached to this day.

Analysis cited in Cattle Drive Capital, "\$190 Oil? J.P. Morgan Thinks It's Possible", cf. <https://seekingalpha.com/>.

ii. Expansion of aggregate demand:  
Possible strong competition from Asian demand

Regardless of its solvency against a sustained rise in oil prices that is necessary for producers, it is to be expected at this point that demand for liquid fuels from emerging countries, primarily China and Asia, and to a lesser extent Africa, will continue to increase significantly. Such is the assumption of the IEA in its " *Stated Policies*" scenario (Figure 46).

If this hypothesis is verified, it means that the European Union will necessarily more or less have to compete for its supplies, mostly with China (which already imports roughly as much crude as the whole of Europe excluding Russia<sup>45</sup>), but also with all emerging countries, in particular from Asia and Africa.

This well-known decisive parameter of demand expansion is aggravated by the decline of both African and Asian oil production (Figure 47), which is expected to continue – particularly in China, a hitherto major producer, which entered a marked decline after 2015 (Figure 48), but also in India, a second-tier producer, which entered a decline after 2017. In total, the volume of additional demand from Africa and Asia Pacific expected between 2018 and 2030 is impressive: + 8 Mb/d, while local productions are about to contract by 3.2 Mb/d over the period, according to Rystad (figure 49). The additional demand from Asia-Pacific and Africa would thus exceed 11 Mb/d over the period, i.e. roughly the equivalent of the EU's total current consumption<sup>46</sup>.

It should be noted that the forecasts published by the IEA before the COVID-19 pandemic also predicted that African and Asian productions would decline, but to a much lesser extent<sup>47</sup>.

Given that China has large foreign exchange reserves, a powerful oil industry and good relationships with many major producers, particularly in Iraq, Iran, Russia, and around the Gulf of Guinea, a competition between the solvency of future Chinese demand (+3, 1 Mb/d alone between 2018 and 2030, according to the IEA) and that of EU countries would probably be risky for the latter - particularly for countries such as France, whose economies seem to be the most vulnerable, with both large imports and high levels of debt).

<sup>45</sup> BP, *Statistical Review of World Energy 2020*, op. cit.

<sup>46</sup> Consumption of the European Union in 2018 according to IEA, see figure 46.

<sup>47</sup> Based on slightly different statistical categories of liquid fuels, the IEA concluded in its annual report published at the end of 2019 that production in Asia Pacific would drop between 2018 and 2030, but significantly less than predicted by Rystad Energy in May 2020 (IEA, November 2019: - 14.5%; Rystad, May 2020: - 27%). The same goes for Africa (IEA, November 2019: - 3.6%; Rystad May 2020: - 12%). We chose to retain only the Rystad data, firstly for the sake of clarity and consistency of the production figures analyzed, and secondly because of the lack of transparency in the assumptions used in the AIE (cf. *World Energy Outlook 2019*, pp. 140-142). In the next section, we will return to the difficulty in assessing the IEA forecasts, due to their lack of detail.

Figure 46.

**Table 3.2 ▸ Oil demand by region and scenario (mb/d)**

	2000	2018	Stated Policies				Sustainable Development	
			2025	2030	2035	2040	2030	2040
<b>North America</b>	23.5	22.8	22.5	21.5	20.3	19.1	17.7	11.7
United States	19.6	18.5	18.4	17.4	16.3	15.1	14.2	9.1
<b>Central and South America</b>	4.5	5.8	6.1	6.2	6.4	6.5	4.9	3.8
Brazil	1.9	2.4	2.6	2.7	2.8	2.8	2.1	1.6
<b>Europe</b>	14.9	13.2	12.4	11.1	9.7	8.7	9.2	5.0
European Union	13.1	11.1	10.1	8.8	7.4	6.3	7.3	3.5
<b>Africa</b>	2.2	3.9	4.9	5.5	6.2	7.0	4.9	5.2
South Africa	0.4	0.5	0.6	0.6	0.7	0.7	0.6	0.5
<b>Middle East</b>	4.3	7.5	8.4	8.8	9.6	10.2	6.7	6.3
<b>Eurasia</b>	3.1	3.9	4.3	4.3	4.2	4.2	3.8	3.1
Russia	2.6	3.2	3.4	3.4	3.3	3.2	3.0	2.4
<b>Asia Pacific</b>	19.4	31.6	35.8	38.0	38.9	39.2	32.4	25.4
China	4.7	12.5	14.5	15.6	15.6	15.5	12.7	9.3
India	2.3	4.7	6.4	7.5	8.4	9.0	6.5	6.1
Japan	5.1	3.6	3.0	2.7	2.3	2.0	2.3	1.2
Southeast Asia	3.1	5.3	6.3	6.6	6.9	6.9	5.8	4.7
<b>International bunkers</b>	5.4	8.2	9.3	10.0	10.7	11.4	7.6	6.4
<b>World oil</b>	<b>77.4</b>	<b>96.9</b>	<b>103.5</b>	<b>105.4</b>	<b>106.0</b>	<b>106.4</b>	<b>87.1</b>	<b>66.9</b>
<b>World biofuels</b>	0.2	1.9	2.8	3.5	4.1	4.7	6.3	7.7
<b>World liquids</b>	<b>77.6</b>	<b>98.8</b>	<b>106.4</b>	<b>108.9</b>	<b>110.1</b>	<b>111.1</b>	<b>93.4</b>	<b>74.6</b>

International Energy Agency, World Energy Outlook 2019

Figure 47.

**Asia Pacific & Africa liquid fossil fuel production, 2010 - 2030**

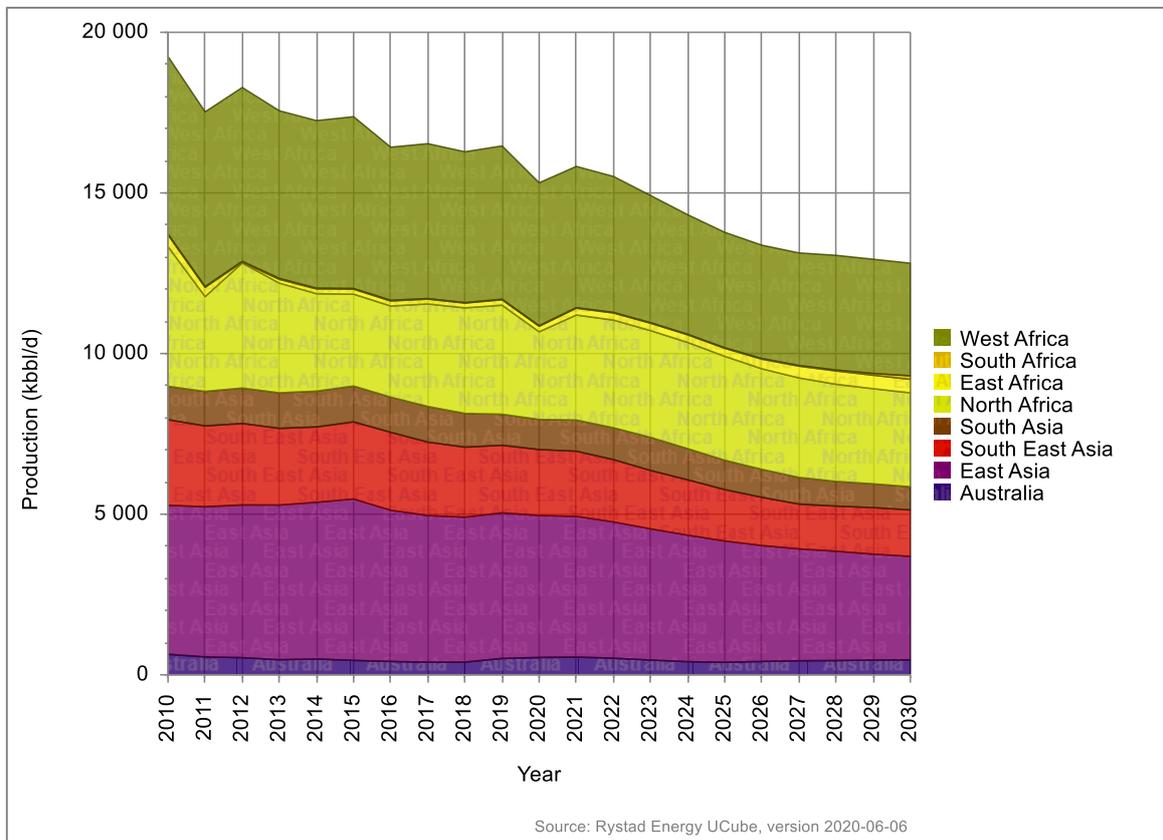


Figure 48.

**China liquid fossil fuel production, 2010 – 2030  
by life cycle category**

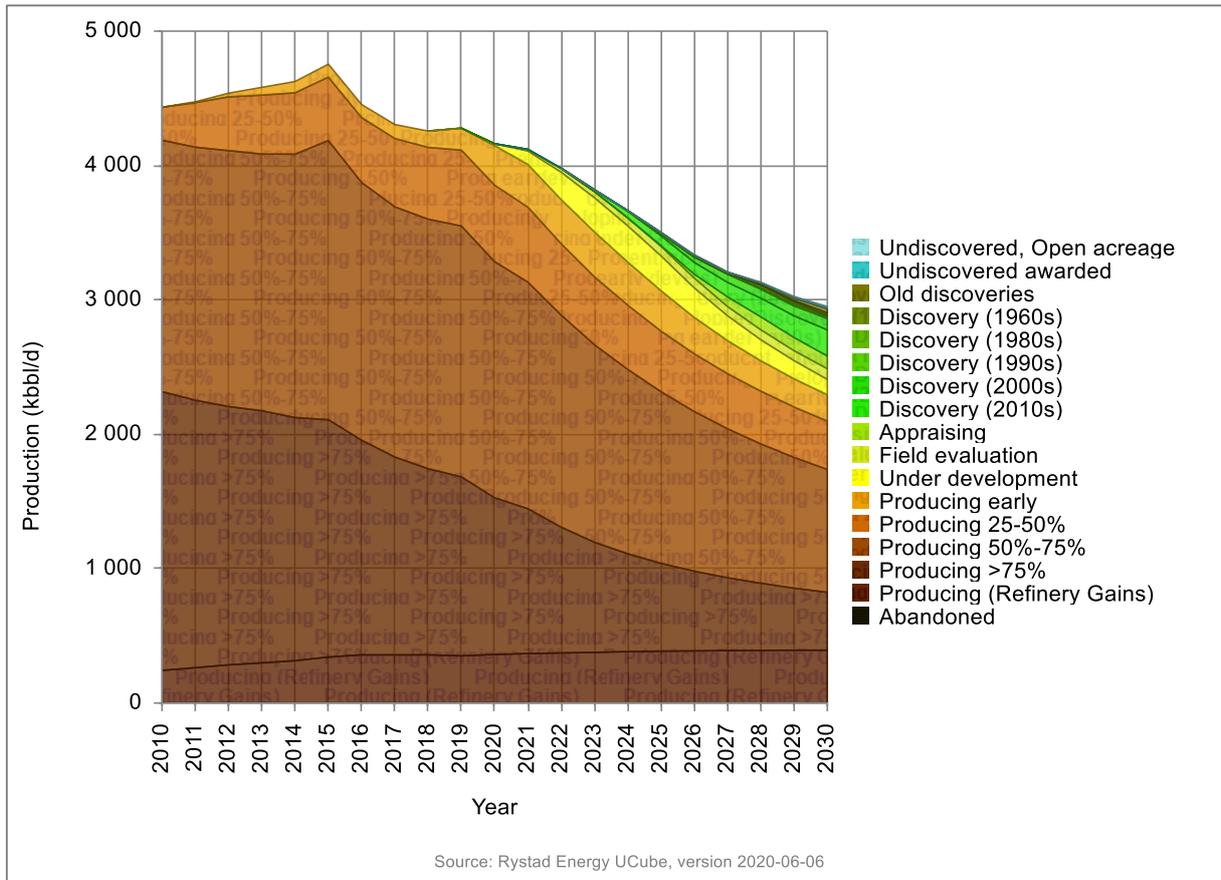


Figure 49.

**Oil production & demand scenarios 2018 - 2030**

Oil Demand, Mb/d	2018	2025	2030
IEA 11-19, "Stated policies"			
Asia Pacific	31,6	35,8	38
Africa	3,9	4,9	5,5
<b>2018 - 2030 TOTAL GROWTH</b>			<b>8</b>

Oil Production, Mb/d	2018	2025	2030
Rystad 06-20			
Asia Pacific	7,3	5,8	4,9
Africa	8,1	7,1	6,9
<b>2018 - 2030 TOTAL DECLINE</b>			<b>-3,6</b>

From this perspective of expanding demand from emerging countries, the likely future limits to the growth of crude oil production once again appear as the “broom wagon” in case of a failure or delay in climate-driven oil exit policies.

We have already highlighted the decline of global oil production outside the Middle East and North America by 2030 (*Figures 11 and 12*). The expected increase in Middle Eastern production may be largely absorbed by Asian demand. As for the United States, given its still massive net crude oil imports in 2019<sup>48</sup> and the large uncertainties regarding the future of the tight oil boom, it is likely that the projected increase in their production will be largely absorbed by its domestic demand.

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<sup>48</sup> See beginning of the previous section.

### III- *A larger picture:* a fatal trend, a major hazard for peace

#### 1- Geology and demography

Rystad Energy expects global production of liquid fuel to peak by 2035. This time frame is similar to that proposed by the most "optimistic" sources since the early 2000s, when the mass media started addressing the peak oil issue. In 2004, a study by the US Department of Energy suggested 2037. After taking into account the unexpected growth of tight oil, the French petroleum geologist Jean Laherrère, who in 1998 co-authored the exact prediction of a peak in conventional oil "*within ten years*<sup>49</sup>" and is considered as the "pessimistic" source of reference, suggested in the early 2010s that peak production for all forms of oil would occur around 2020.

The truth will likely fit somewhere between these two dates: now or in the middle of the next decade. As we pointed out in the introduction (*see also figure 50*), after 2026, production will only be sustained if large, but as yet hypothetical oil discoveries can be brought on stream.

The multiple and converging symptoms of physical, technical and economic limits to the future continuation of crude oil production, which have already appeared or are about to appear during this decade, are a source of concern: limits to the sources of immature oil, conventional oil, oil from onshore or shallow offshore sources, oil from large fields, and oil of median ("*regular*") chemical quality: *Figures 50 to 54*.

Considering the magnitude of the economic and geopolitical risks incurred in the event of unwanted and unanticipated shutoffs, the half-empty glass deserves the closest consideration.

Should we follow Rystad and adopt a central demographic hypothesis, we can then forecast that by 2060, each individual on the Earth would on average have half as much oil available as his or her ancestor of 1980 for a comparable global production. This "average" person would thus have to make do with the amount of oil available per capita in 1950. His or her children would have even less, and so on.

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<sup>49</sup> Colin J. CAMPBELL, Jean H. LAHERRÈRE, "The end of cheap oil", *Scientific American*, March 1998, p. 78-83.

Figure 50.

**World liquid fossil fuel production, 1960 – 2060,  
by life cycle category**

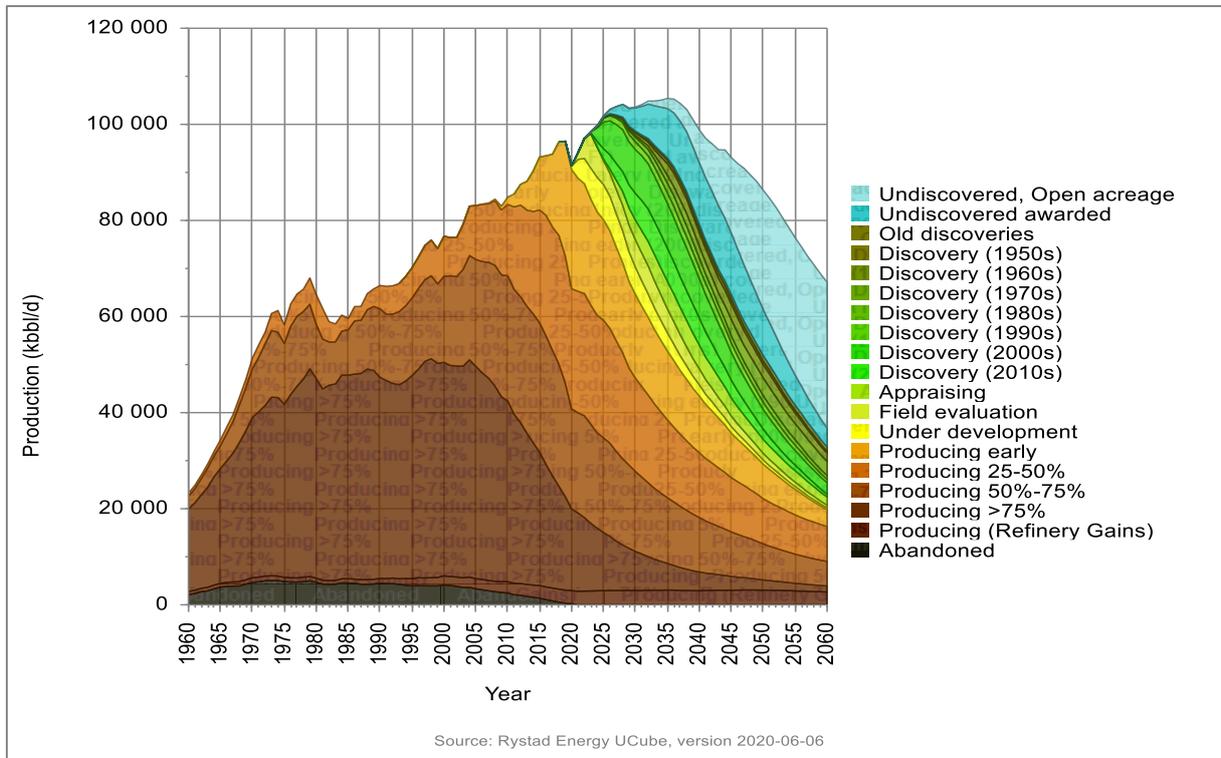


Figure 51.

**World liquid fossil fuel production, 1960 – 2060,  
by unconventional category**

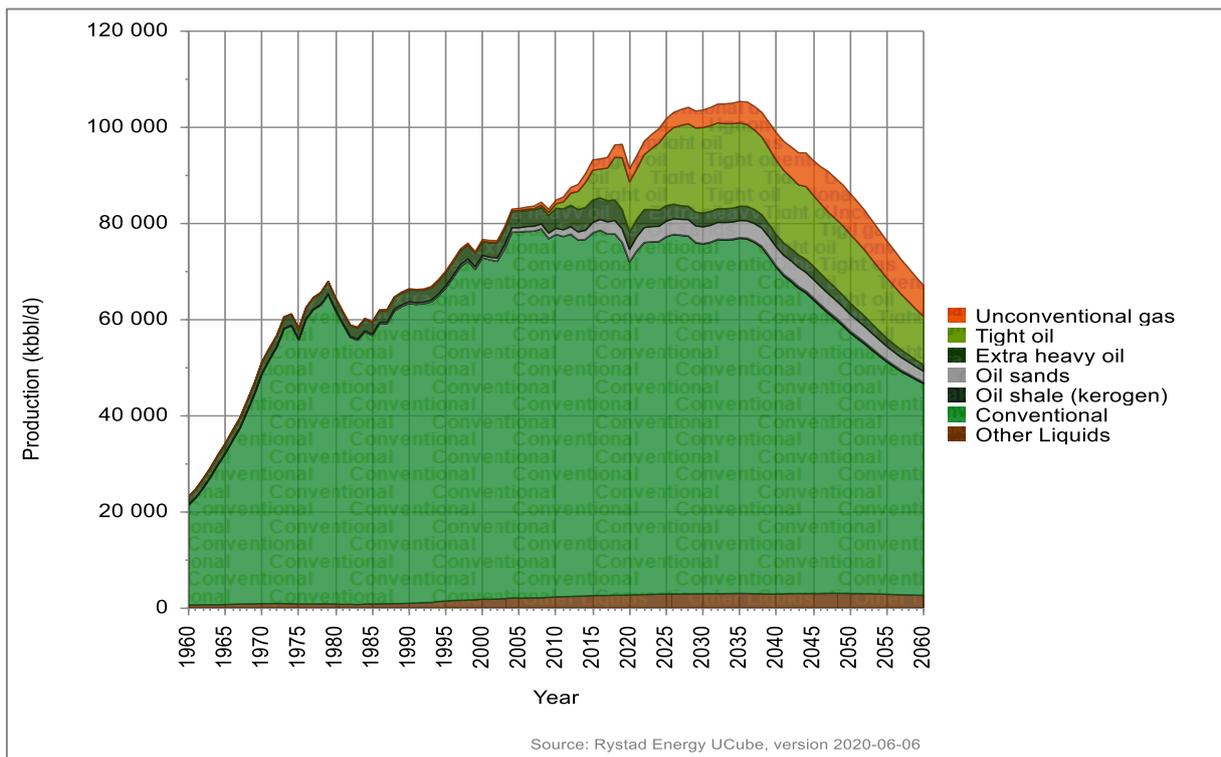


Figure 52.

**World liquid fossil fuel production, 1960 - 2060  
by water depth**

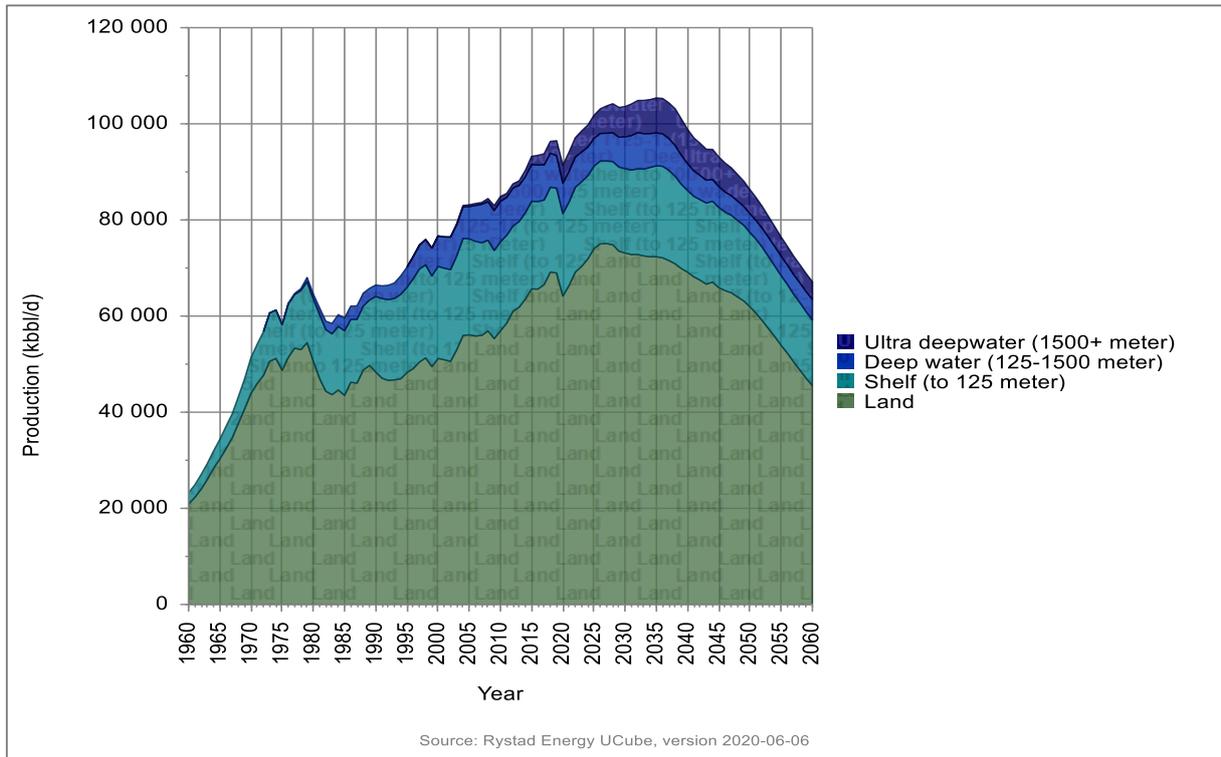


Figure 53.

**World liquid fossil fuel production, 1960 - 2060  
by field size**

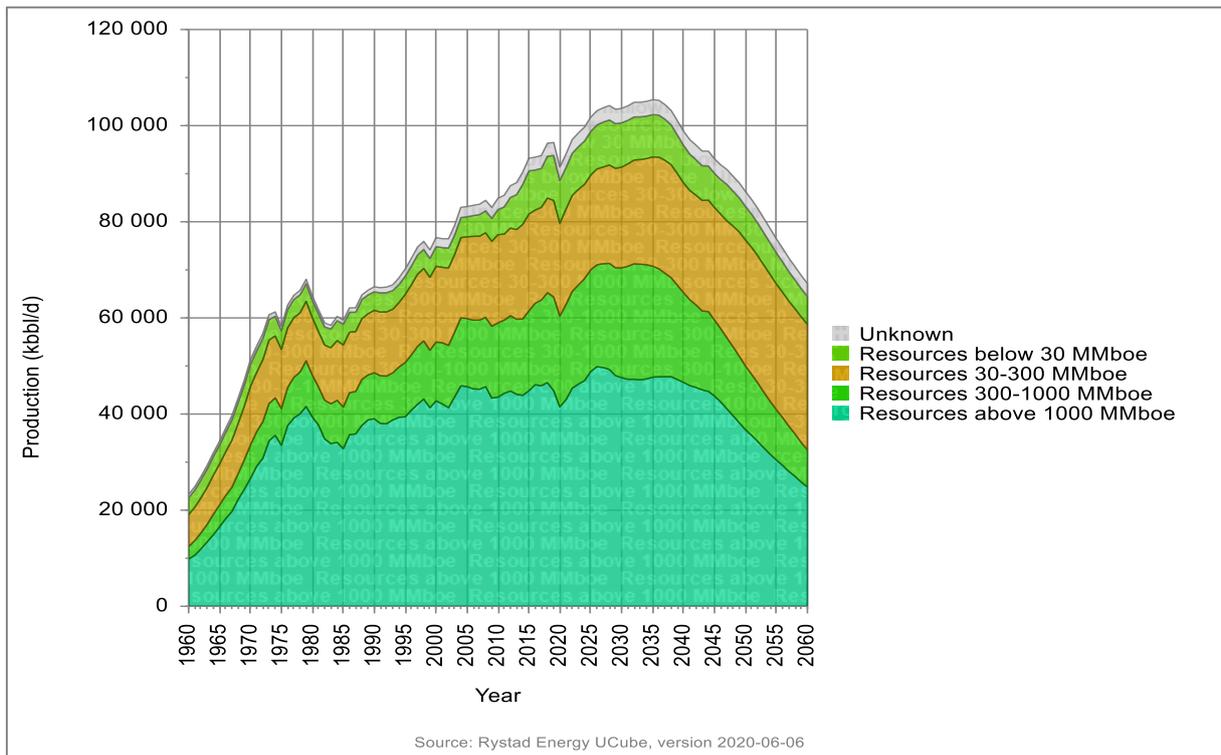
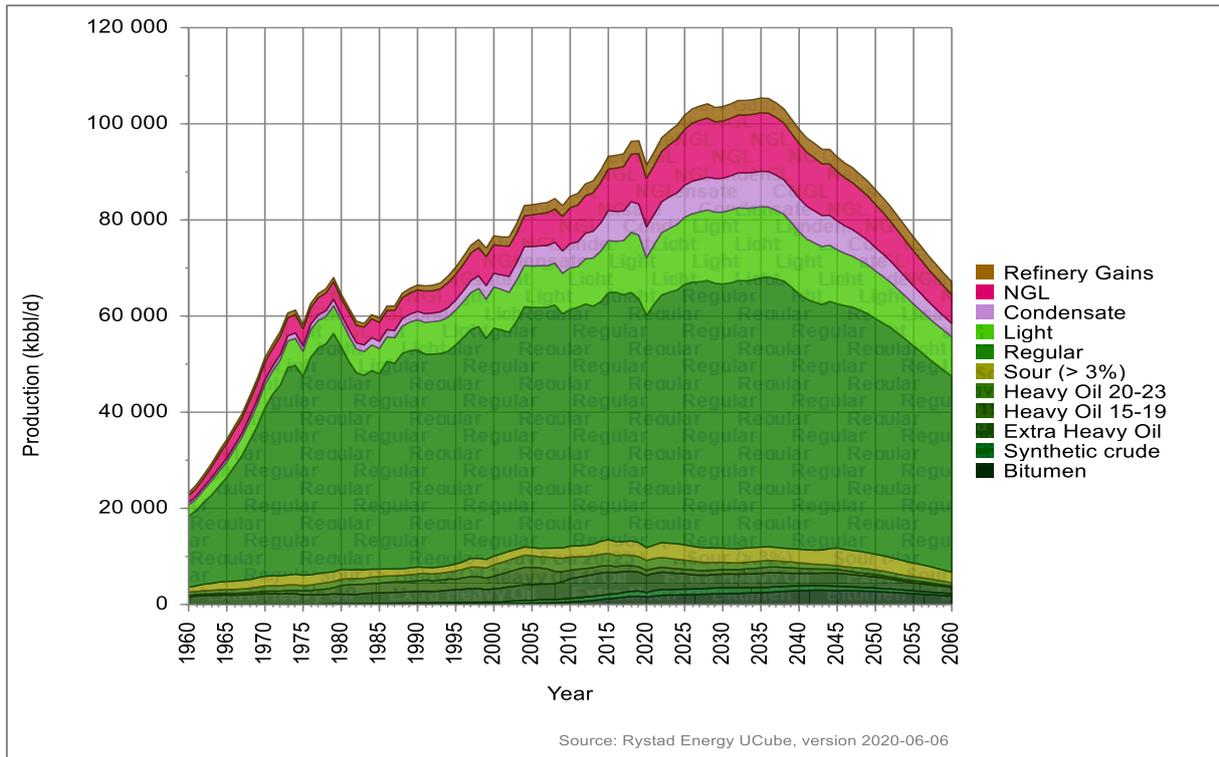


Figure 54.

**World liquid fossil fuel production, 1960 – 2060  
by chemical quality**



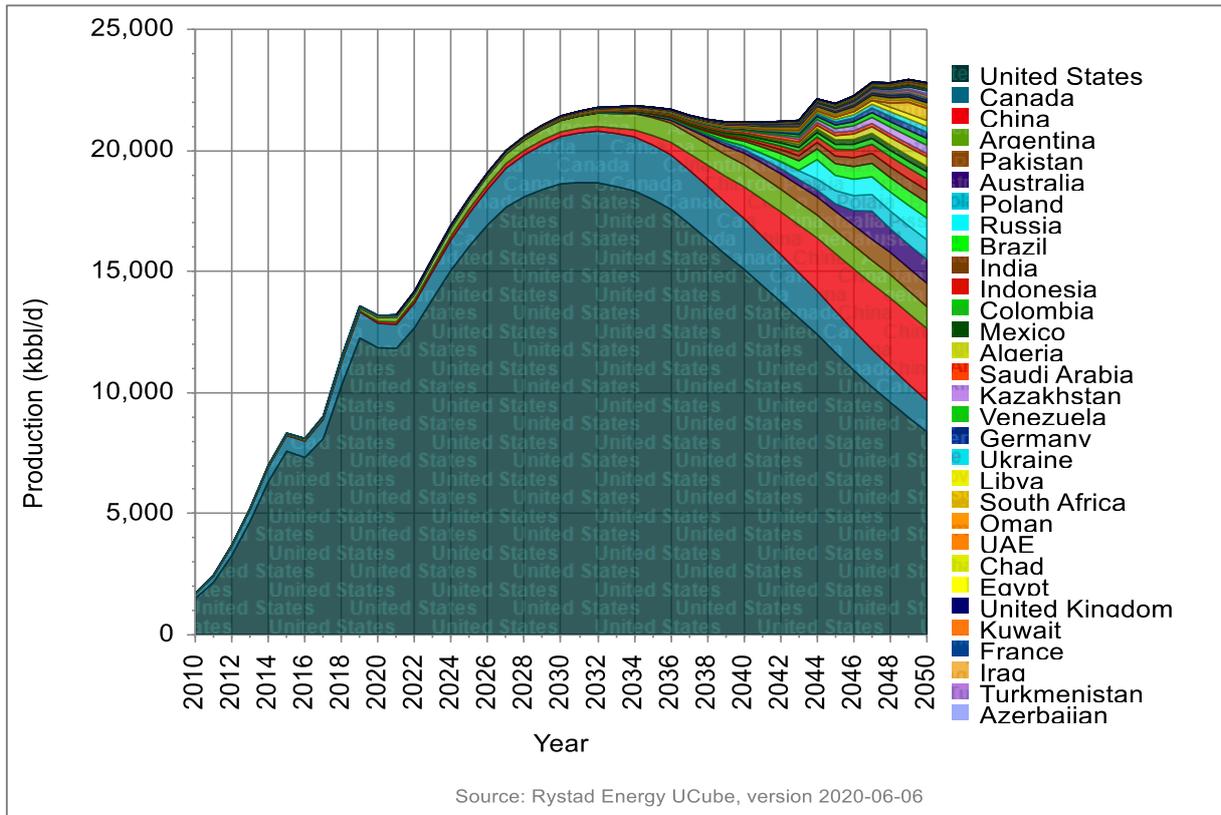
Picking the ripest, low-hanging fruit first is a universal trend. The term “black gold” reflects the fact that in its heyday in the middle of the 20th century, the oil industry enjoyed an unparalleled advantage: very low marginal capital costs were needed to sustain and even increase production, as most conventional crude oil production from large, relatively easily accessible fields was very recent.

These days are largely over, and for most oil companies, oil hardly even deserves its “black gold” nickname anymore: the production of all alternatives to "easy oil" is expensive to implement and sustain.

Considering the impressive hydrocarbon production boom allowed by the fracturing of low-permeability rock since 2010, Rystad expects this boom to resume in the United States from 2021, until the peak for American tight oil and "shale gas" liquids is reached in 2031. According to Rystad's highly speculative projection, the incipient decline would be conveniently offset by multiple, yet much smaller, tight oil booms, in China (in the form of liquids from shale gas wells), Argentina, India and Pakistan - but not in Russia, where tight oil production would remain very marginal, at least until 2040 (Figure 55).

Figure 55.

**Liquid fuel production from tight oil and unconventional gas, 2010 - 2050  
by country**



This assumption of a continued *tight oil* boom is actually a bold one, if we recall that, after a decade of massive and overall loss-making investments to reap the low-hanging fruit of this new tree, the industry seemed, at the end of 2019, to be about to finally achieve economic balance, yet only at the price of a notable investment reduction in future production.

According to Rystad, even under such bold assumptions, which also apply, to a lesser extent, to other unconventional (oil sands) or extreme (deep offshore) forms of oil, production will no longer be maintainable in about fifteen years' time. That is, in two investment cycles for conventional oil, i.e. the day after tomorrow.

A prudential analysis leads us to consider a structural "supply crunch" (in the words of the Executive Summary of the IEA's 2018 annual report) as a very plausible risk in the 2020s, and as an sans doute inexorable trend in the 2030s.

## 2- Geostrategy

At this point, the controversy over peak oil is sometimes the object of hazy and vague concerns; yet, unfortunately, the threat associated with peak oil does not play in the political agenda of oil-consuming countries the urging performative role it should.

The situation is probably quite different with respect to the crude-producing countries' agenda, particularly the major historical producers, which have long been closely following oil-related events around the globe and are frequently seeking to curb the course of events in their favour.

Given the strategic role played by the oil industry in the United States power structure ever since World War I, it is conceivable that Wall Street and Washington will keep trying to preserve the conditions for the perpetuation of that structure, whatever the cost may be.

It may be argued that the 21<sup>st</sup> century started with a war over the control of the last untapped sources of "easy oil". Such assumption now appears robust: the secret objective of the Iraq invasion in 2003 would have been to ensure once and for all the US hegemony around the Persian Gulf, at a time when American oil production was still decreasing in a way that was then considered as irremediable<sup>50</sup>.

Another possible sign of the battle for access to the last abundant and cheap oil resources: the appointment of Rex Tillerson, former Exxon CEO, as head of American diplomacy, and even more so, Tillerson' resignation from the US State department on March 31, 2018, just one month after it was officially announced that a joint venture between Exxon and Rosneft, intended to boost the declining resources of those two behemoth companies in Russia, Siberia and the Arctic Ocean, would not proceed; it had been compromised by the Obama administration imposed sanctions following the invasion of Crimea, and became impossible when accusations of Kremlin meddling in Donald Trump's election as President made it clear that the sanctions would not be lifted<sup>51</sup>.

Another possible sign? It is tempting to think that Russia's bold and ruthless advance in the Middle East and Libya is fundamentally linked to the predicted decline of oil production in Russia, Kazakhstan and Azerbaijan.

If the invasion of Iraq in 2003 was a war for oil, the victory went to China and Russia. The power of the Moscow-(Damascus-Baghdad)-Tehran-Beijing ellipse, which is now well established, has its energy focusses in the extremely generous oil fields in the South of Iraq, where Chinese and Russian oil companies continue to capture the lion's share (*Figures 56 & 57*), and in the oil fields of Eastern Siberia, which can be linked to Asia by pipelines.

<sup>50</sup> Matthieu AUZANNEAU, *Or noir, la grande histoire du pétrole, op. cit.*, chapters 27 and 28.

<sup>51</sup> Matthieu AUZANNEAU, « Avec le pétrole de schiste, l'Amérique est « pleine aux as »... À quel prix ? », *Fin du leadership américain ? - L'état du monde 2020*, dir. Bertrand Badie, Dominique Vidal, La Découverte, 2019.

Figure 56.

**Iraq oil production  
by nationality of operating companies, 2009 - 2030**

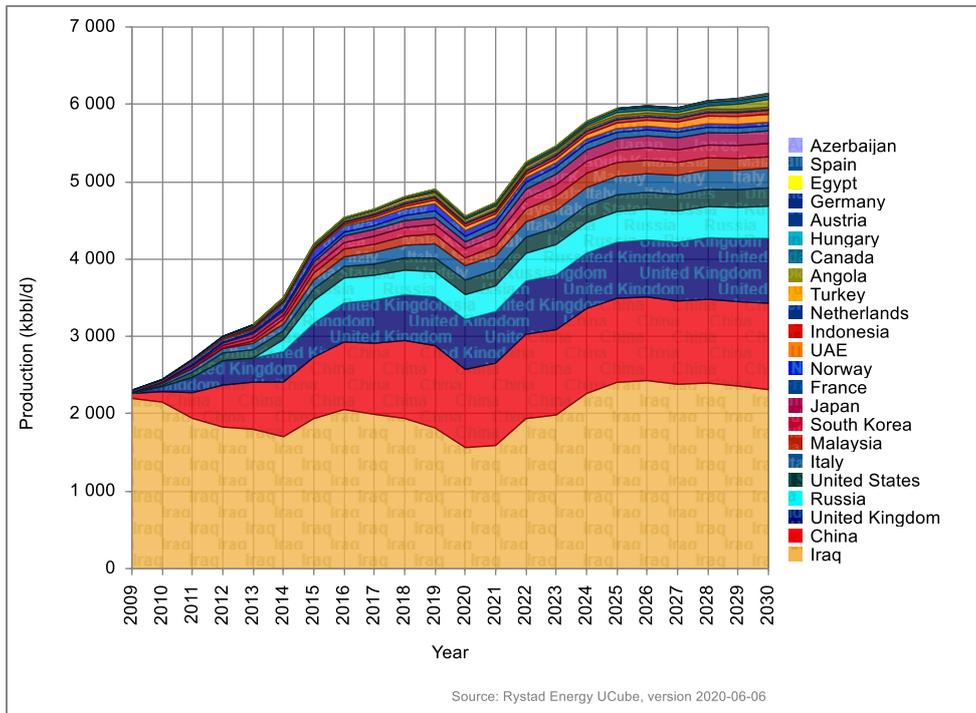
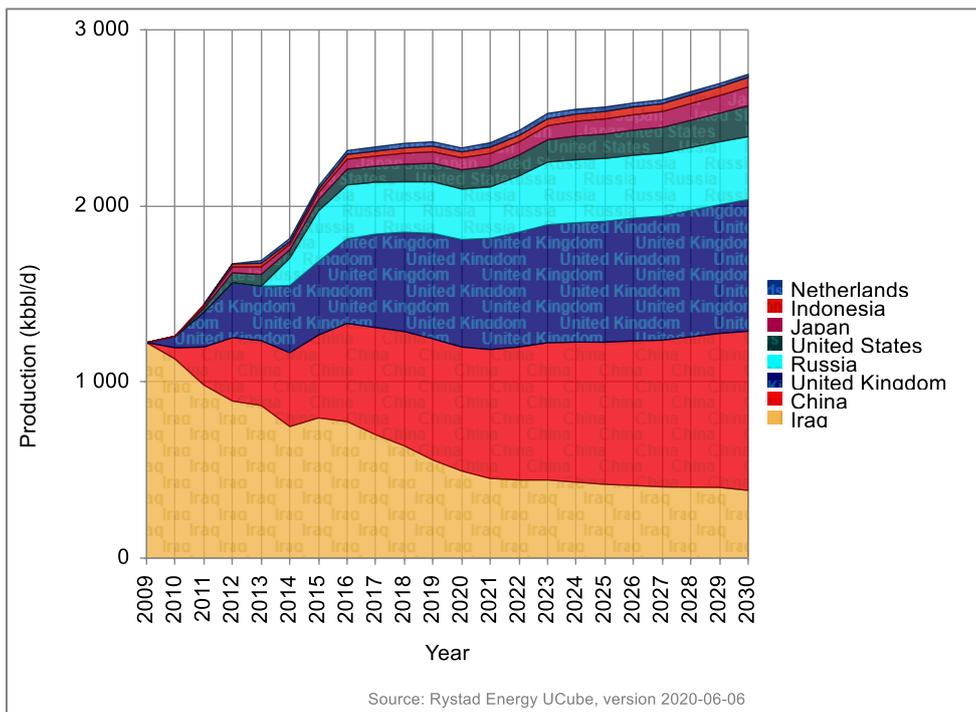


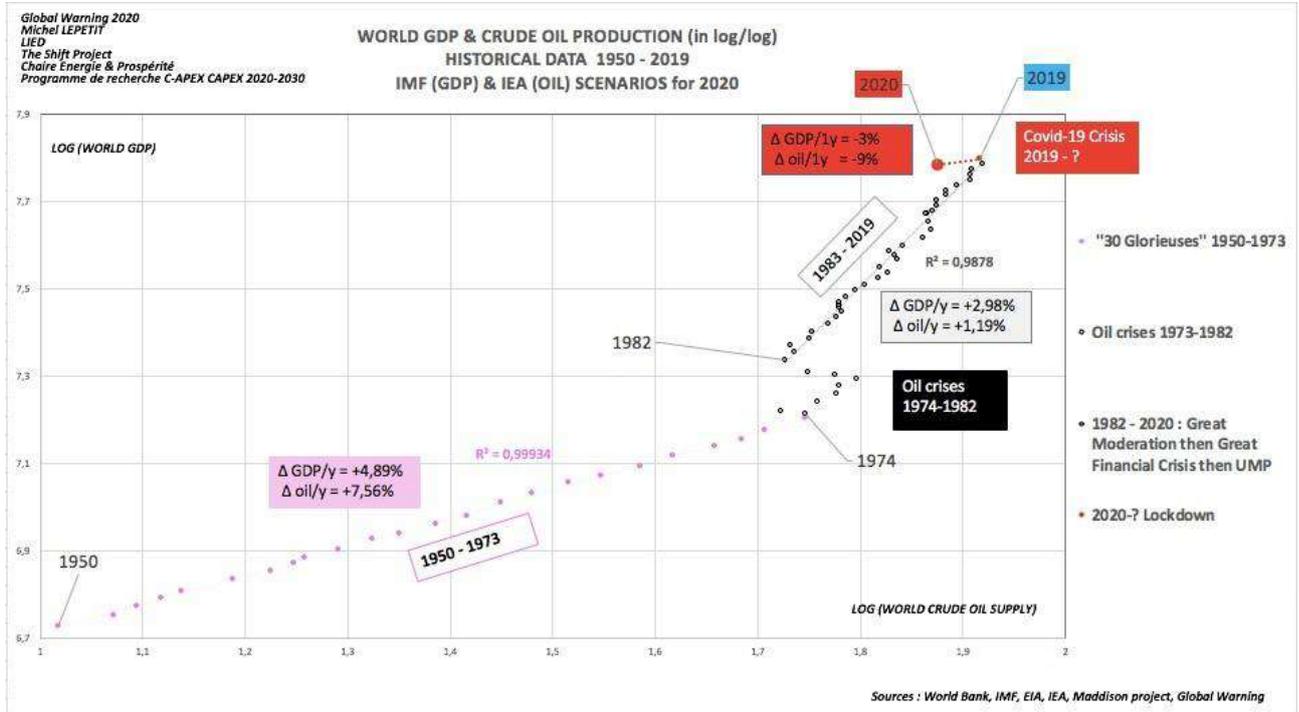
Figure 57.

**Rumaila & Qurna West oil fields production  
by nationality of operating companies, 2010 – 2030**



### 3- Macroeconomics

Figure 58.



Assuming that:

- on the one hand, as shown in *figure 58*, there is a proportional link between economic growth and growth in oil consumption (with only two stable modes of proportionality since 1950, i.e. before and after the oil shocks of the 1970s – then the second mode, from 1982 onwards, being slightly less oil intensive, is strictly speaking the only global energy transition that has occurred since then),
- on the other hand, oil must remain unmatched as an abundant and technically relatively inexpensive source of energy,

then the current global economic order, where growth is now imperative – if only because of the need to repay the unprecedented amounts of debt contracted since 2008 in order to perpetuate this growth – can be compared to the sawing off a branch you are sitting on, or an ice cream licking itself to naught.

A similar, more beautiful and much older metaphor: the *New York Times* recently compared the policy of the Federal Reserve to the Ouroboros<sup>52</sup> (unfortunately, it failed to see the link with our essential and depleting source of energy).



Ouroboros

<sup>52</sup> Niel IRWIN, "The Increasingly Bizarre Interplay Between Trump's Trade Policy and the Fed", *The New York Times*, August 1, 2019.

## 4- Information

If supply shortages are to be expected, and if the battle between the major powers for access to the last untapped sources of cheap and abundant energy<sup>53</sup> persists, then the EU countries, which are major consumers of this energy, are being tragically naive.

Indeed, the signs of the exacerbation of these limitations and of this major battle are by no means hidden; they are visible in broad daylight.

Twelve years after the peak of conventional oil, a minor *think tank* provides the first transparent, detailed and primary data-based public analysis of the evolution of oil production; this is in itself as much of a scandal as the prospect of a looming disaster, unless a swift response is implemented. Only oil companies and the International Energy Agency investigate the Rystad Energy datasets or its two Anglo-Saxon competitors, IHS and Wood Mackenzie; this situation cannot be accounted for by the cost of accessing these data, since it is trivial, considering the value of this information for any forward-thinking government.

The energy transition cannot be achieved in a snap. Moving away from oil is like changing the very blood system of industrial societies; if nothing happens, these may in a near future find themselves gradually drained of blood. Anticipation is crucial.

Therefore, how is it possible that the International Energy Agency, which is supposed to be in charge of this, has yet failed to clearly inform consumer countries, for example, about the state of Russian oil fields since the decline of Western Siberia in 2006? Or that, in its latest annual report, it purports to justify in just four lines its claim that Africa may be able to slow the decline in its production?

Above all, how is it possible that the Paris-based IEA can deliver a message that is mostly mollifying and lacking transparency, without giving rise to a flurry of critical questions and requests for clarification from the governments of the oil-consuming OECD countries whose interests it serves? Where are the prudential counter-analyses of the member states of the European Union? Let us recall that the EU is the world's major oil-importing political entity, ahead of China and the United States, that its own oil sources are low and in decline (even negligible given Brexit), and that it is surrounded by nation states whose stability is jeopardized by the decline of the oil boon, in Algeria, Russia, Nigeria, Angola, Gabon and Congo-Brazzaville.

The IEA's prospective analyses, following the example of most international reference institutions (with the notable exception of the IPCC), are lined with a thick layer of *"story telling"* and *"wishful thinking"*. Indeed, the authors of those analyses are always wary of crying wolf, fearing that the wolf will appear if they do. Thus, should the IEA speak loud and clear of the peak oil as an unavoidable long-term trend (as is the case), investment would perhaps quickly turn away from the oil industry, speeding up the process.

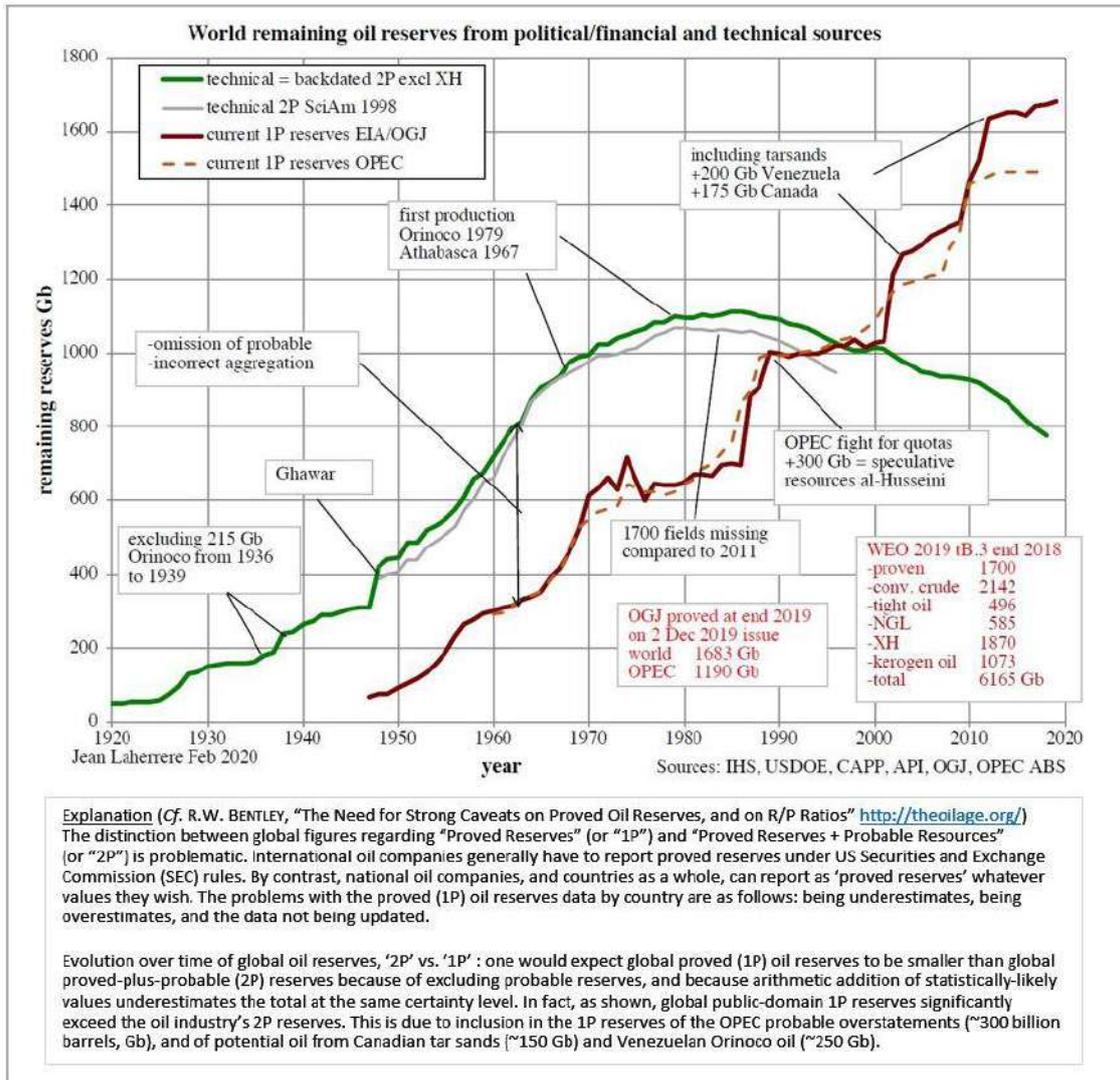
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<sup>53</sup> This game is inevitable as long as everyone seeks to maximize their power, and as long as one watt equals one joule per second.

Misunderstandings regarding the future of global oil production may frequently spring from another source: the confusion between the amount – which has been declining since the 1980s – of the confidential technical reserves, that oil producers trust, the so-called “2P” reserves, and the – still growing – amount of the declared “1P” reserves presented by producing countries in public reports<sup>54</sup>, which consuming countries tend to trust (figure 60).

The OECD Member States, from which the IEA stems, urgently need a detailed and transparent diagnosis of the problem. It is high time for the patient to know how far the disease has progressed.

Figure 60.



<sup>54</sup> Mostly in the *Statistical Review of World Energy*, the authoritative report published each year by BP.

## IV- Conclusion and outlook: climate change and “peak oil”, two cumulative reasons for urgently moving away from oil

Frequently addressed during the 2000s, then entirely dismissed because of the *tight oil* boom, the oil peak issue is a compelling reason to urgently move away from oil; it is just as serious and pressing as climate change.

The compact relationship link between economic growth and growth in the consumption of all fossil fuels, and of oil in particular, should lead us to consider energy transition policies without counting on economic growth. Energy transition has to be addressed mainly as a systemic human and technical problem that demands the implementation of planning under physical constraint<sup>55</sup>. Climate risk and peak oil risk are in no way mutually exclusive hazards. On the contrary, these are two cumulative reasons for implementing bold and coherent energy transition policies. The energy transition must be implemented willingly, in order to avoid an overheated world; otherwise it will happen by force: should humanity persist in its addiction to fossil fuels, it risks being quickly overcome by constraints on access to these very energy sources.

While they are obviously potentially devastating for the economy and the general balance of societies, these physical supply constraints would not save us from the dire consequences of climate change, caused primarily by the consumption of hydrocarbons and coal. Even with severe constraints on oil production, humanity could still keep greenhouse gas emissions far above the warning levels defined by the IPCC. And indeed, for the heating of buildings, industry, power generation, or even transport, the easiest alternative to oil is often a different carbon-based fossil fuel.

China, which unsurprisingly reached its peak in oil production in 2015, does not emit less CO<sub>2</sub> since then. Even if China were to rapidly turn away from coal and oil to systematically favour natural gas, even if it means extracting massive volumes of “shale gas” (and a certain amount of related liquid fuels) from its soil by hydraulic fracturing, its CO<sub>2</sub> emissions would still remain for a long time far above levels compatible with the climate alert levels, with or without methane leaks.

Besides, significant constraints on access to coal and natural gas are likely to appear in various regions of the world, well before the middle of this century. Thus, Rystad Energy, expects a peak in global natural gas production in the late 2030s. And several reports show that the future maintenance of Chinese coal production is far from guaranteed<sup>56</sup>.

How do climate risk and the risk of peak oil gas, and coal combine? It is impossible to know this today, as the issue of peak oil is still radically – one is tempted to write ridiculously – under-documented, at least

<sup>55</sup> *The Shift Project*, « Crise(s), climat : plan de transformation de l'économie française, présentation d'un chantier d'urgence », mai 2020

<sup>56</sup> See in particular the work of Dr. Jian Liang WANG, from the Chinese Petroleum University, in particular “A review of physical supply and EROI of fossil fuels in China”, *Petroleum Science*, 2017

as far as publicly available analyses are concerned. It is radically under-documented, both with regard to the now-reliable and detailed assessment of climate-related risks, and with regard to the huge risk specific to the peak oil issue (which remains an open question).

The word “oil” does not occur even once in the Roadmap handed to Energy Commissioner in December 2019 by the new president of the EU Commission Ursula von der Leyen<sup>57</sup>.

In 2005, three years before the peak in conventional oil occurred, as no great surprise to the specialists, Fatih Birol, the current Executive Director of IEA, stated in an interview to the French newspaper *Le Monde*:

*“Oil is like a girlfriend with whom you are aware, from the very beginning of your relationship, that she will eventually leave you. In order to prevent her from breaking your heart, it is better to split before she does.”<sup>58</sup>»*

This statement was true fifteen years ago, and is even more so today. It is deeply regrettable that, at this point, this crucial message still remains unheeded.

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<sup>57</sup> Ursula von der LEYEN, « Mission letter », 1 December 2019.

<sup>58</sup> Matthieu AUZANNEAU, Jean-Michel BEZAT, « La production pétrolière des pays non OPEP décroîtra "juste après 2010", prévient l'AIE », *Le Monde*, 19 septembre 2005



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