

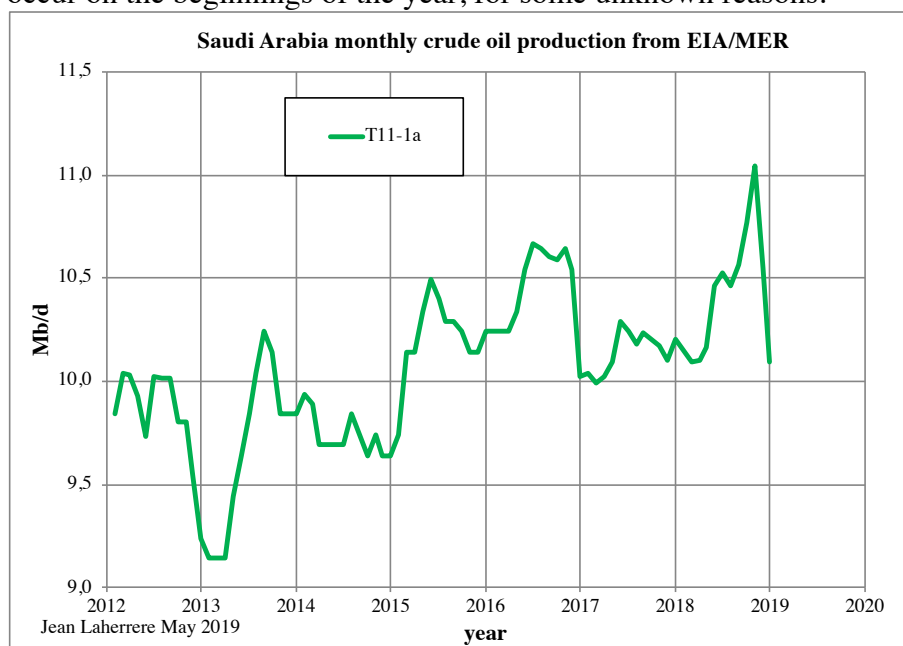
### Updating Saudi Arabia oil & gas production

This first graph from a paper 27 March 2019 on a gas discovery in Red Sea displays a very good view from space of Yemen and Saudi Arabia with the large Empty Quarter = Rub al-Khali desert. <https://www.offshore-technology.com/comment/saudi-red-sea-gas-discovery/>



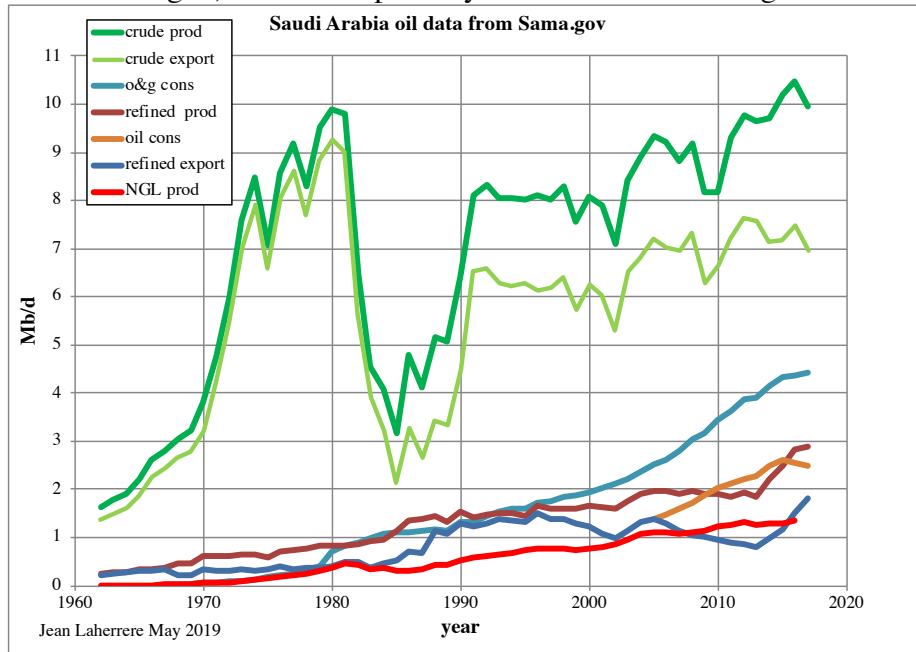
This view is fascinating, because the impact of civilization, as the high towers of Dubai or the gas flaring, cannot be seen, in contrary to geological trends. The satellite view by night shows the town lights and also the gas flaring

Ron Patterson often displays oil production graphs from OPEC recent oil production for main producers on the site <http://peakoilbarrel.com/opec-march-data-and-saudi-report> EIA/MER reports oil production data, showing that the recent variations are mainly political to please Trump by rising production or to increase the oil price by decreasing production. Low levels occur on the beginnings of the year, for some unknown reasons.

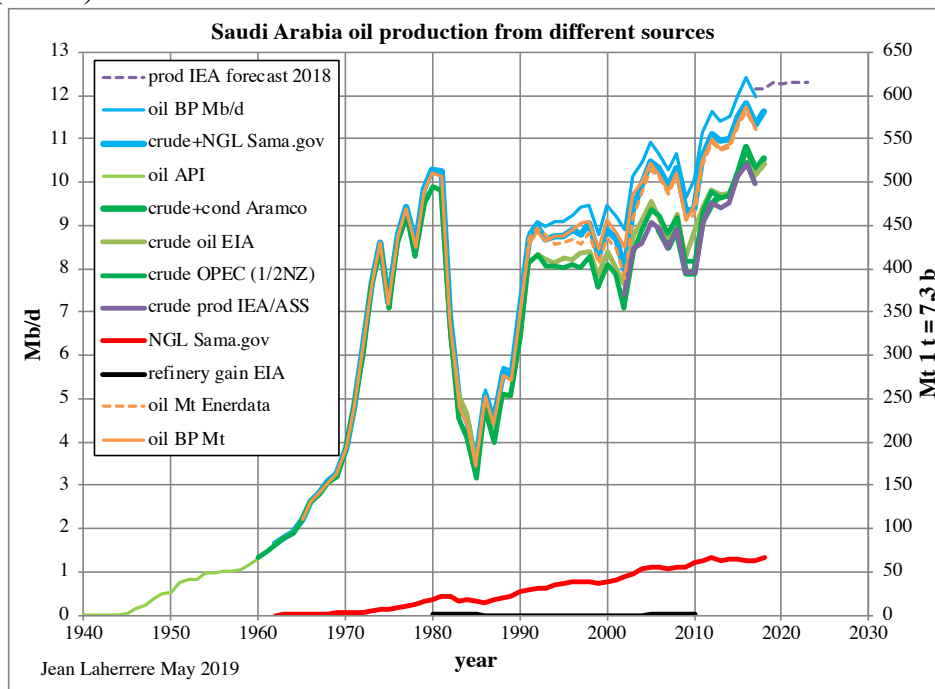


SA first oil discovery was in 1938 (Dammam) and oil production started in 1939, with significant increase in 1945.

Saudi Arabi oil production data varies from sources in Mb/d. The longest historical is from OPEC ASB (1960-2017), the Saudi Arabian Monetary Authority (sama.gov.sa) reports oil data since 1962, giving much better oil data than Aramco. The Saudi Arabia ministry of energy (source of Sama.gov) does not report any real oil data on its English site.

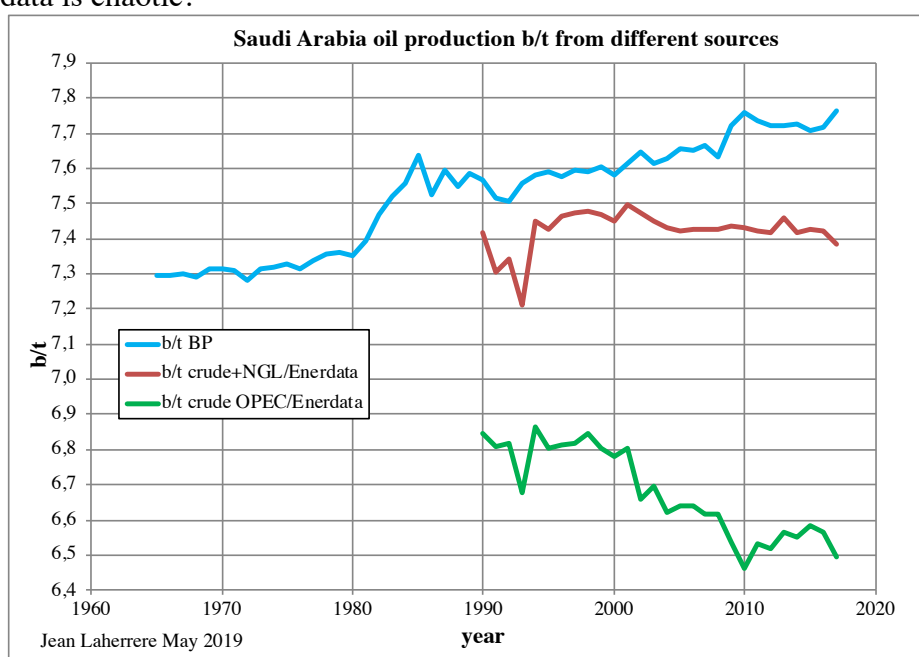


The annual crude oil peak is 2016 with 10.5 Mb/d; BP data is for all liquids, higher than crude +NGL from sama.gov: IEA 2018 forecast to 2023 displays flat production for the last 5 years. Crude oil production is about 2 Mb/d lower than all liquids. EIA refinery processing gain is negligible (7 kb/d)



Production in weight from BP shows the Saudi oil production is getting lighter, giving more barrels per tonne, but mixed data from Enerdata and OPEC are heterogeneous, meaning that

the definitions varies between sources! On page 14 b/t on consumption displays also chaotic trends: SA data is chaotic!



Saudi Aramco annual report 2010 gave only reserves data: 260.8 Gb for crude oil and condensate and 298.7 Tcf for NG, nothing on NGL (35 Gb in 2017)

Crude oil and condensate **reserves** (billions of barrels)

2012:	260.2
2013:	260.2
2014:	261.1
2015:	261.1
2016:	260.8

Gas **reserves** (associated and nonassociated, trillions of scf)

2012:	284.8
2013:	288.4
2014:	294.0
2015:	297.6
2016:	298.7

Saudi Aramco annual report 2017 stated that for 85 years “we have been entrusted with the stewardship of the Kingdom’s oil and gas reserves and reported separated reserves for crude oil, condensate and NGL: 2017 crude oil +condensate remaining reserves are the same as 2010, around 260 Gb; meaning that each year the same volume was discovered as produced?

#### Estimates of proved reserves of crude oil, condensate, natural gas, and NGLs

	2017
Crude oil millions of barrels	256,737
Condensate millions of barrels	4,124
Natural gas millions of barrels of oil equivalent	36,939
NGLs millions of barrels	35,097
<b>Total</b> millions of barrels of oil equivalent	<b>332,897</b>

Reserve figures represent the Kingdom's reserves in the fields operated by the company

For the first time there is a detailed annual report on Saudi Arabia oil (in fact a prospectus published on 1st April 2019) giving the detail of the reserves with an audit by DGMN  
[https://www.rns-pdf.londonstockexchange.com/rns/6727U\\_1-2019-4-1.pdf](https://www.rns-pdf.londonstockexchange.com/rns/6727U_1-2019-4-1.pdf)

Base Prospectus dated 1 April 2019

أرامكو السعودية  
saudi aramco



**SAUDI ARABIAN OIL COMPANY**  
*(incorporated as a joint stock company under the laws of the Kingdom of Saudi Arabia)*

### Global Medium Term Note Programme

In this prospectus, I learned that the Saudi Aramco (strange name for Saudi Arabian oil company) initial concession (starting 29 May 1933) has been terminated on 24 December 2017, replaced by a new Concession for 40 years + 20 years starting 24 December 2017 to December 2077.

The estimate of reserves by DeGolyer and Mac Naughton (DGMN or D&M appendix C) covers only the period of concession (end 2017-end 2077).

The prospectus reports page 20 that at end 2018 the Kingdom's proven reserves are 336.2 Gboe, including 261.5 Gb of crude oil and condensate, 36.1 Gb of NGL and 233.8 Tcf of NG. Page 84 the company's reserves at end 2018 are 256.890 Gboe (such accuracy is ridiculous!), including 198.194 Gb of crude oil, 3.191 Gb condensate, 25.385 Gb NGL and 185.726 Tcf NG. it means that the company's proven reserves are only from 70% to 79% of the kingdom's proven reserves, because of the royalties

Base Pros	Gboe	crude Gb	NGL Gb	NG Tcf
company	257	198	25,4	186
kingdom	336	262	36,1	234
ratio %	76	76	70	79

It is the first time that I find that Aramco's reserves do not coincidence with the Kingdom's reserves. You can see the difference with the 2017 annual report.

In this prospectus there is not a word on the reserves from the production of the Neutral Zone fields (stopped in 2015) owned 50/50 between Saudi Arabia and Kuwait.

The new concession is based on rising royalties of 20% applied to the value of production at prices up to 70 \$/b, of 40% above 70 to 100 \$/b and of 50% above 100 \$/b.

On page 224 appendix C the certification letter by DGMN reports the reserves estimates from Aramco (different from data page 84) and from DGMN: these estimates are reported with 6 significant digits, meaning that the accuracy is about one millionth: such claim!

As it is ridiculous to find the difference on the two estimates for global oil and gas global reserves end 2018 at 208 511 Mboe and 208 677 Mboe = 0.000 01 %

end 2018	DGMN	crude Gb	NGL Gb	crude +NGL	etable gas	Gboe
1P res	Aramco	168	22,6	190	110	209
	DGMN	162	28,7	191	108	209

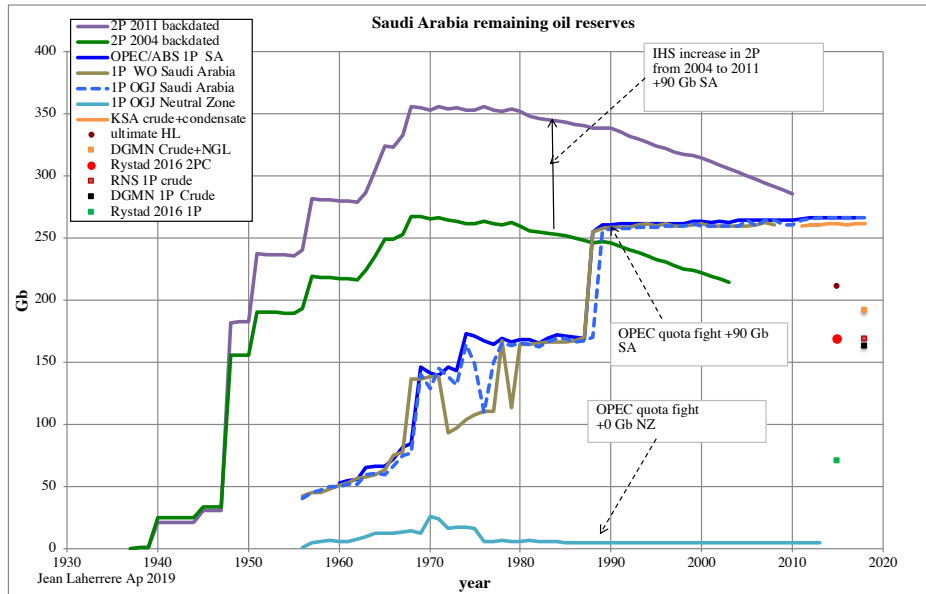
**But DGMN 1P crude oil reserves are 162 Gb** against 168 Gb for Aramco, in contradiction with the 262 Gb of page 84

In fact, it appears that the 1P reserves data are a mess!

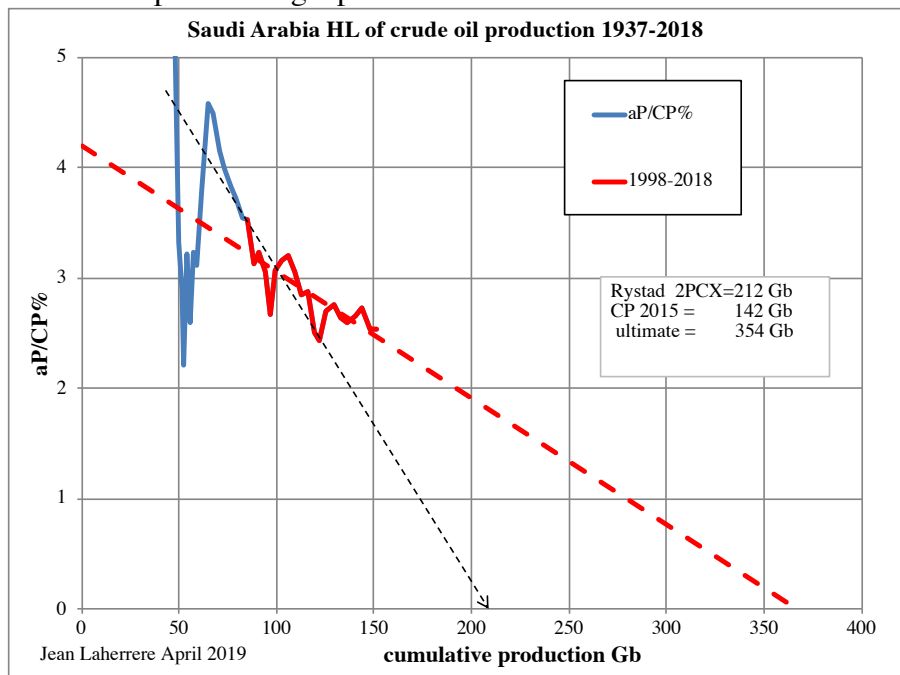


It is obvious that proved reserves are fake news for many countries!

In 2007 “oil and money conference” in London the geologist Sadad al-Huseini (former VP Aramco retired by his oil minister) stated that the 300 Gb increase in proved reserves during the quotas fight 1985-1989 between OPEC members were speculative resources. On this 300 Gb SA represents about 90 Gb as shown by the jump in 1P reserves and in 2P discoveries

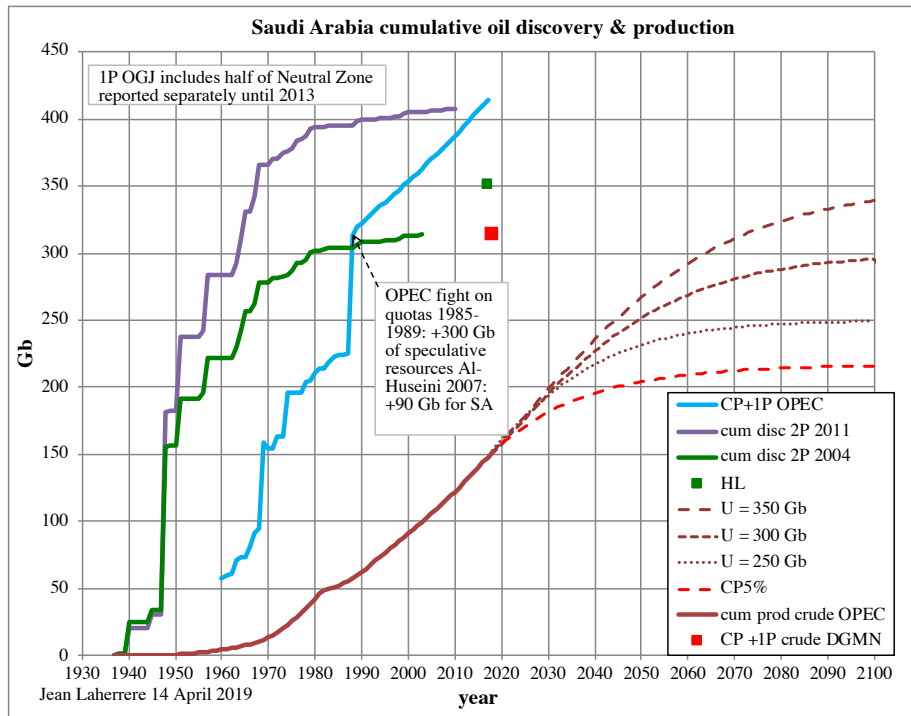


HL of the crude production 1998-2018 trends towards 350 Gb, but SA is bursting the production in the attempt of selling a part of Aramco.

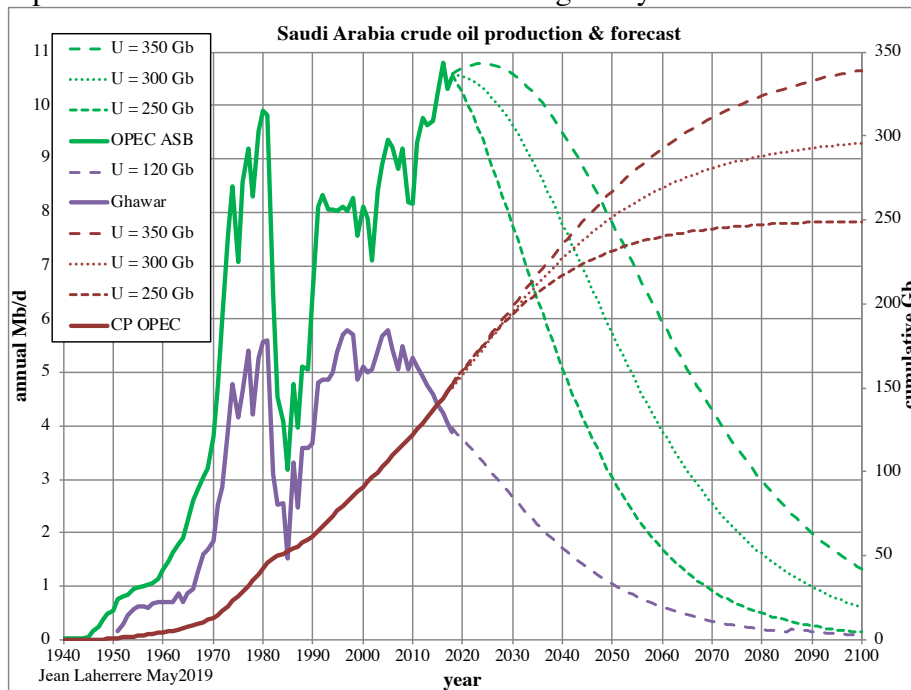


It is hard to choose an ultimate for crude oil +condensate between 350 Gb (HL) or 300 Gb (corrected creaming curve)

Ron Patterson in a recent post (<http://peakoilbarrel.com/opec-march-data-and-saudi-report/#more-21710>) estimates SA remaining reserves between 70 and 74 Gb, when cumulative production is about 150 Gb, giving an ultimate of less than 250 Gb  
I plotted the range of SA ultimates of 250, 300 and 350 Gb



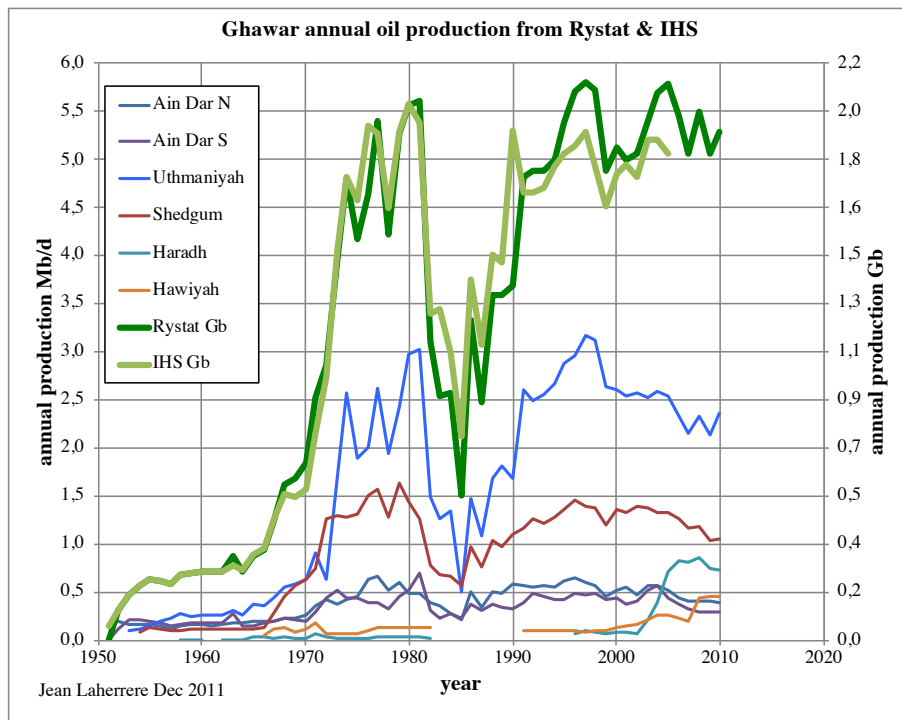
SA crude oil production is displayed for the 3 ultimates of 250, 300 & 350 Gb and Ghawar production is parallel with the SA until 2002 and diverges beyond



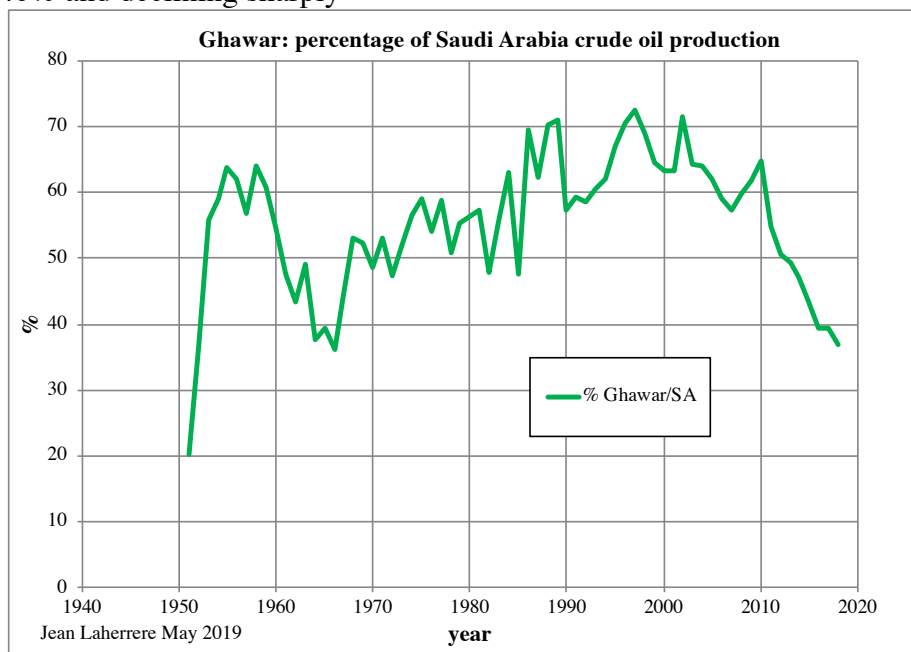
SA crude oil production peaked in 2016 at 10.8 Mb/d, 2018 production is only 10.5 Mb/d.

#### -Ghawar

Ghawar annual oil production data is not very reliable and varies with source.



Ghawar average production share of the SA production was over 70% during the 1990s, but now about 40% and declining sharply



April 2019 prospectus provides some data on the oil production capacity (MSC is the maximum sustainable capacity) of the major fields. NGLs are included in the oil production.

#### Principal Oil Fields

The following table sets forth the Company's reserves and MSC of the Company's largest oil fields as at 31 December 2018, which are listed according to 2018 production.

	Liquids Reserves <sup>(1)</sup> (mmbbl)	Combined Reserves (mmboe)	MSC (mmbpd)
Ghawar .....	48,254	58,319	3.800
Shaybah .....	13,617	14,864	1.000
Khurais .....	20,100	21,402	1.450
Safaniyah .....	33,664	34,029	1.300
Zuluf .....	30,417	31,313	0.825
Other .....	80,718	96,963	3.625
<b>Total .....</b>	<b>226,770</b>	<b>256,890</b>	<b>12.000</b>

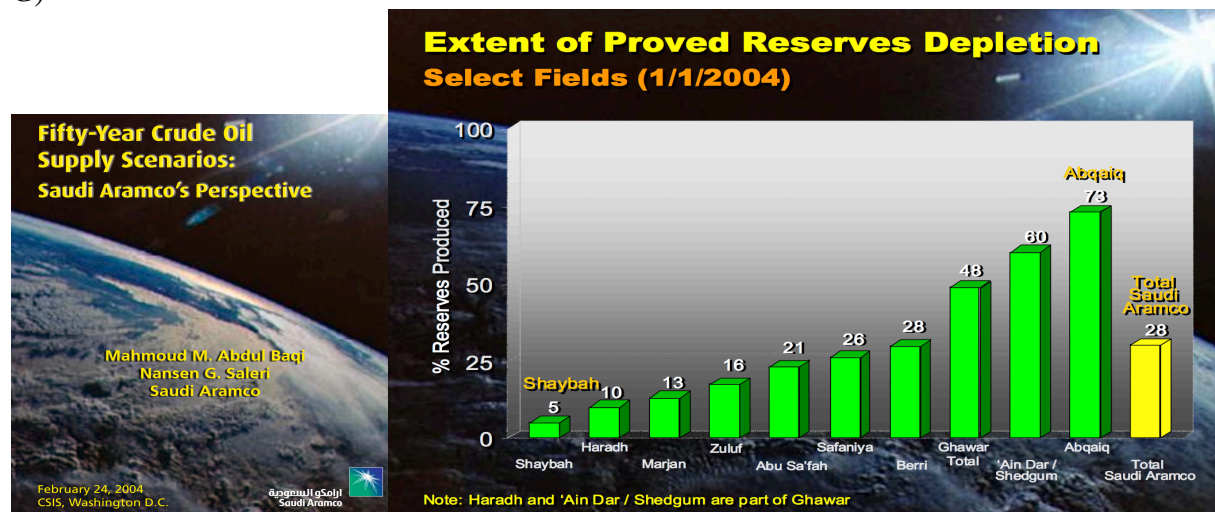
(1) Liquids reserves consist of crude oil, condensate and NGLs.

Ghawar oil production capacity is 3.8 Mb/d of crude in 2018 with remaining reserves for crude +NGL of 48 Gb (giving an ultimate of less than 130 Mb for crude oil)

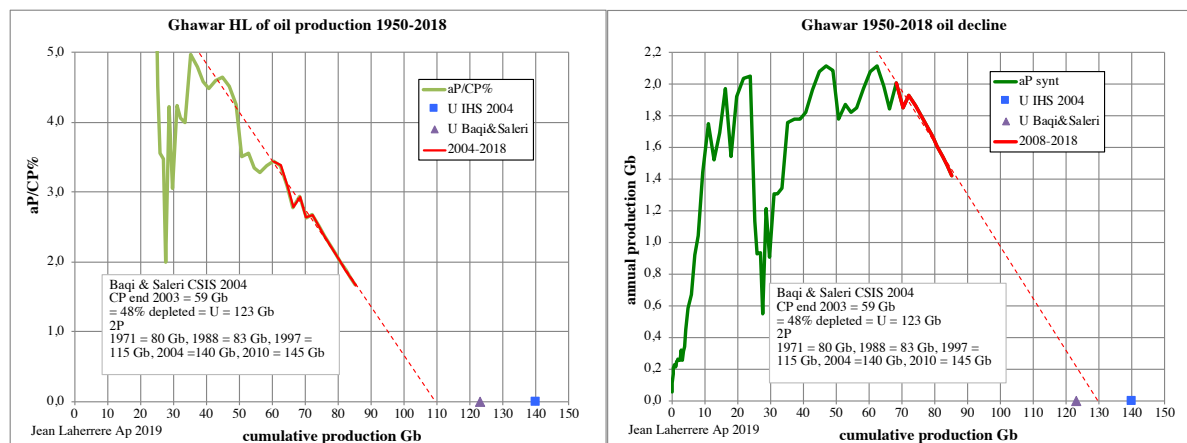
The Company believes that the Ghawar field is the largest oil field in the world in terms of conventional proved reserves, totalling 58.32 billion barrels of oil equivalent as at 31 December 2018, including 48.25 billion barrels of liquids reserves. It has accounted for more than half of the total cumulative crude oil production in the Kingdom but still maintained a MSC of 3.800 million barrels of crude oil per day as at 31 December 2018.

These statements display confusion between crude oil and crude +NGL

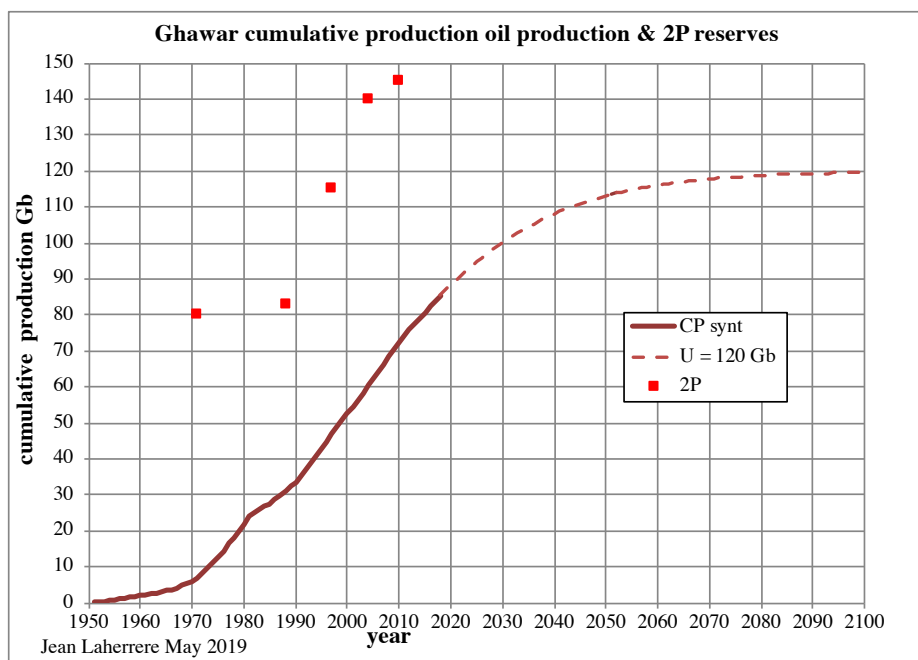
Our annual production data on Ghawar stops in 2010 and we took a linear decline to 2018 value of 3.8 Mb/d (in fact maximum), giving a cumulative production at end 2018 of 85 Mb In 2004 Baqi & Saleri reported that Ghawar has produced at end 2003 59 Gb and was depleted by 48% giving a crude oil ultimate of 123 Gb (Petroconsultants reported 2P at 140 G)

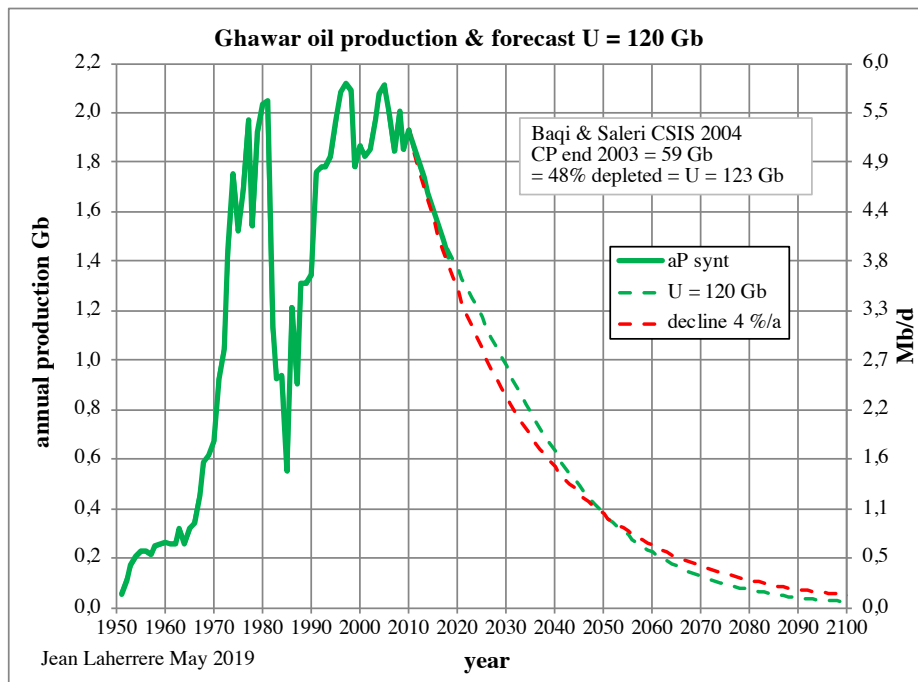


But the extrapolations of Ghawar past production give an ultimate of 130 Gb for oil decline and 110 Gb for Hubbert linearization.

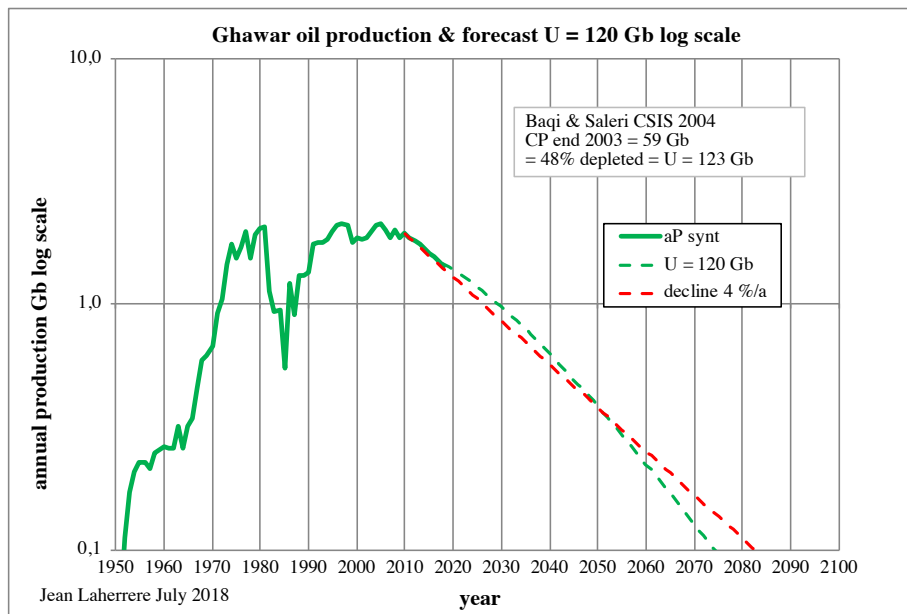


We have taken an ultimate of 120 Gb, despite that 2P reserves have increased from 80 to 145 Gb with time, but recent estimates are not reliable.





Since 2010 Ghawar is on decline of 4 %/a, which will continue at such rate until the end if the ultimate is 120 Gb.



### **-Manifa**

It is strange in the list of the main fields of the 2019 prospectus to not find Manifa oil field, when it is listed as 4<sup>th</sup> (5<sup>th</sup> in production) in 2017.



**Table 1. Major oil fields in Saudi Arabia**

Field	Location	Production capacity as of 2017 (million b/d)	Crude grade
Ghawar	onshore	5.8	Arab Light
Safaniya	offshore	1.2	Arab Heavy
Khurais	onshore	1.2	Arab Light
Manifa	offshore	0.9	Arab Heavy
Shaybah	onshore	1	Arab Extra Light
Qatif	onshore	0.5	Arab Light
Khursaniyah	onshore	0.5	Arab Light
Zuluf	offshore	0.68	Arab Medium
Abqaiq	onshore	0.4	Arab Extra Light

Source: Saudi Aramco, *Arab Oil and Gas Directory*, IHS Markit

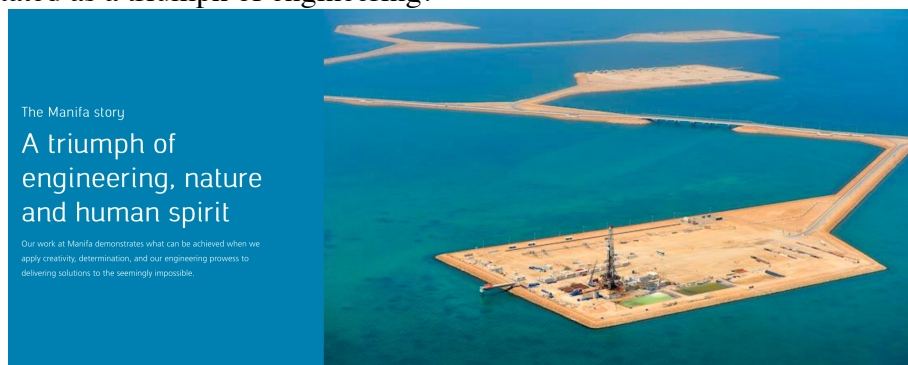
Manifa was listed in 1996 at 29th rank oil in place by Macgregor and 2P reported at 23 Gb in 2005 and 5<sup>th</sup> in the world by Aramco today (see further)

Manifa discovered in 1957 is huge (45 km x 18 km) with six reservoirs, but poor reservoirs, heavy oil and expensive development. Production (capacity 125 000 b/d) occurs from 1964 to 1984: Production resumes in 2013 with 350 wells from 27 man-made drilling islands & 13 offshore platforms, interconnected by a causeway of 41 km, for a cost over 10 G\$.

AR 2015 reports a production capacity of 0.9 Mb/d, but AR 2016 and 2017 does not mention Manifa anymore.

In <https://www.saudiaramco.com/en/who-we-are/mega-projects/manifa>

Manifa is stated as a triumph of engineering!



In the April 2019 prospectus Manifa is mentioned three times: twice on maps and page 225 on the list of reservoirs, nothing on oil production.

It seems that corrosion problems occur in 2017 in the water injection.

There is no data on present Manifa oil production

Meanwhile Manifa is the winner of the 2019 International Petroleum Technology Conference's (IPTC) Excellence in Project Integration Award.

The Manifa book <https://www.saudiaramco.com/-/media/publications/books/manifa-book-english.pdf> states that “**As the fifth largest oil field in the world** and one of Saudi Aramco’s most challenging fields to develop, Manifa features the utilization of the best technologies in infrastructure operations, drilling and production. The field development team also achieved nearly 80 million working hours without injury to score one of the highest global safety levels, and in 2012 it received an award as the best innovative oil project in the world.”

## Reflections on the Manifa Project



"The achievement at Manifa will be recognized for decades to come as a model oil and gas project to follow, and from which to learn, because of its associated successes and creative solutions."

HE Khalid A. Al-Falih, Chairman of the Board,  
Saudi Aramco



"The Manifa project was entirely designed, constructed and operated by Saudis. It was accomplished ahead of time and under budget. The project's team succeeded in overcoming many challenges and problems during the different phases of the project, from design to construction, until the completion of the whole project. This is something to be proud of."

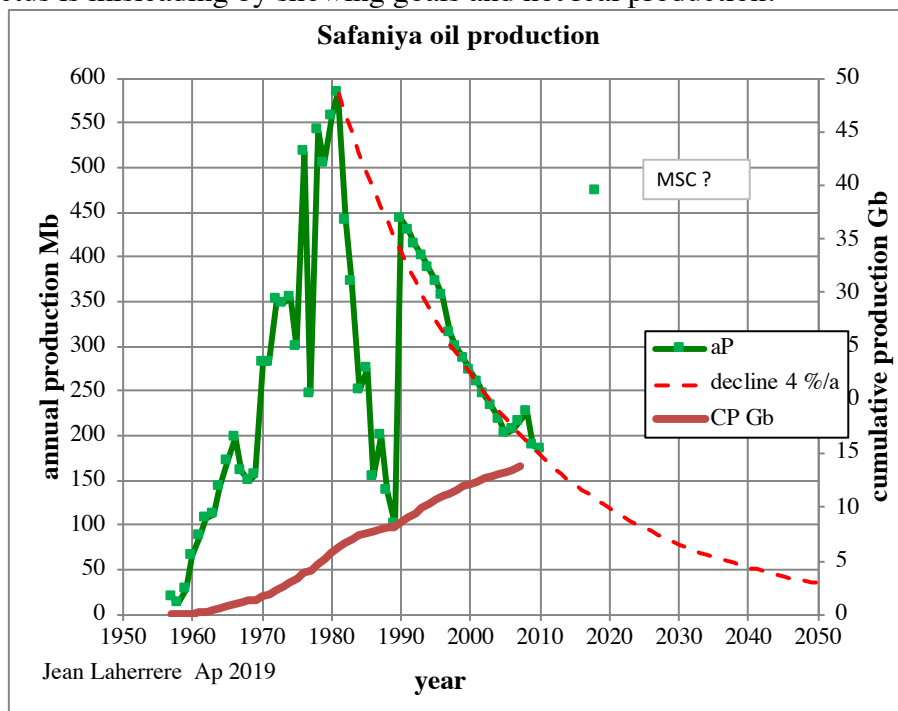
Amin Nasser, President and CEO,  
Saudi Aramco

On 2017 water injection system was hit by corrosion and Saipem reported work on Manifa in 2018, but no news of resuming production! It is impossible to find on Internet Manifa oil production data for the last few years.; it became a State secret!

### -Safaniya

Safaniyah (h was added lately) (world largest offshore field 2P > 50 Gb) production is stated to produce a maximum of 1.3 Mb/d at end 2018, but it is the double of 2010 annual production, which was declining since 1990 at 4%, but trending towards an ultimate less than half reported (50 Gb). Safaniya was in the process to be redeveloped in 2018 but had some problems (power cable cut by an anchor) to achieve such works in 2018. I doubt that the production reaches 1.3 Mb/d in 2018. In February 2019 Safaniyah was suspended after an accident. A redevelopment is planned.

The prospectus is misleading by showing goals and not real production.



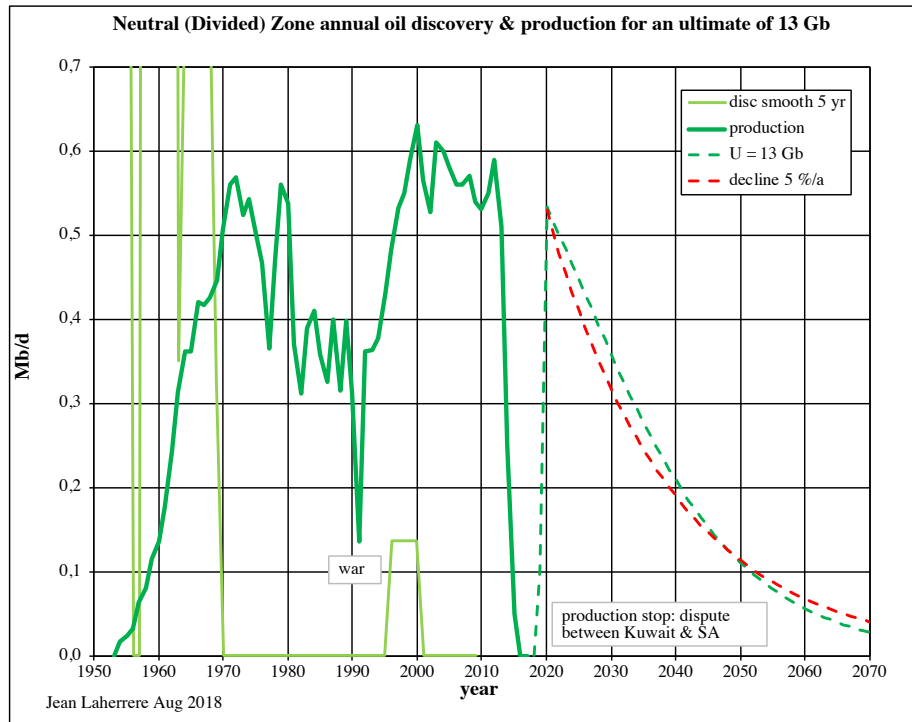
### -Neutral Zone

The prospectus does not mention that Saudi Arabia owns 50 % (Kuwait other 50%) of the Neutral (Divided) Zone. The field of Al Khafji is northern extension of Safaniya (which could extract some of NZ reserves)

In my paper “Extrapolation of oil past production to forecast future production in barrels”

<https://aspofrance.files.wordpress.com/2018/08/35cooilforecast.pdf> I display NZ production which was stopped in 2015 because a dispute with Kuwait. Production could be resumed around 0.5

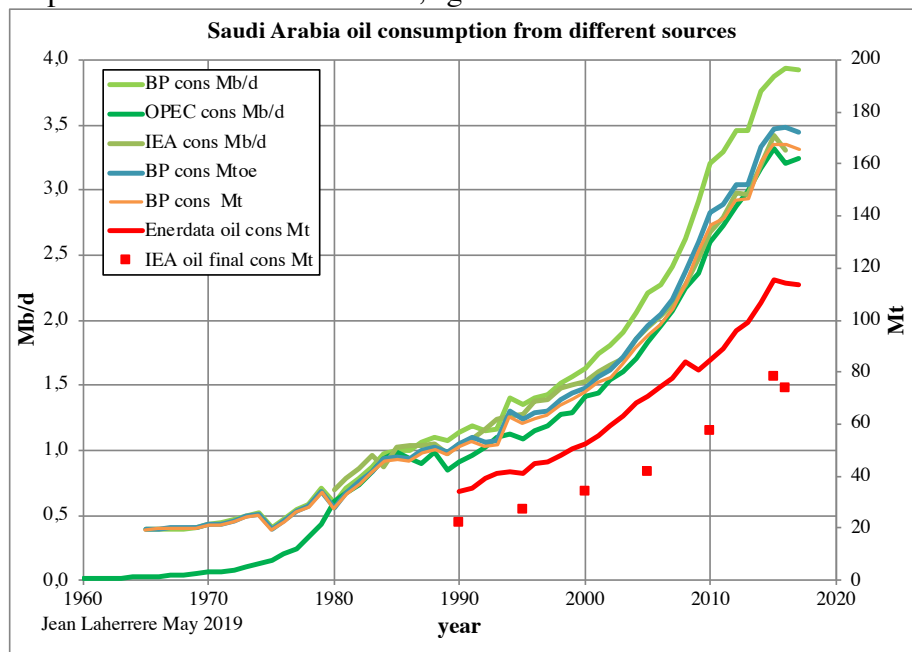
Mb/d with a decline of 5%/a



It means that SA could increase its production by 0.25 Mb/d by starting again NZ oil production in agreement with Kuwait.

### -Consumption

SA oil consumption varies between sources, again with various oil definitions.

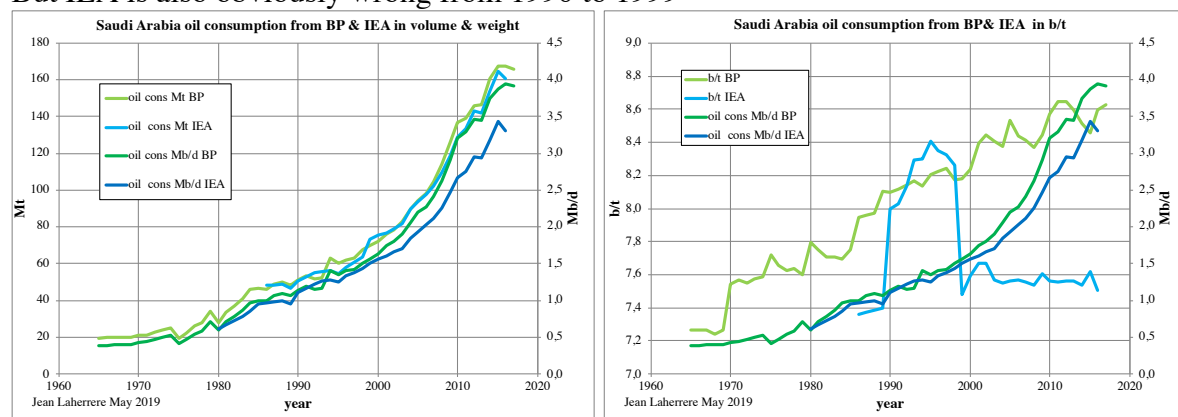


SA oil consumption data varies widely between sources, in particular when reported in Mt for 2016: 73 Mt (final) for IEA, 114 Mt for Enerdata and 166 Mt for BP (174 Mtoe)

This huge variation is due to different definitions and conversion factors, but no one really explains the data or the evolution.

BP reports SA consumption in barrel and in tonne, but the ratio b/t is 7.3 in 1965 and 8.6 in 2017: this value looks too high and far from the value of less than 7.6 b/t from the IEA data: BP data is heterogenous and they confuse definition: SA oil consumption in 2017 is 3.9 Mb/d for BP and only 3.3 for IEA.

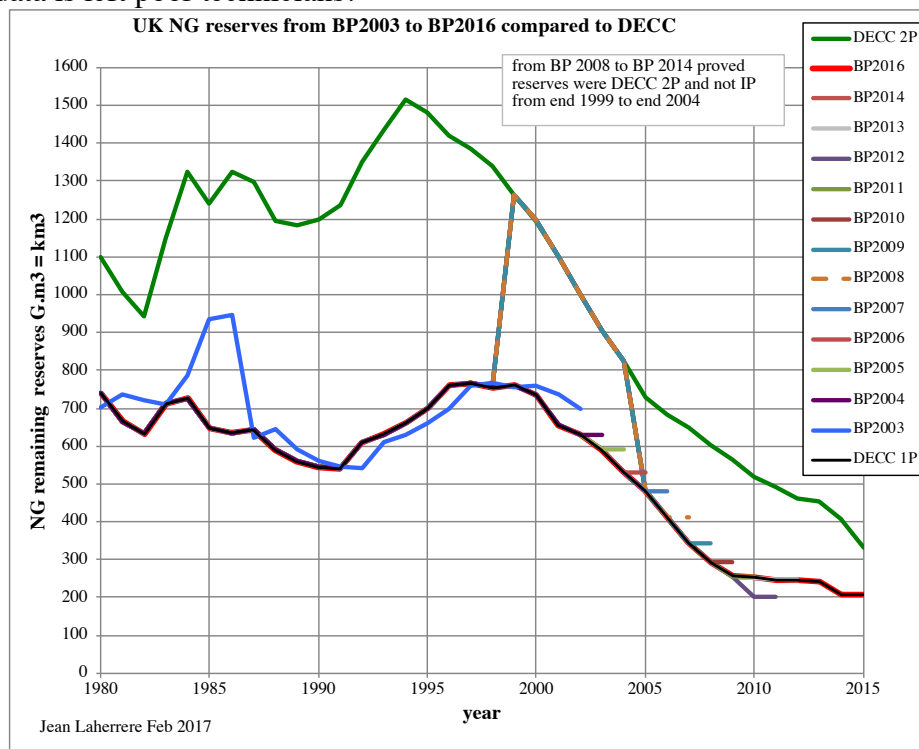
But IEA is also obviously wrong from 1990 to 1999



However, I trust more IEA than BP., but both they do not care to check if their data give realistic density value when reporting both in volume and weight.

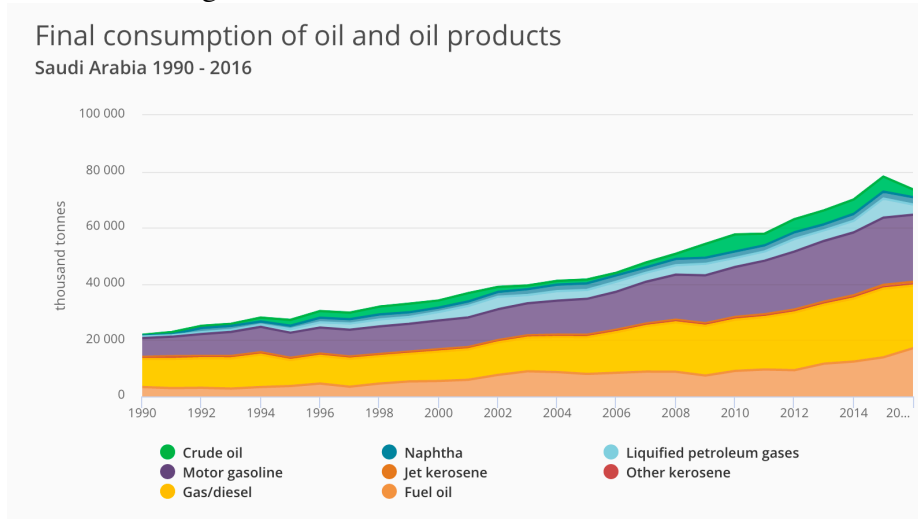
BP even on UK gas reserves confused 2P and 1P in their editions 2008 and 2009, when the UK government with DECC was reporting on the web 1P and 2P separately!

Reporting data is left poor technicians!



Primary consumption is different from final consumption, the difference is the efficiency of the country in this matter.

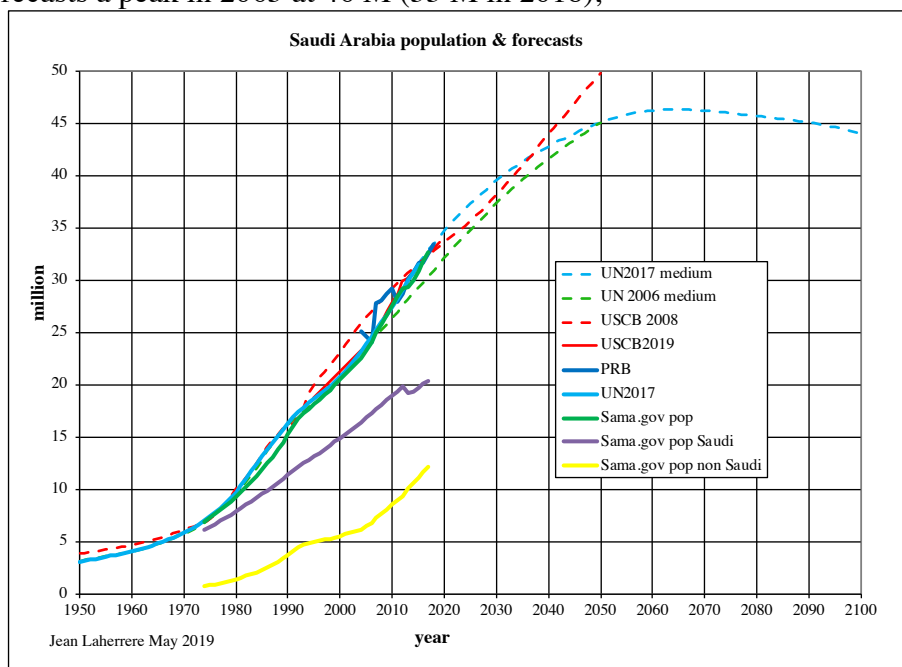
IEA <https://webstore.iea.org/oil-information-2018>



### -Population

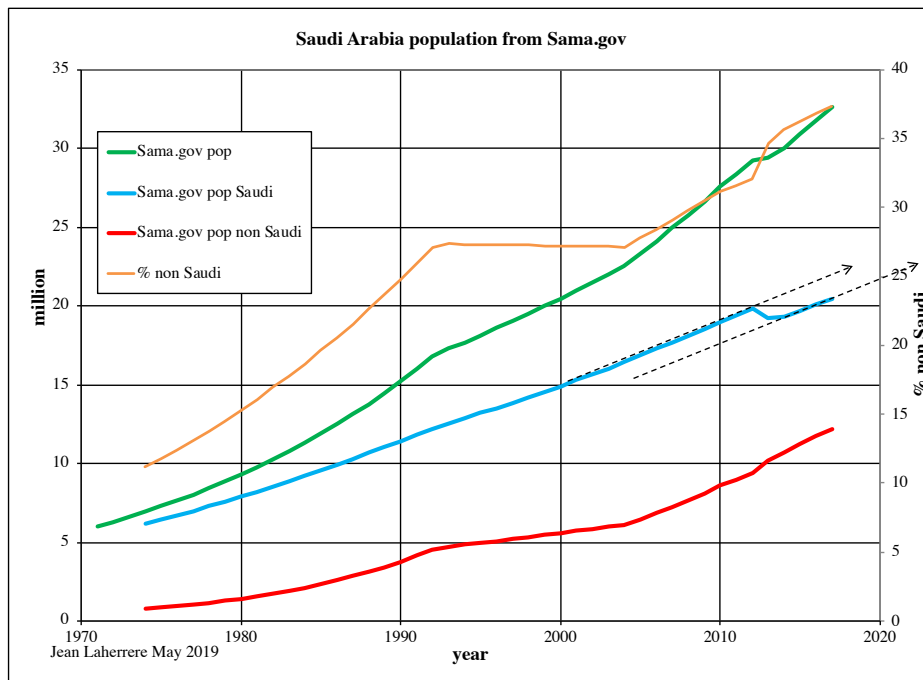
SA population data is unreliable when comparing UN, USCB and PRB data. PRB data seems wrong compared to Sama.gov

UN2017 forecasts a peak in 2065 at 46 M (33 M in 2018);



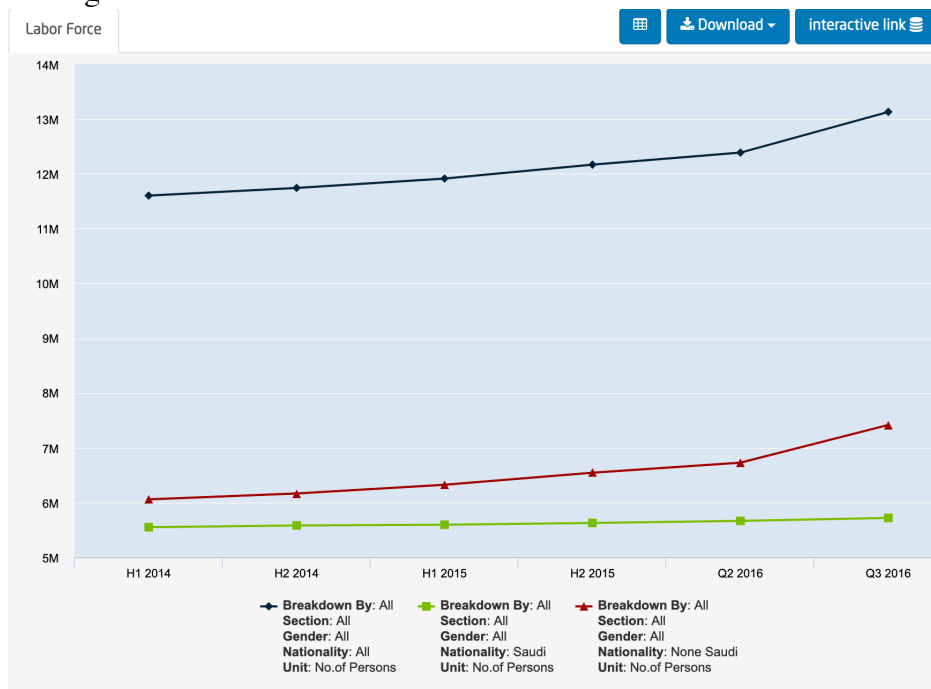
The Sama.gov data is assumed to be reliable, but there is a queer decline in Saudis population in 2013 (with similar slopes).

The percentage of non-Saudi (11% in 1974, 37% in 2017) increases sharply since 2004



General Authority for Statistics reports a labor force higher for Non-Saudis (7 M in 2016) than Saudis (6.5 M)

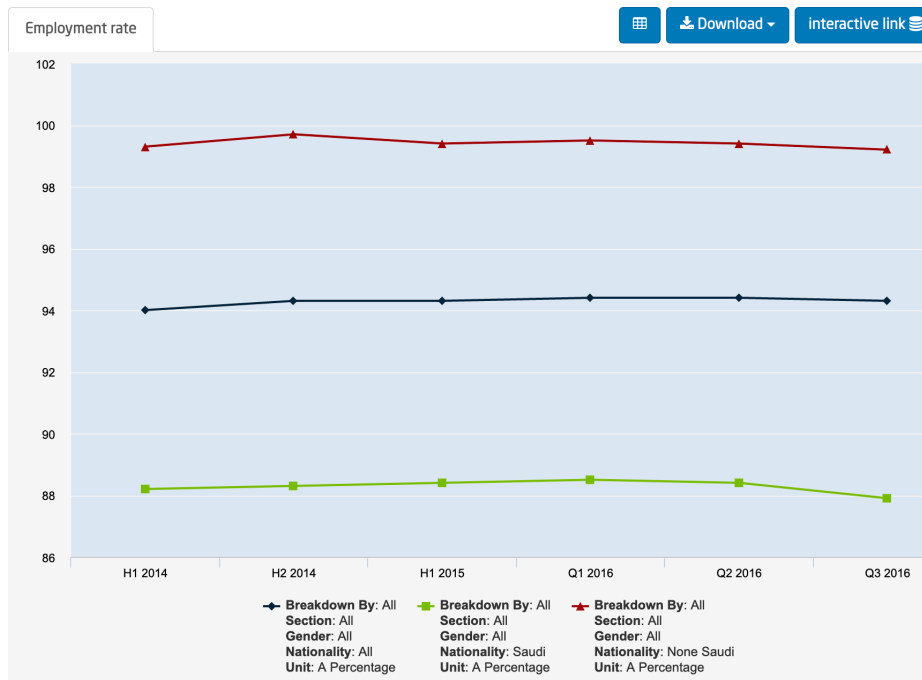
<https://www.stats.gov.sa/en/814>



The employment rate is very high to Non-Saudis, almost 100%, compared to 88% for Saudis

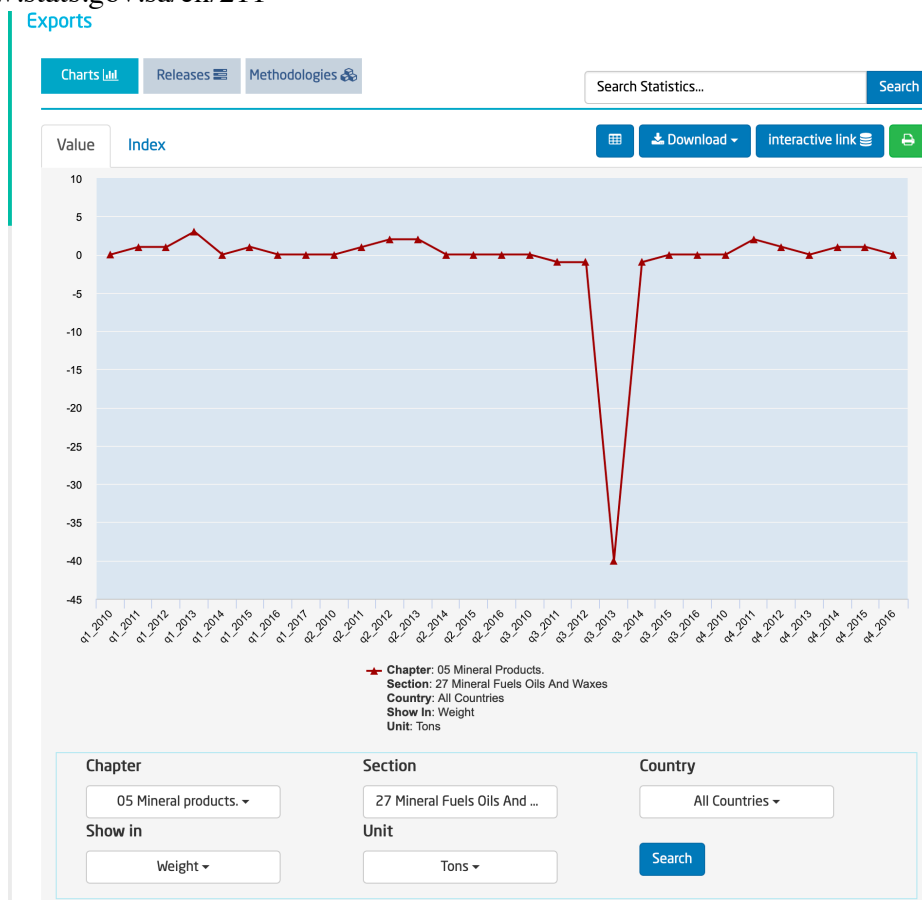
<https://www.stats.gov.sa/en/821-0>





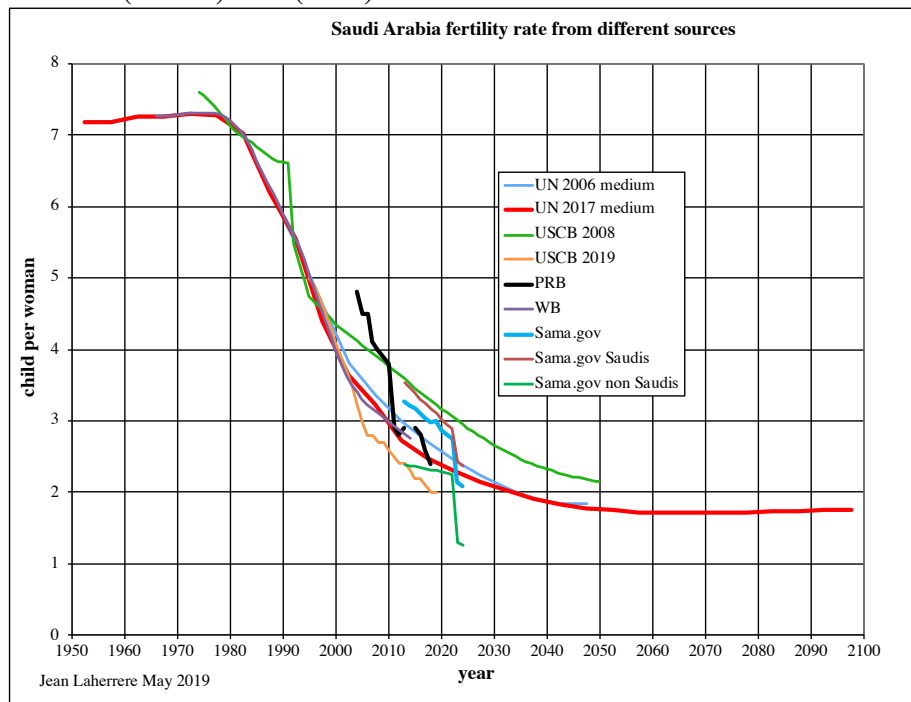
But the search on this site on export to all countries of mineral fuels oils show that the data needs to be improved!

<https://www.stats.gov.sa/en/211>



The percentage of oil in the exports in values <https://www.stats.gov.sa/en/325> is identical to the percentage from [sama.gov.sa](https://www.sama.gov.sa) page

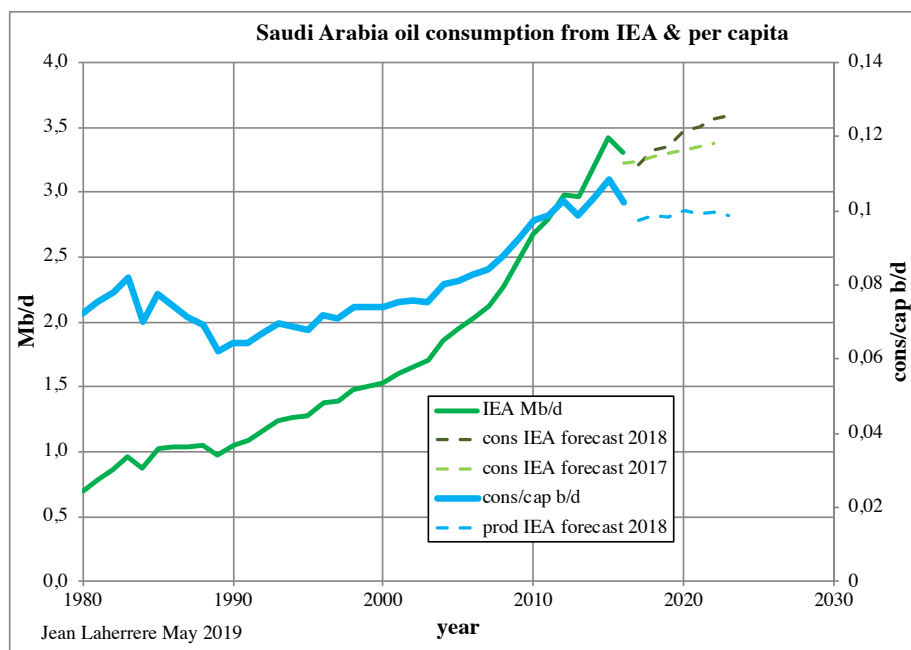
The uncertainty is high on fertility rate data, but the rate dropped from above 7 children per woman in 1980 to 2 (USCB)- 2.4 (PRB) in 2018.



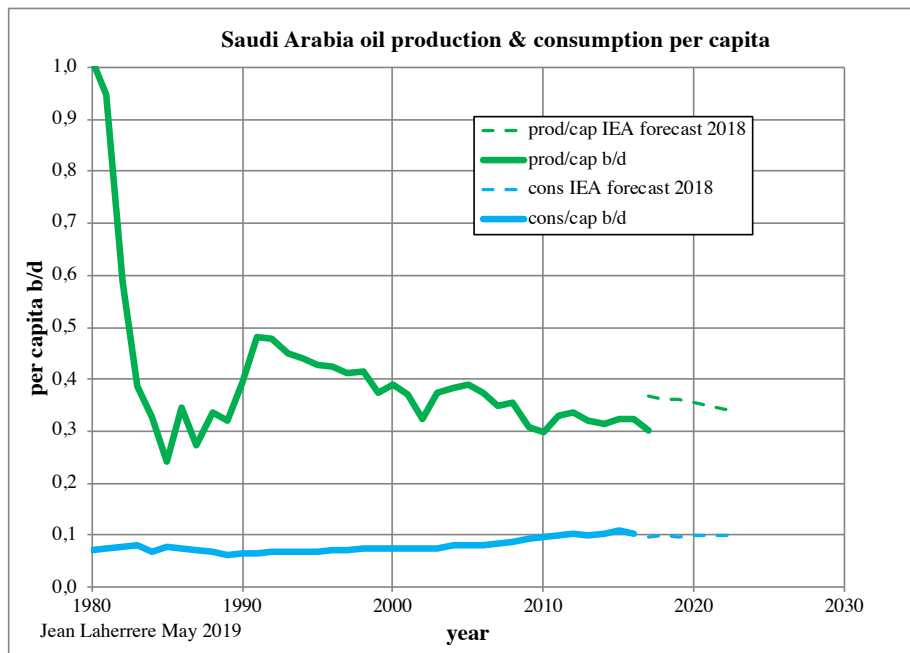
Fertility rate of non-Saudi is lower than Saudi rate!

### -Production & consumption per capita

Consumption per capita (in blue) was low in 1989 and has increased from 1969 to 2016 and has decreased in 2017: IEA 2018 forecast is flat for the next few years.



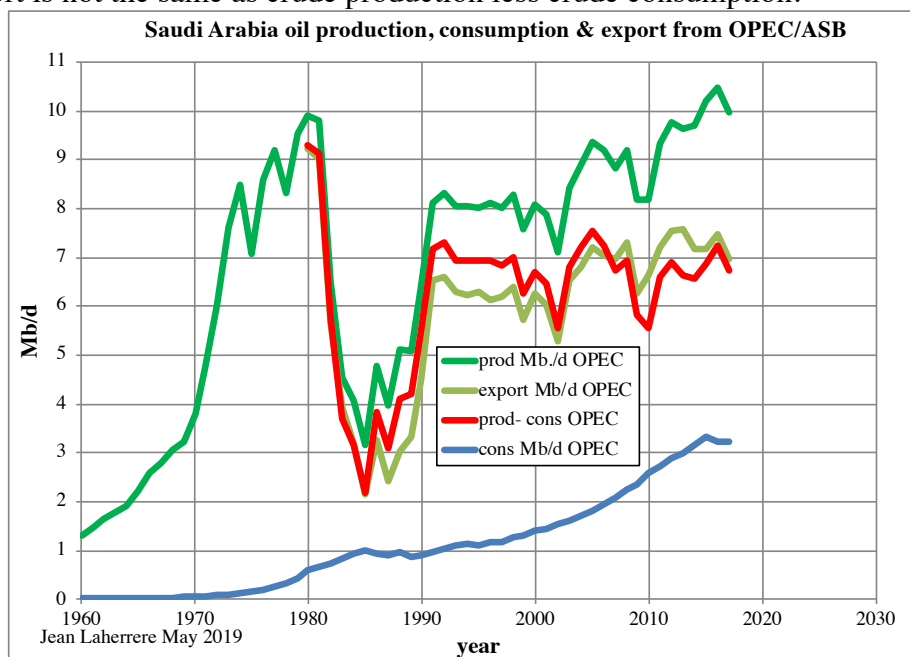
At the same scale, oil production and oil consumption per capita displays a decrease since 1991 for production when consumption displays an increase!



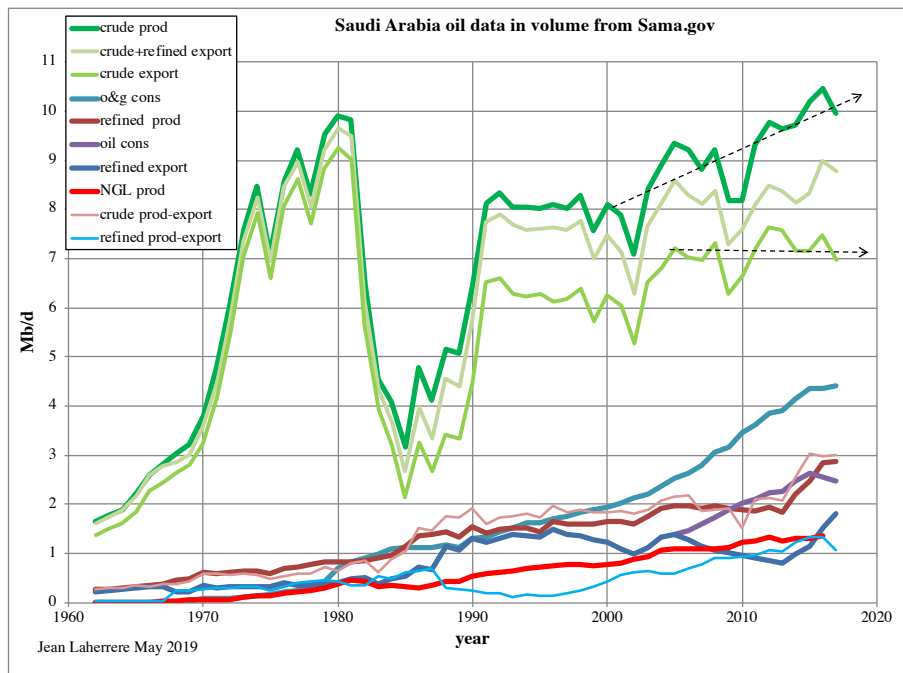
### -Net export

From OPEC data giving SA crude oil production, oil consumption and crude oil net import there is a discrepancy between export and production less consumption because SA has a large capacity of refineries and in 2017 SA has refined 3 Mb/d, export 7 Mb/d of crude oil and 1.8 Mb/d of refined products.

Crude export is not the same as crude production less crude consumption.



Oil data in volume from Sama.gov

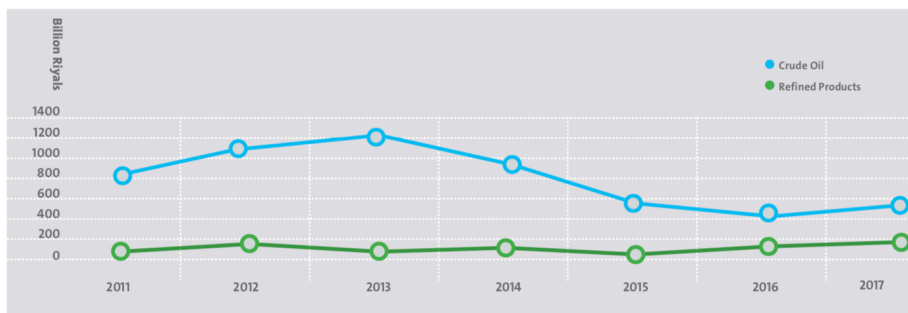


It appears that crude production less crude export is close to the refined production, which has increased sharply since 2013.

It appears that crude oil production has increased from 2000 to 2016, but that crude oil export is flat since 2006.

The value of crude oil has decreased from 2013 to 2014 with the oil price, when the value of refined products export stays flat.

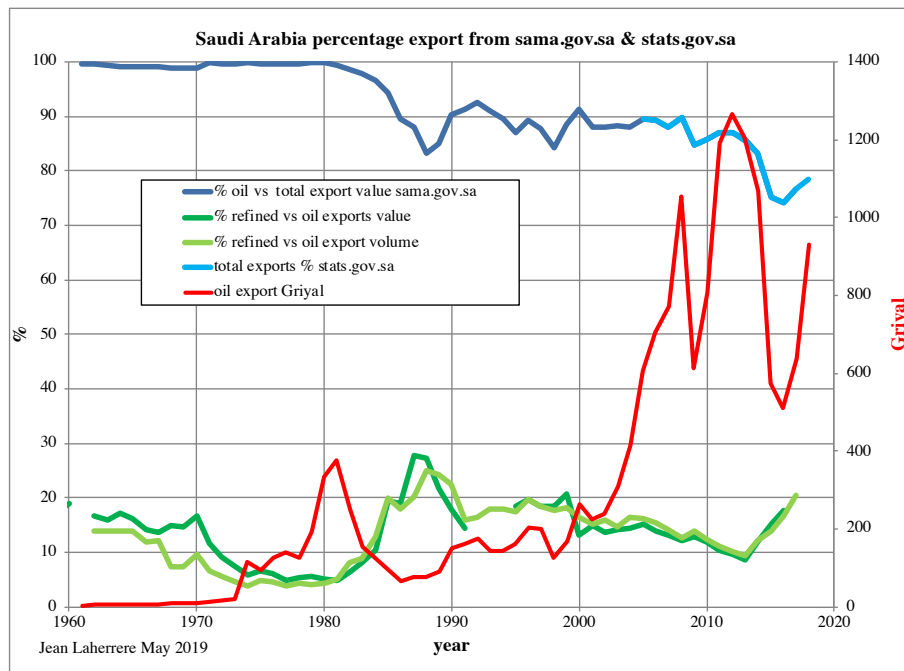
Chart 9.1:  
Value of Saudi Oil Exports



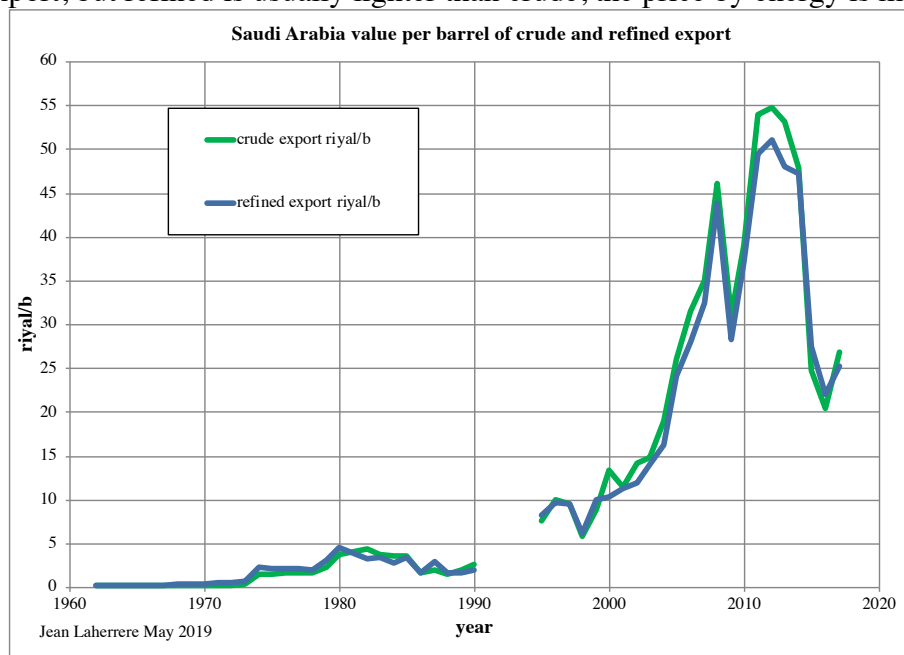
The percentage of the refined value versus the crude + refined value was 15 % in 1970, up to 28 % in 1987, down to 9% in 2013 and 20% in 2017, which is significant. The percentage in volume is similar to the one from sama.gov.sa.

The percentage of oil exports versus total exports in value was 100% until 1980 and is down to 77% in 2017.

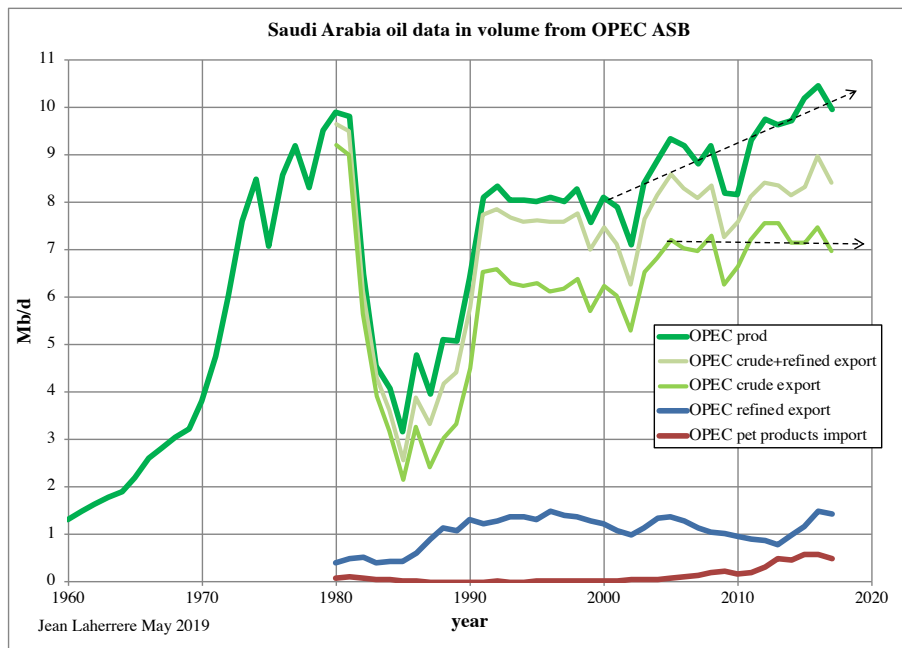
The curve (red) of the oil export value in Griyal displays a peak in 1981 and 2012: it looks like the Russian Mountains!



To my surprise, the price of refined export per barrel is similar even lower than the price of crude oil export, but refined is usually lighter than crude, the price by energy is more

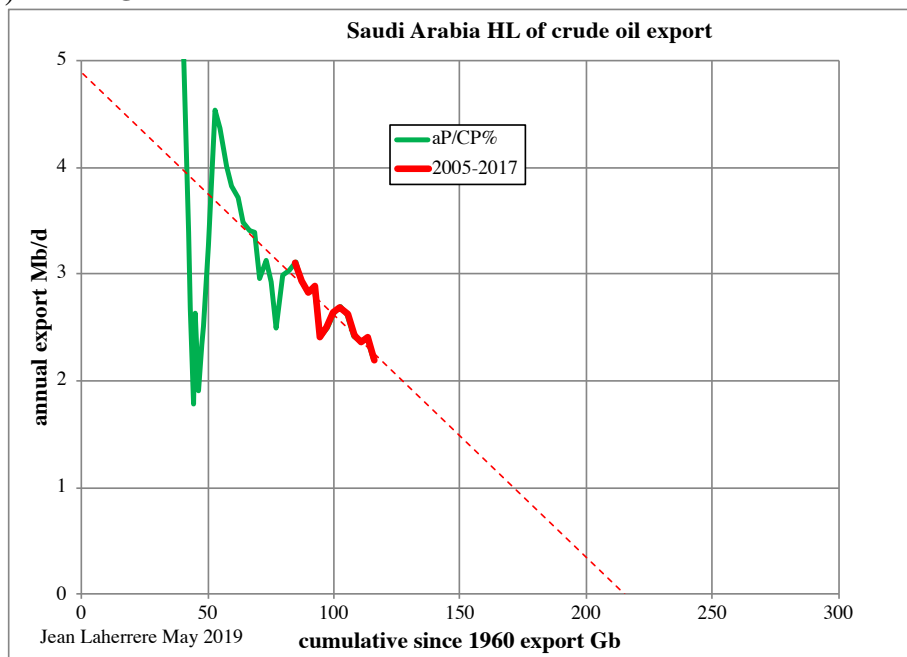


OPEC ASB oil data reports export for crude and for refined, but also imports of petroleum products increasing since 2006, when refined export increases since 2013.



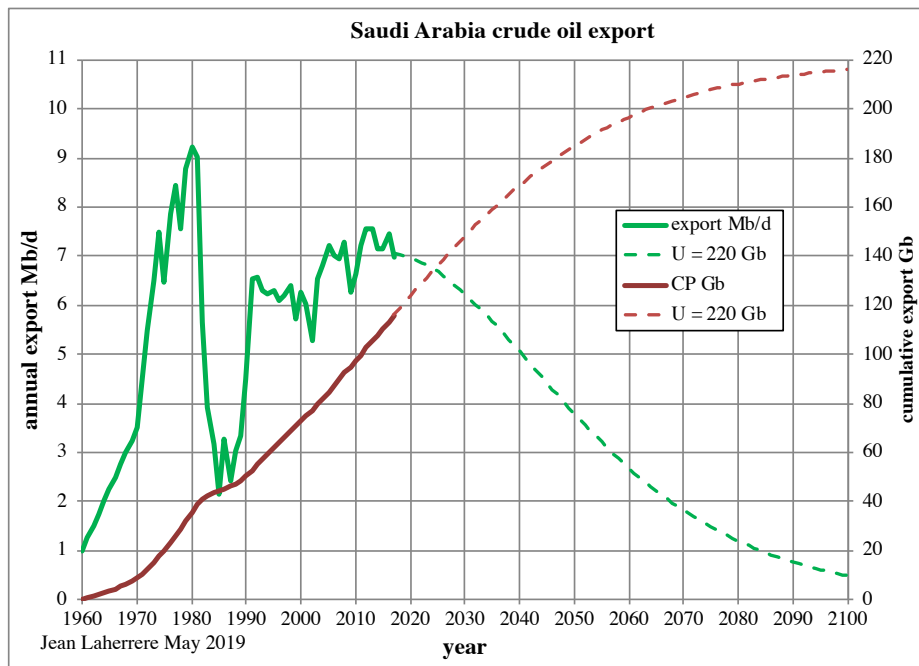
SA is known mainly for their crude oil export, but now refined products provide 20 % of the oil export, and the new refinery in Jubail with Total should increase the importance of refined export.

The HL of crude oil export for the period 2005-2017 trends towards a cumulative production (since 1960) of 220 Gb

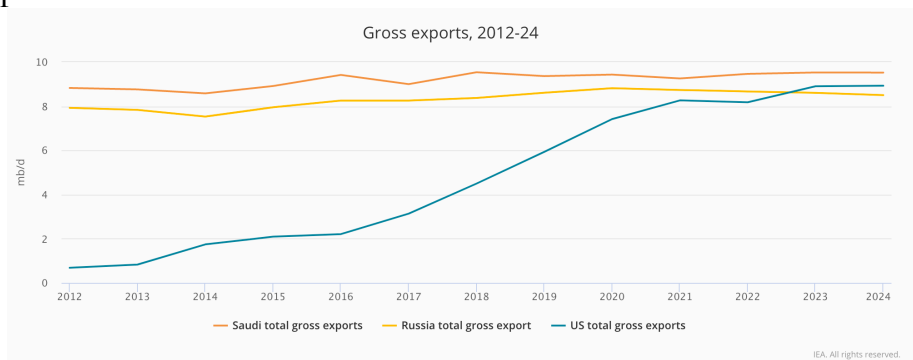


Crude oil export is forecasted using an ultimate of 200 Gb and in 2050 crude oil export will be only 4 Mb/d against 7 Mb/d in 2017





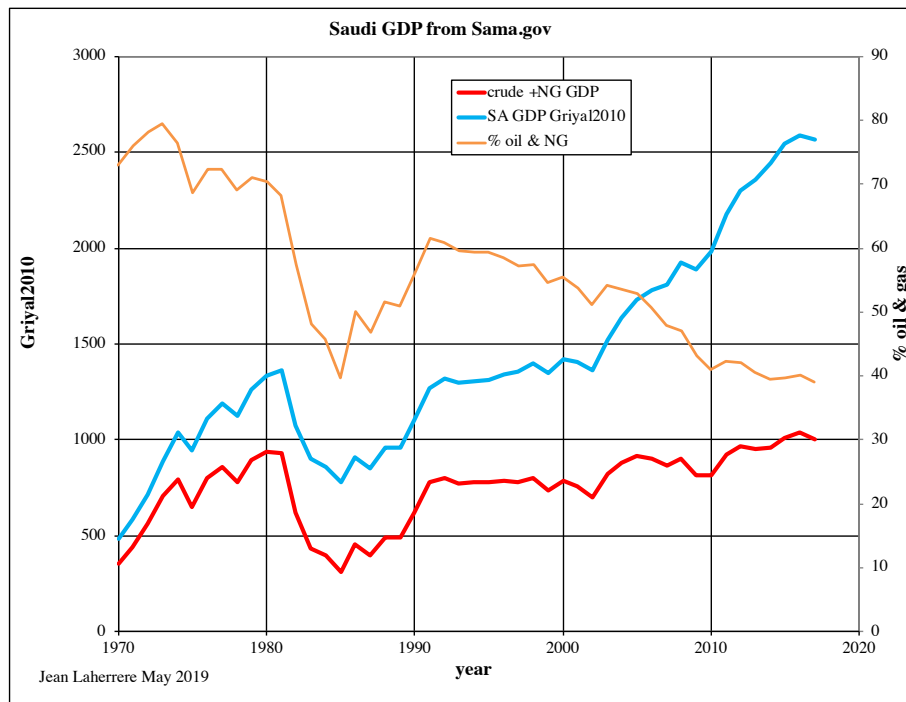
IEA 2019 forecasts a flat SA export up to 2024, as for Russia when Russia oil minister forecasts a peak in 2021!



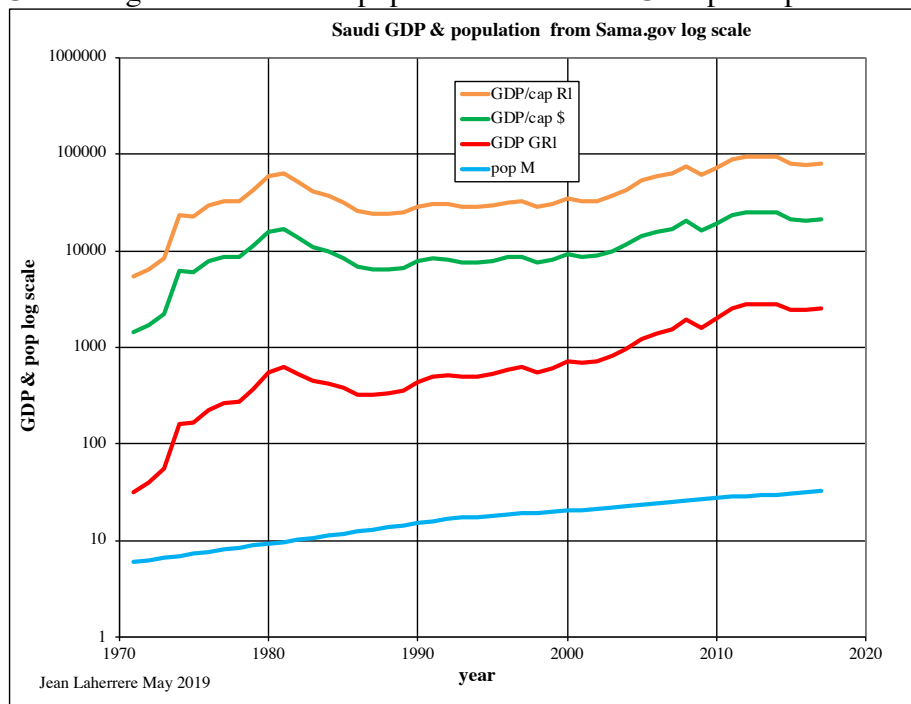
## -GDP

SA GDP in Griyal2010 has increased sharply since 2002 (same level as 1981), but it is flattening.

The percentage of oil & gas in GDP has decreased from 80% in 1973 to 39% in 2017



It is better to display GDP & population graph in log scale to compare the rate of growth; since 1988 GDP has grown faster than population as seen in GDP per capita.

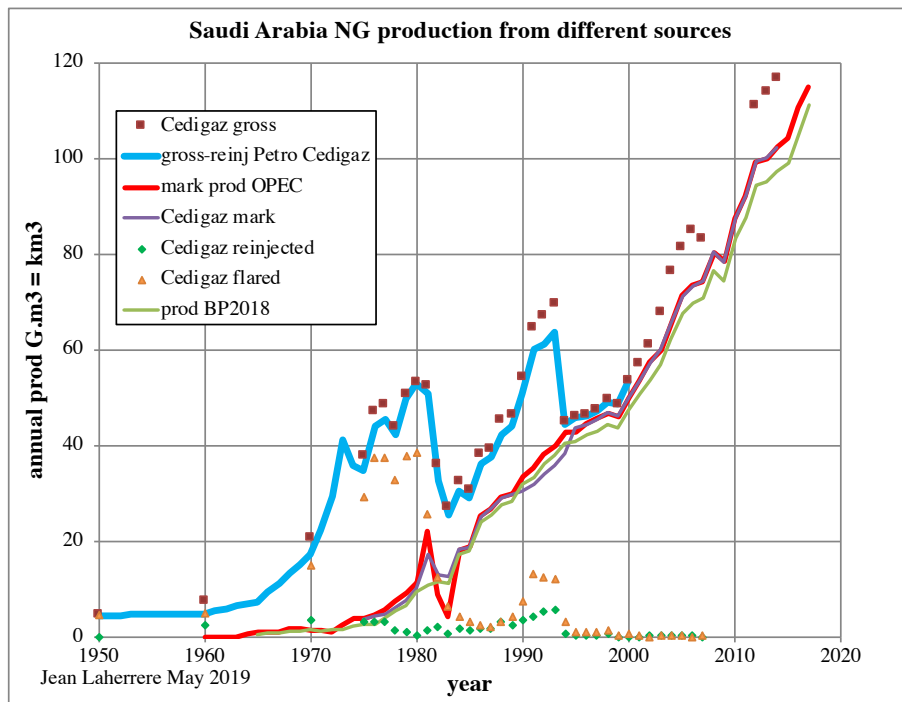


### -Natural gas

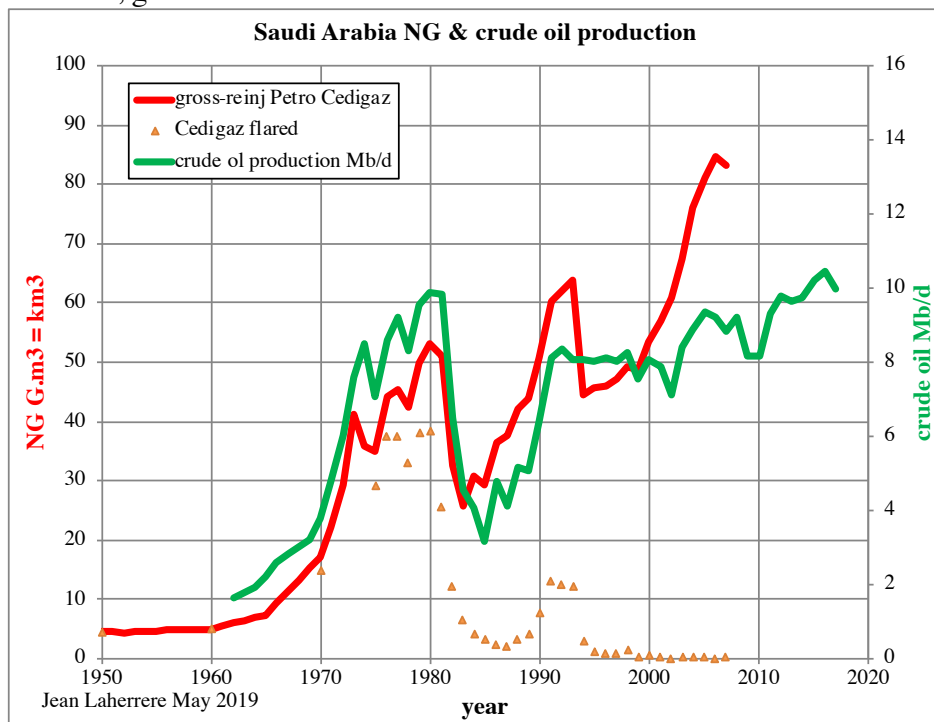
Sama.gov.sa reports NG reserves but not NG production, which is used only domestically. OPEC production starts in 1960 and is marketed production, but Petroconsultants and Cedigaz reported gross less reinjected and the data is quite different because a lot of gas was flared in the 1970s (up to 38,4 G.m<sup>3</sup> = km<sup>3</sup> in 1980)

There is a sharp decline of gross from 1981 to 1983, with a sharp peak in OPEC marketed production, not seen on BP data which smooth this event related to a sharp drop in flaring.

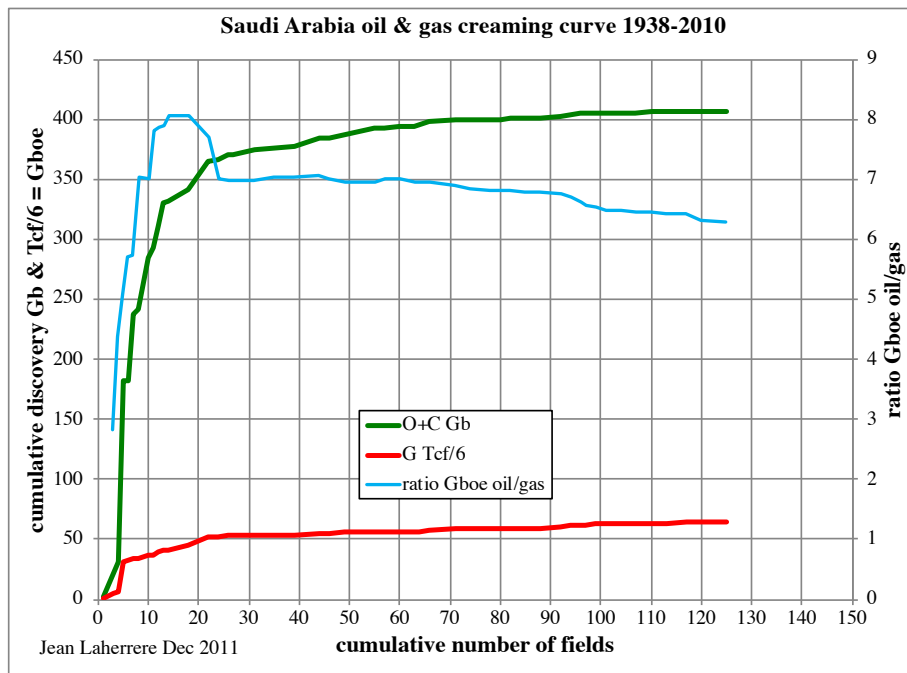
After a second burst of flaring in 1991 (13 G.m3) flaring were stopped in 2000 and gross less reinjected is close to marketed



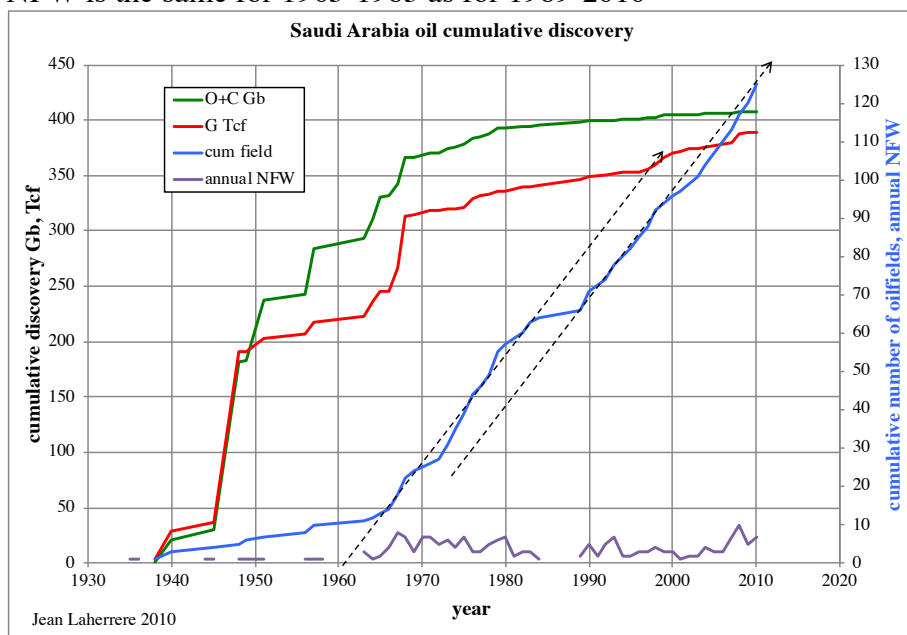
The graph NG & crude oil production shows that up to 1993 gas flaring was connected to crude oil production, gas was a nuisance and flared?



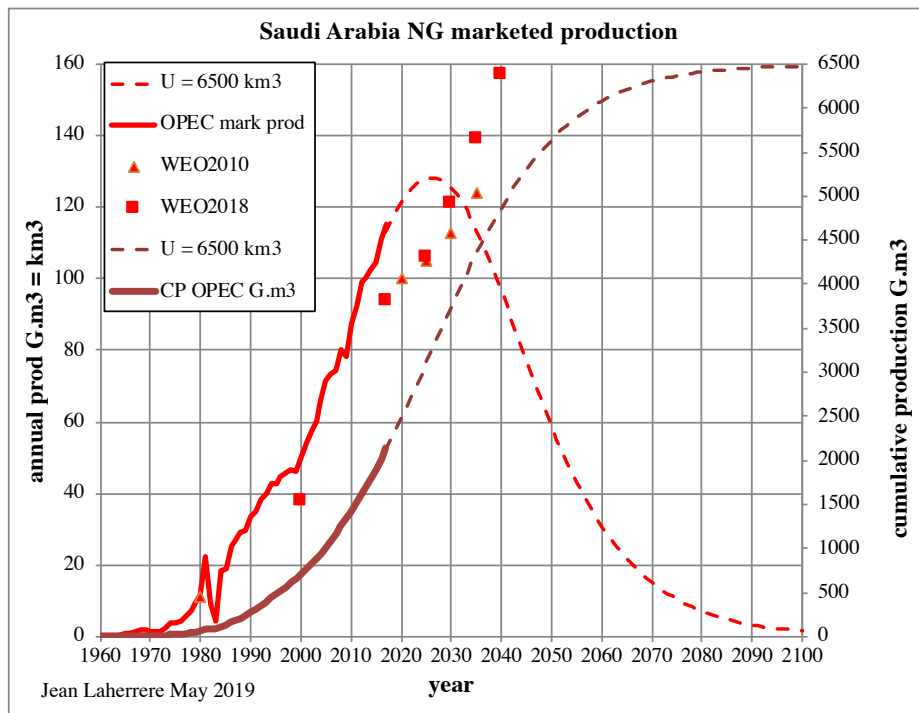
SA oil & gas creaming curve 1938-2010 (cumulative backdated 2P discoveries versus cumulative number of fields) displays a hyperbolic trend with about 7 more oil than NG in Gboe



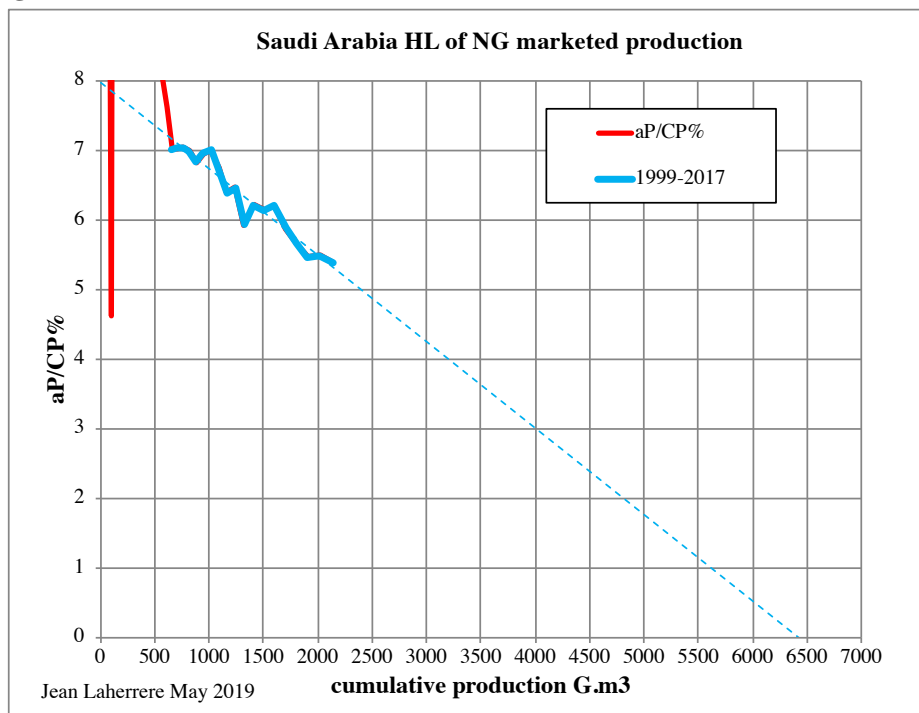
The same cumulative discovery and cumulative number of NFW (new field wildcat) versus time shows the same flattening since 1980. No NFW from 1985 to 1988. The slope of cumulative NFW is the same for 1965-1983 as for 1989-2010



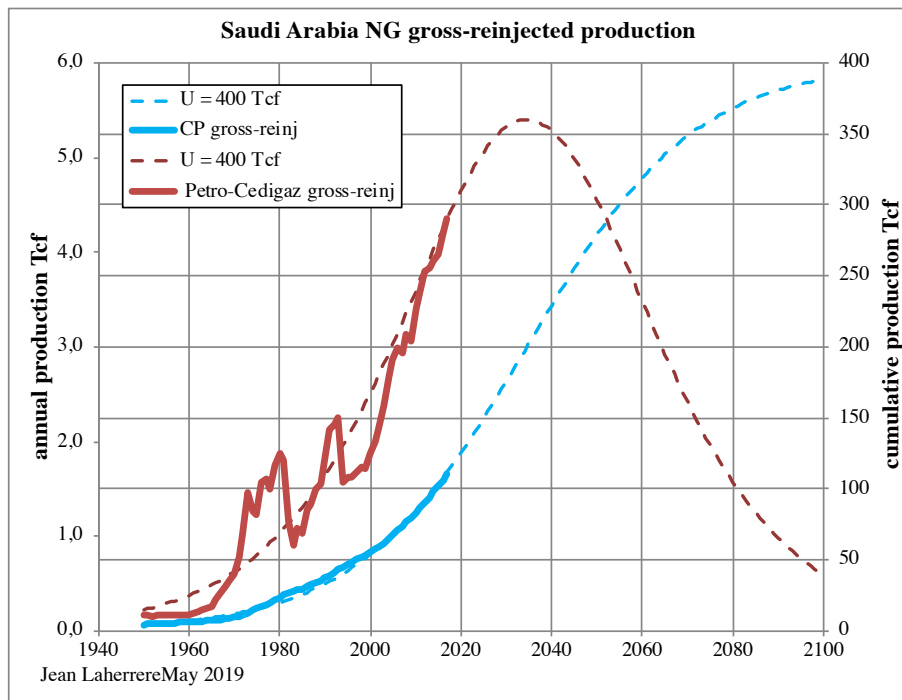
SA marketed NG production from OPEC (the best) is extrapolated for an ultimate of 6500 G.m<sup>3</sup>, giving a peak in 2026, when IEA/WEO 2018 (with low values for the past by 10%?) forecasts 160 G.m<sup>3</sup> in 2040 against my forecast of 100! WEO2010 was much lower.



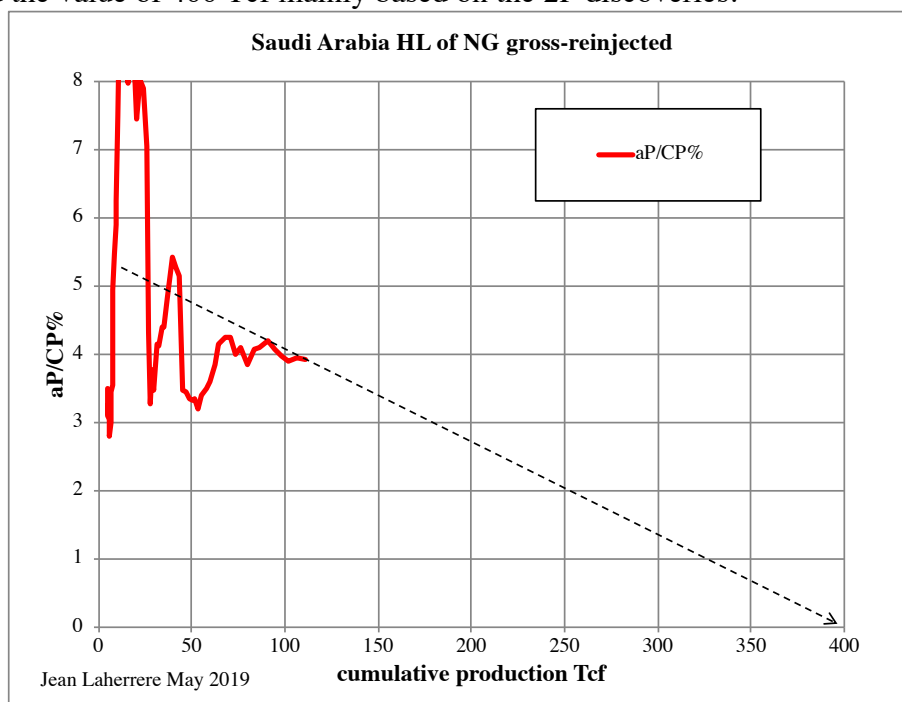
The HL of marketed production trends for the period 1999-2017 towards 6500 G.m3



But the gross-reinjected production is different from marketed production and it is forecasted to peak in 2034 for an ultimate of 400 Tcf

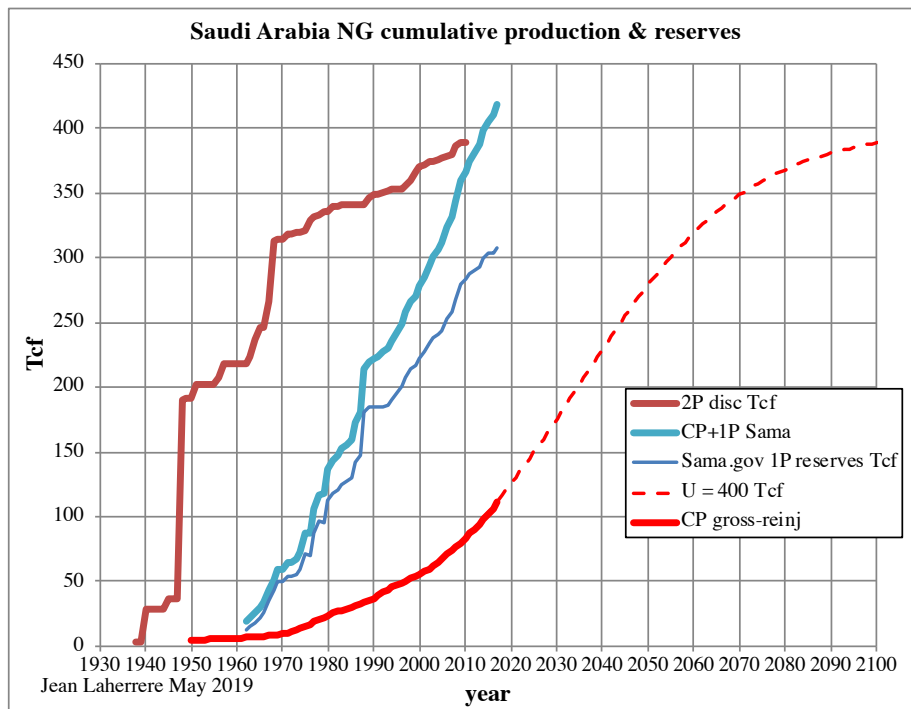


When the HL of marketed is linear for the period 1999-2017 HL of gross-reinjected is more chaotic and the value of 400 Tcf mainly based on the 2P discoveries.

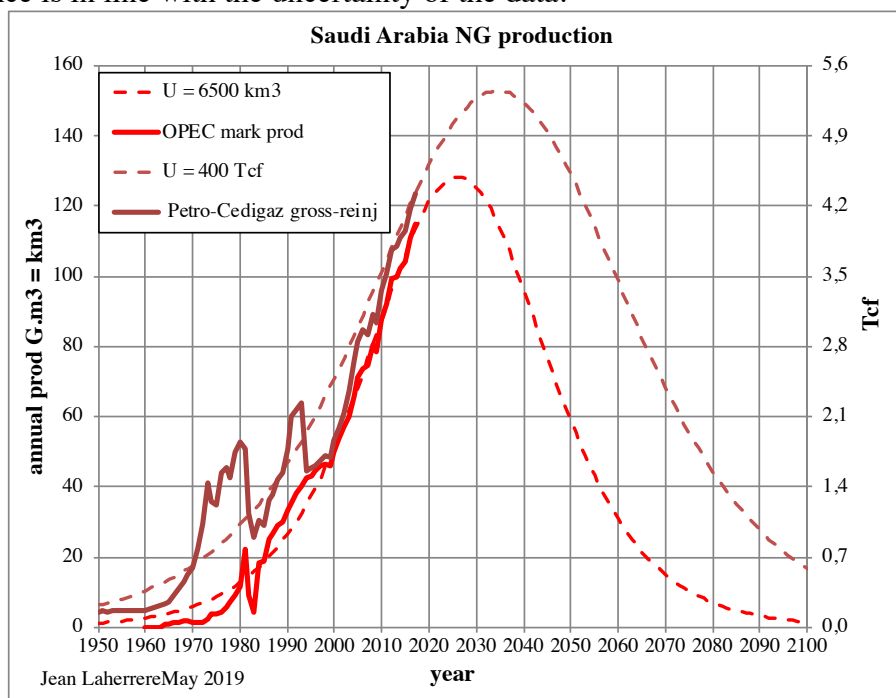


The 2P discoveries were in 2010 less than 400 Tcf and flattening. The cumulative production plus proved reserves are in 2017 at 420 Tcf, likely overestimated as the slope since 1960 is in linear, as if the growth is without end.





The comparison of the forecast of the marketed production and of gross-reinjected shows that the difference is in line with the uncertainty of the data.



SA needs a lot of energy for climatization and desalination and was eager to find more natural gas, as in the past oil was found 7 times more than gas. But the attempts of exploration carried out by the team of Total, Shell and Aramco (agreement in 2003 for the Empty Quarter) were unsuccessful: Total quitted first and last Shell.

<https://www.telegraph.co.uk/finance/newsbysector/epic/rdsb/10948305/Saudi-Arabia-gas-project-has-failed-admits-Shell.html>

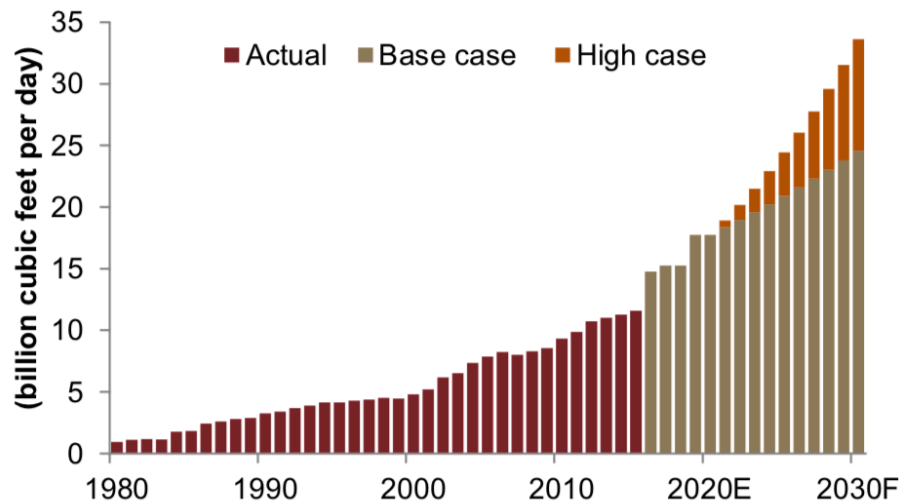
Saudi Arabia gas project has failed, admits Shell

Shell has had no success in its decade long search for gas in the deserts of Saudi Arabia

Andrew Critchlow 05 Jul 2014

In March 2019 a natural gas large discovery was announced but no data on reserves. The 2016 Vision 2030 forecasts in 2030 a production of 23 Gcf/d = 8.4 Tcf, my forecast is less than 5 Tcf

**Figure 1: Saudi actual and forecasted raw gas production**



#### -Shale gas

So now Aramco hopes to explore and produce shale gas and signs in 2018 a 3 year “unconventional gas stimulation services” with Halliburton.

*In 2010, Schlumberger, Halliburton and Baker Hughes were invited by the Saudis to share their shale gas expertise and all three have subsequently established research centres in the kingdom, attempting to match their technology to the specifics of Saudi geology.*

*State oil company Saudi Aramco worked with Halliburton in 2011 to analyse and explore at the Shale-1 well in the Silurian Qusaiba, which had been drilled four years earlier*

*In 2013, then Saudi Oil Minister Ali al-Naimi said the kingdom had “estimates of more than 600 trillion cubic feet (Tcf) of unconventional and shale gas so the potential is very huge and we plan to exploit it.”*

*US oilfield services company Baker Hughes projected that Saudi Arabia has recoverable shale gas reserves of 645 Tcf, which would give the kingdom the fifth largest shale gas deposits in the world. Saudi Aramco has conventional gas reserves of 298.7 Tcf, so the ability to harness the kingdom’s shale gas potential cost-effectively could be a game changer for the kingdom.*

Last news on shale gas: a lot of talk but few facts!

<https://www.oilandgasmiddleeast.com/drilling-production/33567-saudi-aramco-to-develop-al-hasa-unconventional-gas>

Saudi Aramco to develop Al-Hasa unconventional gas March 2019

Although fresh water is lacking in the region’s desert ecosystem and sand is in abundance, Kenawi says that sand is the larger obstacle to cost-effective fracking in the region. In the US, fracking typically requires sandstone or ceramic beads, which are not widely available in Saudi Arabia or the GCC. “One of the most important things to bring costs down to make the unconventional resources economical is using local sand, so our Saudi research and development centre focuses heavily on local sand,” Kenawi says.

<https://www.bloomberg.com/news/articles/2019-04-29/saudi-aramco-sees-shale-gas-as-kingdom-s-next-energy-bonanza>

### Saudi Aramco Sees Shale Gas as Kingdom's Next Energy Bonanza

By Anthony Dipaola and Verity Ratcliffe 29 April 2019

Saudi Aramco is building facilities to tap shale gas in the kingdom's oil-rich eastern region and is making "a lot of progress" toward this goal, Chief Executive Officer Amin Nasser told reporters in Dammam, Saudi Arabia. Plans include a plant to desalinate seawater that Aramco can then inject underground to frack for gas.

"We are looking to take our unconventional gas within the next 10 years to 3 billion standard cubic feet a day of sales gas," Nasser said on Sunday. Aramco currently produces more than 190 million cubic feet of unconventional gas daily, all of it in the remote north.

Aramco plans to double its total gas production to 23 billion cubic feet a day over the coming decade, Nasser has said. He sketched out the kingdom's ambitions on April 25 at a conference in Riyadh.

"For the first time ever, we will be exporting gas either by pipeline or as LNG" -- or liquefied natural gas, Nasser said. "For gas, we will be a major player."

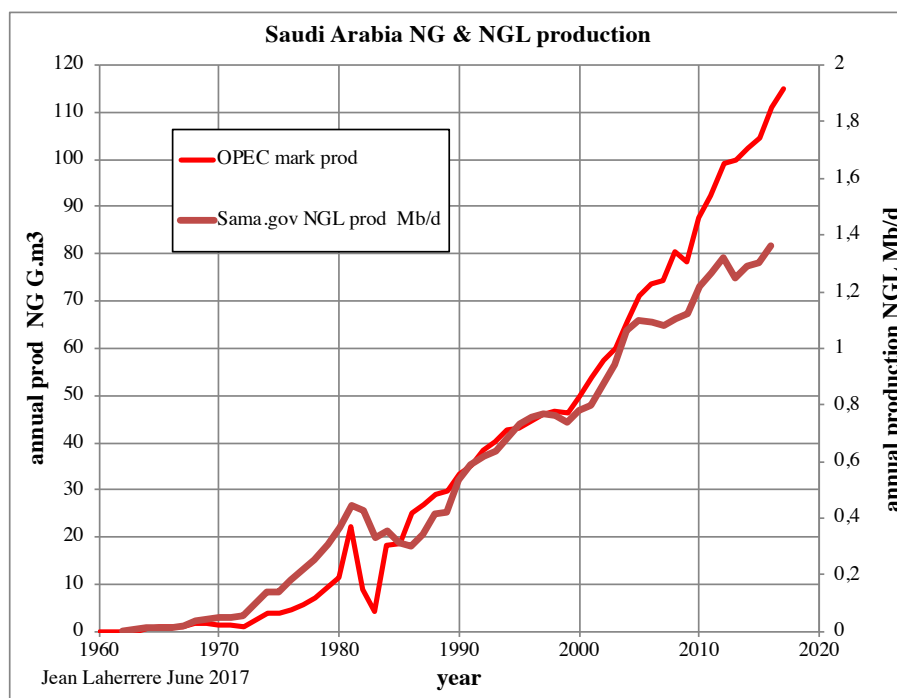
<https://www.thenational.ae/business/energy/saudi-aramco-to-begin-new-phase-of-shale-gas-development-next-year-1.839490>

Jafurah, which has significant unconventional reserves, is located between Ghawar, the world's largest producing oilfield, and the Arabian Gulf.

To acquire experience Aramco is said to consider US shale investment with Equinor in Marcellus.

### -NG and NGL production

NG production is compared with NGL production and they correlate from 1960 to 2005 and beyond NGL is less than NG. I am unable to forecast if this divergence will continue.



## **-Conclusion**

Saudi Arabia is the House of Saud and keeps its oil data confidential.

Published proven reserves have been around 260 Gb for the last 30 years where SA has produced 94 Gb of crude oil, but proved reserves are political, base of the OPEC quotas and of OPEC fight between 1985 and 1989 with the addition of 300 Gb of speculative resources (90 Gb for SA).

Flat reserves mean that for 30 years annual production equals annual discovery: it is unlikely. For the first time SA proved reserves were audited, but the six significant digits, far beyond the uncertainty of the estimate, show for me that the second digit is surely wrong and the first digit likely.

SA crude oil ultimate could vary from 250 Gb to 350 Gb: large uncertainty but representing only 3 years of world oil consumption.

Manifa discovered in 1957 was the last huge oil development in 2013 for a cost over 10 G\$.

Manifa is stated as a triumph of engineering and reported to have produced 0.9 Mb/d in 2015. But corrosion hit the water injection and work was carried on by Saipem, but Manifa crude oil production is now a State secret.

Oil production on the Neutral Zone (50/50 SA/Kuwait) was stopped in 2015 because a dispute with Kuwait, production could be started again quickly bringing 0.25 Mb/d to SA.

SA is not just a crude oil exporter, but also a refined products exporter with now 20%% of the oil export

It is very hard to forecast SA oil & gas production, because production data is incomplete and unreliable, but crude oil production peaked in 2016 and will likely decline in the future; NG production will peak around 200, as the attempts of finding more gas were unsuccessful. A recent NG discovery in the Red Sea could change this poor picture, as the dreams of SA for shale gas production?