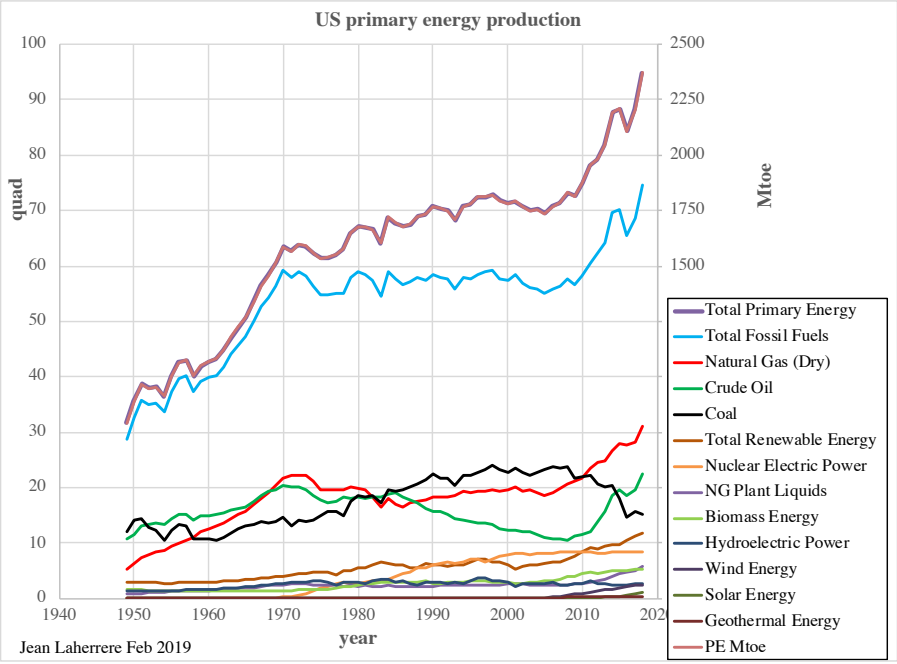
Jean Laherrere 3 March 2019

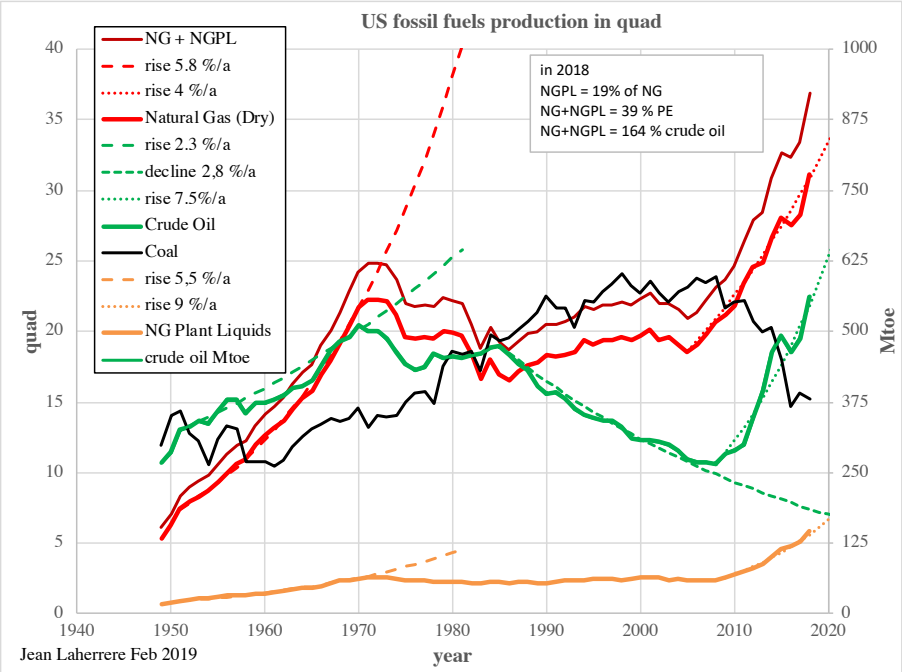
US primary energy in quad

USDOE EIA MER reports each month the primary energy since 1949 in quad = US quadrillion = 10E15 Btu = PBtu (peta)
SI quadrillion = million power 4 = 10E24 = Y
The Btu (British Thermal Unit illegal in the European Union since 1980, replaced by the Joule) is equal to 1055 J and 1 quad ~ 1.06 EJ (exajoule) ~25 Mtoe

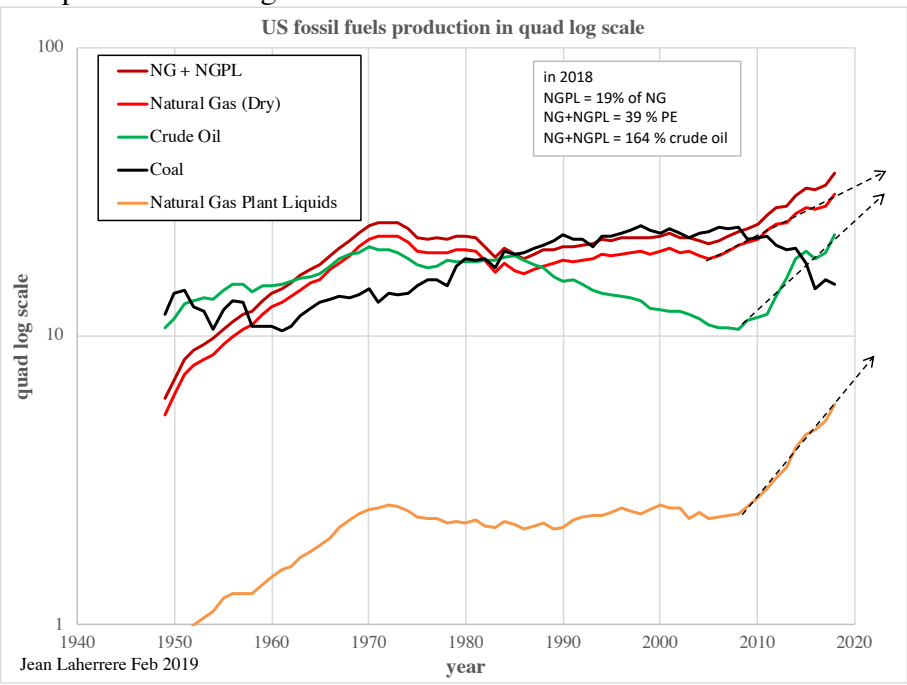
From EIA Monthly energy review US primary energy production displays the large importance of fossil fuels and the largest production is natural gas, overpassing coal (first 1986-2010.



US fossil fuels production in quad displays a large increase of 9 %/a for NGPL since 2009, of 7.5 %/a for crude oil since 2008 and only 4 %/a for natural gas since 2005.
Pour crude oil the rise 1951-1970 was 2.3%/a and the decline 1985-2006 2.8 %/a, pretty close. The US oil production is a good example of symmetry because the high number of oil producers acting in random.

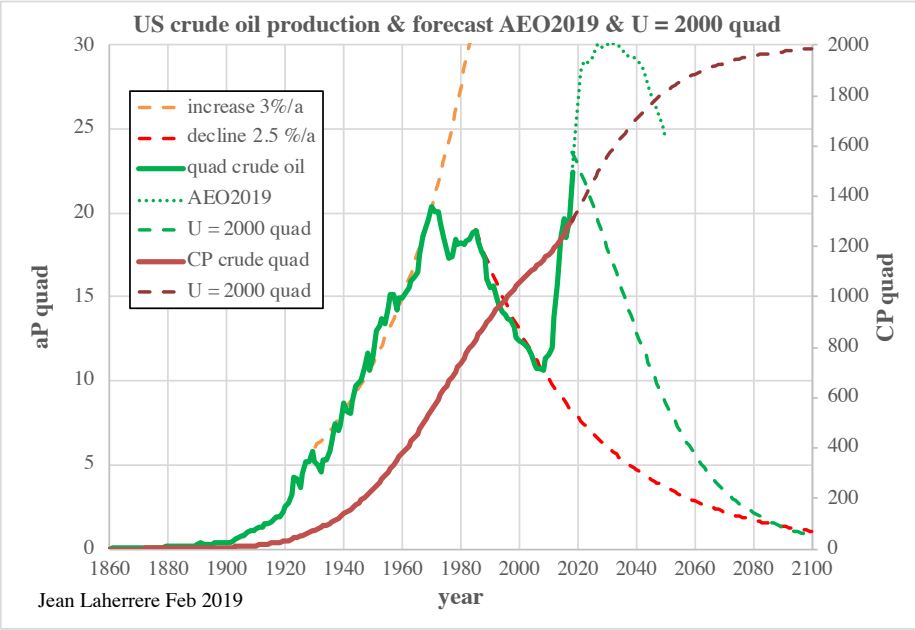


The same display in log scale allows to compare slopes. NGLP production is similar to NG production, except for the shale gas

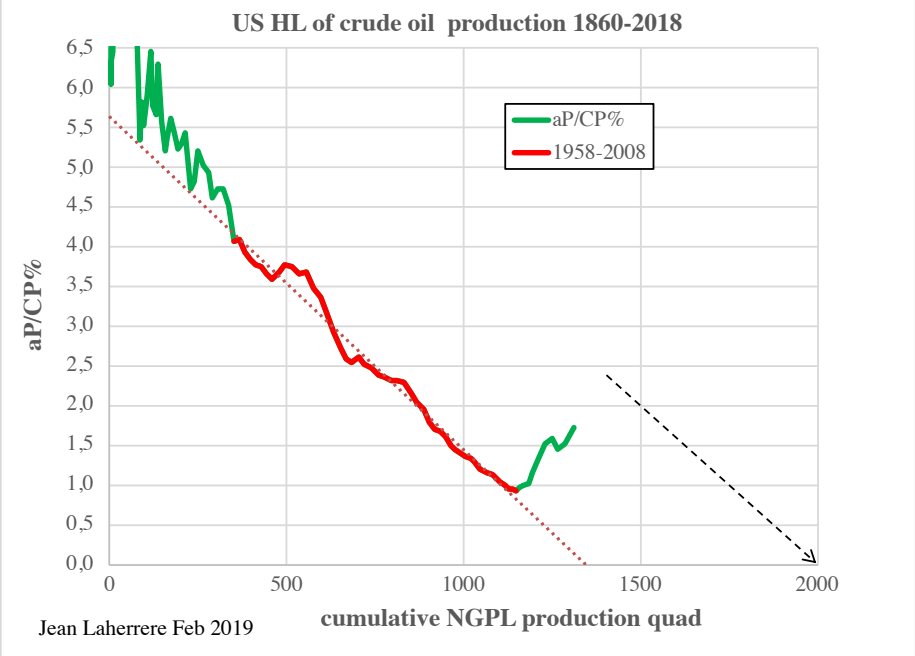


Crude oil 1860-2100

Crude oil (including lease condensate), after a peak in 1970, in 1986 (Alaska) is presently increasing since 2008 with the LTO (*light tight oil* instead of the poorly called *shale oil)*.
Its ultimate is estimated at a round value of 2000 quads = 50 Gtoe = 350 Gb. Comparing to the crude oil ultimate in Gb a value of 1900 quads is closer. But a 2000 quads ultimate shows more the uncertainty of the ultimate, with only one significant digit.
With such ultimate of 2000 quads, the crude oil production will be in 2035 about 15 quads when USDOE.EIA AEO 2019 forecasts the double = 30 quads.

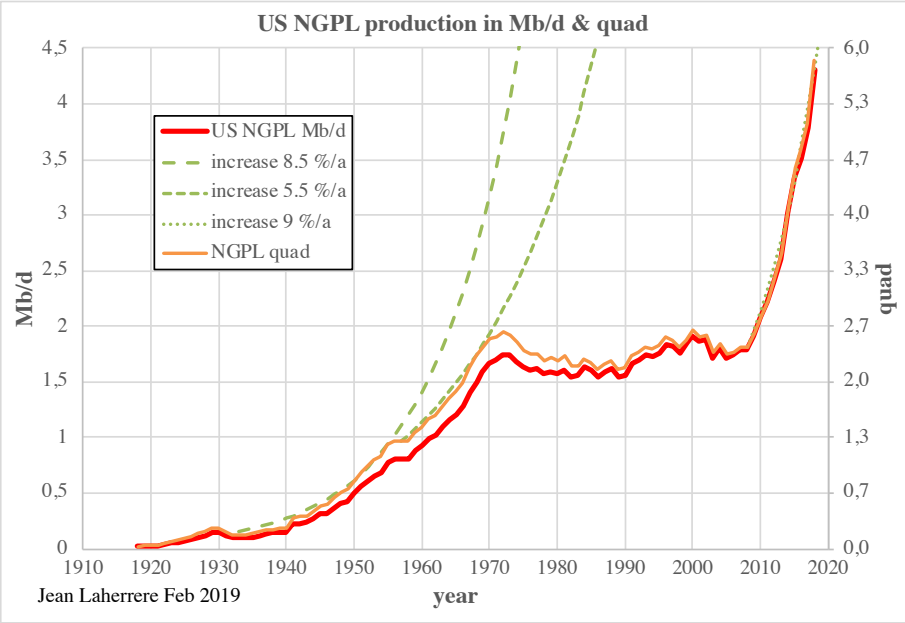


The HL of the crude oil is presently rising with the LTO but its future decline will be parallel to the trend 1958-2008, trending towards the rounded 2000 quads

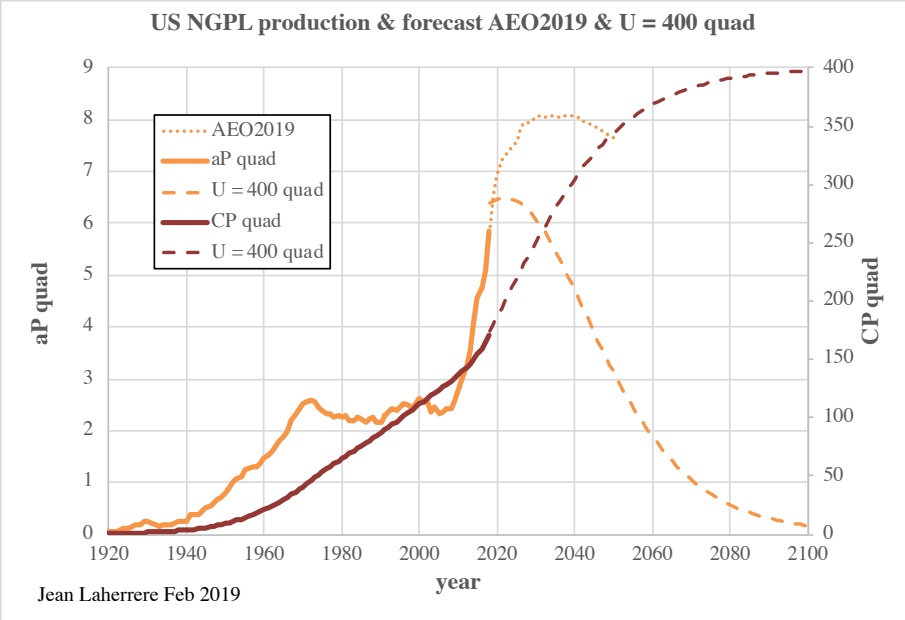


NGPL production 1919-2100

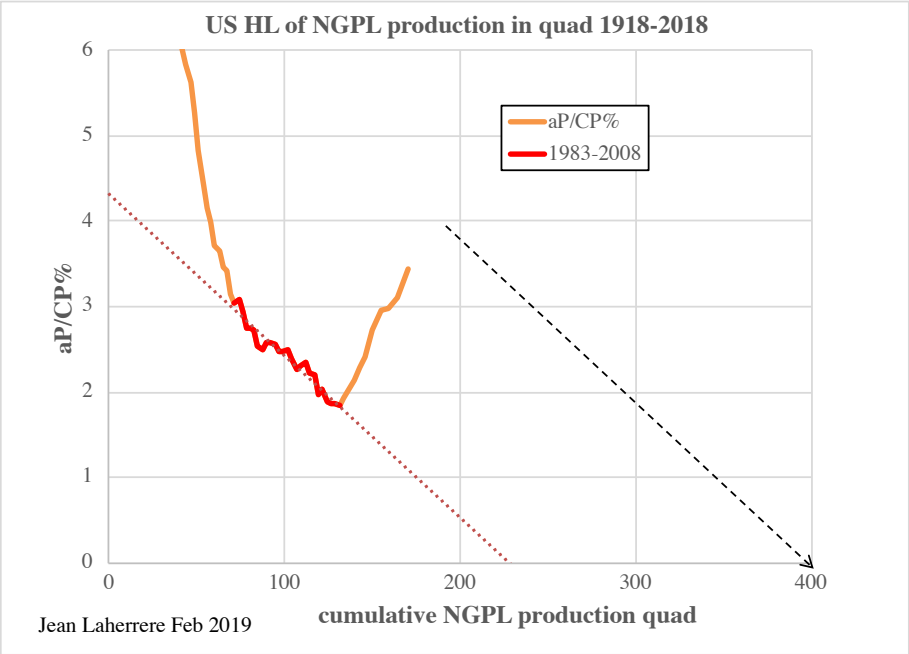
The natural gas plant liquids production has increased since 1933 at 8.5 %/a until 1955, then at 5.5 %/a until 1970, then almost flat and from 2008 increasing at 9 %/a.



NGPL ultimate is estimated at 400 quads, leading to a peak around 2022 and a production in 2050 of 3.1 quads when EIA/AEO2019 forecasts 7.65 quads, more the double!

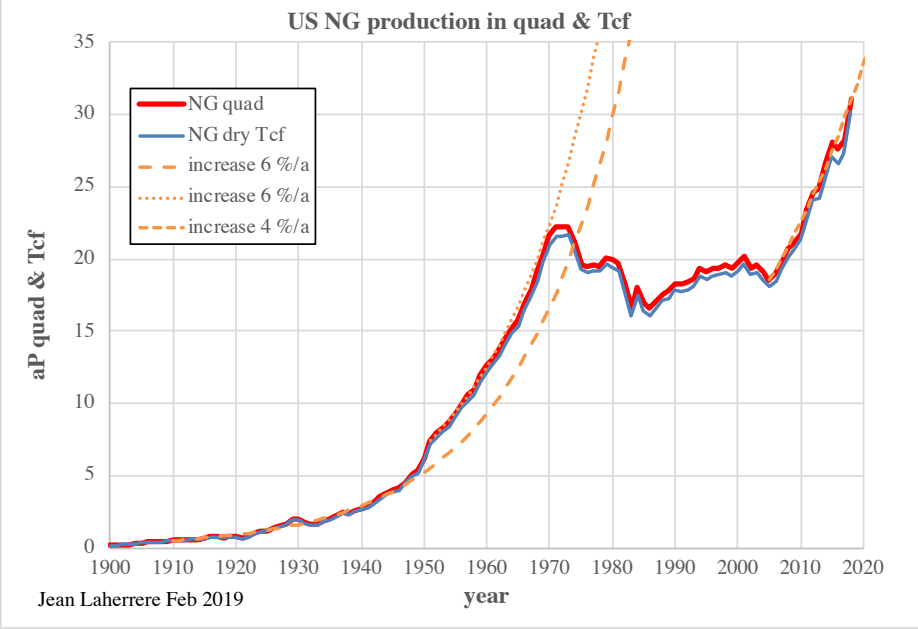


The HL of NGPF production trends towards 400 quads, assuming a parallel decline with the HL decline 1983-2008

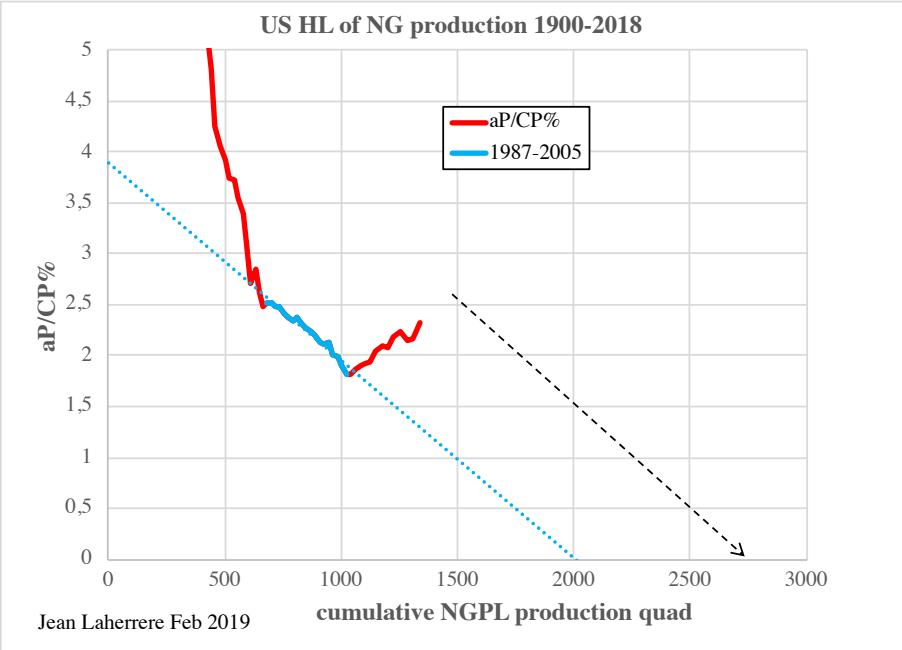


Natural gas production 1900-2100

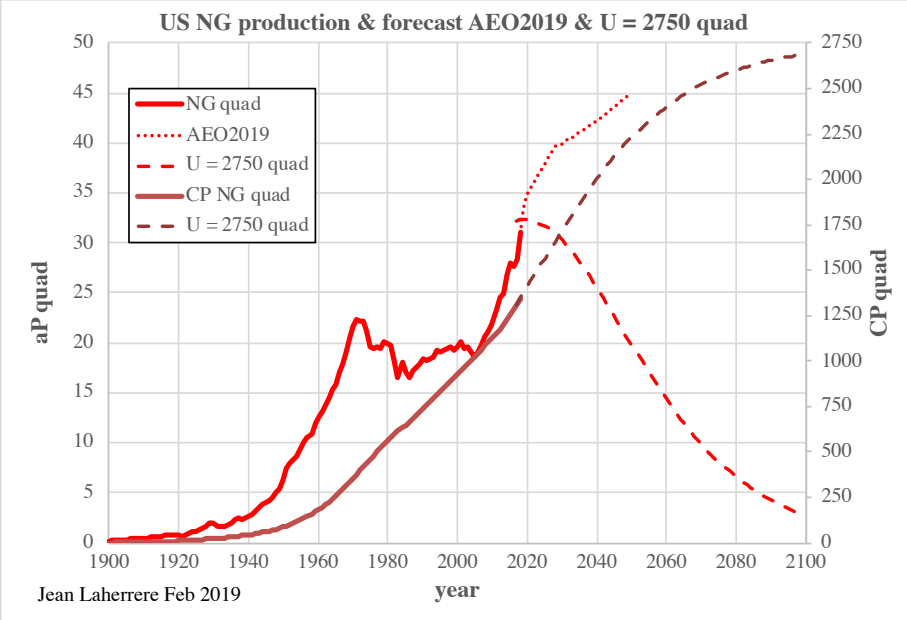
US NG annual production in quad is close to the value in Tcf. Production has increased by 6 %/a since 1910 up to 1970 and again by 4 %/a since 2005



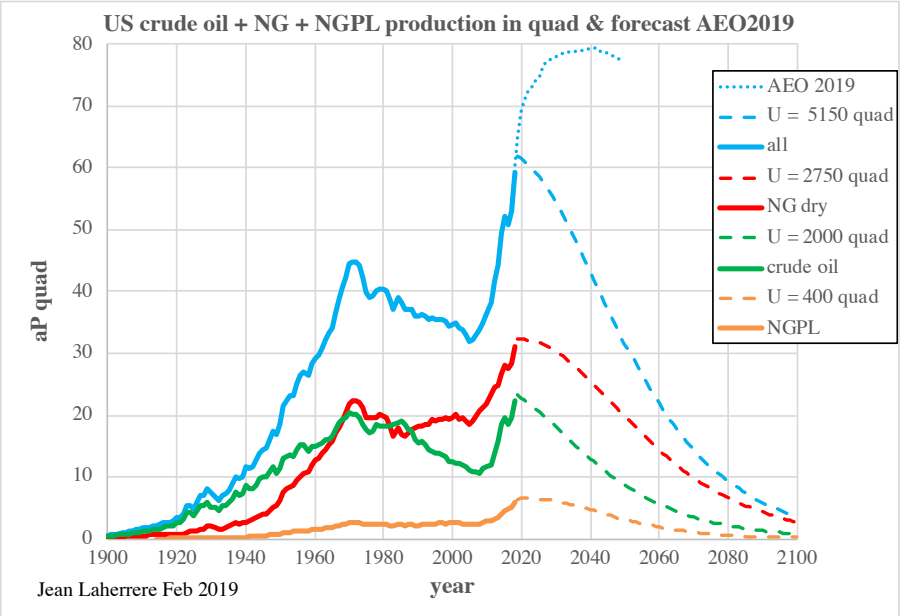
US NG ultimate is estimated at 2750 quads from HL assuming parallelism with the period 1987-2005



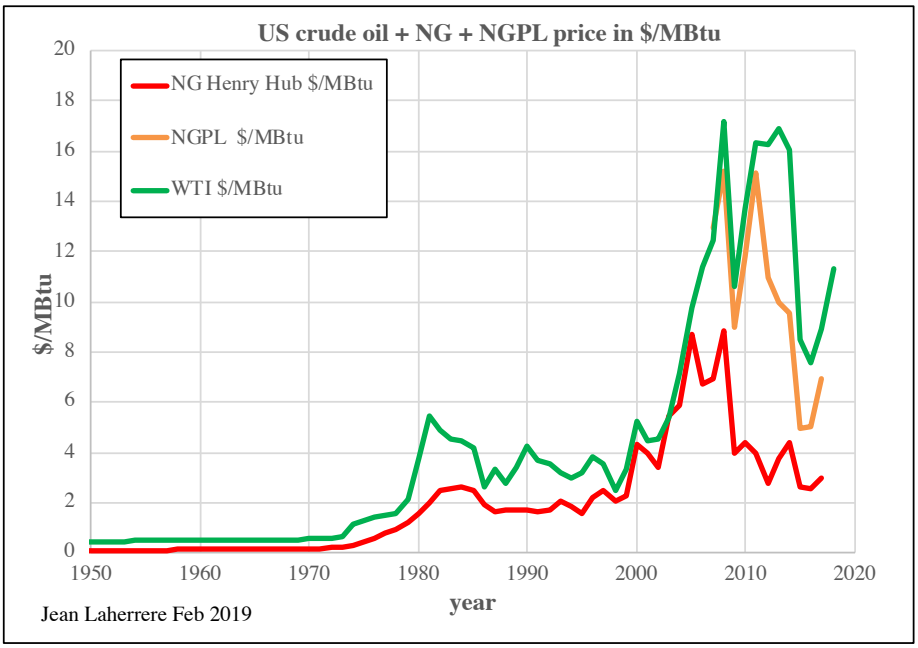
US NG production will peak around 2020 and for the ultimate 2750 quads will be in 2050 at 20 quads against a forecast of AEO2019 of 45 quads: more than double



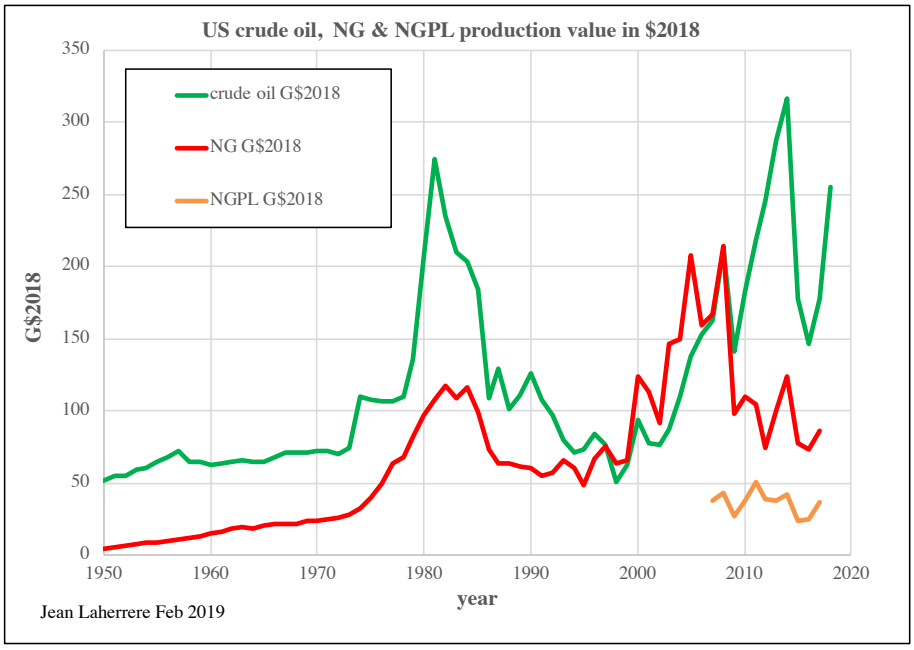
Adding the last three forecasts, crude oil + NGPL + NG productions will be in 2050 at 32 quads against 77 quads for AEO2019: more than double.
It means that, if I am right; the US energy future is bleak, back to the pre-2005. But since 1985 US NG production is much higher in energy than crude oil production.



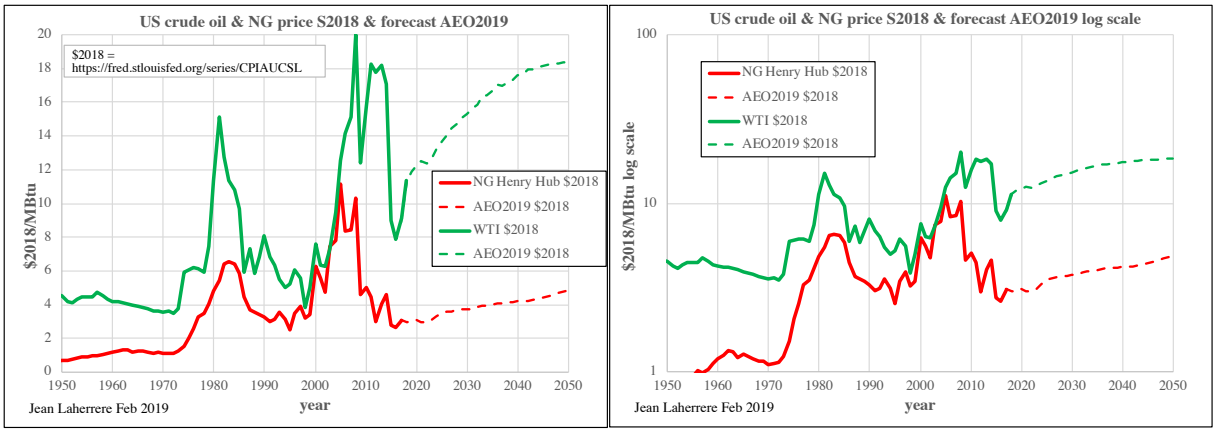
The US fossil fuels price in $/MBtu has changed drastically between sources and with time. Prices are irrational and very hard to forecast



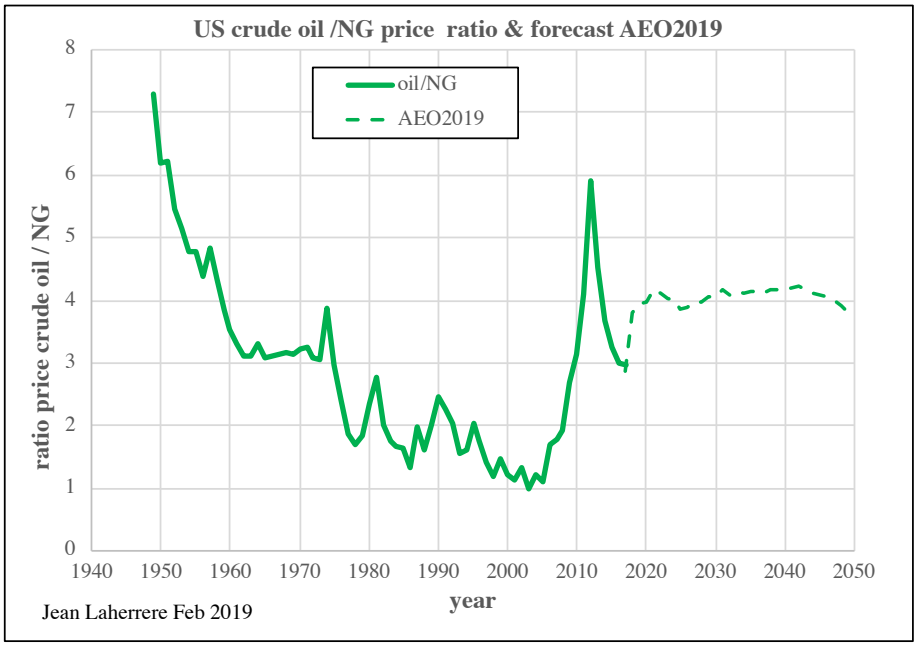
The US oil and gas production converted with such prices and using CPI inflation into $2018 and the NG production is worth much less than crude oil, despite being higher in energy. NGPL production values is presently about half NG production value.



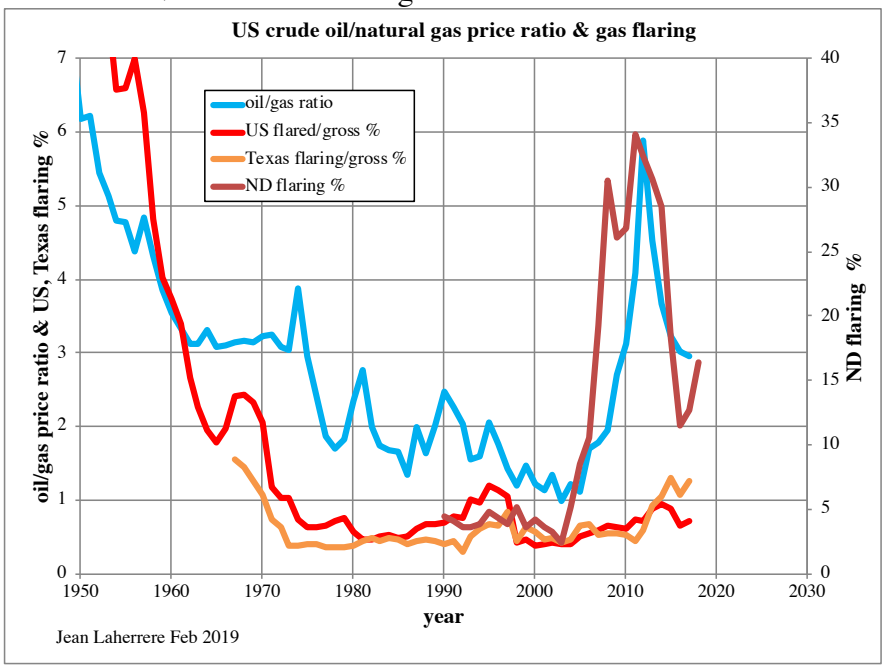
AEO2019 forecast of crude oil and NG prices in $2018 until 2050 is also displayed in log scale



The price ratio oil versus gas is striking: it was about 7 in 1950 declining slowly towards 1, being the equality, in 2005, but with the shale plays it jumped into 6 in 2012 , presently around 3 and forecasted to be 4 from 2020 to 2050, which is strange to me of not trending towards 1 again. Energy equality is not the goal of USDOE/EIA.



In fact gas is wasted and undervalued and flared (or vented) because often associated with oil. The US crude oil/NG price ratio correlates roughly with the US NG flaring (as Texas flaring) and since 2005 with the North Dakota flaring.



It seems hard to believe that the oil/NG price ratio will stay high for the next 30 years, meaning that NG will be continued to be wasted, flared and underestimated

Conclusion

US oil and gas production in energy and in value is a better way to display the truth than the production in volume.

USDOE/EIA/AEO2019 forecasts for 2050 oil and gas production are the double of my forecasts: US oil and gas future could be difficult!