Jean Laherrère 30 August 2019

Are there enough fossil fuels to generate the IPCC CO2 baseline scenario?

IPCC has published 5 assessment reports on climate change: AR1 = 1990, AR2 = 1995, TAR = 2001, AR4 = 2007, AR5 = 2013. AR6 will be in 2021
These reports were based on IS92 scenarios for the first 2 reports, then on 40 SRES energy scenarios for TAR & AR4, last on 4 radiative forcing RCP scenarios (but using mainly the old SRES) for AR5.
CO2 emissions from fossils fuels come from the conversion in GtCO2 (3.7 GtC) of the production of fossils fuels
IEA/WEO (world energy outlook) reports fossil fuels production in Mtoe = million tonnes (metric ton) oil equivalent.
The last WEO2018 forecasts in 2040 for New Policies a primary energy demand of 17.7 Gtoe with 74% of fossil fuels

Table 1.1 ▷ World primary energy demand by fuel and scenario (Mtoe)

			New Policies		Current Policies		Sustainable Development	
	2000	2017	2025	2040	2025	2040	2025	2040
Coal	2 308	3 750	3 768	3 809	3 998	4 769	3 045	1 597
Oil	3 665	4 435	4 754	4 894	4 902	5 570	4 334	3 156
Gas	2 071	3 107	3 539	4 436	3 616	4 804	3 454	3 433
Nuclear	675	688	805	971	803	951	861	1 293
Renewables	662	1 334	1 855	3 014	1 798	2 642	2 056	4 159
Hydro	225	353	415	531	413	514	431	601
Modern bioenergy	377	727	924	1 260	906	1 181	976	1 427
Other	60	254	516	1 223	479	948	648	2 132
Solid biomass	646	658	666	591	666	591	396	77
Total	**10 027**	**13 972**	**15 388**	**17 715**	**15 782**	**19 328**	**14 146**	**13 715**
Fossil fuel share	*80%*	*81%*	*78%*	*74%*	*79%*	*78%*	*77%*	*60%*
CO_2 emissions (Gt)	**23.1**	**32.6**	**33.9**	**35.9**	**35.5**	**42.5**	**29.5**	**17.6**

Notes: Mtoe = million tonnes of oil equivalent; Gt = gigatonnes. Solid biomass includes its traditional use in three-stone fires and in improved cookstoves.

IEA conversion factors for energy

General conversion factors for energy

Convert to:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
TJ	1	238.8	2.388×10^{-5}	947.8	0.2778
Gcal	4.1868×10^{-3}	1	10^{-7}	3.968	1.163×10^{-3}
Mtoe	4.1868×10^{4}	10^{7}	1	3.968×10^{7}	11 630
MBtu	1.0551×10^{-3}	0.252	2.52×10^{-8}	1	2.931×10^{-4}
GWh	3.6	860	8.6×10^{-5}	3 412	1

Note: There is no generally accepted definition of boe; typically the conversion factors used vary from 7.15 to 7.40 boe per toe.

I remind that IPCC is linked with the UN where, on 193 members, only 3 countries (USA, Liberia and Myanmar) are not obliged by law to use the SI = international system of unit (metric system).
But, in fact, gasoline is sold by liter in Myanmar and by gallons in US and Liberia.
Only USA and Liberia (4% of the world population in 2019) do not use SI!

US history towards metric system is a series of steps going forward and backward.
https://usma.org/a-chronology-of-the-metric-system

1866 The use of the metric system made legal in the United States by the Metric Act of 1866 (Public Law 39-183). This law made it unlawful to refuse to trade or deal in metric quantities.
1975 The Metric Conversion Act of 1975 (Public Law 94-168) passed by Congress. The Metric Act established the US Metric Board to coordinate and plan the increasing use and voluntary conversion to the metric system. However, the Metric Act was devoid of any target dates for metric conversion.
1982 President Ronald Reagan disbanded the US Metric Board and canceled its funding. Responsibility for metric coordination was transferred to the Office of Metric Programs in the Department of Commerce.
1988 The Omnibus Trade and Competitiveness Act of 1988 (Public Law 100-418) amended and strengthened the Metric Conversion Act of 1975, designating the metric system as the preferred measurement system, and requiring each federal agency to be metric by the end of fiscal year 1992.
1991 President George H. W. Bush signed Executive Order 12770, Metric Usage in Federal Government Programs directing all executive departments and federal agencies implement the use of the metric system. The Executive Order is also available as an appendix to: Interpretation of the SI for the United States and Federal Government Metric Conversion Policy
1999 Loss of the Mars Climate Orbiter probe because Lockheed provided thruster firing data in English units while NASA was using metric.
2000 September 30 Now suspended, the deadline for metricating highway construction, including all agreements, contracts, and plans processed by individual states for federally-funded highway construction to be in metric units, was canceled by Congressional action, leaving metric conversion as voluntary, but still recommended to comply with the Omnibus Trade and Competitiveness Act of 1988.
2007 January 08 NASA has decided to use metric units for all operations on the lunar surface when it returns to the Moon.

Some years ago, I asked the head of EIA when EIA will use the SI: his answer: “when the hell freezes over”

IPCC uses the SI, as IEA (sometimes badly with mb = million barrels, but Mt = million metric tonnes).

But the oil world is ruled by the US using dollar and barrel (159 liter) and the oil price (WTI = $/b), but this barrel is not an official unit, it is why EIA is obliged after barrel to add “42 US gallons”, as there are many definitions of barrel (depending upon the contents) in US, where in Texas the official liquid barrel = 31.5 gallons.
The 42 US gallons barrel definition was done by oil producers in Pennsylvania came in 1866 (using wood barrel) as 40 gallons plus 2 gallons for taking care of waste. There is no US official definition of an oil barrel at 42 US gallons, but it is the “King Richard III's English wine tierce”
In this paper I forget the barrel, as 96 % of the world use cubic meter and tonne!!

My last paper on CO2 emissions is
-Laherrere J.H. 2017 “Updating fossil fuels production and CO2 emissions graphs » June
https://aspofrance.files.wordpress.com/2017/07/updatingffgraphs.pdf
were based on FF ultimates of about 1500 Gtoe giving 5000 GtCO2 emissions

Our 2015 paper for COP21 in Paris is
-Durand B. & Laherrere J.H. 2015 « Fossil Fuels Ultimate Recovery Appraisal, Clue to Climate Change Modelling » International Scientific Conference 7-10 juin Paris
http://aspofrance.viabloga.com/files/BD_Fossils_Fuels_Ultimate_2015.pdf
https://aspofrance.org/2015/12/11/fossil-fuel-ultimate-recovery-appraisal-clue-to-climate-change-modeling-december-2015-bernard-durand/

This new 2019 update increases the CO2 emissions from fossil fuels (FF) ultimates from 1500 Gtoe to 1600 Gtoe, giving 5000 GtCO2, which is for me similar, as the inaccuracy of such estimates is more than 10%. This stability in FF CO2 emissions ultimates in 4 years is a good sign.

I have criticized these energy scenarios already in 2001 at IIASA conference.
IIASA is the place where these SRES were designed by N. Nakicenovic, with a team of economists dreaming of possible storylines (as described by Nakicenovic),
-Laherrère J.H. 2001 "Estimates of Oil Reserves" IIASA International Energy Workshop June 19-21, 2001 Laxenburg
http://webarchive.iiasa.ac.at/Research/ECS/IEW2001/pdffiles/Papers/Laherrere-long.pdf
http://www.scribd.com/doc/55367641/10/Impact-on-climate-change-IPCC-scenarios
http://www-personal.umich.edu/~twod/oil-ns/articles/laherrere-long_iew2001.pdf
http://www.oilcrisis.com/laherrere/iiasa_reserves_long.pdf
Where I displayed oil & gas SRES (in front of N. Nakicenovic) compared with my estimates

Figure 95:

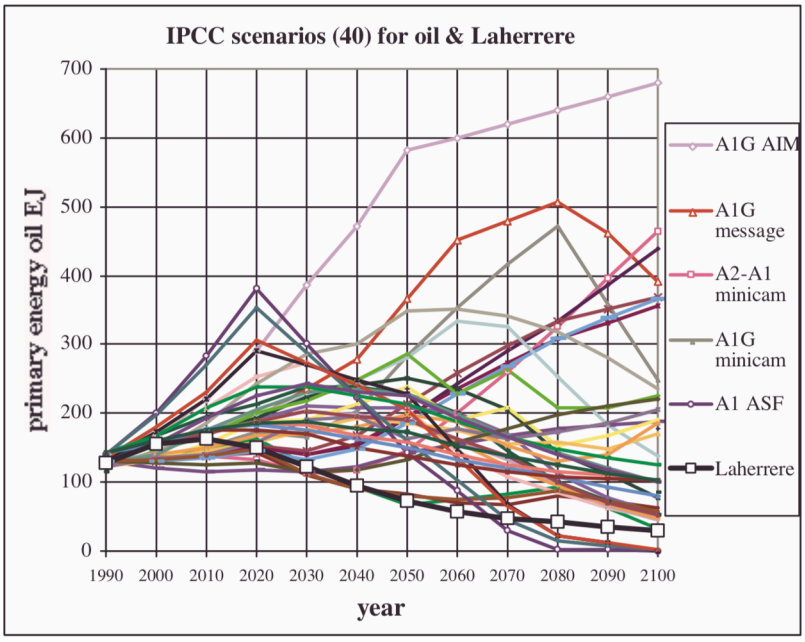
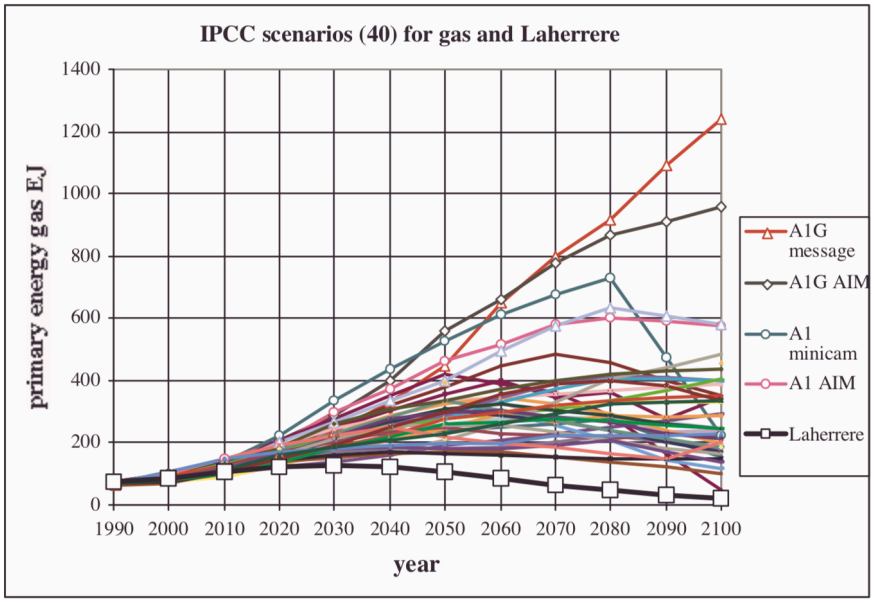


Figure 96:



But in IPCC 2000 Emissions scenarios http://pure.iiasa.ac.at/id/eprint/6101/ page 134 my 1994 paper ("Published figures and political reserves" World Oil) giving an oil ultimate of1800 Gb was described by Nakicenovic as wrong, being too pessimistic. It is true, I was too pessimistic on the oil and gas ultimate, but I was forecasting the conventional oil peak and it occurred in 2006, as stated by IEA/WEO 2010, but there is no consensus on the definition of conventional. But their estimates were many times my estimates. But in fact, they were more wrong than me!
On page 81, IPCC 2000 judges IEA forecasts unsuitable because too short term: IEA WEO2000 forecast for 2020 was 36 GtCO2: RCP8.5 for 2020 is 45 GtCO2!

Table 2.4: **Global CO_2 Emissions by Region and by Sector**
(Million tonnes of CO_2)

Emissions	World*		OECD		Transition Economies		Developing Countries	
1990	20 878		10 640		4 066		6 171	
1997	22 561		11 467		2 566		8 528	
2010	29 575		13 289		3 091		13 195	
2020	36 102		14 298		3 814		17 990	
Increase	**1990-2010**	**1997-2020**	**1990-2010**	**1997-2020**	**1990-2010**	**1997-2020**	**1990-2010**	**1997-2020**
Power Generation	4 012	5 816	1 202	1 369	–200	446	3 009	4 001
Industry	892	1 698	–157	–91	–244	193	1 294	1 597
Transport	2 469	3 577	1 215	1 285	–164	254	1 418	2 038
Other	1 324	2 450	388	268	–367	354	1 303	1 826
Total	8 697	13 541	2 648	2 831	–976	1 247	7 024	9 462

* Excluding international marine bunkers.

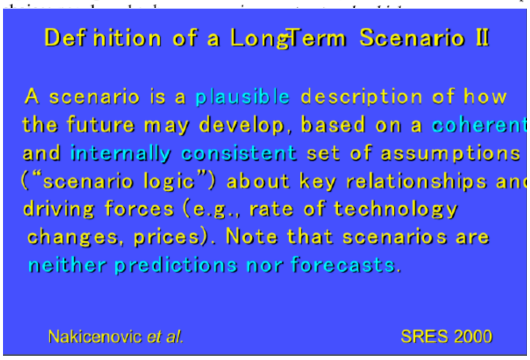
World Energy Outlook 2000

IPCC does not change scenarios because unanimity (as for SPM= summary for policymakers) is needed to change it: it is why old scenarios are still there, when IPCC scenarios should follow modern IEA forecasts.
But SRES scenarios are described by their author N. Nakicenovic as "storylines but not forecasts."

EMISSIONS SCENARIOS

How will the world's climate change in the coming century? The answer to this question depends on how human societies develop in terms of demographics and economic development, technological change, energy supply and demand, and land use change.

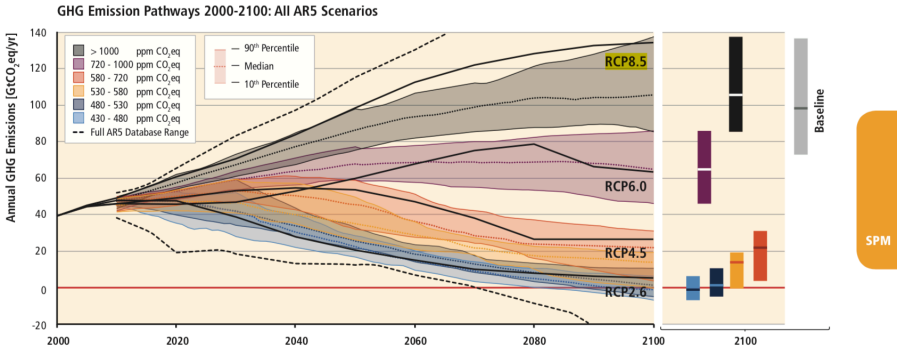
The Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios describes new scenarios of the future, and predicts greenhouse gas emissions associated with such developments. These scenarios are based on a thorough review of the literature, the development of narrative "storylines", and the quantification of these storylines with the help of six different integrated models from different countries. The scenarios provide the basis for future assessments of climate change and possible response strategies. The report illustrates that future emissions, even in the absence of explicit climate policies,



These energy scenarios were designed by economists, without bothering to check with energy experts, as the goal was to reach unanimity within IPCC.
But the worst is that these storylines (not forecasts) were considered as scenarios with the same probability in the 2006 Stern Review on the Economics of Climate Change, making this report completely wrong. Apples cannot be added to oranges to make an apple pie!

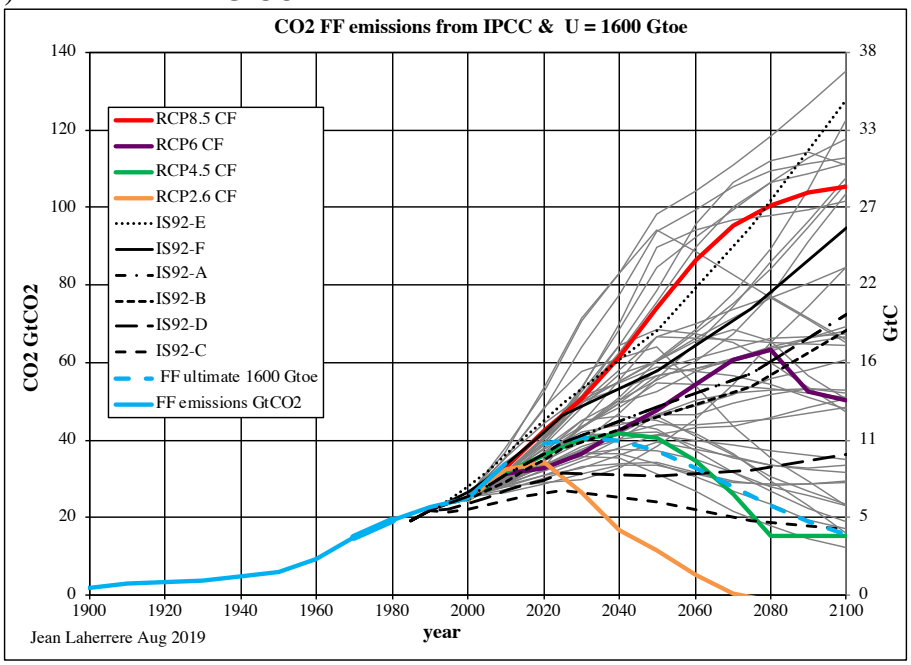
In 2005 I have associated IPCC with GIGO: Garbage In Garbage Out
Laherrère J.H. 2005 « Les perspectives pétrolières et gazières dans le monde et l'Europe »
Club de Nice 17-19 Novembre www.hubbertpeak.com/laherrere/nice.pdf

And as IPCC keeps these wrong scenarios, this description of IPCC = GIGO stands today: in the last report AR5, RCP8.5 is considered as the baseline (business as usual)!
Ipcc_wg3_ar5_summary-for-policymakers.pdf



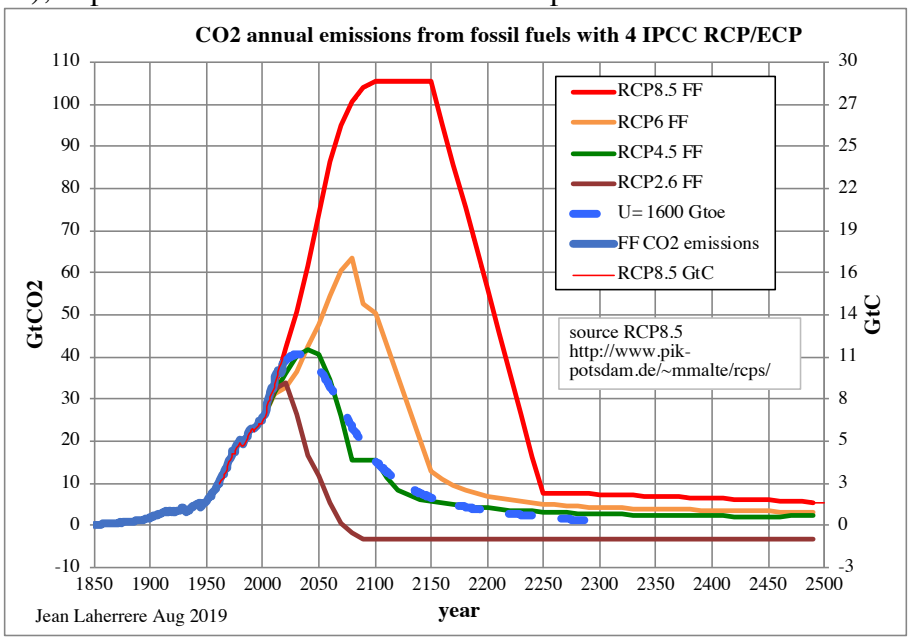
As IPCC scenarios are not probabilistic (storylines!), it is impossible to know which is the most probable scenario!
In 2006 I advised Jean Jouzel (VP IPCC) at European Geoscience Union in Vienna that IPCC has to change their scenarios: he told me that it is too late for AR4, but it will be for AR5
IPCC indeed in AR5 did change the name of the scenarios with RCPs, but not the scenarios!
In fact, they added RCP2.6 which is more unrealistic than the others.
Only RCP4.5 is within the probable CO2 future emissions.

The plot from 1900 to 2100 of FF CO2 emissions with IPCC scenarios (6 for IS92, 40 for SRES & 4 for RCP) and the forecast of FF CO2 emissions from an FF ultimate of 1600 Gtoe. shows that IPCC range for 2100 has stayed the same for 30 years (except for RCP2.6, which is negative?) from 15 to 130 GtCO2.



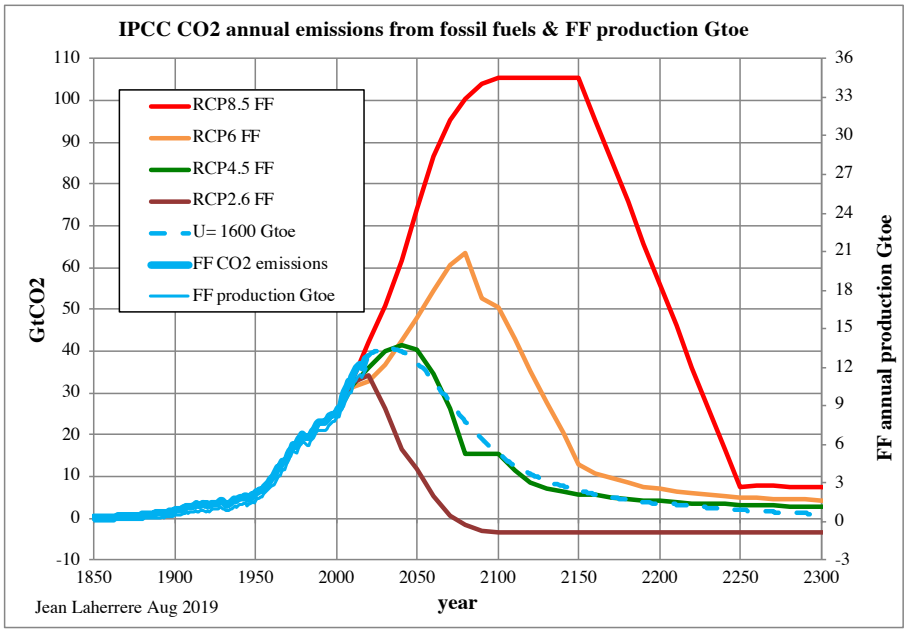
The COP21 goal of 40 GtCO2 in 2030 is fulfilled in our forecast, being the peak of FF emissions!

It is obvious that RCP8.4, RCP6 and RCP2.6 are completely out of line with FF future production. Only RCP 4.5 is in line with future most probable production. But IPCC RCP scenarios are extended to year 2500 (M. Meinshausen Potsdam Institute for climate impact research 2011), in particular RCP8.5. These RCPs are plotted in GtCO2 and GtC



We will see further that the most probable fossil fuels production will be with an ultimate of 1600 Gtoe. The plot of RCP emissions GtCO2 and FF annual production in Gtoe shows that

in 2100 RCP8.5 needs a FF production of 35 Gtoe when the most probable production will be 5 Gtoe: 7 times less!



RCP8.5 is not leading to a radiative forcing maximum of 8.5 W/m2, but to 12 W/m2, when RCP6 is leading to 6 W/m2 and RCP4.5 to 4.5 W/m2.
RCP8.5 is a lie (a fake!) and should be called RCP12!

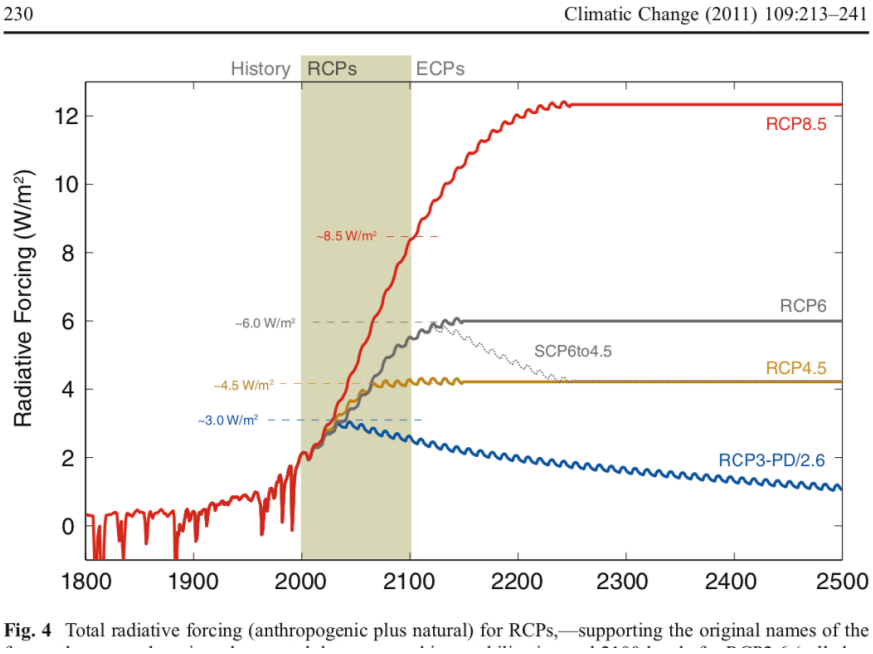
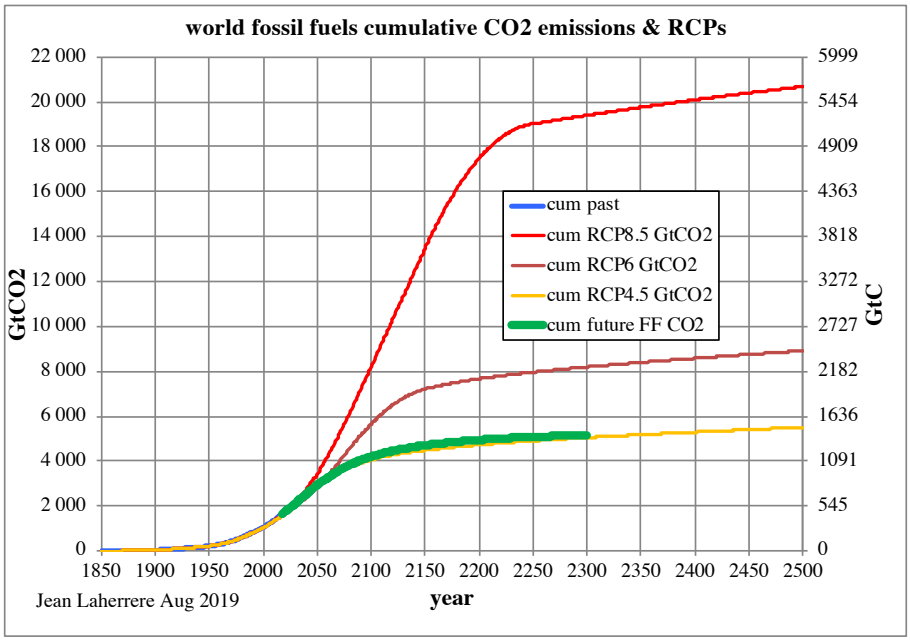
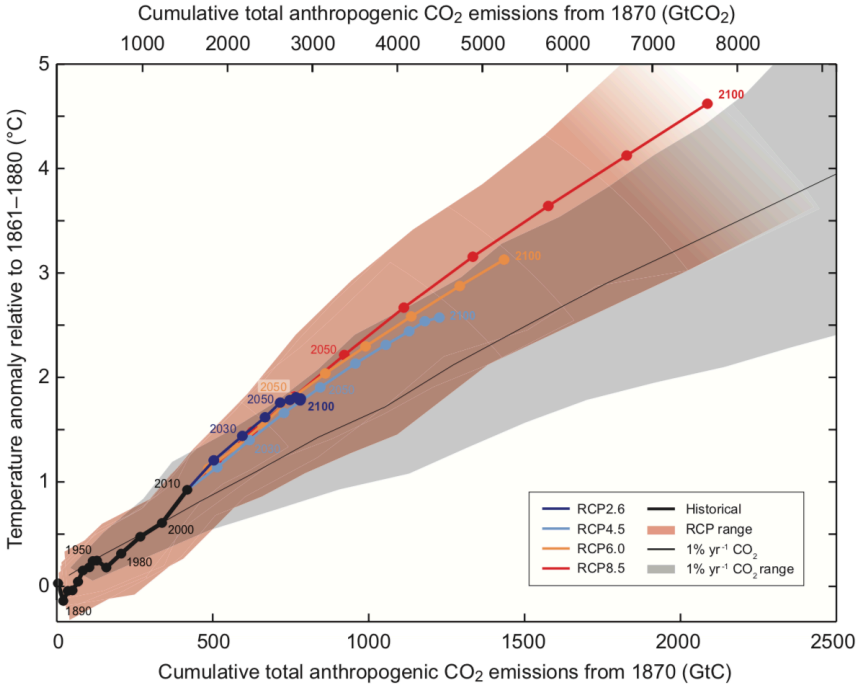


Fig. 4 Total radiative forcing (anthropogenic plus natural) for RCPs,—supporting the original names of the

The cumulative emissions are plotted on the period 1850-2500, showing that for 2500 RCP8.5 was over 20 000 GtCO2, RCP6 was 9000 GtCO2 and RCP4.5 5000 GtCO2 as my estimate from fossil fuels production.



RCP8.5 will give in 2100 a temperature anomaly of 4.7 °C with a cumulative emissions of 2180 GtC



AR5 SPM (summary for policymakers) reports RCP8.5 as baseline with 8000 GtCO2 in 2100

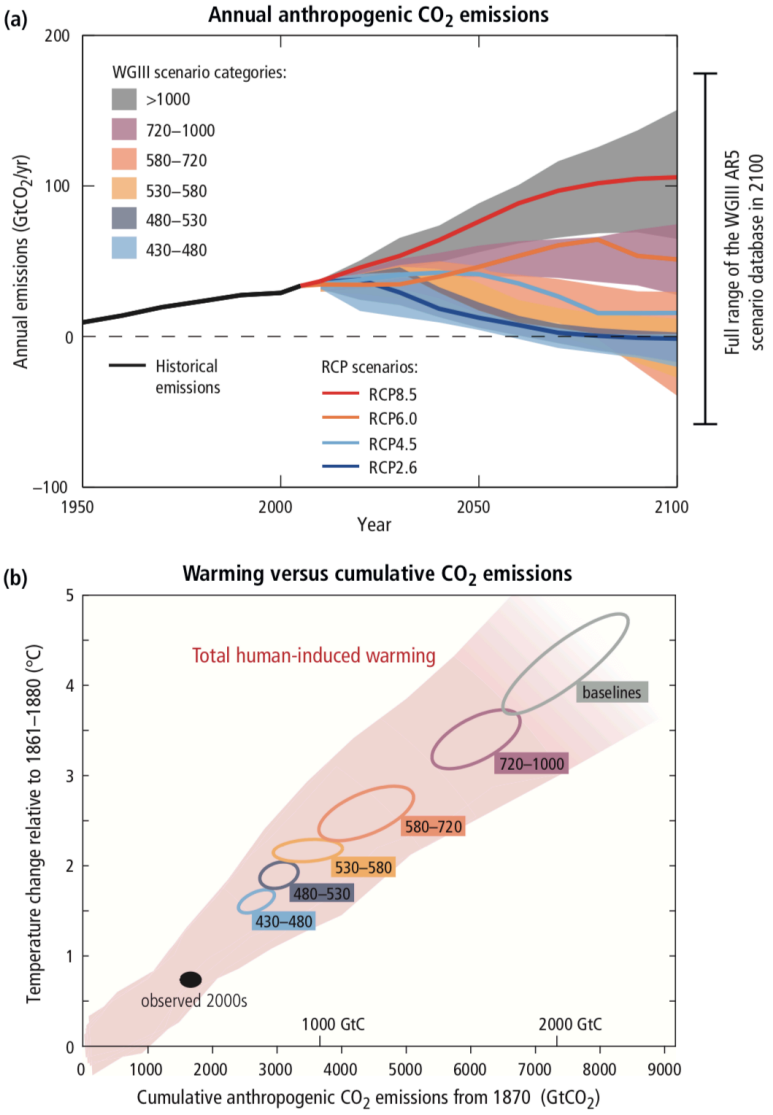


Figure SPM.5 | **(a)** Emissions of carbon dioxide (CO_2) alone in the Representative Concentration Pathways (RCPs) (lines) and the assc

RCP8.5 will give a temperature increase to pre-industrial of more than 9°C in 2300 (and 2000 ppm and 2 m ocean rise)! RCP8.5 is considered as business as usual, if nothing is done: no, RCP8.5 (in fact RCP12) is just crazy!

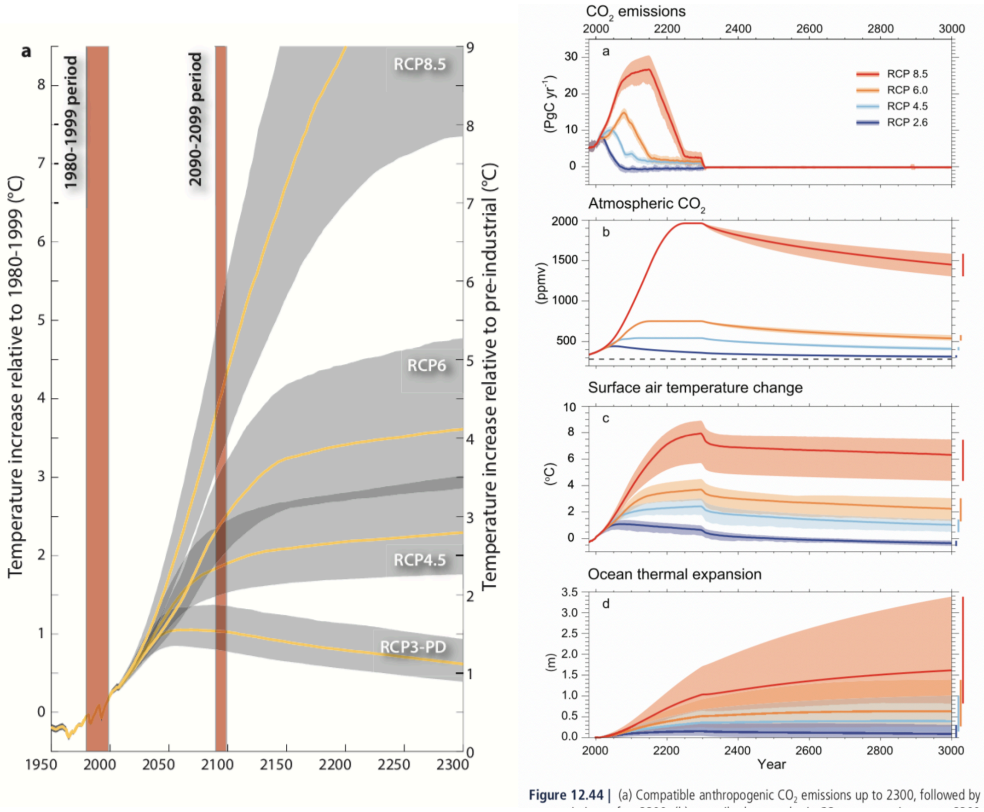
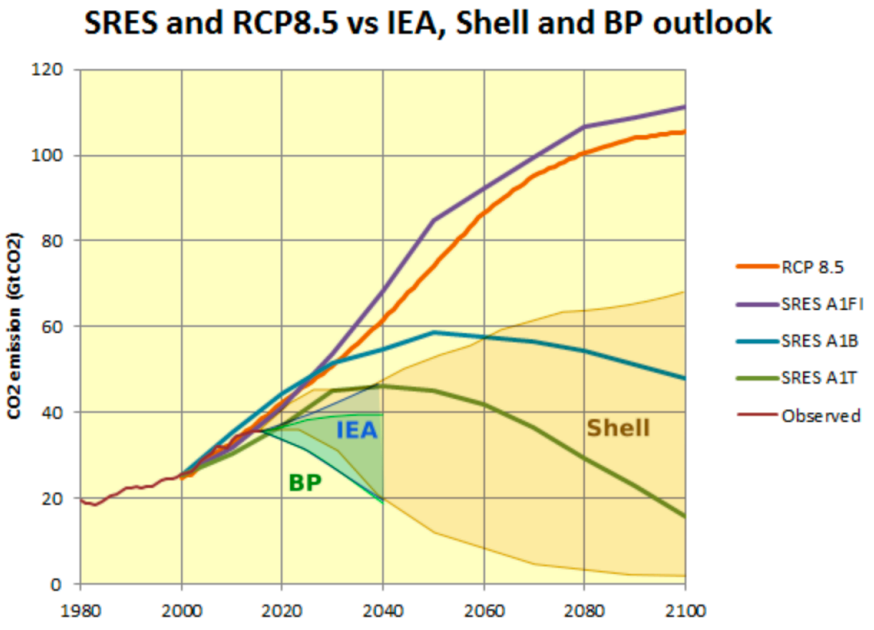


Figure 12.44 | (a) Compatible anthropogenic CO_2 emissions up to 2300, followed by

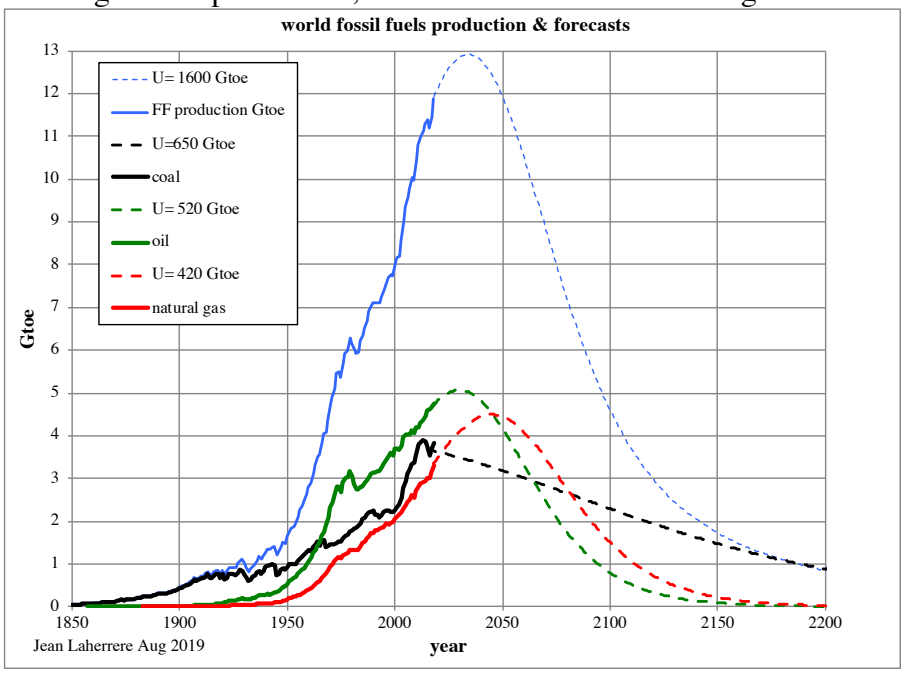
I am not the only one criticizing IPCC scenarios and in particular RCP8.5
https://judithcurry.com/2018/11/24/is-rcp8-5-an-impossible-scenario/



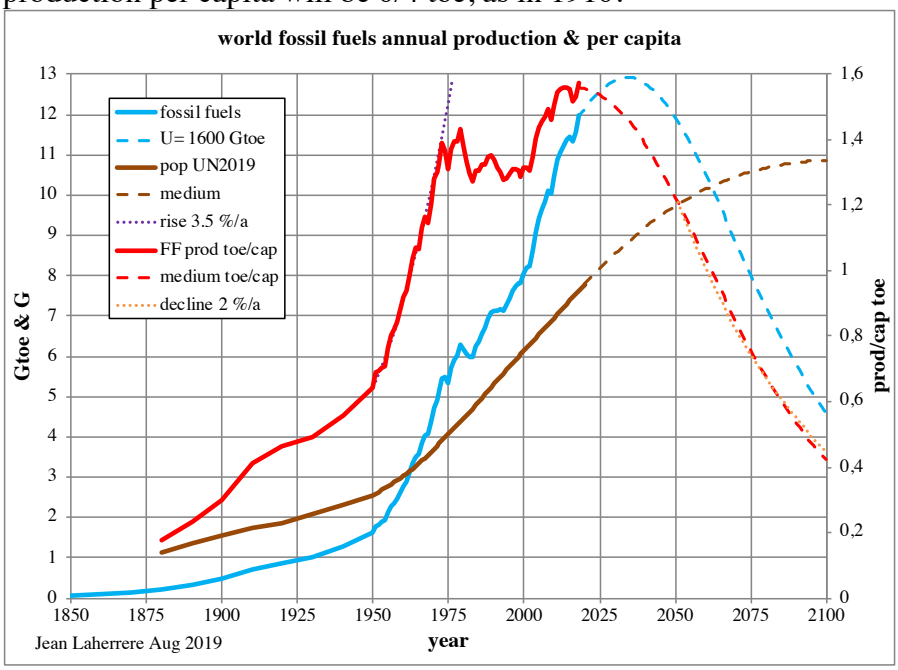
-Fossil fuels production

I have forecasted world fossil fuels production for many years, changing often the ultimates with new data. My last ultimates are 650 Gtoe for coal, 520 Gtoe for oil and 420 Gtoe for natural gas, giving a total of 1600 Gtoe (always no more than 2 significant digits to stay in tune with the inaccuracy). These fuels ultimates are the most probable values, but the range of uncertainty is large. Many believes that reserves increase if price increase, but estimates take care of this evolution and furthermore production is limited by the EROI (energy return on

energy invested). Coal offshore or deeper than 1500 m or seam less than 50cm are considered as resources, but not as reserves, because of EROI.
The most difficult estimate is for coal production with China big jump from 2000, producing half of the world. Coal production has peaked in 2013, because of the strong pollution in China by particles (and not by CO2).
Today oil is the largest fuel production, coal was in 1950 and natural gas will be in 2050



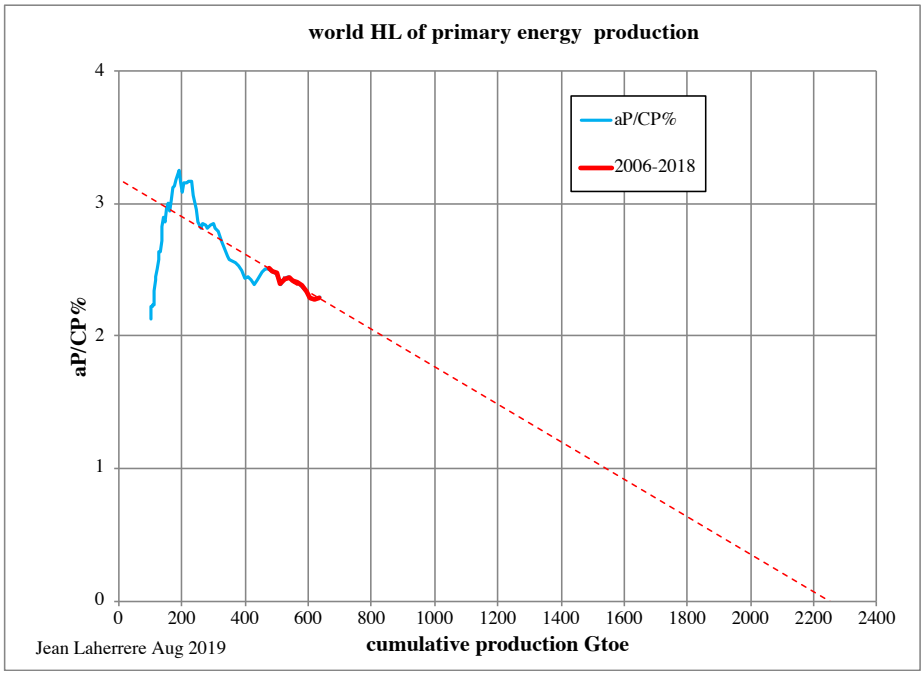
If the peak of FF production is about 2030, the peak of FF production per capita is now with 1.5 toe per capita.
In 2050 FF production per capita will be 1.2 toe, as in 1970!
In 2100 FF production per capita will be 0/4 toe, as in 1910!



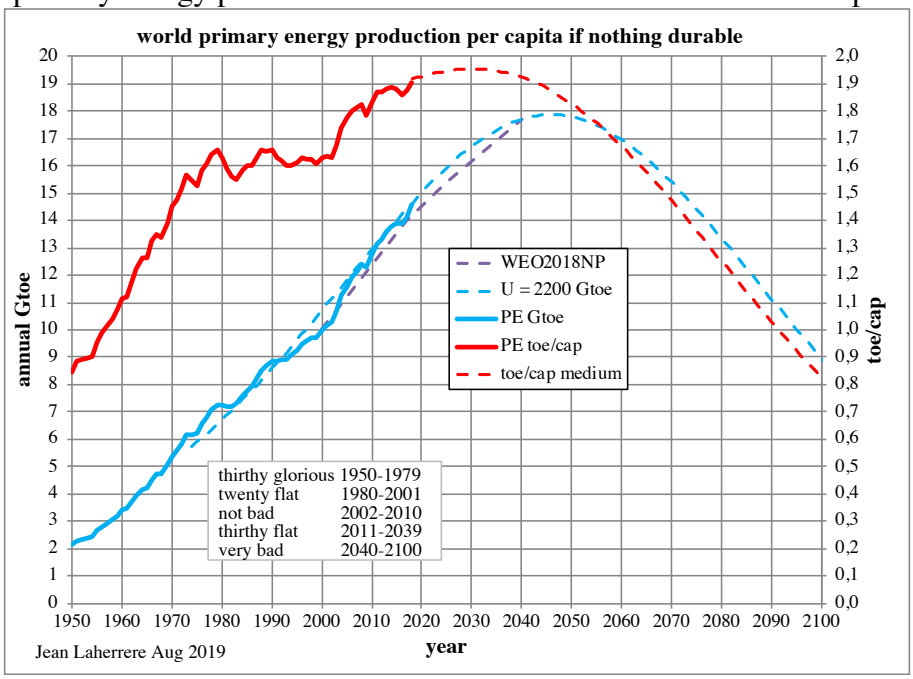
The world will need nuclear and renewable in 2100!

-World primary energy production

Renewable production is based mainly on fossil fuels and it is hard to forecast the future of renewable without the fossil fuels. What is durable on earth?
The world primary energy is forecasted with an ultimate of 2200 Gtoe (if nothing durable is found). Intermittency of wind (23% in France) and solar (11% in France) could not be solved if fossil fuels and nuclear are prohibited! Oil and gas fields have a longer life than wind and solar plants.



The peak of primary energy production will be around 2050 and around 2030 per capita

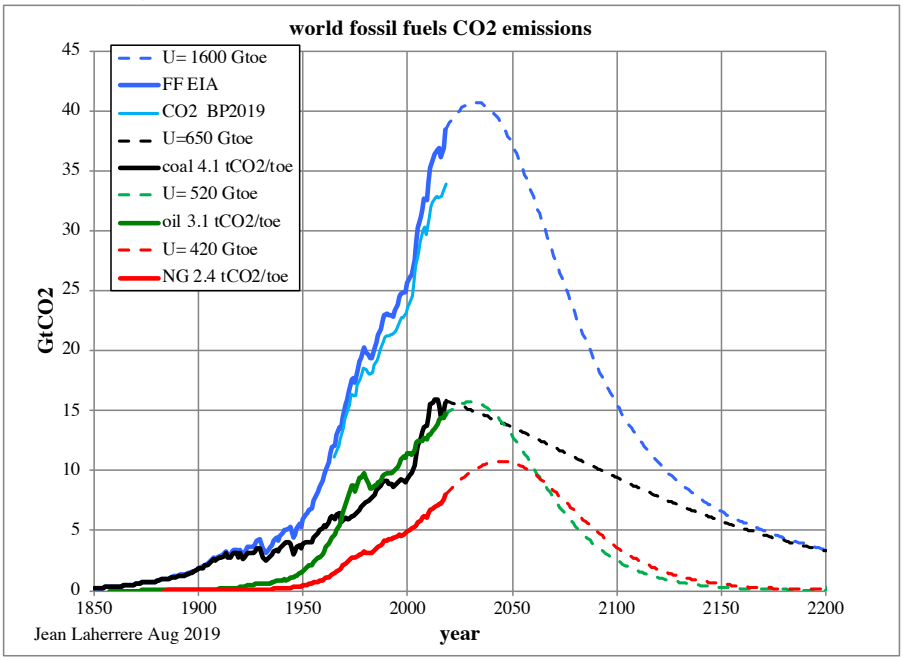


-Fossil fuels CO2 emissions

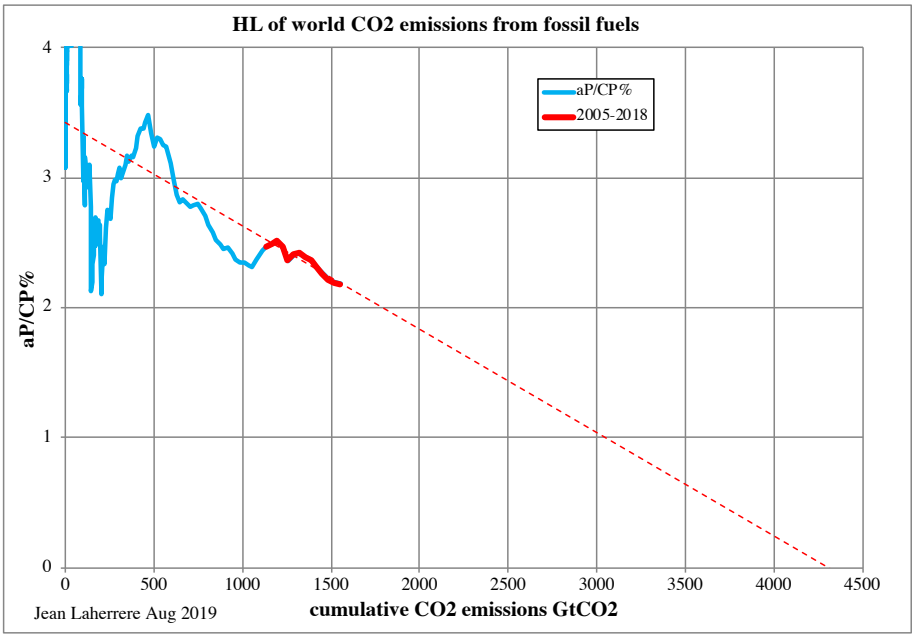
Fuels productions are converted into CO2 emissions taking a ratio of tCO2/toe:

4.1 for coal,
3.1 for oil,
2.4 for gas.

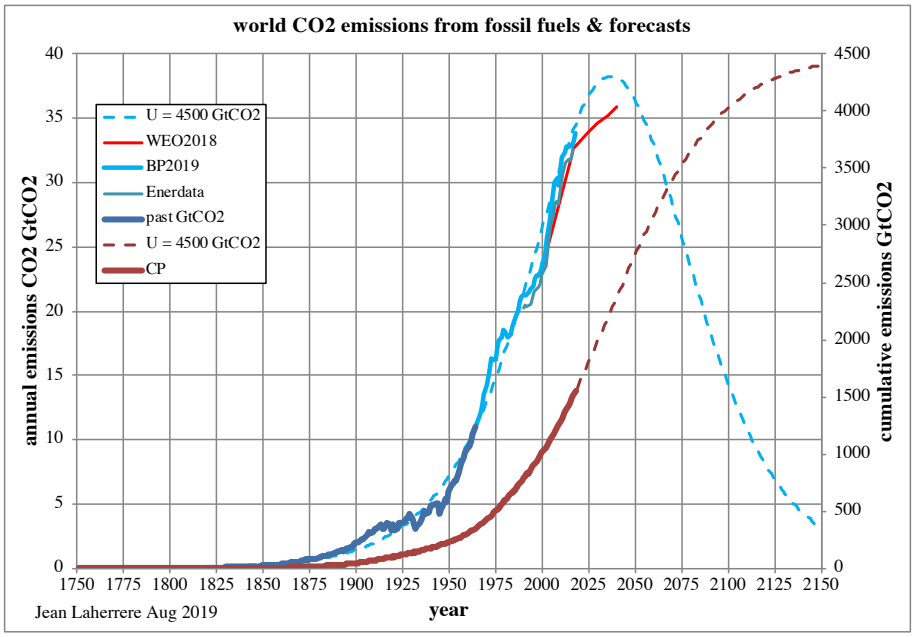
The plot of CO2 emissions is different from the plot of productions: today largest CO2 emissions is from coal, but in 2000 is was from oil.



CO2 FF emissions could be also modelled just from past data just from HL extrapolation of the period 2005-2018 and the ultimate is about 4500 GtCO2

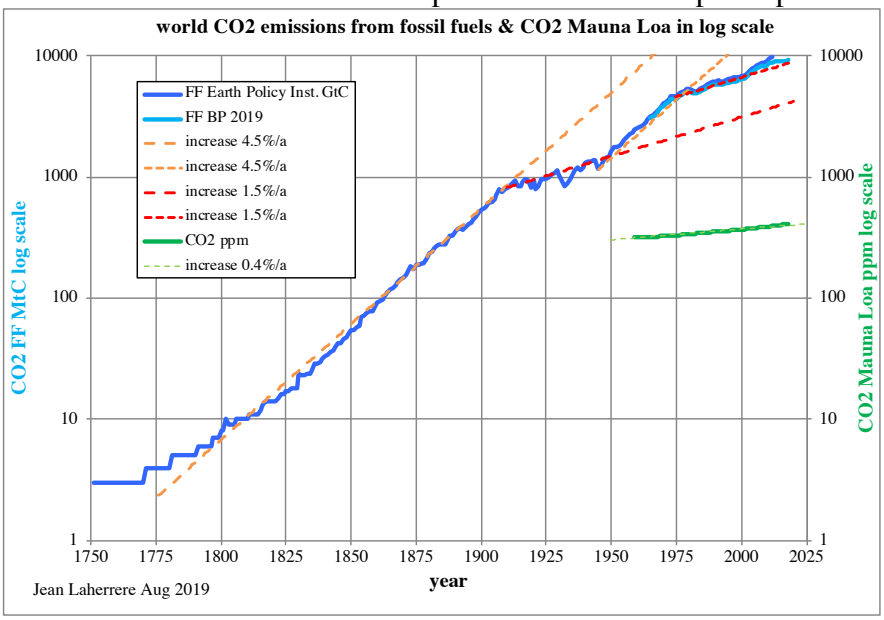


From this 4500 GtCO2 ultimate CO2 emissions peak is about 2030 and less than 40 GtCO2, quite in line with the peak estimated from the fossil fuels production.
My CO2 forecast for 2040 is more than the forecast of WEO2018!

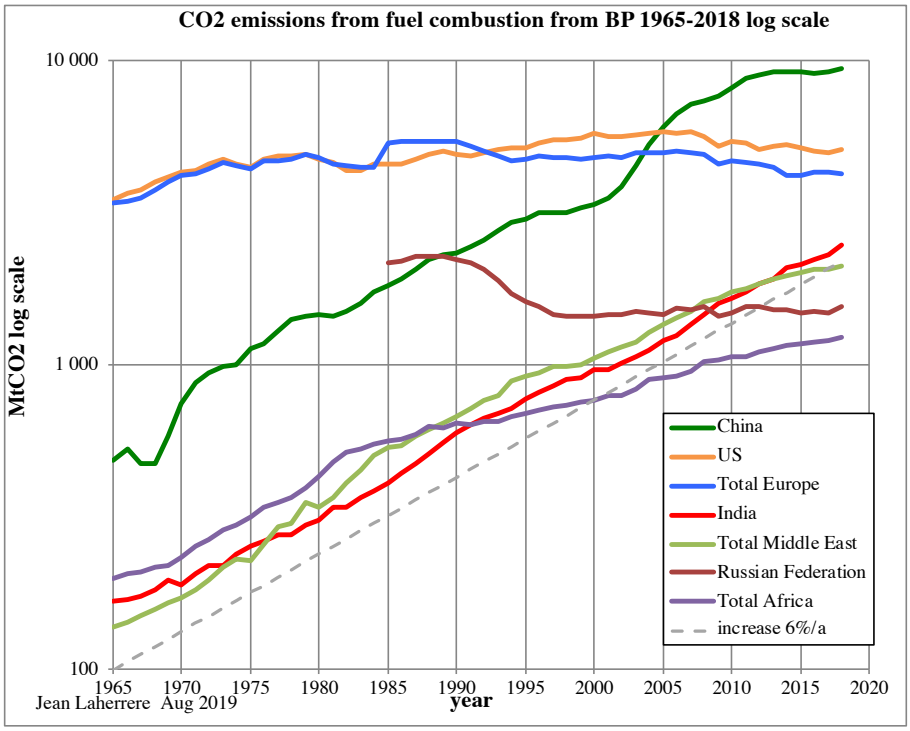


The agreement for a CO2 peak in 2030 from two different approaches is comforting!

FF CO2 emissions since 1790 in a log scale shows that from 1770 to 1914 CO2 emissions were rising at 4.5 %/a, as from 1945-1975 (the Thirty Glorious, while the rise is only 1.5 %/a for 1975-2018 and 1914-1945.
The rise of CO2 concentration1962-2018 in ppm is 0.4 %/a
It is quite different from what is written in the medias!
CO2 emissions rate is 3 times less than in the past since 1800 except the period 1914-1945!

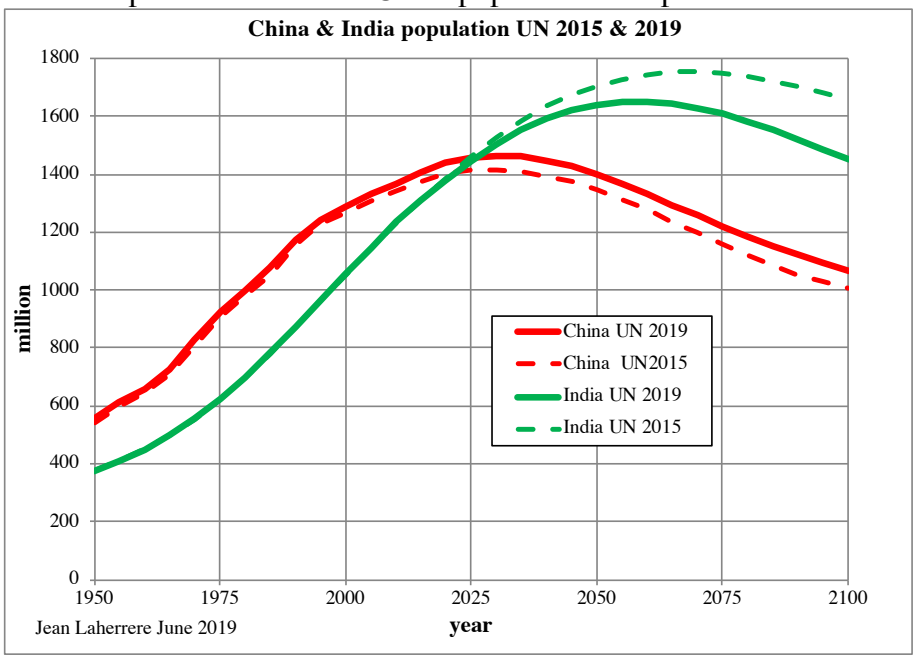


The largest CO2 FF emission is from China, but India has the highest and longest growth rate (with the Middle East).
The comparison of the CO2 emissions on the period 1965-2018 (from BP2019) in log scale shows that China, India and Middle East displays an increase close to 6%/a, except that China stops growing in 2013 with a peak in coal production
US and Europe CO2 emissions are decreasing since 2005



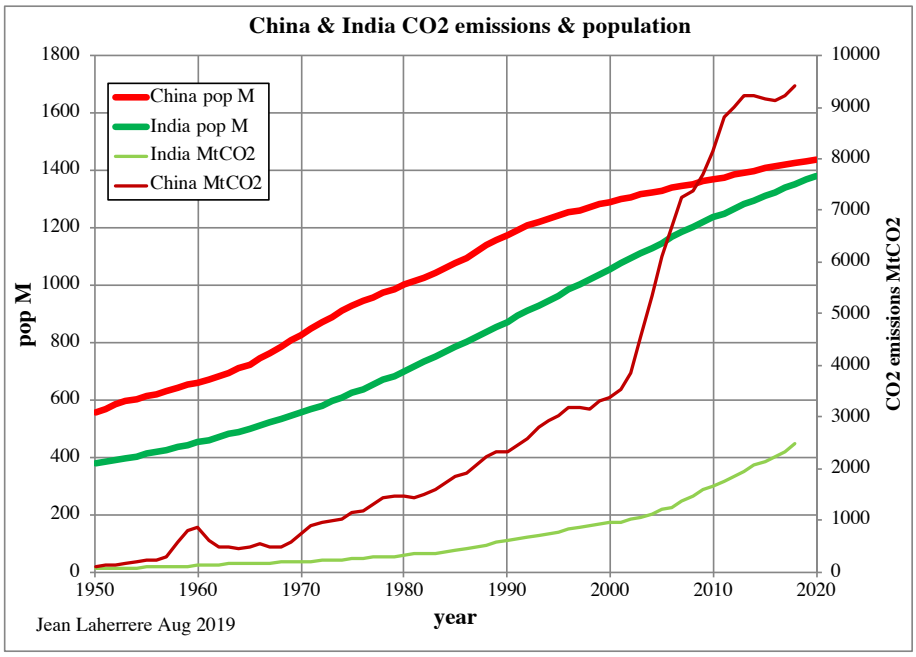
-India & China

India will the most populated country in 2025, passing China.
India population will peak around 2055. China population will peak around 2030

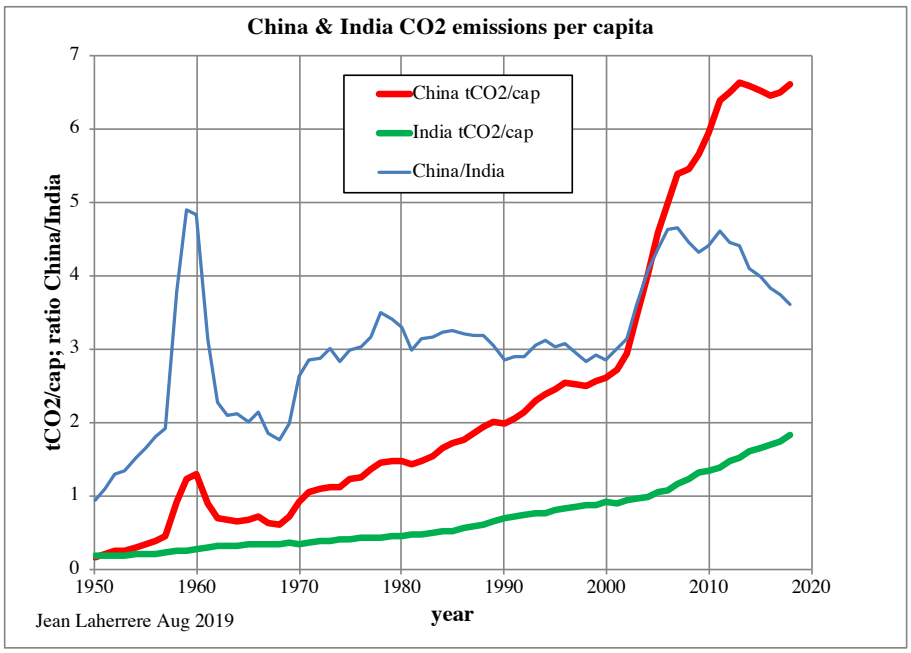


India GDP and CO2 emissions are plotted in log scale to compare growth: increase of 5%/a and 10 %/a are added.
India CO2 emissions have grown by 5%/a since 1990.
GDP is reported in current $, $2010, PPP (purchasing power parity) current $, PPP $2011.
It is obvious that CO2 emissions is growing slower than GDP.
In COP 21 India has agreed (INDC) to reduce the emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.

Most of countries have agreed to reduce CO2 emissions from 2005 level, but India and China have agreed to reduce only CO2 emissions per GDP: it is quite different!
As GDP is growing faster than CO2 emissions this, India has to continue as in the past to reach in 2030 this constraint.
As the text said only GDP, as GDP PPP current $ has grown by 10 %/a since 2007, twice CO2 growth, COP21 INDC is easy to be fulfilled!

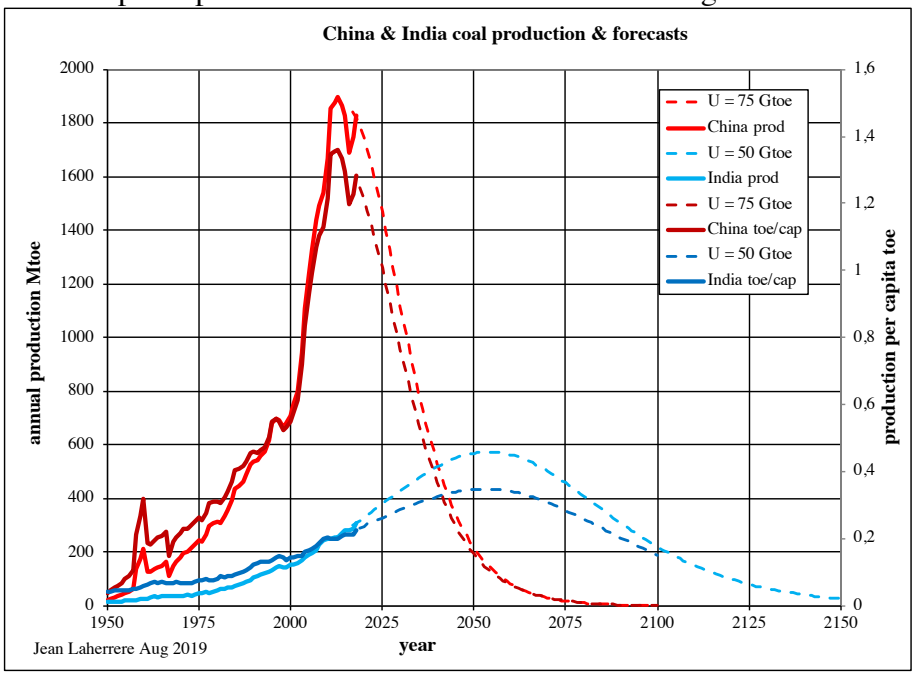


The comparison of CO2 emissions per capita between China and India show the they were equal in 1950, the ratio was 3 for 1970-2000, 4.5 in 2010 and in 2018 3.6.
India needs energy in the future and will increase their CO2 emissions



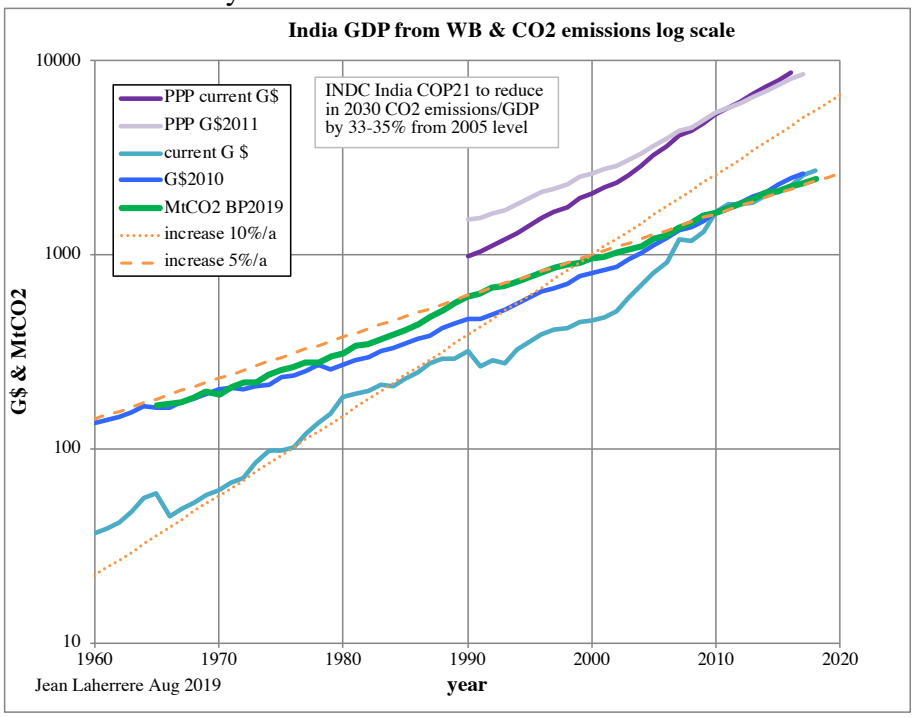
China and India coal past & future production are compared in Gtoe, as the production per capita and they are quite different today!

The coal production per capita was similar in 1950 and it will be again in 2040.

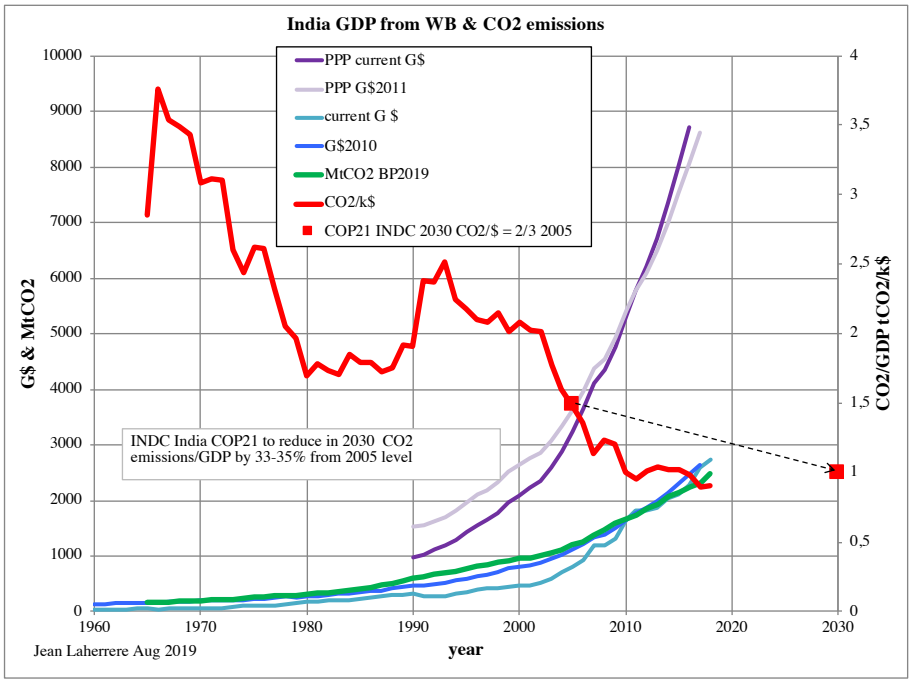


-India GDP, CO2 & FF

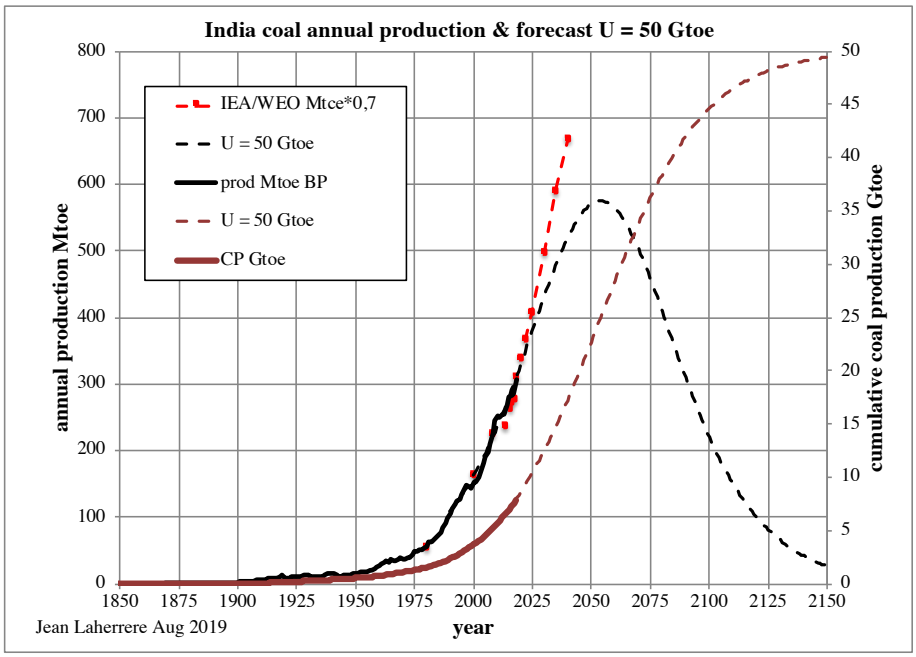
GDP (current & $2010, PPA current and $2011) and CO2 emissions are compared in log scale. CO2 emissions have increased by 5%/a since 1965, no sign of change!
Current GDP has increased by 10%/a since 2003.



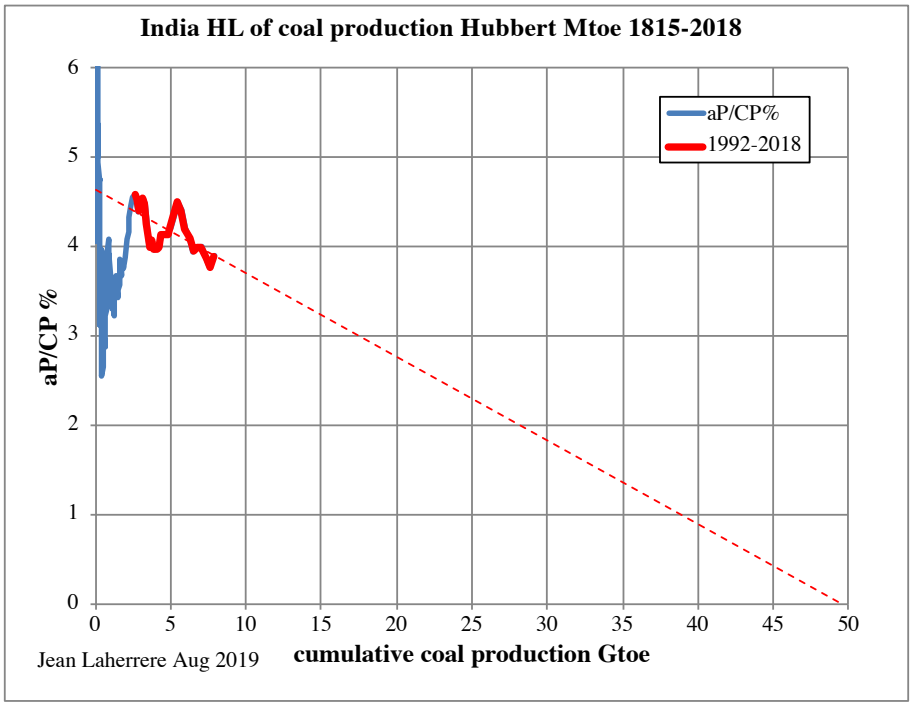
The plot of CO2/$ (in red = current $) is plotted, it peaked in 1966 at 3.7 and in 1993 at 2.5 and it is in 2019 at 0.9, when COP21 INDC needs to be 1 in 2030, in fact more than in 2018.



India coal production will peak at less than 0.6 Gtoe around 2050 for an ultimate estimated at 50 Gtoe, against a forecast more than 0.7 Gtoe for IEA/WEO2018 NP.

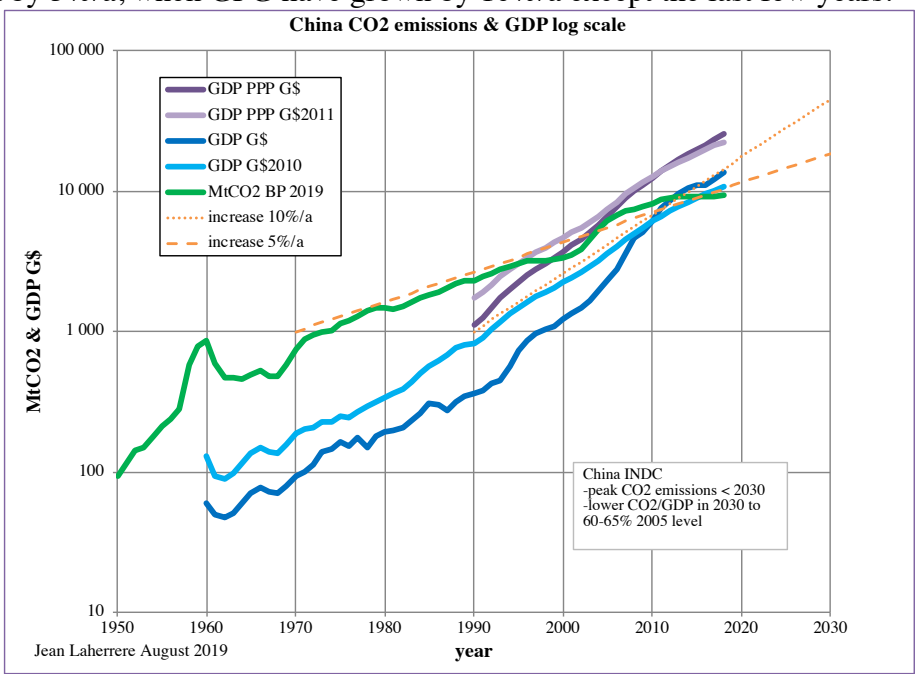


HL of India coal production is extrapolated towards 50 Gtoe for the period 1992-2018



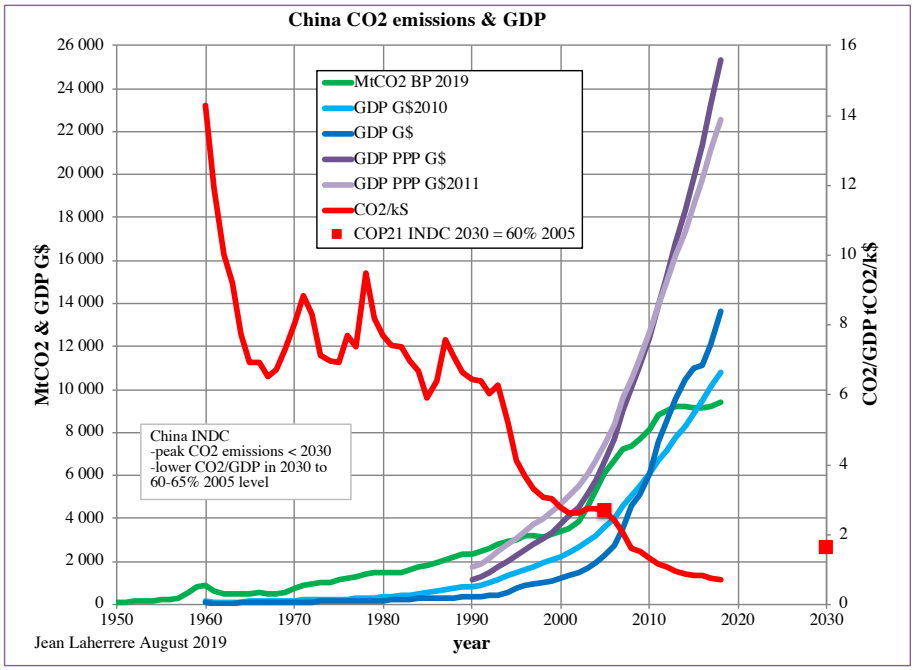
-China GDP, CO2 & FF

China CO2 emissions and GDP are also plotted with log scale: since 1970 CP2 emissions have grown by 5%/a, when GPG have grown by 10%/a except the last few years.

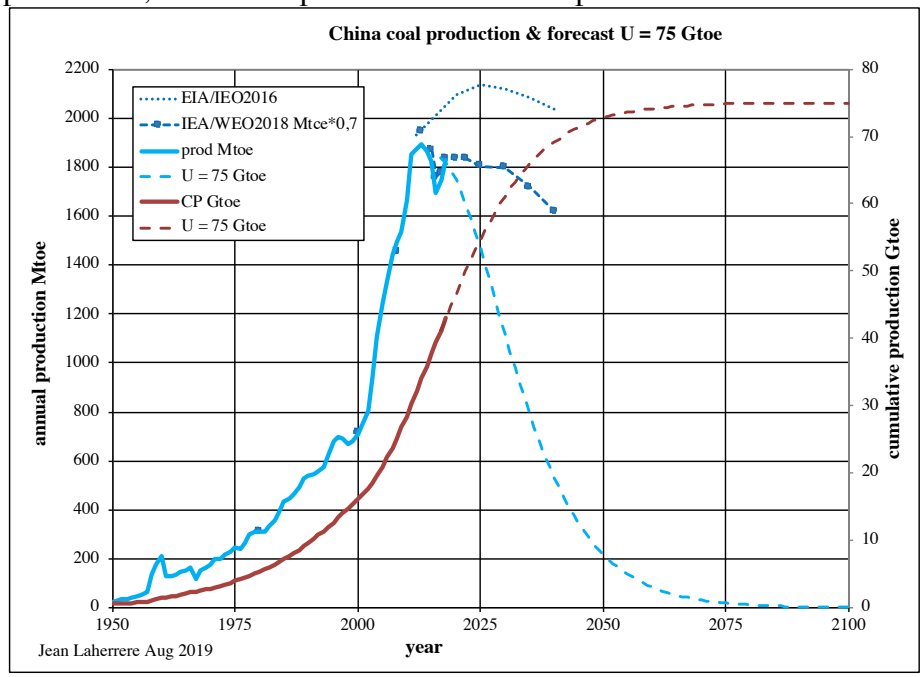


CO2 emissions per GDP in tCO2/k$ was over 14 in 1960, 2.7 in 2005 and 0.7 in 2019

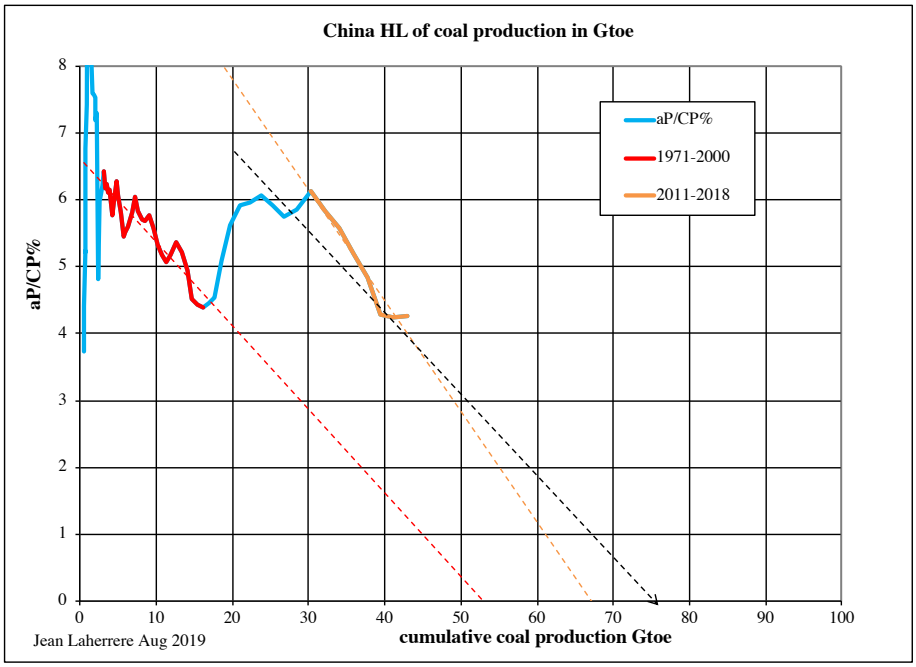
At COP21 China INDC constraints to lower in 2030 CO2/GDP to 60-65 % of 2005 level: it means that this goal (commitment) was already reached in 2018!



China coal production, after a sharp increase after 2000 peaked in 2013.



For an ultimate of 75 Gtoe, coal production in 2025 is forecasted to be 1.5 Gtoe against 1.8 Gtoe for IEA/WEO2018 NP (reported in Gtce).
HL of China coal production in Gtoe is extrapolated towards 75 Gtoe.



-Post carbon

Many Greens are so eager to replace fossil fuels by renewables that they want a" post carbon" era. They forget that organic matter is based on carbon (= carbohydrates) and that their body in mass is composed of oxygen 65%, carbon 18%, hydrogen 10%, nitrogen 8% and calcium 1.5%

No carbon, no food, no life!

-Post Carbon Institute

Post Carbon Institute (PCI) was funded in 2003 by Julian Darley (with Celine Rich and David Room). Its initial purpose was to implement programs to educate the public on issues surrounding global fossil fuel depletion (see peak oil, peak coal, peak gas) and climate change, as well as on possible responses to these challenges. Julian was attending ASPO meetings and I told him that using post carbon was wrong, as without carbon there is no life and, on their site, there is no mention of the needs to eliminate carbon.

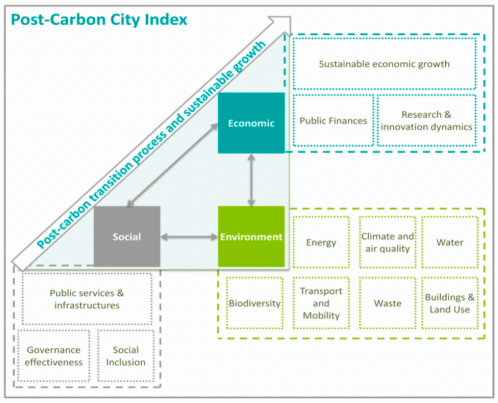
In 2009, Julian Darley and Celine Rich (his wife) left PCI, Asher Miller became Executive Director; Richard Heinberg became Senior Fellow-in-Residence

In 2012 PCI launched Resilience.org, the successor website to EnergyBulletin, as a resource platform for communities building local self-reliance, emphasizing community-based responses to the rapidly emerging fallout from the end of cheap fossil fuels. David Hughes, Canadian earth scientist, had joined Resilience and publishes excellent reports on "shale oil & gas". I still do not understand why such Post Carbon title is still there, except that it is politically correct!

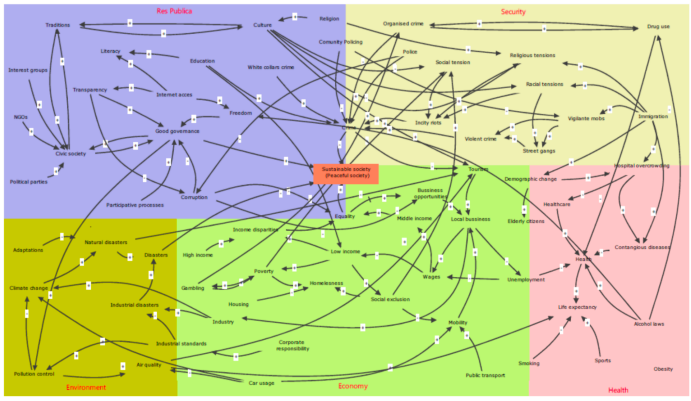
-Pocacito = Post Carbon Cities of Tomorrow

In Europe, Pocacito survey has developed from 2014 to 2016 a 2050 roadmap to support the transition of cities (Barcelona, Copenhagen, Istanbul, Lisbon, Milan, Turin, Offenburg, Zagreb) to a more sustainable or post-carbon future. The Post Carbon City Index (PCI) combines indicators covering environmental, social and economic dimensions.

Figure 3: Dimensions and sub-dimensions of the Post-Carbon City Index



SOCIAL MIND MAP



Pocacito key 2016 recommendations

-1- Cities need to have an integrated approach to city management and planning that is in line with long-term objectives.

-2- Apply a stakeholder-driven visioning and back-casting process when designing strategies for the city. This will increase the acceptance and understanding of city stakeholders about necessary changes.

-3- Support for capacity building should be provided. This could be done through initiatives such as the Covenant of Mayors. A database of global best practices should be established.

-4- Education and raising awareness are essential

-5- City infrastructures and services need to be open, inclusive and affordable for citizens.

-6- Cities need to be rethought and 're-naturalised', with a focus on 'mobility', which is a concept that goes well beyond just transport

-7- National, EU and even global strategies need to be drafted with representatives of cities.

-8- The EU should support the process of reallocating competences in line with the challenges facing cities, i.e., in line with the subsidiarity principle.

-9- The EU should provide clearer and more stringent requirements for energy efficiency while furthering the implementation of circular economy action

-10- Good statistics at the city level are required to be able to analyse needs and benchmark cities.

-11- More research on the interplay between climate, energy policies and local development and easier funding rules for research projects for smaller-sized cities.

Just general words and wishes, nothing practical and at a cost of 3 M€: it ended in 2016 and had no continuation = end of Post Carbon Cities of Tomorrow!

-**Zero Carbon**

Zero carbon is the goal of people who want 100% renewable energy. But for the last 50 years renewable energy is only a small percentage of the global energy mix and It will take a long time to be rid of fossil fuels and nuclear, as shown by Euan Means (two different sources!) on his site: //euanmearns.com/how-much-of-the-worlds-energy-is-supplied-by-renewables/

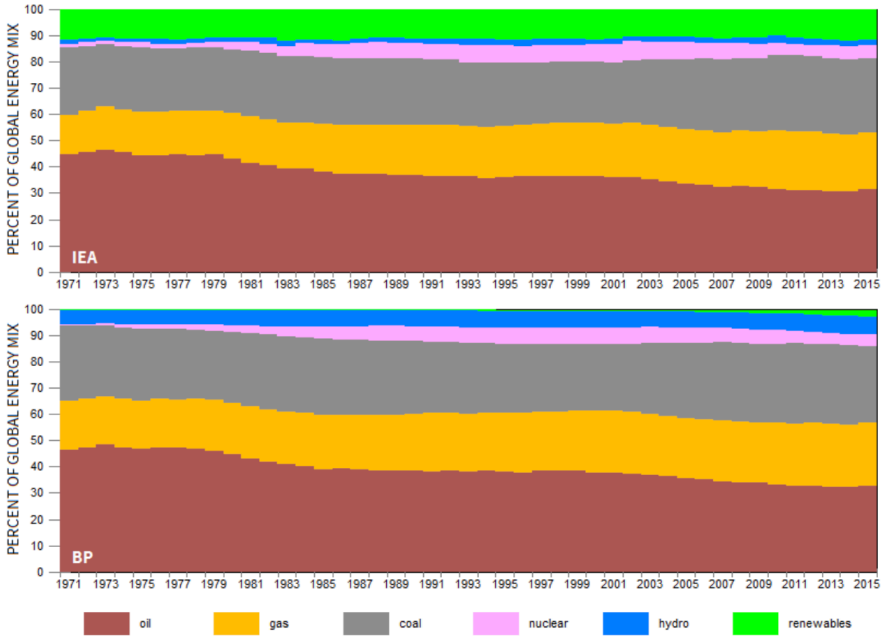


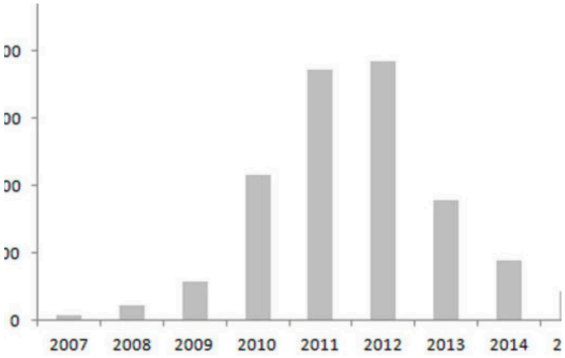
Figure 3: *Percentage contribution to the global energy mix by fuel type since 1971, BP and IEA estimates*

On BP2019 for 2018 primary consumption per fuel =
World = 13 865 Mtoe
Renewable = 561 Mtoe = 4 %
Hydroelectric = 949 Mtoe = 6.8 %

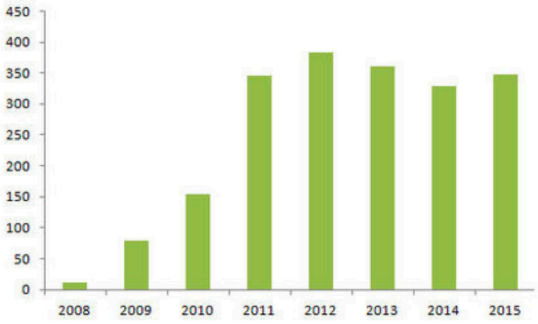
Many Greens dream about zero carbon as in the building (construction and consumption), with zero carbon building (ZCB).
The result is mainly long term wishes and few realizations (confusing zero and low).
World Green Building Council https://www.worldgbc.org/thecommitment
Our definition for a net zero carbon building is a highly energy efficient building that is fully powered from on-site and/or off-site renewable energy sources and offsets.
WorldGBC recognizes that, in most situations, net zero energy buildings (i.e. buildings that generate 100% of their energy needs on-site) are not feasible
In London = wishes https://www.theplanner.co.uk/news/new-buildings-in-the-capital-to-be-carbon-zero-by-2030
Khan said: ""My strategy to improve London's environment includes some of the world's most ambitious targets to reduce carbon emissions from our homes and workplaces. This includes expanding my existing standard of zero carbon new homes to apply to all new buildings in 2019. We want to make London a zero carbon city by 2050 and we're working hard to ensure its buildings are energy efficient and supplied with clean energy sources.
Ecolibrium sept 2018
The term "net zero carbon" has been around for a while, but what does it really mean, and are many buildings pursuing it?
http://zebra2020.ecofys.com/Main_Page
Zero energy building ZEBRA2020 was launched end of April 2014 in Vienna and monitored the market uptake of low-energy buildings across Europe, thereby generating data and evidence for policy evaluation and optimization.
Report of 2016 nZEB-tracker is no longer available, meaning troubles!

In France « Batiments a energie positive » = BEPOS has replaced « Batiments basse consommation » BBC: but no statistics are published showing the historical number of BEPOS, only few pictures! Rather peak data on BBC!

BBC-Effinergie



BBC-Effinergie Rénovation



-Carbon capture storage or sequestration = CCS

CCS has been done on few places, but there are doubts that it could be done for the world CO2 emissions.

Furthermore, few mentions that the energy to carry out CCS is about 25 % (very few recent papers on the subject) and I doubt that the world can find an additional 25% to store CO2.

As renewable and hydroelectric represent only 10 % of present production it is hard to believe that global CCS is the solution!

For me the best solution should be to convert CO2 in hydrates (being heavier than water for water depths greater than 3700 m) and to dump them in deep remote ocean places without currents: they should stay for a long time: ieaghg.org/docs/.../PH4-26 CO2 hydrates.pdf

But it is against the precaution principle, politically incorrect!

-Post peak = post growth

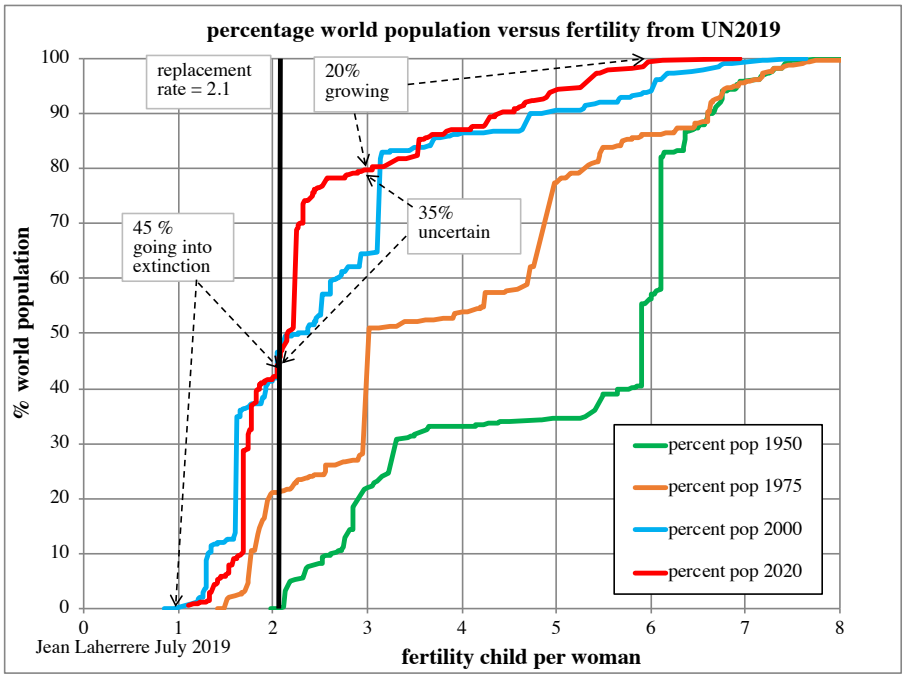
Our consumption society is based on growth, but in a finite earth, growth will end sometimes. Growth concerns production, consumption, but also population.

In my last paper Laherrere J.H. 2019 "UN 2019 world population forecasts" July https://aspofrance.org/2019/07/28/un-2019-world-population-forecasts/ I display this graph where only 20% of the world population has a fertility rate which allows future growth, the rest is going towards extinction.

In 1950 no one country has a fertility rate lower than 2.1 children per woman, which is the replacement rate.

In 1975 20% of the world population has a fertility rate below 2.1.

In 2020 45% of the world population has a fertility rate below 2.1.



Many civilizations have disappeared in the past, and the world population has passed through few peaks (in Europe with the Great plague in 1350 & 1650), but the world is always growing. What will be life when world population declines?
Europe population will decline after 2020 at 744 M (UN2019) and in 2085 will be overpassed by Nigeria (medium fertility). Asia population will peak in 2055 at 5.3 G
UN2019 forecasts world population peak around 2100, but UN forecasts are based on utopic fertility rates going all towards the replacement rate, and world birth rate matching death rate. This forecast forgets that there are two different populations: one below replacement rate and one above, but this rate is not a goal. But migration will compensate for a while.
Our way of life (always more consumption and more growth) is not prepared to post peak.

-Conclusions
In the last IPCC report AR5 the" baseline" RCP8.5 (a lie, in fact RCP12) assumes a cumulative CO2 emission from fossil fuels 4 times what is considered as the most probable and in 2100 an annual FF production 7 times the most probable: it is completely unrealistic. RCP6 and RCP2.6 are also unrealistic: it is why I called in the past IPCC work as GIGO: garbage in garbage out, today three IPCC RCP scenarios can be called fake!
Only RCP4.5 is close to the most probable FF production.
Since the oil shock of 1973, CO2 FF emissions growth rate is 3 times less than in the past since 1800, except the period 1914-1945!

From two independent approaches, CO2 FF emissions will peak in 2030 about 40 GtCO2, when RCP8.5 peaks in 2100 over 100 GtCO2.
The concerns about future fossil fuels CO2 emissions are mainly based on fake scenarios.
The medias are not doing their job! The "politically correct" rules the world!

NB: sorry for my broken English and thanks to Charlie Hall for his remarks.