HDA CONSEIL

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No Fossil fuels and No nuclear ? Is it this the way towards a 1,5° global warming ?

The main purpose of the COP 26 should be the promotion of strict Nationally Determined Commitments (NDCs) in order to reach the objective set in Paris of limiting global warming well-below 2° and if possible at 1,5°.

Several CSO claim that a safe 1,5° global warming could only be reached giving up fossil fuels and nuclear energy, meaning no investments in oil and gas fields and no new nuclear power plants. But is it realistic, analyzing documents published by the IPCC or the IEA on Net Zero Emissions in 2050?

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In 2015, the IPCC[1] presented several pathways in line with a 1,5° global warming.

P1 is based on a de-growth scheme while P2 assumes a sustainable growth with important changes in the utilization of energy and P3 more limited changes. Carbon Capture and Storage (CCUS), which is not considered in P1, offsets some emissions in P2 and more emissions in P3.
The result is a sharp decline in energy consumption in P1 (-32% in 2050 vs 2010 or -37% vs 2020) while it remains stable in P2 (+2%) and increases in P3 (+23%) where efficiency measures are less stringent. At the end, if P2 is the reference, the output of energy would be lower by 40% in P1 et higher by 15% in P3.

			P1		P2		P3	
	2010	2020	2030	2050	2030	2050	2030	2050
Total energy supply/year (EJ)	**544,7**	**589,1**	**463,0**	**370,4**	**517,5**	**555,6**	**637,3**	**659,1**
Renewables	17,0	30,7	**90,1**	**158,6**	**96,9**	**242,6**	**70,6**	**166,3**
Biomass	56,9	61,9	**50,6**	**47,8**	**56,9**	**82,5**	**77,4**	**125,7**
Nuclear	30,1	29,4	**47,9**	**75,3**	**55,1**	**59,6**	**59,6**	**180,9**
Coal	153,0	155,8	**33,7**	**4,6**	**59,7**	**35,2**	**38,3**	**41,3**
Oil	172,1	171,4	**108,4**	**22,4**	**149,7**	**86,1**	**166,9**	**32,7**
Gas	115,2	139,1	**86,4**	**30,0**	**92,2**	**42,6**	**153,2**	**139,4**
Other sources	0,4	0,8	45,9	31,8	7,0	7,0	71,4	- 27,2
Total Emissions CO_2* Gt/year	**32,3**	**34,2**	**13,6**	**2,3**	**17,1**	**1,6**	**19,1**	**2,9**
Total CO_2 captured Gt (until 2100)				**0**		**348**		**687**
Renewables % Electricity Production	**20%**	**28%**	**60%**	**77%**	**58%**	**81%**	**48%**	**63%**

NB : The data for 2010 and 2020 come from the IEA WEO 2021. Future estimations are based on IPCC Data on variations.

It appears in all these pathways that:

- renewables, including hydro-power, are more used and become the first source of electricity without overpassing a share of 81% in P2 in 2050, instead of 20% in 2010 and 28% in 2020.
- fossil fuels decline sharply (Coal - 77 % / Oil - 50% / Gas - 63%) in 40 years but do not totally disappear, representing 15% to 32% of the primary sources of energy in 2050
- nuclear becomes more important and even increases by 150% in P1 which is promoted by most NGOs. The increase reaches 500% in P3 but “only” 98% in P2. By 2050, nuclear would represent 11% to 27% of the primary sources of energy.

[1] https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

In all IPCC pathways, fossil energies and nuclear would provide together between 36% (P1) and 60% (P3) of the supply of energy in 2050.

In a simplistic approach, the level of renewables and biomass reached in P2 (which is the highest one at 325 EJ) would not be sufficient to cover the minimum requirements of energy reached in P1 (which is the lowest one at 370 EJ) ! Does this mean that without any fossil fuels and nuclear the output of energy would be lower and as a consequence the de-growth much stronger ?

It will be interesting to check how these pathways will be revisited in the next IPCC report, expected by next March (with their impacts on levels of economic growth).

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In the meantime, we can refer to the World Energy Outlook 2021 recently published by the IEA[2]. The IEA considers various schemes including :

- NZE (Net Zero Emissions by 2050) in line with a global warming capped at 1,5°. Most growth would come from developing countries where GDP/capita would increase more rapidly (3,4%) than in advanced economies (1,5%). The proportion of advanced economies in the global GDP (50% in 2010) might be divided by 2.
- APS (Announced Pledges Scenario) which assumes that all climate commitments made by governments around the world, including NDCs and longer term net zero targets, will be met in full and on time. The global warming could reach 2,1°, which means that the commitments made today are not sufficient.

In NZE, most of the reduction of CO2 will be reached through a much more efficient utilization of the energy, reducing the energy consumption per unit of GDP by 3,4% a year (-65% from 2020 to 2050).

			NZE		APS	
	2010	2020	2030	2050	2030	2050
Population (m persons)	6 927	7 790	8 520	9 735		
GDP PPP / Capita ($)	14 704	16 900	22 009	32 818		
MJ /GDP PPP USD	3,8	3,1	2,1	1,1		
Total energy supply (EJ)	**544,7**	**589,1**	**547,1**	**543,0**	**651,1**	**674,4**
Total final consumption (EJ)	**382,5**	**412,8**	**393,6**	**343,6**	**473,2**	**473,2**
Renewables	17,0	30,7	94,9	260,3	**63,9**	**159,7**
Solar	0,8	4,7	32,0	109,1	19,1	64,2
Wind	1,2	5,7	28,5	88,9	18,0	51,4
Hydro	12,4	15,6	21,1	30,5	18,3	24,7
Bio energies	56,9	61,9	71,7	101,8	**77,4**	**105,8**
of which Traditional biomass	26,2	24,1	0,0	0,0	20,7	17,1
Nuclear	30,1	29,4	41,4	60,6	**35,8**	**48,5**
Coal	153,0	155,8	71,9	17,2	**141,5**	**78,3**
of which Coal with CCUS	0,0	0,0	13,9	13,9	0,6	15,6
Oil	172,1	171,4	137,4	42,2	**185,1**	**147,6**
of which non-energy use	23,6	28,5	31,7	29,3	33,7	33,9
Gas	115,2	139,1	129,4	60,7	**146,5**	**133,2**
of which Natural gas with CCUS	0,1	0,4	13,3	43,3	2,9	14,1
Renewables % Electricity	**20%**	**28%**	**61%**	**88%**	**53%**	**84%**
Total CO_2 removals Mt	**0**	**1**	**317**	**1 936**	**67**	**885**
Total CO_2 captured Mt	**0**	**40**	**1 665**	**7 602**	**350**	**3 813**

[2] https://www.iea.org/reports/world-energy-outlook-2021

Interestingly, the level of energy supplied in NZE is close (-2,3%) to the one of P2 , while both scenarios consider a 1,5° global warming and a sustainable economic growth.

It also appears in NZE that

- most electricity will come from renewables (at 88% in 2050 vs 81% in P2), including more hydro-energy (in TWh)
- fossil fuels decline sharply to 22% (vs 29% in P2) considering that most coal and gas (73%) will be used with CCUS and most oil (69%) will be used in industrial processes, in the absence of replacement solutions.
- nuclear would provide 11% of the energy supply as in P2 (vs 5% in 2020)

NZE is a scheme which requires less energy and uses more renewables and bio mass than APS but the IEA highlights that this has a huge cost: yearly investments in energy required by NZE over 2020-2050 ($ 4 780 bn) are higher than in APS by $ 1 tn and much higher than the actual ones ($ 1 958 bn over 2016-2020). Their financing will be an issue : the liquidity exists but risks associated to these projects might prevent private investors to support them unless some guarantees are provided by public institutions.

75% of the new investments will be dedicated to

- electrification (production and distribution) for $ 2 857 bn/year
- efficiency measures for $ 708 bn / year. They also will have to be supported by changes in individual behaviors.

Some investments will have remain for :

- new nuclear power plants, mostly in developing economies but also in advanced economies to replace the existing fleets
- oil & gas production, although they will decline from 30% of total energy investments to less than 5% between 2020 and 2050. The IEA considers that exploration can be stopped as of 2021 but recalls that investments in oil & gas fields will be required over the next 30 years (page 278) first in new fields already discovered but not yet developed and then in existing fields as without any investment their production will naturally decline by 8% a year.

	New fields			All (Existing & New) fields		
Upstream Oil & Gas	**2011-2020**	**2021-2030**	**2031-2050**	**2011-2020**	**2021-2030**	**2031-2050**
Investments (bn $ / year)	**344**	**77**	**0**	**590**	**365**	**171**

As all oil& gas projects should not be financed, criteria to select investments to be supported might include:

- alignment on the NDCs of the host country
- compliance with ESG international policies such as the Equator Principles
- low production costs, in order to accommodate low oil and gas prices scheduled by 2050
- low emissions of CO2 in their production processes (clearly below the average of 630 kg CO2/barrel reached in 2018)
- prevention of leaks of methane

It is worth noticing that several public financial institutions expressed at the COP 26[3] that they "*will end new direct public support for the international unabated fossil fuel energy sector by the end of 2022, except in limited and clearly defined circumstances that are consistent with a 1.5°C warming limit and the goals of the Paris Agreement*".

[3] https://ukcop26.org/statement-on-international-public-support-for-the-clean-energy-transition/

NZE also means that 40% (instead of less than 1% today) of the energy consumed in 2050 will be transformed twice mostly to store electricity and produce hydrogen. An increasing proportion of the supply of energy will be dedicated to this transformation as showed by the ratio Energy Consumed/Energy Supplied which falls from 70% in 2020 to 63% in 2050.

In its Net Zero by 2050 Report[4] published early 2021, the IEA explained that a low nuclear and CCUS case would mean much more investments (in the range of $ 2 tn) to secure the availability of power, questioning the affordability of such a Case in relation with its costs (in investments and for the user). The need for an additional capacity of production in renewable energies would be close to 3 200 GW (to be compared the NZE target of 26 568 GW in 2050) while a capacity of 800 GW in nuclear and fossil power plants with CCUS would disappear. The question of the supply of oil used in industrial processes would also remain in the air !

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In order to reach the objective of a global warming capped at 1,5°, it will be necessary to at least double investments in the energy sector, with a focus first on efficiency measures to reduce the consumption of energy by unit of GDP in $ by 65% over 30 years and then on the electrification, with more renewables and better networks, without forgetting changes in individual behaviors.

The IPCC, in its P2 pathway which assumes a sustainable growth, and the IEA with its NZE scenario both concur on the needs for more nuclear (11% of the energy supply in 2050 vs 5% in 2020) and less but some oil and gas (between 19% and 23% of the supply in 2050 vs 53% in 2020) in general combined with CCUS. The absence of nuclear energy and fossil fuels could question the global availability of energy and the financing of energy supplies in advanced and developing economies and would probably raise other questions on an economic activity compatible with the Sustainable Development Goals.

[4] https://www.iea.org/reports/net-zero-by-2050