Analysis of Negawatt version 2017 – by CA-HP

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https://ideesrecuessurlenergie.wordpress.com/2017/06/14/%E2%80%8Banalyse-de-negawatt-version-2017-ca-hp/

The objective of the Negawatt scenario is to succeed in avoiding the use of nuclear energy or fossil energy to meet consumption needs.

It is a challenge and the exercise is interesting. But the Négawatt association likes to present this scenario as something feasible, which can be contested.

We had in 2011, made a detailed analysis of the Négawatt scenario 2011 (NgW11). .

To achieve 100% renewable, in line with ADEME's recent approach, with the same title of 100% renewable, but on electricity alone, Negawatt released its version 2017 (NgW17)

The 2017/2011 changes are already based on a decline in consumption, which goes from – 53% to – 56%, amplifying the importance of sobriety.

These 2017/2011 changes mainly concern a strong increase of 28% of renewable electricity sources (variable and intermittent sources) from 284 TWh to 394 TWh (recall 24 TWh in 2014). In order to take account of the variability, this leads to a reinforcement of the power to gas and methanation multiplied by a factor close to 3, emphasizing the questions already posed on the 2011 version, around the electrolysers, the carbon dioxide origin and in general, yields and losses, which are, whatever the field, underestimated.

Finally, there is a fundamental change, with a clear and significant appeal to heat pumps. Some of the worst watts in 2011 are once again acceptable, and here we find the same approach as that of ADEME, which in a few years erased its display of the no to heat pumps, too similar to nuclear electricity.

Energy consumption :

From 2015 to 2050, according to this scenario, energy consumption is divided by more than two. This assumption has gained its reputation since the LTE, the energy transition law, made it an objective. It may be said that it is no less illusory.

Note:

– The majority of the data displayed in this document are derived from Sankey diagrams expressed in TWh. Negawatt indicates all energy quantities in TWh (terawatt.hour), whether thermal or electric. We translate them here into TOE (tons of oil equivalent (1 toe is 11.6 TWh), except for electricity where TWh is used for quantities and GW for powers.

– Joint reading of the Sankey 2050 text and diagram reveals some inconsistencies. Some of them are listed in the Appendix, item by item, they cover 10 to 20% of the data, all, as well as the returns, always going in the right direction for the demonstration, aimed at the exit of the nuclear. As they do not seriously challenge the main conclusions, we will not take them into account,
The total energy consumption of Negawatt 2017 (NgW17 goes from 157 Mtoe (in 2015) to 69 Mtoe in 2050, ie – 56% in total and – 60% per inhabitant, and it was 74 Mtoe for NgW11. Even further in sobriety / efficiency.
Uses are distributed

– in heat for 33 Mtoe

– on the move for 21.6 Mtoe

– Specific electricity for 14.9 Mtoe (172.8 TWh)

By consumption sector, these uses are distributed :

– Residential and tertiary 29 Mtep

– Transportation 19.4 Mtoe

– Industry 15.8 Mtoe

– Agriculture 4.9 Mtoe

To show the origin of these gains, NgW17 presents the distribution of these gains in relation to what is defined as a trend scenario, measured in primary energy.

At the primary energy level, trend production according to the scenario would be 23% lower than at the level of 2015, which may be surprising since, simply because of the increase in population, we could at least find + 11 %

Sobriety would represent a gain of 17% and efficiency a gain of 27%. The remaining 33% of primary energy production of 74.6 Mtoe (1004 TWh) would be distributed between

– 40 Mtoe (462 TWh) of electric renewables

– 36 Mtoe in biomass (418 TWh)

– 10.4 Mtoe in other renewables (121 TWh)

– 0.26 Mtoe in fossil gas (3 TWh)

Consumption by the residential and tertiary sector

According to the scenario NgW17, in the residential and the tertiary, the total consumption is 29.4 Mtoe.

The consumption for thermal uses alone is 25.1 Mtoe. They are currently 54.5 Mtoe, which means a drop of 46%, more than a factor 2 per capita

The scenario foresees an increase in areas, for example + 12% for the residential (passage from 2,500 to 3,000 m2). This increase is consistent with the increase in population. It is more coherent than NgW11, which provided only + 170 Ms² in the tertiary and stabilization in the residential. There seems to be no more emphasis, as in the NgW11 version, on the need to “squeeze a little” in the dwellings, emphasizing cohabitation (more or less forced), the sharing of dwellings such as those of the elderly living alone …

This leads to a gain on the sobriety substations (reduction of the temperature of the life, of the order of at least 2 ° C) and post efficiency with insulation of a factor 2 (in tep / m²). For this purpose, an annual volume of work must be retained at 780,000 dwellings and about 3.5% of tertiary areas
Among the sources of energy, heat pumps are put forward. This was not foreseen in NgW11. But at the time in the anti-nuclear movement, as at ADEME, heat pumps were excluded from language, because who said heat pump under nuclear power. Absolutely to proscribe at the time. Things have changed, notably at ADEME in recent years, and thus it is cited in NgW17, which reflects an ideological evolution: “a privileged place for high-performance heat pumps, mainly electric, which have undeniable advantages in terms Efficiency and flexibility “.

Heat pumps represent 50% of residential heating and 35% of tertiary heating, ie about 11 Mtoe. Based on an average COP of 3 this would yield 7.36 Mtoe, derived from nature (environment) and 3.7 Mtoe from electricity (42.7 TWh)
With direct electricity practically reduced to zero (about 0.5 Mtoe), the other sources of heat energy for the residential and tertiary complex are:

– biomass for about 6 Mtoe (30% of residential and 15% of tertiary)

– an assembly called "heat network" about 4 Mtoe through the heat networks (8% of the residential and 30% of the tertiary).

– gas for 4 Mtoe from biogas and partly produced by methanation (a reaction of hydrogen from electrolysis and carbon dioxide).

Consumption in the transport sector

The total consumption for transport would be 21.64 Mtoe (11.2 for people, 8.2 for goods and 2.2 for agriculture).

This represents a decrease of 57% by contribution to 2015, to be divided between sobriety and efficiency.
For transport, the first station in terms of final energy is the so-called network gas (biogas origin or gasification from solid biomass or methane derived from methanation) for 13.8 Mtoe, then electricity for 3 Mtoe (36 TWh) and finally fuels Liquids for 3 Mtoe.
The sobriety alone represents a gain of 23 Mtoe, or 45% of current consumption. The summary dossier foresees a slight decrease of 15% in the mobility of persons measured in km / inhab.an (17 200 at present). The place of the car (currently 71% of the mobility of people) is reduced to 49% including the so-called shared mode. The share of public transport, a priori more sober is accentuated, multiplied by 1.75, but this remains limited.

It is envisaged for freight transport measured in Gt.km (currently 300), a decrease of 17%.

The very modest increase in the share of electricity in transport from around 1 Mtoe in 2015 to 3 Mtoe (35.5 TWh) in 2050 should be introduced in the sober section.

It is known that the efficiency for passing into useful energy is of the order of a factor of 3 from the electric motor to the heat engine. These 3 Mtoe of electricity would be the equivalent of 9 Mtoe of fossil fuels and this would result in a gain of 6 Mtoe in final energy. It would therefore be necessary to increase the efficiency of the engines by 40% compared to 2015.

Consumption in the Industry Sector

The industry is increasing from 33 Mtoe (387 TWh to 15.8 Mtoe (183 TWh), down 53%),

Electricity represents 72.8 TWh and heat 9.5 Mtoe (110 TWh)

The heat comes essentially:

– solid biomass 4.6 Mtoe,

– Environment 1.8 Mtoe (Heat pumps)

– solar thermal 0.9 Mtoe,

– methanation gas: 0.6 Mtoe, and finally a little liquid or gas biomass

It is the only consumer sector that keeps a residue of fossils, in the form of petroleum: 0.25 Mtoe

Consumption in the agriculture sector

The agriculture sector moves very little in terms of energy consumption. It went from 5.7 to 4.1 Mtoe, a decrease of 28%, much less than the average of 56%.

The share of electricity increases from 11.2 to 15 TWh (1.3 Mtoe)

A zoom on electricity

From production to final consumption of electricity

Electricity production 462 TWh, comes from:

– Wind 77 GWi to produce 247 TWh, that is an average duration of 3207 hours per year

Note: difficult to accept, because taking 49 GW of land and 2500 hours per year, it would be necessary to arrive at 4446 hours per year for the offshore.

– Photovoltaic 140 GWp to produce 147 TWh,

– Hydraulic earth 54 TWh, starting from the current 21 GWi (including 2.5 from mixed STEP) plus 1.9 GWi of pure STEP (hydraulic pump station).

– Hydraulic sea 14 TWh, assuming a load factor of 38%: 4.2 GWi of power

Note:

The file gives precise information on the capacity of wind turbines (78 GW, of which two thirds onshore, one third offshore) and photovoltaic panels, PV (140 GW). The production of electricity by wind turbines (250 TWh) assumes that the load factor is 36%. Today, it is 20% for wind turbines on land and between 25 and 30% for offshore wind turbines. The PV load factor is very slightly higher than today.
From this primary production of 462 TWh, 53.7 TWh are added from the cogeneration heat stations of all the sectors, ie a total of 516 TWh in production

The latter figure may suggest that in absolute terms, the place of electricity has not changed much compared to today (about 540 TWh produced and about 40 TWh of the export / import balance.

But this changes strongly if we follow the path to consumption and firstly the losses associated with taking into account the variability of intermittent renewables, essentially the 181 TWh withdrawn for methanation, in order to cope with the temporary overproductions of the ENRi Wind and photovoltaic)
This would give an intermediate balance of 335 TWh. To arrive at the final consumption, one must take into account:

– the 6 TWh, of the net balance of the passage through the HPS (STEP) (optimistic return of 80%)

– the 31.6 TWh power supply for the specific energy sector

– the 6.5 TWh of line losses

Note:

With 6.5 TWh announced losses in line, between 1 and 2% of the energy transported, this figure is particularly low, it should be in the vicinity of 7%. But this is true of all the estimates of under-estimated losses in the Negawatt scenario of 2011 or 2017.
This leads to a balance of 291 TWh.

As the net distribution is 272.2 TWh

– 72.8 industry (specific)

– 74.7 residential (36.4 in specific and 38.3 in heating)

– 73.6 tertiary, (48.5 specific and 25 heating)

– 27.9 mobility,

– 23.2 agriculture (15 specific)

In this reassembly there would be a surplus of 19 TWh, exactly that indicated as an electrical surplus;

The variability of wind and photovoltaics

Overview

Electricity, a simple energy vector, is not directly storable. Production must always be adjusted to meet the needs. These needs are already very variable over the course of the year, in medium-energy integrated over several weeks, but there is time to prepare to face these global variations. On the other hand, these needs are even more variable, but here in instantaneous value of power during a single day and it is necessary to react continuously and without break, to the minute, or even to the second.

If one can act in part on consumption, it is up to all sources of production to adapt. All sources of electricity, which can adjust their power levels, thus ensure, to date, that the balance between consumption and production is almost always satisfactory, even if not always perfect. Hydraulics, fossil-fueled power plants and nuclear power are all involved.

However, the introduction of new renewable production systems, including wind and photovoltaic, with highly variable and partly random spill-over powers, will increase the need for modulation by other producers, unless storage techniques Electricity, to date almost limited only to STEPs, take over.

Except by acting almost continuously on consumption, the network must be equipped with reserves that are ready to start or change regimes depending on the production of wind turbines (and therefore wind fluctuations) and Running the sun, it pretty predictably.

The situation in Negawatt 2017

The summary file indicates that the means of flexibility available today (dam hydraulics, pumping stations-turbines, auxiliary thermal plants, effacement of electro-intensive industries, imports, etc.) are largely sufficient to cope with a increase in the contribution of these two channels.

It is recognized that, when they reach high penetration rates, more storage means will be needed to move large quantities of energy over time, citing the inertia flywheels for short times, Power to gas for inter-seasonal storage, batteries, compressed air …
By arriving at an installed total power of 217 GW of variable power, it is clear that we are out of the range of noticeable increase. This is almost double the current situation of installed powers from all sources in France.

It remains to be believed in Negawatt’s assertion that the balance between production and consumption of electricity is assured on an hourly basis.

But on this point, along with ADEME’s presentation of the 100% renewable electricity scenario, we are dreamers and more than incredulous, as shown in the overview below.
For the wind, over the whole of France, we keep in mind that the total power will never be reached and that on the other side there will always be some wind.

Thus, the instantaneous power can vary from 54 GW to 4 GW (anticyclonic period, very little wind, which can affect a few days), with great variability, no regularity to be expected over a few days
For photovoltaics, there are fewer uncertainties, the maximum power without reaching the total peak power can approach 110 GW, but a certainty for the majority of the time will be zero, Peaks of consumption in the evening, ie a range of 110 to 0 GW.
Overall, these two sources together constitute the bulk of the production, and can see their power increase from 164 GW (mid-day, during periods of strong wind) to 4 GW at the end of the day. In one case 50 GW above average production requirements, and in the other 50 GW below;

– For the latter the hydraulics can not at most, STEP included (hydraulic pump station), only produce about, less than 20 GW. It is the black out, out of import, forced shortage. But the connections with our neighbors are still limited and especially these can also be lacking simultaneously. It must be said and reiterated that the false idea of the European expansion, long supported by the proponents of electric renewables was demystified. In anticyclonic times all of Europe is affected.

– When there is overproduction, for example of 50 GW, the solution of “synthesis gas (power-to-gas) is presented by Negawatt,” as one of the keystone of the energy system of 2050 “.

This channel represents 181 TWh (46% of the total solar and wind energy (almost half) diverted from the direct cycle to consumption to supply electrolysers. Losses 39.8 TWh) Very optimistic hypothesis for electrolysers with constant load, which will certainly not be the case with the large variations of productions Do we have an installed capacity of about 40 GW of electrolyzers?

But nothing is clear about where the carbon dioxide comes from. It is suggested that this comes from biomass sources, losses of 47 TWh, in addition to the 39.8 TWh electrolysers cover the energies to separate carbon dioxide, nitrogen, transport it … More doubts …

One can then refer to the scenario developed by the ADEME which assumes that electricity is produced only with renewable energies.

A zoom on the biomass

In primary energy, the total including waste will increase from 16.7 Mtoe in 2015 to 36.5 Mtoe in 2050. The latter are broken down into :

– solid biomass 21.5 (12 in 2015, almost a doubling, towards solid use or methanisation gas)

– liquids 3 Mtoe, substantially the same absolute number (culture generation 1 or 2?)

– gas 11.6 Mtoe (0.5 in 2015, or 20 times more)

– waste 0.5 Mtoe (1.1 in 2015, high reduction of waste in general, generalized sobriety, effect of the life extension of equipment …

Note; There is practically no change compared to the 2011 version, which globally gave 38.9 Mtoe
The biomass of solid origin will remain in this form for 11.5 Mtoe, the remainder being destined for gasification to supply jointly with the biomass of gas of origin and methane resulting from the methanization.

The whole will be the basis of the network gas for 19.1 Mtoe, distributed between heating gas (all sectors except mobility) for 6.8 Mtoe and fuel gas mobility for 12.3 Mtoe

Other sources, solar and geothermal

To be complete in this overview, let us mention these two sources not explained above.

– Solar thermal (domestic hot water) represents 1.6 Mtoe.

It will be 0.1 Mtoe by 2015. It will concern industry, residential and tertiary sectors
– Deep geothermal (hot water heating) represents 0.9 Mtoe

It represented 0.2 Mtoe in 2015, not to be confused with geothermal surface (or geo-solar), implemented in association with heat pumps.

Economic Approach

In our conclusion on the Négawatt 2011 analysis, we regretted the lack of a financial analysis, such as that for Negatep, in preparation for DNTE (National Débats for Energetic Transition). This led us to do the same on Negawatt 2011 and Negatep in 2013.

In any case, as the question asked, was not to obtain a cost in absolute terms, but to relativize the cost of the energy transition, compared to a scenario in a growth perspective and another called the status quo (The current global situation remains independent of the increase in population, for example, fossil consumption, etc.).

In conclusion, in relation to the status quo, the energy transition to reduce carbon dioxide emissions has a relative additional cost (as long as there is no cost to carbon dioxide released and fossil fuels do not see their costs fly away).

This additional cost amounts to 36 G € / year for Negawatt 2011 and 29 G € / year for Negatep (an average spread over a period of 40 years) This reflects a small gap between the 2 scenarios of 7 G € / Year totaling € 280 billion over the entire transition period

Without taking up the previous study and making a simplified correction by extrapolating to Negawatt 2017, notably taking into account the increase in the importance of wind and photovoltaic (+ 38% in energy), but especially the near factor of 3 for the whole methanation, we arrive at an extra cost of 72 G € / year for Negawatt 2017. The change from Negawatt 2011 to 2017 could only cost more. Since then, Negawatt 2017 presents the results of the economic approach, which can be summarized as follows:

– "in so far as the energy sector is concerned, the annual expenditure on investment + functioning + imports is of the same order of magnitude between the Négawatt scenario and the trend scenario up to 2025, ie € 110 billion Euro per year. Beyond that, the total annual expenditure of the Négawatt scenario decreases regularly from 110 to 80 G € / year.

– The aggregate energy expenditure for 2015-2050 is therefore € 4,200 billion in the trend and € 3,530 billion under the Negawatt scenario. The balance in favor of the latter is therefore of the order of 700 billion euros. "

It is interesting to make a comparison with a reference, but as we have mentioned above, by referring to the efforts of sobriety and efficiency, this so-called reference scenario is a so-called tendanciel, is already within a decaying framework.

Having no detailed information on the basic basic costs used in this economic study, we cannot comment.

Conclusion

It appears that the conclusion that we had written after the analysis of Negawatt 2011, is not modified, it is even strengthened, with this more wind and photovoltaic and on the other hand that of methanation. Should 40 GW of electrolysers be used ? And where does carbon dioxide come from and at what cost already energy ?

At first glance, the Negawatt scenario is based largely on very ambitious hypotheses of possible reductions in consumption, on a considerable role given to methane and on errors of scale as regards the possibility of coping with the intermittence of Wind and photovoltaic.

The expected reductions in consumption in the main consumer, housing and transport sectors are technically and financially inaccessible. They also assume that many bans are in place: prohibits increasing housing areas, whereas current trends are due in large part to the increase in lone-parent families and the aging of the population; Prohibited on food; Prohibited on individual habitat, etc. The measures advocated will undoubtedly go in the right direction, but pushed to the extreme they become unrealistic, besides the will to impose them systematically can only worry.

The massive use of methane, in preference to biofuels for mobility and electricity for fixed uses, is based on unrealistic data, notably on the yields of operations, including methanation (hydrogen production, collection Carbon dioxide and storage of these gases). This leads one to wonder about the consequences of a partial failure of the approach: natural gas, in replacement of synthetic methane, would be the only possible way, with, in return, an increased dependence on the countries Producers and, even more serious, an increase in CO_2 emissions.
Annex

Difficulties of reading, of interpretations.

Some examples of inconsistencies

Consumption in the residential and tertiary sector

– The total consumption read is 29.4 Mtoe.

The consumption for thermal uses alone is 25.1 Mtoe.

This would mean that for the specific uses of electricity, consumption would be 4.3 Mtoe, which is well below Negawatt's: 100 TWh or 8.6 Mtoe.

A difference of 4.3 Mtoe (14%)

Consumption in transport

– Between 2 pages of the analysis we find 2 different digits, one of 19.4 Mtoe and the other of 21.64 Mtoe.

Another difference of 2 Mtoe (10%)

End

Editor's note – Untreated and reactions:

1) B.D. : The occupation of space, which is a strong limitation, but which is not taken seriously into account in any document, no more Negatep than Negawatt. On the other hand, on the ground, there is a strong development at the moment of the associations of defense against the wind.

Négawatt apparently wants 26 GW of wind at sea. This represents 52 power stations like the one that will be installed in Saint-Brieuc, much to the detriment of many residents, who have lost all their recourse, and about 5 000 km2 of occupation of the maritime domain in areas where there are already many conflicts of use.

2) P.H .:

When we simulate electrical production here, there is always a background and their electrical consumption is so low that it is not difficult to avoid blackout.

For the same reason, it cannot be said that networks need to be strengthened.

They have corrected the excess biomass, so we cannot blame them for exploiting too much now.

The solar is laid in several directions. But simulating offshore parks can pose enormous problems.

One of the faults also relies on heat pumps, they are aerothermal, if they have not put anything away (see http://www.energie-crise.fr/spip.php?article220), they blow up the network by great cold.

And the economic aspect is also fanciful, they announced 550 € / m2 for the renovation which is 52 billion annually compared to 5 billion Macron and diffuse insulation or 15 billion of buildings without fossils or the FFB .

The lack of surplus energy for the industry while we have the trade deficit record in Europe is another mistake.