Approach to energy demand and related Sustainable Development Goals on the mid and long term using Message

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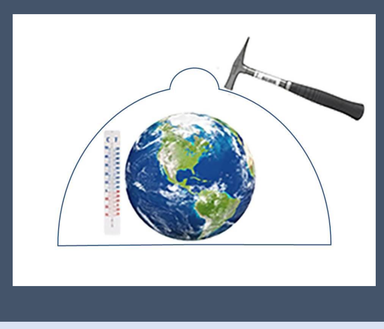


ABSTRACT

- The scenario Message Efficiency of the GEA (2012) (Global Energy Assessment) provides the international community with the future of energy consumption. This scenario may be optimistic in the sense that it does include a limitation of the energy dependence over time and allows for a very large amount of carbon capture. An adapted version of Message, "Supply-N" for 2° C and for 1.5° C objectives (Efficiency-N) has been proposed during the Beijing and Recife IAMC 9th and 10th conferences respectively. Supply-N considers using the very available nuclear energy, when developing the so called fast breeder reactors (8000+ years of electrical energy are available that way, including the electrical transportation), and the Bio Energy Carbon Capture and Storage (BECCS).
- Whatsoever, the energy and the raw material demands, particularly for rare elements, are sufficiently high in these approaches to be addressed with great emphasis, including the evaluation of the CO_2 emissions.
- In order to cope at the same time for the various related SDGs (1, 7, 12, 13, 14 and 15, particularly), as adopted by the United Nations on September 25th 2015, one needs to clarify the available options.
- GISOC poster proposes a comparison of the foreseen solutions when either limiting the CO_2 emission to the envelope of 600Gt or considering a potentially more dynamic development of the consumption and at the same time tries to estimate the impacts on the SDGs.
- Among the constraints, the evolution of the population on one side and the evolution of the population with access to a modern style of life – more energy demanding – on the other side have a direct impact on the Green House Gases, particularly the CO_2.

BACKGROUND

- A dream cannot be easily set aside. 2/3 of the world population are looking forward for a modern way of life, using various appliances to ease their day-to-day work and increase their comfort.
- This could lead, without intervention, and taking a standard of two third of the per capita current consumption in the USA, to a world energy consumption peak in 2060 of more than 50 000 GW compared to the 16 000 GW in 2016 while more than doubling the need for the extraction of raw materials, particularly for fossil energy consumption.

CHALLENGES / METHODS

In order to mitigate the consequences of this evolution, improvements in motors and industrial processes efficiency, conversion to electricity, and adaptation in the building conception will permit a net reduction of the overall, and particularly fossil, energy consumption.

We consider achievable a two third European mean per capita target for the entire world by 2060, while the population increases of 7.2% over the values from the IIASA models, I.e. using the World Energy Council figures. This would represent a 2060 value of around 26 800 GW or 845 EJ.

While these values are by far over the regularly admitted ones, they give a reasonable envelope for the future energy demand, taking into account the expectations for India (1.5 billion peoples), China (1.3), Africa (over 1.2), etc. in the coming decades.

The main question is: How far can Efficiency-N (1.5C compatible) work under these considerations? Can we really achieve the 1.5C IPCC goal?

OUTCOME

Pushing the generation of Nuclear Energy beyond 16 000 GWe

Electricity

First of all, the previous calculations limited the extent of Nuclear Energy to 16 000 GWe, with the assumptions provided in IIASA's models, as a goal for the IPCC limit of 1.5C. There is no reason to stop increasing this value.

Cogeneration

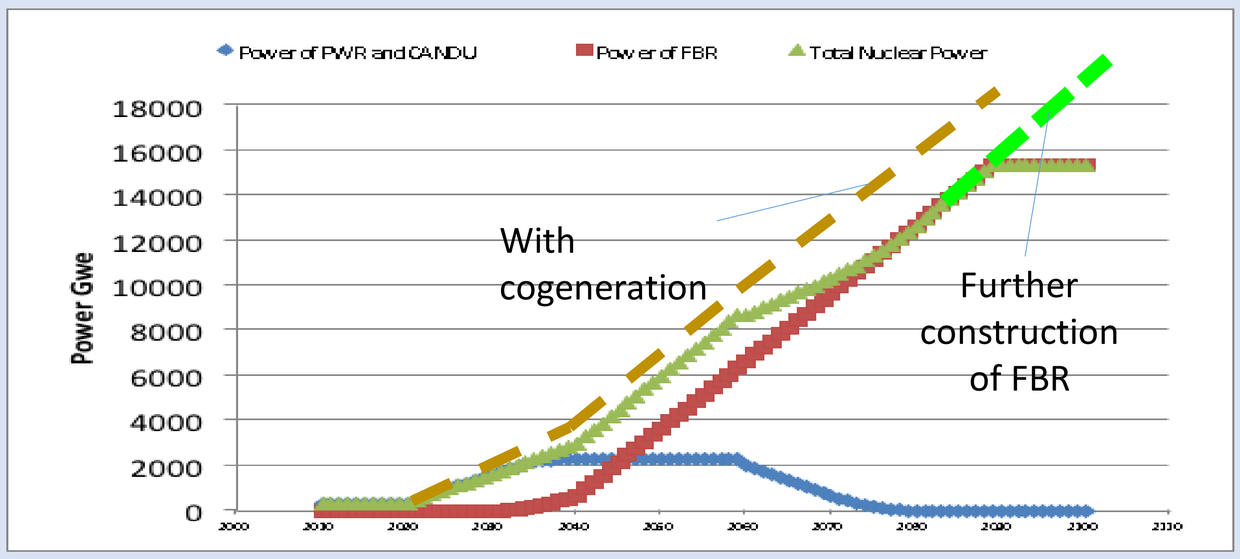
Reference 1 indicates a potential gain over 10% on the energy output when cooling down and using the heat generated for desalination and heat transfer purposes with FBR. Said otherwise, the output would then be raised to 20 000+ GW total, I.e. over 630 EJ by 2100 (56% of the primary energy), allowing for the 1.5C goal to be achieved.

Stability and Economy

Since the source material for FBR is quasi unlimited (8000+ years), the competition to gain access to the required nuclear material can be reduced, allowing for a rather constant energy price to be achieved (as observed, by the way, since more than 40 years in the nuclear industry worldwide).

Emissions and impact

The nuclear fuel cycle is essentially Green House Gas free and the amount of waste in FBR is extremely low, 80-100 times less than in Light water reactors, I.e. the fleet of 16000 reactors would produce only three times the waste of the currently existing reactors for which solutions already exist (transmutation, deep geological repositories, etc.). This also limits the high demand of rare earth, etc. required by windmills and solar panels.



CONCLUSION

Based on the experience gained by SLC and GISOC over the last two years, one can see that not only the Efficiency-N still works, but it also allows to address properly the poverty (1) and availability of clean energy (7), the responsible production and consumption (12), and the climate action (13) while reducing the impact on land and ocean (14 and 15).

Said otherwise, we cannot figure out, as mentioned recently by the IPCC, scenarios where nuclear energy would not contribute to the largest share of the primary energy consumption.

ACKNOWLEDGEMENTS / REFERENCES

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3 - Nuclear energy and bio energy carbon capture and storage, keys for obtaining 1.5C mean surface temperature limit
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