How to Assess the Sustainability Performances of Nuclear Energy and Renewable Sources in a Neutral Way

Editorial

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Undoubtedly, today we are in the midst of a multiple crisis (energy, geopolitical and climate crisis). In addition, economic disparities can cause a migration crisis at any time. Today's world is in a profound change generated by structural demographic changes, as well as by an accelerated development of disruptive technologies (artificial intelligence, robotics, drones, biotechnologies, nanotechnologies, additive manufacturing, internet of things, energy storage, big data, block-chain, etc.).

It is extremely difficult to make predictions in the medium and long term and, sometimes, even in the short term. Despite the amazing development of computing power and of the algorithms, the future remains quite unpredictable.

Clearly, energy is a crucial element of our existence in modern civilization. We cannot function without energy, and its production and consumption are producing significant impacts on the environment, health, as well as on the future conditions for the next generations.

At the level of the modern society, the concerns of recent years are increasingly closely related to the imperious need to reduce carbon emissions to curb an imminent global warming. Renewable sources are seen, in many countries, as the main vector to reduce emissions. Some countries are considering nuclear energy to be mandatory added in the energy mix to balance *two crucial objectives: the reduction of carbon emissions and the ensuring of the energy security*, for a stable operation of the grid.

In these conditions, a comparative analysis conducted on the sustainability performance of different energy generation alternatives with a focus on renewables and nuclear is extremely useful.

A series of evaluation methodologies have been developed and used, most of them having a clear biasing for a certain technology. This situation complicates the comparative evaluation, a series of indicators being developed to shed light on the performance of a certain technology.

Any comparative methodology must be technologically neutral and accepted by experts, a large group of stakeholders and the society. The evaluation of alternative technologies will highlight the advantages and at the same time the weaknesses of the investigated technologies. Clearly, society has an imperative need for energy, supplied exactly when the consumer needs it, in the required quantities, with acceptable costs and without producing emissions that affect the environment and public health.

Each of the existing technologies for energy generation has good parts and weak parts. *There is no perfect technology*. Society indirectly chooses, through its representatives, a mix of generating technologies capable of satisfying its own demands. These differ from one country to another, the understanding of the current and future contexts and the priorities being different.

From this point of view, a comparative methodology must be enough flexible to be adaptable to the local, regional or global context. It should not be forgotten that any context can change in future, following the inherent technological, economic or social developments.

The methodologies are based on the evaluation of some indicators chosen so that they can be used for all the targeted technologies and ensure the neutrality of the evaluation.

A large number of indicators will allow covering in detail all the impact elements of the energy generation alternatives, but the more the number of indicators, the heavier the evaluation will be, and the more difficult it will be to apply the methodology.

A too small number of indicators will limit the evaluators' attention only to those aspects that are essential from the point of view of their own experience and expertise.

Therefore, *finding an optimal number of indicators* is a first step in the construction of a methodology that must be effective in its use.

The *prioritization of indicators* represents the second step and is usually done by weighting of their importance at the level of decision-makers. Most of the time, such an intervention affects the neutrality of the study, the decision-makers being tempted to introduce their own visions and wishes in directing the evaluation towards an expected result. That is why this step should be taken through the widest possible participation of society, in the most democratic possible way.

Another question is related to the assessment team. Who should be part of it? *As a rule, a group of experts assumed to be sufficiently equidistant from the interests on each of the targeted technologies performs the evaluation*. Reducing judgment to the level of experts will enlighten some interests and tendencies existing in the society.

A broad participation, in a simplified version involving three categories (experts, decision-makers, stakeholders), can significantly increase the credibility and value of any energy technology assessment.

Within the ECOSENS project (Economic and Social Considerations for the Future of Nuclear Energy in Society) H2020, Euratom, 2022-2025, under the coordination of RATEN ICN, the construction of such a methodology is underway. A broad participation of energy experts, economic and social development specialists, decision-makers and society representatives is expected. The construction will be correlated with the objective of better understanding what will happen at the level of society and energy markets in the year 2050, in the European context. Clearly, the goal is extremely ambitious, the efforts will be significant, but there is a strong need to begin such construction to support society's requirements in an honest and informed dialogue regarding the stable energy supply as a critical element of our existence.

In this context, our journal is oriented to publish meaningful results oriented to reflect the efforts of the research and development, education and training, academia and industry, and also the efforts to build sustainable decisions by involving the diversity of the stakeholders.

Dear readers and dear potential contributors, you are welcomed in our journal to participate to a balanced debate on the nuclear issues and moreover to contribute with innovative and valuable solutions to the nuclear development in the context of the modern society sustainable development.