IS NUCLEAR POWER DEVELOPMENT READY TO FOLLOW THE MARKET?

Editorial

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The decarbonization of the energy sector plays an important role to reduce the carbon dioxide emissions in order to satisfy the constraints of 2 ºC scenario (2050). Due to the free carbon characteristic, both the nuclear energy and the renewables are able to play important roles.

The support for renewables is based on the green vision aiming to protect the world and the planet by a severe reduction of the emissions, not only for the energy sector, but also for heating, transportation, and all the other sectors of the economy and living. Often the enthusiastic measures proposed by the green movements are very utopian targeting energy systems based exclusively on the renewable alternatives.

In such systems, the daily-night cycle of the photovoltaic and high variations of the wind have to be compensated. The classical view of the electricity system with base load and peak units seems to be more and more inappropriate, as the variable renewable production is growing. More peak units become necessary in the system stimulating the development of very flexible alternatives, such as the natural gas based units. The peak units are used for very short periods and at high prices of the electricity, compensating the low capacity factors. By increasing the number of peak units, a reduction of the profit is quite probable, and a large wasting of the resources will also appear (materials, systems, and lands). This is clearly an unsustainable approach for the development of the humanity.

A high penetration of the variable renewables (vRES) obligatory requires adequate storage capacities. The only large scale storage technology currently available is based on hydro-pumping systems, but adequate landscape and water resources should be available to pump large volumes of water to a higher elevation.

The development of batteries for large storage capacity is a too optimistic vision in comparison with the real progress registered in the last decade. On the other hand, the large penetration of the electric transport and the use of the cars batteries as storage capacity is not a realistic option due to the large cost related to the needed infrastructure and social behavior (derived from the property issues, costs, habitudes).

Nuclear power is not seen as complementary with variable renewables due to the low flexibility. The volatility of vRES production is compensated by natural gas units, or sometimes by coal electricity production. Nevertheless nuclear power plants (NPPs) and renewables are green capacities and can contribute together to a major reduction of the emissions. In the current stage of development, both NPPs and vRES may benefit from the development of the storage capacities. A better interconnectivity of the electricity networks and more investment in hydro-pumping units seems to be applicable at least from the technical point of view and economics.

For Romania, the investment in nuclear (such as the plant life extension of Unit 1, the continuation of work at Unit 3 and Unit 4) will keep an important share of nuclear power in the total electricity production. On the other hand, the share of vRES is expected to increase continuously (over 20% in 2030). The project for hydro-pumping at Tarnita-Lapusesti is able to introduce a 1000 MWe storage capacity in the system, based on the large volume of the higher lake (10 million m^3) and high elevation difference (564 m) contributing to the smoothening of the variability.

On long term, nuclear power has to be more adaptive to the market needs such as a higher flexibility, shorter duration for construction, less centralized production. *Is nuclear development able for it? What kind of efforts have to be invested? What kind of awareness should be created?*

The orientation for Small Modular Reactors (SMR) may capitalize some opportunities such as: progressive investment, construction schedule, acceleration of return of the investment, adaptability to non-electric applications, economy of multiple units, standardization, modularity, inherent safety, and lower emergency planning zone.

At the same time, the development of SMR has to overpass some difficulties in terms of licensing, sitting of multiple units, operability and human factors, etc.

Clearly the nuclear sector has to invest more efforts in innovation in order to cope with expected characteristics of the future energy market. The investment in RDI activities should be high and be done now. Otherwise the opportunity created by the climate change policies will not be capitalized.

The efforts should be focalized on innovation aspects even their penetration in the practice of the nuclear sector is affected by multiple barriers derived from the extensively regulations and standardization.

The limitations of the current load following may be relaxed by using the amazing development of new materials and by the development of systems not very sensitive to the poisoning effects.

The reduction of cooling water consumption or the development of new type of cooling will have a significant impact on the sitting, with good results in a better distribution of the nuclear power units.

Important efforts should be also paid to increase the overall efficiency of the nuclear systems, especially by using of the wasted heat in non-electric applications.

The innovation should be closely influenced by the new understanding of the climate changes and risks perceptions. Enough efforts have to be devoted to radioactive waste management, decommissioning and site remediation aspects, as well as to the safety and security issues.

In this context, we are expecting a sensitive growth of the innovation spirit and a rejuvenation of the nuclear sector. The young generation is welcomed to express new ideas and to go further and further, combining the knowledge captured from the experts and the freshness of a new perspective on the things.

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.