CRISIS AND OPPORTUNITIES FOR THE NUCLEAR DEVELOPMENT IN ROMANIA

Editorial

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From time to time the world is facing major crises: financial or economic crises, pandemics, armed conflicts, humanitarian crises, refugee crises, food crises, energy crises, even less predictable crises such as the driver crisis, and the most known and the most worrying one, the global warming crisis. All of them have rather a global influence than a local one, due to the continuous reshaping of the word, increasing of the connectivity between economies and populations, restructuring the production and consumption.

Understanding of the great difficulties that climate changes are generating has led to new political agreements, to policies, strategies, and programs to prevent or, at least to mitigate, the burdens on the environment and future society. Among them, the package of measures included in the Green Deal offers a set of hopes for a coherent application at the level of the European Union, and a possible path for limiting global warming to less than 2 ^{0}C.

The energy is a key sector in limiting carbon emissions. Electricity production, space heating, the use of heat for industrial processes, the use of fuels in transportation are all treated in the Green Deal recommending measures to increase the energy efficiency, to eliminate the waste of the resources, to reduce the consumerism, to limit the use of the fossil fuels in order to progressively go towards the climate neutrality.

In the production of electricity there is a systematic encouragement of renewables, seen as an universal solution to obtain the needed energy avoiding carbon emissions. In the European landscape there is a diversity of opinions. A number of European countries believe that nuclear energy must be stimulated as a substantial contributor to clean energy in a similar manner as for the renewables. For other countries, nuclear power is not a solution for the future energy market, while for a few, the nuclear power is even considered as a major problem due to the impact of accidents and radioactive wastes.

In the last couple of years, the European citizens have seen significant efforts of policy-makers and other stakeholders in debates around the inclusion and exclusion of nuclear energy from the set of energy alternatives contributing to sustainable development. The results seem to converge towards understanding the indispensability of nuclear energy in the set of measures for climate protection, even if there are still enough opponents of this idea.

This autumn, additionally to the pandemic context, the global world tends to face a difficult energy crisis. It seems to rise in an extremely unfavorable period, that of the cold winter. The rising prices for electricity, heating and transport fuels will accentuate energy poverty, and will enlarge the social segment in poor living conditions. This situation has already raised political concerns about the possible public reactions to the EU Green Deal policies.

In such context, the Green Deal costs become a very sensitive issue. The target of climate neutrality in 2050 introduces higher prices for carbon emissions, discouraging the burning of fossil fuels. The intention is to close most of the plants using fossil fuels, especially coal. On the other hand, the need for investments in renewables to replace the coal-based energy units is quite high. Therefore, it is difficult to support them, both as a financial effort and in terms of the pace of construction. The energy crisis seems to undermine the expected smooth path of the implementing Green Deal measures. Initially estimated as a complex and difficult process, the energy transition now seems to be extremely difficult.

From another perspective, any crisis brings with it a set of opportunities, first of all those related to a more correct understanding of the problems, constraints and of the realism of the envisaged solutions. In these conditions, nuclear energy has a new chance for development, despite the opposition of some groups generally interested exclusively in stimulating other technologies.

Some developed countries tend to reconsider their latest policies taking into account the introduction of investments in new nuclear power plants. Clear support has emerged for SMR-type systems as a possible solution easily adapted to the future energy market.

In a fair comparison of the electricity production by different technologies, the nuclear power has an environmental profile with the lowest impact on all indicators. For example, for the GHG emissions, nuclear has better performances as the renewables: 5-7 g CO_2 eq per kWh in comparison with 8-20 g CO_2 eq per kWh for wind, and 20-80 g CO_2 eq per kWh for the solar PV. In terms of the land occupation, the performance of nuclear is excellent being around 1 m^2/MWh. Moreover, the renewables have introduced concerns in terms of the need of the resources. For example, a significant increase occurs for Copper and, also, for special materials (precious metals, rare elements) resulted from the development of wind, solar PV, and batteries. Therefore, nuclear power has some advantages that cannot be ignored in the fight against climate changes on the way of a more sustainable world and life.

For Romania, the present decade is an extremely busy one in terms of the planned investment in the nuclear sector. The refurbishment project of Unit 1 from Cernavoda NPP is in the straight line. The continuation of the works at Cernavoda NPP Units 3 and 4 seems to have finally a financing solution. The construction of the experimental infrastructure for the authorization of the LFR technology in order to implement ALFRED demonstrator has started.

During the CoP26 conference, Romania and the USA announced the collaboration agreement for the construction of the first SMR plant, based on integral concept of the PWR technology. After that, Romanian national company Nuclearelectrica and NuScale Power company signed a teaming agreement to advance the deployment of NuScale's SMR technology in Romania.

In agreement with the National Recovery and Resilience Plan around 4.6 GWe coal-based capacity will be phase out by 2032. The investment in nuclear is seen to replace the old coal-based units with modern nuclear free-carbon capacities. The SMR plant to be built in Romania will have 6 modules with a total electrical power of 462 MWe and it is expected to be finalized in 2028. The contribution to the climate objectives is estimated as a reduction of the emissions by 4 million tons of CO_2 emissions per year.

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.

In this context, at the end of this decade, Romania could have 4 CANDU units in operation, with a modernized Unit1, and a NuScale type SMR based power plant, together with the finalization of all preparatory activities for ALFRED construction.

The process is not simple and there are many obstacles that need to be overcome, mainly in terms of optimal use of financial and human resources. It is a wide-ranging effort that requires the rigorous use of existing competences and the creation of new ones. What is important at this moment is to keep a high determination in decision-making, together with the financing framework

Beyond of these difficulties, it is important to not forget that the success of this complicated process will significantly contribute to assure the country's energy independence and to produce appropriate solutions for the difficult problems of economic, social and sustainable development.

On long-term, the energy market development will be driven by factors as the climate actions, technological developments, restructuring of the economies, occupations, consumers' behavior, etc. The climate issues, the progressive investment, a better flexibility and adaptability, improved safety, standardization, design simplifications, fabrication in series are favorable factors stimulating the SMR deployment.

There are still issues and barriers to be overcome:
(i) the economic performances are not yet demonstrated and there is a difficult competition with the economy of scale promoted by the large reactors approach,
(ii) there is an insufficient development of the regulatory framework to cover the SMRs specificities (transport, co-sitting, factory fabrication),
(iii) the demonstration of the innovative engineered safety features needs time and large efforts,
(iv) possible instabilities in energy policies for many states may appears, including the tendencies to reduce the nuclear power share in the national energy mix,
(v) the economic conditions in the future electricity market are uncertain,
(vi) there is a lack of operational experience for SMRs.

The RDI efforts are oriented to give a substantial contribution to find appropriate solutions for such issues towards of the consolidation of the trust, improving the performances, and convincing the society on the value of the SMR approach.

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.