

## **OPINION**

on a dissertation thesis for the award of the educational and scientific degree  
“Doctor”

**Author of the dissertation thesis:** Eng. Anton Lyubomirov Ivanov

**Title of the dissertation thesis:** “Final Investment Decision for the Construction of a Nuclear Power Plant in the Context of a Liberalized Electricity Market in Bulgaria (Methodological and Applied Aspects)”

**Member of the Scientific Jury:** Prof. eng. Ivaylo Ganev, PhD

I was appointed as a member of the scientific jury in the procedure for the defense of the dissertation thesis of Eng. Anton Ivanov for the award of the educational and scientific degree “Doctor” by Order No. 319/04.05.2025 of the Director of the Institute for Economic Research at the Bulgarian Academy of Sciences.

The procedure complies with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and its implementing regulations. The following documents have been submitted: dissertation thesis, abstract, publications related to the dissertation thesis, curriculum vitae, and other supporting documents.

### **Relevance and significance of the problem addressed in the dissertation thesis**

The topic of the dissertation thesis is highly relevant. In recent years, the energy sector has undergone a number of transformations. These concern both the types of newly built generating capacities and the liberalization of electricity trading. In this context, making a final investment decision for the construction of a new nuclear power facility should be based on consideration of numerous factors. The role of the state in the construction of such a facility is substantial. It can largely determine the future development of nuclear energy. The construction of a new nuclear power facility with state participation requires a conservative and cautious approach when making decisions regarding investments in such public infrastructure. Such an installation is expected to have an operational lifetime of at least 60 years. The final investment decision should therefore be based on systematic analysis rather than on short-term considerations. The presented dissertation thesis develops a scientifically grounded approach for evaluating alternatives for the construction of nuclear capacities in Bulgaria.

### **Main theses and achieved results**

The dissertation thesis is structured as follows: introduction, three chapters, conclusion, bibliography, and appendices.

The introduction defines the main thesis of the dissertation. The leading aspects of the research are systematized. In line with the development of the electricity market within the EU and in Bulgaria, arguments are substantiated on the basis of which the dissertation thesis is developed.

The first chapter presents the development of the electric power sector as well as the trends in the development of generating capacities. The regulations in the sector that influence this field are also examined. An analysis is made of the different market models in the liberalization of the electricity market and their evolution. EU regulations imposing certain restrictions on the free electricity market are presented. The critical analysis of the free electricity market is not overlooked. Attention is also paid to the investment risk related to the construction of new nuclear capacities, emphasizing that under current electricity trading conditions, technical and economic analysis alone cannot encompass all factors influencing investment decisions regarding their construction.

The second chapter develops a methodological approach for substantiating a sustainable investment decision for a nuclear power plant. The approach is developed under the conditions of a liberalized electricity market in Bulgaria. The specific characteristics of nuclear power projects are presented, including very high initial investments, long operational lifetimes, and decommissioning processes. Various aspects of state participation in the development of a new nuclear power project are examined. A PEST/SWOT analysis is conducted based on numerous factors reflecting a broad range of conditions affecting the final reasoned investment decision.

In the third chapter, the developed approach is applied to Bulgarian conditions. The currently existing options for the construction of new nuclear capacities at Kozloduy Nuclear Power Plant and Belene Nuclear Power Plant are examined. The development of the projects to date, the commitments of the state, and the specific features of the two projects are taken into account. In addition to these two projects, the analysis also includes an option for the construction of Small Modular Reactors (SMRs). At present, the options for building SMRs are more hypothetical than concrete. The conducted analysis provides quantitative assessments based on accepted qualitative indicators, which may serve as a basis for investment decision-making. A sensitivity analysis is also carried out with respect to two key indicators.

The conclusion presents in a synthesized form the key points of the dissertation thesis. Emphasis is placed on the uncertainty surrounding long-term forecasts for the development of projects for new nuclear capacities under liberalized electricity market conditions.

It is also concluded that the financing of nuclear projects cannot be justified solely through analysis of the market environment, but requires consolidation of supportive policies, whereby the state becomes the leading factor guaranteeing the protection of the public interest.

## **Assessment of the candidate's personal contribution**

Eng. Anton Ivanov is an established specialist in the field of nuclear energy, well acquainted with both the practical problems and the scientific developments in this area. He also possesses many years of professional experience in the field. This is evident from the large number of literary sources used.

The dissertation thesis is an independently conducted study by Eng. Anton Ivanov. This is demonstrated by its structure, the formulated thesis and hypothesis, and the analyses performed.

The formulated contributions and presented results are the personal work of Eng. Anton Ivanov. His specialized engineering knowledge in the field of nuclear energy enables him to explore in depth the decision-making process related to the construction of new nuclear capacities.

## **Publications and fulfilment of national minimum requirements**

A total of four independent scientific publications have been presented. They are related to the topic of the dissertation thesis and present the main results of the conducted research.

This demonstrates that the candidate fulfills the national minimum requirements for the award of the educational and scientific degree "Doctor," stipulated in the Law on the Development of the Academic Staff in the Republic of Bulgaria and its implementing regulations, as well as in the Regulations for the Award of Scientific Degrees and Academic Positions at the Institute for Economic Research at the Bulgarian Academy of Sciences.

## **Critical remarks, questions, and recommendations**

I have no substantial remarks regarding the dissertation thesis. Some minor inaccuracies have been identified, such as a referenced figure that is actually missing (p. 49). The presentation could also have been somewhat more concise.

A more detailed analysis could have been provided regarding the problems arising from the excessive penetration of generating capacities based on photovoltaic systems and battery energy storage systems.

I also believe that one criterion has been insufficiently addressed — namely, public attitudes toward the implementation or non-implementation of a given project. At present, public attitudes in Bulgaria are predominantly positive toward projects related to the construction of new nuclear capacities. However, these attitudes should be analysed very carefully, because no matter how good a project for the development of new generating capacity may be, without public approval it may fail.

It would also be beneficial to conduct sensitivity analyses with respect to a larger number of criteria.

These remarks should be viewed more as recommendations for the future development of Eng. Anton Ivanov's work, as they exceed the requirements for the preparation of a dissertation thesis.

## **Conclusion**

The presented dissertation thesis by Eng. Anton Ivanov has a clear scientific and applied character. The developed methodology may serve as a basis for comparing alternative projects and for making investment decisions regarding the construction of new nuclear capacities in Bulgaria.

The minimum national requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria and its implementing regulations, as well as the minimum requirements of the Regulations for the Award of Scientific Degrees and Academic Positions at the Institute for Economic Research at the Bulgarian Academy of Sciences, have been fulfilled.

I propose that the members of the Scientific Jury accept the dissertation thesis of doctoral candidate Eng. Anton Lyubomirov Ivanov titled "Final Investment Decision for the Construction of a Nuclear Power Plant in the Context of a Liberalized Electricity Market in Bulgaria (Methodological and Applied Aspects)."

I give a positive evaluation of the dissertation thesis and propose that the respected Scientific Jury award Eng. Anton Lyubomirov Ivanov the educational and scientific degree "Doctor."

Sofia, 29.05.2026

MEMBER OF THE SCIENTIFIC JURY:

(Prof. eng. Ivaylo Ganev, PhD)