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Sofia

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Professional field - code 05.02.05

REVIEW

of dissertation by **Todor Dimitrov Georgiev**
on the topic
„INVESTMENTS IN PHOTOVOLTAIC POWER PLANTS – FINACIAL AND ENVIRONMENTAL APSECTS"
for the award of the educational and scientific degree "doctor" in the doctoral programme "Finance, Money Circulation, Credit and Insurance"
code 05.02.05

I. General description of the dissertation:

The author has formulated **the subject** of his research - *"as the financial and environmental aspects in deciding for investments in photovoltaic power plants, based on the price levels and supply and demand volumes in the national and international electricity markets."*

The dissertation has a standard structure - an introduction, three chapters and a conclusion in total volume of 209 pages. The first chapter presents the author's understanding of Theoretical, market and environmental aspects of investments in the electricity sector. The second chapter outlines and analyses the problems of the price segment "Day ahead" as a determining factor for the return on investments in solar power plants. Chapter three presents a financial analysis and evaluation of a project company for investment in the construction of a photovoltaic plant.

In the bibliography, the author has referenced 151 titles.

II. Assessment of the form and content of the dissertation:

1. Relevance of the dissertation

The topic of the dissertation is relevant given the state and development of the Bulgarian electricity market and the increasing role of renewable energy sources.

The author presents an interesting **research thesis** "*...that the EU Green Deal shapes increasing demand for low-carbon electricity production. This, in turn, presents a favourable prospect for investments in photovoltaic power plants, supported by financial models ensuring returns while adhering to environmental regulations in both the country and the EU.*"

In order to prove the his thesis, the author formulates the following main purpose and tasks:

The research purpose *is to conduct a financial-economic analysis and propose well-founded decisions for investment in low-carbon electricity production, highlighting the benefits of photovoltaic power plants and in conformity with the environmental regulations in Bulgaria and the EU, price levels, demand on independent energy exchanges, and the strategic advantages of the geographic location of the country in South-eastern Europe.*

The specific tasks set for the dissertation are:

First*. To analyse the theoretical research in the sector and the empirical evidence regarding the development of the "Electric Power Sector" in Bulgaria in the context of the European Green Deal and the trend towards increasing the share of renewable energy sources in the electricity mix of the country.*

Second*. To conduct an econometric analysis for the period 2019–2023 of the day-ahead segment of the independent energy exchange, focusing on Bulgaria and economies from Central and South-eastern Europe. This analysis aims to determine the characteristics of the price (in Euro/MWh) as a leading indicator in investment models for photovoltaic power plants.*

Third*. To justify an investment proposal for the establishment of a network of photovoltaic power plants in Bulgaria, combining the best technological performance indicators for solar panels and to explore the options for project company financing through credit mechanisms.*

In a ***methodological aspect****, the study relies on the use and application of comparative analysis, deductive and inductive methods, the graphical method, statistical methods for analysis, descriptive statistics, regression and correlation analysis, and others.*

The tasks are well arranged and logically connected. The author's ideas are clearly presented and well-argued by the by the empirical research.

2. The studied issues are developed correctly and in completeness.
3. The volume of the dissertation is larger than standard notions, but this is due to the extensive topic that has been chosen for scientific research.

4. Diagrams, graphs and tables are used to present summaries of data from research conducted, new arrangements of criteria or facts, probability distributions and correlations to help illustrate the author's thought, or to strengthen arguments in support of the thesis put forward
5. The scientific, linguistic and stylistic editing of the work are good. The author's expression is precise and clear.
6. The data for the empirical study were selected according to the objectives of the research thesis and I found no serious discrepancies or logical contradictions.
7. I found no evidence of violation of the rules of scientific ethics by the author.
8. The abstract fully reflects the research done and meets the requirements.

III. Scientific and applied contributions:

A total of four contributions are listed in the reference to SCIENTIFIC AND APPLIED CONTRIBUTIONS IN THE DISSERTATION as follows:

First. *The significance of issues related to the European Green Deal as an environmental regulatory standard in the energy sector and a powerful driver for investments in photovoltaic power plants, is thoroughly justified. Projections and justified expectations of an accelerated pace and an increasing share of renewable energy sources in the energy mix of the country, with a priority of the energy generated by photovoltaic plants, are confirmed through the evaluation of target metrics in national strategic documents.*

Second. *By conducting econometric analysis of the day-ahead segment of independent energy exchanges across twelve economies in Central and Southeastern Europe, regression models have been developed to forecast the annual price (in Euro/MWh) of electricity as a key indicator in business plans for investments in photovoltaic power plants.*

Third. *Trends indicating a heightened correlation of price levels in the day-ahead segment of energy exchanges have been identified, particularly in countries with closely interconnected electric power transmission systems. For Bulgaria, using stepwise multifactor regression modeling, a regression equation has been derived illustrating the dependence of electricity prices on Romania's price (the leading factor), as well as prices in Greece and the Czech Republic as of the year 2023.*

All these contributions can certainly be classified as application of scientific advances in practice.

The author has published his ideas in two papers and three reports, which shows that these ideas and proposals have already found resonance and recognition in the specialized scientific literature

IV. Critical remarks and recommendations

The stresses that "*...the topic remains relevant, and the following research directions could be identified for future investigation:*

1. *Exploration of Coal-fired Power Plant Conversion within the European Green Deal Framework.*
2. *Determining the optimal capacity of pumped-storage hydroelectric power plants (PSHPPs) that can function as batteries, balancing the overall system capacity.*
3. *Inclusion all EU countries in the study of the day-ahead segment to establish trends and results from the European Target Model for electricity market price formation.*

It would be interesting for the author to make a research and comparative analysis of the possibilities for hedging of electricity exchange transactions on the different European markets. Undoubtedly, options and futures (especially financial ones) provide additional opportunities for hedging a position on the European Energy Exchange - EEX and their impact would probably be interesting for the Bulgarian market as well.

As a recommendation I can only wish the Ph.D. student to keep his scientific interest in researching the problems of the electricity market and possible solutions to environmental problems, because in my opinion the scientific discussions about the peculiarities and specificities of the Bulgarian reality on the Green Deal are yet to come.

V. Conclusion

In conclusion, I believe that the dissertation submitted for defense meets the requirements of the Law for development of the academic staff in the Republic of Bulgaria and proves **Todor Dimitrov Georgiev** possesses the ability to formulate and research a topical scientific problem, as well as to derive theoretical and applied contributions significant for financial theory and practice. Taking into account the undeniable contributions of the scientific work I give a positive assessment of the dissertation and propose to the *Honorable Scientific Jury to award the scientific and educational degree of "Doctor"* to **Todor Dimitrov Georgiev.**

Reviewer: .....

(prof. d-r. T. Nedev)