

OPINION

of a dissertation

with author PhD student Todor Dimitrov Georgiev,

Department of "Finance and Credit" at D.A. Tsenov Academy of Economics

by Prof. Stoyan Prodanov, PhD with a scientific specialty "Finance, money circulation, credit and insurance", registered in the NACID from 01.12.2018, member of the Scientific Jury, Order No. №255/ April 16, 2024, of the Rector of the D. A. Tsenov Academy of Economics regarding the composition of the scientific jury for the dissertation on the topic "Investments in Photovoltaic Power Plants – Financial and Ecological Aspects" by doctoral candidate Todor Dimitrov Georgiev.

Form of doctoral study: Full-time doctoral student

Leading department: Department of Finance and Credit at the Faculty of Finance

Scientific supervisor: Prof. Dr. Andrey Zahariev, Department of Finance and Credit at the Faculty of Finance, D. A. Tsenov Academy of Economics

Doctoral program: "Finance, Monetary Circulation, Credit, and Insurance" (Finance)

Dear members of the scientific jury,

The topic of doctoral student Todor Georgiev's dissertation is „ Investments in Photovoltaic Power Plants – Financial and Ecological Aspects”. This opinion has been developed in accordance with the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria - ZRASRB, the Regulations for the Implementation of ZRASRB - PPZRASRB and the internal regulations applicable to the D. A. Tsenov Academy of Economics.

1. Information about the PhD Candidate

Doctoral student Todor Dimitrov Georgiev was trained in a doctoral program at the "Finance and Credit" department of the "D. A. Tsenov" in the scientific specialty "Finance, money circulation, credit and insurance (Finance)".

Dr. Todor Georgiev was born on February 4, 1970. She received her higher education in the following degrees during the periods:

- Industrial Mechanization, Forestry University, Master (1996-1999).
- National Security, Academy of the Ministry of Internal Affairs (1997-1998).
- International Political Relations and Security at Sofia University "St. Kliment Ohridski", Master (2005-2007).

He is currently the Executive Director of Smart Energy Group AD. Scientific supervisor is Prof. Dr. Andrey Zahariev.

2. General presentation of the dissertation work, assessment of the form and structure of the dissertation work.

The dissertation submitted for evaluation is prepared in a classic structure of three chapters. In the introduction, the problem area of research is developed as follows: relevance, object, subject, thesis, aim, tasks, working hypotheses and methodology.

The dissertation has a volume of 234 standard pages, incl. 219 pages of main text. It is structured in an introduction, three chapters, a conclusion and a bibliography. The exhibition presents 54 figures and 122 tables. The bibliography contains 150 sources. In the conclusion, the main results of the dissertation work are presented. The bibliography is in APA style. The main content and bibliographic reference are proof of correct compliance with the requirements for bibliographic citation and bibliographic description. A declaration of originality of the research is attached.

The opinion presented corresponds to the normative requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Regulations for the Implementation of the Law on the Development of the Academic Staff in the Republic of Bulgaria and those applicable to SA "D. A. Tsenov" internal regulations.

As the subject of the research, the author defines investments in solar renewable energy sources in Bulgaria. The subject of the development is focused

on the financial and environmental aspects in making decisions for investments in photovoltaic plants, justified by the price levels and volumes of demand on the national and international electricity market.

The research thesis, which is proved in the dissertation, is formulated as follows: "The 'Green Deal' in the EU forms an increasing demand for low-carbon electricity production, which creates a positive outlook for investments in photovoltaic plants based on financial models of return on compliance with the environmental regulations in the country and the EU."

The purpose of the development is to make a financial and economic analysis and propose justified solutions for investments in low-carbon production of electricity, with justification of the advantages of photovoltaic plants, taking into account the environmental regulations in Bulgaria and the EU, the price levels and the volumes of demand for the independent energy exchanges, as well as the strategic advantages of the country's geographical location in southern Europe.

The specific tasks set in the development are:

First. To analyze the theoretical studies in the sector and the empirical evidence for the development of the "Electricity" sector in Bulgaria in the light of the "European Green Deal" with the tendency to increase the share of renewable energy sources in the country's electricity mix.

Second. To make an econometric analysis for the period 2019-2023 of the "day-ahead" segment of the independent energy exchange based on the example of Bulgaria and economies from central and south-eastern Europe to determine the price characteristics (in Euro/MWh) as a leading indicator in the models for investments in photovoltaic plants.

Third. To justify an investment intention to build a network of photovoltaic plants in Bulgaria, combining the best technological indicators for the performance of solar panels with options for credit financing of a project company.

Based on the object, the subject, the research thesis, goal and tasks, the following working hypotheses have been formulated:

Hypothesis one. In the conditions of environmental regulations and goals

set out in the "European Green Deal", the development of renewable energy sources in Bulgaria and the EU should take into account an accelerated pace and a growing share in the energy mix.

Hypothesis two. Through an econometric analysis of a Day Ahead segment of the independent energy exchange in twelve Central and South Eastern European economies, models can be derived to predict the price (in Euro/MWh) of electricity as a key indicator in PV investment models and establish increasing trends (by years) in the correlation of price levels in the sector for countries with high interconnection of electricity transmission systems.

Hypothesis three. The increased demand for investment in renewable energy sources in the conditions of a free electricity market is the basis for profitable business models of project photovoltaic companies using the techniques of financial leverage combined with the best technological indicators of solar panel performance.

3. Scientific and substantive evaluation of the development

The dissertation is structured in the following separate parts:

Chapter one examines the energy sector in theoretical, discursive and applied terms, making comparative analyzes both nationally and internationally. It analyzes the state and trends in the sector, the impact of the environmental goals of the European Union, the parameters and regulatory regulations for local investments in photovoltaic power plants, as well as the market dynamics in the price of electricity in certain countries with block connectivity of the power transmission systems.

In the second chapter, an econometric analysis of market trends in the "Day Ahead" segment in twelve countries of Central and Southeastern Europe for the period 2019-2023 is carried out. The aim is to establish the degree of correlation between national markets and to overcome price shocks from 2022. The stock exchange segments "Day Ahead" in the Czech Republic, Slovakia, Hungary, Romania, Slovenia, Greece, Poland, Germany, Austria, Italy, Croatia and Bulgaria

are analyzed. Also, the relationship between the price levels in Bulgaria and the other selected countries, as well as the volumes of traded electricity in the time zones of the IBEX segment, is examined. The scope of the analysis includes a large amount of stock transaction data, which is analyzed to draw conclusions about the most important trends.

Chapter three focuses entirely on the financial and economic rationale for investment in photovoltaic power plants above 1 MW, including through project companies. These investments are seen as a response to the projected increase in the share of solar energy and the growing demand for components to build decentralized networks of solar installations to produce "green energy".

In the conclusion, the main results of the dissertation work are presented. Key summaries are drawn and directions for future research on the topic are formulated. Appendices and a list of cited literature (in APA style) are presented to the development.

4. Evaluation of the formulated contributions and achieved theoretical, theoretical-applied and empirical results.

1. An accelerated pace and a growing share in the energy mix of renewable energy sources in Bulgaria and the EU is predicted and justified in the conditions of environmental regulations and goals set out in the "European Green Deal".

2. Econometric analysis of the Day Ahead segment of the independent energy exchange in twelve Central and South-Eastern European economies leads to models for forecasting the price (in Euro/MWh) of electricity as a key indicator in PV investment models

3. Trends have been identified to increase the correlation of price levels in the sector for countries with high connectivity of electricity transmission systems.

4. The increased demand for investment in renewable energy sources in the conditions of a free electricity market is the basis for profitable business models of project photovoltaic companies using the techniques of financial leverage combined with the best technological indicators of solar panel performance.

5. Evaluation of dissertation publications

PhD Candidate is the author of 5 publications on the topic of the dissertation work, including two articles and three scientific reports, which are proof of the quality of the author's overall output and the ability to popularize the author's ideas among the scientific community. The author took part in five scientific conferences with presentations on the topic of the dissertation.

6. Evaluation of the abstract

The presented abstract in a volume of 45 pages by doctoral student Todor Georgiev successfully presents in a qualitative and quantitative aspect what was achieved in the voluminous dissertation work. Through it, the author confirms the ability to synthesize and systematize by deducing accents and conclusions of a scientific-problematic nature.

7. Criticisms, recommendations and questions

I would like to ask the following questions:

1. What are the strategic advantages of Bulgaria's geographical location for investments in solar power plants in southern Europe? What influence do international energy policies and EU regulations have on investment decisions in the sector, and how can Bulgaria benefit from these dynamics for sustainable development of the energy sector?

2. In the third chapter, the financial and economic justification for investments in photovoltaic plants with a capacity of more than 1 MW in Bulgaria is considered. How does the assessment of the return on these investments compare with the risks associated with regulatory changes, technological innovation and potential environmental constraints? Can additional indicators, such as potential for innovation or environmental benefits, be integrated to formulate a more comprehensive assessment of the long-term sustainability of these projects?

8. Conclusion:

The dissertation of doctoral student Todor Georgiev entitled "Investments in Photovoltaic Plants - Financial and Environmental Aspects" is a thorough and up-to-date study that is positioned in the context of modern trends and challenges in the energy sector of the Republic of Bulgaria. The paper covers a wide range of issues related to the development of the photovoltaic industry, reflecting the key environmental and financial dimensions of the topic.

The author successfully argues the importance of photovoltaic plants for achieving the goals of the European Green Deal and for the sustainable development of the energy sector in Bulgaria. The attention to detail and the analysis of the geographical, climatic and technological factors that motivate investment in photovoltaic plants show a deep understanding of the issues.

Doctoral student Georgiev presents a clearly structured and logically constructed development, supported by up-to-date data and research. Econometric analysis of market trends and forecasts for the development of the photovoltaic sector are an important contribution to understanding the potential effects of investments in renewable energy sources. The analysis of financial models for profitability and their compliance with environmental regulations in Bulgaria and the EU is particularly impressive.

The presented dissertation work for the educational and scientific degree "doctor" has the required by the Law on the Development of the Academic Staff in the Republic of Bulgaria - ZRASRB, the Regulations for the Implementation of ZRASRB - PPZRASRB and the internal regulations applicable to the D. A. Tsenov Academy of Economics quantitative and qualitative characteristics. The dissertation of doctoral student Todor Georgiev is a contribution to research on renewable energy sources and offers valuable analyzes and proposals for the development of photovoltaic plants in Bulgaria. This research can serve as a basis for future energy policies and strategies aimed at sustainable development and environmental efficiency. The dissertation shows that the candidate has in-depth

theoretical knowledge and capacity for independent scientific research.

Based on the above, I propose that the scientific jury award doctoral student Todor Dimitrov Georgiev the educational and scientific degree of Ph.D. in “Finance, monetary circulation, credit and insurance” program.

08.05.2024

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/ Prof. Stoyan Prodanov, PhD/