Summary of doctoral dissertation

„DETERMINANTS OF INVESTMENT EFFICIENCY OF PHOTOVOLTAIC SYSTEMS IN THE ELECTRICITY MARKET"

This doctoral dissertation deals with the determinants of investment efficiency of photovoltaic systems, referring in particular to the area of relations between entities participating in electricity exchange processes.

Determinants of the impact on investment efficiency of PV systems relate are very demanding area of research. It consists of many elements between which relationships of varying intensity occur. For this reason, the subject of research can be classified as complex. Characterized by hierarchical construction. Theoretical and practical knowledge, and analysis of the subject of research were utilitarian in the same way for the research area and business practice. The scope of research adopted in the dissertation includes the development and use of photovoltaic systems offered by global producers, with particular emphasis on the perspective of the volume of market turnover.

The subjects of the research were the main participants of the global electricity market, who in total account for the global increase in installed photovoltaic generating capacity.

Dissertation has theoretical and cognitive character. The research was primarily of an identifying (cognitive, explanatory) nature, consisting in seeking to explain phenomena, which is characteristic of basic research.

The main goal of the research was to create a full classification of groups of determinants affecting the results of investment activities described from the perspective of the relationship of the effects obtained to the expenditure incurred on solar systems on the electricity market.

To implement the above, the following specific research goals have been formulated.

C.1.1. Analysis of the relationship between individual factors affecting on their formation process.
C.1.2. Identification of factors affecting the investment efficiency of photovoltaic systems.
C.1.3. Presentation of changes in investment conditions of photovoltaic systems in an evolutionary approach.
C.1.4. Explanation of the mechanism for determining the investment efficiency of PV systems on electricity market.
C.1.5. Presenting the special importance of creating new value chains for investment efficiency of photovoltaic systems on the electricity market.
C.1.6. Examination of the current state of knowledge in the field of investment efficiency of photovoltaic systems and its critical analysis.
C.1.7. Identifying cause-and-effect relationships between economic phenomena and the level of investment efficiency of PV systems on the market that deals with electricity.

Research hypotheses resulting from the adopted goals of the work were formulated as follows:

H. 1. Factors determining the investment efficiency of photovoltaic systems on the electricity market are strongly associated with global economic phenomena, especially in highly developed countries and in China.

H. 2. Factors affecting the investment efficiency of photovoltaic systems can be divided into micro- and macroeconomic.
H. 3. Two factors have a decisive impact on the development of the photovoltaic system market:
a) product and technological innovation of photovoltaic systems creating new value creation chains,
b) energy policy instruments, in particular evolving support systems and other specific regulations.
H. 4. The growing amount of power installed from solar systems leads to a reduction in the cost of generating 1 GW of electricity.
H. 5. The growing complexity of economic systems contributes to the creation of new solutions affecting the investment efficiency of photovoltaic systems on the electricity market.
H. 6. The variety of forms of electricity sales from photovoltaic systems stimulates an increase in its supply.

The specificity of the main objective together with the specific objectives of the work played a decisive role in the selection of the research procedure and accompanying research methods. These translated into the structure of the doctoral dissertation. It consists of an introduction, six chapters, a summary, a list of sources, drawings, tables and an attachment.

The structure of the work is as follows:
INTRODUCTION
1. CHARACTERISTICS OF THE ELECTRICITY MARKET
1.1. Features of the electricity market
1.2. Functions of the electricity stock exchange
1.3. Market players and market mechanism
1.4. The role of regulators on the electricity market
1.5. The role of balancing markets
1.6. Structure of the domestic electricity market
2. BASIC FACTORS CONDITIONING THE DEVELOPMENT OF PHOTOVOLTAIC ELECTRICITY GENERATION SOURCES
2.1. Energy and climate policy
2.1.1. The essence of energy and climate policy
2.1.2. Contemporary energy and climate policy of the EU and Poland
2.1.3. The objectives of EU and national energy and climate policy
2.1.4. The evolution of support systems
2.1.5. The impact of public policy on the development of renewable energy
2.1.6. The role of governmental bodies in promoting renewable energy sources
2.2. Energetic safety
2.3. Formal and legal conditions
2.3.1. Regulatory conditions
2.3.2. Procedural conditions
2.4. Socio-economic conditions
2.5. Environmental conditions
3. INNOVATIONS AS THE MAIN DETERMINANT FOR THE DEVELOPMENT OF PV SYSTEMS IN THE WORLD
3.1. Structure of processes in the life cycle of photovoltaic systems

3.2. Innovations in the field of solar system components
3.2.1. Characteristics of photovoltaic cell development
3.2.2. The problem of efficiency of solar modules
3.2.3. Inverters and panels in a PV system
3.2.4. Features of PV systems
3.2.5. The problem of energy storage
3.3. New challenges in the value creation chain of solar systems
3.4. Efficiency and availability of the main components of the solar system in terms of economically
4. SYSTEM CONDITIONS FOR ANALYSIS OF FINANCIAL EFFICIENCY OF SOLAR INVESTMENTS
4.1. Factors affecting the result of financial analysis
4.1.1. Introductory remarks
4.1.2. The state of so-called grid parity
4.1.3. The impact of location on the availability of solar radiation
4.1.4. Forms of utilization of acquired energy
4.1.5. Types of risks in the process of investing in solar farms
4.1.6. Factors affecting costs and revenues
4.2. Methodology for analyzing the profitability of investments in solar farms - financial efficiency
4.3. Average cost of electricity production
4.4. Electricity generation costs not included in LCOE
4.5. Examples of using the investment profitability method
5. THE WORLD PHOTOVOLTAIC MARKET IN TERMS OF DEMAND AND SUPPLY
5.1. The nature of the changes on the global electricity market
5.2. The evolution of the global PV market
5.3. Analysis of market mechanisms in countries with the highest level of development of PV systems
5.3.1. Justification for the selection of countries for benchmarking
5.3.2. Impact of support instruments on photovoltaic development
5.3.2.1. Photovoltaic support instruments in selected countries
5.3.2.2. Expenditure focused on the goals of energy policy of countries for research and development
5.3.2.3. Expenditures on the production of elements and their assembly in photovoltaic systems conditioned by the objectives of energy policy
5.3.3. Effects of photovoltaic activities in the analyzed countries
5.3.4. It influences political and climate strategies on the functioning of demand and supply mechanisms
6. THE IMPORTANCE OF PHOTOVOLTAICS IN POLISH ENERGY MIX
6.1. Conditions for the development of solar farms in Poland
6.2. Analysis of the impact of the housing and institutional sector on photovoltaic development trends
6.3. Impact of the auction system on photovoltaic development
6.4. Impact of photovoltaic sources on the National Power System
SUMMARY
LIST OF SOURCES
LIST OF DRAWINGS

LIST OF TABLES
ATTACHMENTS

Specific theoretical and cognitive goals have been achieved. The research hypotheses put forward have been verified positively. As a result, a complete classification of groups of determinants of investment efficiency of photovoltaic systems on the electricity market was created.