

# Features investment in projects related to renewable energy

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**Abstract** — The introduction and use of renewable energy sources in the world is increasing every year. Most countries have taken a series of measures to combat the greenhouse effect. One of the most common is the widespread implementation and subsidization of renewable energy sources. One thing is that there are a number of problems associated with investing in projects that are associated with renewable energy sources for investors. Obviously, investments in traditional energy sources dominate the total investment in the energy sector, so the main question to assess the prospects for the renewable energy market is how to get enough investment to change the direction of investment towards renewable energy. It is important to analyze the relationship between sources of financing and the areas of renewable energy to which this financing goes. In addition to generating income from the investments themselves, investing in renewable energy can be attractive for investors to diversify the investment portfolio, as well as to improve the reliability of the energy system in individual markets and to achieve energy security of individual regions. The purpose of the research in this article is to establish the relationship between how certain types of financing create prerequisites for the development of certain types of renewable energy sources, as well as to identify and systematize the barriers that affect the attraction of funds for renewable sources at various stages of investment.

**Keywords** — renewable energy sources, projects funding, investments in renewable energy.

## I. INTRODUCTION

The purpose of this study was to study and identify the relationship between various sources of financing renewable energy projects attracted at various stages of the life cycle of renewable energy projects, as well as emerging barriers to projects and measures to overcome these barriers. This study is based on a review and analysis of statistical sources of information from international agencies on financing renewable energy projects in order to identify and systematize the links between the tools used to attract funding for renewable energy projects, state and intergovernmental policy measures aimed at developing the renewable energy market, and barriers. overcoming which use of these tools and measures is directed.

## II. THE RESULTS OF THE STUDY

In 2017, of the total investment in renewable energy in the amount of 279.8 billion dollars, investment from non-public sources in new projects in the form of project private financing accounted for more than 77% of the total investment [1, 2]. Despite the growing trend of increasing investment in renewable energy from 47 billion dollars in 2004 to a maximum of 323.4 billion dollars in 2015, the trends show a decline to 279.8 billion dollars in 2017 (a decrease of 13% by 2015 ) and a corresponding increase in risk sensitivity among financiers [1-3]. However, for the further advancement and scaling of renewable energy technology require significant investments in companies, projects and infrastructure up to 8.5 trillion. dollars for the period from 2018 to 2050 [4,5]. To date, more than 150 countries have adopted a special policy on renewable energy, 75 countries have policies regarding the generation of heat based on renewable energy sources and 72 countries for renewable energy in transport [6,7]. Support measures and public policies are evolving with the development of the industry itself. In the early periods of development of the renewable energy industry, most of the measures were aimed at compensating for the gap in the costs of energy production from renewable sources and in traditional energy. But as technology develops and the industry expands, new policy support initiatives are aimed at reducing the risks of investors making capital-intensive investments. Green tariffs were key in accelerating the deployment of renewable energy sources and remain the dominant form of

political support for generating electricity from renewable energy sources; but 2015 was the first year since 2000, in which new support scheme schemes were not launched [6,8]. A positive indicator of market maturity is the growing popularity of using auctions for purchasing electricity from renewable sources: an auction mechanism was introduced in more than 60 countries in 2015 [6,8]. When making decisions, investors make a choice between financing renewable energy projects and traditional energy projects, including taking into account the support measures offered by state institutions. Therefore, for institutions engaged in promoting renewable energy, it is necessary to propose solutions that help overcome institutional, political, financial, economic and barriers [9] [10].

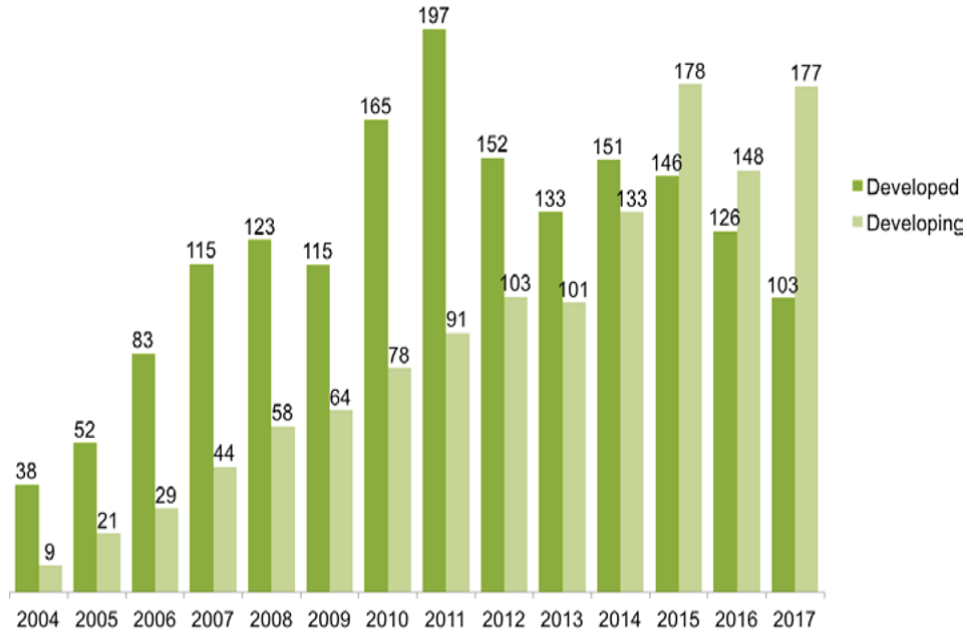


Fig 1. GLOBAL NEW INVESTMENT IN RENEWABLE ENERGY: DEVELOPED V DEVELOPING COUNTRIES, 2004-2017 [1]

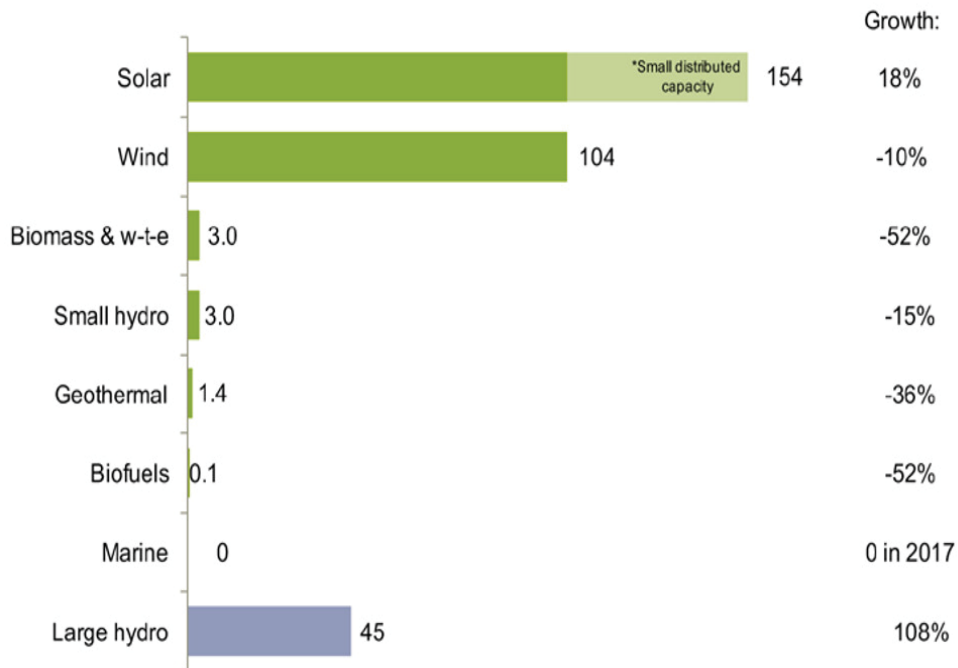


Fig 2. RENEWABLE ENERGY ASSET FINANCE AND SMALL DISTRIBUTED CAPACITY INVESTMENT BY SECTOR, 2017, AND GROWTH ON 2016 [1]

### III. TECHNOLOGICAL BARRIERS

The most important technological barrier that must be overcome for the sustainable development of renewable energy is the emergence of a sustainable understanding that for renewable energy there is widespread use in the present and future [11]. When choosing

alternatives for investment, a private investor will primarily rely on mature traditional energy technologies. To overcome this technological barrier, funding in the form of partnerships with public sources, government agencies, as well as specialized non-government agencies such as Advanced Research Projects Agency - Energy (ARPA-E) [12] will be effective. At the testing and demonstration stage, it is important to provide investors with reliable information about the feasibility and commercial viability of the project, which will reduce information asymmetry and facilitate further investment [11,13].

#### IV. INSTITUTIONAL BARRIERS

Institutional barriers are associated with changes in social behavior. Traditional energy sources have sustainable markets and developed infrastructure. In order to overcome institutional barriers it is required that structures promoting the development of renewable energy sources support the development of infrastructure and infrastructural technologies with the involvement of investors from the traditional energy industries, in order to ensure, in particular, the availability of electrical networks to include newly created renewable energy projects. For the commercial stage, it is important to create and maintain a state regulatory regime that provides guarantees to investors in the long term [11]. When implementing projects that require approval for implementation by the population, it is necessary to create an environment for obtaining such approvals, as well as creating a positive image for RES projects among the population.

#### V. ECONOMIC BARRIERS

The lack of sufficient information on the profitability of the projects being implemented, especially in comparison with significant data on the traditional energy projects implemented, creates economic barriers for investors. Bloomberg New Energy Finance has published the annual report on the development of world energy New Energy Outlook 2018 [4]. It states that by 2050, investment in the global "green" energy will be over \$ 8.5 trillion, and the share of renewable energy in global output will be more than 50%, and taking into account hydropower and nuclear energy more than 70% [4]. When comparing the economics of energy generation projects from renewable and traditional sources, the investor often does not take into account the negative environmental impacts in the cost of the latter. At the development stage, the main economic barrier is the lack of a reliable estimate of commercial sales and market uncertainty. In this case, grants and subsidies are a mechanism to stimulate investment. At the same time, the reduction of subsidies to traditional energy would be a signal to demonstrate the direction of innovative development [13]. At the stages from testing to commercial launch, the main economic barriers are the high startup costs, the high discount rate on future revenues when attracting debt financing. At this stage refinancing will be needed for venture capital that has entered projects in the previous stages. At the commercial launch stage, it is important to form steady demand from consumers. Forms such as various tax credits can at this stage create a competitive advantage for RES. For RES, additional incentives such as the introduction of tariffs for the supply, special certificates and the introduction of quotas will also contribute to the expansion of investment.

#### VI. FINANCIAL BARRIERS

Financial barriers come from informational asymmetries, since financiers usually do not have sufficient technological or political knowledge to assess risks and the effectiveness of return on investment between traditional sources and new clean technologies. Therefore, there is a lack of investment in clean energy research and development. To attract private investors at this stage, government guarantees are necessary to ensure the provision of private loans, as well as investment in capital from innovative companies [14]. These barriers can be mitigated by financing through a combination of public and private investment banks, for example, for infrastructure investments. In order to attract private investment and expand market opportunities, it is necessary to create, in the context of understanding the market prospects, expectations of its growth trend. Direct financing, investments in technology support and demand stimulation projects, and fiscal policy will form sufficient strength to overcome financial barriers [14]. On the part of state bodies, it is necessary to create an investment environment and minimize regulatory and political risks. In order to attract institutional investors in renewable energy, requirements for risks and creating reserves should be relaxed specifically for investments in renewable energy. In order to stimulate investments from such institutional investors as investment funds, the issue of special regulatory standards is necessary.

#### VII. POLITICAL BARRIERS

Political barriers are primarily associated with the lack of coordination of various state and intergovernmental institutions, and often the lack or weakness of government policies regarding

energy diversification [15]. To perfect such a policy, it is necessary to include in it both the areas of support for direct investments in renewable energy sources and the improvement of policies regarding the infrastructure supporting this development - transport, energy, and agriculture. Changes in public policy can have a negative effect, since various methods of support can be laid by investors when making investment decisions, and the instability of the political environment will impede investment. In addition, it is necessary to take into account the political influence of the traditional energy lobbyists, who also receive state support in certain areas, and will prevent changes related to diversification in favor of renewable energy [11,15]. To overcome political barriers, it is first of all necessary to improve state policy and ensure its stability in the long term. Political barriers have a significant impact on all stages of the implementation of renewable energy projects.

### VIII. TRANSFORMATION BARRIERS

Transformation barriers take place at the stage of transition between development and testing and launching projects into commercial operation, and are associated with the very nature of launching new technologies. Overcoming this barrier is possible by attracting new investors with the experience of launching projects for commercial implementation, such as venture capitalists. Open competition and the fullest possible information about commercial opportunities will help mobilize private funding at this stage. Creating an economic environment that is interested in developing "clean" technologies will help overcome the transformation barriers and increase investor interest and renewable energy projects.

### IX. CONCLUSION

Growth Financing RES projects are associated with overcoming technological, economic, political, financial and transformational barriers. This article examines the causes and specificity of barriers to attracting financing and developing projects in the field of renewable energy. To overcome them and attract investors, it is important to offer various forms of state and interstate support and to form sustainable market regulation rules. The renewable energy market is subject to greater uncertainty than traditional energy, and is experiencing additional impacts from outside, since further energy diversification in favor of renewable energy will be associated with the redistribution of financial and investment flows from traditional sources.

### ACKNOWLEDGMENT

This work was supported by the Scientific Grant Agency of the Ministry of Education of Slovak Republic and the Slovak Academy of Sciences by the projects VEGA No. 1/0372/18.

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