

# THE CAPITAL PROJECTS OF JSC "ESM" AS A FACTOR FOR THE DEVELOPMENT OF THE COMPANY

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## Abstract

Electricity is certainly the noblest form of energy that humanity has learned to create, control, and use. Its production represents an important economic activity, as well as the most important factor for the socio-economic development of a country, while production capacities, i.e., the largest production capacity, the company JSC "ESM", represents the most important segment of the power system.

Accordingly, the issue that has been elaborated on is very actual because it addresses the capital projects of JSC "ESM", which are of great economic and environmental importance. After all, investing in growing electricity production, especially from renewable energy sources, has a large impact on the economic development of the country as a whole, as well as on environmental protection.

In this context, the analysis in this paper is mainly focused and aims to address the importance and impact of the construction of the capital projects of JSC "ESM" in the development strategy and the creation of sustainable company competitiveness. Therefore, JSC "ESM" as a serious company, should strive and make a great contribution to the implementation of capital projects, due to the great impact, and to be the most important and leading factor in the liberalized market, especially in times of energy crisis in the country and beyond.

For this purpose, the data that are carefully selected and processed, form the basic thesis for the specificity, importance, and actuality of the capital projects for the development and competitiveness of the company.

*Keywords:* electricity, production capacity, capital projects, market liberalization, renewable energy sources, sustainable company competitiveness.

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## 1 Introduction

The electricity system in general, i.e., the electricity production sector with its production facilities in particular, is an important element for the development of the economy of each country. If continuously upgraded, it will not only attract large investments but will also enable more comfortable planning and improvement of its operation, development of the market, and competitiveness.

The analysis in this paper focuses and aims to address the importance and impact of the activities within the strategy for development and investments of JSC "ELEM", as well as company management, achieving better business performance, improving efficiency and effectiveness in operations and development, attaining a better position in the liberalized electricity market, creating sustainable company competitiveness, along with the economic development of the country as a whole. To achieve these goals and challenges, the research is based on data that are carefully selected, and processed and which form the basic thesis of the specificity, importance, and relevance of the capital projects of JSC "ESM", as the largest electricity production company in the country.

Hence, the paper comprises two parts. The first part analyzes the process of strategic management of electricity generation and human resources. In the second part, we will consider the capital projects of JSC "ESM", the financial resources and funding sources, to increase electricity production to meet the growing needs of consumers in the Republic of North Macedonia, in conditions of full liberalization of the electricity market and finally, the paper ends with a conclusion. All of these combined will enable us to join the modern and technologically advanced countries and at the same time, the country would be a step closer to integration into the European Union.

## 2 Strategic production management and human resources at JSC "ESM" in state ownership

The production in JSC "ESM", although mainly decreasing by years, still ranges within the planned production, which in the period 2015-2020 amounts to 25060 GWh and ranges from 3590 GWh in 2020 to 4742 GWh in 2015. This production has a share of 55% of the electricity consumption of 45453 GWh in the Republic of North Macedonia for the same period, which ranges from 6904 GWh in 2019 to 8159 GWh in 2015, i.e., from 47% in 2020 to 61% in 2019, while the production of 8488 GWh by other producers has a share of 19% and ranges from 752GWh in 2019 to 2492 GWh in 2020, i.e., from 11% to 33% in the respective years. Hence, the domestic production, i.e., the production of JSC "ESM" and the production by other producers of 33548 GWh participate with 74% of the electricity consumption. In this production, JSC "ESM" participates with 74.70%, while other producers with 25.30%. The remaining part of electricity of 11905 GWh, which is attributed to import, participates for 26% of the electricity consumption in the Republic of North Macedonia and ranges from 1538 GWh in 2020 to 2513 GWh in 2015, i.e., from 20% to 31 % in the respective years. (Table 1).

**Table 1:** JSC "ESM" production, import and electricity consumption in the Republic of North Macedonia in the period 2015-2020

Year	2015	2016	2017	2018	2019	2020-estimation	Total	Average
Planned by ESM [GWh]	5091	4383	3940	4072	4467	4472	26425	4404
Produced by ESM [GWh]	4742	4300	4080	4116	4232	3590	25060	4177
No. of employees - ESM	4772	4892	4796	4733	4691	4699	28583	4764
Employees /GWh	1.00	1.14	1.17	1.15	1.11	1.31	1.14	1.14
Produced by others [GWh]	904	1329	1520	1491	752	2492-est.	8488	1415
Imported electricity [GWh]	2513	2031	1983	1920	1920	1538-est.	11905	1984
Electricity consumption [GWh]	8159	7660	7583	7527	6904	7620-est.	45453	7576
Production ESM/consumption. [%]	58	56	54	55	61	47	55	55
Other producers/consumption [%]	11	17	20	20	11	33	19	19
Import/consumption [%]	31	27	26	25	28	20	26	26

Source: (JSC ESM, 2015-2020), (Government of RNM, 2015-2017) and (Government of RNM, 2018-2020), as well as from own calculations based on data obtained thereof

In JSC "ESM" as the largest electricity production company, a joint stock company 100% state-owned, the number of employees is fluctuating by year. Starting from 2016, the number decreased and in 2019 it is 4691, 201 employees or 4.11% less compared to 2016. Then the number in 2020 increased by 8 employees compared to 2019 and amounts to 4699 employees. In terms of production, the number of employees is fluctuating by year, and in the observed period, it ranges from 1.00 employees / GWh in 2015 to 1.31 employees / GWh in 2020 (Table 1). This indicates that during a drastic reduction in production, despite the reduction in the number of employees, employment still drastically increases, which leads to increased costs, thus to higher production price of electricity.

## 3 The strategy of JSC "ESM" for the fulfillment of capital projects

The essence of the company's strategy is balanced in order to use the characteristics of the internal and external environment to achieve the plans of its owners. J. Quin had a similar idea, defining strategy as a set of activities undertaken by an organization to respond to the opportunities and threats of the environment using its strengths or avoiding its weaknesses (Đuričin, Janošević, & Kaličanin, 2010).

The Development and Investment Strategy of JSC "ESM" is based on the reconstruction, revitalization, and modernization of the existing production facilities, and the highest priority is given to investment in the construction of new production facilities, especially for the growing electricity production from renewable energy sources. This will enable the Republic of North Macedonia, as a candidate country for EU membership, to provide a major contribution to meeting the objectives of the EU Internal Market.

The aim of the increase in the electricity production in the country is to meet the needs of the consumers, achieve a better position in the liberalized electricity market, improve competitiveness, as well as attract foreign and domestic investors, thus ensuring stable and sustainable development of the energy power capacities and protection of the environment. All this combined has a great impact on the reduction of the country's import dependence, and thus the trade deficit, creation of sustainable company competitiveness, economic development of the entire domestic economy, and the macroeconomic stability of the country in general.

In line with the afore mentioned, the new Government in May 2018 adopted a new Law on Energy. According to this Law, the largest electricity producer in the country is obliged to offer to the universal supplier at least 80% of the total annual needs of the supplier in 2019, reducing this percentage over the years, to 30% in 2025 (Assembly of the Republic of Macedonia, 2018). Despite this, as of 2019, even today, the Government ordered JSC "ESM" to provide 100% of the electricity required by the universal supplier to meet the needs of households and small consumers. The reason for this is to avoid price shocks and protect consumers with the price of JSC "ESM", which is set by the Government.

The afore mentioned should be used as an important indicator for the further productive and economically justified operation of the largest electricity producer in the Republic of North Macedonia - JSC "ESM", considering the company's competitiveness, especially in conditions of a liberalized electricity market.

Also, to provide long-term and stable electricity production, as well as, a stable energy power system, JSC "ESM" bases its strategy for the fulfilment of capital projects on investment activities that it plans to realize by providing financial resources from: its funds, from loans, public-private partnerships, etc. (Table 2).

Table 1 clearly shows that the electricity production by JCS "ESM" in 2020 had decreased by 25% in comparison to 2015. This is due to several reasons, but mainly due to the reduction of the quantities of coal in the mines, decrease of the calorific value of coal, the obsolescence of the energy power facilities that are more than 40 years old, etc.

As aforementioned, especially in times when the country is facing an energy crisis, JSC "ESM" for easier confrontation with the energy crisis and to reduce electricity imports, thus avoiding shocks to the price of electricity, was forced, and had to increase electricity production, as it was the only way to meet these challenges.

Moreover, the increased production of electricity should replace the current electricity production from thermal power plants which have an installed capacity of 800 MW and should be gradually phased out in the future.

The Republic of North Macedonia became a member of the Powering Past Coal Alliance (PPCA) during the London Climate Action Week. Together with Spain, our country has committed to abandoning electricity production from coal sources by 2030 (JSC ESM, 2021).

North Macedonia's decision to join the European countries that will abandon electricity production from coal sources by 2030 underlines the fact that the Paris Agreement on climate change has become the norm for European countries," said Mahi Sideridu, Managing Director of Europe Beyond Coal. He added

that the entry of North Macedonia into this group is particularly important, as it is the first country from the Western Balkans to commit to abandoning coal (Meta. MK, 2021)

To achieve the above JSC "ESM" prepared an ambitious plan of capital projects for the construction of new production facilities, especially from renewable energy sources (Table 2). These are vital and represent the most important factor for the company's development, both in terms of energy and in terms of meeting the strict European environmental criteria.

**Table 2: Capital projects of JSC "ESM"**

<b>CAPITAL PROJECTS</b>			
<b>PROJECT NAME</b>	<b>Power AC (MW)</b>	<b>Annual production (GWh)</b>	<b>Financing source</b>
1. Construction of a Photovoltaic Power Plant with installed capacity of 10MW in the area of MPC Oslomej-PVPP Oslomej 1	10	14.6	5.9 MEur EBRD. 2.871 MEur ESM.
2. Construction of a Photovoltaic Power Plant with installed capacity of 10MW in the area of MPC Oslomej-PVPP Oslomej 2	10	16	The loan from EBRD, PVPP Oslomej 2 and PVPP Bitola 1 through one Loan Agreement.
3. Construction of a Photovoltaic Power Plant with installed capacity of 2X40 MW (MAX. 2X50 MW) in the area of MPC Oslomej-PVPP Oslomej 3 with PPP	2X40 (max.2x50)	2x80	The project is planned to be realized with PPP.
4. Construction of a Photovoltaic Power Plant with installed capacity of 20 MW within the area of MPC Bitola-PVPP Bitola	20	32	The project is planned to be financed by the EBRD with a state guarantee, together with the project PVPP Oslomej 2.
5. Construction of a Photovoltaic Power Plant with installed capacity of 60MW within the area of MPC Bitola-PVPP Bitola 2	60	96	The capital investments are~35MEur loan from KfW is possible.
6. Construction of a Photovoltaic Power Plant with installed capacity of 100 MW in the area of REK Bitola-PVPP Bitola 3	100	160	Preparation of a feasibility study through a grant from KfW, the Government of RNM will decide whether the implementation of this project will continue and if it continues, with which financial model?
7. Construction of a Photovoltaic Power Plant with installed capacity of 100MW at the site Tikves-Vitachevo with PPP	100	173	The project is planned to be realized with PPP.
8. Construction of a Photovoltaic Power Plant on the site Leunovo 9MW	9	15	The investment value is estimated at around 8 Meur. The forthcoming feasibility study should examine all technical & environmental aspects.
9. Construction of a Photovoltaic Power Plant on the site Piskupshtina 1.5 MW	1.5	3.1	The investment value is estimated at around 1.2Meuros. For this project, tender documentation for preparation of a feasibility study is being prepared, which would show the future steps, including the financial model for this investment.
10. PVPP Bogdanci (16 MW)	16	29	For this project, a tender documentation for the preparation of a feasibility study is being prepared, which would show the future steps, including the financial model for this investment. The estimated value of the project is around 11M euros.
11. PVPP Brod-Gneotino (100 MW)	100	185	A feasibility study will be prepared for this project by IFC. Further implementation is planned to be with PPP.

12. Construction of a floating photovoltaic Power Plant with installed capacity of 76 MW in the area of Mavrovo accumulation-FPVPP Vrutok.	76	134,4	IFI / ESM/ SP
13. Construction of a floating photovoltaic Power Plant with installed capacity of 76 MW in the area of Kozjak accumulation-FPVPP Kozjak.	76	137,1	IFI / ESM/ SP
14. Construction of a floating photovoltaic Power Plant with installed capacity of 96 MW in the area of Debar accumulation-FPVPP Shpilje.	96	176,1	IFI / ESM/ SP
15. Construction of a floating photovoltaic Power Plant with installed capacity of 64 MW in the area of Tikvesh accumulation-FPVPP Tikvesh.	64	121,5	IFI / ESM/ SP
16. Gas Power Plant Bitola 250 MW (combined cycle)	250	1.275	250 MEUR
17. Wind Park Bogdanci-II Phase	13.8	50	21 MEUR
18. Wind Park Miravci 50 MW	50	127	Total investment of 75 Meur. Grant of 1.2 Meur from KfW for PVPP and SEA provided.
19. HPP CEBREN	458	1044	553 MEUR
20. Optimal energy utilization of the waters from HPP Raven to Kozjak storage	-	-	Several variants may be considered.
21. Vardar Valley	360	1075	
22. Modernization and upgrade of the complex Energetika	50	450 GWh-el 14 GWh-th	34 MEUR
23. Mining equipment and mechanization			19 Meur-auxiliary mechanization 22 Meur-procurement of cyclic mechanization TOTAL 41 MEUR
24. Nuclear Energy Program			

Source: (JSC ESM, 2022)

The total installed capacity of the planned capital projects by JSC "ESM" is 2018.8 MW, which is 508.6 MW more than the current total installed capacity of JSC "ESM", amounting to 1510.2 MW, that is, 79.19 MW less than the current total installed capacity of 2097.99 MW at state level. The current total installed power of JSC "ESM" will be reduced by 800 MW by the end of 2030, which is the capacity of the thermal power plants. Therefore, with the implementation of the planned capital projects, the total installed capacity of JSC "ESM" will amount to 2729.0 MW.

The total installed capacity of the planned capital projects is mostly attributed to RES, i.e., 1718.8 MW or 85%, while the remaining part of 300 MW or 15% is attributed to gas power plants (Bitola and Energetika), for the production of base energy.

The energy transition of the country is one of the priorities of the Government and JSC "ESM", and the Energy Strategic Plan is one of the points of Action 21 and the Intervention Plan on Investments 2021-2027, (Government of RNM, 2021) with a total value is 8 billion and 175 million euros. About 3.144 billion euros are planned for the energy sector, of which 85 million euros are planned investments in REK Oslomej. This amount was assigned in order for R. North Macedonia to implement the green scenario (MASA, 2020), as a candidate country for EU membership, by transforming the production of electricity from conventional thermal sources (coal, oil, etc.) with production from RES (water, sun, wind, etc.).

TPP Oslomej as part of JSC "ESM" is the first facility, which through this type of energy transformation, with this investment will realize and build the following energy power projects:

10 MW photovoltaic plant by the state's investment, worth 7 million Euro, which is a big and important challenge for TPP Oslomej, in the recultivated part of the Mine Oslomej, with an area of 15 ha, which construction is completed and has been officially operational since 6<sup>th</sup> April 2022.

In addition, another 10 MW photovoltaic plant will be constructed with support from the EU and the EIP from the Western Balkans Investment Fund. Now is the time for the projects for the production of electricity from RES, and in the future, only such projects will be stimulated, promoted, and supported through loans from relevant European institutions.

Another facility with 100 MW capacity will be constructed within TPP Oslomej i.e., two photovoltaic power plants of 50 MW each. The value of this investment will be 70 million Euro, and they will be constructed on the principle of public-private partnership, for which the agreements with companies from Turkey "FORTIS ENERJI" and Bulgaria "SOLAR PRO" have already been signed. Both investors of the 100 MW photovoltaic power plants are obliged to hire 1 employee per megawatt, i.e., 100 employees from TPP Oslomej. This investment ensures an 18% profit from one company, and 18.5% from the other company which has exceeded all expectations, thus confirming the Republic of North Macedonia as an excellent destination for investments in photovoltaic power plants (JSC ESM, 2021).

These projects will use the same infrastructure (location and transmission network) and staff (MASA, 2020).

The construction of these photovoltaic power plants in the mine of TPP Oslomej, during times of energy crisis, is of great economic, energy, social, and environmental importance, because the use of RES, especially the investment in increasing electricity production from RES, has a great impact on the economic development of the country, the sustainable development of the power energy system as a whole, the creation of new jobs, as well as the direct impact on the protection and preservation of the environment in general and the health of the citizens in particular.

The construction of the capital projects continues with the construction of the photovoltaic power plants in the mine of TPP Bitola, as well as the 250 MW gas power plant in TPP Bitola, and then with the construction of the other projects foreseen in Table 2.

The construction of the HPP Cebren is of great interest and importance, for which the Government published a public call (Government of RNM, 2020) for construction through a public-private partnership, and is an investment between 500 and 800 million euros (Government of RNM, 2021).

The second phase of the tender procedure for selection of the most favorable bidder for the construction of HPP Cebren continues, with the participation of some of the largest energy companies from Europe and the world, i.e., 9 companies, of which 2 Chinese, 2 Turkish and 5 European giant companies. It is expected to sign a concession agreement with the private investor for the construction of HPP Cebren by the end of 2022 (Government of RNM, 2022).

JSC TPP Negotino will be part of JSC "ESM" and will be transformed and adapted to operate using natural gas as soon as possible (Government of RNM, 2022).

## **Conclusions**

This paper is of great importance because it covers the production, human resources, and their strategic management, as well as the strategy for implementation of capital projects, to achieve greater success, improvement, and growth of the performance of JSC "ESM".

The increase of production by JSC "ESM", in a time of globalization is also an imperative for the modern economy. It has a great impact on the reduction of imports, as well as the reduction of the employment

coefficient per GWh, and all this together affect the achievement of sustainable competitive advantage for the company.

Imports, on the other hand, are directly dependent on the total domestic production of electricity (production of electricity by JSC "ESM" and other producers), as well as on the consumption of electricity. The same is observed in 2015, where we have a smaller share of the total domestic production of electricity in the consumption of electricity, i.e., 69%, and a higher share of imports, i.e., 31%, compared to 2020, where we have a larger share of the total domestic production of electricity in electricity consumption i.e., 80%, and lower imports i.e., 20%. This indicates the impact of increased production in reducing imports regarding consumption and vice versa.

In relation to the employment coefficient per GWh, it is observed that in 2015 it was lower, i.e., 1.00, due to higher production, i.e., 4742 GWh, compared to 2020, when this coefficient was higher, i.e., 1.31, due to lower production, i.e., 3590 GWh. despite the reduction of employees from 4772 in 2015 to 4699 in 2020.

Additionally, increasing production, especially from renewable energy sources, has a direct impact on the protection of the environment. Therefore, JSC "ESM" contributes greatly to the achievement and fulfillment of the EU Internal Market objectives by the Republic of North Macedonia. Furthermore, the total installed capacity of the planned capital projects to produce electricity from RES is 1718.8 MW, or 85%, of the total installed capacity amounting to 2018.8 MW, while the total installed capacity of the thermal power plants should be phased out by the end of 2030 is 800 MW. Finally, with the implementation of the planned capital projects, the total installed capacity of JSC "ESM" will amount to 2729.0 MW, which also represents the development of the company from an energy and environmental aspect.

Additionally, the Republic of North Macedonia became a member of the PPCA during the London Climate Action Week, together with Spain, committed to abandoning the production of electricity from coal sources by 2030. This is particularly significant because the Republic of North Macedonia is the first country from the Western Balkans to commit to abandoning coal and join the PPCA, which according to the latest data has 132 members, 18 of which are European and 5 non-European governments.

The capital projects should be implemented at an accelerated pace to increase production and replace the production from thermal power plants, thus increasing domestic production, and meeting the growing needs of consumers, especially in times of energy crisis, when the electricity prices in the stock exchanges are extremely high. All the above, together with the productive and economically justified employment and operation of JSC "ESM", will ensure long-term and stable electricity production. This will enable a better position in the liberalized electricity market, macroeconomic stability of the country, and at the same time, approximation to the European Union.

## **Nomenclature**

AC-Alternating current

EBRD-European Bank for Reconstruction and Development

FPVPP-Floating Photovoltaic Power Plant

GWh-Giga Watt Hour

HPP-Hydro Power Plant

IFC-International Finance Corporation

JSC ELEM-Join Stock Company Power Plants of Macedonia

JSC ESM-Join Stock Company Power Plants of North Macedonia

MASA- Macedonian Academy of Sciences and Arts

MPC-Mining Power Combine

MW-Mega Watt

PPCA-Powering Past Coal Alliance  
PPP- Public-Private Partnership  
PVPP-Photovoltaic Power Plant  
RES-Renewable Energy Sources  
RNM- Republic of North Macedonia  
TPP-Thermal Power Plant

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