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ARTIFICIAL INTELLIGENCE (AI) IN ENHANCING ENERGY EFFICIENCY IN THE GREEN ECONOMY

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Abstract: By choosing this topic, one of the most important measures is achieving how to enhance energy efficiency in the green economy using artificial intelligence through concrete application in the energy sector. The aim of the research is to make an overview of why a dual transition - digital and green - is necessary in order to improve energy efficiency. As a contribution to the selected goal of the work, we will use, for example, Siemens research on how artificial intelligence and digitalization drive clean energy. As an aid in order to better research, we will use effectively and examples from some EU economies - Spain. Specifically, the experience of closing

coal power plants, the expansion of wind farms and solar farms, as well as ambitious plans for hydrogen and energy storage, are part of the new energy picture of the country we have presented. These are essentially sets of specific questions related to the topic being addressed, and the answers obtained will be the result of this work.

Keywords: *artificial intelligence, energy efficiency, green economy, transition, clean energy.*

INTRODUCTION

Expert forecasts indicate that the contribution of artificial intelligence to the global economy in the next 5 years will bring more than 22 billion dollars[9]. This situation of artificial intelligence use requires new and reliable infrastructure and adequate solutions. Specifically, the green transition and economy will change education, healthcare, finance, production, and virtually all industries with the contribution of artificial intelligence [1]. Before us is a dual transition - digital and green. This transition includes technological innovations, various forms of partnerships, and the building of an intelligent ecosystem [10]. In order to achieve the pinnacle of artificial intelligence's impact on energy efficiency in green economies, it will require a combination of cooperation at the local level according to government guidelines, investment in talent, and solutions that will allow the smallest possible gap between innovation and concrete application [2]. The methodology we applied in the work forced us to use knowledge from the Siemens report on how artificial intelligence and digitalization drive the next phase to clean energy. Our research achievements go one step further through a concrete example of the ENEL PS company, which is a leader in the field of uninterrupted power supply, where we monitor news from this company to support the title of our work, for example, 5 current questions about battery storage, EMS - the brain of the new generation microgrid and UPS system - the key to continuity of operations and protection of critical infrastructure. Further in the work, we will use measurements of the contribution to energy transition through artificial intelligence. All of this led us to justify the title of the work through answers to questions about what green artificial intelligence is, energy efficiency means sustainability and techniques for it, what infrastructure follows renewable energy sources which has been confirmed by case studies from individual countries such as Spain, and which best practice steps in this field to apply through startup companies and green transitions in Serbia.

ENERGY TRANSITION – ENERGY EFFICIENCY, EXPERIENCE OF SPAIN, CHINA AND INDIA

As an experience we can very effectively use and adapt to our conditions Spain, which is a European leader in the production of energy from renewable sources, thanks to the development of wind turbines and solar energy over the previous 20 years[4]. Wind is an inexhaustible source of green energy, and Spain as a leader with the largest wind capacity for wind energy. Solar energy, which this economy promotes, experienced growth as solar panel prices fell. In this regard, Spain two years ago, in 2023, renewable energy sources accounted for more than 50% of total electrical energy, where solar panels and wind played a dominant role. In our conditions this can be used as very effective experience. Thus, according to the long-term economic scenario of 5 projects for the year 2050, we are moving towards 56% of total global electricity production being generated with the help of solar power plants and wind turbines [3]. As an exclusive example following the Renewables 2025 report, the main annual report by the IEA on the sector, predicts that global renewable energy capacity will grow by 4,600 GW - which is approximately equal to if they had together added the capacity of electricity generation of China, the European Union, and Japan. India is on the path to become the second largest market for renewable energy growth in the world, after China, it is expected that it will easily achieve its ambitious goal by 2030. China has been by far the largest supplier of solar panels, with a share of 98 percent of total imports. By 2030, China aims for AI application - artificial intelligence in energy to reach the leading world level, with more advanced mechanisms for coordination of computing power and electricity supply [6]. In China, optimization of artificial intelligence use is underway, including the electricity grid, renewable sources, and nuclear energy. The key element that we particularly highlight and can use as experience in our country, China believes that additional efforts should be made to ensure financial support and promote education of skilled personnel who have qualifications in the energy system and the application of artificial intelligence. Although the share remained the same as in 2023, the total value of this import fell from 19.0 billion euros to 10.9 billion euros in 2024. When it comes to biofuels, China was also the leading supplier, but with a smaller share of 24 percent of total imports, compared to 36 percent in 2023. Major partners in the import of liquid biofuels were also Malaysia (15 percent), United Kingdom (13 percent), and Brazil (12 percent). According to forecasts, solar panels will account for about 80 percent of global renewable energy capacity increase in the next five years [7]. As for exports in 2024, the EU exported solar panels valued at 0.7 billion euros, liquid biofuels valued at 1.8 billion euros, and wind turbines valued at 2.8 billion euros. Unlike solar panels and liquid biofuels, wind turbine exports significantly exceeded the value of imports. Solar panel exports decreased by 22 percent in value but increased by 24 percent in weight. Liquid biofuel exports declined in both value and weight. Our proposal is that we must follow these trends. If we compare our position in relation to this EU economy leader in terms of

energy efficiency for Serbia compared to Montenegro, 2025 is expected to see a significant increase in renewable energy capacity, primarily through solar and wind power plants, as well as an increase in the number of customers-producers. As an experience of our neighboring economy of Montenegro, it will have close to 700 MW of renewable energy. From the table, it is clearly seen that Serbia leads in relation to the former EX Yugoslavia economy - BiH and Macedonia.

Table 1. Capacity of Solar and Wind Power Plants in Serbia and Montenegro 2025

Country	Capacity of Solar and Wind Power Plants
Serbia	908 MW
Montenegro	187 MW
Bosnia and Herzegovina - Vedro Polje	20 MW
North Macedonia - Oslomej	80 MW

ENHANCING ENERGY EFFICIENCY IN THE GREEN ECONOMY - SIEMENS EXAMPLE

From many research and results so far, we can conclude that digital technology has a concrete contribution to increasing global economic growth. With the green economy, digital transition becomes a priority in the coming time period [12]. If we look at the application of artificial intelligence in Serbia, jobs that will be exposed to impact include somewhat less than 400,000, which is about 17% of the total number of registered employees in our country in 2023 [11]. Increasing demand for electricity and decarbonization in the world are growing, electricity systems are becoming increasingly complex, which in the entire energy sector has led to increasing application of technologies of industry and artificial intelligence [8]. Siemens conducted an exclusive survey in which 1,400 senior executives participated, based on which we conclude that the foundation of everything should be large investments in autonomous systems from the grid, and more than half of respondents believe the main contribution to reducing emissions. This implies gradual phasing out of energy from fossil fuels, while at the same time storage of energy on a large scale through the production of renewable energy sources must be pursued. The main emphasis derived from the survey is that in the German power grid there is outdated network infrastructure, which represents the main threat to the transition to clean energy. Digital technology will only and exclusively contribute to increasing grid capacity, which will ensure reliability, resilience, and clean energy. According to them and the results of the survey, electrification is key to decarbonization, but grid upgrades are necessary to manage growing consumer demand. According to them from the survey, outdated regulations and market design hamper progress. Strategic cooperation - especially between government and business - is gaining importance, as seen in India's introduction of

smart grids, showing how technology and partnerships can drive national transformation [13]. All of this is in favor of our experience, which steps we must take through the effect of following this example. The reality on the ground in our country reflects the age of our energy grid, especially its transmission part, and we can use this as healthy experience from the Siemens survey in favor of clean energy in Serbia. Based on experience from the survey as the main threat to energy efficiency, we have cyber security, so most organizations feel ready to accept digitalization, while only one-third of respondents avoid digital tools due to cyber security concerns. We can likewise use this as experience in Serbia's conditions and increasing its energy efficiency towards the development of a green economy.

Table 2. Digitalization and Organizational Change in Favor of Energy Efficiency

Digitalization - Key Enabler of Energy Transition	Organizational Change in Companies Towards Energy Resource Benefits to Profit
63%	59%

ENEL PS COMPANY AS A PRACTICAL EXAMPLE OF ELECTRICAL POWER SUPPLY

When excess wind occurs, large continuous consumers - the network of wind farms from previous experience can respond faster than most classical power plants (thermal power plants and hydroelectric power plants). We have from this company's experience how BESS systems help companies optimize the consumption of clean electrical energy and income from it. This BESS system can be useful and applicable as a sample to increase energy efficiency in our conditions as well, and from an economic perspective it includes: A. Sale of services to the grid. When the grid needs a fast source of power - the Data Center has it, and the operator pays for it. The EU already expects this from Data Centers. We as EPS are moving in that direction so that in this way EPS will have the highest level of protection of critical information structure, software that is of vital importance for the company's operations, which for citizens and the economy means additional security of services that EPS provides to its customers. This practice must be applied in our country, as well as throughout the energy sector, and thus in all sectors that are part of the critical infrastructure of the Republic of Serbia [13]. EPS has already signed contracts with the State Data Center in this regard. B. Safety of power supply. It is not income, but it is a very applicable benefit - if BESS prevents one serious delay in production or operation of data centers, it has practically paid for itself. We particularly emphasize this because of how much this means the effective application of the data center to increase energy efficiency towards green transition. How significant is the importance of this BESS system, we have data that Europe is rapidly expanding the use of battery systems - an increase in installations of over 30% per year until 2030 is expected - because without them the grid can no longer absorb the increasing quantities of solar and wind energy. Our country Serbia

is on the same path: as the number of RES projects grows, BESS becomes a necessary part of every new facility and transformer station, as it stabilizes the grid and allows further development of renewable sources without costly reconstructions [14]. In order to acquaint ourselves with Serbia's strength in terms of creating electrical energy as a contribution to green transition to improve energy efficiency, we have exclusive data as presented in the table.

Table 3. Total Number of Wind Farms and Rooftop Solar Systems in 2025 in Serbia

Type of System	Number of Systems	Capacity
Wind Farms (2025)	Approximately 11 wind farms	Approximately 600 - 680 MW
Rooftop Solar Systems	More than 5,000 rooftop solar systems	Approximately 250 - 300 MW

CONCLUSION

From this time distance we tried in an effective way to propose how artificial intelligence can contribute to improving energy efficiency in the green economy. The application of technologies based on artificial intelligence could increase the global GDP by an additional 15% by 2035. This research was conducted by PwC. Based on the set questions and research, we come to the conclusion that artificial intelligence is the driver of modern energy transition and as such occupies a high place in the development of the green economy, which we have confirmed. We have also proven through the example of Serbia in the work that the application of artificial intelligence in the energy sector is in the phase of accelerated growth. Our concrete proposal is that in some new research we engage in promoting the use of smart meters and advanced distribution grid management systems. We need to focus on digitalization of the electricity system as well as on energy sources - especially wind farms and solar power plants where artificial intelligence can prov maximum results. As a significant feature in this research that is behind us, we noticed that EPS introduced machine learning technologies in the process of forecasting demand for electrical energy in order to reduce losses in production and distribution. The key significance of all findings is reflected in the fact that artificial intelligence simultaneously enables improvement of economic efficiency and environmental sustainability of energy systems, which is the essence of the green economy in favor of our economy's approach towards the European Union. This implies further work on this topic through the analysis of existing and future projects in order to accelerate through our proposal the path of the Serbian energy system to energy efficiency and an ecologically sustainable future.

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