

ANALYSIS OF THE ACTIVITY OF COMPANIES IN THE SPHERE OF ENERGY SAVING IN THE COUNTRIES OF THE EUROPEAN UNION

АНАЛІЗ ДІЯЛЬНОСТІ КОМПАНІЙ В СФЕРІ ЕНЕРГОЗБЕРЕЖЕННЯ У КРАЇНАХ ЄВРОПЕЙСЬКОГО СОЮЗУ

It has been proven that namely the innovations in the energy sphere are prioritized for sustainable development at all levels of economy. It is defined that the European Union spearheads the formation and implementation of innovative strategies of sustainable development, particularly with regard to environmental responsibility. Environmental responsibility of companies and countries is targeted at sustainable management of natural resources, development of the system of safe technologies within energy sector, increased use of renewable energy sources and the clean energy, provisions for nuclear and energy security. To ensure these strategic objectives the EU maintains a continuous improvement related to the regulatory policy in the sphere of energy sphere competitiveness, specifically in the sphere of sustainable sources of energy. It is asserted that energy sector is pivotal to economic stability and growth of the EU states. The work analyzes the objectives of sustainable energy development in the EU countries in respect of energy efficiency and use of endogenous energy sources. The paper studies patenting activity in clean energy technologies targeted at intensifying the innovative restructuring of economy and providing fixed annual incomes for companies in the long term. From the analysis of consumption by sectors of the EU economy, it is revealed that the largest energy consumers are sectors of heating and cooling in buildings and industry. Hence, there emerges an acute problem of decarbonization in the industrial sector and achievement of the stated objective by 2050, which would greatly rely on combination of energy efficiency, electrification of heat energy, carbon capture and storage or utilization. Analysis of the dynamics of structure in the production of energy by the EU countries showed an increasing share of renewable energy sources in the overall structure. The paper examines the sources of financing for energy saving and energy efficiency projects for implementation of innovations and development programs which creates new capacities for transformation of energy sector.

Key words: energy saving, energy efficiency, energy sector, company strategy, renewable energy sources.

Вияснено, що саме інновації в сфері енергетики являються пріоритетними в цілях устійливого розвитку на всіх рівнях економіки. Определено, що Європейський Союз виступає ініціатором формування та впровадження інноваційних стратегій сталого розвитку, особливо екологічної відповідальності компаній та країн направлена на сталі управління природними ресурсами, розвиток системи безпечних технологій у енергетичному секторі, збільшення використання відновлюваних джерел енергії та чистої енергії, забезпечення ядерної та енергетичної безпеки. З метою забезпечення цих стратегічних завдань в Європейському Союз постійно здійснюються удосконалення регуляторної політики у сфері конкурентоспроможності енергетики, особливо у сфері використання альтернативних джерел енергії. Доведено, що енергетичний сектор є запорукою економічної стабільності та зростання країн Європейського Союзу. Проаналізовано цілі розвитку альтернативної енергетики в країнах Європейського Союзу, що спрямовані на енергоефективність та використання ендогенних джерел енергії. Проаналізовано активність патентування в чистих енергетичних технологіях з метою інтенсифікації інноваційної перестройки економіки та забезпечення постійних річних доходів в довгостроковій перспективі у компаніях.

Ключевые слова: энергосбережение, энергетическая эффективность, энергетический сектор, стратегия компании, возобновляемые источники энергии.

UDC 330.341:338.45

<https://doi.org/10.32843/infrastruct38-70>

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З'ясовано, що саме інновації у сфері енергетики є пріоритетними з метою сталого розвитку на всіх рівнях економіки. Визначено, що Європейський Союз виступає ініціатором формування та впровадження інноваційних стратегій сталого розвитку, особливо екологічної відповідальності. Екологічна відповідальність компаній та країн направлена на сталі управління природними ресурсами, розвиток системи безпечних технологій у енергетичному секторі, збільшення використання відновлюваних джерел енергії та чистої енергії, забезпечення ядерної та енергетичної безпеки. З метою забезпечення цих стратегічних завдань в Європейському Союз постійно здійснюються удосконалення регуляторної політики у сфері конкурентоспроможності енергетики, особливо у сфері використання альтернативних джерел енергії. Доведено, що енергетичний сектор є запорукою економічної стабільності та зростання країн Європейського Союзу. Проаналізовано цілі розвитку альтернативної енергетики в країнах Європейського Союзу, що спрямовані на енергоефективність та використання ендогенних джерел енергії. Проаналізовано активність патентування в чистих енергетичних технологіях з метою інтенсифікації інноваційної перестройки економіки та забезпечення постійних річних доходів в довгостроковій перспективі у компаніях.

Ключові слова: енергозбереження, енергоефективність, енергетичний сектор, стратегія компанії, відновлювальні джерела енергії.

Introduction. Energy is an everyday use product. Energy industry, in its turn, is an indispensable constituent of competitive capacity of countries across the globe. Energy sector is in constant development with novel technologies and opportunities being created; therefore this sector is not feasible without continuous innovations implemented within its scope.

Presently, innovation-driven productivity is a crucial factor in determining the competitive capacity and national progress.

Over recent years, Europe and the rest of the world faced an entire range of problems: achievement of balance between ecology and environmental protection, political and business interests, as well as

meeting the demand for energy in particular economies of the world [6; 7; 8]. Limited energy resources lead to increased efforts with regard to searching for sources of renewable energy. Therefore, the appeal of employing renewable energy sources is directly related to their inexhaustible supply.

Renewable energy sources may play an active role in energy needs of buildings. Further importance lies in the fact that renewable energy sources are significantly safer for environment. Another determining factor is that some of the countries provide additional incentives to investors and award grants to support projects pertaining to energy generation from renewable energy sources [3].

Hence, in the contemporary world the renewable energy sources are a sector of energy generation that demonstrates the highest rate of growth around the world and Europe in particular. Sweden, Austria, Finland, Germany, Portugal, Spain are the most intensively developed markets of sustainable energy in Europe.

Analysis of recent research and publications.

Presently there exists a multitude of research efforts in the energy sphere and developmental peculiarities of companies in the sphere of energy efficiency. As an instance, we may refer to such scholars, as Bluszcz A. [1], Boersma T., Goldthau A. [4], Matschoss K., Repo P. [9], Nasiritousi N. [10], among others. Despite this, a number of issues remain beyond the scrutiny of scientific community. Specifically, the necessity for development of renewable energy sources within the context of energy saving at the micro-level of economy.

Formulation of objectives of the article. The objective of the article is the systemic study, critical evaluation of theoretical foundations and current practices related to the development of companies in the sphere of energy saving in the countries of the European Union.

Results. Development of renewable energy in the EU has been advanced with the aim to reach 20% share in total final energy consumption by 2020 and at least 27% by 2030 [4]. It should be noted that such strategy targets at the EU achieving «global leadership in renewable energy» (European Commission, 2015). Promoting this target in Europe has led

to impressive growth of generating capacities from renewable energy sources. Only China manages to generate more electrical energy from renewable sources than the EU.

However, the European Union aims at establishing itself as a leader in the renewable energy generation and combating climate change through the implementation of projects and signing of the corresponding agreements.

With consideration for it, back in 2014 the European Union ratified the Paris Agreement with its central goal to limit a global temperature rise in this century. In practice, this would lead to the reduction in global carbon emissions from the use of energy to zero by 2060 and preserving such level until the end of this century.

Further to it, in November 2016 the European Commission adopted a package titled «Clean energy for all Europeans». The package proposes a comprehensive legislative framework to support the deployment of renewable energy production. These studies are conducted in tight cooperation with the Commission which constitutes a part of the project REmap – IRENA's renewable energy roadmap. REmap is the methodology by IRENA which relies upon a thorough analysis of what is technically feasible and economically viable for the future of European energy sector [12].

In the process of developing the mechanism to support technologies relevant to sustainable energy sources the heads of public sector research foundations seek to realize effective management of innovations. Such support may acquire a variety of forms, more specifically grants, investment support or direct market support through public and private company funding.

Currently Europe has a count of approximately 50 projects, both planned and already completed, concerned with full transition to renewable energy. Notably, member states set their own objectives that address the development of renewable energy (Table 1).

Therefore, the EU is making solid progress on its way to the established objectives that are supported by its member states. Objectives of the European Union, focused upon energy efficiency and use of endogenous energy sources, furthermore find their reflection in programmes and legislation of the European Union member states. Moreover, the EU harmonizes

Table 1

Objectives of alternative energy development in specified EU countries

Country	Objective	Year of projected fulfillment
Denmark	100% of produced heat energy	2035
	100% of produced electrical energy	2050
Germany	complete decarbonization of Frankfurt am Main	2050
France	40% of produced electrical energy from renewable sources	2030
Great Britain	20% share of renewable energy in total produced energy	2020
Scotland	generation of 100% of total annual consumption of electric energy	2020
Sweden	100% of produced electrical energy from renewable sources	2020

Source: developed by author on the basis of [12]

the policies of the European countries implementing programmes intended to effectuate the transition to renewable sources of energy and increase the competitive capacity of national economies.

It must be further mentioned that the European Investment Bank provides support to the development and expansion of all renewable energy projects with the purpose of rendering Europe's energy supply more sustained, steady, competitive and safe. By investing into renewable energy, the EIB supports the European Union's climate policy [5].

Consequently, to achieve the reduction of emissions and the eventual transition to renewable energy one of the most economically efficient means proves to be a shared use of technologies and investments into research and development of renewable energy strategies, realization of existing projects and implementation of the new ones. Environmentally sustainable economic growth is a primary goal of all economies. Hence, transition to renewable energy sources remains one of the pivotal issues not only with the EU policy but also with policies of countries all around the world.

Presently the European Commission proposes projects for development of renewable sources of energy for countries of the European Union. These projects commonly incorporate overhaul and expansion of the existing public and urban infrastructure and services.

Thus, the issue of energy lies in the very core of the long-term energy strategy of Europe as it directly contributes to the reduction of greenhouse gas emissions and decreases the importation of energy in Europe allowing it for more independence. This rapidly evolving sector of economy promotes the European technological leadership providing EU countries and their regions with new «green» workplaces, possibility to export energy with high added value and enhance the competitiveness in manufacturing goods and rendering services.

The European Union is following the «green track». Europe is shifting from the energy generation system based on fossil fuels towards a low-carbon, entirely digital and customer-oriented one.

Currently the EU is in dependence on the energy import, specifically of oil and, lately, gas. Hence, there exists a pressing need for innovations in the energy sector in a way that would ensure the transformation of the energy system, establishment of the EU's energy sustainability, competitiveness and security.

Clean energy production gives not just a mere possibility to develop renewable energy sources but ensures an opportunity to have a global environmentally clean production in order to reduce greenhouse gas emissions and to stimulate the economic advancement.

For instance, the patenting activity in the domain of clean energy technologies in on the rise in Europe (Figure 1). European companies are also increasingly seeking protection for their inventions. It is worth noting that the EU occupies second position after Japan by the number of international patents regarding energy technologies.

The majority of patents for clean energy innovations originate from the private sector. On the average, these are represented by energy projects with the payback period of 2-8 years which generates sustainable annual revenues in the long term. In this way energy innovations serve as the factors of intensification of innovative restructuring of economy.

Climate change poses a real problem that needs to be resolved straight away. According to the assessments by international climate experts a global temperature rise must not exceed 2°C in order to avoid the most hazardous of consequences brought about by climate change. Further to it, the study conducted by Eurelectric indicates that a complete decarbonization of the EU by 2050 would require a 63% rate

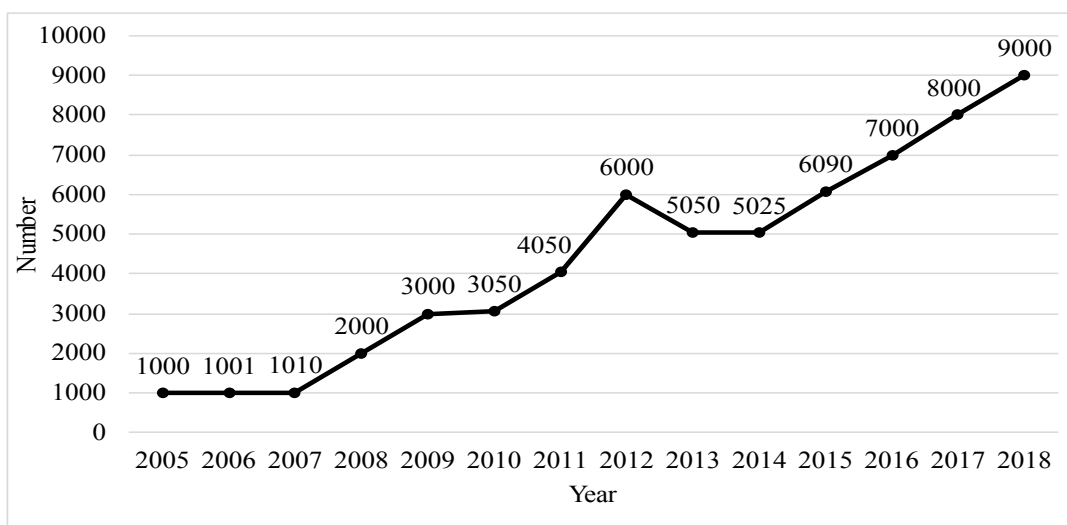


Figure 1. Dynamics of the number of EU patents for clean energy technologies

Source: developed on the basis of [12]

of electrification in transport and building with 50% rate of electrification within industrial processes. In 2015 a direct electrification in the EU fluctuated within 18-32% with the largest share represented by groups which consist of Nordic and Baltic countries [14].

The largest energy consumers in Europe are the sector of heating and cooling in buildings and industry constituting an approximate 50% of the final energy consumption [4]. Despite the fact that the sector is shifting towards low-carbon energy nearly two-thirds of the energy consumption still comes from direct combustion of fossil fuels (natural gas, oil, coal) (Figure 2).

Analysis of consumption by the sectors of economy demonstrates that the highest value of final energy use is observed in the gas sector – 42%, significantly higher than with any other sector of consumption: final electrical energy consumption amounts to 13%, heat supply consumption for heating and cooling amounts to 9%, coal consumption – 8%, while final consumption of biomass and oil for heating and cooling in buildings and industry comprise 11% each. It must be taken into consideration that the largest district heat supply systems are deployed in Poland (56,5 GW) and Germany (49,7 GW) [12].

Any policy aimed at decarbonization of heating in buildings and industrial heating for production facilities will have important impact upon the demand for natural gas in the future. Reduction in carbon emissions within industrial sector and achievement of stated objectives by 2050 would depend substantially on the combination of energy efficiency, electrification of heat energy, carbon capture and storage or utilization (CCU/CCS).

The EU has moreover emphasized the importance of solar photovoltaic plants to provide for 100% of energy demands of the EU from renewable sources and ensure the decarbonization of the energy sector.

Solar photovoltaic capacities are predominantly installed on rooftops and facades of buildings. Rooftop installations have higher capital costs however the generated energy can be fully or partially consumed on the site. This also yields better correspondence between the supply and the demand and ensures gradual electrification of heating in the EU.

Presently, the European market of photovoltaic systems is in rapid development. According to evaluation by EuPDRresearch, the market grew beyond 10 GW in 2018. When compared to global indicators Europe ranks second by the number photovoltaic systems installed (28%) behind only Asia Pacific (50%) [14].

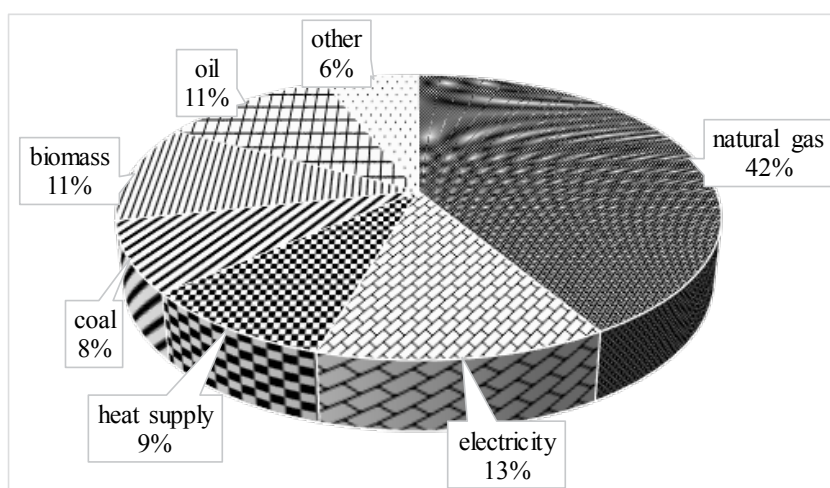


Figure 2. Final energy consumption for heating and cooling by fuel sources in EU, 2015

Source: developed on the basis of [14]

Consequently, the largest share belongs to the Netherlands – 20,4%, the second being Germany – 13,5%. The share of deployed domestic photovoltaic systems in Italy constitutes 6%, Great Britain and France – 3% each (Figure 3).

Consequently, the transition to clean energy with a simultaneous increase in the use of renewable sources of energy and electrification of the energy system is the primary goal of the European Union in the energy sphere.

European regions play a prominent role in the development of innovative technologies, creation of new value chains and opening up the markets for sustainable energy-saving solutions. Currently, the EU aspires for finding cutting-edge solutions to the issues that might arise in the upcoming future. The EU actively promotes innovations and sustainable technological developments through participation in research projects, testing new technologies or by means of creating pilot projects. Thuswise, the EU shapes the future in the energy policy of the European Union member states.

The European Union is engaged in the development of innovative technologies aimed at reducing energy consumption, depletion of primary limited resources and fuels such as coal, crude oil and natural gas. It must be noted that the EU provides the conversion of electrical energy into heat energy and inversely further implementing innovations and development programmes, deploying new capacities for transformation of the energy sector.

Europe confidently promotes a common energy policy based on competitive, sustainable and safe components. It is why namely the leading countries of the EU play a considerable part in the development of the energy sector. The European Union helps its member states fund their plans, targeted at energy efficiency, by means of its own budget and through

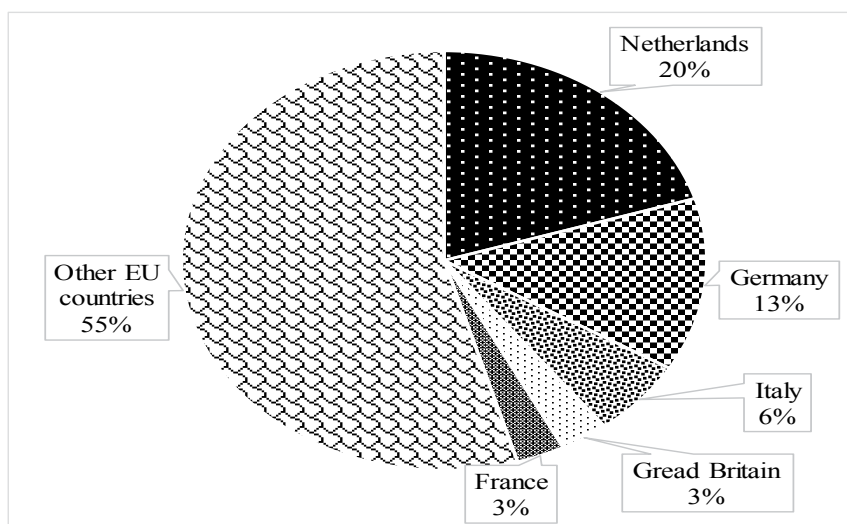


Figure 3. Share of deployed domestic photovoltaic systems by EU countries, 2018

Source: developed on the basis of [14]

EU financial institutions. A substantial funding within was made available on the part of the European Union with the purpose of increasing the energy efficiency among its population for 2014-2020.

The share of energy obtained from renewable sources in the structure of the total consumption of electrical energy in the countries of the European Union in 2016 constituted 17%. Among EU member states Sweden holds a leadership in the use of electrical energy from renewable sources – 53,8%. Among the countries with the highest rate of electrical energy consumption from renewable sources are Austria – 33,5% and Denmark – 32,2% [12] (Figure 4).

Overall, the EU stays on the right track with the share of renewable energy sources being on the rise year after year. It was already back in 2016 that 11 member states managed to reach the level nec-

essary to ensure the achievement of their national goals by 2020. Among them Sweden, Denmark and Italy fulfilled and exceeded their national goals. Austria has approximately 1% left from its goal by 2020. However, Germany and France are clearly not meeting their set objectives.

It is worth noting that in 2017 electrical generation from wind, solar and biomass energy comprised 20, 9% of total generated electrical energy in the EU (Figure 5).

In comparison to the indicator of 2010 the growth rate was 1,7 percentage points per year. This, in its turn, led to the situation when the generation of electricity from solar, wind and biomass energy outdid the generation capacities of

energy from lignite and black coal.

This indicates an extremely high rate of progress taking into consideration that only five years ago the energy generation from black coal was more than twice more extensive than the energy generated from hydropower, wind power and biofuels [13].

Conclusions. It has been elucidated that in 2017 the renewable energy sources constituted 30% of all the electrical energy of the European Union, 0, 2% higher in comparison to 2016. This was due to the fact that the growth of wind energy was offset by the lowest level of electrical energy generation at hydropower stations in the past 10 years.

Hence, energy sector is pivotal to the economic stability and growth of the countries of the European Union. The new Energy Sector Strategy (ESS) promotes secure, affordable, and sustainable energy

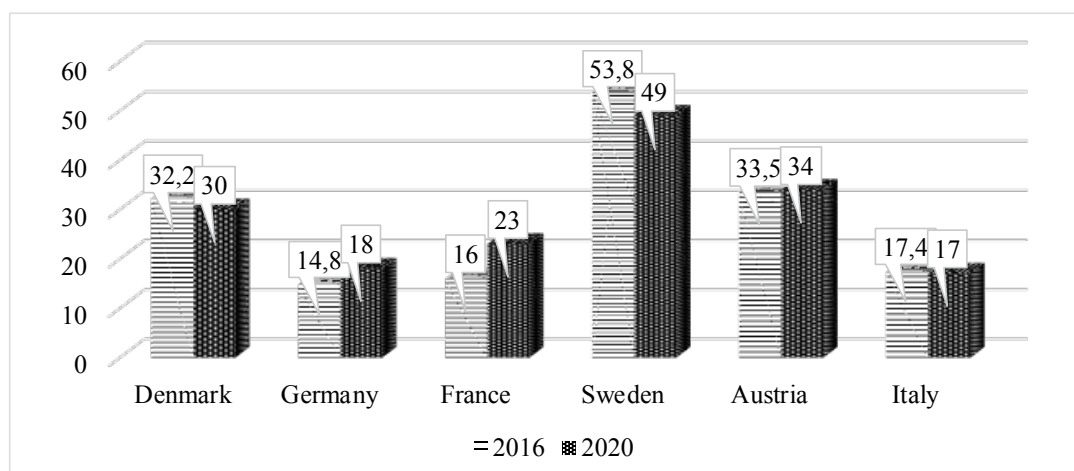


Figure 4. Share of energy from renewable sources in leading EU countries in 2016 and target values by 2020 (% from total final energy consumption)

Source: developed on the basis of [12]

through the transition to a market-oriented energy sector. Primary role in this lies in scaling-up the renewable energy sources.

For the purpose of developing energy efficient technologies it is expedient to conduct research related to development and optimization of complex systems of power supply to facilities, priority setting for improvements and upgrades to energy saving and environmentally safe technologies, for instance by formulating the procedure of consumer support for implementation of the complex system of energy supply and climatization which incorporates energy-active fencing and draws energy from renewable sources.

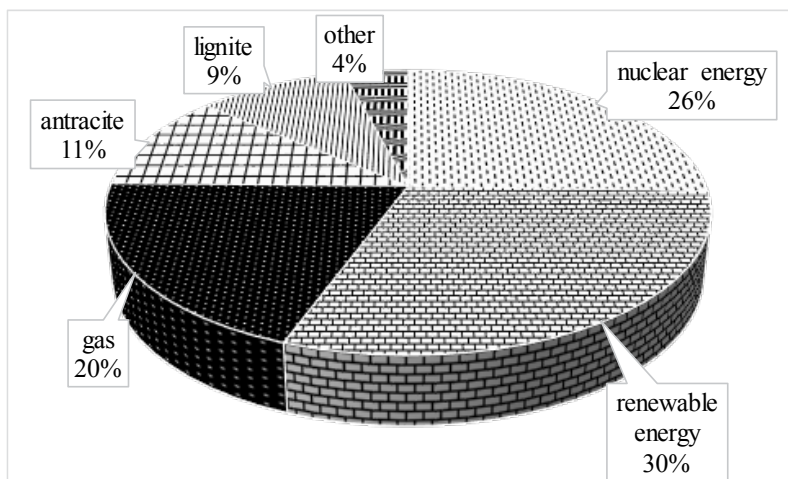


Figure 5. Structure of energy generation from various energy sources in EU in 2017

Source: developed on the basis of [13]

REFERENCES:

- Bluszcz, A. (2017). European economies in terms of energy dependence. *Quality & Quantity*, 51(4), 1531–1548. URL: <https://link.springer.com/article/10.1007/s11135-016-0350-1>
- Boersma, T., & Goldthau, A. (2017). With the EU's Market Making Project in Energy: From Liberalization to Securitization? In *Energy Union* (pp. 99–113). Palgrave Macmillan, London. URL: https://link.springer.com/chapter/10.1057/978-1-137-59104-3_6
- Bowden, N. & Payne, J. (2009). The casual relationship between U.S. energy consumption and real output: a disaggregated analysis. *J. Policy Model*, 2(31), pp. 180–188.
- Energy. URL: <https://op.europa.eu/en/publication-detail/-/publication/664e7979-229e-%204326-b7e5-cbf4c51545ed>
- European Investment Bank (EIB). URL: <http://www.eib.org/en/index.htm>
- Gil'orme, T., Ryzhyk, Y., & Yaresko, A. (2016). Formation of the mechanism of energy efficiency management on the basis of 'predator-prey' concept. *Problems of development modern science: Theory and practice: Collection of scientific articles*. EDEX, Madrid, España, 107–110. URL: http://conf.at.ua/27.07.2016_ispanija.pdf#page=107
- Gilorme, T. V., & Shachanina, Y. K. (2016). Corporate Social Reporting as a Dominant of Information Support for Enterprise Management. *Economics and Society*, (5), 672–677. URL: http://www.economyandsociety.in.ua/journal/2_ukr/120.pdf
- Hilorme, T., & Shachanina, Y. (2017). Staff development as an object of accounting of a social activity of the entity. *Economics and Finance*, 6, 14–20. URL: http://ecofin.at.ua/maket_ehkonomika_i_finansy_06_2017.pdf
- Matschoss, K., & Repo, P. (2018). Governance experiments in climate action: empirical findings from the 28 European Union countries. *Environmental Politics*, 27(4), 598–620. URL: <https://www.tandfonline.com/doi/full/10.1080/09644016.2018.1443743>
- Nasiritousi, N. (2017). Fossil fuel emitters and climate change: unpacking the governance activities of large oil and gas companies. *Environmental Politics*, 26(4), 621–647. URL: <https://www.tandfonline.com/doi/abs/10.1080/09644016.2017.1320832>
- Renewable energy in the EU (2018). URL: <https://ec.europa.eu/eurostat/documents/2995521/8612324/8-25012018-AP-EN.pdf/9d2%208caef-1961-4dd%201-a901-af%2018f%2021%20fb2d>
- Renewable Energy Prospects for the European Union. URL: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Jan/IRENAREmapEUpre-view_2018.pdf
- The European Power Sector in 2017. URL: <https://sandbag.org.uk/wp-content/uploads/2018/01/EU-power-%20sector-report-2017.pdf>
- Uropean energy innovation (2018). URL: <http://www.europeanenergyinnovation.eu/OnlinePublication/Autumn2018/index.html>