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THE IMPACT OF ENERGY TRANSITION ON THE CHANGES TO THE ENERGY COMPANY'S BUSINESS MODEL

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Purpose: The article focuses on the issue of energy transition in relation to Polish entities operating in the energy sector. The aim of the article is to analyse and assess the scale of the changes in the business models of energy companies resulting from the transformation.
Design/methodology/approach: The literature on the study of energy models and transformation has proposed theoretical frameworks to support energy transformation. They provide inspiration to examine the impact of energy transition on the business models of Polish traditional energy companies operating in the form of integrated capital groups. Three energy companies of the Polish energy sector, operating in the form of integrated capital groups – PGE, TAURON and ENEA – were selected for the study. The research used such methods as literature review and materials concerning the current situation and market trends in the energy sector as well as case study research. The research model uses the approach proposed by A. Osterwalder and Y. Pigneur, describing the rationale behind the way in which an organisation creates value and provides and profits from the value created.
Findings: The article summarises the results of research devoted to the changes in the configuration of the business model of a traditional energy company in the context of building a new energy market structure, characterised by distribution of generation sources, fast-growing prosumerism, intelligence of solutions resulting from the innovative ICT technologies applied and virtualisation of the offered customer value. The research covered selected Polish energy companies operating within the structure of capital groups.
Practical implications: The presented summary of the impact of the energy transition confirms that its presence triggers profound changes in the business model of the traditional energy company and its components.
Originality/value: The article presents a synthesis of the regulatory, legal and market conditions shaping the scope and depth of the transformations in the energy sector. The article summarises a review of new business models in the power industry and defines directions of changes in the business model of an energy company, which were determined as a result of the research. The article also discusses a possible scenario for further restructuring and changes in the business model of an energy company in the light of governmental programmes for the transformation of coal production assets and hard coal mining.

Keywords: business model, energy company, energy transition, energy sector, climate change, restructuring.

Category of the paper: research paper.

1. Introduction

Building a new energy sector, one that would be using digital technologies as well as the ICT industry on a large scale, by replacing coal- and gas-fired generation sources with renewable energy sources is the main prerequisite for the transformation which is currently taking place (Popczyk, 2018). The energy transition process is changing the structure of the energy sector (Giehl et al., 2020). Functioning of the Polish energy sector entities is significantly determined by the political and regulatory environment in Poland and the European Union (EU). Decarbonisation and the resulting transformation of the energy sector towards a permanent change in the structure of electricity production and a reduction of the share of coal with an accompanying increase in the share of Renewable Energy Sources (RES) in the energy mix are the key challenges for the Polish energy sector. A rapid transition of the power systems towards modern, low-carbon pathways and technologies will be necessary to achieve climate goals, while at the same time enabling other key objectives to be achieved such as economic development, energy access and resilience of the energy system (Sadie et al., 2020).

Adjusting the energy sector entities to the challenges resulting from the energy transition process means restructuring these entities, while assuming a fundamental remodelling of the activities conducted by them so far. Restructuring is defined as systematic rebuilding, modernisation or updating the organisational structure as well as the principles of operating. It represents a strategy of growth and reorientation (Borowiecki and Wysłocka, 2012), a thorough, conceptual redesign of business processes. It is a complex process of fundamental changes in a company, whose aim is the operational and strategic shaping of the attributes of its subjectivity in terms of changes in the environment and internal needs (Suszyński, 2003).

The article focuses on the issue of energy transition in relation to Polish entities operating in the energy sector. The aim of the article is to analyse and assess the scale of the changes in the business models of energy companies occurring as a result of the transformation. Taking up the subject in the article results from the importance of the problem in the light of the current regulatory and political conditions related to climate, both in the context of the scale and volume of the process and property changes associated with the transformation, but also in the context of the future structure of the energy sector in view of the inevitable resource, process and organisational changes, changes in competitive conditions and reformulation of the expected and offered value on the energy market in the future.

The article summarises the results of research devoted to the changes in the configuration of the business model of a traditional energy company in the context of building a new energy market structure, characterised by distribution of generation sources, fast-growing prosumerism, intelligence of solutions resulting from the innovative ICT technologies applied and virtualisation of the offered customer value. The research covered selected Polish energy companies operating within the structure of capital groups.

The article presents a synthesis of the regulatory, legal and market conditions shaping the scope and depth of the transformations in the energy sector. It also summarizes a review of the directions of the changes in the current business models and creation of development of new models in the area of energy. The article also defines a possible scenario for further restructuring and changes in the functioning of Polish energy companies in the light of the governmental programmes for the transformation of coal production assets and hard coal mining.

2. Energy company business model

Building long-term value of a company that guarantees its success on the market can be achieved by adopting an appropriate business model. It should enable implementation of effective measures for the company to become a market winner or a strong, stable market player (Jabłoński, 2013).

A business model describes the design or architecture of the mechanisms of value creation, delivery and capture that it employs. In the concept of a business model, an enterprise is treated as a set (system) of logically connected elements that allow the enterprise to create value and enable it to profit from that created value (Teece, 2010).

In recent years, the business model concept has become increasingly popular. This is due to the underlying holistic approach to business management, both from a static perspective, emphasising the resources and competences underlying competitive advantages, as well as from a dynamic perspective, encompassing the realisation of processes in order to use these resources and generate value.

P.B. Seddon and G.P. Lewis treat a business model as an abstract representation of some aspect of a company's strategy (Seddon and Lewis, 2003). Ch. Zott and R. Amit, define a business model as an abstract, rational way of describing how a corporation creates, delivers and obtains value and the basic competitive advantage of the enterprise from the point of view of value creation (Zott and Amit, 2009). D.J. Teece's concept of a business model is created around a set (system) of logically connected elements, which allow a company to create value and enable it to profit from this value (Teece, 2010). According to A. Afuah and C.L. Tucci, a business model is a method of building and using resources to offer customers better value than its competitors, which at the same time ensures the company's profitability through a system consisting of components, links between components and activities (Afuah and Tucci, 2001). In turn, the business model as a representation of the underlying logic and strategic choices of value creation and retention in the value network area is presented in the works of S.M. Shafer, H.J. Smith, J.C. Linder (Shafer et al., 2005). Similarly, H. Chesbrough and R. Rosenbloom, call a business model a structure that combines technical potential with economic value, in which the factors of the resource aspect of the business model, should lead

to the creation of added value (Chesborough and Rosenbloom, 2002). Many other definitions of a business model can be listed, emphasising its essence as a description of the roles and relationships between a company's consumers, customers, allies and suppliers that identify the main flow of products, information and money and the main benefits for the participants (Weil and Vitale, 2001), or product, service and information architecture, including a description of the different business entities and their roles, a description of the potential benefits for the different business entities and a description of the revenue streams (Timmers, 1998), either content, structure and transaction management designed to create value by exploiting business opportunities (Casadesus-Masanell and Ricard, 2010). In the concept of A. Osterwalder and Y. Pigneur, a business model describes the rationale behind how an organisation creates value and delivers and profits from the value created. As a construct of nine basic elements (customers, value proposition, channels, customer relationships, revenue streams, key resources, key activities, key partners, cost structure), it provides a sketch of the strategy to be implemented within structures, processes and systems (Osterwalder and Pigneur, 2010).

Interest in the business model is indeed noticeable also in the Polish literature. One can mention here the works of K. Obłój (Obłój, 2002), J. Rokita (Rokita, 2005), J. Brzóska (Brzóska, 2009), T. Gołębiowski et al (Gołębiowski et al., 2009), A. Jabłoński (Jabłoński, 2013), B.E. Matusiak (Matusiak, 2013) and many others.

The above review of selected definitions and theoretical approaches to the application of business models confirms the role and importance of this interesting tool in company management and strategy implementation. Therefore it implies the need to analyse the factors that influence and will influence in the future the manner and models of operation of entities in the energy market.

An analysis of the body of literature indicates that researchers are interested in both identifying and defining new business models in the energy market and in the impact of the energy transition on the business models of energy companies.

A general division of models in the energy market was proposed by L. Frantzis, S. Graham, R. Katofsky and H. Sawyer. These are: prosumer/customer-side, large-scale generator business models (building off-shore and on-shore wind farms, solar farms, VPPs, biomass CHPs, tri-generation, etc.) (utility-side) and service business models (service provider and/or aggregator models and medium supplier models: electricity, heat or gas) (Frantzis, 2008).

S. Bryant, K. Straker and C. Wrigley identify a Traditional Energy Utility, a Green Energy Utility, a Cooperative Utility, a Prosumer Utility and a Prosumer Facilitator (Bryant, 2018). B.E. Matusiak's concept of new business models in the energy market includes the prosumer/customer model, the ESCO (Energy Saving Company)/HSCO (Home Service Company) model, the generator's business model, the market aggregator's business model and the business model of electric car users in the energy market (Matusiak, 2013).

Examples of studies of the impact of transformation on selected business models in the energy industry are presented in Table 1.

Table 1.
Studies on the impact of transformation on selected business models in the energy sector

No.	Author	Subject of the study
1.	M. Provance, R.G. Donnelly, E.G. Carayannis/ 2011	The impact of political and socio-institutional dynamics on the business models of microgeneration ventures in geopolitical context.
2.	M. Richter/ 2012, 2013	Impact of the transformation on business models, in particular in the context of climate aspects and adaptation of business models to them. Investigating the business models of traditional companies in the energy sector in the context of renewable energy transformations.
3.	B.E. Matusiak/ 2013	New business models in the energy market using smart solutions, so-called e-energy.
4.	L. Strupeit, A. Palm/ 2016	PV deployment in the context of accelerated diffusion of distributed PV systems.
5.	J. Brzóska, M. Krannich/ 2016	Concepts of business models in the context of technological and organisational transformations based on a wide range of implemented innovations.
6.	S.P. Burger, M. Luke/ 2017	Analysis of business models in the context of distributed energy resources, photovoltaic applications, energy storage using an empirical approach.
7.	M. Hamwi/ 2019	Analysis of innovative changes in business models in the electricity system initiated by energy start-ups in the context of energy transition.

Source: own elaboration based on: Provance M., Donnelly R.G., Carayannis E.G. (2011); Burger S.P., Luke M. (2017), Richter M. (2012), Richter M. (2013), Strupeit L., Pal A. (2016), Matusiak B.E., (2013), Brzóska J., Krannich M. (2016), Hamwi M. (2019).

In a study of the impact of the transformation on business models in the energy industry, J. Giehl, H. Göcke, B. Grosse, J. Kochems, and J. Müller identified three research gaps, based on which they developed a framework of the Business Model for Energy Transformation (BMFE). The identified research gaps include (Giehl et al., 2020):

- existing business model systematisations are not sufficient to characterise business models for energy system transformation;
- there is no comprehensive overview of currently existing business models in the field of energy;
- there is no adequate approach to describe the impact of the energy system transformation on the interactions between business models and the structure of the energy industry.

The BMFE framework describes business models in the energy industry, classifying them, based on primary (practice-based) and secondary (theory-based) data, identifying a total of 638 business models classified into 69 prototypes and 17 classes of business models according to the dimensions of "customer proximity" and "proximity to the classic value chain in the energy industry". Complementing these results is a framework for classifying the business model of start - ups in the energy sector by M. Hamwi (Hamwi, 2019), which is a conceptual tool for managing R&D business models.

The above literature review highlights the different logics of business models and their applications to accelerate energy transition. New business models are emerging based on value creation in sustainable development conditions combining environmental and community aspects, using renewable energy sources and break-through innovations. The literature review indicates a lack of an adequate approach to studying the effects of the transformation on Polish energy companies in relation to the current situation. The factors determining the resilience of the business model of an energy company to transformational changes have not been sufficiently investigated. Thus, an adequate methodological framework for measuring and assessing the resilience of the business model of an energy company in this context has not been developed.

3. Energy transition

3.1. Energy transition – the legal and regulatory aspect

Redefinition of political and regulatory priorities results in the transformation of the traditional energy sector model into a completely new dimension of the new energy industry. Regulatory actions play an important role in this process, stimulated by the European climate policy, which assumes drastic reduction of carbon dioxide emissions by 2050. The transformation of the energy sector is necessary to face the challenges resulting from limited fossil fuel resources and to end Europe's dependence on energy imports from politically unstable areas (Sobolewski, 2019).

The following key EU regulations address the long-term vision of trying to achieve climate neutrality in the EU by 2050 resulting from the climate and energy policy as well as the regulatory mechanisms stimulating the achievement of the objectives in the coming decades:

- United Nations Framework Convention on Climate Change of 2015, the so-called Paris Agreement, and the Katowice Climate Package of 2018, implementing the postulates of the Paris Agreement;
- the 2019 regulatory package Clean Energy for Europeans, which operationalises the EU's 2030 climate and energy targets (PEP2040, 2020);
- The European Green Deal of December 2019, as a strategy to transform the EU into a modern, competitive climate-neutral economy in 2050, sets out the EU's goals to achieve climate neutrality by 2050;
- European climate law (COM 4.3.2020, 2020);
- Climate Plan 2030 – a proposal to further reduce greenhouse gas emissions by at least 55% by 2030 – included in the Commission Communication of 17 September 2020 (COM 17.9.2020, 2020);

- A new EU Climate Adaptation Strategy;
- Communications from the European Commission on an EU strategy for the integration of the energy system and the EU Hydrogen Strategy (COM 8.7.2020, 2020);
- The 'Fit for 55' legislative package (Council of the European Union, 2021).

The European Commission's September 2020 targets aim to increase the target level of greenhouse gas emissions reduction, including emissions and removals, to at least 55% by 2030 compared to 1990 levels. Financial support and technical assistance for the regions most affected by the transition to a green economy could amount to €100 billion between 2021 and 2027(www.ec.europa.eu).

The July 2021 'Fit for 55' legislative package involves updating and aligning existing regulations with a greenhouse gas emissions reduction target of at least 55% by 2030 (Council of the European Union, 2021).

Poland supported the 2019 European Green Deal target for the EU to achieve climate neutrality by 2050. Due to the difficult starting point of the Polish transformation and its socio-economic aspects, a specific national derogation was developed. Over the past several years, Poland has implemented measures aimed at reducing the environmental impact of the energy sector, in particular through modernisation of generation capacity and diversification of the energy generation structure. However, dependence on fossil fuels is still significantly higher than in other EU Member States. A just transition remains crucial for Poland, which means taking into account the starting point, the social context of the transition, and counteracting the uneven distribution of costs among countries, burdening economies with high coal fuel use more (PEP2040, 2020).

The objectives for the Polish energy sector and the directions of changes in the energy mix are defined by the Energy Policy of Poland until 2040 (PEP2040, 2020) approved in February 2021. A just transition, a zero-emission energy system and good air quality make up its three pillars. The objectives of the Policy assume the optimal use of own energy resources, expansion of the generation and grid infrastructure of electricity, diversification of supplies and expansion of network infrastructure for natural gas, crude oil and liquid fuels, development of energy markets, implementation of nuclear energy, development of renewable energy sources (RES), development of district heating and cogeneration and improvement of energy efficiency. The gradual abandonment of electricity generation in high-emission coal units and the simultaneous development of low- and zero-emission sources are in line with the EU energy policy.

The specific objectives of PEP2040 include (PEP2040, 2020) optimal use of own energy resources, development of generation and grid infrastructure of electricity, diversification of supplies and development of grid infrastructure for natural gas, crude oil and liquid fuels, development of energy markets, implementation of nuclear energy, development of RES, district heating and cogeneration, as well as improvement of energy efficiency. In terms of the expected effects, this indicates (PEP2040, 2020):

- no more than 56% of coal in electricity generation in 2030,
- at least 23% of RES in gross final energy consumption in 2030,
- deployment of nuclear power in 2033,
- a 30% reduction in GHG emissions by 2030 (as compared to 1990),
- reduction of primary energy consumption by 23% by 2030 (as compared to 2007 consumption projections).

The National Energy and Climate Plan 2021-2030 sets out the objectives and targets, as well as policies and actions to achieve the energy union dimensions encompassing energy security, internal energy market, energy efficiency, decarbonisation and research, innovation and competitiveness. On 2 February 2022, the Regulation of the Minister of Climate and Environment on energy market processes was published. It is an implementing act to the so-called Metering Act of 20 May 2021, introducing the smart metering system in Poland. The regulation will enable the implementation of the Central System for Energy Market Information (CSIRE) operated by the Energy Market Information Operator (OIRE). This function will be performed by PSE S.A. company. The task of CSIRE will be to process energy market information, which will allow, among other things (Rozporządzenie…, 10.01.2022):

- quicker supplier switching,
- free and easy access to information about one's contracts and energy consumption,
- obtaining information on offers and savings available on the competitive electricity market,
- further secure integration of RES in the energy system,
- the use of synergies in the sector, including increased flexibility of the system and the potential of active consumers.

Further tightening of EU climate policy is to be expected. From the perspective of the challenges facing energy companies, other regulations, both EU and national, also remain important. A selection of these is indicated below.

Implementation of Directive 2019/944 of the EU Parliament and of the Council of 5 June 2019 on common rules for the internal market in electricity(Dyrektywa…, 2019), introduces to the Energy Law an obligation to install remote reading meters on a mass scale. By the end of 2028, at least 80% of the total number of energy consumption points of end users in households should be equipped with a remote reading meter, and 100% by 30 June 2031. At the same time, if the installation is not completed, the Distribution System Operator (DSO) may be subject to a penalty of no more than 15% of the fined entrepreneur's revenue from licensed activities achieved in the previous fiscal year.

Law on Electromobility and Alternative Fuels of 11 January 2018 (Ustawa o elektromobilności…, 2018), sets out the rules for the development and operation of infrastructure for the use of alternative fuels in transport, the obligations of public entities within

the scope of developing alternative fuel infrastructure and the conditions for the operation of clean transport zones, as well as the national policy framework for the development of alternative fuel infrastructure and the manner of its implementation. It also defines the obligations related to the construction by DSOs of publicly available charging stations for alternating current electric cars.

Also the BAT conclusions (Ustawa o rynku mocy…, 2017), the RES support system, the so-called RES auctions and participation in them as well as the regulations related to the so-called "capacity market" concerning reservation of capacity of coal units together with the mechanism of remuneration for generating capacity change the processes, costs and conditions of operation. The launch of the capacity market, within which electricity is supplied by generating units, results in the simultaneous idling of the mechanisms of operational capacity reserve and intervention cold reserve. The system of support for electricity generation in dedicated sources (coloured certificates), on the one hand results in costs related to the redemption of the certificates for the energy selling entities to end users and on the other hand brings revenues from the sale of the certificates to energy generators.

From the point of view of resources and generating capacities of energy entities, it is important to take into account the growing requirements related to environmental protection as a consequence of the changes introduced to the Environmental protection law, the so-called anti-smog resolutions, as well as the planned amendments to the regulations relating to the Act of 25 August 2006 on the system of monitoring and controlling the quality of fuels, i.a. the quality requirements for solid fuels.

Changes in regulations concerning the energy sector, as well as changes in the legal environment, including tax law, commercial law, environmental protection, and changes in regulations concerning the operation of the Polish Power Exchange are other important issues from the perspective of energy sector entities.

The above review of selected EU and national regulations on the broadly understood business activity in the energy sector shows the significant impact of these regulations and provisions on the structure, processes and resources of current and future business models in the energy market.

3.2. Energy transition – the market conditions

Transformation of the energy sector to a completely new dimension, apart from being burdened with political and regulatory priorities, is the result of changes in market conditions, putting stress on disruptive innovations that, thanks to ICT technologies, allow the use of alternative network, generation or customer service solutions. It is also the result of a new configuration of forces and market mechanisms on the energy market in the conditions of a new combination of factors, including the development of new models of operation and new players getting involved in the links of the existing value chains.

The contemporary energy market is shaped by a decreasing demand for coal, reduction or even elimination of coal use by individual users by 2030, development of electric heating, decreasing share of coal and increasing share of RES in the domestic energy mix, development of photovoltaic, wind, marine and nuclear energy, electromobility, electricity storage technologies and the use of hydrogen. The behaviour of individual and business customers is changing, shaped in particular by the increasing environmental awareness and responsible business.

These days, for the energy industry, "transformation" as a term denoting a transition, transformation, metamorphosis in the light of historical experience, is taking on a new, groundbreaking meaning. Deep changes in the European regulatory systems promoting liberalisation and integration of energy markets that have been taking place since the beginning of the 1990, as well as the structural changes in the national energy sector – demonopolisation, commercialisation, privatisation and consolidation – have created the current shape of the energy sector and the business models of energy companies that cover the full value chain from coal mining to the sale and distribution of energy, heat and gas.

Historically, changes in the sector were aligned with the then-current EU energy policy, priorities of governmental restructuring programmes and changes in the organisational, functional and ownership structure. The changes in energy market conditions changed the strategic reorientation of enterprises in the sector, and the restructuring was reflected in the scale and level of concentration of energy enterprises, currently operating within vertically consolidated capital groups. Governmental actions at the time were aimed at creating a competitive energy market and unbundled entities in the sector. They included the introduction of competition in the generation and trading phases and the regulation of electricity transmission and distribution activities, as well as the division of activities between three subsectors: the distribution subsector (33 power plants), the trading subsector and the generation subsector (heat and power plants). Commercialisation was initiated by the Act on Ownership Transformations of 1993. Six consolidated electricity trading and distribution groups were established (Enea, Energia Pro KE, Enion, PKE, WGE), two energy trading and distribution companies were privatised (GZE, Stoen), two fuel and energy groups were established (PGE, PKE). In total, over a dozen power plants and combined heat and power plants were privatised. On the basis of the government's 2006 Programme for the Power Sector, consolidation of four energy groups (PGE, Energetyka Południe (currently TAURON), Energa and Enea) and the separation of distribution system operators was carried out. IPOs of Polish companies were also finalised (Enea in 2008, PGE in 2009, TAURON in 2010, Energa in 2013) (Staszewska, 2014) The organisational transformations were not accompanied by sufficient modernisation and development processes in generation of assets for today's needs. At present, the Polish energy sector faces new, important challenges.

For the most part, due to historical conditions and access to domestic fuels, the Polish power sector is based on units powered by hard coal and – to a lesser extent – lignite. The position of power sector entities has not changed significantly in recent years. The three largest generators, grouped in capital groups around companies with State Treasury shareholding, i.e. PGE Polska Grupa Energetyczna S.A. (PGE) , ENEA S.A. (ENEA), TAURON Polska Energia S.A. (TAURON), have almost 2/3 of installed capacity and generate about 67% of the country's electricity. More than 70% of the installed capacity in the National Power System comes from 30 years ago. Their technology is much less efficient than the current state of technology allows, moreover, they require relatively frequent and capital-intensive maintenance. In this state of affairs and with the growing demand for electricity, multi-billion investments in new generation sources are needed. The transition must ensure energy security and economic efficiency for decades to come, which is why it is based on low- and zero-carbon sources. The current structure of generation assets, concentrated in three energy groups, limits the investment potential of these companies in the segment of low- and zero-emission sources and slows down the pace of the country's energy transition. (MAP, 2021).

The macroeconomic situation in Poland, the EU and global level of the economy, including changes in interest rates, exchange rates, etc., which affect the valuation of assets and liabilities of energy entities, remains important for the operations of energy companies. Revenues and the level of generated costs are influenced by the market situation in Poland and the EU, as well as the global economy, including changes in energy prices, prices of CO_2 emission allowances, prices of raw materials, etc. Poland has the highest wholesale electricity prices in Europe. This is a consequence of the large share of coal in the Polish energy mix, high prices of CO_2 emission allowances and low competition on the Polish market.

Geological and mining factors as well as natural hazards may affect the volume of fossil fuel extraction, resulting, in the case of energy groups which include coal extraction in their chain, in a decrease in extraction and the need to increase external purchases and related costs.

Access to financing for the transformation also remains important. On the one hand, it is limited by the changes in policies of financial institutions in relation to financing coal-based energy sector, on the other hand, there is a possibility of using European funds supporting transformation of the energy sector and mitigating the social effects of the changes (TAURON, 2020).

Transformation of the energy sector is a difficult process, due to the characteristics of the industry connected with the specific nature of the product which electric energy is, including the constant need to balance supply and demand, and its strategic importance for the economy and the state. After the restructuring process initiated in the 1990s, in the light of the current regulatory and market realities, on the one hand it faces the challenge of transforming its generation portfolio towards low- and zero-emission sources, while on the other hand it also faces the challenge of shedding the burden and unprofitability of coal-fired generation units and coal production facilities.

Summarising the above considerations, it should be stated that achieving the goal of climate neutrality by 2050 requires the participation of Polish energy enterprises in the energy and climate transformation. A change in the business models of these enterprises is unavoidable, to the extent that will enable them to actively participate in the transformation and then to achieve long-term strategic goals in the new balance of power in the transformed energy sector. Today, a total of 21 Member States are already coal-free (Estonia, Latvia, Lithuania, Belgium, Malta, Luxembourg, Cyprus) or have committed to phase out this fuel with specific dates in their National Energy and Climate Plans (Sweden and Austria – 2020, Portugal -2021, France – 2022, Slovakia – 2023, Italy and Ireland – 2025, Greece – 2028, Netherlands, Finland, Hungary, Denmark, Spain – 2030, Germany – 20 38, Czech Republic – 2038). Gradual withdrawal from coal is also planned by Slovenia.(MAP, 2021) This status confirms and emphasises the scale and scope of changes in the Polish energy sector, including changes in the business models of energy companies.

4. Changes in the business model of an energy company under the conditions of energy transition

4.1. The research process

Literature on the study of energy models and transformation has proposed some theoretical frameworks to support energy transformation. They provide inspiration to examine the impact of energy transition on the business models of traditional Polish energy companies operating in the form of integrated capital groups. Three energy companies of the Polish energy sector, operating in the form of integrated capital groups – PGE, TAURON and ENEA – were selected for the study.

The first step of the research was to conduct a literature review. This approach was aimed at analysing and synthesising current information and research works on business models applied in the power industry. At this stage, the approach to business model construction proposed by A. Osterwalder and Y. Pigneur, which describes the rationale behind the way an organisation creates value as well as provides and profits from the value created, was used directionally as a research model framework.

This was followed by a review of literature and materials on the current situation and market trends in the energy sector in the context of the challenges and directions of energy transformation. An analysis was made of the EU and national regulations underlying the construction of a low- or zero-emission economy. Selected reports and national reports of energy sector entities and industry reports were reviewed. The aim of this stage was to review and synthesise the legal, regulatory and market conditions shaping the changes and the future shape of the energy system and the entities operating within it. It also made it possible to review

the business practices and to summarise the key trends in market changes relating to the particular components of business models used in the energy sector.

The interest in the Polish energy sector in the context of studying the impact of the energy transition stems from the fact that the vast majority of the Polish energy sector, due to historical conditions and access to domestic fuels, is based on units powered by hard coal and – to a lesser extent – lignite. Over 70% of the capacity installed in the National Power System dates from 30 years ago. Their technology is much less efficient than the current state-of-the-art, moreover, they require relatively frequent and capital-intensive maintenance. In this state of affairs and with the growing demand for electricity, multi-billion dollar investments in new generation sources are needed. The transformation of the energy system must ensure energy security and economic efficiency for decades to come, and is therefore based on low- and zero-emission sources. (MAP, 2021).

Based on the conclusions from the above-described stages of the research and expert interviews with energy specialists, the criteria were identified that served to isolate the components and characteristics of the business model necessary to analyse the impact of the energy transformation on the business model in the next stage of the research. These are the significance and scale of impact of the transformation on the components of the business model (including costs/inputs), the use of innovation in building competitive advantage, customer perspective, impact on the shape of the energy sector. Assuming certain criteria, the following components and characteristics of the business model were identified for further research: role, dominant model kinds/types, main products, value offered to customers, forms and channels of customer service, type of competitive advantage, sources and methods of generating profit related to value capture, material resources – size and structure of assets, characteristics of manufacturing potential, organisation / value chain and strategic skills.

In the next stage of the research, using the results of the previous stages and expert interviews as well as the author's own experience from many years of professional practice in the power industry, by means of analysis and synthesis as well as interpretation and deductive reasoning, the directions of changes in the business model that are determined by the energy transformation were defined in specific cross-sections of the analysis, which consist of components and characteristics of the business model.

The presented methodological approach makes it possible to identify and analyse the impact of energy transformation on the business model of the studied energy companies, which constitutes the research problem of this study.

4.2. Research findings

The traditional power industry concentrated in energy companies currently covers the full value chain, including fuel extraction, electricity and heat generation, distribution, wholesale, retail and customer service. The Polish power sector is dominated by large entities, mainly energy groups (Staszewska, 2014), integrated vertically. In the literature, traditional business models are seen as constructs of an organisation's internal values, strategies and resources

(Provance, 2011). An energy company's business model includes the value proposition for the participants in the model, the Consumer Relationship model used, the model of return on the capital employed, and the configuration of all tangible and intangible assets involved in achieving this value (Matusiak, 2011).

The transformation of the energy system and the changing conditions in which it operates are changing the energy market structures. The existing value chain is being transformed from a unidirectional energy flow into an information flow (Savenije, 2014). The development of digitalisation and innovative information technologies, as one of the biggest challenges of today's electricity sector, is becoming the creator of new business models, causing traditional business models to fall behind.

The process of creating an information and measurement environment in the energy market with the use of intelligent SG networks (Smart Grid), advanced metering infrastructure AMI (Advanced Metering Infrastructure) along with the smart SM meters (Smart Metering) creates a new reality of the so-called e-energy. This makes it possible to create completely new products and services, as well as activities and areas in the energy market that did not exist before. Energy companies face the challenge of actively searching for and implementing new areas of activity, new products and services and new functionalities of ICT systems, which they should develop in the integrated energy utility market, metered in real time (Matusiak, 2013).

New technologies, micro grids and distributed generation based on micro RES sources (Popczyk, 2017) and intelligent networks of interconnected, small and medium-sized market participants (nodes, prosumers, generators, service providers, traders, intermediaries, trading and clearing operators or information operators) are replacing the outdated system based on large-scale energy sector and centralisation of large generation units. The heterogeneous structure of the energy market is replacing the traditional energy market and creating new market players. The current balance of competitive forces in the energy market is changing, resulting in changes in the business models of market participants. The transformation is changing the conditions of competition for the sector's entities. The competitive environment determines the growth of activity, structure and competitive strategies in the energy market. The development of the prosumer market, two-way energy flows and the potential changes to the prosumer billing system affect the energy sales and distribution processes in the value chain.

The increase in demand for electricity, the development of energy market products taking into account the changes resulting from seasonality and weather conditions and the development of peri-energy products change the perspective of the value offered in business models.

A summary of the research results on the impact of the energy transition on the business models of the traditional energy company (system generator) using case study analysis for the entities surveyed is presented in Table 2.

The table shows similar directions of changes in the business models of the surveyed companies identified by the research.

Table 2.
The impact of transformation on the business model of a traditional energy company on the example of the Polish Energy Group PGE S.A., TAURON Polska Energia S.A. and ENEA S.A.

General features of the model	Description of the predominant features of the energy company's pre-transformation business model	Directions of change in the business model of an energy company as a result of the transformation
Role	Business model as a tool for strategy implementation.	Business model as a tool to implement sustainable development, social responsibility and ESG issues[1].
Dominant model kinds/types	– A business model focused on creating value by exposing customer value and leveraging this value for corporate profitability through appropriate business architecture and gradual innovation. – A high degree of integration.	– A business model focused on long-term value creation combining the concepts of corporate social responsibility and value management by balancing company capabilities/capitals and disruptive, radical innovations targeting low and zero carbon generation assets. – Decentralisation and distribution using digitalisation and better, cheaper and faster monitoring, recovery and servicing of assets and components building a smart network of interconnected, small and medium sized sources of market participants: hubs, prosumers, generators, service providers traders, intermediaries, trading and clearing operators and clearing or information operators.
Main products	– Electricity. – Thermal energy. – Distribution services of electricity. – Distribution services of heat. – Wholesale and retail trade in electricity. – Gas.	– New energy and energy-related products and services based on green and innovative approaches, using ICT technologies (electromobility, hydrogen technologies, blockchain, and others). – Integration and use of distributed energy business models (prosumer energy development, operator services, including microgrids). – Products based on the principles of circular economy.
The value offered	– Reliable, low-cost supply of electricity and heat from own sources (based on coal and RES) and supply of gas. – Competitive prices.	– Providing customers with a secure and stable supply of electricity and heat combined with building relationships with the external environment, including the social environment. – Tailoring the offer to the personalised expectations of current and future customers. – Creating value from the perspective of the entire portfolio of stakeholders, using the model as a vehicle for different types of innovation, especially process innovation (new technologies for energy generation) and marketing innovation (relationships with customers - prosumers). – Energy, heat and gas offered in various packages with other energy and energy-related services (installation services of photovoltaics, air conditioning, air purifiers, energy efficiency, smart-home, charging stations, car-sharing.

[1] E – environmental, S – social responsibility, G – corporate governance.

		– Increasing importance of non-financial factors - quality, ecology/clean energy, smart solutions, social responsibility. – Transparency of practices in customer relations implemented in the framework of the Proclient Social Policy.
Forms and channels of customer service	– Own customer service points, partner points with customer facilities (comprehensive service, convenient location and opening hours). – Traditional meter service.	– Internet-based sales and customer service and communication channels using innovative information technologies, feedback systems on the effectiveness of service forms and channels. – Service within the information environment (e-energy) with the use of intelligent networks SG (Smart Grid), AMI (Advanced Metering Infrastructures) with SM (Smart Metering) meters.
Type of competitive advantage	– Natural advantage derived from distribution system ownership and location. – Advantage based on reputation, brand and trust.	– Price and differentiation advantage resulting from complexity (integrated products and services), quality and reliability. – Innovation and technology.
Sources and methods of making profit related to value capture	– Profit from the scale of transactions (customer base, power exchanges). – Capacity contracts. – Efficiently allocated operating costs.	– Efficiently allocated operating costs, high operational efficiency. – Complexity of the offer/operational and cost synergies. – Financial capital as a basis for effective use and development of other capitals.
Material resources - size and structure of assets, characteristics of production potential	– Base of regulated assets (power grids), conventional assets and few RES assets. – Generation potential based on coal (mines, power plants, CHP plants) and to a small extent RES. – Underdeveloped and outdated distribution networks.	– Turning to renewable energy sources. – Generation capacity based on RES, gas and heat using innovative/smart generation and IT/ OT technologies. – Distributed energy in the generation portfolio in place of large coal-fired generating units. – Flexible distribution networks, meeting the requirements of distributed generation sources and active customers. – Automated and smart metering of energy consumption.
Organisation / value chain	– A vertically integrated group with operations in all key segments of the energy sector.	– Value chain leveraging virtualization effects and innovation ecosystem as well as innovative technologies, including information technologies. – Gradual transition from a linear cycle of activity to a closed system aiming to achieve the assumptions of circular economy.
Strategic skills	– Management of regulated activities. – Electricity production. – Handling wholesale market operations and energy market instruments. – Management of the capacity market.	– Innovative projects and technologies, research and development. – Organisational culture and employees (knowledge and competences of employees). – Intellectual capital management (employee rationalisation, utility models, industrial designs and patents).

Source: own study.

The presented summary of the impact of the energy transition confirms that its presence triggers profound changes in the business model of the traditional energy company and its components.

6. The scenario of further changes in the energy sector in the light of the government's transformation programme

The government's solutions for the shape of the Polish coal mining and power sector constitute a response to the challenges facing the Polish electricity sector. One of them is the April 2021 draft concept of spinning off the assets related to electricity generation in conventional coal units from the Polish energy groups with State Treasury participation. It assumes that heat and cogeneration units will remain within the structure of the concerns, which will be gradually replaced with gas units adapted to be powered with zero-emission hydrogen in the future. Once the coal assets are spun off, the energy groups will focus on implementing low- and zero-carbon investments. The coal assets will be owned by the National Energy Security Agency (NABE), operating as a company with 100 per cent state ownership. This entity will be the guarantor of the country's energy security, ensuring the necessary availability of power in the energy system. NABE's investment processes will be limited to the necessary replacement investments and gradual phasing out of coal-fired units, with a progressive increase in the capacity of low- and zero-emission sources. At the same time, NABE will be fully independent from the existing owners. The process of spinning off coal assets is one of the key stages of the transition towards strengthening Polish entities operating in the energy sector. The purpose of spinning off the coal assets into a new entity is to facilitate the transition for the energy sector and to facilitate financing, in particular of investments in low- and zero-emission sources (MAP, 2021).

The advancement of the transformation towards the energy sector of tomorrow and the planned governmental solutions interfering with the future structure of the energy market allow us to assume that the transformation of the energy sector will become the reason for consolidation of the restructured energy groups in the future. Considering the consolidation processes in the Polish fuel sector in recent years, this scenario seems realistic and feasible in the processes of creating a strong power sector, as it serves to further strengthen the position of Polish energy companies.

As part of the transformation, a reform of the tariff model is inevitable. Tariff design is an integral part of public policy. Today's distribution system is outdated and unadapted to the rapid changes that are taking place. Smart tariffs provide consumers with incentives to do the right thing: to save energy or to use it when it is most economical for them. Well designed dynamic tariffs can help optimise the use of already existing networks and minimise future investment (Jahn, 2021). It is also necessary to improve the flexibility of distribution networks in order to meet the requirements of distributed generation sources and active customers. These issues may provide a rationale for further system and structural solutions in the area of distribution in the energy market.

7. Conclusions

1. Liberalisation and transformation of the energy system have significantly increased the pace of change and significantly affected the business model (Giehl, 2020). The zero carbon economy and energy self-sufficiency, as a new paradigm for thinking about energy, is changing the traditional value chains and business models in the energy sector. The decarbonisation of energy production towards low- and zero-carbon energy results in a decentralised structure of the energy sector. The priorities related to climate and energy policy are making the conditions for companies to compete in the market increasingly demanding. The energy transition process is forcing changes in business models to meet the demands of the new energy industry. Business models play a key role in transformational change, both as triggers of change (in the short term) and as their architecture (in the medium and long term) (Ogrean, 2020).
2. The classic business model of an energy company operating as an integrated energy group is being transformed. The balance of competitive forces is changing, and the emergence of new entities entering the energy markets is changing the role, objectives and values offered by the existing energy operators.
3. The current structure of the energy sector and the directions of its future changes is an important subject of both empirical and theoretical research. The article summarises the results of research dedicated to the transformation of the business model configuration of a traditional energy company in the context of the construction of a new energy market structure, characterised by distribution of generation sources, fast-growing prosumerism, intelligence of solutions thanks to the innovation of applied ICT technologies and virtualisation of the offered customer value. Energy companies need to make decisions that are compliant with and consistently adjusted to changes in national and EU law, leading to effective and efficient implementation of operational and strategic goals, while taking into account the assumptions of just transformation, and make it possible to maintain flexibility of operation and adaptation to changes in the national and international environment.
4. The search for the most optimal business solutions under these conditions requires a resilient business model for the energy company. This justifies the need to conceptualise the factors influencing the resilience of the energy enterprise and to implement measures to increase this resilience. It requires qualitative as well as quantitative approaches, both to better understand the factors contributing to resilience and to consistently assess resilience in order to increase it, which will contribute to building the value of the energy enterprise.

References

1. Afuah, A., Tucci, C.L. (2001). *Internet Business Models and Strategies*. McGraw-Hill Higher Education.
2. Borowiecki, R., Wysłocka, E. (2012). *Analiza ekonomiczna i ocena ekspercka w procesie restrukturyzacji przedsiębiorstw.* Warszawa: Difin.
3. Bryant, S., Straker, K., Wrigley, C. (2018). The typologies of power: Energy utility business models in an increasingly renewable sector. *Journal of Cleaner Production*, doi: 10.1016/j.jclepro.2018.05.233.
4. Brzóska, J. (2009). Model biznesowy – współczesna forma modelu organizacyjnego zarządzania przedsiębiorstwem. *Organizacja i Zarządzanie, nr 2*.
5. Brzóska, J., Krannich, M. (2016). Modele biznesu innowacyjnej energetyki. *Studia Ekonomiczne, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach, nr 280*.
6. Burger, S.P., Luke M. (2017). Business Models for distributed energy resources: A review and empirical analysis. *Energy Policy*.
7. Casadesus-Masanell, R., Ricard, J.E. (2010). From Strategy to Business Models and onto Tactics. *Long Range Planning, No 43*, www.businessmodelcommunity.com/fs/root/8oex1-casadeus_et_ricart.pdf, 24.11.2020.
8. Chesborough, H., Rosenbloom (2002). The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spinoff companies. *Industrial and Corporate Change, No 11*.
9. COM 02.05.2021 (2020). 562 final, https://eur-lex.europa.eu/legal-content/PL/TXT/HTML/?uri=CELEX:52020DC0562&from=EN, European Commision, 2030 Climate Target Plan, https://ec.europa.eu/clima/policies/eu-climate-action/2030_ctp_en, 02.05.2021, doi: 10.106/j.lrp.2009.07.003.
10. Dyrektywa Parlamentu Europejskiego i Rady (UE) 2019/944 z dnia 5 czerwca 2019 r. w sprawie wspólnych zasad rynku wewnętrznego energii elektrycznej oraz zmieniająca dyrektywę 2012/27/UE, https://eur-lex.europa.eu/legal-content/PL/TXT/PDF/?uri=CELEX:32019L0944&from=ES, 02.06.2021.
11. European Commision, Communication, Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change, https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/eu_strategy_2021.pdf, 02.05.2021.
12. European Commision, Communication, Powering a climate-neutral economy: An EU Strategy for Energy System Integration, Brussels, 8.7.2020, COM(2020) 299 final, https://ec.europa.eu/energy/sites/ener/files/energy_system_integration_strategy_.pdf, 02.05.2021.
13. European Commision, EU economy and society to meet climate ambitions (europa.eu), 16.02.2022.

14. Fit for 55 Package – Overview of progress of the "Fit for 55" package of legislative proposalsCouncil of the European Union, Brussels, 22 November 2021, https://data.consilium.europa.eu/doc/document/ST-13977-2021-INIT/en/pdf, 10.02.2022.
15. Frantzis, L., Graham, S., Katofsky, R., Sawyer, H. (2008). *Photovoltaics Business Models*, Subcontract Report of the National of the U.S. Department of Energy, Office of Energy Efficiency& Renewable Energy, www.nrel.gov, 09.01.2021.
16. Giehl, J., Göcke, H., Grosse, B., Kochems, J., Müller, J. (2020). Survey and Classification of Business Models for the Energy Transformation. *Energies, 13(11),* 2981, https://doi.org/10.3390/en13112981, 4.06.2021.
17. Gołębiowski, T., Dudzik, T., Lewandowska, M., Witek-Hajduk, M. (2009). *Modele biznesu polskich przedsiębiorstw.* Warszawa: SGH.
18. Hamwi, M. (2019). *Understanding and analysing business models in the context of energy transition. Proposition of the DRBMC (Demand Response Business Model Canvas) to design a new entrepreneur's Business model in Demand Response markets, Thesis*. Understanding and analysing business models in the context of energy transition. Proposition of the DRBMC (Demand Response Business Model Canvas) to design a new entrepreneur's Business model in Demand Response markets (researchgate.net), 13.06.2021.
19. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_pl, 27.02.2021.
20. IMMC.COM%282020%2980%20final.POL.xhtml.2_PL_ACT_part1_v2.docx (europa.eu), Europejskie prawo klimatyczne: wstępne porozumienie Rady z Parlamentem – Consilium (europa.eu), 02.05.2021.
21. Jabłoński, A. (2013). *Modele zrównoważonego biznesu w budowie długoterminowej wartości przedsiębiorstwa z uwzględnieniem ich społecznej odpowiedzialności.* Warszawa: Difin.
22. Jahn, A., Gawlikowska-Fyk, A. (2021). Dynamiczne i sprawiedliwe. Przyszły kształt taryf sieciowych w Polsce. *Forum Energii, 06.05.2021*, Dynamiczne i sprawiedliwe | Przyszły kształt taryf sieciowych w Polsce – Forum Energii (forum-energii.eu), 02.06.2021.
23. Komisja Europejska, Komunikat Ambitniejszy cel klimatyczny Europy do 2030 r., Bruksela, 17.9.2020.
24. Matusiak, B.E. (2013). *Modele biznesowe na nowym zintegrowanym rynku energii.* Łódź: Uniwersytet Łódzki.
25. Obłój, K. (2002). *Tworzywo skutecznych strategii.* Warszawa: PWE.
26. Ogrean, C., Herciu, M. (2020). Business Models Addressing Sustainability Challenges – Towards a New Research Agenda. *Sustainability, 12(9),* 3534, doi.org/10.3390/ su12093534.
27. Osterwalder, A., Pigneur, Y. (2010). *Tworzenie modeli biznesowych. Podręcznik wizjonera*. Gliwice: Wydawnictwo Helion.

28. Polityka Energetyczna Polski do 2040 (PEP 2040; 2020), www.gov.pl/web/klimat/polityka-energetyczna-polski, 27.11.2020.
29. Popczyk, J. (2018). Transformacja energetyki (za pomocą reformy ustrojowej rynku energii elektrycznej) do monizmu elektrycznego odnawialnych źródeł energii 2050 – Raport. *Energetyka Społeczeństwo – Polityka, Nr 2(8),* doi: 10.4467/24500704ESP.18.008.11344.
30. Projekt dokumentu pn. Transformacja sektora elektroenergetycznego w Polsce. Wydzielenie wytwórczych aktywów węglowych ze spółek z udziałem Skarbu Państwa, Ministerstwo Aktywów Państwowych (MAP), Warszawa, kwiecień 2021, https://www.gov.pl/web/aktywa-panstwowe/rozpoczecie-konsultacji-programu-transformacji-sektora-elektroenergetycznego, 04.06.2021.
31. Provance, M., Donnelly, R.G., Carayannis, E.G. (2011). Institional influenses ob business model chice by new ventures in the mocrogenerated energy industry. *Energy Policy, 39(90),* 04.06.2021.
32. Provance, M., Donnelly, R.G., Carayannis, E.G. (2011). *Institional influenses of business*.
33. Richter, M. (2012). Ulities' business models for renewable energy: A review. *Renewable and Sustainable Energy Reviews, 16*.
34. Richter, M. (2013). Business model innovation for sustainable energy: German utilities and renewable energy. *Energy Policy, 62*, 1226-1237, doi: 10.1016/j.enpol.2013.05.038.
35. Rokita, J. (2005). *Zarządzanie strategiczne. Tworzenie i utrzymywanie przewagi konkurencyjnej*. Warszawa: PWE.
36. Rozporządzenie Ministra Klimatu i Środowiska w sprawie procesów rynku energii z dnia 10 stycznia 2022 r., Dz.U. 2022 poz. 234, www.isap.sejm.gov.pl, 05.02.2022.
37. Rozporządzenie Parlamentu Europejskiego i Rady ustanawiające ramy na potrzeby osiągnięcia neutralności klimatycznej i zmieniające rozporządzenie (UE) 2018/1999, Bruksela 4.3.2020, COM (2020) 80 final, 2020/0036(COD).
38. Sadie, C., Bowen, T., Zinaman, O., Cory, K., Reber, T., Xu, K., Burton, R., Benioff, R., Eskstein, J., Wachsmuth, J. (2020). *Power Sector Transformation Pathways: Exploring Objectives, Conditions, and Technology Innovation to Inform Power Sector Pathway Decisions.* Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-75138, https://www.nrel.gov/docs/fy20osti/75138.pdf, 05.06.2021.
39. Savenije, D. (2014). *Is Google becoming an energy company? Utility dive*, http://www.utilitydive.com/news/is-google-becoming-an-energy-company/216848/, 02.06.2021.
40. Seddon, P.B., Lewis, G.P. (2003) *Strategy and Business Models: What's the difference?* www.pacis-net.org/file/200/papers/e-business/219.pdf, 23.11.2020.
41. Shafer, S.M., Smith, H.J., Linder, J.C. (2005). The power of business models. *Business Horizons, Vol. 48*.
42. Sobolewski, M. (2015). Innowacyjne technologie energetyczne – w stronę energetyki rozproszonej . in: M. Gwiazdowicz, P. Stankiewicz (eds.), *Technology Assessment.*

Problematyka oceny technologii. Studia Biura Analiz Sejmowych Kancelarii i Sejmu, nr 3(43).

43. Sprawozdanie Zarządu z działalności z TAURON Polska Energia S.A. i Grupy Kapitałowej TAURON w 2020 r., www.tauron.pl, 02.06.2021.
44. Staszewska, J. (2014). Restrukturyzacja przedsiębiorstwa energetycznego. *Zeszyty Naukowe Politechniki Śląskiej, nr 73.*
45. Strupeit, L., Pal, A. (2016). Overcoming barriers to renewable energy discussion: business models for customer sited solar photovoltaics in Japan, Germany and the United States. *Journal of Cleaner Production, Vol. 123*, https://doi.org/10.1016/j.jclepro.2015.06.120.
46. Suszyński, C. (2003). *Restrukturyzacja, konsolidacja, globalizacja przedsiębiorstw.* Warszawa: PWE.
47. Timmers, P. (1998). Business Models for Electronic Markets. *Computer Science, Economics, Vol. 8, No. 2,* doi: 10.1080/10196789800000016.
48. Ustawa o elektromobilności i paliwach alternatywnych z dnia 11 stycznia 2018 r. (Dz.U. 2018, poz. 317), www.isap.sejm.gov.pl, 27.02.2021.
49. Ustawa. o rynku mocy z dnia 8 grudnia 2017 r. (Dz.U. z 2020 r., poz. 247 z późn. zm.), www.isap.sejm.gov.pl, 27.02.2021.
50. Weil, D.P., Vitale, M. (2001). *Place to Space: Migrating to e-Business Models.* Harvard Business School Press.
51. Zott, Ch., Amit, R. (2009). Designing Your Future Business Model: An Activity System Perspective. *Long Range Planning*, doi: org/10.1016/j.lrp.2009.07.004.