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Innovative activity of Polish enterprises from the energy industry 2005 to 2017

This article focuses on the nature of activities related to the implementation of innovation. It presents the dynamics of change in the innovative activity of Polish energy companies involved in the generation and distribution of energy in 2005–2017. The companies face serious challenges in the field of innovative energy management.
Based on mass statistical data and an analysis of the literature, the article, using descriptive and tabular analysis methods, presents the dynamics of change in expenditure for the innovative activities of entities operating in the energy sector in Poland between 2005–2017. The results are presented in various cross-sections, considering, inter alia, the size of enterprises, the type of sector and the types of innovation implemented.
The article concludes that, despite increasing expenditure on innovation, the share of innovative enterprises is not growing significantly. Only the number of innovatively active enterprises increases, which can be explained by the increase in the implementation of innovative projects. However, this does not affect the increase in net income from innovative activities.

Keywords: innovation, energy innovation, enterprise, R&D activity, energy production

Introduction

Innovations play a very important role in the contemporary economy. They are one of the main elements that stimulate the growth, speed and direction of economic development, but they also affect competitiveness of enterprises at the micro scale − that

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is, on the entity level, as well as at the macro scale − that is, on a national or global level. Innovations are also important when it comes to ensuring proper quality of life, but most importantly, from the point of view of sustainable development. Moreover, the implementation of innovations in a given area, on their own, frequently forces development of new processes or products and their application in a different sphere. This happens, for example, as a result of the negative impact of a given innovation on the environment, or because of the fact that the full benefits stemming from the implementation of a given innovation will be possible to achieve after adjusting the environment to new products or processes. Therefore, it may be considered that innovations and innovativeness are a necessity in the contemporary world. This was noticed by the European Union, among others, and was stressed in the strategic documents that it issues. One such document is the program *Europe 2020. Strategy for smart, sustainable and inclusive growth*, which was developed in 2010. This program has three priorities:

- smart growth – growth of the economy based on knowledge and innovation.
- sustainable development – support of effective economy, which uses resources in a more environmentally friendly way, and which is more competitive;
- inclusive growth – support of economy with high employment level, which ensures social and territorial cohesion (*Europa 2020. Strategy for smart, sustainable and inclusive growth*, 2010: 5).

All the above priorities are reflected in the energy sector, which has been undergoing an intense transformation for nearly two decades. The development of science and technology in this sector allows for development of substantially enhanced products and processes related to energy production and transfer, but most importantly, it allows the search for new solutions (technologies) related to its production. This also involves ensuring energy safety for society. Innovations in the energy sector also contribute to the reduction of costs and improvement of quality parameters. Energy production started to develop in Poland in the last decade of the 20th century, based on heat energy production. Moreover, the project of heat recovery from industrial processes for the sake of urban heating was carried out, which contributed to the reduction of CO_2 emission (*Wkład polskiego sektora energetycznego w realizację globalnej polityki klimatycznej*, 2018: 61). Additionally, more and more frequently, new ways to obtain energy are being searched for, using technologies which have not been known so far. Taking all the above considerations into account, it can be stated that the implementation of innovations into the energy sector stems from the need to protect climate and environment from growing consumption which leads to an increased need for goods and services and, by this, to increased exposure to emissions. There is also the need to constantly look for savings, but also to ensure the security of energy supplies in the face of lack of supplies of energy fuels. Another argument which forces the need to implement innovations in the energy sector is the successive development of novelties related to digitalisation and to industry 4.0.

In order to have a closer look at the issues related to implementation of innovations in Polish companies from the energy industry, a short summary of this topic has been made in the article. The dynamics of changes in the structure of entities within the industry in question which introduce innovations into their activities, as well as the dynamics of changes in the expenditures on innovative activities, has also been presented. Additionally, the structure of sources of funding of innovative activities has been presented, as well as the structure of the share of the net income obtained from the applied innovations. All the analyses have been carried out on a national scale over the period 2005 to 2017. Therefore, the basic aim of the analyses was to point to the dynamics of changes when it comes to the innovative activity of Polish enterprises within the energy industry, which produced and distributed energy between 2005 and 2017.

Innovative activity of Polish enterprises within the energy industry in the light of theoretical discussion

Practically in every industry, or in every area of our lives, we meet the term "innovation" on a daily basis. This term is related to the introduction of new, substantially enhanced applications, products or processes to the market. The term 'innovation' was defined for the first time not so long ago. Innovations in the economy have been a topic of discussion for not for longer than fifty years. J.A. Schumpeter was the first to introduce the term „innovation" to economics. He defined innovation as (Schumpeter, 1960: 104):

- the introduction of new goods or giving new properties to already existing products,
- introduction of new methods of production or its improvement,
- the opening of a new market,
- the conquest of a new source of supply of raw materials or semi-manufactured goods,
- introduction of a new organisational structure to a given industry,
- application of a new way of sales or shopping.

Currently, this term has been stretched substantially and has come outside the technical sphere. It has been defined that innovation takes place when economically successful exploitation of new ideas occurs. Innovations, therefore, are defined as a string of technological and organisational changes, which involve simple modifications of the existing products, processes and practices (which may be new to an enterprise, but not necessarily to the industry) to fundamentally new products and processes (which are both new to the industry as well as to an entity). The execution of innovations engages numerous scientific, technological, organisational, financial and commercial activities (Porter, 1990: 152–175).

These days, the definition of innovation commonly used almost all over the world is the one that can be found in the Oslo Manual, where innovation means introduction

of a new or significantly enhanced product (item or service), new marketing method or a new organisational method when it comes to business practices, organisation of the workplace or the relation with the external environment. For the sake of science and technology policy, but also to maintain comparability with the existing results of statistical research on innovations over time, in many cases the so-called "narrowed down" definition is applied where innovations only refer to so-called "technical" innovations, so-called new or significantly enhanced products and processes. Products (items and services), processes and methods (technical, organisational and marketing-related) are considered innovations if they are new or significantly enhanced at least from the point of view of an enterprise that implements them (*Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data*, 2005: 140–155).

A very similar definition of innovation to the one presented above was created in the Act of 30 May 2008 on certain forms of support for innovative activities, in which the term innovation refers to an activity that involves development of a new technology (i.e. technology in the form of industrial property law or research and development service, which enables generation of new or significantly enhanced goods, processes or services that have not been globally used for more than 5 years) and on that basis initiation of production of new or significantly enhanced goods, processes or services. On the other hand, technological investment means an investment that relies on the purchase of new technology or development of own technology, its implementation and on its basis the initiation or creation of new or significantly enhanced goods, processes and services (Ustawa z dnia 5 sierpnia 2015 r. o zmianie ustawy o niektórych formach wspierania działalności innowacyjnej oraz ustawy o Krajowym Funduszu Kapitałowym).

The interpretations of the term "innovation", quoted above, are quite similar; however, the ambiguity concerning this definition makes it difficult to apply objective evaluation criteria and classification of degrees of innovativeness.

Regardless of different interpretations of this term, four basic types of innovations can be listed:

- marketing innovation, whose characteristic feature is implementation of a new concept or marketing strategy which is significantly different from marketing methods that had been previously used in an enterprise;
- organisational innovation, which is about implementation of a new organisational method in rules of operations applied by an entity, organisation of a workplace or relations with the surroundings that had not been previously used in an enterprise;
- process innovation, which implies implementation or significant enhancement of previous methods of production, distribution and support of activities related to products and services;
- product, which is about introducing items or a service to the market, which are new or significantly enhanced when it comes to their features or scope of application (*Oslo Manual…*, 2005: 140–155).

Process and product innovations are classified as technological innovations. On the other hand, marketing and organisational innovations are classified as non-technological innovations (Mazur-Wierzbicka, 2015: 97–109).

In order to come up with new solutions, or to develop a new product, the innovator − that is the person or entity who is dealing with the implementation of innovations − should carry out innovative activity through scientific, technical, organisational, financial and commercial activities in general. Some of those activities, on their own, are of an innovative character, others are not new, but are necessary for the implementation of innovations.

Innovations and innovative activities are important also in the energy sector, where, these days, modern technologies and innovations are a key element. They are a definite guarantee of energy safety, but also a condition necessary for the growth of competitiveness of the sector. In order to accelerate the speed of changes in the energy sector and taking into account active incorporation into the innovations trends, in 2017 the Ministry of Energy developed a document titled "Directions of development of energy innovations". This document describes the best model of development of innovations in Poland from the point of view of technology, processes, sources and model of financing, as well as of implementation of new solutions. Three main goals have been set: to increase the competitiveness of energy enterprises, increase energy safety and maximise benefits for the Polish economy that arise from changes that take place in the energy sector (*Innovations for the energy industry. Directions of energy, innovation development*, 2017: 10).

The above discussion is reflected in numerous mass statistics which, depending on the obtained resource data, allow presentation of the dynamics of changes concerning entities that run innovative activities, or point out the changes that take place in the structure of entities that are actively innovative. What is more, mass statistics take into account the data referring to entities which implement product and process innovations. Information on expenditure the entities make on implementation of novelties is also significant. This involves taking into account different types of innovative activities, as well as the net income that comes from innovations applied in an entity.

Research material and methodology

The research and analyses carried out in this article are based on economic theory. The spatial extent of the research covers all of Poland, and the time-frame covers the years 2005 to 2017. Analyses were carried out based on the literature on the subject and the data from the mass statistics provided by the Central Statistical Office, which collects data concerning innovations and innovativeness, including implementation of innovations by Polish enterprises. In the energy sector the collected data is presented on the basis of categories of the Polish Classification of Activity (PKD) and it

is presented in a collective way as enterprises that operate in the field of energy, gas, vapour and hot water production and supply. On that basis, with the use of methods of processing and interpretation of facultative knowledge, the aim of this work has been achieved by providing interpretation of research results with the use of the system of analysis based on figures and descriptions.

Results and discussion

An innovative enterprise in the understanding of the methodology of Oslo is an enterprise which in the analysed period of time (most frequently 3 years) introduced at least one technical innovation to the market (a new or significantly enhanced product or a new or significantly enhanced technological process) (*Oslo Manual…*, 2005: 140–155).

It can be stated that in the analysed period the number of innovative enterprises operating within the energy industry underwent slight fluctuations when compared to the overall number of enterprises from this sector (Table 1). In 2007, which was part of the three-year period in which implemented innovations were taken into account, the number of such enterprises amounted to 35.6%. In another period there was a 6% increase in the share of entities from the energy sector. In the next two three-year periods the dynamics of changes in that respect was slight. As late as at the end of 2016 another rise was noted in the share of enterprises from the industry of energy production and supply. While comparing the data concerning the enterprises from the energy sector and the collective data of all Polish entities, it can be observed that the analysed industry is characterised by a greater ratio of enterprises which implement new or enhanced products and processes than the enterprises in general. It is also noticeable that more innovative enterprises come from the private sector.

Table 1. Innovative enterprises from the production and supply of electric energy, gas, vapour and hot water industry in comparison with innovative enterprises in total in the years 2005 to 2017

Specification	2005 – 2007	2008 – 2010	2010 – 2012	2012 – 2014	2014 – 2016	2015 – 2017
	% of the overall number of enterprises					
Innovative enterprises, in total	36.7	35.3	34.2	36.2	37.8	37.5
– public sector	44.1	37.4	32.8	33.2	35.0	32.4
– private sector	36.0	35.1	34.3	36.5	38.0	38.0
Enterprises from the of production and supply of electric energy, gas, vapour and hot water industry	35.6	41.6	40.4	41.5	45.1	41.8
– public sector	33.6	44.5	38.6	43.1	45.6	37.4
– private sector	43.1	36.5	44.6	39.1	44.3	48.3

Source: Original publication on the basis of the statistical yearbooks for the industry (2007–2018).

The inclination of enterprises to undertake innovative activities and to introduce innovations is determined by many different factors. The literature on the subject draws attention to the size of an enterprise, measured in the number of employees and the type of activity a given entity performs. Large enterprises introduce innovations more often than small and medium enterprises. Similarly, enterprises which operate in more technologically advanced fields i.e. the so called "high tech sector" are in a way more innovative due to their character than enterprises that operate in traditional fields of the so called "low tech" sector (Wrzosek, 1999: 2). The information provided above is reflected in the analysis of the structure of innovative enterprises according to their size class (Table 2). Both from the overall perspective, as well as from the perspective of the energy industry, the number of large enterprises that implement innovations is almost twice as big as the number of medium entities. This trend was present throughout the whole analysed period.

Table 2. Innovative enterprises from the production and supply of electric energy, gas, vapour and hot water industry in comparison with innovative enterprises in total in the years 2005 to 2017, according to their size class

Specification	2005–2007		2010–2012		2015–2017	
	Enterprises with the number of employees					
	50–249	> 250	50–249	> 250	50–249	> 250
	in % of the overall number of enterprises					
Innovative enterprises, in total	31.3	59.2	29.4	56.2	32.3	59.3
– public sector	36.3	63.7	26.7	56.3	26.8	56.6
– private sector	30.9	58.5	29.6	56.2	32.8	59.6
Enterprises from the production and supply of electric energy, gas, vapour and hot water industry	28.5	58.7	31.1	68.8	34.3	66.7
– public sector	28.0	53.3	31.7	62.9	32.7	61.9
– private sector	30.5	73.5	31.9	75.9	37.3	70.0

Source: Original publication on the basis of the statistical yearbooks for the industry (2007–2018).

While analysing the dynamics of changes in the structure of innovative enterprises, according to the innovations they implement, it can be observed that in the case of the overall group, the number of enterprises which implement product innovations is similar to the number of enterprises which introduce process innovations, what is more, this applied to the whole analysed period (25–30%) (Table 3). The situation looks similar when we take a look at entities from the private sector. On the other hand, in the public sector it noticeable that there are more entities which implement new or enhanced processes than products. An even greater difference has been observed in the case of enterprises from the energy industry. In this sector, entities mainly go for process innovations, where as much as 40% of enterprises declare that they want to implement such. 40% of entities introduce new or enhanced products.

Table 3. Innovative enterprises from the industry of production and supply of electric energy, gas, vapour and hot water in comparison with innovative enterprises in total in the years 2005 to 2017 according to types of innovations they introduce

Specification		2005–2007	2008–2010	2010–2012	2012–2014	2014–2016	2015–2017
		in % of the overall number of enterprises					
Innovative enterprises, in total	a	28.0	26.0	23.8	25.1	26.1	25.9
	b	25.2	27.2	26.8	26.8	31.0	31.8
– public sector	a	24.3	17.5	14.8	11.7	11.9	12.1
	b	33.8	31.2	28.2	30.2	32.5	30.2
– private sector	a	28.4	26.9	24.7	26.4	27.3	27.2
	b	24.4	26.8	26.2	26.4	30.8	31.9
Enterprises from the industry of production and supply of electric energy, gas, vapour and hot water	a	4.5	4.8	3.8	5.5	5.4	5.5
	b	34.3	40.9	39.2	40.7	44.2	40.5
– public sector	a	3.8	5.8	3.2	4.9	5.9	5.3
	b	32.6	43.4	37.3	42.4	44.1	35.9
– private sector	a	6.9	3.1	5.0	6.5	4.5	5.6
	b	40.5	36.5	43.6	38.0	44.3	47.2

a – enterprises which introduced new or significantly enhanced products

b – enterprises which introduced new or significantly enhanced processes

Source: Original publication on the basis of the statistical yearbooks for the industry (2007–2018).

Enterprises that are actively innovative are the entities which, during the analysed period of three years, introduced at least one technical innovation (a new or substantially enhanced product and/or process) or which were carrying out at least one innovative project in that period (i.e. a project aimed at the development and implementation of an innovation of product and/or processes), which was terminated during the analysed period (unsuccessful) or which had not been finished (was still being carried out) (*Działalność innowacyjna przedsiębiorstw w Polsce w latach 2015–2017*, 2018: 21–48). During the analysed period the number of entities which were considered actively innovative enterprises increased more than twofold (Table 4). In 2008, after the three-year research period, there were 8.3% of such enterprises in the overall number of companies, and during the last analysed period every fifth entity introduced at least one innovation or carried out an innovative project. In the structure of enterprises from the energy industry, 15.3% of companies were innovatively active in 2008. During the following periods their number increased and by 2016 there were almost 40% of them.

Table 4. Share of the innovatively active enterprises from the production and supply of electric energy, gas, vapour and hot water industry in comparison with the overall number of innovative enterprises in Poland in the years 2010 to 2017

Specification	2006–2008	2008–2010	2010–2012	2012–2014	2014–2016	2015–2017
	in % of the overall number of enterprises					
Enterprises that are active when it comes to innovations, in total	8.3	17.1	17.7	18.6	20.3	20.2
Enterprises that are active when it comes to innovations from the production and supply of electric energy, gas, vapour and hot water industry	15.3	18.1	28.4	31.3	39.6	33.4

Source: Original publication on the basis of *Działalność innowacyjna przedsiębiorstw w Polsce*, 2008–2018.

In the statistical research on innovations carried out in accordance with the guidelines of the Oslo Manual (*Oslo Manual…*, 2005: 140–155) observations are made regarding the so-called innovation budget. In such cases all of the following are defined: all the running costs and investment expenses (expenditures), regardless of funding sources, incurred in a reporting year on all types of innovative activities, and works which were successful (that is when innovations were implemented) and which still have not been carried out (continued) or terminated.

A significant increase in expenditure on research and development activities was observed during the analysed period (Table 5). Since 2005 till 2017, overall, enterprises increased their expenditure almost four times, from 1367.1 million PLN in 2005 to 5976.0 million in 2017. On the other hand, when it comes to the energy industry companies, expenditure incurred on this type of activity fluctuated in each report period. In 2008 it was merely 24.4 million PLN, and in 2010 as much as 114.3 million PLN. In 2015 it again went down to 50.2 million PLN. The situation is a bit different in the case of other expenditure on innovative activities. In general, the expenditure differs in individual years. The most was spent on purchase of knowledge from external sources in 2010 (1362.4 million PLN). However, this expenditure was gradually decreasing in the following years and in 2017 it dropped more than half the initial amount compared to seven years back. On the other hand, in the case of investment expenditure in 2008, it increased to the level of almost 20.5 billion PLN, and later it was gradually decreasing to the level of less than 15 billion PLN in 2012. In the following years the expenditure increased again to reach the amount of 22 billion PLN. Since that year this expenditure started to decrease again.

The level of expenses on the training of staff and marketing does not have a steady tendency in individual years and it fluctuates. The biggest budget in this group of expenses was devoted in 2017 (546.8 million PLN), and the smallest, on the other hand, in 2005 (332.3 million PLN). When it comes to expenditure on innovative activities, it has been observed that the enterprises from the private sector spend substantially more.

Table 5. Expenditure on innovative activities regarding product and process innovations in innovative enterprises that operated in the production and supply of electric energy, gas, vapour and hot water industry, compared with the total number of innovative enterprises in Poland in the years 2005 to 2017, according to types of innovative activities

Specification		2005	2008	2010	2012	2015	2017
		in million PLN					
Innovative enterprises, in total	a	1367.1	1992.7	3272.8	3529.7	4838.3	5976.0
	b	625.1	264.5	1362.4	1026.9	578.9	612.9
	c	11835.8	20518.2	16736.7	14933.7	22299.6	18713.0
	d	332.3	227.9	528.6	508.7	472.9	546.8
– public sector	a	#	223.2	403.1	414.4	401.0	381.0
	b	#	34.7	155.6	18.8	#	166.2
	c	#	5023.4	5286.9	1854.7	2474.2	1636.5
	d	#	6.5	10.9	15.6	16.9	#
– private sector	a	#	1769.6	2869.8	3115.3	4437.4	5594.9
	b	#	229.8	755.0	632.4	#	446.7
	c	#	15494.9	11449.9	13079.0	19825.4	17076.6
	d	#	221.3	77.4	493.2	456.0	#
Enterprises from the production and supply of electric energy, gas, vapour and hot water industry	a	#	24.4	114.0	114.3	50.2	76.5
	b	#	21.4	13.1	#	133.4	#
	c	#	2964.3	3287.1	3220.1	#	#
	d	#	6.3	3.3	#	#	#

a – expenditure on research and development activities
b – expenditure on purchase of software and knowledge from external sources
c – expenditure on investments (buildings, constructions, grounds, machines, technical devices, tools and means of transport)
d – expenditure on training of staff and marketing of the new or significantly enhanced products
Source: Original publication on the basis of the statistical yearbooks for the industry (2007–2018).

Enterprises finance innovative activities mainly from their own financial resources (Table 6). It is especially apparent among enterprises from the private sector. Such a situation is present both in a general perspective but also in companies from the energy sector. On the other hand, expenditure/funds from other resources, that is, those obtained outside the country or bank loans, were on similar levels.

The situation does not look good when it comes to the share of net income from the sales of new or significantly enhanced products in the net income from the general sales (Table 7) in individual enterprises. In the analysed period the share of income was gradually decreasing. At the end of 2008 it was above 14% in the overall number of enterprises, and in 2017 it was less than 8%. There was a similar situation in energy industry enterprises. From 2008 till 2017 the share of income obtained from innovative activities decreased twofold.

Table 6. Expenditure on innovative activities regarding product and process innovations in innovative enterprises that operated in the production and supply of electric energy, gas, vapour and hot water industry, compared with the total number of innovative enterprises in Poland in the years 2010 to 2017, according to the source of funding

Specification		2005	2010	2012	2014	2016	2017
		in million PLN					
Innovative enterprises, in total	a		77.3	76.2	72.2	72.7	77.2
	b		7.2	6.9	8.4	1.5	2.5
	c		7.3	9.0	8.6	#	7.3
	d		8.2	7.9	10.9	#	8.2
– public sector	a		59.5	75.0	59.7	73.7	65.5
	b		12.4	6.1	27.4	11.2	0.6
	c		11.0	5.9	3.2	3.3	#
	d		17.1	12.9	9.7	11.8	#
– private sector	a		84.2	69.5	73.7	72.1	78.3
	b		5.3	6.8	6.0	0.8	2.6
	c		5.9	8.9	9.3	#	#
	d		4.6	14.8	11.0	#	#
Enterprises from the production and supply of electric energy, gas, vapour and hot water industry	a		78.3	75.8	51.9	35.0	48.0
	b		0.1	6.1	8.7	#	#
	c		0.8	5.5	#	1.2	1.6
	d		20.8	12.6	#	#	#

a – expenditure from own resources

b – expenditure from resources obtained from other countries

c – expenditure from bank loans

d – other

Source: Original publication on the basis of the statistical yearbooks for the industry (2007–2018).

Table 7. The share of net income from the sales of new or significantly enhanced products of the net income from sales in enterprises from the production and supply of electric energy, gas, vapour and hot water industry compared with Polish innovative enterprises in total in the years 2010–2017

Specification	2006–2008	2008–2010	2010–2012	2012–2014	2014–2016	2015–2017
	in %					
Innovative enterprises, in total	13.4	12.4	10.2	9.6	9.0	7.8
Enterprises from the production and supply of electric energy, gas, vapour and hot water industry	0.8	0.0	0.0	0.4	0.5	0.4

Source: Original publication on the basis of of *Działalność innowacyjna przedsiębiorstw w Polsce*, 2008–2018.

Conclusions

Modern technologies and innovations are the key elements of the development of the energy industry. On the one hand, they are a guarantee of energy security, on the other, however, they are a condition that is necessary for the growth of competitiveness of the sector that allows it to meet multidimensional challenges on a national, European and global level.

In the analysed period it can be stated that the number of innovative enterprises from the energy industry when compared to the overall number of enterprises from this sector was at the level of about 40% and it underwent slight fluctuations. When it comes to the size of enterprises, from the perspective of the energy industry, the number of large enterprises is almost twice the number of medium-size entities that implement innovations. During the analysed period the number of entities which were considered actively innovative enterprises doubled.

It was observed that, in the energy sector, entities mainly opt for process innovations. On the other hand, more finance for innovative activities was invested in infrastructure, and the finance came mainly from companies' own financial resources. In energy industry enterprises the share of income obtained from innovative activities is gradually decreasing.

Summing up, it can be stated that, despite increasing expenditure on innovations, the share of innovative enterprises is not increasing substantially. It is only the number of actively innovative enterprises that is growing, which can be explained by the growing number of innovative projects that are carried out. This, however is not reflected in the increase of net income from innovative activities.

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Streszczenie

Działalność innowacyjna polskich przedsiębiorstw branży energetycznej w latach 2005–2017

Artykuł koncentruje się na zwięzłej charakterystyce działań związanych z wdrażaniem innowacji, a podstawowym problemem badawczym jest przedstawienie dynamiki zmian w zakresie działalności innowacyjnej polskich przedsiębiorstw branży energetycznej zajmujących się wytwarzaniem i dystrybucją energii w latach 2005–2017, które muszą sprostać poważnym wyzwaniom w skali globalnej w zakresie innowacyjnej gospodarki energetycznej.

W oparciu o dane statystyki masowej oraz na podstawie analizy literatury przedmiotu, przy wykorzystaniu metody opisowej, metody analizy tabelaryczno-opisowej zaprezentowano dynamikę zmian w nakładach podmiotów działających w branży energetycznej na działalność innowacyjną w Polsce w latach 2005–2017. Wyniki zaprezentowano w różnych przekrojach, uwzględniając między innymi wielkość przedsiębiorstw, rodzaj sektora oraz rodzaje wdrażanych innowacji.

Powyższe rozważania pozwoliły stwierdzić, że pomimo zwiększających się nakładów na innowacje udział przedsiębiorstw innowacyjnych nie ulega większym wzrostom. Jedynie rośnie liczba przedsiębiorstw aktywnych innowacyjnie, co można tłu-

maczyć wzrostem realizacji projektów innowacyjnych. To jednak nie wpływa na zwiększenie przychodów netto z działalności innowacyjnej.

Słowa kluczowe: innowacje, innowacje energetyczne, przedsiębiorstwo, działalność B+R, wytwarzanie energii