ECONOMIC ASPECTS OF THE IMPLEMENTATION OF CIRCULAR TECHNOLOGIES WITHIN THE FRAMEWORK OF RENEWABLE SOURCES TO STRENGTHEN THE NATIONAL ENERGY SECURITY OF THE CZECH REPUBLIC

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Abstract

Especially as a result of the events of February 24, 2022 (the aggression of the Russian Federation in Ukraine), the importance of ensuring the energy security of the national economy is growing within the economic policy of the state. This is related to the restructuring of the energy system, decentralization and technological innovation. In this context, the article focuses on the economic issue of supporting the development of the implementation of circular technologies within the framework of renewable sources in the production of strategic energy commodities (electricity and thermal energy). A certain possible solution consists in the introduction of a circular economy in the use of energy waste, which also fulfills the ecological goals within the strategy of sustainable development. The issue is also linked to the energy diversification of sources, self-sufficiency, national security and the independence of the Czech economy from fossil resources. Of these, the article is prepared for interdisciplinary reasons by the approach of interested social science disciplines to the issue (economics, economic policy, environmental policy...), where the application of analytical and comparative methods prevails.

Key words: circular technology, renewable resources, energy security

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Introduction

In connection with the armed act of the Russian Federation in Ukraine (events of February 24, 2022), the phenomenon of energy security has grown in importance in the Czech economy and in the entire Western European area. An integral part of the aforementioned security concept is the search for alternative sources. It is logical, because it is in the interest of every

state to ensure, as far as possible, an economy that is as independent as possible from the import of energy raw materials from abroad, and to achieve at least partial energy self-sufficiency within its capabilities. There is no longer enough fossil natural resources (such as coal, oil and natural gas) on the European continent. By the end of the 20th century, conventional energy based on massive coal and nuclear power generation resources was dominant worldwide (Koirala et al., 2016). Green sources generating from solar and wind were considered more as a supplement. In connection with the reduction of carbon dioxide emissions, which contribute to global warming, bets were placed on the further development of nuclear energy.

For the reasons mentioned above, not only the Czech, but also the European electric power industry is working in parallel as part of the strategy of strengthening energy security and in an ecological direction. This results in the shutdown of large non-ecological electricity production plants and their replacement in the form of decentralized ecological production of energy commodities, including through circular technologies (Bag et al., 2021). This established way of producing energy commodities through alternative sources represents an ideal way of fulfilling the strategy of sustainable development, that is, the fulfillment of economic, ecological and social goals.

1 Processing method

The basis for determining processing methods lies in the phenomenon of state energy security. Its integral part is the search for alternative sources for the production of energy commodities, which represent strategic importance for the national economy. Applications of circular technologies can contribute in a certain way in all areas of the economy. The aim of the aforementioned security concept is to ensure the protection of economic entities (producers and consumers) against the potential risk of e.g. blackout, shortages, etc., which can result in e.g. household energy poverty, etc.

For these reasons, the use of the method of analysis, comparison, synthesis and generalization prevails during processing. The interdisciplinary approach of social sciences and humanities (especially economics, economic policy, sociology, ecology, and security sciences) is also applied to the current development trend of energy security of the Czech economy in connection with the emerging era of Industry 4.0.

2 Results

2.1 Background to the monitored issue

Directing one's own development belongs to the basic natural aspects of the existence of human society. If these activities are to stand on a rational basis, it is impossible to do without forecasts representing realistic, scientifically based ideas of future development. Within these ideas, all sectors of the economy cannot be neglected. It is certain that each sector and area occupies its specific strategic positions in ensuring national security. Agriculture and energy, linked to circular economy implementations, are no exception. A clear proof of this is the theoretical concept of the Copenhagen School. Its beginnings date back to the turn of the 80s and 90s of the 20th century, when, based on a study of the world, it argued that it was necessary to expand the then concept of military security to address political, economic, energy, environmental and social issues within the framework of national and global security. (Šetek & Petrach, 2017). From the mentioned period, a "broader" concept of security can be observed in the history of security sciences, which is also extended to include other non-military sectors with five sectors (military, economic, social, political and environmental). It can be stated that the mentioned security sectors correspond to the basics of fulfilling Maslow's pyramid of human needs, applicable not only to individuals, but also to the whole society (Šetek, 2018).

In the context mentioned above, the state's energy security represents one of the basic strategic directions of its energy policy, the current effort of which is the cleanest possible production of energy commodities (especially electrical and thermal energy). Reducing carbon emissions, combating climate change - these are the topics that determine the direction of the current energy industry. This is primarily the use of hydro, solar and wind power plants, but there are of course other renewable sources that are somewhat in the shadow of these, namely biogas and biomass. Their production can be ensured through the implementation of the circular economy in all spheres of material production. In this context, the circular economy is often defined as a zero-waste concept. Its essence lies in technological applications within the framework of connecting material flows and maintaining their value in the cycle for as long as possible (Balaman et al., 2018). Following the model of natural ecosystems, it proposes closing material flows in functional and never-ending cycles, drawing energy from renewable and sustainable sources, and creating sustainable products and

services (Bag et al., 2021). Materials that would thus become waste in the existing linear economy are reused or recycled.

The production of energy commodities has many crossroads and decisions on its way, which will especially affect the price for services within the energy market. Proponents and opponents of the implementation of circular technologies in the production of energy commodities in agricultural production sectors within the framework of a sustainable development strategy usually differ in how they evaluate the macroeconomic effects of environmental measures. These are without a doubt a phenomenon that has gained popularity together with the requirements for the protection and creation of the environment. Due to the prevailing uncertainty after the start of the third decade of the 21st century surrounding energy supplier entities, tools to strengthen the state's energy security can also be seen in the mentioned implementations, especially through diversification and decentralization in the production of the mentioned strategic commodities (Šetek, 2015).

2.2 Requirements for ensuring energy security within the national economy

Since the last third of the 20th century, the concept of energy security has been widely used in the world economy and national security strategies. A certain impetus for this would be the term "oil peak - turning point", i.e. a state in which the world economy is experiencing a decrease in energy mineral resources - fossil fuels (Gökgöz & Güvercin, 2018). In this context, the so-called Hubbert curve (according to the American geologist King Hubbert) can also be mentioned. Based on this curve, stocks are at their peak in a given period, so production will gradually decline (Lucas et al., 2016). This was logically related to the growth of energy commodity prices in the world economy, some important exporters began to use energy commodities (mainly oil and natural gas) as a certain "weapon" in their foreign policy.

Based on the above-mentioned facts, the starting point for creating the state's energy security is its economic policy. In the mentioned case, its goals are to protect the producer and the consumer from the potential risk of e.g. blackout, shortage, etc., which can lead to e.g. household energy poverty, etc. (Faltová Leitmanová et al., 2021). At the same time, it also addresses a possible potential risk for instability within the functioning of the economic system (typical enormous inflationary growth of the Czech economy as a result of the war and energy crisis with the events of February 24, 2022). The basis of energy security of the national economy is determined by its energy base, which is determined by the state of raw

energy commodities, production, distribution, energy infrastructure (electricity transmission system, oil pipelines, gas pipelines, steam pipelines...) final consumption, import and export of energy commodities (Šetek, Alina & Edrová, 2022). From the point of view of energy security, the main energy commodities of strategic importance for the economy still include electricity, oil, natural gas and thermal energy.

According to the analysis of some selected concepts of energy security within the framework of fulfilling the goals of the economic policy, a clear conclusion of its nature can be reached. This consists in access to a sufficient amount of reliable energy at an acceptable price with due regard for the quality of the environment. The implementation of circular technologies in the framework of industrial and agricultural production in the production of electrical and thermal energy can also contribute to the fulfillment of these goals (Šetek, Alina & Edrová, 2022).

2.3 The importance of energy utilization of waste within alternative sources

One of the basic strategic goals of the implementation of the circular economy is the reduction of negative externalities resulting from the production, use and disposal of products. The mentioned attitude can contribute to restructuring in the production of energy commodities. The main tool for the development of restructuring consists in the liberalization of the energy market, which should create a competitive environment as a necessary condition for dynamic development (Grafström, & Aasma, 2021). The technical means for this are decentralization, diversification and technical innovation (Šetek, Alina & Edrová, 2022). At the same time, the integration of these means can contribute to the concept of smart energy, which represents one of the basic pillars of the Smart Region concept (Woods & McDonagh, 2011). It mainly includes the use of renewable energy sources, smart grid elements in the electricity distribution system in the region, intelligent management of energy consumption, including energy management of buildings and intelligent management of city services, especially public lighting. Smart energy is closely linked with other pillars of the Smart Region concept – environment and mobility (Woods & McDonagh, 2011).

In this context, the circular economy points out that any natural systems are capable of evolutionary development in a positive direction. When it comes to the biomimetic aspect of the circular economy, nature is imitated in terms of resource efficiency and the creation of sustainable ecosystems (Woods & McDonagh, 2011). Understanding the system is key if we want to make changes within such a system. Ignoring or misinterpreting trends, processes, the

functioning of things and the degree of real human impacts on the socio-ecological system can lead to catastrophic results (Šetek, 2016).

2.4 The energy base as a starting point for creating a concept of energy security based on the example of the Czech economy

The production of energy commodities within the national economy is one of the most monitored areas of the economic policy of each state. The basic starting document for the Czech Republic in the aforementioned issues is the State Energy Concept, whose processing is guaranteed by the Ministry of Industry and Trade of the Czech Republic. The basis for its creation is the analysis of the energy base. Within the framework of the national economy, this represents the monitoring of raw energy commodities, production, distribution, energy infrastructure (electricity transmission system, oil and gas pipeline networks), final consumption, import and export of energy commodities. The mentioned concept is also the basis for energy security (self-sufficiency). From the point of view of energy security, the main energy commodities of strategic importance include electricity, oil, natural gas and thermal energy.

The use of renewable resources can also contribute to strengthening the energy security of the economy, for the unlimited use of energy sources (Musil, 2009). The implementation of the principle of decentralization of the production of electrical and thermal energy can clearly contribute to this. The essence is that instead of giant fossil sources, electricity is produced by a larger number of smaller units within the region, city, municipality. The mentioned projects can be implemented on the basis of linked economic, energy, ecological and regional policies. Following the example of the Scandinavian countries, it is also possible to introduce technological devices for the energy use of waste within municipalities, thereby complementing the concept of a circular economy, where residual waste from recycling is incinerated in combination with municipal waste to create thermal and electrical energy (Yildizbasi, 2021).

Electricity production in the Czech economy and within the European Union is based on the energy mix. According to the share of electricity production for the year 2021 (see Table 1), in the Czech Republic 85.4% is accounted for by non-renewable sources, in some members of the European Union the share of renewable sources significantly predominates (Austria 83.9%) or is almost 1 : 1 (Germany).

Tab. 1: Comparison share renewable (RS) and non-renewable of resources (NS) on production electricity of the Czech Republic and selected members European Union in 2021 (in %)

Source energy	Czechia	Slovakia	Hungary	Austria	Germany	Poland	France
Biomass	3.1	3.1	3.8	2.6	7,8	1.2	0.6
Aqueous power plants	4.7	15.5	0.6	65.2	4.7	1.8	11.9
Photovoltaic power plants	2.9	2.1	0	1.6	9.4	2.9	2.7
Windy power station	0.9	0	2.1	12.6	22.8	9.6	6.9
Next renewable resources	3.0	1.8	0.8	1.6	1.5	0	0.3
Other	0.1	4.7	2.0	0.3	0.6	0	0
Total RS	14.6	27.2	9.3	83.9	46.8	15.5	22.4
Nuclear power plants	36.6	54.3	51.2	0	13.0	0	70.4
Brown coal	35.2	3.5	10.3	0	19.5	26.1	0
Resources gas	10.4	13.7	29.2	16.1	10.4	8	6.4
Black coal	3.2	1.3	0	0	10.3	50.4	0.8
Total NS	85.4	72.8	90.7	16.1	53.2	84.5	77.6

Source: Ministry Industry and trade, Energy Council regulatory office. 2022 and own processing

It is certain that the implementation of circular technologies and the use of renewable resources is determined by a number of factors of the national economy, such as area, geographical location and natural conditions. Based on the analysis of the mentioned determinants, the Czech Republic is a small country without the possibility to plant its territory with crops used as biomass. Water flows are also limited, without access to the sea for the construction of tidal power plants, the solar intensity does not reach the appropriate level as, for example, at the equator, it does not have large areas for the installation of large photovoltaic panels, and the wind does not blow as strongly as on the coast in northern Germany. According to these facts, renewable sources together with the use of energy waste from agricultural production within the framework of innovative circular trends will probably never reach a more fundamental share in the energy mix in the economy of the Czech Republic, so that the foundations of the state's energy security are completely guaranteed. However, the most important contribution of the mentioned innovative trends can be seen in the ecological benefits. For these reasons, the energy use of waste in agricultural production

means additional resources, the use of which will contribute to strengthening independence from exhaustible raw materials and supporting participation in the diversification and decentralization of the production of energy commodities.

On the basis of analyzes of energy concepts to date, it is important for the Czech economy to speed up the construction of new nuclear units in the future in order to maintain energy security in the production of electricity. The question of whether the government should buy back the once privatized energy sectors of the economy is also coming to the fore. It is logical, because the position of the energy industry within the national economy and its external relations enters the role of an essential strategic sector, over which, following the example of many European countries, the state should retain control.

Conclusion

Green sources from solar and wind were considered more of a supplement. In connection with the reduction of carbon dioxide emissions, which contribute to global warming, bets were placed on the further development of nuclear energy. For these reasons, not only the Czech, but also the European electric power industry is working in parallel as part of the strategy of strengthening energy security and in an ecological direction. This results in the shutdown of large non-ecological power plants and their replacement in the form of decentralized ecological power plants, including through circular technologies. The electric power industry has many crossroads and decisions on its way, which will affect in particular the price for services in the electric power industry as well as the price of power electricity. The installation of own electricity production plants with the accumulation of electrical energy brings a reduction in dependence on the future development of the electric power industry (Šetek, Alina & Edrová, 2022). If sufficient storage capacities are built, a certain part of the capacity can also be offered as a support service for managing the energy system. In the case of large performances, it may be an offer of a support service to the operator of the transport system. On the other hand, it can be assumed that for small performances, support services can be offered using an aggregator. The latter will then ensure the contracting of the necessary amount of capacity and power from small operators of electricity production plants and as a whole will be able to offer support services in the required quantity and quality. This is another possible source of income from the installed power plant with storage.

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