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The influence of photovoltaic and nuclear energy sources on the use of land in the Czech Republic

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Abstract: The human population is highly dependent on electricity, and to maintain the current progress of its use and for future requirements, it is necessary to look for ways to ensure sufficient energy. The aim of the article is to compare nuclear energy as a representative of non-renewable energy sources with photovoltaic energy as a representative of renewable energy sources (RES). The comparison is made in terms of the effect on agricultural land occupation, given that soil as a basic production factor is completely unique and that nuclear energy sources are often used as a backup for RES. We used a quantitative research method based on deduction using available real data to compare agricultural land occupation by these two energy sources. The results indicate that the effect of photovoltaic power plants on agricultural land occupation is 100 times greater than that of nuclear power plants. In terms of the effect on agricultural land occupation, the combination of solar and nuclear power plants seems to be appropriate. This combination partially eliminates the negative agricultural land occupation consequence of using solar power plants.

Keywords: agricultural land resources; electricity; nuclear power plant; photovoltaics; soil

At present, in the field of energy, great attention is paid to renewable energy sources (RES). The basic RES usable in the Czech Republic are mainly wind energy (wind power plants), solar energy (solar photovoltaic power plants) and biomass (biomass combustion). Replacing fossil fuel energy sources with RES is a worldwide effort. This article deals with the comparison of two different sources of electricity in terms of their effect on agricultural land occupation. The most used renewable source in the Czech Republic is the solar photovoltaic power plant. The main non-renewable low-emission energy source in the Czech Republic is the nuclear energy source (Czech Statistical Office 2020). Agricultural land is also one of the basic factors of production and is a basic input factor affecting each country's economy, as its quantity is limited. The land is used primarily for agricultural production but also for other activities ensuring economic prosperity and the satisfaction of human needs, including the energy needs of the population.

THE BASIS OF RES

RES are those that are naturally renewed in terms of human life expectancy. They are therefore considered inexhaustible. Their main advantage is low-emission effects on the environment. Even in the case of RES, it cannot be said that they are emission-free because during production, maintenance and disposal, there is some emission effect on the environment. However, compared with non-renewable energy sources burning fossil fuels, the effect is significantly lower. The basic RES include solar energy, wind energy, tidal energy, wave energy and geothermal energy. In the case of solar energy, it is possible to obtain electricity by direct and indirect methods. The direct method is based on the principle of the photovoltaic phenomenon (or photoelectric effect), where electrons are released by the action of light. The indirect method is based on obtaining heat from solar energy (Gielen et al. 2019).

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Photovoltaic power plants

As the graph in Figure 1 shows, photovoltaic energy sources are the most important among a number of RES in the Czech Republic in the size of installed capacity, which is 2.1 terawatt hours of electricity (TWhe) (amount of electricity produced/consumed in one hour) (Energy Regulatory Office 2019). For example, in 2019, 2.3 TWhe was produced in the Czech Republic by means of photovoltaic power plants. As the graph in Figure 2 shows, the value of electricity produced by photovoltaic power plants has been reaching very similar values for a long time, despite the considerable pressure exerted by the national government. As follows from the overall overview of the electricity balance in the Czech Republic in 2019 (Figure 3), a total of 87 TWhe were produced in the Czech Republic. However, this production of electricity by using photovoltaic power plants with a value of 2.3 TWhe does not correspond to 9% (the value of the installed capacity in terms of the portfolio of production sources) but only to 2.6%. This production level is because photovoltaic power plants produce efficiently only if there are suitable environmental conditions – high intensity of sunlight, cold environment, etc. If the climatic conditions are not ideal, the potential of photovoltaic panels is not fully exploited, and the actual amount of electricity does not match the value potentially possible – the value of the installed capacity (Energy Regulatory Office 2019; European Environment Agency 2020).

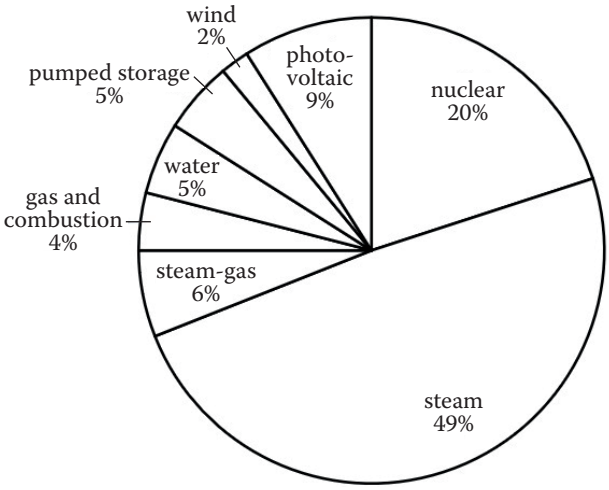

Figure 1. The part of installed capacity of various sources in the Czech Republic

Source: Energy Regulatory Office (2019)

The actual efficiency of photovoltaic panels – the conversion of solar energy into electrical energy – is approximately 15%, and its value is highly dependent on the surrounding external conditions. The efficiency increases with the increasing intensity of sunlight. Contrarily, with increasing cell temperature, the efficiency decreases significantly; photovoltaic panel manufacturers most often state that when the temperature increases by 10 °C, the power decreases by up to 4%, and when the temperature increases by 25 °C, it decreases by up to 10% (Dubey et al. 2013; Praveen and VijayaRamajaru 2017). From this information, it can be deduced that photovoltaic panels achieve the highest efficiencies and the highest power at the turn of the seasons from winter to spring, when there are low air temperatures and a suitable angle of impact of solar radiation with high intensity (Firas 2018). As stated by individual manufacturers of silicon photovoltaic panels (the type most frequently used in the Czech Republic), a photovoltaic cell with a size of 10 × 10 cm can produce 1.5 W with 3 ampere (A) direct current (DC) parameters of 0.5 V (Rashel et al. 2017).

To achieve higher performance, the photovoltaic cells are connected in series to increase the output voltage and in parallel to increase the value of the flowing current. This structure creates photovoltaic panels composed of individual cells. These panels are further connected in various ways to achieve the desired power output values (Askari et al. 2015; Parida et al. 2019).

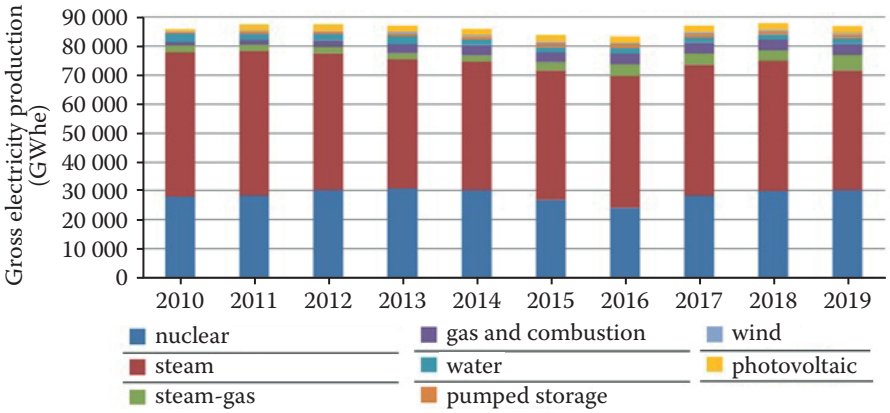

Figure 2. Development of gross electricity production

GWhe – gigawatt hours of electricity

Source: Energy Regulatory Office (2019)

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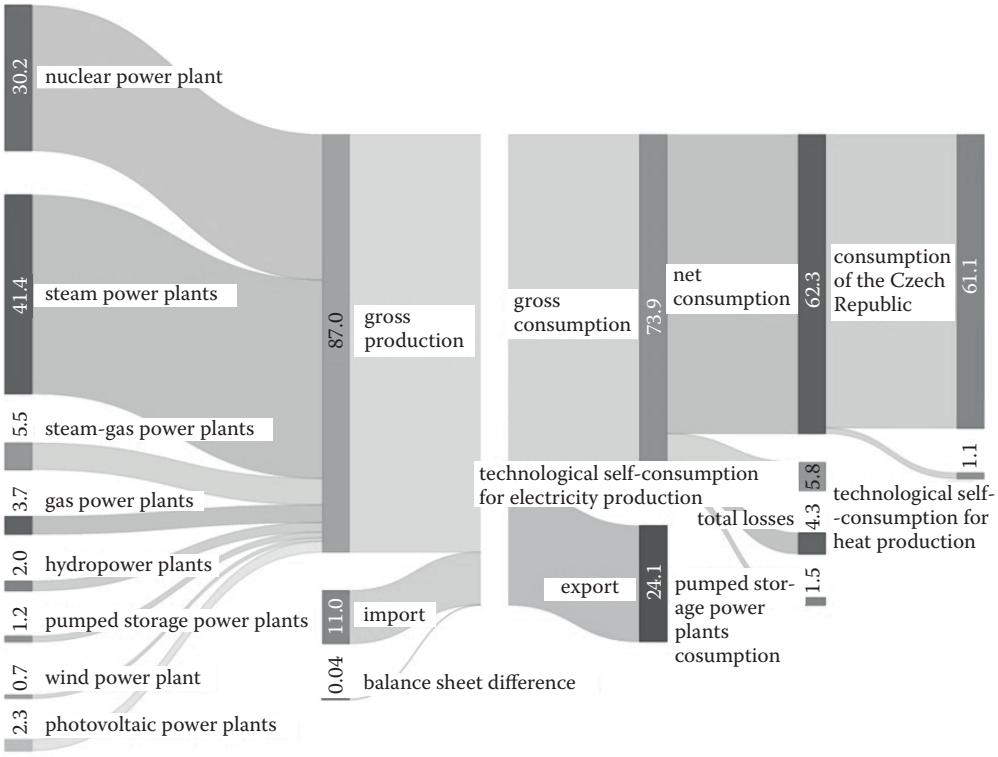

Figure 3. Electricity balance for 2019 (TWhe)

TWhe – terawatt hours of electricity
Source: Energy Regulatory Office (2019)

The suitability of a locality for solar energy production and its conversion by means of a photoelectric effect into electrical energy is best described by the total solar radiation map, which is based on long-term meteorological measurements. Figure 4 shows this map for the Czech Republic and indicates that, on average, over a period of one year, 940 kWh to 1 337 kWh of solar energy falls on an area of 1 m^2. It is obvious that, on average, during the year, the most solar energy falls in the area of South Moravia (Czech Hydrometeorological Office 2019; Chudinzow et al. 2020).

As the graph in Figure 5 shows, most electricity was generated in 2019, for example, by using photovoltaic power plants in the summer months. The production of electricity by using photovoltaic panels is not constant over time; its value varies depending on environmental conditions. However, long-term statistical data show that photovoltaic panels produce the maximum

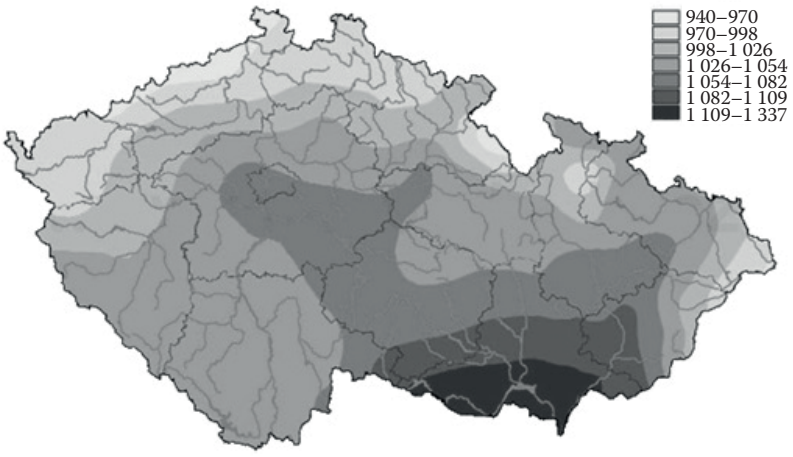

Figure 4. Average annual total solar radiation in the Czech Republic (kWh/m^2)

Source: Czech Hydrometeorological Office (2019)

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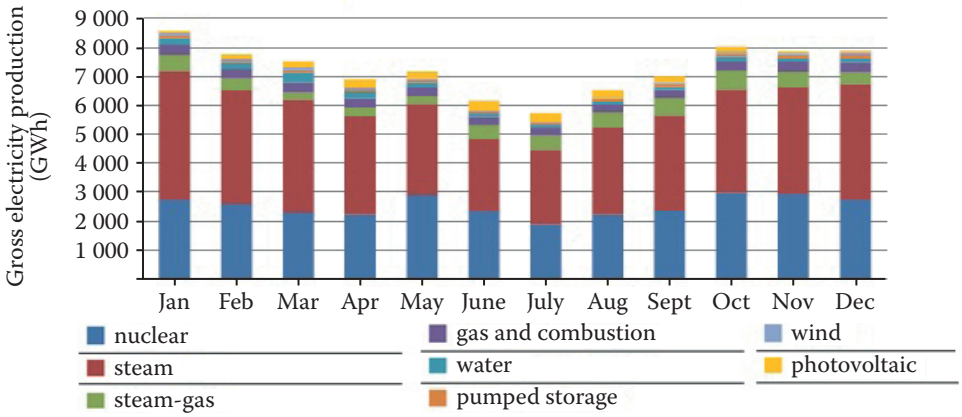

Figure 5. Gross electricity production in individual months

Source: Energy Regulatory Office (2019)

values of electricity during the summer months of individual years (Energy Regulatory Office 2019).

Advantages. In terms of benefits, it is important that the use of solar energy for electricity is, from the point of view of human life expectancy, an inexhaustible naturally renewable energy source. During the operation of a photovoltaic solar power plant, no emission substances harmful to the natural environment are generated, especially the production of the greenhouse gas CO_2. The operation is also completely quiet, as no relative movement of power plant parts is required. It is a completely autonomous unattended source with the possibility of remote control, and it is a very reliable device (Lakatos et al. 2011).

Disadvantages. Like any energy source, a solar photovoltaic source has certain disadvantages. The main disadvantages include the instability of electricity production over time. As the intensity of solar radiation fluctuates due to climate change, as well as changes in the form of the daily cycle, the value of electricity produced fluctuates during the day or throughout the year. It is important to take such a fact into account when designing the energy policy and to provide a suitable energy source for backup needs at a time of low electricity production from solar photovoltaic sources. Another disadvantage may be the relatively low efficiency of photovoltaic panels in the process of converting solar energy into electrical energy. For commercially available panels, the efficiency is approximately 15%, although theoretically, it is possible to reach a value of up to 34%. Over time, however, the efficiency of solar photovoltaic panels continues to decrease, and their productive lifespan is approximately 20 years (Lakatos et al. 2011).

Nuclear power plants

There are currently two nuclear power plants operating in the Czech Republic – the Temelín Nuclear Power Plant and the Dukovany Nuclear Power Plant. Their total installed capacity is 4.29 TWhe. In 2019, the nuclear power plants provided 35% of the total annual electricity production in the Czech Republic (Energy Regulatory Office 2019).

Advantages. One of the great advantages is that nuclear power is an intensively reliable source, and its operation is only weakly affected by external conditions. Another advantage is that the volume of fuel consumed per unit of electricity produced is very small. A 1 000-megawatt electric (MWe) nuclear unit needs only approximately 32 tons of nuclear fuel per year. The fuel can thus be transported without problems and at low costs, even over long distances, and its stocks can be stored for several years in advance. Also, the volume of waste from used nuclear fuel is relatively small – the same amount in volume as fresh fuel. The effect of storing used nuclear fuel on agricultural land occupation is negligible. In both nuclear power plant sites in the Czech Republic, used nuclear fuel is stored directly in the guarded zone of the nuclear power plant, always in a separate building with an area of approximately 700 m^2. The capacity of the secured areas of such a building is the production of all the fuel used for the entire life of the power plant. Used fuel can be safely stored directly on the grounds of the nuclear power plant with the maximum degree of security. Used nuclear fuel is also a valuable raw material, as it can be further reprocessed and reused as fuel in nuclear power plants. The big advantage is that the production costs of this source are relatively (compared with other energy sources) very small. These operating nuclear power plants were originally expected to have a service life of approximately 30 years; however, it has emerged that they can be operated safely for much longer (the state energy policy of the Czech Republic talks about a lifespan of more than 50 years). Thanks to this

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lifespan, nuclear power is one of the cheapest sources of electricity in general. Another advantage is the small area occupied by the power plant per unit of supplied electricity because it is a very concentrated energy source. During normal operation (except for abnormal to emergency operating conditions), it is a very ecological resource. Problems with environmental effects occur only in the event of an accident, sabotage or misuse of the potential of this energy source or nuclear waste. Compared with other energy sources, nuclear energy has the advantage that the nature of radioactive decay and the action of ionising radiation allows us to measure radioactive discharges very accurately and evaluate their direct and indirect effects on humans and the environment. These measurements are performed for both Czech nuclear power plants. However, radioactive substances have been present all around us since the formation of our planet, regardless of the existence of a nuclear power plant. Natural sources of ionising radiation include cosmic radiation and radiation from radioactive elements contained in the Earth's crust. Artificial sources of ionising radiation include equipment for medical applications of ionising radiation, radioactive elements resulting from nuclear weapons tests and, for example, television screens. In connection with concerns about global warming, the importance of nuclear power plants is constantly increasing. Nuclear power plants produce electricity at base load without emitting greenhouse gases. Nuclear energy is one of the most environmentally friendly sources of electricity production. The operation of nuclear power plants does not damage the environment, does not produce greenhouse gases and does not consume oxygen and resources (such as oil, coal, natural gas and other fossil fuels), which are of irreplaceable importance, including for the chemical and other industries (IEEE 2006; Ministry of Industry and Trade 2015; Ye 2016).

Disadvantages. One of the disadvantages of nuclear resources stems from their size and scale. According to the market model, there are large barriers to entry into this sector for the construction of this type of resource. The construction can thus be carried out only by a large investor (or an association of investors, consortium, etc.). At the same time, there must be a certainty that this energy source can be operated for a sufficiently long time to return the investment with a share of profitability. Nuclear energy uses very advanced technology, which requires a high level of technological education and, at the same time, the organisation of the company running it and its management system. The potential use of nuclear energy is also affected by the degree of public acceptance. Aspects perceived by the public are primarily the risk of an accident with an effect on the environment and the management of spent nuclear fuel. The generation of a small amount of highly radioactive waste (approximately 32 tons/year from a power plant with an output of 1 000 MWe) can also be considered a disadvantage. In recent years, however, this material is not considered directly as waste but as a material that offers great energy potential for further use – for example, after reprocessing again as a fuel for nuclear power plants. However, spent nuclear fuel is a material that must be treated properly; the prevention of its theft and misuse must be ensured, environmental safety must be ensured, and its careful registration and monitoring must be ensured. At present, all spent nuclear fuel from both domestic nuclear power plants is stored in the relevant location of the power plant. It is stored in special containers that guarantee these safety measures. These containers are located in spent nuclear fuel depots, which are located directly in the guarded area of the domestic nuclear power plants. Another disadvantage is the risk of an accident with a far-reaching effect on the environment. The probability of such an accident in the case of domestic nuclear power plants with a pressurised water type of reactor is very low; however, it is not completely impossible (IEEE 2006; Ye 2016).

An important aspect at present is the requirement of the European Commission to build a permanent, deep repository for nuclear waste by 2050. This requirement is based on the proposal of the European Commission. The draft taxonomy text states that nuclear power should be considered a sustainable economic activity if European Union (EU) countries that host the plants can safely dispose of toxic waste and meet the criteria of causing 'no significant damage' to the environment. The construction of new nuclear power plants will be recognised as green for permits granted until 2045, the text says. If the proposal is approved by the majority of EU Member States and also by members of the European Parliament, it will also be necessary to consider the potential agricultural land occupation for the construction of a deep nuclear waste repository in connection with nuclear energy (Financial Times 2022).

There is currently a dependence between photovoltaic and nuclear sources. Solar energy sources produce electricity only under suitable climatic conditions. Electricity cannot currently be stored efficiently, with the exception of pumped storage hydropower

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plants. However, this can be a problem if people need electricity and, at that time, there are no suitable climatic conditions for the operation of solar power plants. For this reason, solar energy sources must be backed up by other suitable sources that do not harm the environment by producing emissions during operation. These backup sources are mainly nuclear power plants, which can be operated at a lower power level, and in the event of a power shortage in the transmission system, the power can be proportionally increased. Otherwise, nuclear power plants can be operated at maximum (nominal) power, and when climatic conditions are suitable for the operation of RES, the power of nuclear power plants can be reduced within the secondary power regulation. However, existing central nuclear energy sources are not primarily designed for frequent power level changes. The number of such cycles of reducing and increasing the power level has a negative effect on the lifetime of nuclear power plants. For easier regulation in the transmission system, small modular reactors (nuclear reactors with an installed capacity of up to 300 MWe) appear to be a more suitable option. These can be connected to or disconnected from the transmission system as decentralised energy sources (Hedayat 2020).

It follows from this information that it is not clear what effect individual energy sources have on agricultural land occupation. As already described, the subjects of comparison are photovoltaic and nuclear sources in terms of their effect on agricultural land occupation. Because of this gap in research concerning the effect of energy sources on land use, the main goal of this article is to compare these two energy sources, especially their effect on agricultural land occupation. The amount of agricultural land is limited, and this commodity is irreplaceable in terms of useful capacities, so it is necessary to assess whether a backup of solar energy sources by nuclear energy sources does not disproportionately devastate agricultural land.

MATERIALS AND METHODS

For the purposes of this analysis, we used the method of direct calculation of the size of agricultural land for various energy sources. The considered energy sources are nuclear and photovoltaic power plants. For nuclear power plants, we used the equivalent of the area the Temelín Nuclear Power Plant occupies. For photovoltaic power plants, we used data provided by various manufacturers of photovoltaic panels. For the amount of electricity, which is the input data of the comparison, we used the amount produced in the Czech Republic in 2019 from nuclear power plants. The comparison is focused on the land of the Czech Republic and the agricultural land occupation of the Czech Republic.

RESULTS

There is a global trend of increasing the use of RES, as environmental protection is a priority for every country. However, in line with the requirements for increasing the use of RES, it is also necessary to address the issue of their backup. RES, as described (especially photovoltaic and wind), are sources that depend on the daily cycle and current state of the climate – on the actual weather. It is, therefore, necessary to have an adequate compensation of installed capacity for these sources when the conditions for their energy production are not optimal. Given its specific properties, nuclear energy is a suitable variant; it is the only large, stable low-emission energy source that is capable of producing electricity without being affected by the weather and that has a low effect on agricultural land occupation (and thereby a low effect on agriculture).

Agricultural land occupation by individual energy sources with an effect on agriculture

The total area of the land of the Czech Republic is 7 887 027 ha. The area of the agricultural land as of 31 December 2017 is 4 205 288 ha. Agricultural land, therefore, is 53.3% of the total land of the Czech Republic, of which 37.5% (2 958 603 ha) is arable land (from the total area of the land of the Czech Republic). Hop gardens occupy 10 066 ha, vineyards 20 008 ha, gardens 164 815 ha, orchards 45 245 ha, and permanent grasslands (meadows and pastures) 1 006 552 ha. Forest areas occupy 2 671 659 ha (33.9% of the total land area of the Czech Republic), water areas 166 253 ha, built-up areas and courtyards 132 333 ha, and other areas 711 464 ha (Ministry of Agriculture 2018).

Nuclear power plants – Effect on agricultural land occupation. We are using the Temelín Nuclear Power Plant as an example. It is a relatively modern nuclear power plant with a large output within one production unit – approximately 1 100 MWe. The power plant is constructed with containment, which is a safety barrier preventing the spread of radioactive substances into the environment in the event of a nuclear accident. The Czech Republic's state energy policy involves the consideration of constructing nuclear power plants of a type similar to the Temelín Nuclear Power Plant. The Temelín Nuclear Power Plant,

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with its installed capacity of 1 100 MWe, covers a total area of 143 ha. At present, the nuclear power plants in operation in the Czech Republic have an installed capacity of 4.29 TWhe. If we consider the same rate of land use as in the case of the Temelín Nuclear Power Plant, the total area for the value of installed capacity of 4.29 TWhe would be 557.7 ha. This area then corresponds to the value of 0.0071% of the land of the Czech Republic and the value of 0.0132% of the agricultural land of the Czech Republic (Ministry of Industry and Trade 2015; European Commission 2020).

When considering the acquisition of agricultural land in connection with the construction of a deep depository facility with a capacity of 9 000 tons of spent nuclear fuel (the production of spent nuclear fuel for 90 years of operation of the currently operating nuclear power plants in the Czech Republic), the considered area of nuclear power plants is increased by 23.4 ha. This use of land is a project being considered by the State Office of Radiation Protection in the Czech Republic. Their study states that for the storage and handling of excavated rock outside the area of the deep repository, the area can be reduced by more than half. In considering the area of 27.3 ha, there is an increase in the use of the land to the value of 0.0073% and in the case of the agricultural land to the value of 0.0138% (State Office of Radiation Protection 2016).

Photovoltaic power plants – Effect on agricultural land occupation. Nuclear power plants in the Czech Republic in 2019, with an installed capacity of 4.29 TWhe, produced a total of 30.2 TWhe [30 246 200 000 kilowatt hours of electricity (kWhe)]. The power of photovoltaic panels is often given in units of kilowatt-peak (kWp), which is the unit of peak power of a photovoltaic panel per power plant, which is the power of the photovoltaic panel per power plant under standard test conditions (solar electromagnetic radiation strikes the panel vertically and has a power of 1 kW/m^2, ideal atmospheric transparency, panel temperature 25 °C). Such conditions are not standardly available during the normal operation of solar panels in industrial practice. However, long-term statistics show that 1 kWp of installed capacity produces an average of 950 kWhe per year in the climate of the Czech Republic. Commonly available photovoltaic panels from various manufacturers with an output of 1 kWp occupy a total area of approximately 6.1 m^2. Therefore, if we wanted to ensure the production of 30.2 TWhe (30 246 200 000 kWhe) in one calendar year by using photovoltaic panels, we would need panels with a total area of 194 212 442 m^2. For the construction of solar power plants, however, it is necessary to consider an area three times larger (various manufacturers and suppliers state two to four times larger) to prevent mutual shielding, maintenance, etc. For this model, three times larger is considered. Such a solar photovoltaic power plant would therefore occupy an area of 582 637 326 m^2, thus 58 263 ha. For the total land of the Czech Republic, this area is 0.7389% and 1.3855% of the total value of agricultural land. It is obvious that these are approximately 100 times the values of the land or agricultural land occupation in comparison with nuclear power plants (Ministry of Industry and Trade 2015; European Commission 2020). On the basis of these findings, in the conditions of the Czech Republic, nuclear power plants occupy 100 times less agricultural land than solar photovoltaic power plants.

The possibility of using brownfields to mitigate the effect on agricultural land occupation. A brownfield is a property (land or building) that is underused and neglected and may even be contaminated. It was created as a remnant of industrial, agricultural, military or other activities. It can be individual buildings, building complexes, campuses with buildings or just areas without buildings. These include unused agricultural and industrial buildings and sites, unused transport structures and warehouses, empty administrative buildings and cultural centres, unused shopping centres, and also unused residential buildings. According to results from a study by the CzechInvest Agency, a total of 2 355 brownfields with a total area of 10 362 ha were identified in the Czech Republic, with a distribution as shown in Figure 6 (Klusáček et al. 2014; CzechInvest 2022).

One of the alternatives for using brownfields is the construction of solar photovoltaic power plants. Some brownfields (former landfill types) may have unstable subsoil. Therefore, they are not suitable, for example, for the construction of wind power plants. Such brownfields are suitable precisely for the construction of photovoltaic power plants, which do not have such strict requirements for the stability of the subsoil. Such a combination of a solar power plant built on an original landfill site can also serve to collect biogas from the base of the solar power plant. Figure 7 shows the distribution of solar power plants with an installed capacity of more than 1 megawatt-peak (MWp) in the Czech Republic.

Comparing the distribution of brownfields in Figure 6 and the distribution of solar power plants in Figure 7, it is clear that currently the majority of solar power plants with an installed capacity greater than 1 MWp are located outside the identified brownfields.

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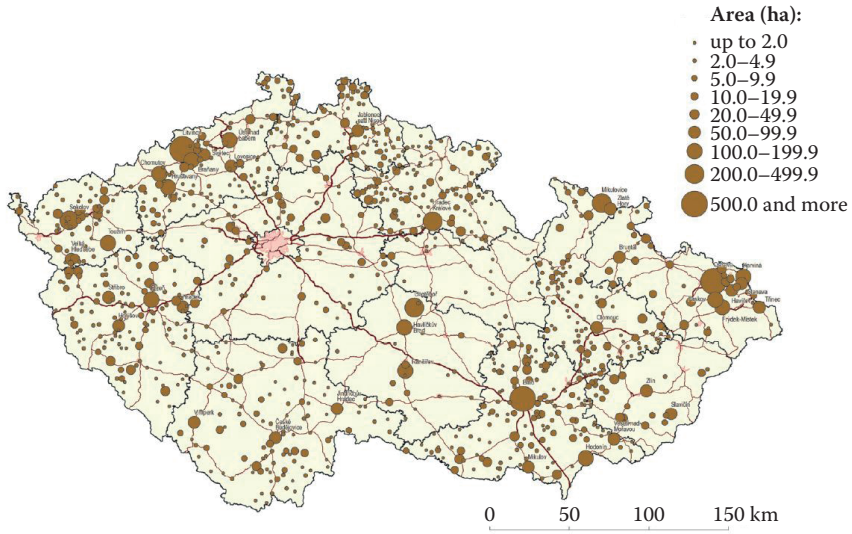

Figure 6. Spatial distribution of brownfields in the Czech Republic

Source: Klusáček et al. (2014)

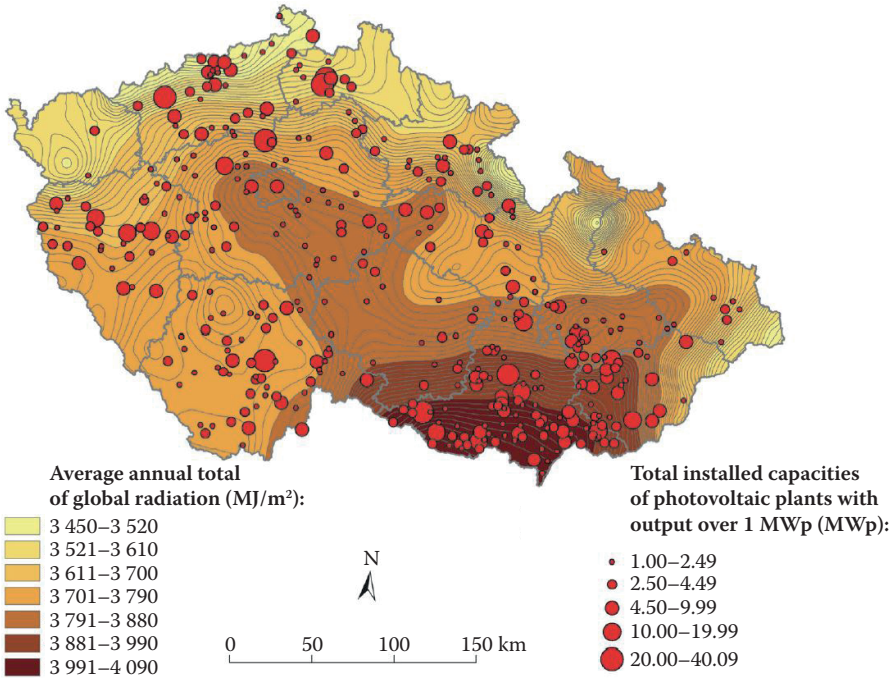

Figure 7. Spatial distribution of solar power plants in the Czech Republic

MWp – megawatt-peak
Source: Klusáček et al. (2014)

It is also clear from Figure 7 that the density of the location of photovoltaic power plants is greatest in South Moravia, which has the greatest total intensity of solar radiation. If we were to consider a simple model (described in the Photovoltaic power plants – Effect on agricultural land occupation section) when installing photovoltaic panels on the entire area of identified brownfields, it would be possible to produce 5.4 TWhe (5 379 247 968 kWhe) annually, which covers 7.3% of the total annual electricity consumption of the Czech Republic (Figure 3).

The installation of photovoltaic power plants on brownfields has some fundamental advantages. These are mostly locations with the existing infrastructure that facilitates the transportation of material and also the output of the produced power. The surfaces are often paved. Brownfields are often located near large consumers of electricity, so it is possible to consider the direct consumption of produced electricity without the need for storage or solving the problem of overflows in the electricity network.

DISCUSSION

Agricultural land is the basic natural wealth of the Earth, an irreplaceable means of production enabling

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agricultural production and is one of the main components of the environment. The protection of agricultural land and its improvement and rational use are activities that also ensure the protection and improvement of the environment. The amount of agricultural land is limited, so it is necessary to consider all the influences and effects of these decisions when deciding on its use. Research on the effect of restructuring the energy sector on agriculture is not sufficiently considered in terms of agricultural land occupation. Within the Czech Republic and the entire EU, it is necessary to take into account the influence of individual energy sources on agricultural land occupation. The common goal of the EU Member States is to increase the share of RES at the expense of non-renewable energy sources. However, it is necessary to consider the effects of this change on the agricultural sector and agricultural land occupation. In comparing photovoltaic and nuclear power plants in the conditions of the Czech Republic and in relation to agricultural land occupation, it is clear that photovoltaic power plants occupy approximately 100 times more area than do nuclear power plants – and often this is agricultural land. As is clear from this article, the construction of a deep repository for nuclear waste has only a very small effect on agricultural land occupation in the context of comparing nuclear and photovoltaic energy sources. This fact is important, as agricultural land is scarce, irreplaceable and non-reproducible. In terms of creating a common energy policy, for example for the EU Member States, this fact should be taken into account.

Using brownfields for the construction of solar power plants can mitigate the effect of agricultural land occupation. As mentioned, 10 362 ha of brownfields are available in the Czech Republic. When used for photovoltaic power plants, they can provide an annual production of electricity in the amount of 5.4 TWhe (7.7% of the total annual electricity consumption of the Czech Republic) without occupying agricultural land.

CONCLUSION

On the basis of these findings, in the conditions of the Czech Republic, nuclear power plants, even when considering the construction of a deep repository for nuclear waste, occupy 100 times less agricultural land than solar photovoltaic power plants. In terms of the effect on agricultural land occupation, the combination of solar and nuclear power plants seems to be appropriate. This combination partially eliminates the negative agricultural land occupation consequence of using solar power plants. The effect of appropriate backup on reducing emissions is thus significantly enhanced by reducing the use of irreplaceable agricultural land. This reasoning is generally valid for the use of comparable energy source technology in general and not only in the Czech Republic.

As stated, a possible solution for eliminating agricultural land occupation when building photovoltaic power plants is the use of brownfields. If brownfields are fully used in the Czech Republic for the operation of photovoltaic power plants, it would be possible annually to produce electric energy in an amount corresponding to 7.3% of the consumption of electric energy in the Czech Republic, without affecting the agricultural land occupation.

In this article, we compared only solar and nuclear energy sources in the Czech Republic. Research in this area, from the point of view of a larger entity such as the EU, should focus further on the currently supported energy policy. In terms of the effect on agricultural land occupation, other energy sources should be analysed, precisely in the context of the resources preferred by the energy policy.

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