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A POLYCENTRIC APPROACH TO THE GREEN ENERGY TRANSITION IN BULGARIA

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A POLYCENTRIC APPROACH TO THE GREEN ENERGY TRANSITION IN BULGARIA

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Abstract: Ostrom's polycentric model for the governance of social systems has been gaining popularity as an alternative approach to the low-carbon energy transition in recent years. This article considers its potential application to three issues in Bulgaria's green energy transition: finding substitutes for coal-based electricity production in the Maritsa-East lignite complex, providing new employment opportunities for workers affected by the transition, and understanding the broader social impacts of moving away from the traditional hierarchic model in the energy sector. It is important to note that while polycentric organizing is intended to support low-carbon solutions, it could also serve the interests of coal energy actors, who may prioritize short-term gains over the long-term public interest. Overcoming inertia is a major challenge for adopting the polycentric principle as part of Bulgaria's industrial policy, particularly in implementing decentralized low-carbon energy solutions.

Keywords: polycentric governance systems; energy transition; coal phase-out; Maritsa-East; Elinor Ostrom

JEL codes: L94; P48; Q48; Q52

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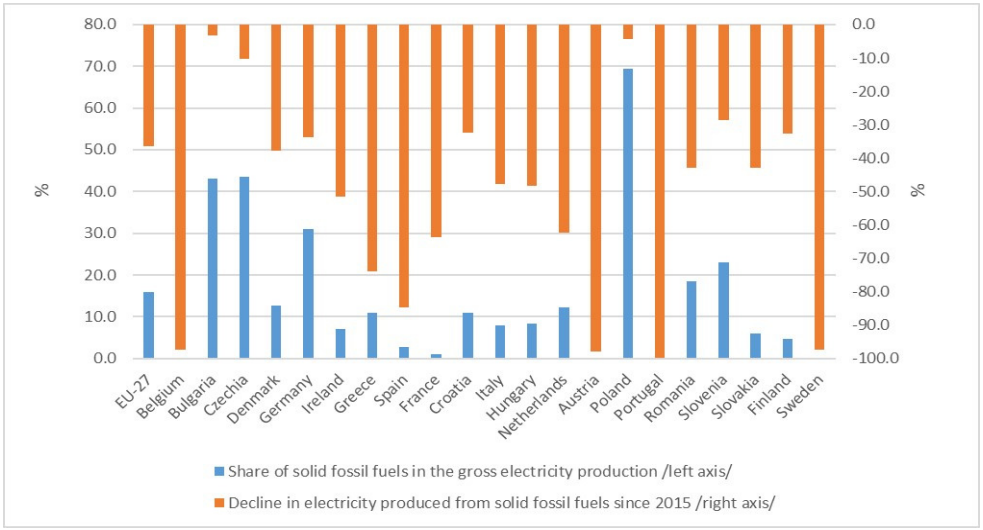
Introduction

Although theorized much earlier, the fundamentals of the modern polycentric approach to the governance of social systems were laid by Vincent and Elinor Ostrom during the 1960s with their research on self-emerging multipolar governance structures in the metropolitan areas of the United States (Ostrom, 2010a). Polycentricism is an interdisciplinary concept that overlaps with different theoretical frameworks like social-ecological systems and multilevel governance, among others (Partelow, 2018). Its practical applications include managing irrigation systems (Ostrom, 1990), sustainable governance of pastures, forests, and fisheries (Chhatre & Agrawal, 2009), conservation and management of protected areas,

waste management, and energy systems (Sovacool, 2011; Bauwens, 2017). The latter is the focus of this article.

At first sight, the framework of effective communal governance of primary resources laid out by E. Ostrom in her seminal book *Governing the Commons* does not presuppose a successful application in the energy sphere – at least not the energy of the 20th century. Yet growing awareness of the climate and energy crises over the last few decades has accompanied an urgent demand for new concepts and solutions, opening the door for applying Ostrom's polycentric approach in the energy sector (Goldthau, 2014). An influential input in this respect was Ostrom's policy paper of 2009, commissioned by the World Bank, where the eminent economist stresses that a multitude of local initiatives, despite their small individual scale, might contribute to the mitigation of the global climate crisis (Ostrom, 2009).

Transforming the Bulgarian energy system in accordance with the European Union's Green Deal initiative (as outlined in van Zanden, 2020) is a critical challenge for the national economy. The exit from coal-based energy, expected at the latest by 2038, will make redundant tens of thousands of Bulgarian energy workers (Alves Dias et al., 2018). In addition to this structural unemployment, the entire national energy system will have to undergo deep transformations. As evident in Figure 1 (left axis), as of 2022, solid fossil fuels, mostly lignite, were responsible for 43% of the gross electricity production in Bulgaria; the EU average was only 15.9%. The right axis of Figure 1 reveals the diminishing role of fossil fuels for electricity generation in the EU; Bulgaria had the smallest contribution to lowering the EU's electricity carbon footprint.



Source: Author's calculations based on Eurostat data.

Figure 1. Share of solid fossil fuels in the gross electricity production for 2022 and decline in electricity produced from solid fossil fuels since 2015

Despite several publications on the theoretical contributions of Ostrom appearing in the last several years in the Bulgarian literature (Sabotinova, 2019; Egbert, Sedlarski & Todorov, 2023), the concept of polycentric governance is still a novel one within the national economic discourse. The same, to a certain extent, is also valid at the international level: a recent bibliometric study states that the conceptual debate on polycentric energy governance is "living its early days" (Petrovics, Huitema & Jordan, 2021). This article is the first attempt to discuss the polycentric governance approach as an organizational alternative for the green and just energy transition in Bulgaria. The next section introduces Ostromian polycentrism, paying attention to its application in energy systems. The third, fourth, and fifth sections are dedicated to three issues of the national energy transition that might utilize the polycentric approach: electricity production after closing coal power plants, new employment opportunities during the energy transition, and the energy transition's broader social effects along polycentric lines. The last section concludes with a short discussion on the feasibility of the polycentric energy approach, both globally and domestically.

The polycentric approach in the energy sector

Epoch-making inventions of the late 19th and early 20th centuries altered not only the lifestyles of individuals but also the social system itself (Gordon, 2016). In electricity production, the principles of expansion and centralization established a hierarchical system: huge power facilities aimed at economies of scale while centralized networks sprawled to capture every end consumer (Hughes, 1983). This mode of organization of the electricity system reflected the Zeitgeist before the World Wars, yet it remained dominant long thereafter. It even persists today due to the strong path dependency in the energy sector.

Claims about the universality of the hierarchical energy model have been challenged in recent decades in two major respects. The first is the effort of the European Union to liberalize its energy system by separating the ownership of energy production from distributional networks (Goldthau, 2014). The second is the possibility of supplying off-grid energy services, for instance in Africa or rural China. Ostrom and her collaborators additionally confirmed that mainstream energy systems might be supplanted by effectively governed low-carbon energy commons.

In the broadest sense, human society and the economy do not adhere to the "state–individual" dichotomy: there exists a multitude of overlapping and nested social

structures – groups, institutions, conceptual levels, etc. – situated between these two extremes. Medial structures of human society and the economy are equipped with mechanisms that suppress unwanted activities and promote socially desirable behaviour (Turchin, 2003). Such intermediate structures might emerge: on a territorial principle, as a neighbourhood, city, municipality, mountain region, or coastline; on the basis of occupational, guild, or class criteria; in a religious, ethnic, or opinion minority group; or by rising to the challenge of governing common-pool resources.

Entities on this sophisticated *meso* structural level interacting in both micro and macro directions might be labelled as polycentric. Ostrom's more formal definition states: "Polycentric systems are characterized by multiple governing authorities at different scales rather than a monocentric unit" (Ostrom, 2010b, p. 552). Elinor Ostrom also refers to the definition of a polycentric type of governance by her late husband: "One where many elements are capable of making mutual adjustments for ordering their relationships with one another within a general system of rules where each element acts with independence of other elements" (Ostrom, 2009, p. 33).

In his definitional analysis, Sovacool (2011) compares polycentrism to "nestedness", which involves "multiple authorities and overlapping jurisdictions"." He asserts that polycentric approaches mix "scales, mechanisms, and actors". These scales might be local, regional, national, or global; the mechanisms include centralized commands and regulations, decentralized and local policies, and the free market. Among the actors, in addition to governments, corporations, and households, there are also diverse institutions that make up civil society. "Polycentric climate and energy governance refers to how people and institutions make and enforce decisions concerning various aspects of climate change and energy use" (ibid., p. 3833).

In the broad framework of polycentric systems, community-based energy initiatives, with their most popular form of local renewable energy (RE) cooperatives, deserve special attention (Bauwens, 2017; Lapniewska, 2019). These green energy communities partly cover the energy needs of their members and supply energy to the central network when possible. In this way, they can decrease local energy costs while reducing greenhouse gas emissions. RE cooperatives have expanded greatly in recent years: as of July 2024, the membership of REScoop, the European federation of RE cooperatives, included 2250 energy communities (only two in Bulgaria) that united 1.5 million individuals. According to some optimistic projections, half of the EU population could be producing its own RE by 2050, with 37% of the total electricity being supplied by RE cooperatives (Lowitzsch & Hanke, 2019).

Polycentric prospects for the coal phase-out in Bulgaria

Bulgaria is the only coal-reliant EU economy where coal production increased between 1990 and 2022: during this period, it grew by 5.5%, against the backdrop of an average 64.4% decrease in the EU (Sabev, 2023). More than 95% of Bulgarian coal energy originates in the Maritsa-East basin, where lignite extracted from open-pit deposits is being burnt in several thermal power plants (TPP) situated nearby. These TPPs, with a combined capacity of 3400 MW, have a complex ownership structure: there are private, public, and mixed entities of domestic and multinational origin (for details: see Ilieva, Bardarov & Sabev, 2023). A state-owned company is responsible for lignite production and deliveries. The electricity is sold to the National Electricity Company with quotas determined by the energy regulator KEVR or supplied on the domestic or international free markets. In addition to energy companies and different public bodies, the main actors of this techno-social system include two labour unions, several municipalities (that will lose revenues and jobs when dismantling the energy complex), a group of national and international environmental NGOs, and others. Above these local and national levels, there exist international climate accords and several supranational actors, most importantly the European Commission and its zero-carbon energy policy.

This techno-social system closely resembles polycentrism's above definitions: many formally independent centres of decision-making coexist at multiple levels while operating under an overarching set of rules (Bauwens, 2017). The key interests – sometimes overlapping but also conflicting – of the major actors in Maritsa-East are presented in Table 1.

It is important to note that precisely the polycentric nature of the Maritsa-East energy complex has allowed its thus far successful opposition to stricter energy and climate measures in Bulgaria. Several strikes and street protests in recent years have united labour unions, business groups, and local authorities against future closures, resulting in nationwide transport disruptions, retrograde legislation, and hefty national funding which was secured for the ongoing coal-mining operations. Arguments about climate change, public health (with at least 500 annual excess deaths due to air pollution in Maritsa-East: see Kushta et al., 2021), public financial interests, and the prospects of losing EU funds for the energy transition, have been neglected by this polycentric opposition.

Therefore, polycentrism and its noted resilience as well as adaptability is not necessarily "a force for good" in the field of climate policy. Although Ostrom's polycentrism is mostly seen as a means for achieving desired outcomes, from direct democracy to social and environmental justice, polycentric structures might effectively oppose the change outlined in the present case towards low-carbon energy.

Table 1. Major actors in the Maritsa-East techno-social system and their interests in the future of the energy complex

Major actors	**Interests in the rapid dismantling of Maritsa-East**	**Interests in preserving the status quo**
European Commission	Lower total carbon emissions The New Green Deal carried forward Coordinated energy policy across the bloc	Not provoking anti-EU sentiments EU energy security in cases of contingency
Bulgarian governments	Political approval on the EU level Access to EU funds for energy transition Faster economic and energy cohesion Fewer transfers to state-owned companies Fewer subsidies to the energy sector Impetus for industry and innovation	National energy security Preventing structural unemployment Avoiding opposition of the coal lobby, political parties and labour unions Corruption
Local authorities in the Maritsa-East region	Healthier environment Possibility to implement own regional development programs Access to EU and national transition funds New businesses with new investments	Avoiding drastic loss in tax revenues Avoiding drastic loss in employment Preserving the socioeconomic structure Avoiding regional depopulation
Existing energy businesses in the region	EU and national funds for just transition Public support for modernization and rationalization of production processes Easier access to funds (while major creditors divest from fossil fuels) Healthier labour force	Utilization of the existing production capacity Fossil fuel subsidies Vested financial interests: cold reserve and capacity payments, public procurements, etc.
New businesses in the region	Skilled labour force made available EU and national funds for just transition Utilizing the existing energy and industrial infrastructure Expected lower labour costs	Integrating in the established value chains and profiteering from transfer schemes
Labor unions	Economic modernization Healthier labour conditions Creating a new industrial ecosystem	Preserving membership base and organizational structure Lever for political influence Higher regional wages
Employees in Maritsa-East	Healthy environment and labour conditions Entrepreneurship opportunities (credit lines for new business) Lavish compensations	Higher-paying jobs State-guaranteed employment Coal-industry identity preservation
Green NGOs	Lower carbon emissions Green energy transition Energy decentralization	Funding for research and advocacy Political influence
Regional population	Healthier environment and lower morbidity and mortality New regional future	Higher wage levels Avoiding structural unemployment Preserving induced employment

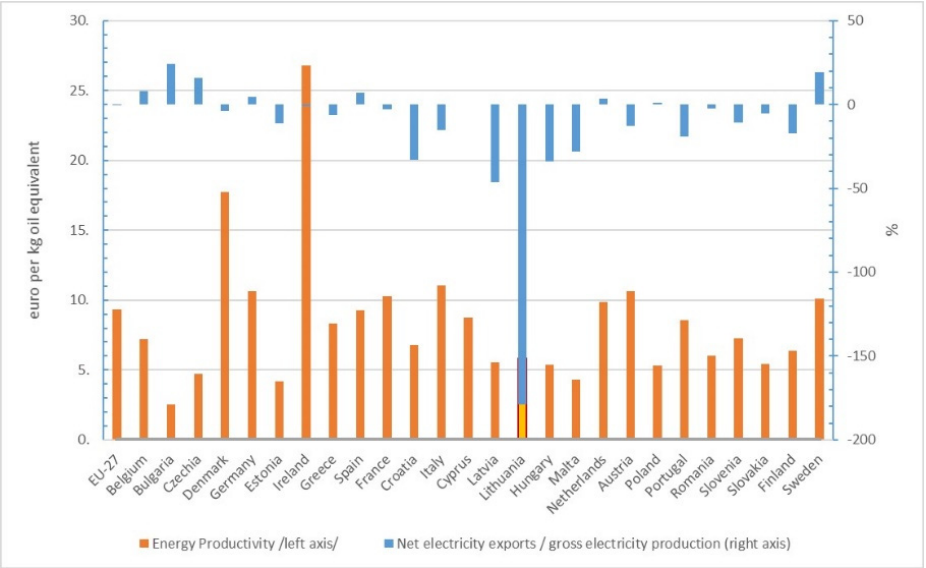
Source: Author's research and analysis.

The issue of replacing coal energy in Bulgaria has no simple solution. Currently, production costs are considerably lower in solar than in coal energy, yet solar panels stand mostly idle in winter and during the night. Without massive storage capacity, the complete replacement of coal and nuclear power plants would be impossible. The lower energy density of RE is another reason why some experts doubt the prospects for rapid greening of the established energy system (Smil, 2010). Vaclav Smil states that decentralizing energy generation and distribution are "the leading mantras of renewable energy advocates" – electricity generation by small units that may or may not be connected to the grid but that are always close to the point of final use (Smil, 2015, p. 223). To refute this idea, Smil uses the example of the Tokyo metropolitan area, stating that its energy needs could only be met entirely by photovoltaics if 70% of its surface were covered by such panels: an obviously impossible proposition.

The solar-only solution discussed by Smil does not suggest replacing the existing hierarchical system with a polycentric one. It would simply substitute one domineering energy source with another. While the widespread use of solar panels could generate RE with lower emissions (and possibly more heat in urban areas), it cannot be considered the "final energy solution." Even if entire metropolitan areas were covered with solar panels, they would not meet the demand for energy during night and winter/summer peak periods. A sustainable energy delivery system would need numerous independent and complementary energy sources – that is, a polycentric approach.

Bulgarian policymakers often relate the potential closure of the lignite complex to replacing it with something of a similar scale, albeit less carbon-intensive: a huge solar park on the degraded coalmine terrains, a new nuclear power plant, a hydrogen megaproject, or equipping all coal TPPs with natural gas installations. This large-scale approach to the energy transition is typical not only for Bulgaria but also on an international level (see EBRD, 2011). Ostrom's polycentric approach suggests a different strategy for the energy transition: a multitude of energy decisions, at both central and local levels, which complement each other and create positive externalities. In the words of Ostrom herself, "Reliance on a single 'solution' may be more of a problem than a solution" (Ostrom, 2009, p. 27).

Additionally, some key energy decisions need to be made outside of the energy production sphere; in the case of Bulgaria, these include rethinking extensive electricity exports, liberalizing the electricity market for households, and addressing the issue of energy productivity. As evident in Figure 2, Bulgaria is the EU member state with the lowest energy productivity (measured in euros produced with 1 kg oil equivalent) and the highest relative electricity exports (calculated in percentages by dividing the net electricity exports by gross electricity production).



Source: Author's calculations based on Eurostat data.

Figure 2. Energy productivity and net electricity exports in the EU countries, 2022

New jobs for those dismissed from coal energy

As of 2022, 11,330 people were directly employed in the Maritsa-East complex; together with the indirect and induced employment, the total number of coal-related jobs approached 32–35,000. Roughly, 60% of the people directly employed in the Maritsa-East complex worked at the state-owned mines and the rest at the TPPs (Ilieva, Bardarov & Sabev, 2023). The Bulgarian labour market is among the most affected by the EU's energy transition plans (Alves Dias et al., 2018). This fact has been weaponized by the labour unions, which predict a spike in unemployment and regional depopulation – although Bulgaria suffers a deficit of labour supply, especially in the industry. With low general and sectoral unemployment, the labour force losing jobs during the coal phase-out will have relatively good prospects of finding new employment in manufacturing and RE.

This prospective new employment depends largely on deploying a polycentric approach. So far, the popular opinion has preferred replacing jobs in the lignite complex with something of an equal magnitude. There have been numerous suggestions about the most "decent substitute": a mega factory for batteries, electric cars, or solar panels; agriculture coupled with solar panels with millions of euros' worth of annual food production; etc. However, instead of a single high-stakes scenario, polycentrism proposes a multitude of lesser-scale employment solutions.

A significant part of the current coal energy workers might leave the labour market as pensioners, as in the United Kingdom or Spain (Fothergill, 2017). The highly skilled engineers of the TPPs could be offered entrepreneurial opportunities in newly built industrial parks in the affected municipalities, with credit lines for innovative energy startups provided by development banks or other financial institutions. Workers with medium skill levels, as well as middle-level managers, might find new employment in RE, machine production, or other kinds of manufacturing in existing or new businesses in the region. Another possibility would be daily labour migration to the booming industrial zone around Plovdiv, only 80 km from Maritsa-East. Rehabilitating the terrains affected by decades of coal mining would create thousands of lower-skill jobs for a period of up to 10 years.

Given the overheated Bulgarian labour market, with a less than 5% unemployment rate, an additional labour supply of 20 or 30 thousand workers (less than 1% of total national employment) of whom most would have considerable industrial skills cannot become the devastating problem suggested by the labour unions but rather a business incentive. Still, there are organizational obstacles: Bulgaria has little experience with polycentric governance, especially in the energy field. Polycentrism requires the deliberate collaboration of the central government with the local authorities, regional businesses, potential external investors, trade unions, and civil society.

Such broad engagement is untypical for Bulgaria, where the medial level of socioeconomic organization suffered during the era of central economic planning, followed by a chaotic market transition (Easterly, 2006). Yet the polycentric approach remains the most promising way to guarantee new employment during the coal phase-out, since the sources of financing for new employment will be multiple and complementary. In addition to the EU energy transition funds, prospective loans from development banks, and national public support, private enterprises (including multinational corporations) have already revealed investment programs with a total worth of 870 million euros for clean energy production and storage in the region. Separately, foreign investment in a large-scale production of solar panels was disclosed in the summer of 2024, with the expected creation of more than 800 new RE jobs. The possibilities briefly listed above do not substantiate predictions of regional desolation – although the price of labour could somewhat decline from its current elevated levels, as it is supported by state-sponsored coal energy.

In the described polycentric model, the role of the central government is of chief importance: not to build factories or new energy structures but to provide a framework that will organize other actors (as was the case in Denmark's wind energy launch: see Bauwens, Gotchev & Holstenkamp, 2016). Polycentrism does not imply a lack of organizational centres but rather the harmony of separate interests on different

levels that constantly seek and incrementally find an optimal interaction model in the process of overcoming challenges.

Polycentric spillovers in energy transition

As noted, the design of the now dominant energy systems reflects and actually influenced the guiding social principles and values of the 20th century. In the case of Bulgaria, the establishment of a vertically and horizontally integrated large-scale energy base under a central command embodied the ideal of Soviet-style industrialization that reached its most accomplished form in the Maritsa-East complex. Conceptually, to stop burning the lignite of Maritsa-East means not only losing an entire economic subsector but also abandoning the idea of national industrial self-sufficiency. This inertia within domestic industrial policy looms as the biggest obstacle to the energy transition.

On the other hand, an energy transition implemented along polycentric lines would strengthen the dormant meso-level social structures in Bulgaria. Excessive fiscal and administrative centralization is a long-standing national issue. According to Eurostat, the tax revenues of the Bulgarian local governments were equal to only 0.8% of GDP in 2022, while the EU average was 4.1% (or even 7.2% if accounting for the province level). A polycentric energy transition might deliver further benefits by enhancing economic decentralization, in addition to its positive effects on Bulgaria's energy security, climate resilience, public health, and energy poverty.

The lessons of the European regions that already underwent an energy transition (for instance, the abandonment of hard coal in the Ruhr area) indicate that each city of an affected territory could follow its own strategy based on its strengths (Herpich, Brauers & Oei, 2018). These might be investments in science, higher education, innovation, different forms of tourism, clean energy utilizing existing delivery networks, the transfer of employees to other industries, etc. The scale and effectiveness of a polycentric energy transition depends on and influences the level of social engagement in the affected economy or region.

Bulgaria has had remarkable examples of communal governance structures, for instance, in the large-scale protoindustrial wool production of the 19th century and successful forestry and agricultural cooperatives in the first half of the 20th century. Paradoxically, it was exactly the period of communist industrialization which most adversely affected the Bulgarian communal spirit. Yet the existence of strong traditions in cooperation and governance over the commons supports the feasibility of a polycentric energy transition for Bulgaria. If realized in practice, it might inspire similar initiatives in other economic sectors or disadvantaged regions.

Conclusion: Polycentric approach as an engine for green energy transition

The polycentric approach to energy transition has certain weaknesses. Its results come at a slower pace since the aligning of interests on different levels and among various actors requires more iterations. For that reason, some authors hold that the model of "Chinese capitalism" often outmatches liberal capitalism in solving problems that require a quick response, including levying carbon taxes or enabling RE production that faces local opposition (Milanovic, 2019; Wolf, 2024).

An even more important limitation is that climate change is driven by anthropogenic activity induced on a systemic level: led by the imperative for endless growth of the capitalist socioeconomic system. A polycentric energy transition offers local solutions aiming at self-sufficiency, while capitalist civilization relies on maximizing supply and demand. Local exclusion from the current global energy system could be sanctioned on a market or political level.

An energy transition along polycentric lines – that is, of self-organized and largely self-sufficient local prosumers – tries to bypass not only the energy hierarchy model but also the dominant socioeconomic system. Energy democracy, which entails decentralization and localization of energy production and transmission, threatens to disrupt a long-established industry; therefore, it will certainly be met with astute ideological opposition. Ostrom herself was not definitive that local polycentric energy solutions would be the main remedy for the climate crisis but only "an important element" (Ostrom, 2009). Polycentric governance may contribute to mitigating the climate and energy crises, but only conditionally so. Energy decentralization requires a vital social structure with many future-oriented decisions that have to be made on a central level.

Despite these broad remarks, when it comes to Bulgaria specifically, a polycentric governance approach may be instrumental in the country's low-carbon energy transition, mostly for the new employment of people dismissed from coal energy. As regards production, the Bulgarian electricity system has to avoid the automatic replacement of one domineering energy source (coal) with another (solar panels). The notion of "green energy" does not fit well with the common practice of building large solar parks far from consumer centres, especially on arable land or in the vicinity of diverse ecosystems. Measures strengthening energy efficiency, localizing production and consumption, and employing a plethora of energy sources while promoting energy innovations could be far more instrumental for the green and just energy transition.

Conflicts of Interest

The author has no conflicts of interest to declare.

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