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Editorial

Energy Security and the Transition toward Green Energy Production

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The topic of this Special Issue, "Energy Security and the Transition toward Green Energy Production", acquired an uncomfortable timeliness while it was still in progress. On 24 February 2022, Russia invaded Ukraine, and a war broke out that posed unprecedented problems for Europe's energy security. All at once, the dependence of Europe's energy supply on Russian gas became obvious to all. Their transition to green energy had to and should continue to proceed even faster, according to political wishes. Europe wanted to become independent, not only from nuclear power, but also from non-renewable energies such as gas, and due to this incident, the transition of this had to go even faster. Therefore, the topicality and importance of our Special Issue cannot be overestimated.

The idea of a transition to green energy is, of course, older than the Ukraine war. In Europe especially, political actors have wanted to move away from nuclear and non-renewable energy and toward renewable energy. There exist several political initiatives that propose this transition toward renewable energy. Most prominently, the European Union (EU) adopted a Green Deal in October 2014 (revised in 2018). However, the US is also interested in this, and President Joseph Biden has pushed for a Green New Deal (GND). The plan is to channel hundreds of billions of dollars into programs that are designed to speed up the country's transition away from an economy that is based largely on fossil fuels to one that utilizes cleaner energy sources.

This legislation has been called the Inflation Reduction Act of 2022. If the deal finally passes, over 10 years, it will give billions of dollars in tax credits to companies that build new sources of emissions-free electricity. The plan is to subsidize wind turbines, solar panels, battery storage, geothermal plants, or advanced nuclear reactors. Moreover, there would be subsidies for the companies that captured and buried carbon dioxide, and for electric vehicles. This proposed legislation also includes spending on agriculture in order to reduce emissions, and on forests to increase their absorption of carbon dioxide.

Also important for this transition are technological innovations that may help pave the way toward green energy. While nuclear energy is regarded by many as the cheapest and most reliable source of energy, and while Hungary plans to build new nuclear plants and the Green New Deal includes subsidies for advanced nuclear reactors, countries such as Germany have shut down their nuclear reactors.

In the wake of the Ukraine war, this has led to a major discussion in Germany about whether to extend the lifetime of their remaining three nuclear power plants, which were scheduled to be shut down at the end of 2022, in order to ensure their energy security. In addition, energy-saving programs were introduced in Germany and elsewhere in the summer of 2022 to ensure energy security, especially for the winter. Households suffered and continue to suffer from higher energy prices. Without a transition to green energy, energy prices would not have had to rise so much, and energy security could have been better ensured by nuclear power plants. Now people are suffering and many are worried about whether they will be able to meet their energy costs, or whether they will have any

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energy at all. In Germany especially, many people are still installing photovoltaic systems and buying emergency generators to secure themselves for the coming winters.

All of this shows that the transition comes with consequences for political, technological, and economic security. On the political side, conflicts about energy are as old as mankind, with energy supplies needing to be secure and thus being of geopolitical importance. Russia is an energy superpower and is ready to use it politically [1]. In Europe, there is a fear that Russia could cut off its gas supplies altogether. A transition away from Russian gas is the program in many countries after the outbreak of the Ukraine war. Green energy can play a major role in reducing this dependence on Russian gas. However, Europe has also made itself vulnerable through its politically desired and subsidy-supported hasty transition to green energy. Germany has shut down many nuclear power plants and cannot replace them without Russian gas. Now, coal-fired power plants in Germany are to increase their production.

On the technological side, the vulnerability of economies is related to their energy reliability. Finally, on the economic side, a transition toward green energy carries important costs, which must be balanced with its benefits and the increasing scarcity of hydrogen resources. Cheap and secure energy is vital to economic growth and prosperity. In this respect, the transition toward green energy must take into account the difficulties of a post-COVID-19 world and the new geographical circumstances caused by the Russian attack on Ukraine. The present Special Issue deals with many of the economic, technological, and geopolitical aspects that the transition to green energy exerts, with a focus on energy security.

In this editorial, we would like to briefly present the contributions to our Special Issue. The Special Issue's articles can be divided into two broad categories. One deals with the economic and political aspects of the energy transition and energy security. The others deal with the technological possibilities of an energy transition to green energy and ask how it is practically and technologically possible to ensure energy security with green energy. The second category includes the paper by Borge-Diez et al. [2]. These authors offer a novel optimization strategy for concentrating solar power plants, with thermal energy storage systems which aim to stabilize and reduce the electricity prices in spot markets. Their findings exhibit the importance of optimized concentrating solar power plants for an energy transition. The authors also offer a strategy that can be extended to other locations in the world. Thereby, they offer solutions for this energy transition.

In the article by Mohammadi et al. [3], the authors optimize a computational model of a new underground passive solar greenhouse, in order to improve the thermal performance, storage, and saving of heat solar energy. These authors compare optimized and conventional passive solar greenhouses, with regard to indoor air temperature, irradiation, and energy demand. Their findings demonstrate that the annual total heating requirement of the optimized model was 30% lower than that of the conventional passive solar system. Thereby, the authors contribute to the technological solutions for the energy transition.

The article by Pierie et al. [4] asks if it is necessary to adjust the current load balancing system from a central to more decentral system. The authors look at different combinations of technology and optimize a scenario. In this scenario, the self-consumption of a municipality obtains a level of around 95%. The total hours per year of production matches the demand to over 90%, and overproduction can be curtailed without any substantial losses lowering the grid strain.

The contribution of Romaniuk et al. [5] article discusses the new technologies that make gas generators that work with agricultural waste more efficient. They analyze the processes that produce gas fuel from agricultural waste. Alternative technologies for energy production may play an important role in the energy transition.

The rest of the contributions discuss the economic and political aspects of the energy transition. Van Emous et al. [6] offer an econometrical study that explores the relation between carbon emissions reduction and corporate financial performance. Their result does not give a clear-cut answer to the question of if it pays to be green.

Reimers [7] analyzes the effects of fiscal policies on the European automotive market during the period of 2010 to 2018. This paper looks at the consequences of subsidizing alternative fuel vehicles. The article investigates the distorting effects of these subsidies. The contribution finds that the transition of the European car industry toward electric vehicles may decrease the European dependency on fossil fuels. However, it opens up market opportunities for non-European competitors.

Șimandan and Păun [8] deal with green central banking and analyze the consequences of central banks trying to contribute to the green energy transition. While the current literature has mainly focused on the advantages of green central banking, the authors also consider its costs and trade-offs. They find that there are important disadvantages and costs that come with green central banking.

The contribution by Wang et al. [9] reviews the principle of free-market environmentalism, in order to offer an empirical study of this energy transition in Germany, Denmark, and the United Kingdom. They find that the UK has achieved its environmental goals with free-market-oriented policies. The article argues that a free market transition, including entrepreneurial innovation and liberty, leads to better environmental results than state interventionism.

In the article by Náñez Alonso et al. [10], the issue of crypto-mining is examined. The mining of cryptocurrencies involves high electricity costs, which has raised concerns of sustainability. This green energy transition may provide more sustainable cryptocurrency mining. The study by these authors builds on the Environmental Performance Index, which ranks countries according to their mining of cryptocurrencies in a sustainable manner.

Espinosa et al. [11] look at the political economy of rent seeking in relation to the energy transition. They focus on the case of Spain and find that there is important rent seeking behavior within the energy sector, which leads to higher energy bills for consumers and market concentration. This rent seeking behavior in the Spanish energy sector places a drag on economic growth, thereby making the energy transition more difficult. The problem lies in the politization of Spanish society that makes such rent seeking behavior possible.

The contribution by Follert et al. [12] provides a case study of the German exit from nuclear energy in the wake of the Fukushima accident. The decision to do this was made in a panic mode, without discussing the relevant parameters from the perspective of decision theory. These authors suggest that political decision-making processes should include a mandatory consideration of decision theory and risk management, because these decisions affect future generations. In this case, a fatal effect of the decision happened quite soon. The German exit from nuclear power has made Europe more dependent on Russian gas, and thereby politically vulnerable.

It is almost as if providence led to this Special Issue. Energy security is more important than ever now that Russia has attacked Ukraine and there is the prospect of Europe being cut off from Russian gas supplies for the time being. The issue of energy security has now become the focus of widespread public attention, and politicians are dealing with it on a daily basis. Questions regarding the energy transition to green energy are thus more important and urgent than ever. This Special Issue addresses several issues related to the green energy transition and energy security, providing analyses and also advice on how to improve things. We hope that readers, policymakers, and the broader public can benefit from this research.

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