



The European Green Deal, Energy Transition and Decarbonization

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Climate change is becoming an increasingly cogent issue. In November 2019, the European Parliament declared a climate emergency asking the European Commission to ensure that all its proposals are in line with the 1.5 °C target. In response, the Commission announced the European Green Deal, a roadmap for Europe to become a climate-neutral continent by 2050. The crisis resulting from Covid-19 has further underscored the need for urgent environmental measures. The pandemic showed the magnitude of a global catastrophic event and prompted policy makers to consider a long-term strategy to prevent climate change from causing irreparable damage to the socioeconomic system. It has become even more strategic to adopt the European Union's Net Zero Emissions 2050 policy, which entails drastic decarbonization and could lead the European Union to be the leader in renewable energy production. This responsibility could have strategic significance for the future, allowing Europe to play a relevant role in the global geopolitical chessboard. Energy transition is clearly a “sine qua non” condition to pursue these goals. It is a new kind of transition, which is generated not only by technological innovation but also (or mainly) by the internalization of externalities and the attempt to avoid imminent climate damage. The energy transition must be pursued by all actors in the economic system: consumers, businesses, and institutions. Policy makers must identify the right tools to be able to stimulate the shift of energy resources from fossil fuels to renewables.

This special issue was born just between 2019 and 2020 and sought to gather some important research that would try to study the process of decarbonization through the energy transition. Many events have occurred since then, some of which (like the pandemic) have

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already deeply changed our life and habits, others (like the ongoing Ukrainian war) are bound to affect the world economic and geopolitical system in the years to come. However, all the themes addressed in this special issue remain extremely up to date. Indeed, the collected papers study a variety of issues which are of key importance for the implementation of the Green Deal, a proper energy transition and a successful decarbonization: the effects of previous policies on the technological transfer, the optimal level of carbon pricing, the effect of volatility and policy uncertainty on the green transition and on the optimal investments, and the role of firms and their structure in pursuing decarbonization goals. We expect that all these topics and the related research lines will keep having a central stage in the academic and political debate in the next years.

A few key elements seem to emerge from the studies included in the special issue. First, incentive policies play a key role for decarbonization. Whether and to what extent this should be pursued through carbon taxes is still debated. Some studies point out that carbon taxes are too low to produce effective changes and that values above \$400 per ton need to be reached to pursue relevant results. Other studies argue that carbon taxes are not strictly needed for decarbonization, showing that in some cases emissions have been successfully reduced even in untaxed provinces through efficiency-improvements in emission-intensive industries. Though still heavily debated, the Carbon Border Adjustment Mechanism might also contribute to decarbonization, helping the EU reduce the risk of carbon leakage while incentivizing emission reductions in countries exporting to the EU.

Second, a topic of extreme interest relates to policy uncertainty as this can heavily affect energy transition and decarbonization. Fiscal uncertainty may trigger precautionary savings, causing additional growth and further environmental deterioration; vertical fiscal imbalance (VFI) may also affect energy intensity (EI), indicating that EI may increase as VFI improves. Policy uncertainty, moreover, acts on firms' precautionary investment timing, in some cases slowing down project implementation time, partly because innovative clean energy firms are found to be particularly vulnerable to financing constraints and react more strongly to policy and systemic shocks. The financial structure of corporate debt itself also shows a link between the level of liabilities, growth rate and carbon emissions.

Third, a key role for a proper energy transition and decarbonization can be played by synergies among enterprises. Emission reduction could be efficiently achieved through cooperation among enterprises in industrial chains, leading to industrial symbiosis. In addition to this, inter-firm cooperation can also benefit from "market symbiosis," meaning that investments are more likely to occur in markets that are positively correlated.

Fourth, emissions trading can help energy transition and decarbonization, but several aspects need to be carefully considered. In particular, emissions trading turns out to depend on many different firm's features, such as its size, net position, industry affiliation, productivity and location. Transaction costs that increase the total cost of the process are also relevant. Policy makers must account for all these characteristics to construct optimal emissions trading schemes (ETS). Moreover, not only the domestic, but also the international dimension of the ETS should be taken into account: in some cases (as in the EU ETS), the ability of the system to affect the trading partners' decisions and possibly reduce foreign emissions might eventually be even more relevant than its impact on domestic emissions. This suggests that the EU can play a key role in designing global long-term strategies. No matter the future evolution of the economic and political situation at the world level, it is,

therefore, crucial to stick to the medium-term goals announced by the European Green Deal if Europe wants to drive the energy and technology transition.

The insights briefly described above are just a bird's-eye look at some selected results and not an exhaustive description of the many rich outcomes deriving from the collected studies. All papers, however, provide a different (and complementary) perspective on the challenges and relationships among the three topics of this special issue: the EU Green Deal, the energy transition and the decarbonization process. By advancing our understanding of these topics, we believe this special issue can shed light on how these three aspects can and should be addressed, transforming this challenging triad into a successful trio in the near future.

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