COOPERATION IN THE EUROPEAN ENERGY TRANSITION: IMPACTS TO THE ECONOMY AND THE ROLE OF CARBON PRICE POLICIES

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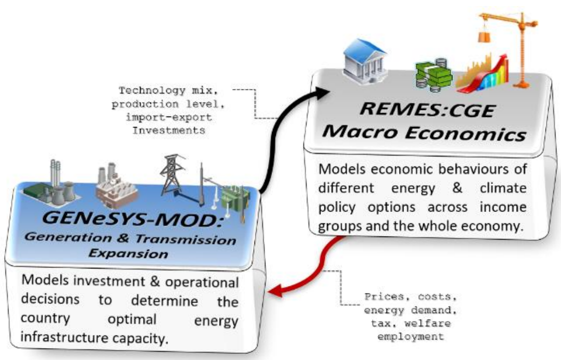
Overview

The European energy transition envisions at least a 60-70% renewable energy sources (RES) as part of the final energy generation share by 2050. This transformation of the energy system will not only affect all major energy carriers but also have implications for the European economy and hence policy directives. In this work, we are analyzing the impact of carbon price policies on the European energy system and economy and try to assess whether the energy transition is an economic turn-down. Furthermore, we analyze what mechanisms need to be implemented to ensure cooperation on a climate policy level.

Methods

To perform the analysis, we soft-link the bottom-up techno-economic energy system optimization model GENeSYS-MOD ([6]) with the top-down computable general equilibrium model REMES_EU ([3]).



The multi-carrier investment model has a sophisticated detailed representation of the overall energy system, but does not explicitly account for possible rebound effects in the economy sector as prices and energy demand are assumed exogenously. On the other hand, the general equilibrium model considers, in an aggregated structure, effects on prices and demand as a consequence of policy or technology changes. In this respect, a change in technology mix usually leads to a change in prices and a consequent reallocation of the demand for both energy and different fuels. The linked models (see e.g. [1,4,5] on soft-linking) evaluate two scenarios based on the data and features of the SET-Nav Pathways (see [2]) to analyze the impact of cooperation. Two pathways are considered in our analysis. A first pathway assumes cooperation between all the European countries, which translates into a common objective for the reduction of emissions. Here, A common goal for emission decrease will be defined for all countries. A second pathway will instead assume that some of the countries will not aim for the reduction of emissions by not implement a carbon tax, trying to leverage on the possibility of sustaining the competitiveness of the national economy by avoiding the allocation of large investments to enforce a green transition.

The main objective of the CGE model will be providing information about the possible development of the main economic indicators. In this respect, monetary flows between different actors and sectors will serve as the basis to explain the future mutual interactions and convey information about the sectoral value-added as well as the growth of the overall economy. Typical key indicators provided by the REMES_EU model are GDP and sectoral value added projections for each country. Simultaneously, the model will deliver information about projected activity levels and changes in demand for the commodities relevant to GENeSYS-MOD. This model then calculates the new future technology mix, production levels and investments. These values are again sent to REMES_EU, to recompute the macro-economical variables. This iterative approach is continues until a change in mutually exchanged values is no longer observed within a given tolerance.

Results

Our results suggest that the decarbonization policies might impair the level of economic growth if the intensity at which these policies are introduced is not consistent with the rate of technological change of the production sectors. Moreover, the more resistant Countries are to technical change, the higher will be the negative impact of a decarbonization policy on their economy. Finally, levying tariffs on imports from Countries calling off the decarbonization agreements might lead to a decrease in GDP of every country, also the ones decarbonizing ones.

Conclusions

We show results the economic impact in terms of GDP, sectoral value added and carbon price and the energy system impact in the power production technology mix for four scenarios: a decarbonisation scenario with full cooperation within the EU, a decarbonisation scenario with some countries deciding to call off the agreements and a business as usual scenario both with and without cooperation between all the EU members.

Our study focuses on the impact of cooperation in reaching the goals of full decarbonisation of the EU within 2050. By analysing these impacts we are able to evaluate instruments to prevent opportunistic behaviours and to ensure a steady transition towards a greener system.

References

[1] Böhringer, C., & Rutherford, T. F. (2008). Combining bottom-up and top-down. Energy Economics, 30(2), 574-596.

[2] Del Granado, P. C., Resch, G., Holz, F., Welisch, M., Geipel, J., Hartner, M., ... & Ramose, A. (2020). Energy Transition Pathways to a low-carbon Europe in 2050: the degree of cooperation and the level of decentralization. Economics of Energy & Environmental Policy, 9(1), 121-135.

[3] Helgesen, P. I., Lind, A., Ivanova, O., & Tomasgard, A. (2018). Using a hybrid hard-linked model to analyze reduced climate gas emissions from transport. Energy, 156, 196-212.

[4] Hwang, W. S., & Lee, J. D. (2015). A CGE analysis for quantitative evaluation of electricity market changes. Energy Policy, 83, 69-81.

[5] Lanz, B., & Rausch, S. (2011). General equilibrium, electricity generation technologies and the cost of carbon abatement: A structural sensitivity analysis. Energy Economics, 33(5), 1035-1047.

[6] Löffler, K., Hainsch, K., Burandt, T., Oei, P. Y., Kemfert, C., & Von Hirschhausen, C. (2017). Designing a model for the global energy system—GENeSYS-MOD: an application of the open-source energy modeling system (OSeMOSYS). Energies, 10(10), 1468.