Decarbonization in the non-ETS with sector coupling via input-output linkages

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The EU climate policy architecture distinguishes the ETS (Emission Trading System) and the non-ETS and defines GHG targets for the latter, whereas for the ETS trading leads to a market price for CO2. non-ETS in the member states. These targets can be achieved with a variety of policy measures, including price instruments. In any case, decarbonization in the Non-ETS implies electrification of end-use energy purposes accompanied therefore by shifting the burden of decarbonization to the electricity sector that is covered by the ETS. Several studies have already highlighted the potential overlapping in EU climate policy and the problems arising from that. In the worst case, large part of carbon reduced in one part of the energy system reappears in another part, a phenomenon known as leakage. For this purpose, the analysis must focus on the linkages between different sectors. These linkages must cover sector coupling in the energy system on the one hand and other energy sources on the other hand, as well as between energy and non-energy sectors.

The main research question in this paper is to account for all feedback mechanisms between ETS and Non-ETS sectors in the energy system and in the economy in a parallel manner. The macroeconomic IO model applied fully integrates the energy system and explicitly deals with different types of linkages: (i) input-output (IO) linkages in production and (ii) energy demand linkages between ETS and non ETS. The model therefore disaggregates the most important sectors from the perspective of climate policy: several energy intensive industries (ETS), electricity and heat generation (ETS), non-energy intensive industries (non ETS), mobility of households (non ETS), and heating of households (non ETS). For the non-energy intensive industries in non ETS, energy demand and technologies are also split up into heating and mobility, like in the household sector. The full integration of the energy system into a macroeconomic IO model guarantees that all changes in the energy system have a consistent impact in the economy, both at the level of quantities and of costs and prices. The IO linkages in (i) therefore comprise quantity as well as price linkages. The model describes the national economy of an EU country that attempts to achieve emission targets for the non ETS using a policy mix. Electricity prices are described by a formalized merit-order price model that incorporates the emission cap and permit costs. Domestic carbon leakage takes place, when energy demand in the non ETS shifts from fossil fuels to electricity.

The analysis assumes decarbonization scenarios for heating and mobility (non-ETS) in Austria, by flexibly combining ambitious policy instruments from existing scenarios and combining them with other instruments aiming at shifts in investment behavior. Prices of appliances and the relative fuel price (fossil/electricity) are assumed to be the main drivers for investment behavior. The policy measures plus the model feedbacks change these drivers and guide the decarbonization process in non ETS. The feedback and general equilibrium effects working in the full model determine the impacts of decarbonization.