General Equilibrium Analysis of Energy Development Scenarios: the Case of Lithuania

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The aim of the research is the evaluation of overall economic impacts caused by the choice of an energy development scenario in Lithuanian case.
The energy sector development scenarios are considered as exogenously described energy pathways that cause responses from the remaining economy. All these responses, including inter-sectorial linkages and impacts of changes in relative prices, are evaluated using especially created dynamic computable general equilibrium (CGE) model, which covers four energy products (electricity, district heat, natural gas, and biomass), 19 other commodities and economic activities; sectors of corporations, government, and households; international trade with the rest of the world. An aggregated reflection of tax system, other transactions as well as explicit representation of the energy infrastructure is also incorporated into the model. This allows assessing changes in the energy sector in the context of entire economy, considering energy sector as an integral part of the economy, which affects other types of economic activity and institutional sectors, both due to changes in supply of energy resources, and as a result of changes in demand for other commodities and production factors, impact on the fixed capital formation, and other issues caused by energy development. The net impacts of a particular scenario are revealed by comparison of results of selected scenario with results from other scenarios.
Various data sources were used in the analysis. Basic information about the energy scenarios (capacities installed, energy produced, fixed and variable operation and maintenance cost, etc.) was obtained from bottom-up energy planning model and complemented by the detailed description of energy technologies in terms of commodities and production factors used and other properties. The core data for economic modelling is social accounting matrix (SAM), which has been created using official data from Eurostat and Statistics Lithuania, which was adjusted taking into account the physical energy flows reported in Fuel and Energy Balances. The most of parameters that are employed in the model are calibrated directly from SAM or collected from external data sources. The shares of minimum necessary purchase of commodities have been estimated econometrically from the dataset of Household Budget Survey which is provided by Statistics Lithuania. Following the usual praxis, elasticity parameters for constant elasticity functions have been taken from scientific literature.
The novelty of the present research can be characterised not only by the results obtained (various economic indicators are calculated and the most influential factors are determined), but also by several methodological innovations. First of all, new modelling solutions were developed for the integration (â€œsoft-linkingâ€•) detailed bottom-up energy modelling data into a CGE model. Second, the analysis covers not only electricity, but also three other energy products that are most relevant in Lithuanian context. Finally, especial attention is devoted to the modelling of energy infrastructure. The energy infrastructure and its cost allocation among consumers is in the CGE framework is modelled explicitly. This modelling approach reflects the real world situation when energy prices for consumer groups are different as a result of either different type and amount of infrastructure used (e. g., electricity from transmission or distribution networks) or due to disparities in market regulation that allows differentiation of infrastructure cost attributed to the consumers.