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## **INTERTEMPORAL HYBRID MODELING OF ENERGY POLICY IN POLAND: HOW TO AVOID BIASED RESULTS**

### **Abstract:**

In the coming decades the energy sector in Poland will undergo a substantial transition towards low carbon usage which will have a preponderant impact on the economy. Several modernization scenarios for energy policy are currently being discussed and not yet concluded. The main objective of the paper is to provide a tool that allow to simulate such scenarios and to show the impact into the whole economy by accounting for complex set of linkages between energy sector and other parts of economy. Those scenarios should assume, in different proportions, increasing use of nuclear energy, renewable sources and natural gas in exchange for reduction of carbon.

Energy is a crucial economic input circulating in the economy, widely utilized as production factor and consumed in different forms by households. For this reason, any changes in energy will have a preponderant impact on the entire economy, thus partial equilibrium modeling is not sufficient. Currently there is no appropriate research tool in Poland which could accommodate complex structure of different energy sources and wide linkages of the energy sector to assess economy-wide impacts of the energy policy in longer horizon for Poland. We propose a hybrid general equilibrium modeling that incorporates energy technologies (bottom-up approach) directly into macroeconomic structure (top-down approach).

By accounting for wide adjustments in the economy, while controlling for all major constraints - such as energy balance and available capital stock - the model can give a unique and detailed insight into the future shape of energy sector and low carbon economy in Poland.

Based on the model outcomes we can state that simulation results can be very much biased even if the model is properly calibrated. We present several issues that should prevent modelers to supply results to policy-makers without careful tests. The immediate source of "strange" results is wrong model design to study specific topics. The lack of formal tests to validate computable general equilibrium models should not be a pass for unreasonable results. Our study helps to understand the source of selected "strange" results.

### **Keywords:**

computable general equilibrium modeling, dynamics, capital market, energy technologies

**JEL Classification:** C61, D58, Q43