



**The Coalition
of Finance Ministers
for Climate Action**

Sweden's EMEC model, designed to study the long-term economic effects of energy and climate policies

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Sweden has set ambitious national climate targets, and the Ministry of Finance works to ensure that policy measures to reach these targets are effective, cost-efficient, and equitable. In the policymaking process, a key analytical question for the Ministry is how to design climate policies that are not only effective and efficient but also gain public support, including through the use of appropriate compensation/support mechanisms. To get help answering these questions, the MoF draws upon researchers at the National Institute of Economic Research (NIER) to provide scientific economic insights in the Swedish context. Besides providing qualitative insights, the NIER has developed and long maintained the Environmental Medium-Term Economic (EMEC) model to also provide numerical insights. The EMEC model is a computable general equilibrium model of the Swedish economy in the medium to long term. It captures the primary interactions between the economy, energy use, and greenhouse gas emissions, encompassing more than 30 sectors, 40 products, and the main greenhouse gases (for a full description, see NIER [2023]).

The EMEC model's main strengths lie in its holistic specification of the Swedish economy and its calibration to the comprehensive system of national and environmental accounts. This calibration grounds the model on the same database as used for other macroeconomic analyses and policymaking within the Government. A key assumption in the model is that the economy adjusts fully when transitioning from one equilibrium state to another. Consequently, the model is well-suited for studying the economy in different states, but less so for examining frictions during the transition. The EMEC model has a few additional limitations on its use. For example, while it can be used to identify plausible ways to achieve a given target, it cannot be used to determine the optimal target itself. Integrated-assessment models, which specify environmental damages, are necessary for such analysis. Similarly, the EMEC model cannot be used to assess whether the plausible pathways are also likely or feasible at the required scale, a task better suited for detailed energy-system models (e.g., models of the TIMES family).

At NIER, the EMEC model is used to study the long-term impacts of energy and environmental policies on the economy and emission trajectories of several pollutants. Policies assessed with the model include the EU Emissions Trading System (EU ETS), the national energy and CO₂ taxes, and renewable fuel standards for road-transportation fuels. Policy questions addressed by the model include

- Does a policy achieve its stated target?
- Are there potential conflicts with other targets or policies?
- Does the policy achieve its objective at the lowest cost?
- What are the expected effects on GDP, employment, and the economic structure?
- What are the expected impacts on greenhouse gas emission levels and household income distribution?

Using the model to address these questions helps the policymakers at the MoF design national policies that are effective, cost-efficient, and equitable. In Sweden, the EMEC model has been used to inform several governmental bodies. For instance, it has contributed to the Swedish Environmental Targets Committee analysis of the effects trading options under the EU ETS would have on the Swedish economy ("Miljömålsberedningen"; SOU, 2005) and to the national energy and greenhouse gas projections by the Swedish Energy Agency (2021) with an analysis of the combined effects on the Swedish economy that all energy and climate policies currently have in place.

The model is continuously updated and developed to meet evolving research needs. Two types of model developments are underway. First, more frictions are introduced during the transition from one economic state to another. For instance, a more detailed specification of capital use and capital vintages per sector is being worked on to consider the sunk costs under stringent emission reduction targets as well as to allow for sector-specific capital cost variations. Second, further details from energy-system models on abatement technologies are incorporated into the EMEC model to make deep decarbonization scenarios more precise. For instance, more detailed specifications of production technologies and abatement options within the steel and cement industries are being developed.

Finally, there are several key lessons to share. One is that the assumed abatement costs significantly influence the costs of climate policy in the model, making it crucial to get these assumptions right and incorporate inputs from energy system modelers. Such inputs include not just the estimated emission reduction and cost increase per unit output produced but also whether the abatement options are feasible or likely at the required scale. Abatement options in Sweden for which such capacity limits are important include the refinery of biofuels, expansion of hydro- and nuclear power generation, and carbon capture and storage within the cement sector. Yet, another lesson is the trade-off between the detail and transparency of the model specification and the results obtained. While aiming for precise results is tempting, additional detail should not come at the cost of obscuring the economic channels through which the results come about. It is often these insights behind the numerical results that hold the greatest value.

References

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