Final Exercise: Model improvement for an IGE assessment

Course: Inclusive Green Economy (IGE) modelling

1   Overview and objective

In this final exercise, you will work in small groups of two to four people on an actual model, applying what you have learned throughout the course about integrating relevant social, economic and environmental indicators into traditional sectoral models.

You will identify one or more **issues** to analyse; **targets** for selected indicators of performance and improve models; and estimate the **investment** required to reach such targets and then propose and analyse **policies** that would allow, as enabling conditions, to implement the investment required.

2 What needs to be done and how

2.1 Tasks

The exercise requires that the following tasks are carried out:

1. **Identify a relevant issue at sectoral or national level**
   - Select the issue to analyse, such as growing air and water pollution.
   - Identify relevant indicators for the analysis of this problem.
   - Create a list of indicators that cause the issue as well as a list of the indicators that are impacted by the issue, considering social, economic and environmental indicators.
   - Identify the variables that should be included in a modelling assessment of the issue.

2. **Search for existing targets, such as from the NDC for emission reduction, or use best practice**
   - Select the target to analyse, such as emission reduction.
   - Identify relevant indicators for the analysis of this target.
   - Create a list of indicators that may influence the implementation of the target as well as a list of the indicators that are impacted by the target, considering social, economic and environmental indicators.
   - Identify the variables that should be included in a modelling assessment of the target.

3. **Modify model structure and inputs based on whether the model chosen uses investment or policy as an input**
   - Select the model to use for the analysis of the issue and target.
   - Identify and describe the strengths and weaknesses of the model chosen.
   - Identify the variables that should be added to the model for a proper IGE assessment of the opportunity or problem.
   - Carry out research on how the new indicators are calculated in their field, i.e. look for best practices, for instance on how emissions are calculated in models for power generation.
   - Integrate these indicators in the model. Different approaches could be used, including adding multipliers or changing the structure of the model by including new endogenous variables.

4. **Simulate the model and analyse results**
   - Depending on the model used, setup the model for simulation by adding assumptions on investment or policy, using a target or policy-driven approach.

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- Simulate the baseline scenario and alternative ones, by including selected targets, policy interventions or investments.
- Assess whether the results of the model change when the new indicators are added. Document the changes made and the results of the model.

5. **Present the work completed to the class and deliver the final report.**
   The presentation includes:
   - A 20-minute overview of the work performed.
   - A 10-minute discussion of the main challenging tasks.
   - Reaction of the class, with any potential questions for clarification and suggestions for the improvement of the analysis.

2.2 Common challenges

The starting point is the identification of an issue related to the IGE and the SDGs. Think of starting with existing known issues. For subnational and sectoral models, where national targets are not available, best practice (technology) could be used.

The second subject to consider is the use of simulation models. For this final assignment, you will need to have a laptop or workstation, have access to a simulation model (e.g. from previous courses[1]) and be able to use such a model. Chose a model you are familiar with or that someone in your group has experience with.

Thirdly, you will need to carry out research on the areas that have to be added to the model and then implement the changes required. Then you need to focus on the analysis of the solution, such as estimating the investment required or policy impact. The approach to use depends on the model chosen. Specifically, some models cannot estimate investment. In this case, you will have to use a target approach or a policy approach.

Fourthly, it is difficult to remember what changes have been made to the model if these are not documented immediately. It is important that each modification to the model is documented in detail, so that it will be possible for everyone to understand what changes are made and why.

3   Example of results

Examples can be provided for each of the steps mentioned above, and more examples of specific modelling exercises are provided and discussed in class.

1. Select the issue, such as the growth of GHG emissions.

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[1] See PAGE (2017) IGEM framework, where codes for SD model, CGE model and IO-SAM can be found for the application to Mexico: https://www.un-page.org/resources/macroeconomic-policymaking/integrated-green-economy-modelling-framework

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- o Relevant indicators for the analysis of the causes of the issue include energy consumption by energy source, forest cover and carbon sequestration.

2. Select relevant targets: e.g. 29% of emissions relative to 2005, or baseline, as per the NCD
    - o Relevant indicators for the analysis of the impacts of reaching the target include construction of renewable energy power generation capacity, improvement of energy efficiency, employment creation, energy use, emissions and air quality, and health impacts.
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3. Select the model and modify the model structure
    - o Select the model to use for the analysis of the issue: a systems engineering model of the energy sector or a CGE model for macroeconomic performance.
    - o Identify and describe the strengths and weaknesses of the model chosen: CGE models are strong in assessing economic performance, but often miss biophysical indicators or make high level assumptions, such as for energy consumption and emissions.
    - o Identify the variables that should be added to the model for a proper IGE assessment: add a more disaggregated energy demand module to the GCE, by sector and energy source, or consider adding a land component that allows you to forecast land use and forestland for carbon sequestration.
    - o Identify channels through which these models can be articulated, by reflecting on the IGEM framework. Are there common variables across models that can be articulated?
    - o Carry out research on how these required indicators are calculated in their field. Was any CGE model coupled with a system engineering energy demand and supply model?

4. Simulate the model and analyse results
    - o Set up the model to analyse either investments, such as $10 million invested in solar PV, or policy, such as introduction of a 30% incentive to reduce the capital cost of solar PV, or targets, such as assume that a 10% penetration rate of solar PV is achieved by 2030.
    - o If investment is not the scenario input, estimate the investment required to reach the target, with and without policy incentive.

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4 Evaluation criteria

The following evaluation criteria will be used:

- Ability to explain the strengths and weaknesses of the model chosen.

- Inclusion of social, economic and environmental indicators in the model.

- Extent to which changes are made to the model to improve its structure and analysis, including the potential articulation across different models.

- Presentation of results considering costs and benefits, and outcomes for different economic actors.

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