PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

Inclusive Green Economy (IGE) Modelling

Syllabus for a Higher Education Course

UN environment United Nations Environment Programme

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unitar United Nations Institute for Training and Research

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1 Overview

Following the adoption of the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change, many countries have set ambitious goals and targets for themselves to foster economic growth, create income and jobs, reduce poverty and inequality, and promote environmental sustainability.

Inclusive green economy (IGE) modelling is a powerful tool that allows to assess the investments required to deliver on these goals and targets in an integrated and synergistic manner. IGE modelling is used to inform policy and investment assessments and decision-making processes, employing existing techniques commonly used by economists and public policy specialists, and adapting them to provide analysis of economic, social and environmental impacts. Questions IGE modelling can help to address include:

- What policy measures will help to achieve a national emission reduction target?
- How will Gross Domestic Product (GDP) change when implementing climate mitigation interventions?
- What is the value of the ecosystem services being provided by nature?
- Will new jobs be created under an IGE strategy?

This course familiarizes students with various methodologies and models, and provides an opportunity for students to start using modelling tools, such as input-output, general and partial equilibrium, systems engineering, system dynamics and spatially explicit models, in an area of interest to them. The type of skills acquired through this course are usually needed in institutions that deal with medium to long-term planning, across sectors. These include, for example, forecasting departments in Ministries of Finance (for economic analysis); Ministries of Infrastructure (e.g. energy or water, to determine the needs for improved and expanded infrastructure to provide adequate services to the population); Ministries of Social Development (to determine the effects of policies on poverty and inequality); Ministries of Labour (to assess the implications in the job market and job creation opportunities); and Ministries of the Environment (to assess the environmental impacts of policy interventions and plan for complementary measures).

The course materials were developed through the Partnership for Action on Green Economy (PAGE), a One UN initiative that brings together five United Nations agencies – the UN Environment Programme, the International Labour Organization, the UN Development Programme, the UN Industrial Development Organization, and the UN Institute for Training and Research. The package is freely available to higher education institutions that are interested in establishing recurrent courses on modelling. Partner institutions can also choose to integrate components of the course into their existing course portfolio or to use components of the course for a series of seminars.

2 Target Group and Prerequisites

The target audience for the course is Master's students. Prerequisites include completion of (i) one or more modelling courses (economic, e.g. as part of micro- and macro-economics courses, and/or biophysical modelling courses) and knowledge of optimization, econometrics and/or simulation; and/or (ii) courses on social, economic and/or environmental policy (e.g. with information on policy instruments and methods of assessment, such as cost benefit analysis).

The course could potentially also be offered to undergraduate students in their final year. The decision on when to offer the course would partially depend on the extent to which macro-economic and sectoral modelling courses are offered at the undergraduate or graduate level. The IGE modelling course should be offered after other conventional modelling courses.

3 Learning Objectives

Students will learn about (i) the key characteristics of IGE models; (ii) the methodologies and simulation models available to inform IGE policy and investment analysis; and (iii) methods to correctly interpret and use the results of such studies in the context of the 2030 Agenda. More broadly, students will understand the need for an integrated approach to economic modelling and analysis that integrates social and environmental parameters.

After completing the course, students will be able to:

- Define the concept of an Inclusive Green Economy (IGE) and explain its value in relation to the 2030 Agenda and the Sustainable Development Goals (SDGs).
- Identify the key indicators (social, economic and environmental) required to carry out an IGE assessment for sectors or assets, policies or investments.[1]
- Identify relevant modelling approaches and models for an IGE assessment and describe their advantages and disadvantages.
- Identify data requirements for the use of different methods/models.
- Interpret the results of various modelling exercises, based on the modelling approach and simulation model used.

[1] The identification of indicators could be based on existing strategies and plans or the assessment of existing problems and priorities, even if not formalized in sectoral or national plans. For more information on how to work with indicators for IGE see PAGE (2019), Indicators for an Inclusive Green Economy – Manual for Introductory Training. Geneva and PAGE (2019), Indicators for an Inclusive Green Economy – Manual for Advanced Training. Geneva.

- Improve existing models to capture all three dimensions of sustainable development (economic, social and environmental), link existing models in an integrated framework, or create new and customized IGE models.
- Provide examples of the use of simulation models, sectoral and integrated, for IGE assessments and explain how these models can support assessing progress towards the SDGs.

4 Course Structure and Content

The course is structured around four modules. The modules cover the following topics: Inclusive Green Economy concept and method, indicators for IGE modelling, and modelling approaches and models.

Module 1 – Different pathways towards inclusive green economies

Module 1 introduces the concept of Inclusive Green Economy and its main policy instruments, and highlights the role of simulation models in understanding interdependencies across (i) sectors and variables (within sectors); (ii) economic actors; (iii) dimensions of development (social, economic and environmental); (iv) over time (short, medium and longer term); and (v) in space.

The main content covered by Module 1 includes:

- Definition of IGE, Green Growth/Circular Economy/Low Carbon Development and other relevant concepts, and its contribution to the SDGs and the Paris Agreement.
- Opportunities that can be realized with the use of an IGE approach, highlighting why such an approach is suitable for planning in the context of sustainable development.
- Policy instruments for IGE strategies, by sector and by thematic area, across sectors.
- Potential contribution of models to IGE assessments:
    - Models help assess the potential outcomes of IGE interventions, set and respond to targets, and support a system view, which is at the core of the IGE concept and sustainable development.
    - Models also provide exploratory scenarios to help manage uncertainty and risk, i.e. filling knowledge gaps.
    - Models can create a conducive and collaborative environment for different experts to work together.

Exercise: Development of a qualitative system map, which could be a Causal Loop Diagram or a tree diagram, by sector, for a specific geography, such as country, city or landscape, and identify main drivers of change, both internal and external. This includes the identification of problems, which could emerge for

social, economic and environmental indicators, and the formulation of solutions, such as policy interventions and target setting.

Module 2 – Identifying indicators for IGE modelling

Module 2 discusses the variety of indicators required to carry out an IGE assessment and a method to identify them. Indicators are key to determining what type of model is required and what the boundaries of such models should be, such as sectoral vs. integrated.

The main content covered by Module 2 includes:

- Assessment of the required indicators of performance for the definition of IGE, specifically for the definitions used at the global, national or landscape level.
- Overview of the process to identify key indicators, such as use of Systems Thinking, for issue identification, policy formulation and assessment, and for monitoring and evaluation.
- Assessment of the domains or sectors in which these indicators are calculated, such as for emissions found in energy and land use.
- Lessons learned from IGE country studies, especially on what indicators were chosen and how these were used.

Module 2 will introduce the Integrated Policymaking Cycle and use it as a framework for the identification of indicators for problem identification, policy formulation, policy assessment, and policy monitoring and evaluation.

Exercise: Assessment of whether key IGE indicators are included in existing and ongoing modelling exercises that the students have been exposed to or are involved in. Review data availability and data gaps, from global and national databases, so that the students know where to find data when they start customizing models later in the course.

Module 3 – Overview of modelling approaches and models

Module 3 first provides an overview of the methodologies and models available for IGE assessments. It distinguishes between sectoral, narrowly focused models, such as an economic model or one that focuses on electricity supply, and cross-sectoral, integrated models, such as energy-economy models or cross-sectoral national development planning models. Secondly, Module 3 gives details on the characteristics of each model analysed, covering both outcomes generated and requirements for customization and use. Finally, Module 3 provides information on how to assess model results, based on the methodology and models used. For instance, partial equilibrium models are likely to overestimate outcomes, while general equilibrium models may underestimate policy and investment outcomes. The analysis will be presented by thematic area, such as policy, subsidy removal and renewable energy incentives.

The main content covered by Module 3 includes:

- Overview of methods, such as qualitative and quantitative, including optimization, econometrics and simulation.
- Overview of models:
    - Overview of available models in each of the key domains/sectors analysed, such as economy, energy and land use.
    - Overview of system/nexus models available, linking several sectors or IGE indicators together.
- Description of the main characteristics of these models:
    - General introduction
    - Scope
    - Data needs
    - Steps for customization and timing
    - Complementary with other models and analyses
    - Limitations
    - Case studies
- Interpretation of results, depending on the methodology and model used, such as general vs. partial equilibrium assessments, and sectoral vs. systemic analysis.
- Lessons learned from IGE country studies, not only case studies on the use of models, but documentation on their use and success factors, as well as causes of "failure".

Exercise: See Module 4, the exercise can be introduced at the end of Module 3.

Module 4 – Final exercise

Module 4 is the final exercise of the course. For this module, students work in small groups of two to four people on an actual model, applying what they have learned about integrating social, economic and environmental indicators into their traditional modelling.

A few key tasks will be performed by the students:

1. Identify a relevant issue at sectoral or national level:
    - Select the issue to analyse, such as increasing 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 Nationally Determined Contribution (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 affect 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 by looking 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.
   - 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 done 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 or suggestions for the improvement of the analysis.
   - Role playing could be used. Various groups of students could represent the interest of selected ministries and ask targeted questions in relation to their specific policy priorities.

5 Learning Methodology

The course pedagogy is adapted to full-time students at graduate level. Participants are provided with the opportunity to learn through various experiences: absorbing (reading and listening); doing (activities); interacting (socializing); and reflecting (relating to one's own reality).

A range of learning activities and experiences that include interactive exercises, discussions in class and an applied case study complements each week of in-class presentations.

Each module follows the same pedagogical structure: i.e. introduction and learning objectives; core content (presentation and discussion), practice exercise and additional resources.

The course features the following instructional elements:

Lectures / presentations

Lectures provide an introduction to the main content of each module. They present the theory and information required to understand the problem to be analysed and the identification of solutions. Following lectures is essential to the successful completion of exercises. Lectures will be as short and interactive as possible, as most content will be covered through background reading and research outside class hours.

Self-study

Self-study includes reading the materials provided and researching the key themes of sustainable development at the national and sectoral level, modelling and using existing experience to carry out an IGE assessment at the country and global level. Self-study will allow students to better contextualize the IGE concept and improve the quality of the analysis carried out in the exercises.

Group exercises

Group exercises are envisaged for each module. The main goal of these exercises is to put into practice what is discussed in the lectures and to stimulate exchanges among course participants.

6 Study Hours and Schedule

Study Hours

The course comprises 46 study hours, including 20.5 class hours (lectures, supervised exercises and final presentation of group work), 9.5 hours for exercises and 16 hours of self-study.

- Time in class (lectures, final presentation): 20.5 hours
  - 1.5 hours per week (weeks 1 – 11), including lectures and discussions
  - Presentation of the final exercise (week 12): 4 hours
- Labs/exercises (with supervision): 9.5 hours
  - Exercises for Modules 1 and 2: 2 x 2 hours = 4 hours. Exercises may start in class
  - Final exercise: 5.5 hours
- Self-study: 16 hours (4 hours per module).

Course schedule

Week	Topic	Learning activities	Due date
Weeks 1 and 2	Module 1: Inclusive Green Economy concept and method	Lecture, assigned reading/text, discussion, group assignment on the Causal Loop Diagram	
Weeks 3 and 4	Module 2: Identification of key model outcomes	Lecture, assigned reading/text, discussion, group assignment	
Weeks 5 and 6	Module 3: Overview of modelling approaches and models	Lecture, assigned reading/text, discussion, group assignment	
Week 7	Module 4: Final exercise	Assigned reading/text, group assignment, written summary	
Week 8	Module 4: Final exercise	Discussion on model selection	
Week 9	Module 4: Final exercise	Discussion on model additions	
Weeks 10 and 11	Module 4: Final exercise	Implementation of model changes	
Week 12	Final presentations	Oral presentation	

7 Learning Assessments and Completion Requirements

The final course grade will be calculated using the following assessments:

Assessment	Percentage of final grade
Participation in class (including discussion of group assignments)	40%
Final assignment	60%

Students are asked to attend lectures and participate actively in class, including two group exercises as part of modules 1 and 2.

A final exercise, to be completed as a group assignment, is proposed for modules 3 and 4. The assignment will be evaluated according to the following criteria:

- Was the group able to explain strengths and weaknesses of the chosen modelling approach in the context of an IGE assessment?
- Did the group include social, economic and environmental indicators in their modelling assessment?
- Did the group make actual changes to the model to include more indicators? How were these changes made? For instance, adding multipliers, changing the structure of the model or integrating different modelling tools.
- Were required investments, potential avoided costs and added benefits of IGE interventions identified and quantified with the new model?
- Were impacts assessed for different economic actors, over time and for specific locations?
- Are the students able to explain how their improved model can support decision making for sustainable development?

8 Course Evaluation/Feedback

To be completed by instructor.

9 Technical Requirements

Students will be requested to work with Excel databases, to modify and simulate mathematical models, and to present their results with PowerPoint or similar software. Knowledge of MS Office or OpenOffice is therefore required, as well as familiarity with Internet browsers and modelling software.

Advanced computing is not required for this course, and it is expected that the assignment will be carried out using students' own laptops or the IT lab of the university.

10 Contact Information

Instructor information

Name

Contact info

Office location

Office hours

Technical Assistance information [if applicable]

Name

Contact info

Office location

Office hours

11 Key Readings

Eaton, D., & Sheng, F. (Eds.), 2019: Inclusive Green Economy: Policies and Practice. Zayed International Foundation for the Environment & Tongji University.

This textbook attempts to offer a systematic framework for the green economy model. It builds on and extends from the traditional economic growth model by articulating the contributions to productivity from investing in natural capital, clean technologies and green skills, enabled by fiscal, finance, trade, and labour policies. It also addresses the importance of institutions and progress measurement for ensuring that transition towards a green economy is pro-poor, inclusive, fair and just.

United Nations Environment Programme (UNEP), 2011: Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.

This analytical report demonstrates that the greening of economies is not generally a drag on growth but rather a new engine of growth. It can also be a net generator of decent jobs and a vital strategy for the elimination of persistent poverty. The report seeks to motivate policy makers to create the enabling conditions for increased investments in a transition to a green economy. It makes a compelling economic and social case for investing two per cent of global GDP in greening 10 central sectors of the economy in order to shift development and unleash public and private capital flows onto a low-carbon, resource-efficient path.

United Nations, 2012: The Future We Want. Rio+20, Rio de Janeiro, 20-22 June 2012.

The 2012 UN Conference on Sustainable Development adopted the outcome document, The Future We Want, which addresses a range of global issues to advance sustainable development. The document calls for a wide range of actions, among many other points, including: launching a process to establish sustainable development goals; detailing how the green economy can be used as a tool to achieve sustainable development; and strengthening the UN Environment Programme and establishing a new forum for sustainable development.

UNEP, 2014: Using indicators for Green Economy Policymaking.

This manual provides guidance to users at the country level on the selection of indicators for Green Economy assessments. Specifically, it supports the development of indicators across the stages of the UN integrated policymaking cycle for sustainable development (UNEP, 2009). It allows the user to develop GE indicators and describes how they can be used as tools for the identification of priority issues, the design and assessment of GE policies, and for monitoring and evaluation of policy performance. A step by step description for the development of indicators and their use in the respective stages of the policymaking cycle is provided.

Partnership for Action on Green Economy (PAGE), 2017: The Green Economy Progress Measurement Framework - Methodology

This handbook describes the development of the Green Economy Progress (GEP) Measurement Framework as a vehicle for bridging indicator-based measurement initiatives at the global level. Technical guidance is provided for the evaluation of progress on a single indicator case, the composition of the GEP Index for multidimensional assessments and the development of a dashboard. The integration of indicators for identifying priority issues, designing and assessing GE policies, and monitoring and evaluating their performance into a progress measurement framework is described. A description of the theoretical framework, the weighting of the GEP Index in various countries, and the process of aggregating information from the Dashboard and the GEP Index into a single measurement framework is provided.

UNEP, 2014: Using models for Green Economy Policymaking.

This report describes the rationale behind choosing models for Green Economy assessments. Modelling for Green Economy generally requires the appreciation of local context factors and the choice of models determines the type of assessment that can be conducted and the results obtainable. Different modelling methodologies and models are presented, and information is provided about their applicability on sectoral, cross-sectoral or national level.

United Nations Economic Commission for Africa (UNECA), 2016: Integrated Assessment Methodologies and Tools for Inclusive Green Economy Analysis in Africa.

This technical document provides an overview of methodological frameworks and tools applicable to an IGE analysis. It constitutes a comprehensive review of different modelling disciplines, providing a description of each tool, the supported stages in the policymaking cycle, and the respective strengths and weaknesses. Through its comprehensive review of methodologies, this document can serve as a source book and a go-to guide when planning an IGE assessment.

PAGE, 2017: The Integrated Green Economy Modelling Framework – Technical Document.

This document presents a methodology on how to integrate three of the main modelling techniques used for Green Economy policy assessment (system dynamics, computable general equilibrium models, and input-output and social accounting matrix) to refine impact analysis of green policies and investments in the economy. It aims to respond better to country's needs in terms of analysing the cross-sectoral impacts of Green Economy policies.

PAGE, 2019: Indicators for an Inclusive Green Economy – Manual for Introductory Training.

This course is intended to introduce the concept of indicators to support policymaking for an Inclusive Green Economy (IGE) and to illustrate the use of methodologies for selecting and applying indicators. It seeks to contribute to the capacity of countries to choose indicators for IGE relevant to their country contexts, particularly considering the pursuit of the Sustainable Development Goals. Potential participants in this training include policymakers in governments and international and regional organizations; policy analysts and statisticians in these organizations; and academics from a range of disciplines concerned with the economy, the environment and society.

PAGE, 2019: Indicators for an Inclusive Green Economy – Manual for Advanced Training.

This course builds on the concepts and processes described in the Introductory Training. It focuses particularly on the application of the Partnership for Action on Green Economy's (PAGE) Green Economy Progress (GEP) Measurement Framework. The GEP Measurement Framework has been supported by PAGE and developed by its partner UN agency, the United Nations Environment Programme (UNEP). This framework provides a methodology for comparing performance on IGE over time.

Citation

PAGE (2020), Inclusive Green Economy (IGE) Modelling: Syllabus for a Higher Education Course.

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This document is a syllabus for a Higher Education Course on Inclusive Green Economy (IGE) Modelling. It provides an overview of the course, its target group and learning objectives, structure and content, as well as the learning methodology. The syllabus also features a list of key readings.

The Partnership for Action on Green Economy (PAGE) is a joint programme between the UN Environment Programme (UNEP), the International Labour Organization (ILO), the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO), and the United Nations Institute for Training and Research (UNITAR).

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