Results of the workshop on Sustainability Performance of the Energy Systems

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Workshop on Sustainability Performance of the Energy Systems

- CIEMAT, Madrid
- 29th-30th May 2017
- Organised by CIEMAT and IFE
- Financial support by IEA ETSAP
- Researchers from 13 organisations
- 14 presentations

Workshop on Sustainability Performance of the Energy Systems

Sessions:

1. Assessment of the energy systems sustainability
2. Energy Systems Modelling and Life Cycle Assessment
3. Input-Output assessment
4. Impacts of energy policies

And a lot of discussion and exchange of ideas
Assessment of the energy systems sustainability

Methodology:
- POWER SECTOR DETAIL IN GEM-E3_PT
- INVESTMENT MATRIX
- SCENARIOS
- SUSTAINABILITY INDEX

Objective:
Improve the connection between the bottom-up TIMES and top-down CGE model

Results showed:
- Scenarios with best environmental quality may have the worst economic and social sustainability index

RENEWABLE ELECTRICITY INVESTMENT: COMBINING TOP-DOWN AND BOTTOM-UP MODELLING APPROACHES

Sustainability index

Patrícia Fortes
Analysis: Kenya’s NDC target is achievable with a timely deployment of RE.

Due to new national policies, acceptance, etc. all the scenarios will fail (too much nuclear, too little RES).
The project:
• Local scale TIMES model for four different cities
• Different methods and tools have been used to support the municipalities in the development of Sustainable Energy Action Plan: GIS energy database, Door-to-door surveys, Smart meters
• Develop a planning tool to identify optimum mix of short, medium and long-term measures

The SureCity modelling framework
• Three cities
• Identification of cost-effective strategies and measures to reduce CO2-emissions without decreasing
The overarching objective of ECHOES is to unlock the policy potential of an integrated social science perspective on energy behaviour.

**Questions:**
- Is it economically sustainable?
- What are the CO2-emission impacts?
- Are there other important sustainability impacts?

**Methodology:**
- Case study
- Scales
  - Local
  - Regional
  - National
Methodological framework:

A new indicator to measure energy security based on electricity demand satisfaction and national renewability factor was introduced.

LCA indicators Climate Change, Ecosystems Quality, Human Health, and Resources was added to TIMES-Norway as emission factors.
Input-Output assessment

An input-output model for Irish economy - a preliminary study of stepwise substituting imported fossil-fuel electricity with renewable electricity

Mitra Kamidelvand (mitra.kamidelvand@ucc.ie)
Caíman Cahill, Maria Llop, Fionn Ragan, Brian O’Gallachoir

Environmental and socio-economic impact from decarbonising the economy - an IO perspective

Objective

- Based on this policy, the socioeconomic and environmental impacts associated to two scenarios have been estimated.
- The study has been conducted in two phases:
  1. Through an energy model, the evolution of the Mexican electricity systems in the long term has been analyzed.
  2. Based on the energy model results, and using a Multiregional Input-Output Analysis, the socioeconomic and environmental impacts have been estimated for both scenarios.

RESULTS

Concluding remarks

- IO-based analysis:
- Portrays all the economic activities of the system
- Coefficients and multipliers rely on strong assumptions
- Implicit assumptions in expanding renewable electricity
  - There is (excess) capacity in all sectors and factors, e.g. (un)employed factors of production

Future work

- IO to CGE model linked with energy systems
  - Analysing e.g.:
  - Impacts of price changes and changing elasticities?
  - Coal and gas substitution with renewables?
  - Overall environmental and socio-economic outputs of low carbon energy scenarios?
  - ....
Impacts of energy policies

The Italian Energy Strategy: energy and macroeconomic impacts

Workshop on Sustainability Performance of the Energy Systems - Madrid
29th and 30th May 2017

M. Gaeta / M. Rao / M. R. Virdis

Methodological approach

1) Reference energy scenario
2) Policy scenario with decarbonisation goals without any measures or government influence (only optimization results).
3) Impact analysis in different fields (emissions, business competitiveness, electrical system, etc.)
4) Weakness and strengths
5) Economic and environmental feedback
6) Introduction in energy scenario of policies/measures and sectoral goals set by the government

The impact assessment is not yet complete and air quality impacts and macroeconomic analysis with $GDP = E$ are postponed to the elaboration phase of the National Integrated Energy and Climate Plan

Presentation focus: energy analysis and macroeconomics impacts with SAM

Workflow for integrated analyses by ENEA

- Focus on economic impacts with Social Accounting Matrix

Adding Air Pollution to UKTM-UCL

- Added an air pollution emissions database for:
  - Particulate matter (PM$_{10}$ and PM$_{2.5}$)
  - Nitrogen oxides (NO and NO$_2$)
  - Sulfur dioxide (SO$_2$)
  - Ammonia (NH$_3$)
  - Non-methane volatile organic compounds (NMVOCs)
- Included both emissions factors and damage cost values
- For emission factors (EFs), we used:
  - Fuel-based EFs for the agriculture, industry, process, residential, services, and electricity sectors
  - Activity-based EFs for the transport sector, which allowed us to capture non-tailpipe emissions of particulate matter

Soft-linking UKTM to CMAQ for spatial representation of pollution

Air quality modelling with a Community Multiscale Air Quality Model (CMAQ) in partnership with King's College London.
Impacts of energy policies

Energy security assessment methods - quantifying the security co-benefits of decarbonising the Irish Energy System

James Glynn | @james_glynn | james.glynn@ucc.ie
Alessandro Chiodi, Brian Ó Gallachóir,

Not just affordably supply, - Sovereign, robust, resilient markets & infrastructure

Primary energy
- Domestic Fuels
- Fossil Fuel Imports
- Renewable Resource Potentials

Conversion & Transport
- Diesel
- Petrol
- Natural Gas
- Electricity

Energy (Service) Demands
- Passenger Transport
- Freight Transport
- Heat
- Light

2030 security in lower carbon scenarios

Scenario Comparison

Energy security

European Commission: Integrated National Energy and Climate Plans (Mechanism for Monitoring and Reporting)

Greenhouse gas
- Renewable
- Per sector, ETS/Non-ETS
- Non-energy sectors

Decarbonization
- Energy efficiency
- Energy security

Electricity interconnectivity
- Electricity and gas transmission
- Market integration
- Flexibility and renewable
- Prices, protection consumer
- Energy poverty

Internal energy market
- Research, Innovation and competitiveness

Other impacts

Various policies and measures

Sustainable Development Goal 7

Electricity
- Off grid / locally-based

Cooking
- Various fuels and technologies

Universal Energy Access
- Minimal levels of access

Nexus Water
- Linkages with Climate (Nationally Determined Contributions, climate mitigation and adaptation)
Some conclusions

✓ Including **behaviour** into the models

✓ **Transparency** with the implementation of technologies, with special mention to renewable

✓ Characterisation of **critical materials** like silver, copper, etc. considering costs but also competition with other uses

✓ **EC categories factors** should be kept in mind when analyzing climate and energy scenarios (descarbonization, energy efficiency, energy security, internal energy market, research, innovation and competitiveness, and other impacts)

✓ Technology and energy explicitness, the **representation of the consumers** regarding preferences and behaviour (microeconomic robustness and non-market preferences), the **trade** as interdependence between countries in the EU and from outside, macroeconomic feedback, and the **uncertainty analysis**

✓ Models can also play a good role analysing the **Nexus Water-Energy-Land (Food)**

✓ Holding **Stakeholders consultations** as well as the **involvement of the general public**

✓ Dealing with **energy efficiency**

✓ Other issues discussed: **car sharing**, relevant in local models; **air pollution and dispersion models** to move from pollutants dispersion to concentrations; **agricultural sector** as supplier of the cities and sectors; **demand based on ecosystem services** instead of socioeconomic drivers; **external costs of biodiversity**
General conclusions

✓ Contribution to improve the analysis of the interaction between the energy system and the economy and society incorporating environmental, social and socioeconomic aspects

✓ Thanks to the participation of ETSAP members and TIMES users

✓ Productive, interesting and stimulating
THANK YOU
Backup slides
Objective

- To hold a workshop on **Sustainability performance of the energy systems**

Motivation

- Sustainability indicators are a measure of sustainability performance of the energy systems and can deal with different aspects of sustainability: economic, social and environmental
- While environmental sustainability indicators have been broadly investigated and applied to energy systems, the research on the applications of socioeconomic and social indicators are still lagged behind in their incorporation
- To take a step forward in the incorporation of new indicators to our analyses

Benefits for ETSAP

- This project contributes to improve the analysis of the interaction between the energy system and the economy and society incorporating environmental, social and socioeconomic aspects
- Collaboration between ETSAP teams
Deliverables

- D1. Two-day workshop to be held in spring 2017
- D2. Workshop proceedings
- D3. Document with main results from discussion

Time schedule

January-December 2017

Tentative date for the workshop: April
CIEMAT, Madrid