



This project is co-financed by the European Union
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Technical Assistance for Developed Analytical Basis for Formulating Strategies and Actions towards Low Carbon Development



TIMES modelling framework: Approach and methodology for sectoral (buildings, transport, agriculture and waste) GHG mitigation potentials and costs assessment under Activities 3.1 and 3.2

15 November 2018, Ankara





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What is TIMES Modelling Framework?

- Is a bottom-up Energy-Technology-Environmental systems modelling framework,
- It identifies the least-cost set of Technologies to satisfy end-use Energy service demands and user defined constraints.
- Linear modelling approach
- Represent economy wide energy system and/or sub-sectoral systems permitting to observe economy wide impacts of policies analyzed .

What is TIMES Modelling Framework? (Objective)

$$NPV = \sum_{r=1}^R \sum_{y \in YEARS} (1 + d_{r,y})^{REFYR-y} \cdot ANNCOST(r, y)$$

- Each year, the total cost includes the following elements:
- *Capital Costs* incurred for *investing* into and/or *dismantling* processes;
- Fixed and variable annual *Operation and Maintenance (O&M) Costs*, and other annual costs occurring during the dismantling of technologies;
- Costs incurred for *exogenous imports* and for domestic resource *production*;
- Revenues from exogenous *exports*;
- *Delivery* costs for required commodities consumed by processes;

What is TIMES Modelling Framework? (Objective)

$$NPV = \sum_{r=1}^R \sum_{y \in YEARS} (1 + d_{r,y})^{REFYR-y} \cdot ANNCOST(r, y)$$

- *Taxes and subsidies* associated with commodity flows and process activities or investments;
- *Revenues from recuperation of embedded commodities*, accrued when a process's dismantling releases some valuable commodities;
- *Salvage value* of processes and embedded commodities at the end of the planning horizon;

What is TIMES Modelling Framework? (Technology/Processes)

- *Each process defined by*
 - *Capital Costs*
 - *Operating & Maintenance Costs*
 - *Fixed Costs*
 - *Inputs - Energy commodities/materials per unit activity*
 - *Outputs – Energy commodities/materials per unit activities*
 - *Emissions resulting from fuel from combustion*
 - *Emissions resulting from internal processes*
 - *Initial capacity level*
 - *Efficiency*
 - *....*

What is TIMES Modelling Framework? (Results)

- TIMES has the following features:
 - identifies the least-cost pattern of resources use and technology deployment over time;
 - Quantifies the sources of emissions from associated energy system;
 - Quantifies the system wide effects of changes in resource supply, technology availability, and policies related, but not limited, to energy and environment;
 - Provides framework for exploring and evaluating future scenarios under various technology and policy options;
 - it allows for regional analysis of the energy system and related inter-regional transactions;
 - it allows elastic demand for energy service demands.

Why TIMES modelling framework?

- Ability to model each sector independent of each other
- Ability to model sectors technology explicitly coupled with clear commodity flows
- Ability to implement very detailed policy scenarios including taxes and subsidies based on commodity and/or technology,
- Ability to implement quantity based policies

Why TIMES modelling framework?

- Ability to implement technology specific discount rates
- Ability to combine individually developed sectoral models with the economy wide models to assess the overall impacts on the economy and/or national emissions.
- Ability to assess full cost of the policies for the economy when used in combined form.
- Ability to compute marginal value pricing


Advantages?

- Technological explicit
- Linear model
- Ability to implement wide variety of policies
- Modularity
- Transparent and publicly available model code
- Internationally accepted and globally used modelling framework
- Maintained updated by International Energy Agency – Energy Technology Analysis Programme (IEA – ETSAP)

Disadvantages?

- Data Intensive
- Requires future projections
- Deterministic
- Perfect foresight
- Assumes rational decision makers
- Results are data sensitive

TOR Updates?

- «National»  «Sectoral»
 - TIMES framework perfectly fits to this requirement
 - Sectoral models would be developed without the rest of the economy
 - Only sectoral baselines will be developed for the project

Report outlines and Model correspondence

- Sectoral GHG baseline scenario projections
 - Model will provide Baseline Emission projections
 - Baseline projections will include current policies as well as requested policies for the modelling time horizon.
- GHG mitigation potential assessment of selected actions specified in NCCAP and other documents for four targeted sectors
 - Model will provide GHG mitigation potential assessment for selected priority actions
- Cost assessment sectoral emission mitigation options

Sectoral approaches for GHG calculations

- Model is able to handle fuel combustion and process emissions via technology/process specific emission factors.
 - Building and transport sectors are mainly responsible for fuel combustion related emissions
 - Waste and agriculture sector has significant process emissions; thus process based emission factors will be implemented for each specific current and future Technologies based on corresponding sector experts

Data Issues

- Model is data intensive
- Some data may not be present
- Expert guessess will be crucial for specific conditions!

A misty lake with mountains in the background. The scene is serene and calm, with the water reflecting the surrounding landscape. The text "• Any questions?" is centered on the page.

- Any questions?

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Practice areas

Electricity Markets

Energy/Environment/Economy Modeling

Integrated Energy System Assessment

Energy System Design



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Thank You

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