



# Task 2: Implementation and Trainings for the Selected Energy Sector Modelling Tools

Inception Meeting: Task 2

Dr. Leonidas Paroussos

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# Overview



# Key objective of task 2

- Task 2 is a core Task of the project and its activities are mainly streamlined into two distinct but also interconnected tasks:
  - (a) the delivery of a structured training to MENR's staff covering issues pertinent to the capabilities, the use, and the implementation of the model
  - (b) the preparation, customization and calibration of the model to facilitate the long term energy planning activities of MENR, including: data gathering and preparation, reference and alternative policy scenarios formulation and analysis.
- An additional sub-task relates to the realization of three country visits to familiarize MENR's staff with EU energy system modelling practices

# Work is split in the following tasks

- **Sub-task 2.1:** Introduction of the approach and initial training on the modelling tools to be implemented;
- **Sub-task 2.2:** Implementation;
  - **Activity 2.2.1:** Data Gathering and Preparation
  - **Activity 2.2.2:** Trainings and Implementation of Energy Modelling Tools
    - **Sub-activity 2.2.2.(a):** preparation of trainings
    - **Sub-activity 2.2.2.(b):** Training for utilization
    - **Sub-activity 2.2.2.(c):** Implementation and on the Job training
    - **Sub-activity 2.2.2.(d):** Running of scenarios by the trainees and evaluation/certification
- **Sub-task 2.3:** Study visits for energy sector planning and modelling;
- **Sub-task 2.4:** Procurement documents for the required hardware.

# 02

## Sub-task 2.1: Introduction of the approach and initial training on the modelling tools to be implemented

# Objective

- The objective of this sub-task is **to familiarize MENR with the energy system models' features and capabilities.**
- This will be achieved through an intensive five-day training course **“Energy System model components”**, to take place in **March 2019.**
- The objectives of the training course are:
  - Train the users to use GAMS
  - Train the users to the key features of the modelling system and
  - To receive feedback from the client regarding model features so as to better adjust the model to meet the client's requirements.

# Initial Training – Topics to be covered

Date	Title and description of Training	Responsible: E3M
<b>Initial Training on the modelling tools (2<sup>nd</sup> week of March)</b>		
11/03/2018	Introduction to GAMS (General Algebraic Modeling System) software	
	The topics to be covered in this session include: GAMS installation, Introduction to GAMS	
12/03/2018	Main features of the EST model	
	Overview of the main features of the model to be delivered and presentation of the different components of the model (transport, industry, buildings, power generation etc.)	
13/03/2018	Modelling Demand: Industry	
	The first part of the session will be delivered as a theoretical presentation on the modelling of the “Industry” sector, will a second part will follow where the trainees will work on a model maquette (GAMS hands on)	
14/03/2018	Modelling Demand: Transport	
	The first part of the session will be delivered as a theoretical presentation on the modelling of the “Transport” sector, will a second part will follow where the trainees will work on a model maquette (GAMS hands on)	
15/03/2018	Modelling Demand: Buildings	
	The first part of the session will be delivered as a theoretical presentation on the modelling of the “Building” sector, will a second part will follow where the trainees will work on a model maquette (GAMS hands on)	

# Output

## Outputs

No	Name of deliverable	Description	Timeline
D2.1	Initial Training Report	<ul style="list-style-type: none"><li>› Training program background and objectives</li><li>› Training Methods and Activities</li><li>› Key Findings and recommendations</li><li>› Supporting documentation</li></ul>	Month 9

# 03

## Sub-task 2.1: Implementation

# Objective

- The objective of this subtask is to implement the model in such a way to cover the energy planning and modelling needs of MENR, and to provide on the job training to MENR's competent experts for the selected scenarios.
- Within this subtask, the preparation, customization and calibration of the models will be performed.
- The Implementation is further divided into two (2) distinct activities: i) Data gathering and preparation and ii) Trainings and Implementation of Energy Modelling Tool

# Data gathering and preparation (responsible AF-Mercados)

**Active participation of core MENR team in this Activity is considered essential for both, to ensure that all appropriate sources are exploited and, most important, to be trained on-the-job in data gathering and analysis.**

- This task involves
  - a. collect all data required, and
  - b. prepare the collected data in the appropriate form so that they will be directly applicable to the developed model and the scenarios considered for the energy planning.
- The first step in this Activity will be to **compile a detailed list with the data required** by the EST model and to **develop appropriate data templates**.
- The second step regards the **data availability assessment** in dedicated meetings with MENR. In this exercise, an assessment on which extent the required data is available from publicly available sources and which data is confidential will be made. In case of missing data, the Consultant will propose methods to fill in the gaps.
- The data gap analysis will also provide an assessment of the data quality and length of the time series. A plan will be proposed to collect the missing data, where expert judgement will be used to create reasonable assumptions to fill the data gaps.
- In order to realize this task of data gathering and data preparation close cooperation will be needed with various departments of MENR, but also with other **relevant stakeholders, namely Turkstat, EMRA, TEIAS, BOTAŞ, MTA, TKI, TKK,** among others.
- As a parallel activity, **the quality of data will be evaluated**. It is noted that it can be expected that some data will be of questionable quality. The latter will be understood after undertaking a **QA & QC assessment**. The consultant will establish and run a QA&QC procedure for data in collaboration with the assigned for this task experts from MENR

# Activity 2.2.2: Trainings and Implementation of Energy Modelling Tool

- The objective of these training sessions, is to make the owners of the model independent users able to run the model, design and implement alternative scenarios, perform consistency checks and realize small model developments.
- To maximize the effectiveness of the training, a staged teaching approach is adopted where the model is developed in stages hand to hand with the trainee.
- This process has already started in the previous training delivered by E3-Modelling and will become more intense in this training.
- The training course will involve the development of model maquettes that illustrate key mechanisms of the energy system modelling in specific energy sectors (e.g. in power generation).
- The next stage of the training is to make a transition from mini models to fully fledged large scale applied models. This entails the increase of the detail of the model in many respects, including technological options, time segments, sectors and fuel types and its calibration to the most recent statistics.
- The staged training procedure is much more efficient than conventional training programs where users are trained on an already developed modelling platform missing this way critical knowledge regarding the different aspects/stages of model development and model operation which is masked usually under the complexity and detail of a finalized model. To illustrate the model usefulness, the model is going to be used and tested on real energy policies, which will be first extensively discussed and agreed with MENR

## Sub-Activity 2.2.2 (a): Preparation of trainings

- Collection and reconciliation of data, collection of other model input requirements (i.e. international fossil fuel prices, technology dynamics etc.) and the calibration of the model to base year statistics.
- With the consultation of MENR, a reference scenario (reflecting continuation of current tendencies of the energy and economic system) will have to be developed prior to the delivery of the trainings.
- Intentionally made mistakes and errors will be part of the reference and counterfactual scenarios training exercises so as to demonstrate the evaluation and correction processes that trainees need to follow.

## Sub-Activity 2.2.2 (b): Training for utilization

- The training regarding the utilization of the model will cover both its theoretical and technical aspects. The theoretical training will provide a detailed presentation of the mathematical formulation of the different components of the model. The mathematical formulations of the EST model are derived from the PRIMES energy system model.
- For each model component there will be a detailed description of the mechanisms of the model, their algebraic formulation, key alternative approaches available in modelling the specific mechanisms (i.e. peak load pricing, marginal cost pricing, Ramsey pricing) and a justification for the specific mechanism selected.
- The focus of this part of the training will be to communicate to the trainees the behaviour of the model according to its mechanisms and not to develop realistic simulations (the quantification of real life policy scenarios will take place in the subsequent proposed training).

# Training – Topics to be covered

Date	Title and description of Training	Responsible: E3M
<b>Use of the energy system model (2<sup>nd</sup> week of May 2019)</b>		
13/05/2019	Modelling of specific sectors	
	This training will cover the modelling of specific sectors that the EST model considers. The sectors to be covered are: Iron and Steel, Nonferrous metals, Non-Metallic Minerals, Chemicals, Pulp, paper and printing Food, drink and tobacco, Textiles, Engineering, Other Industries, new technologies. The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)	
14/05/2019	Modelling energy supply	
	The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)	
15/05/2019	Data input/output handling	
	The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)	
16/05/2019	Complete Energy System model (part I)	
	The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)	
17/05/2019	Complete Energy System model (part II)	
	The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)	

## Sub-Activity 2.2.2 (c): Implementation and on the Job training

- The design and development of the baseline scenario will be initiated early in the beginning of the project. The baseline scenario will develop a “business-as-usual” case for Turkey in horizon to 2070.
- In this training session, participants will learn how to develop a detailed reference scenario , i.e. a scenario that is based on current energy system trends and implementation of already adopted policies (without additional energy and climate policies), which is used as a benchmark to compare alternative policy-driven scenarios.
- Alternative scenarios will be prepared by the Consultant in close collaboration with MENR in order to simulate different energy and climate policy related issues. The alternative scenarios will include impact analysis of energy and climate policies, impact on energy system costs from reaching different energy and climate targets, energy system impacts from expansion of RES, and any other topic suggested by the client.

# Training – Topics to be covered

Date	Title and description of Training	Responsible: E3M
<b>Use of the energy system model (2<sup>nd</sup> week of July 2019)</b>		
8/07/2019	Presentation of the EST model	
	Overview of the EST model, key features and potential capacity for simulations	
9/07/2019	Calibration of the EST model to the Turkish energy system	
	Data requirements of the EST model, other input requirements (projections of technology costs, fossil fuels, elasticities etc), methods of model calibration.	
10/07/2019	<ul style="list-style-type: none"> <li>Using the EST model (Part I)</li> </ul>	
	Using the EST model to develop a Reference Scenario. The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)	
11/07/2019	<ul style="list-style-type: none"> <li>Using the EST model (Part II)</li> </ul>	
	Using the EST model to develop a Reference Scenario – part II. Using the EST model to develop a Policy Scenario – an introduction. The training will involve theoretical presentations followed by a model maquette (GAMS hands on training).	
12/07/2019	<ul style="list-style-type: none"> <li>Reporting and analysis of the results</li> </ul>	
	Walk through the reporting and analysis of the results	

# Sub-Activity 2.2.2 (d): Running of scenarios by the trainees and evaluation/certification

- In order to ensure that the training will be materialized into capacity of MENR's staff to professionally customize and utilize the delivered models, following the completion of the first implementation of the Baseline and the agreed with MENR Alternative Scenarios, **the Consultant will prepare a number of Scenarios in the form of exercise for the trainees.**
- The trainees will be divided into teams and each team will be provided with a specific Scenario. The members of each team will collaborate and will have 15 working days (i.e. a 3-week period) to work on their assigned Scenario. In particular, the trainees will have to follow the whole modelling and planning circle as it was presented to them in the previous activities of the project.
- The Consultant will avail a dedicated team of experts who will be responsible of answering the potential questions of MENR staff during the exercise period of 15 working days.
- Upon completion of the exercise period of 15 working days, the Consultant will evaluate the work of each team of MENR staff and will provide detailed comments on how their work will be improved towards the achievement of the desired outcome.
- At the end, the successful participants will be given a certificate of successful completion of the training course. It is noted that the certificate will not be awarded on an exam basis, but on the proven capability of the trainee.

# Training – Topics to be covered

Date	Title and description of Training	Responsible: E3M
<b>Use of the energy system model – Scenarios and Policies (3<sup>rd</sup> week of September 2019)</b>		
16/09/2019	<ul style="list-style-type: none"> <li>• Scenario on Energy Efficiency</li> </ul> <p>This training course will deal with the development of alternative scenarios of Energy Efficiency policies, and their implementation in the EST model. Examples include the following:</p> <ul style="list-style-type: none"> <li>› Identification of the cost-effective energy efficiency potential in the time horizon of up to 2070 in sectors specified in the energy model – industry, transport, households, agriculture and services and presentation of the energy savings by sector as a cost curve (€ / kWh),</li> <li>› Calculation of total investment costs for achieving the energy efficiency target defined by the Client.</li> </ul> <p>The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)</p>	
17/09/2019	<ul style="list-style-type: none"> <li>• Scenario on RES</li> </ul> <p>This training course will deal with the development of alternative scenarios of RES policies, and their implementation in the EST model. Examples include the following:</p> <ul style="list-style-type: none"> <li>› Scenarios for the development of the various renewable energy sources</li> <li>› Scenarios regarding alternative energy prices development</li> <li>› Analysis of deployment of low carbon technologies on energy prices.</li> </ul> <p>The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)</p>	

# Training – Topics to be covered

Date	Title and description of Training	Responsible: E3M
<b>Use of the energy system model – Scenarios and Policies (3<sup>rd</sup> week of September 2019)</b>		
18/09/2019	<ul style="list-style-type: none"> <li>• Scenario on climate change mitigation</li> </ul> <p>This training course will deal with the development of alternative scenarios of climate change mitigation policies, and their implementation in the EST model. Examples include the following:</p> <ul style="list-style-type: none"> <li>› Impact analysis of implementation of an Energy-Climate package with outlook up to 2070 on the technology and energy mix of Turkey</li> <li>› Scenarios for the development of renewable energy sources, energy efficiency, and fossil fuel by type</li> <li>› Impact of various climate change mitigation policies on energy prices and energy demand and supply.</li> </ul> <p>The training will involve theoretical presentations followed by a model maquette (GAMS hands on training)</p>	
19/09/2019	<ul style="list-style-type: none"> <li>• Combined policy scenario</li> </ul> <p>A combined policy scenario that simultaneously includes components from all instruments, policies and measures that have been individually implemented in previous days.</p> <p>Theoretical presentation followed by a model maquette (GAMS hands on training)</p>	
20/09/2018	<ul style="list-style-type: none"> <li>• Scenario Analysis</li> </ul> <p>Reporting and decomposition of the results into their key drivers.</p>	

# Exams

- After the completion of the training for Implementation / Scenarios and Policies a final 5-days training course will be delivered aiming to recap the previous training sessions, to organize exams for the participating MENR experts, and to conduct both trainees and training evaluation.
- The realization of this training towards the project completion will ensure that, on one hand, the participating trainees will be able to apply the acquired knowledge and accumulated experience, and on the other hand, the Consultant will be able to holistically evaluate the extent of assimilation (both in terms of theoretical knowledge and software deployment).

# Training – Topics to be covered

Date	Title and description of Training	Responsible: E3M
<b>Staff Evaluation and Final Delivery of the model (3<sup>rd</sup> week of November 2019)</b>		
16/11/2019	<ul style="list-style-type: none"> <li>Written Exams</li> </ul>	
	Participants will be asked to answer a number of questions regarding the model operation	
17/11/2019	<ul style="list-style-type: none"> <li>Hands – On Exams</li> </ul>	
	Participants will be asked to perform certain exercises regarding the calibration of the model	
18/11/2019	<ul style="list-style-type: none"> <li>Hands – On Exams</li> </ul>	
	Participants will be asked to perform certain exercises regarding the development of the Reference scenario of model	
19/11/2019	<ul style="list-style-type: none"> <li>Hands – On Exams</li> </ul>	
	Participants will be asked to perform certain exercises regarding the development of the Policy scenarios using the model	
20/07/2019	<ul style="list-style-type: none"> <li>Solutions to the exams and discussion</li> </ul>	
	Analytical presentation of the solutions and interaction with the participants to clarify and remaining model questions	

# Outputs

No	Name of deliverable	Description	Timeline
D2.1	Initial Training Report	<ul style="list-style-type: none"><li>› Training program background and objectives</li><li>› Training Methods and Activities</li><li>› Key Findings and recommendations</li><li>› Supporting documentation</li></ul>	Month 9

# Outputs

No	Name of deliverable	Description	Timeline
D2.3	Initial User Manual for each of the modelling tool	<ul style="list-style-type: none"><li>› User Manual for the EST model, including documentation for the demand forecasting model.</li></ul>	Month 12
D2.4	Implementation Report	<ul style="list-style-type: none"><li>› The customized EST model (incl. the demand forecast model) and documentation on the structure and the use of the software.</li><li>› Baseline and Alternative Scenarios, as agreed with MENR and implemented by the Consultant in the course of the Implementation phase (Task 2).</li></ul>	Month 14

# Sub-Task 2.4: Technical specifications for the required IT hardware equipment

- The aim of this subtask is to specify the hardware requirements (Technical Specifications) in order to ensure that the proposed energy planning computational tools will run smoothly and, therefore, MENR staff will be able to perform their tasks efficiently.
- The basic criteria for the determination of the system technical specifications will be such as to ensure:
  - High system performance, i.e. short running times for the most demanding modelling tasks
  - System robustness and reliability.

## Indicative hardware requirements

Item	Minimum Specifications	Recommended Specifications
CPU cores	8	16
CPU speed (GHz)	3-4	3-4
Memory	16 GB RAM	128 GB RAM
Hard Disk Drive	1 TB SATA	1 TB SSD
Display Resolution	not important	not important
Display Card	not important	

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# Thank You

