National Energy System Modelling with TIMES – an MSc. Course at DTU

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Overview

- General info
- Course design
  - Learning objectives
  - Teaching methods and activities
  - Assessment
  - Core elements
  - Course timetable
- Anticipated challenges
- Questions & Comments
General Info

Title: National energy system modelling with TIMES
Duration: 3 weeks
Students: 12 – 100?
Crew: 2 Senior Researches, 2 Postdocs, 4 PhD Students
Workload: 5 ECTS
Launch: January, 2017
General Info: Students

Study programme: Master in Sustainable Energy
Year: 2\textsuperscript{nd}

Course prerequisites (previous DTU courses):
- Modelling and Analysis of Sustainable Energy Systems using Operations Research
- Energy Economics, Markets and Policies
- Feasibility studies of energy projects
Course Design: Learning Objectives

- **Collect** and **evaluate** data critically e.g., by comparing production costs of technologies
- **Develop** and **analyse** internally consistent future energy scenarios
- **Critically reflect** on a tool functionalities as well as main assumptions and limitations of that type of tool in general and specifically for the applied tool
- **Validate** and **explain** results
- **Use** TIMES model generator for creating a national energy system model and **describe** its structure
- **Analyse** national energy system scenarios applying a TIMES model
- **Apply** constraints in TIMES to represent e.g., limited renewable resource potentials
- **Represent** energy demand, transmission, conversion and resource potentials for different sectors of an existing energy system in TIMES
- **Explain** the modelling of specific technologies in a TIMES energy system model and **compare** the system consequences of implementing them
- **Clarify** sensitivities of main assumptions through sensitivity analysis
- **Synthesise** the main conclusions and **discuss** results in relation to results of other energy system analyses and current debate in society
- **Coordinate** model development
Course Design: Teaching Methods

- Project-based learning
  - Develop a national TIMES model
  - Use it for an analysis

- Spiral learning
  - Gradual exposure to TIMES and VEDA
  - Increasing sophistication of model sectors
Course Design: Teaching Activities

- Lectures

- e-Learning
  - Mostly tutorials

- Group work (matrix structure)
  - Every "work group" develops a country model and uses it for an analysis
  - Every "study group" contains students responsible for a single sector (e.g. transport)
Course Design: Assessment

- Summative
  - Group posters
  - Written exam (e.g. multiple choice)

- Formative
  - Pre-test
  - ...
Course Design: Core Elements

- Temporal aggregation
- Validation and calibration
- Scenario analysis
- Geographical aggregation
- Data quality
- TIMES
- Sector modelling
- Error checking
- VEDA
- ESA and tools
Course Design: Course Plan

- Week 1: lectures, exercises, data
- Week 2: model structure and data
- Week 3: validation and analysis
Course Design: Other Practicalities

• Modelling sophistication and heterogeneity
  – We provide example structure for sectors (developed in exercises)

• Data availability
  – We point out data sources (e.g. make sure some data is available for students)
Anticipated Challenges

- Recommended (not mandatory) prerequisites
- Flexible class size
- X-mas holidays
Thoughts, comments, questions...?

Thank you for attention!