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

Olexandr Balyk
Energy Systems Analysis Group
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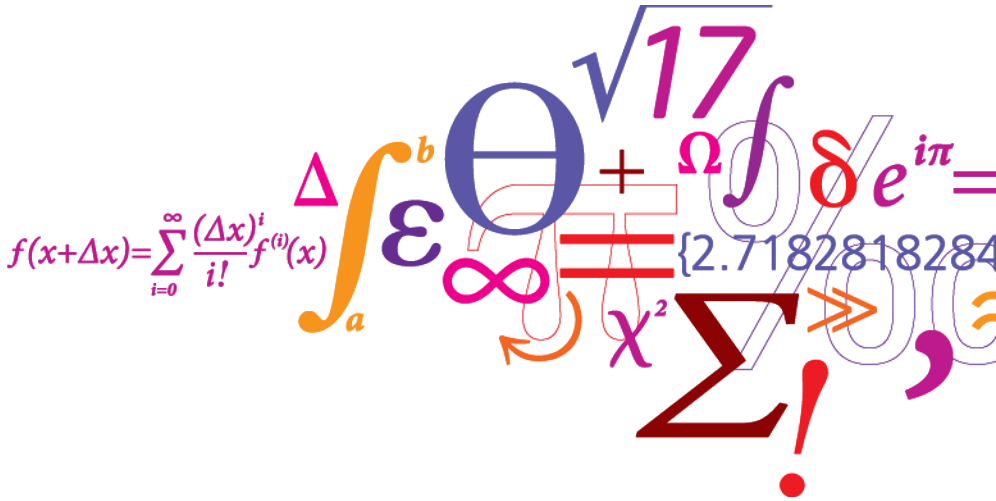


DTU Management Engineering
Department of Management Engineering

Overview

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

General Info

Tittle: 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: 2nd

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

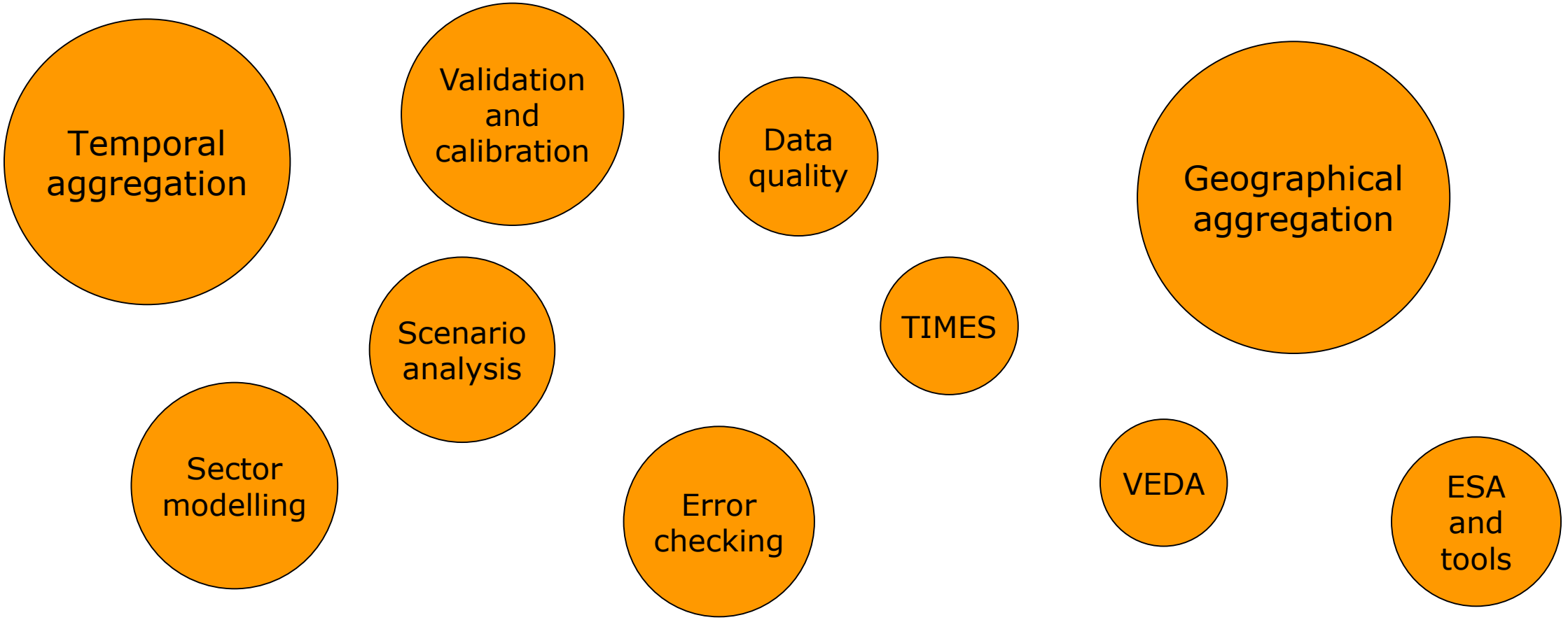
- Lectures
- e-Learning
  - Mostly tutorials
- Group work (matrix structure)
  - Every "work group" develops a country model and uses it for an analysis
  - Every "study group" contains students responsible for a single sector (e.g. transport)

Course Design: Assessment

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

- Formative
  - Pre-test
  - …

Course Design: Core Elements



Course Design: Course Plan

- Week 1: lectures, exercises, data
- Week 2: model structure and data
- Week 3: validation and analysis

	Day 1	Day 2	Day 3	Day 4	Day 5
Week 1	ESA & tools, Scenario analysis	Supply, EX	Power & Heat, EX	RES & IND & COM, EX	Transport, EX
	Intro TIMES, group forming	Data Quality, CG	CG	CG	CG
Week 2	P1 – country overview and agenda	Model structure, EX	Time, EX	Geography, EX	Validation& calibration, EX
	Intro, SG	SG/CG	SG/CG	SG/CG	SG/CG
Week 3	P2 – model structure and analysis	CG	CG	CG	CG
	SG	SG	SG	SG	P3 - 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!