Model validation, benchmarking, calibration – some open questions

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Some terminology

- Model verification
  - Confirming that model is correctly implemented

- Model benchmarking
  - Comparing model performance with other models

- Transparency & reproducibility

- Model validation
  - Accuracy of the model's representation of the real system
  - Model outcome versus reality
Perspective and time scales

- Device/single actor perspective
  - Control
  - Bidding strategy
  - Power plant operation/commitment

- System level perspective
  - Operation of power plants
  - System planning – investment
The LUSYM model determines the **optimal unit commitment and economic dispatch** decision for a set of power plants, in order to meet a given electricity demand at **lowest operational cost**.

### Input
- Conventional power plant portfolio (fixed)
- Technical characteristics of each power plant (e.g. minimum power output)
- Cost characteristics of each power plant (e.g. fuel cost, start-up cost)
- Interconnection capacity
- Hourly demand, possibly with part of it being flexible
- Hourly generation from renewables and cogeneration

### Model
- Mixed-integer linear program
- Minimizes operational system cost
- Assumes perfect competition
- Deterministic/stochastic
- Hourly time resolution
- Renewables curtailment possible
- Network limitations
- Outages implicit in the model

### Output
- Hourly generation schedule
- Hourly generation cost
- Hourly CO₂ emissions
- Hourly regional prices
- Hourly transmission flows
- Hourly curtailed load
An example
LUSYM: Set-up of the standard unit commitment model

- Model benchmarking
An example
LUSYM: Set-up of the standard unit commitment model

• Calibration
  o Power plant availability
  o Maintenance schedules
  o Power plant efficiencies (or other uncertain input data)
  o Fuel price?
  o Cross-border exchanges?
  o …

• To what extent do calibration measures hold in counterfactual scenario?
An example
LUSYM: Set-up of the standard unit commitment model

- Model validation
  - Fuel shares
  - Annual basis

(c) Coal generation (TWh/year).
(d) Gas generation (TWh/year).
An example
LUSYM: Set-up of the standard unit commitment model

- Model validation
  - Cross-border exchanges $\Rightarrow$ net import
    - Annual basis
An example
LUSYM: Set-up of the standard unit commitment model

- Model validation
  - Hourly electricity prices
An example
LUSYM: Set-up of the standard unit commitment model

- Model validation
  - Hourly electricity prices
Reflections

• Use of this type of models
  o Model runs should be compared to one-another
  o Observe impact of certain modifications/boundary conditions/scenarios

• But what if (reference) model outcome departs (too) much from reality?

• To what extent can conclusions hold?
Reflections

- Good practices for calibration?
- Good practices in model use?
- Model versus data-driven approaches?