Towards a Norwegian regional TIMES model

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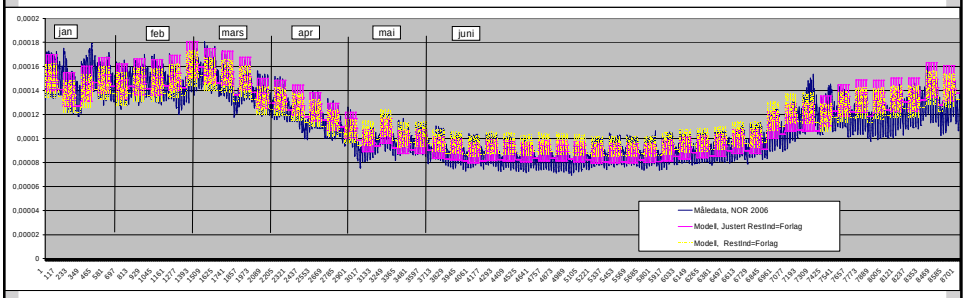
Background

- Several MARKAL models for Norway available
  - Norwegian national model
  - Several region models (Oslo, Telemark, Rogaland)
- The models have different level of aggregation (by sectors) and time resolution/time horizon
- The Norwegian Water Resources and Energy Directorate (NVE) want to improve modelling of end use options
  →Development of regional TIMES model with high time resolution which could be used in connection with power market models at NVE

Modelling demand sectors

- Household
  - Existing single/multi family houses
  - New single/multi family houses
  - Cottages
- Agriculture
- Service
  - Construction
  - Education
  - Healthcare
  - Hotels and restaurant
  - Offices
  - Other commercial
  - Road light
  - Wholesale and retail
- Industry
  - Aluminium (large companies)
  - Chemical industry (large companies and other)
  - Metal industry (large companies and other)
  - Mining
  - Pulp and paper (large companies and other)
  - Refineries
  - Residual industry
- Transport
  - Air transport
  - Cars
  - Freight
  - Other mobile combustion
  - Buses
  - Trains
  - Sea transport

Developing load curves from measuring data

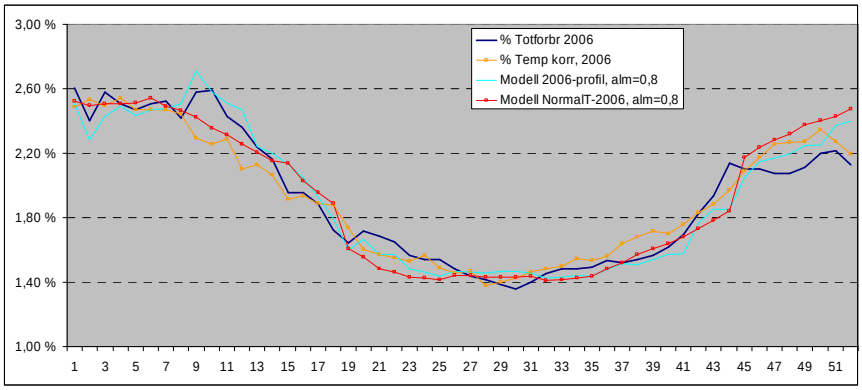


Measuring data not available pr sector and type of use

→ Need to modify different datasets

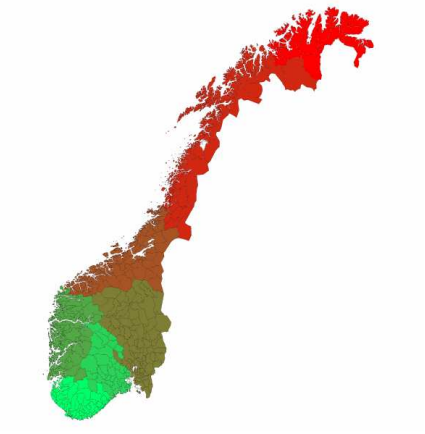
(Figure: Karen Lindberg, NVE)

Temperature correction- weekly profile



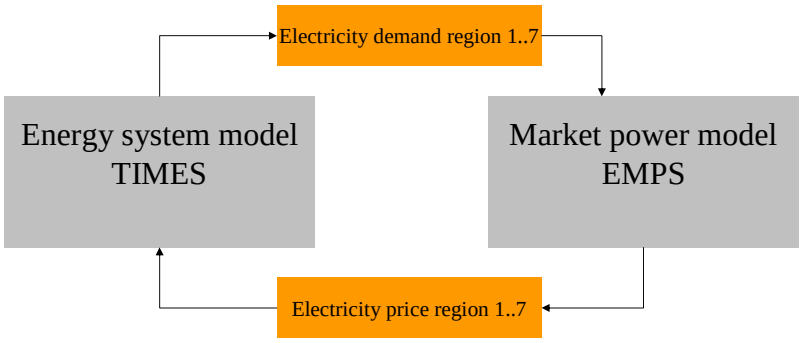
(Figure: Karen Lindberg, NVE)

Times model- regions

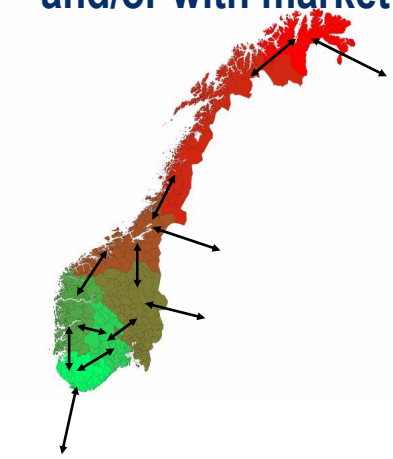


1	South
2	Central
3	West
4	East
5	Mid
6	North
7	Finnmark

Interaction between TIMES and EMPS model



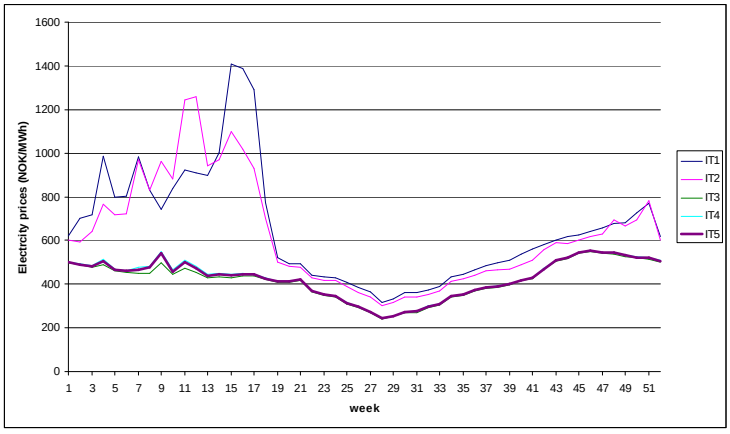
Exchange of electricity within regions and/or with market power model (EMPS)



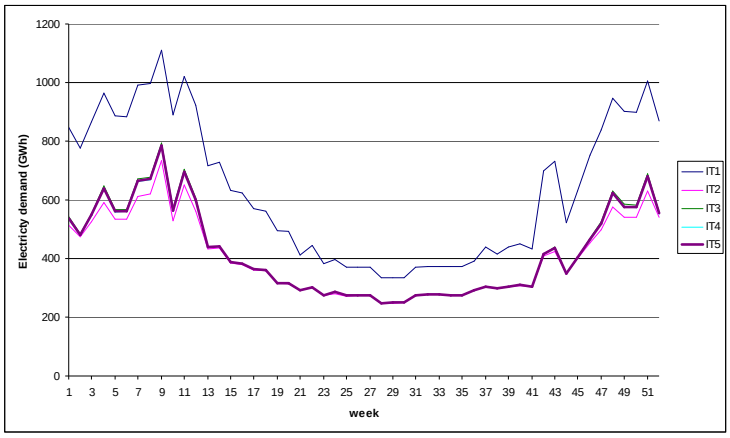
Region	Price of electricity
1	Pel_1
2	Pel_2
3	Pel_3
4	Pel_4
5	Pel_5
6	Pel_6
7	Pel_7

Iteration between TIMES and EMPS model (1)

Electricity prices



Iteration between TIMES and EMPS model (2)
Electricity demand



Conclusions and Further Work

- Conclusions so far
  - Several challenges when moving from MARKAL to TIMES
  - The TIMES model seems to fit well with the Power Market model EMPS (first iterations)
  - Improved modelling of hydropower storage important
- Further work
  - Linking of regions/grid exchange
  - Introduction of MIP needed due to the size of regions?