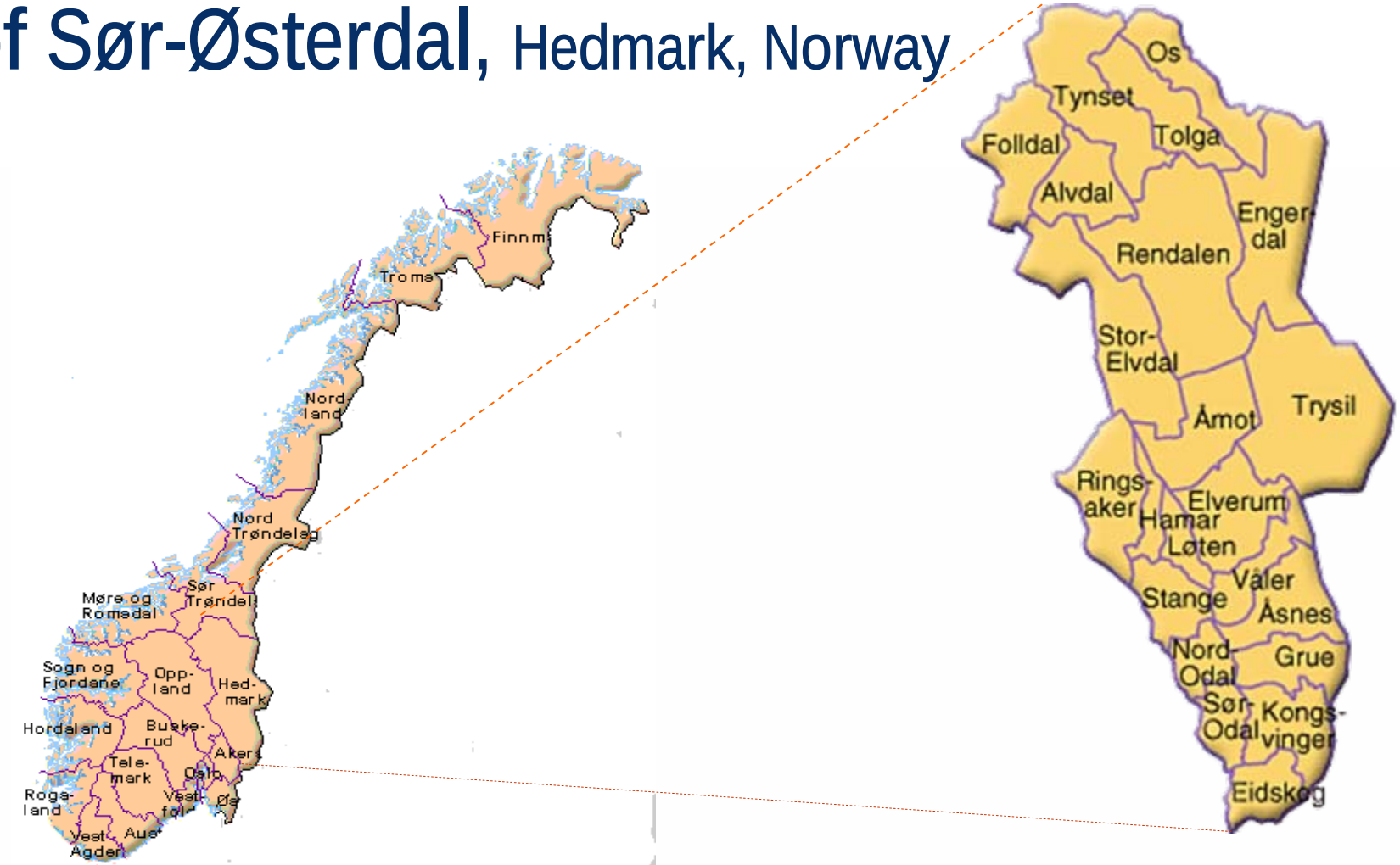
Sustainable Energy Planning in the region of Sør-Østerdal, Hedmark, Norway



Presentation

1. Sør-Østerdal (SØ):
   - General facts
   - Statistics
   - Predictions

2. Regional Energy Analysing Model (REAM):
   - Input data
   - Sources

SØ: General facts

- Elverum
  1229 km^2, 19200 inhabitants. Urban settlement, increasing population
- Trysil
  3015 km^2, 6800 inhabitants. Mixed settlement, decreasing population
- Åmot
  1339 km^2, 4300 inhabitants. Mixed settlement, increasing population
- Stor-Elvdal
  2167 km^2, 2700 inhabitants. Rural settlement, decreasing population
- Engerdal
  2195 km^2, 1500 inhabitants. Rural settlement, decreasing population

SØ: Large scale energy production

- Elverum

  Hydro power, district bio heating, methane gas from waste
- Trysil

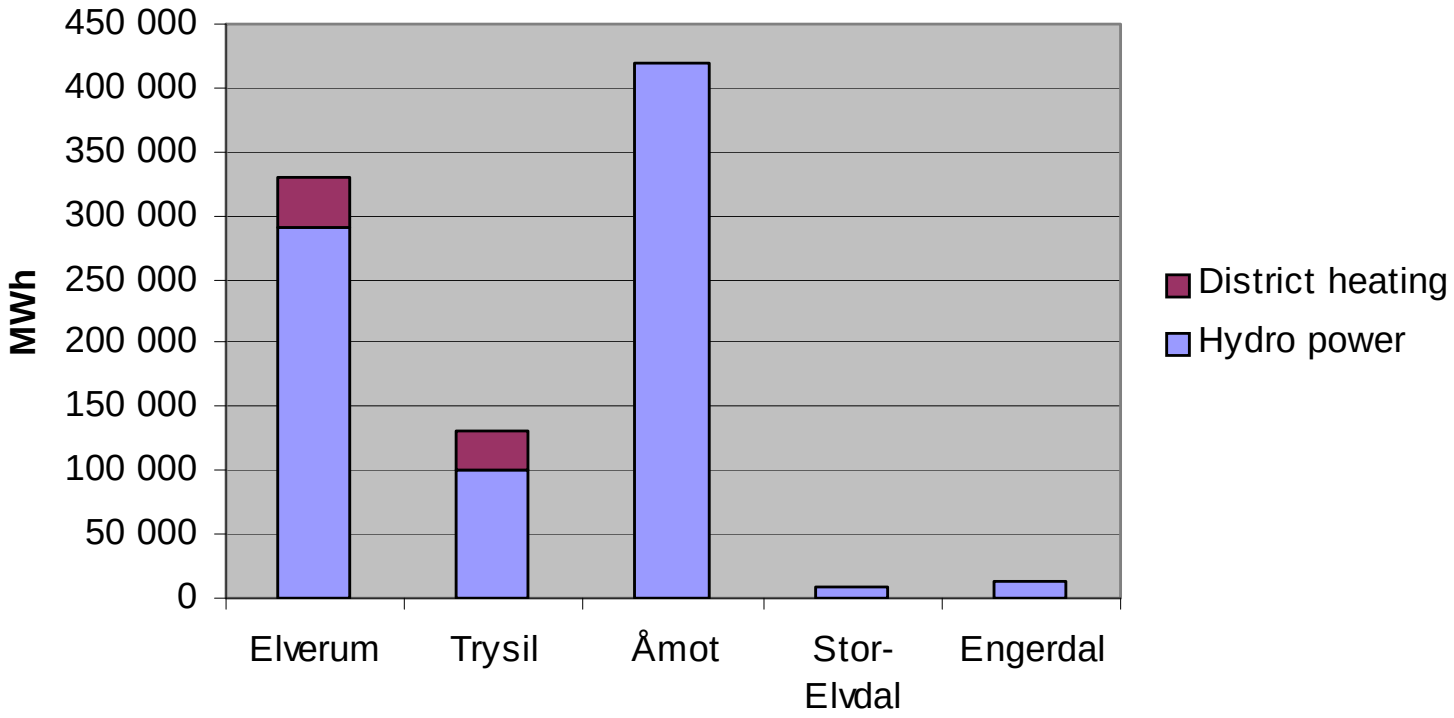
  Hydro power, district bio heating. Plans to establish pelletizing prod.
- Åmot

  Hydro power. Plans to establish district bio heating
- Stor-Elvdal

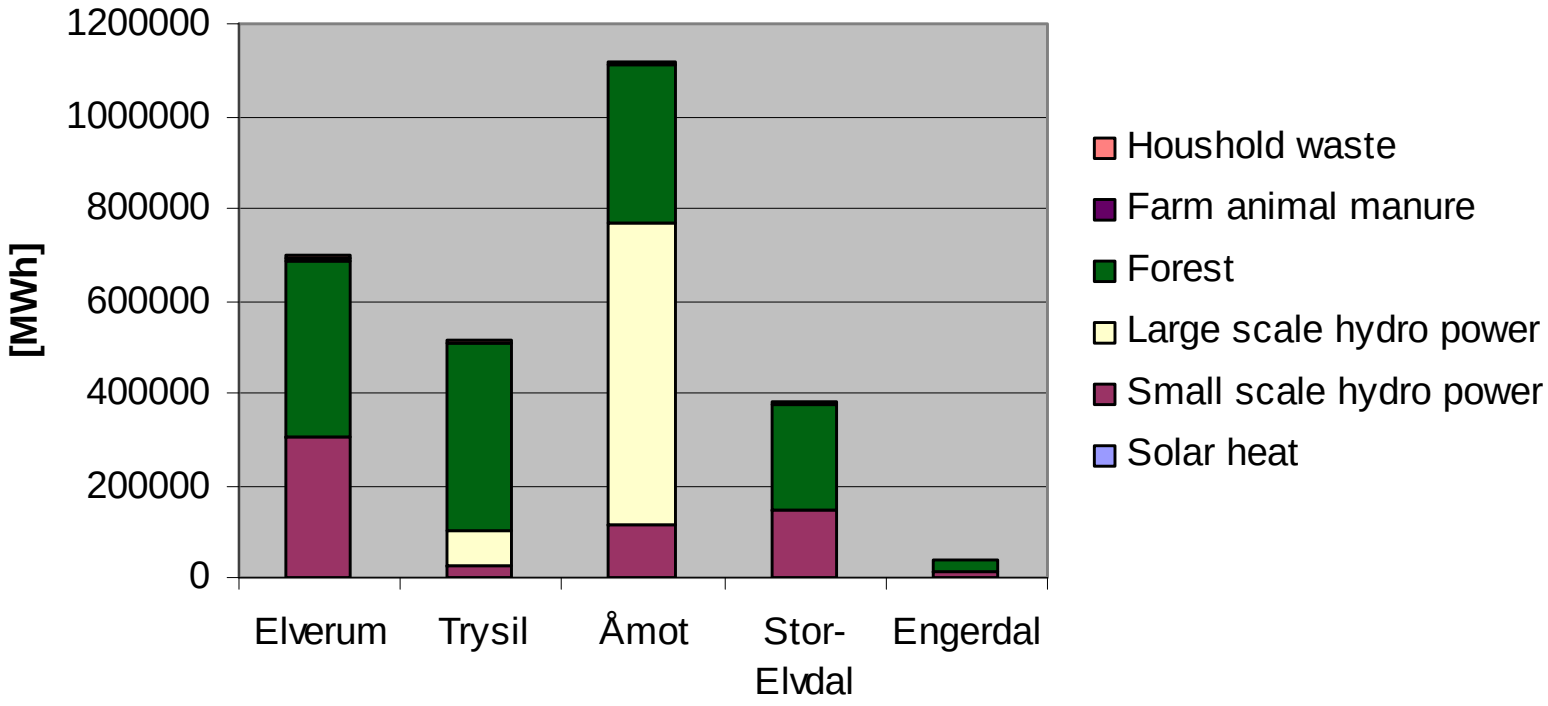
  Hydro power. Plans to establish district bio heating
- Engerdal

  Hydro power

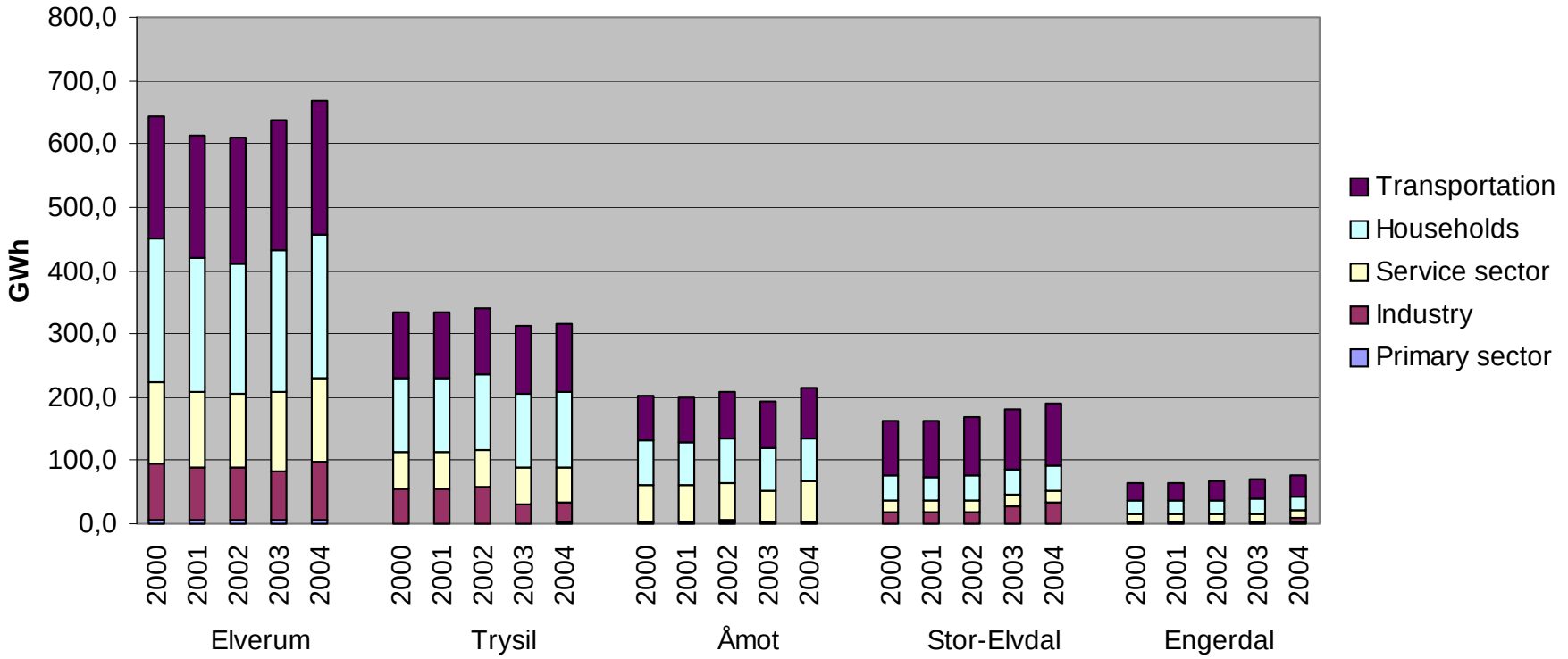
SØ: Large scale energy production



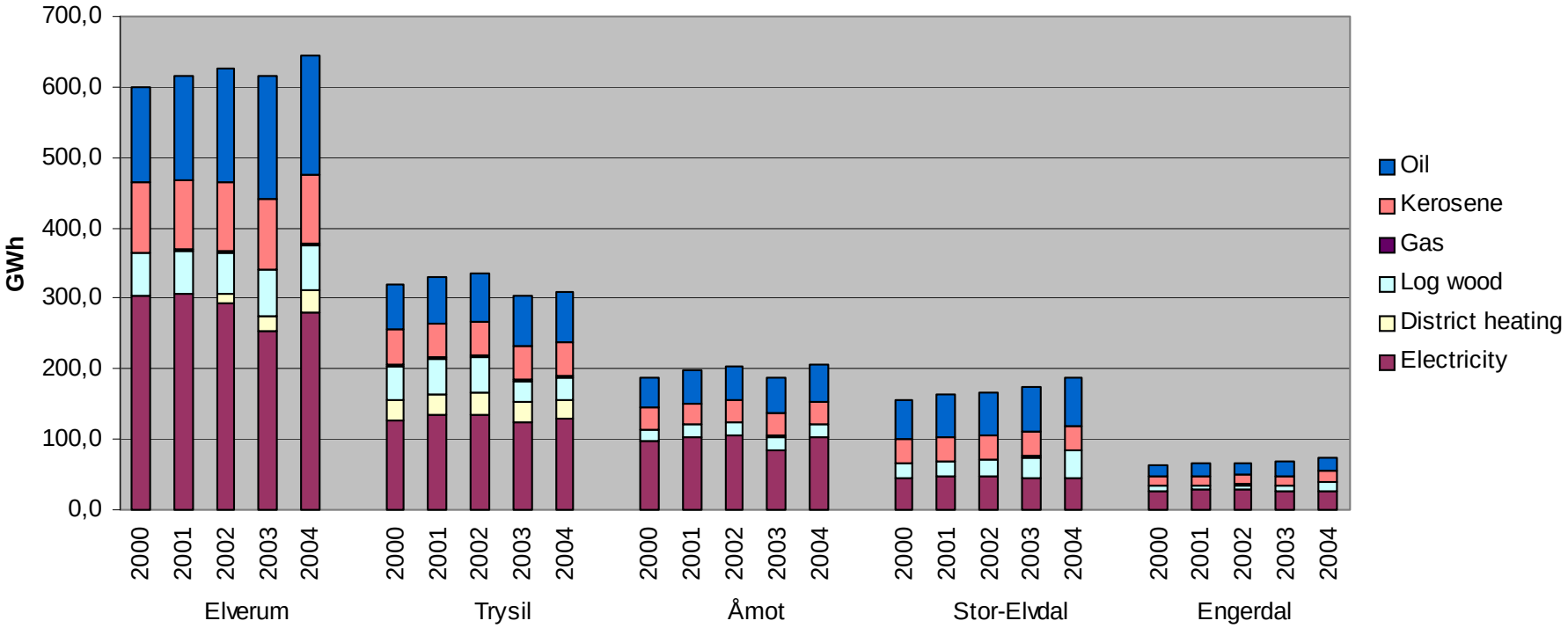
SØ: Energy resources



SØ: Energy demand, 2000-2004

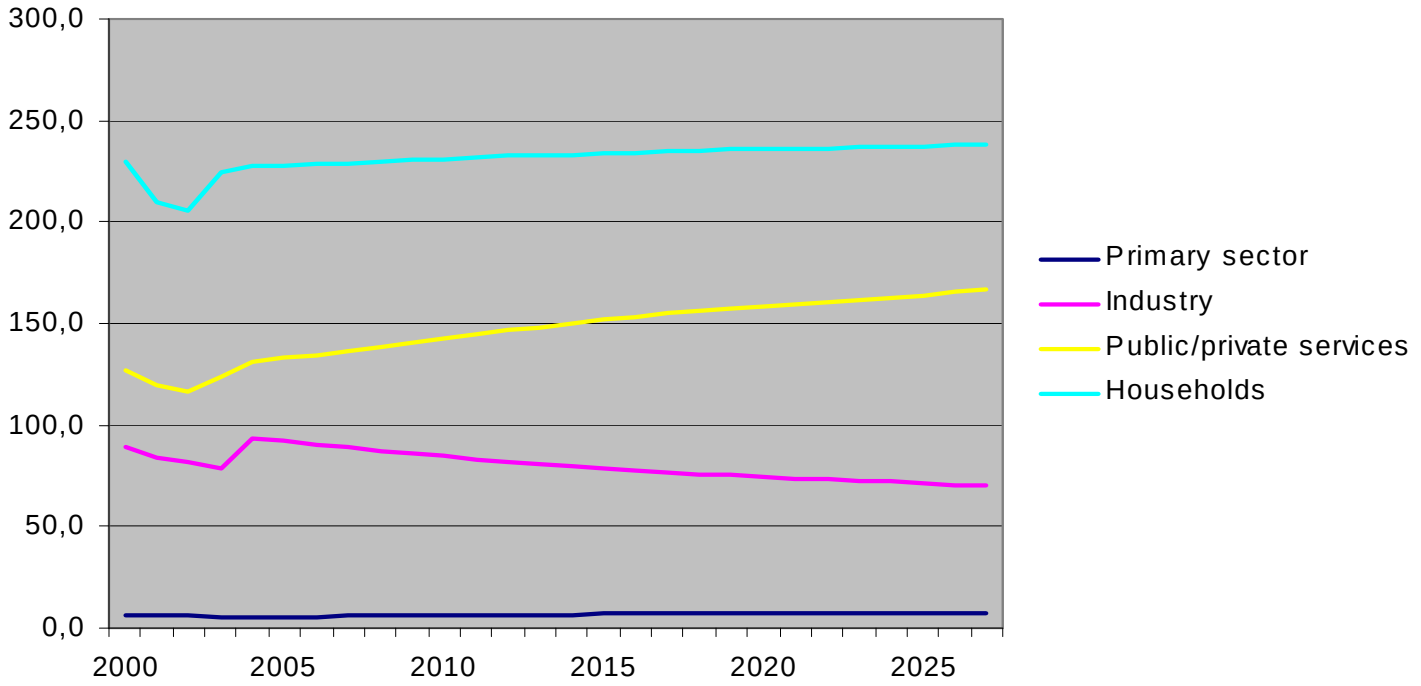


SØ: Stationary energy demand, 2000-2004



SØ: Predicted energy demand, 2007-2027

- Example: Elverum, based on historical demand 2000-2004



Presentation

1. Sør-Østerdal (SØ):
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REAM: Small Scale Systems

- Demand technologies

  Example: Households in Elverum
  - Electric panels
  - Heat exchanger (district heating)
  - Wood stove + electric panels
  - Gas stove + electric panels
  - Oil boiler
  - Pellet boiler
  - Paraffin stove + electric panels
  - Heat pump(air/air) + electric panels
  - Heat pump(ground/water)

REAM: Small Scale Systems

- Based on predicted demand, 2007-2027
  Example: Energy types: Heating and electricity

	Heating	Electricity
Primary sector	60%	40%
Industry	70%	30%
Service sector	55%	45%
Households	60%	40%

REAM: Small Scale Systems

- Extra investments

  Example: Households

  - Chimney
  - Central heating

- Fee share

  Example: Households

  - CO_2, NO_x, Sulphur: 0 %

REAM: Demand technologies

- Technical data: Capacity
  - Capacity Residual: stationary energy demand for each fuel in each sector makes out first years capacity residual
  - Fixed/upper/lower capacity: corresponding to expected or required development throughout period for each scenario

- Technical data: Fuels
  - Example: Electric panels + wood stove

	Efficiency	Maximum share
Electricity:	100 %	100 %
Log wood:	70 %	30 %

REAM: Demand technologies

- Economical data

	Invest. cost [kr/Mwh]	Life length [years]	Extra invest.
Electric panels	1100	20	
Heat exchanger	400	20	Central heating
Oil boiler	2300	15	Chimney & central h.
Pellet boiler	3200	20	Chimney & central h.
Kerosene stove	2500	15	Chimney
Gass stove	2000	15	Chimney

REAM: Demand technologies

- Emissions
  - Example: Oil

CO_2:	78 g/MJ
NO_2:	40 mg/MJ
Sulphur:	23 mg/MJ

- Grids
  - Choose distribution grid, if any.

REAM: Large Scale Systems & Grids

- The region of Sør-Østerdal:
  - Hydro power: LSS joint for each municipality
Grid joint for entire region
  - District heating: Each system

- Other
  - Nuclear power
  - Gas distribution
  - Minigrids (district heating)
  - Etc..

REAM: Large Scale Systems & Grids

- Equivalent to demand technologies in small scale systems:
  - Technical data: Capacity, Fuels
  - Economical data: Investment costs, Life length
  - Emissions
  - Grids: Efficiency

REAM: Emissions

- Defining of each emission category and corresponding unit
  - CO_2: g/MJ
  - NO_X: mg/MJ
  - Sulphur: mg/MJ
- Existing emission fee and expected development throughout period (restricted by fee share in each sector)
  - Example: CO_2: 203 kr/tonne, 2 % increase p.a.

REAM: Fuels

- Defining of each fuel type
- Economics: Existing prices, and expected development throughout analysing period

  Example: Oil, year price
  - Fuel price: 670 kr/MWh, 2 % increase p.a.
  - Fuel tax: CO_2-tax: -
    Energy tax: 42,8 kr/MWh, 2% increase p.a.
- Emission: Emission in LCA-perspective