**Energy** System
Analysis **Associates**

ESA²

# PERSEUS –Electricity System Model

## Main characteristics

- Multi-periodic energy and material flow model of the European electricity supply system with its specific techno-economic characteristics and constraints.
- Modelling time horizon is from the year 2007 to 2050, where one year is represented by a typical week and weekend day for the seasons, resulting in 44 time intervals for one year.
- The model is based on linear and mixed-integer programming approaches with perfect foresight.
- The target function consists of a minimisation of all decision-relevant expenditures within the entire system.
- Integrated capacity and dispatch planning model.

## Role within ESA²

- The electricity demand calculated by FORECAST and eLOAD is used as input.
- Typical results used by other models (e.g. ELTRAMOD) are: (i) installed capacity of conventional and renewable energy power plants, (ii) country specific electricity exports and imports or (iii) emission certificate prices.
- ELTRAMOD calculates the grid and storage expansion.

FORECAST
eLOAD

PERSEUS

ELTRAMOD
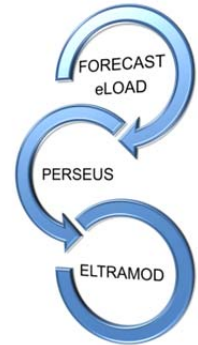
## Exemplary Results

- High increase in electricity production from renewable energy sources until 2050.
- Due to a restrictive GHG emission reduction target the electricity production from $CO_2$ intensive fossil fuels, especially hard coal and lignite, decreases.
- Flexible gas fired power plants, also with CCS, play a major role.
- Base load technologies like nuclear are no longer economic due to a decrease in full load operating hours.
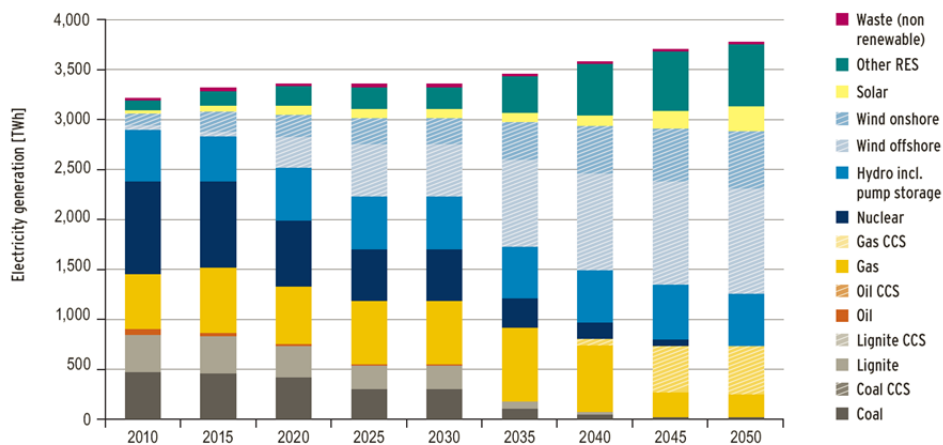


## Exemplary References

**Eßer-Frey, A.:** Analysing the regional long-term development of the German power system using a nodal pricing approach. Diss. Karlsruhe Institute of Technology, 2012

**Möst, D.; Fichtner, W.:** Renewable energy sources in European energy supply and interactions with emission trading. Energy Policy, Vol. 38, issue 6, 2010, p. 2898–2910.