

# Pathways to Sustainable European Energy Systems

## - Phase 2 initiated!

After a successful first phase of Pathways, the project continues into a second phase. Pathways phase 2 started January 2011 and will be running for three years. The areas of research in phase 2 are those for which there is a solid base in the methodology developed and for which it is believed that the Pathways research group has scientific excellence.

### Areas and key research questions

#### 1. Assessing the European electricity generation market (the Chalmers Energy Infrastructure Databases)

For some eight years the Division of Energy Technology has developed the so called Chalmers Energy Infrastructure Databases. This work will be continued with overall purpose to provide one of the best available descriptions of the European energy systems and global fuel markets in order to assess and provide analyses of the electricity generation system and to be used in modeling (area 2) and CCS assessment (area 3).

#### 2. Modeling the European electricity generation system and related systems

There will be a continued development of the modeling package developed within the Pathway project with the overall aim to provide a well-balanced and powerful modeling toolbox, which can illustrate possible development pathways for the European stationary energy system from now and until year 2050 as well as be used to assess key parts of the electricity system (generation, distribution and demand side management).

The model package developed (partly) within the Pathway project consists currently of the following models: ELIN (Electricity investment), BALWIND (Wind power integration), WALL (Wind power allocation), EPOD (Electricity production) and DCFlow (Transmission network). The different models can either be used alone or together in an iterative way (see Newsletter #1/2010). Key issues are to model effects of intermittent power generation including demand side management, possibilities for CCS, geographic allocation of wind power and requirements on development of the transmission network.

#### 3. Assessment of CCS infrastructure

It is uttermost important to incorporate a CCS infrastructure analysis in the energy systems modeling in order to assess the prospects of CCS. This is normally not done in energy systems modeling but within the Pathway project we have started such work which has gained international interest and, as an example, cooperation with the European Joint Research Center (EU-JRC) around this issue (as well as for other issues) is currently under discussion.

A methodology to model and assess CO<sub>2</sub> transportation and storage infrastructure will be developed. The methodology will be made so as to enable application of the Chalmers Energy Infrastructure Databases (see area 1) and fit with the energy systems modeling (area 2). An important part of this task is to include detailed description of CO<sub>2</sub> storage sites with respect to location, storage capacity and geological parameters. The overall aim of this area is to provide a clear and thorough analysis of the ramp-up of CCS infrastructure which can be linked to the energy systems modeling developed in Pathways.

*“Phase 2 initiated!”*

#### 4. Assessment of biomass – supply and climate benefit

There are several open questions related to how biomass can be included in the energy conversion infrastructure as well as how much biomass is available both domestically within EU and as from import. It is proposed to continue the assessment of biomass with respect to both supply (such as the cost-supply curves developed in the REFUEL project) as well as with respect to analysing conditions for establishing a biomass supply infrastructure. The research will aim at illustrating development pathways for biomass supply and utilization in the European



power and heating system, including climate benefits.

### 5. Assessment of biomass – conversion technologies

There are many possibilities for integrating biomass in the energy conversion system such as co-firing in coal plants or using biomass in polygeneration schemes.

The aim of this research area is to continue the technology assessment work which was initiated in the first phase of the Pathway project. An important objective is to develop a methodology which can compare different biomass conversion technologies as well as identify their niche markets with respect to economy, plants size, required infrastructure and fuel quality requirements.

### Management, organization and reporting

The organization will be as for the first phase of the project with Professor Filip Johnsson as project leader and Bo Rydén (Profu) for additional project management. In addition, there will be a project coordinator assisting the project leaders (Ulrika Claeson Colpier). This organization has proven efficient with Filip Johnsson focussing on the scientific leadership and Bo Rydén on the overall management and coordination between researchers as well as on producing newsletters and arranging workshops and seminars.

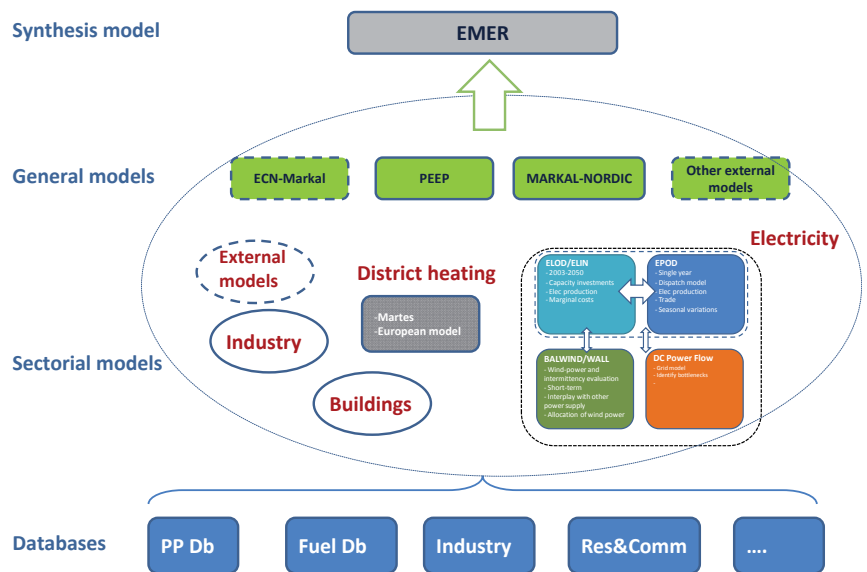


Figure: Structure of databases and models used in the Pathway project. Databases describing the current situation represent input to different models that describe possible future developments for different parts of the energy system. The model results are summed up in a synthesis model to describe different pathways.

Reporting will be through scientific papers, newsletters, reports and with a final book in the end of the period. As for the first phase of the Pathway project, the project participants will present the work in various workshops and lectures, including invited lectures.

One important aim in this second phase is also to cooperate and to coordinate the work with a new project hosted by ELFORSK ("North European Power Perspectives") as well as with the European Joint Research Center (EU-JRC) in Petten.