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## METHODS AND MODELS

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### ELIN/ELOD

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The ELIN/ELOD model is a techno-economic investment model used for analysis the long-term development of the European electricity system. The model applies scenario analysis and generates cost-efficient investment strategies for the European electricity supply system, under stringent CO<sub>2</sub> emissions reductions from present day until 2050, with an annual level resolution. The model can be regionalised to the level of an EU single member state, multiple regions or the entire European Union. The ELOD/ELIN model can also easily be linked to several other models.

### EPOD

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The goal with EPOD is to describe the yearly, seasonal, weekly, daily and hourly variations in electricity production for a given year. The model is applicable on most EU27 member states and can be regionalised in the same fashion as the ELIN/ELOD model. Some of the key outputs from the model include annual electricity production by fuel and technology, annual CO<sub>2</sub> emissions from electricity supply, capacity utilisation and marginal cost for electricity.

### DC POWER FLOW

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The DC Power Flow model gives a detailed representation of the high-voltage transition network for European power systems. It is a model implemented using PowerWorld Simulator and it is an efficient tool to evaluate grid associated challenges and adjustments. By using the results from the ELIN and EPOD models as input it enables the calculation of the power transfer in the entire transmission network. Thus being able to identify bottlenecks in the power grid and allowing for future adjustments and reinforcements in those areas.

### BALWIND

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The BALWIND model is a tool used to analyse interactions between intermittent wind power and thermal power plants in a region electricity grid system. With large-scale wind power integrated into a power system, the intermittent nature of wind power results in an increase in variations in load on other units in the system. The BALWIND model is able to investigate and quantify the consequences of wind power variations, in order to determine a power plant dispatch strategy that yields the lowest system costs.

### ECCABS

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The Energy, Carbon, and Cost Assessment for Building Stocks (ECCABS) model is a bottoms up model for assessing different options and selection of the best one while developing energy efficiency strategies for building stocks. The model allows for assessing the effect of different energy efficiency measures, including market realism, and produces an assessment of the direct and indirect cost per unit of energy and CO<sub>2</sub> saved.

### EMER

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The Energy Merge model for Europe (EMER) is a simulation model where the total energy use and production over different energy sectors is summed and compared, in order to ensure balance. The EMER model utilizes the output from the previously described models and this input enables an opportunity to follow-up the realisation of the sustainability targets for the European energy system in its entirety

## METHOD FOR TECHNO-ECONOMIC COMPARISONS OF INTEGRATED BIOMASS-FOSSIL PLANT

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This method can be used for two purposes: to show the potential of improved energy and/or cost-efficiency in biomass conversion. It is also used to present results for efficiency, costs, and risks, with clear connection to factors such as heat to power ratio, renewable fuel share, fuel moisture, gasifier/boiler type, and fuel cost. The method involves heat balance simulations in Epsilon Professional software, which is soft-linked with the Aspen Plus software for its chemical equilibrium simulations.

## FLUIDIZATION BED CFD MODELS

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The Computational Fluid Dynamic (CFD) models on fluidized beds, allows for simulation of how the fuels fluidized bed disperse and mix with the combustion air.