



## Synergistic Approach of Multi-Energy Models for an European Optimal Energy System Management Tool

### Deliverable D3.1

### Description of model interconnections

### Summary

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## List of Abbreviations

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- CEM Capacity expansion model
- CHP Combined heat and power
- CP Cutting plane
- CTS Commercial/trade/service
- CWE Central western europe
- DER Distributed energy ressources
- DG Distribution grid
- DSR Demand side response
- EUC European unit commitment
- LODF Line outage distribution factor
- LV Low voltage
- NUTS Nomenclature des unit\_es territoriales statistiques
- PTDF Power transfer distribution factor
- PtX Power-to-X
- RES Renewable energy source
- SDDP Stochastic dual dynamic programming
- SSV Seasonal storage valuation
- TGEM Transmission grid expansion model
- UC Unit commitment
- VC Voltage control
- WACC Weighted average cost of capital



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## Executive Summary

The goal of plan4res is to develop a modeling framework that allows to obtain a holistic assessment of the energy system. Having such an ambitious goal, it is required to divide the energy system in models that cover the different aspects of the energy system. This modular framework allows to make use of the most promising solving techniques and the most efficient optimization solvers, each tailored towards the needs of every single submodel. In order to guarantee a flawless workflow, it is vital to have a detailed description of the interconnections between these models. The goal of this deliverable is to give an overview of the plan4res modeling framework and describe these model interconnections.

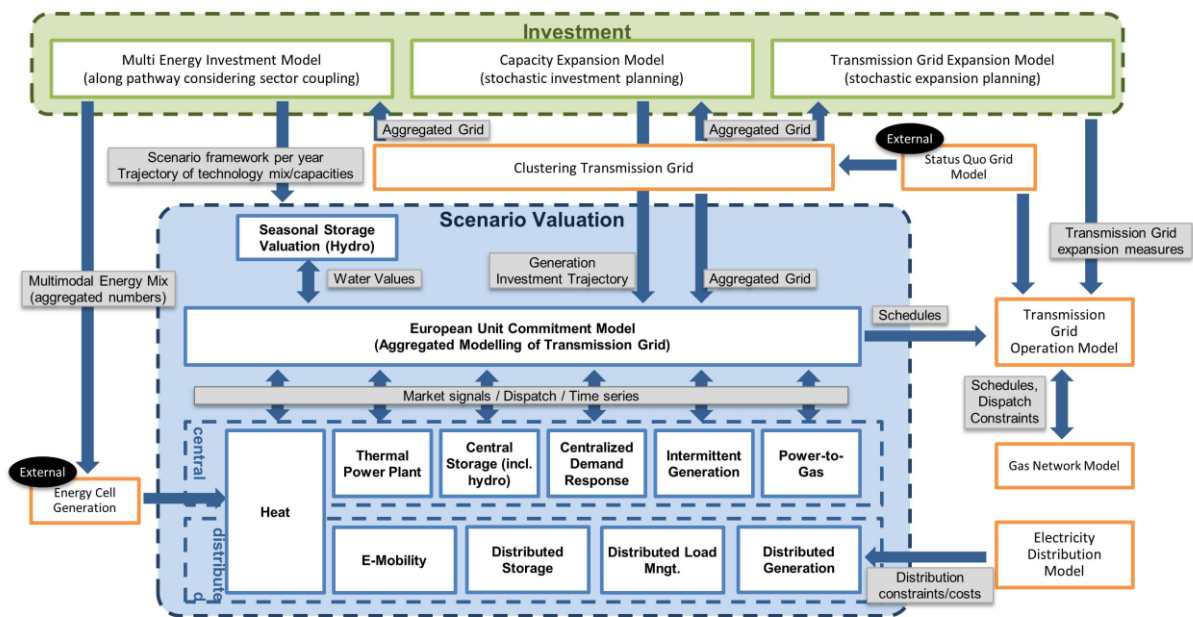


Figure 1: The plan4res model framework

Figure 1 gives an overview of the modeling framework, that is divided into

- Expansion models
- Valuation/operation models



- Supplemental models

The goal of the expansion models is to determine the optimal investment decisions for the future energy system. Since the case studies of plan4res have different key aspects, three investment models are defined that are tailored towards the needs of each case study.

The core of the scenario valuation is the European unit commitment (EUC) model, that optimizes the operation of the generation units determined by the investment models. A Lagrangian relaxation approach enables to decouple the generation units and define submodels for the different assets in the energy system. This modular approach also allows to only take the submodels into consideration, that are important for the respective case study.

Supplemental models are needed to either make input data available that are needed within the investment or valuation models (e.g. clustered version of the transmission grid, distribution reinforcement cost curves) or to do grid operation calculations (transmission grid as well as gas grid). The latter allow to also analyse the energy system regarding grid congestions, the amount of redispatch to clear these congestions and the capability of the gas grid to include gas provided by power-to-gas units.