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PowerACE – Agent-based electricity market model

Current state and future plans in PowerACE, the agent-based electricity market model from IIP

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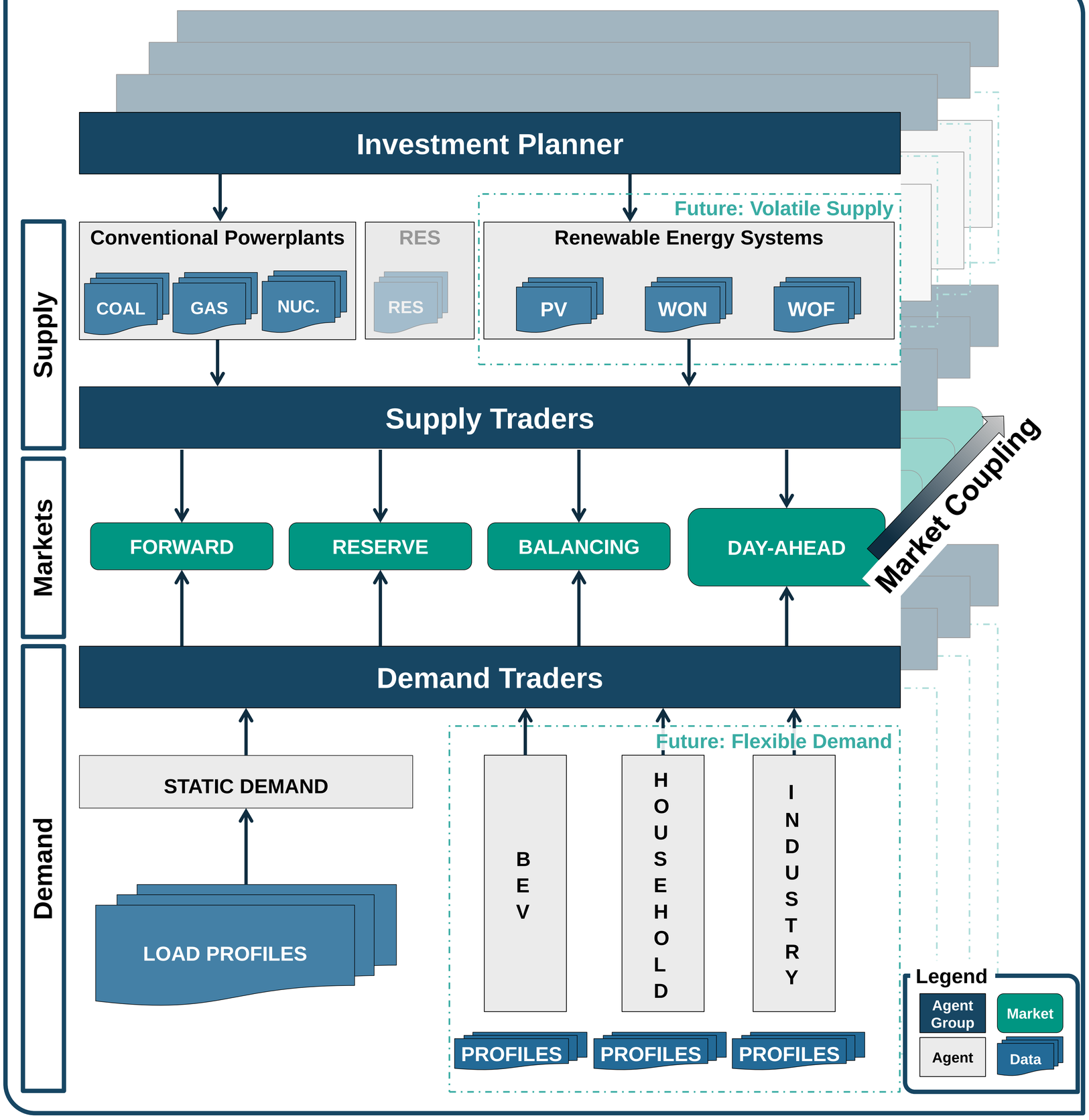
Introduction

PowerACE simulates the European day-ahead electricity market in hourly resolution for several years into the future with bidding agents for demand and supply. The model integrates an endogenous calculation of investment decisions for conventional power plants by the operating agents.

Outputs & Results

PowerACE can be used to simulate various energy policy and energy economic scenarios in the medium and long term. Effects and shocks on electricity prices, the expansion activity of conventional power plants by market players or national security of supply can be observed. In addition to the macroscopic perspective on several European countries, national effects can also be captured.

Method



General Parameters

- 1-hourly resolution of simulation
- Runtime until 2050 for market simulation & investment decisions
- Investment decision based on endogenous electricity price forecasts and NPV calculations by agents
- Investments possible for conventional power plants, BES and electrolysers
- Market coupling for 16 countries from Europe
- Multiple power plant portfolios by large utility agents
- Hourly generation profiles by RES
- Hourly aggregated static demand profiles as well as DSM options by demand trader agents
- Integrated diffusion model for EV expansion
- National regulatory requirements e.g., technology phase-outs, strategic reserve, capacity reserve, CO_2-prices etc.
- National market design aspects
- Perfect foresight of several years by agents for demand and RES generation
- Output analysis possible for general market results such as hourly electricity prices or electricity production schedules; financial investment options with regard to capacity development as well as aspects of the security of supply like Loss of Load Expectations (LoLE)

Current work & Future implementations

Supply: The supply side is expanded to include investment decisions for the expansion of RES (PV, onshore wind and offshore wind). This means that agent portfolios can consist of conventional, storages and renewable plants.

Demand: Different profile categories for aggregated households, industries and e-mobility will be represented in high resolution and marketed by separate agents. This allows more options for DR and DSM.

Market: Balancing power markets consisting of national auctions for capacity and harmonised auctions for energy will be implemented. This will create additional marketing opportunities with sequential bidding strategies for flexible suppliers and consumers.

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