PowerSUME – A Model Interface

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1. Motivation
2. Market Models
   - PowerACE
   - ASSUME
3. PowerSUME
4. Conclusion

Motivation

Various open source models available

Different scope and strengths of the models

More complex markets need more simulations

Coupling of different models to enhance the research capabilities

Motivation

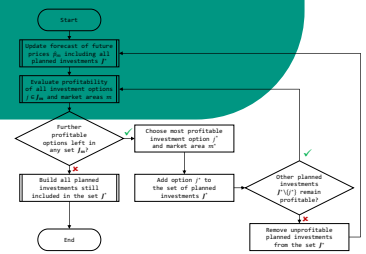
1. Motivation
2. Market Models
   - PowerACE
   - ASSUME
3. PowerSUME
4. Case Study
5. Conclusion

PowerACE

PowerACE

Characteristics

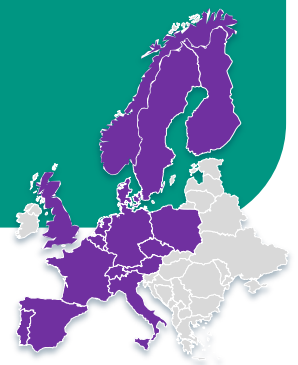
- Hourly simulation of the day-ahead market (8760 h/a)
- Yearly investment decisions
- Time horizon until 2050
- Cross border effects
- Different bid types



Source: Genoese (2010), Fraunholz (2021), Zimmermann & Keles (2023)

Input Data

- Fuel and CO_2 prices
- Detailed power plant data with techno-economical parameters (e.g., efficiency, …)
- Hourly RES profiles and demand profiles
- Trading capacities between market areas



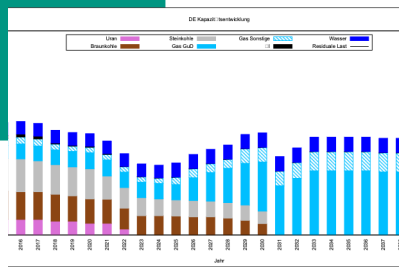
Model results

From market simulation, e.g.,

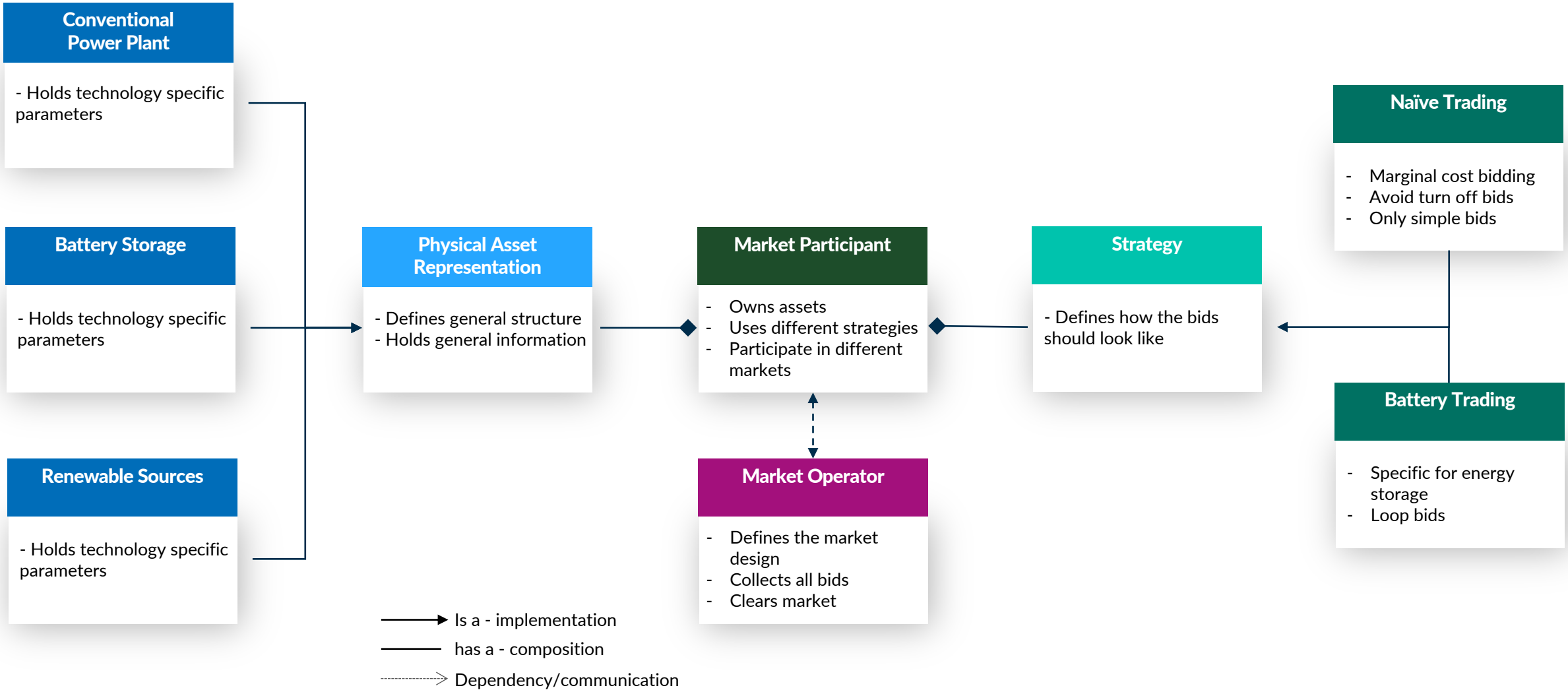
- Power plant dispatch
- Spot market prices and volumes
- CO_2 - Emissions

From investment evaluation, e.g.

- Capacity development
- Investment decisions



PowerACE - Simplified Day Ahead Scheme



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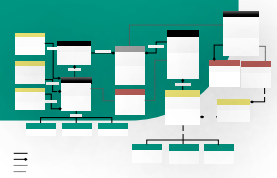
ASSUME

ASSUME

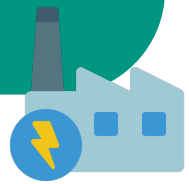
Characteristics

- Reinforcement Learning Strategies
- Hourly simulation of the day-ahead market (8760 h/a)
- Cross border effects
- sequential markets like DA and ID
- Redispatch with PyPSA
- Detailed demand side management
- Different bid types



Input Data

- Fuel and CO_2 prices
- Detailed power plant data with techno-economical parameters (e.g., efficiency, …)
- Hourly RES profiles and demand profiles
- Trading capacities between market areas
- Interface to other model datasets such as PyPSA and AMIRIS



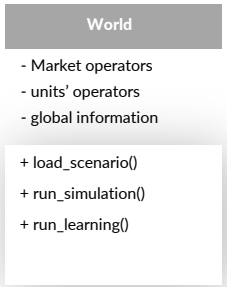
Model results

From market simulation, e.g.,

- Power plant dispatch
- Spot market prices and volumes
- Bidding behavoir

Source: Harder et al. (2025), Miskiw & Staudt (2024), Adams et al. (2024), Maurer et al. (2023)

ASSUME



Is a - implementation

has a - composition

Dependency/communication

descriptor

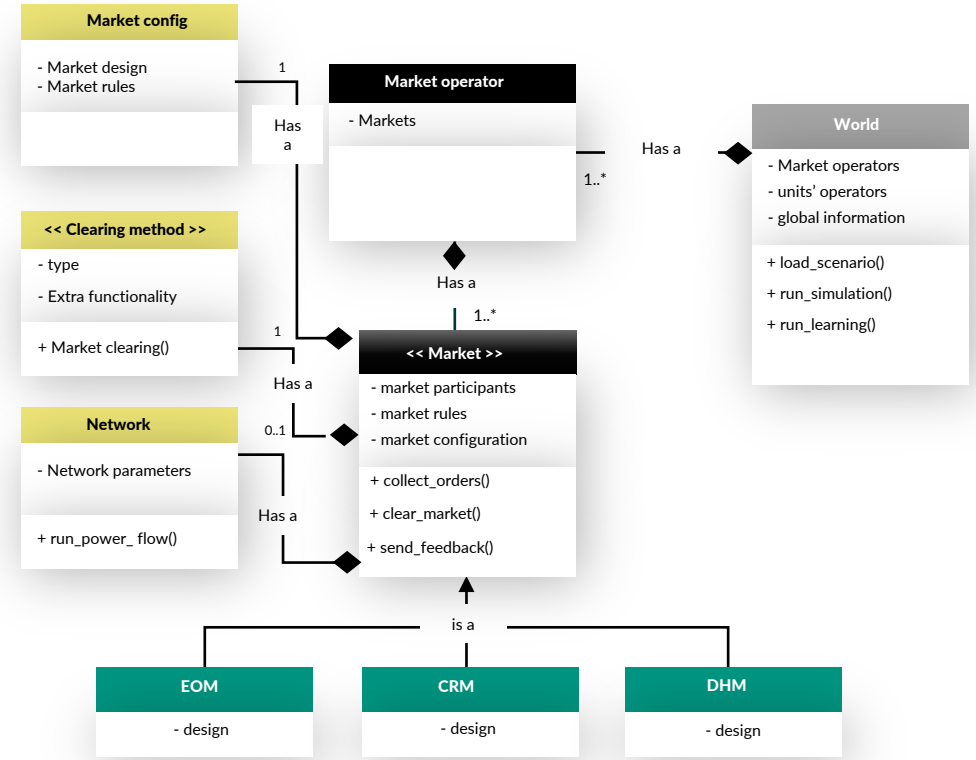
1..* one or more class are defined

0..* or more classes are defined

"_" refers to a private attribute / method

"+" refers to a public attribute / method

ASSUME



Harder et al. (2025)

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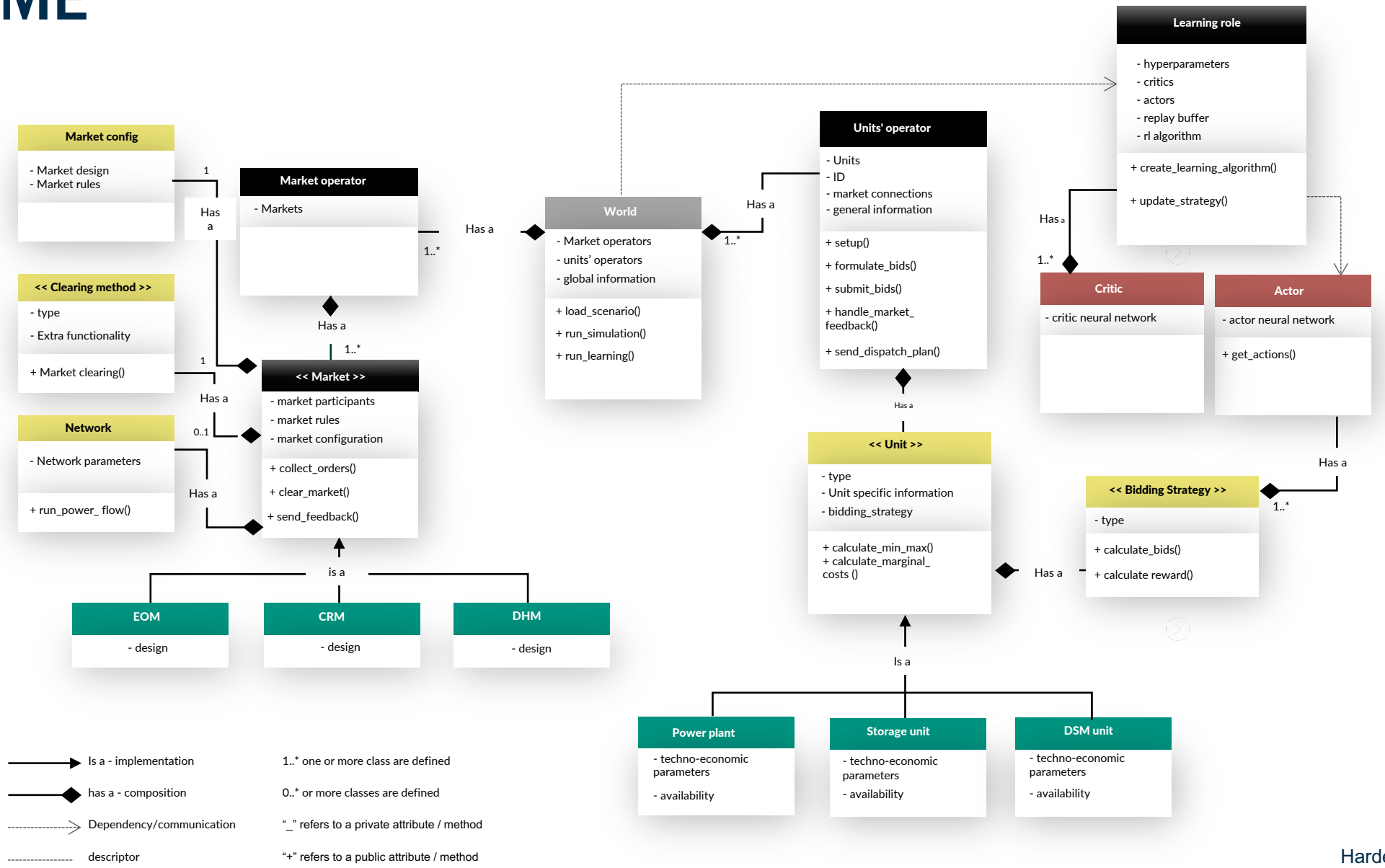

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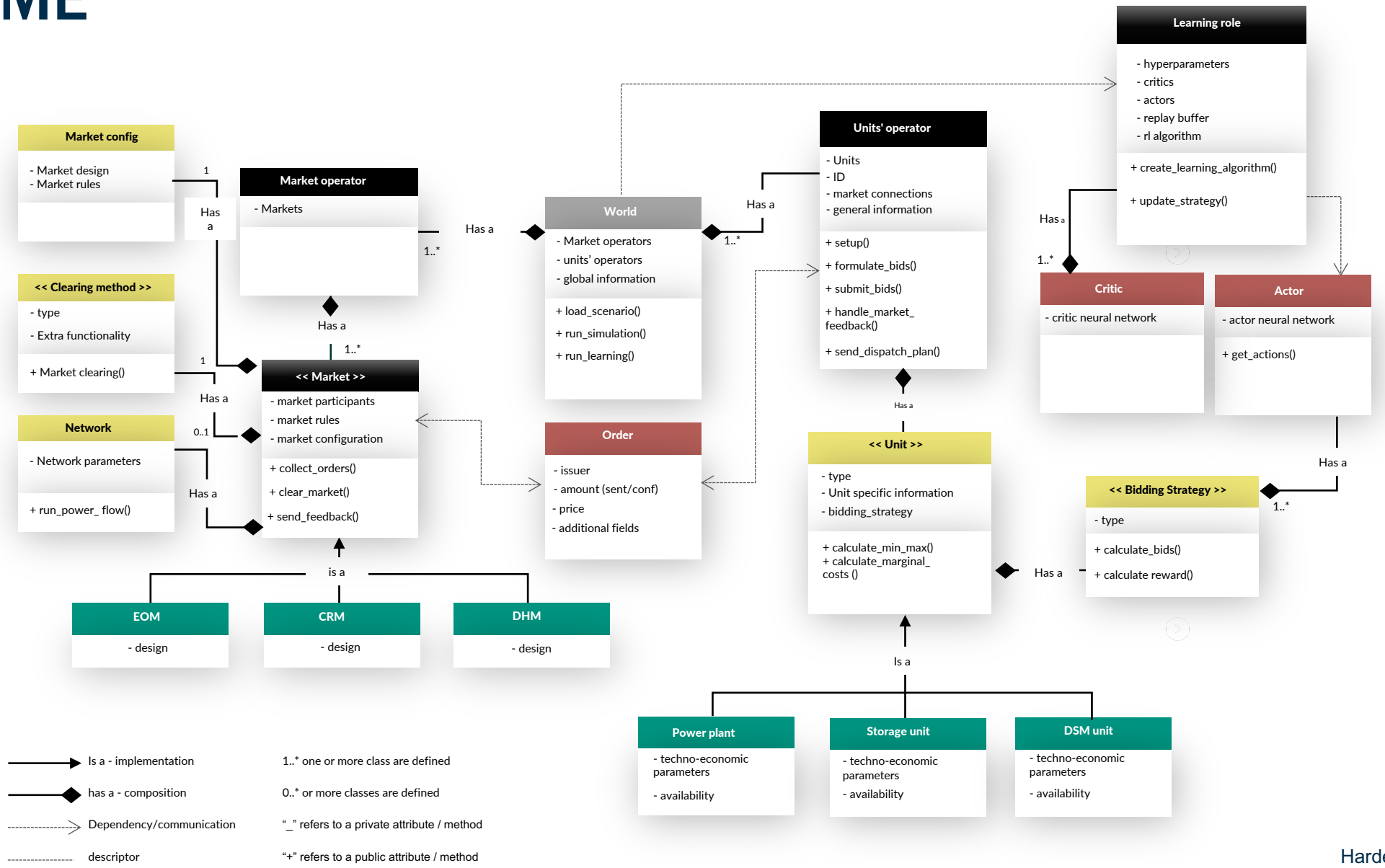

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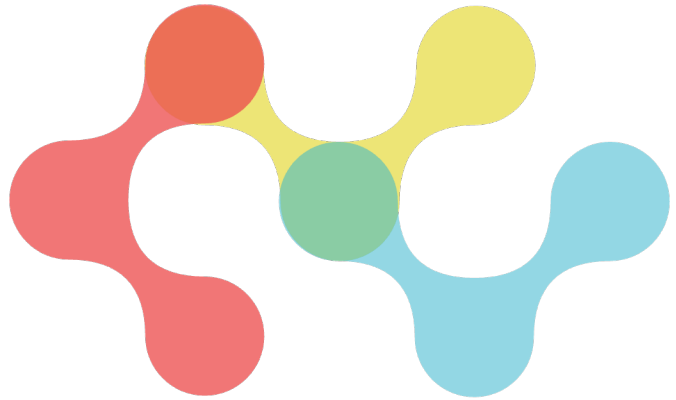
PowerACE



PowerSUME

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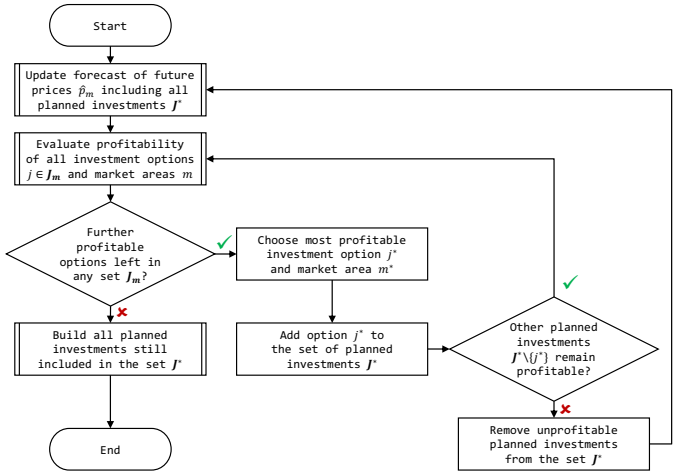
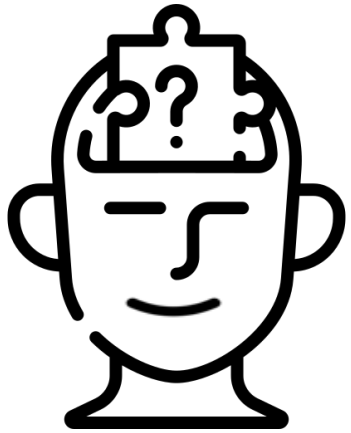


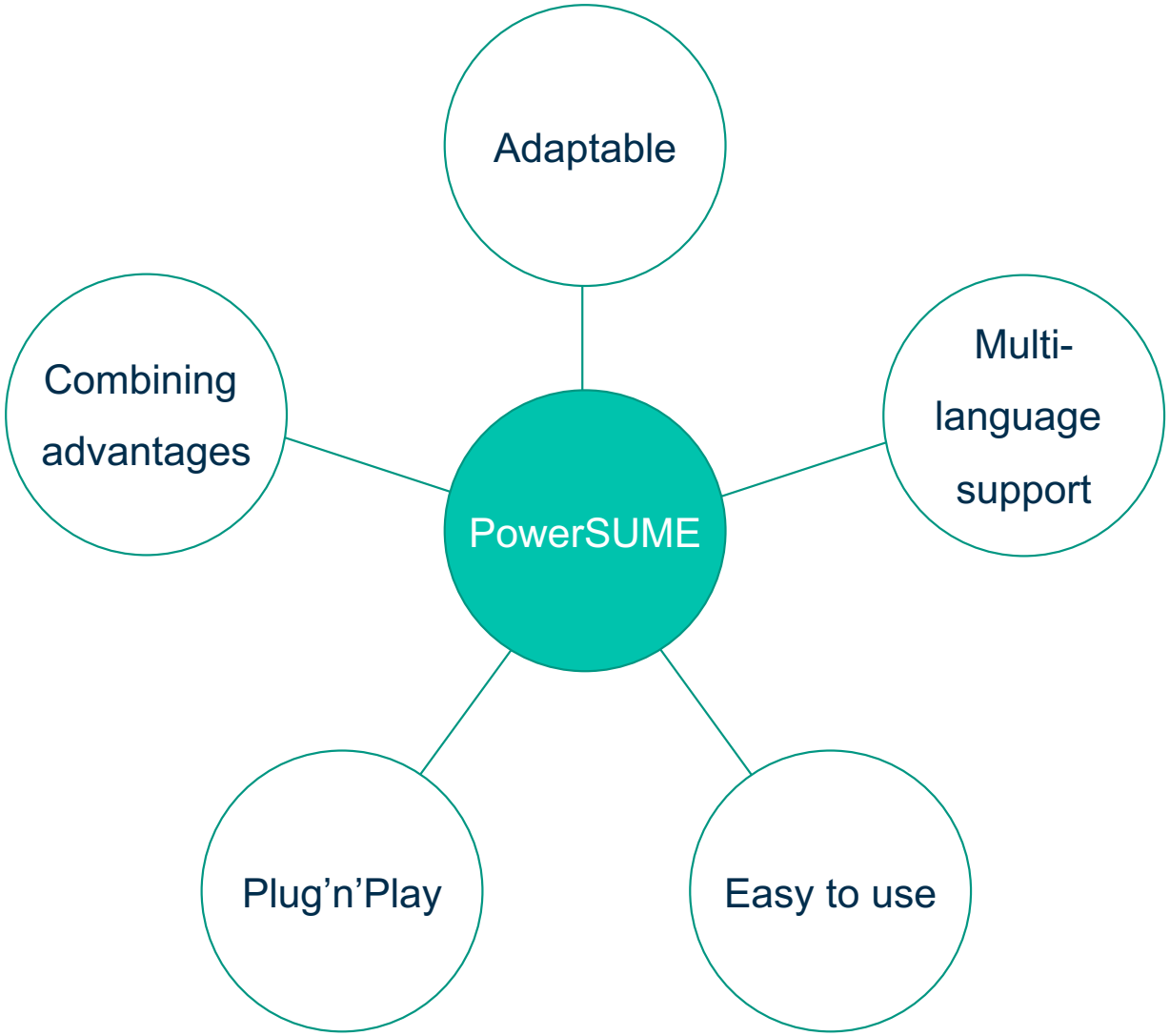
Long-term investment decisions

ASSUME toolbox

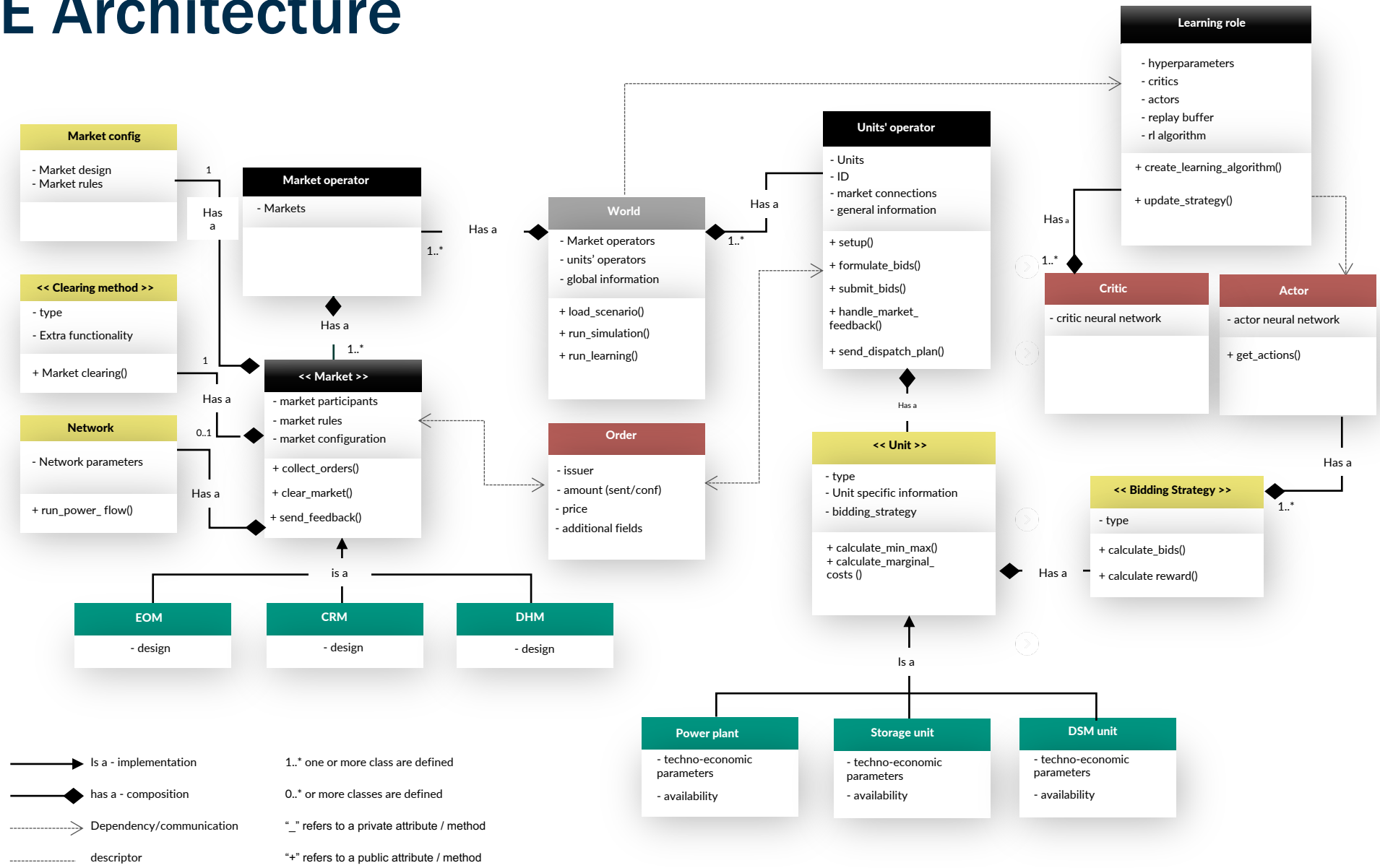


Complex bidding behavior

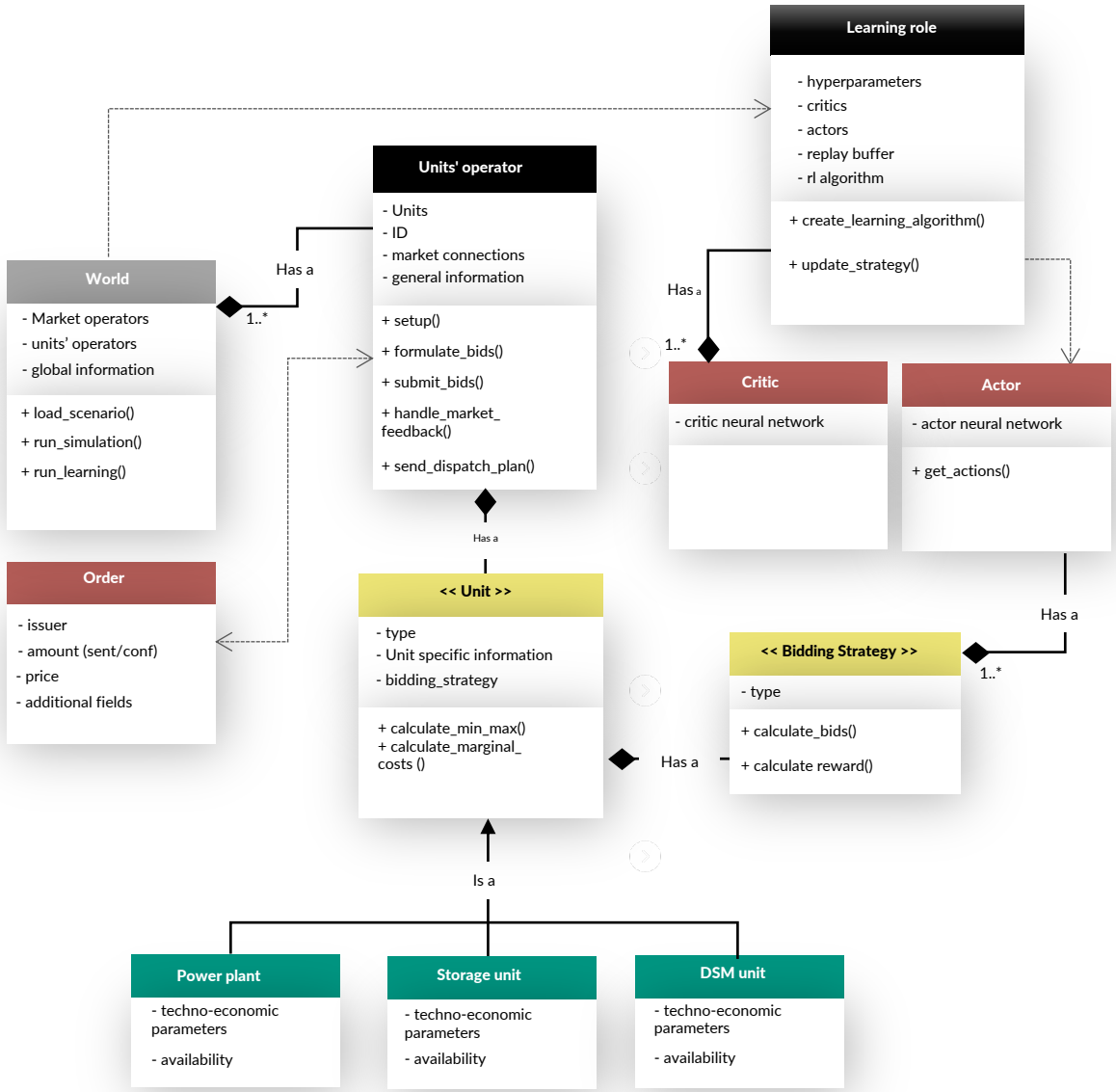
PowerSUME


Adaptable
Combining advantages
Multi-language support
PowerSUME
Plug'n'Play
Easy to use

PowerSUME Architecture



PowerSUME Architecture



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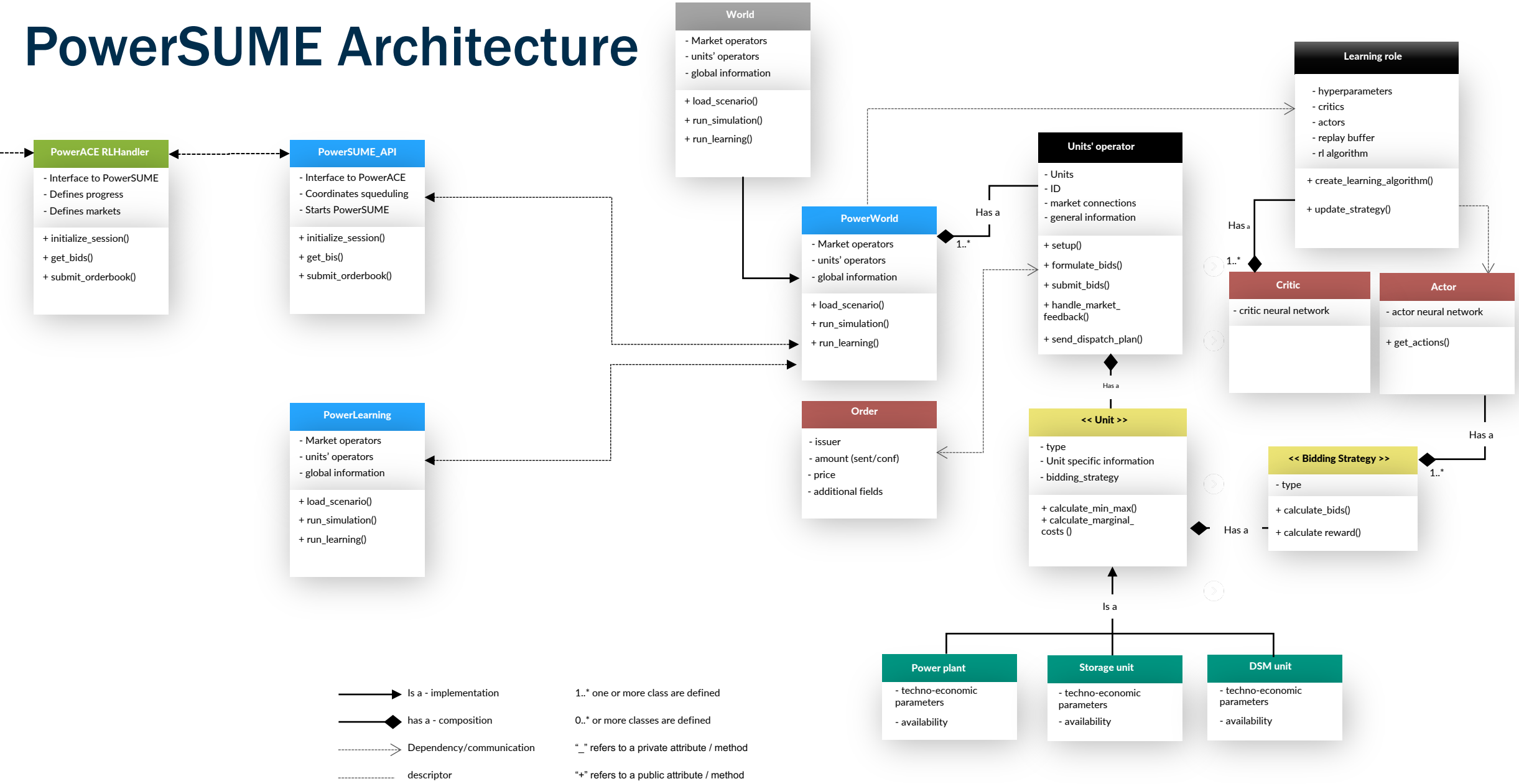
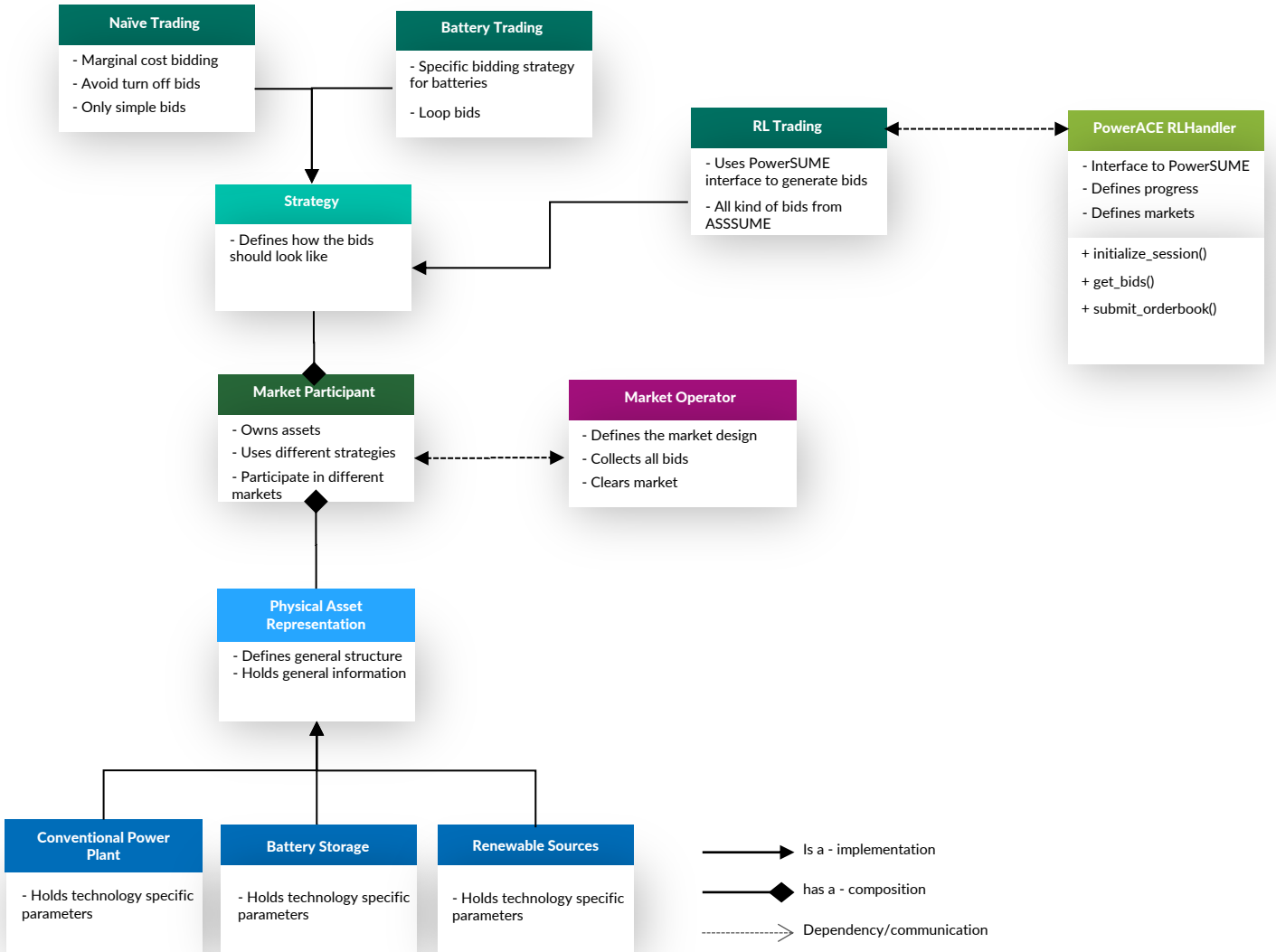
PowerSUME Architecture



PowerSUME Architecture

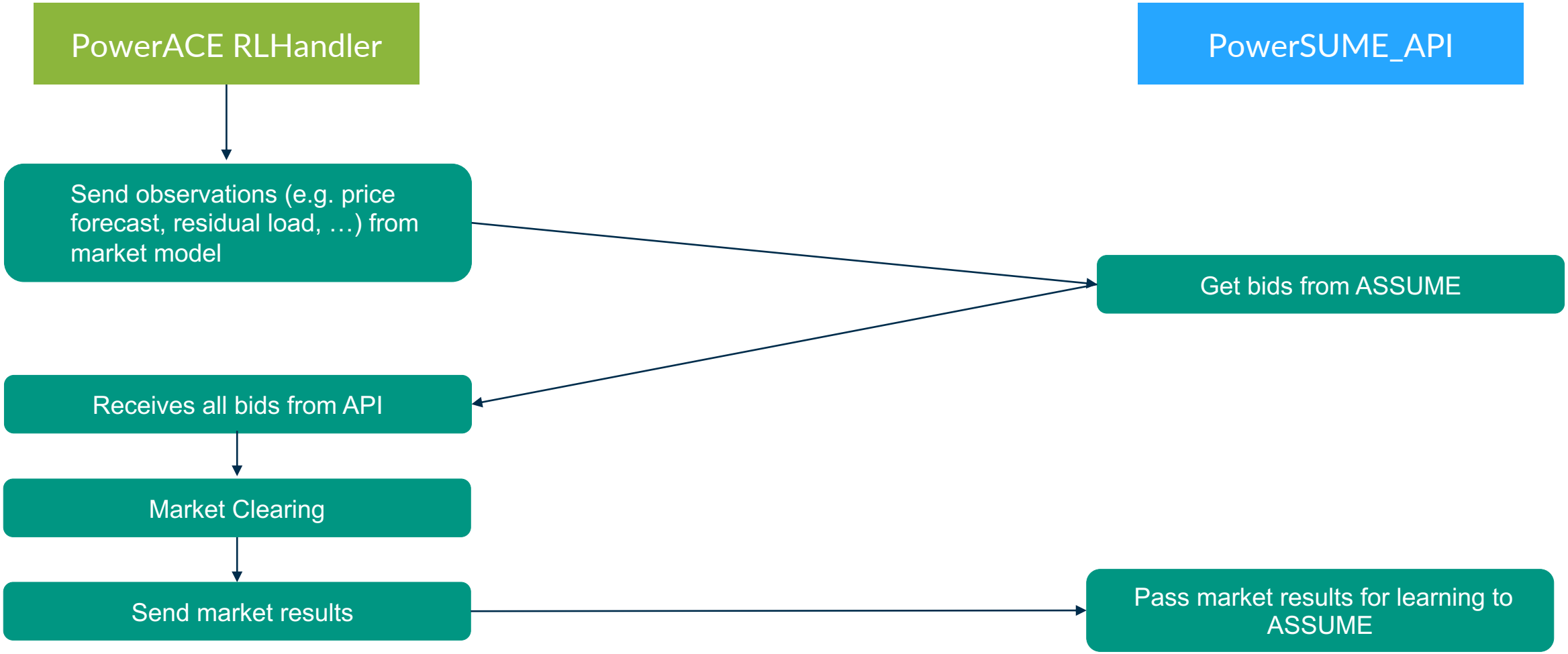


PowerSUME API – General

- Initializes scenario files and the PowerSUME API
- Ensures the synchronization of the used market model (PowerACE) and the API

- Starts learning sessions
- Ensures the synchronization of the API and ASSUME
- FastAPI and uvicorn

PowerSUME API – Communication Loop



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Conclusion

Proof of concept for an easy-to-use model interface

Combining advantages of two complex market models

Enables future research, e.g. bidding behaviour on investment decisions

Next Steps

Gefördert durch:

Bundesministerium
für Wirtschaft
und Klimaschutz

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DFG