intEMT

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Intelligent Energy Management Toolbox for Simulation and Optimization of Energy Systems

intEMT is a modular and flexible software toolbox for intelligent energy management designed to model, simulate and optimize complex energy systems. Its five core libraries can be used standalone or in combination, enabling tailored solutions from component-level modelling to full-scale intelligent energy management.

Your advantages

With the help of intEMT, we provide our partners many benefits and offers, including the following:

- **Digital twin development.** We design an accurate model of your energy system based on your components and data.
- **Intelligent energy management strategies.** We optimize your energy flows and consider demand-side management to reduce costs and emissions and make the best possible use of renewable energies.
- **Scenario-based system investigation.** We non-invasively calculate supply scenarios for your energy demands and compare different supply strategies and component constellations.
- **Optimal component sizing.** We identify economically and technically optimized dimensioning of energy storages, generation plants and grid assets.
- **Tailored operational strategies.** We develop and validate advanced operational strategies for your energy system non-invasively without intervention in the real system.
- **Software tools.** You are looking for a specialized software tool based on intEMT? We develop a customized solution for you.

Wide range of Applications

Thanks to the flexible modeling approach, the possible applications are almost unlimited and new ones can be easily integrated. Applications are for example:
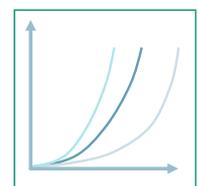
- **Peak shaving** with electrical and thermal components
- **Self-sufficiency** with renewable energy sources and storage
- **Day-ahead optimization** of energy storages and systems
- **Battery Electric Vehicle (BEV)** charging stations management
- **Energy management** of microgrids and isolated networks (stationary and mobile)
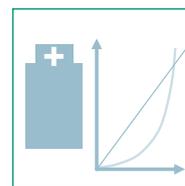- **Combination** of different use-cases (multi-objective)
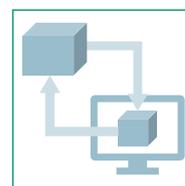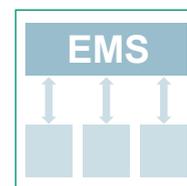
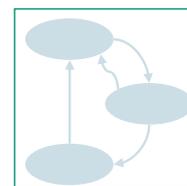|		
Digital Twins	Intelligent EMS	Energy Studies
Dimensioning	Operation Strategies	Software-Tools

Benefits for project partners resulting from intEMT.
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Software library modules

The five libraries shown in the table below provide the core functionality of intEMT. They are complemented by interfaces to PV and weather databases, as well as other utility modules (e.g., data handling). This forms the foundation for holistic, intelligent energy management and comprehensive system optimization.

Module	Description	Main features
Component model library	Generalized modelling approach covering numerous use cases	■ Includes simulation, optimization and evaluation methods ■ Types: converter, external data, external supply, sources, storage ■ Examples: battery, thermal energy storages, fuel cell, etc.
Operational strategies library	Operational strategies for plants with or without storages	■ Provides standalone operation for plants and storages ■ Monitors operation constraints like minimum operation and standby times or state of charge limits ■ Includes interface to energy management strategies
Systems library	Builds energy systems from components and grids	■ Manages simulation and optimization of comprehensive energy systems including job system for multiple parallel runs ■ Additional features like logging and evaluation
Dimensioning library	Sizing of energy storages and plants for various applications	■ Integrates components and operational strategies ■ Use for peak shaving, local consumption optimization and other
Energy management library	Economic MPC-based energy management	■ Integrates all other libraries ■ Real-world application of the strategy

Supporting your individual goals

The intEMT library can be used to achieve a wide range of overarching optimization objectives. These include cost savings through intelligent energy management methods, advanced operational strategies, and optimal component sizing. Another key objective is the reduction of emissions by maximizing the use of locally available renewable energy sources such as photovoltaic systems, solar thermal installations, and wind turbines. In addition, the library enables a resilient energy supply by supporting robust operational strategies, incorporating redundancy concepts, managing storage capacities intelligently, and assessing potential fault scenarios. Together, these capabilities make the intEMT library a powerful tool for developing energy systems that are economically efficient, environmentally sustainable, and technically reliable.
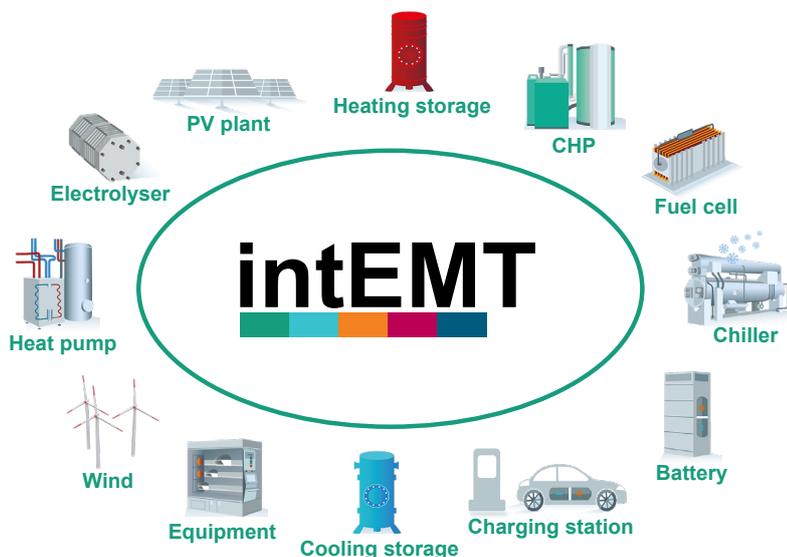
Areas of application for intEMT. © Christopher Lange / Fraunhofer IISB

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