

OpenEMS

# Dynamic Tariffs & Energy Scheduling

# Powermanagement vs. Energymanagement

- State-of-the-Art
  - (Nearly) nobody really does Energymanagement but only Power-/Relaymanagement
  - Even OpenEMS Controllers are mostly optimized for „Single-Objective Optimization“
    - e.g. Self-consumption optimization with Battery, Electric Vehicle PV surplus charging, threshold based relay switching
- Multi-Use Applications are hardly possible with thresholds. Example:
  - Optimization of
    - When to charge/discharge a local battery?
    - When to charge (or discharge) an electric vehicle?
    - When should a heat pump or electric heater run?
    - ...

# Genetic Algorithms

„Genetische bzw. Evolutionäre Algorithmen (EA) sind eine Klasse von stochastischen, metaheuristischen Optimierungsverfahren, deren Funktionsweise von der Evolution natürlicher Lebewesen inspiriert ist.“

„Oft führen Aufgabenstellungen der **Künstlichen Intelligenz (KI)** zu Optimierungsproblemen. Diese werden je nach Struktur entweder mit Suchalgorithmen aus der Informatik oder, zunehmend, mit Mitteln der mathematischen Optimierung gelöst. Bekannte heuristische Suchverfahren aus dem Kontext der KI sind evolutionäre Algorithmen.“

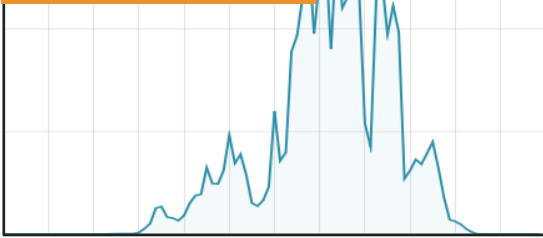
(Wikipedia)



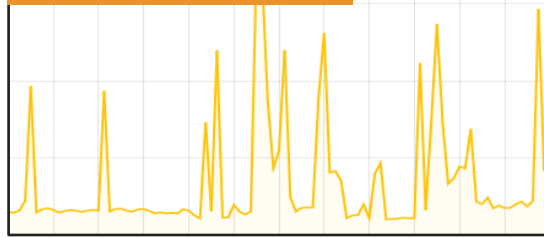
every 15 Minutes

predictor

Production



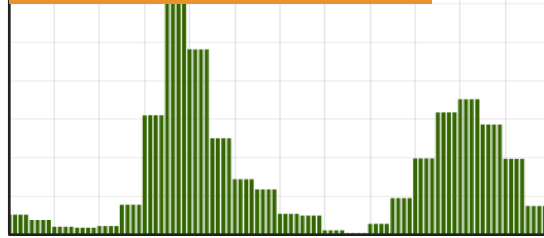
Consumption



daily

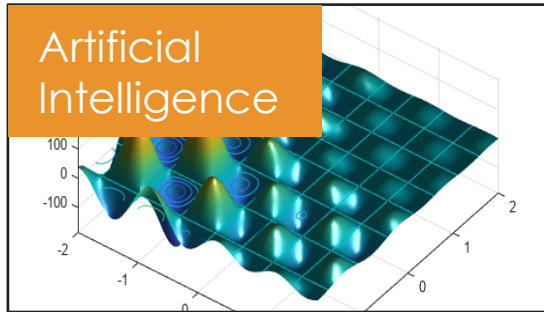
pull

Time-of-Use Tariff



optimize

Artificial Intelligence

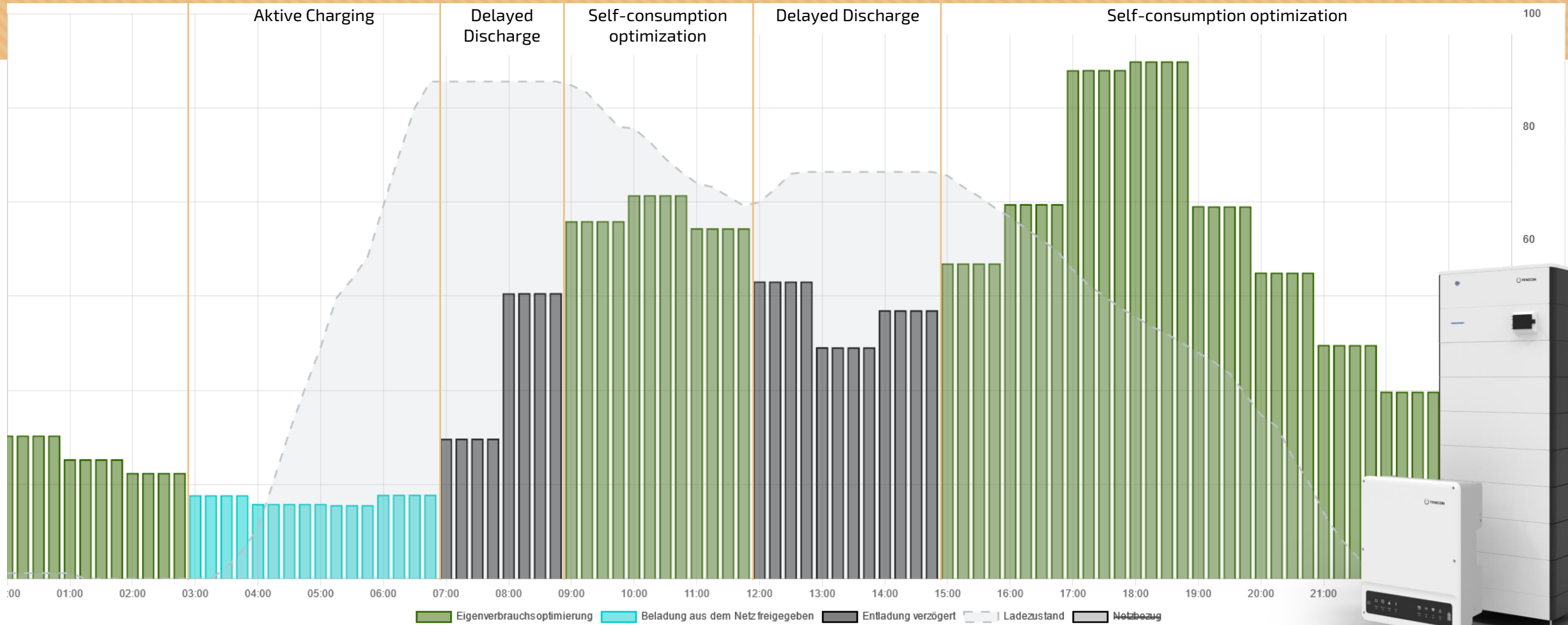


execute

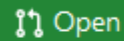
**Energy Schedule**

00:00 – 00:15	Self-consumption optimization
00:15 – 00:30	Self-consumption optimization
00:30 – 00:45	Delay discharge
00:45 – 01:00	Charge from Grid
01:00 – 01:15	Delay discharge
...	...

# Battery charging from grid



# Energy Scheduler #2789



Open

sfeilmeier wants to merge 2 commits into `develop` from `feature/energy-scheduler`

Conversation 1

Commits 2

Checks 4

Files changed 90



sfeilmeier commented yesterday

Member ...

- Introduce generically usable EnergyScheduleHandler (ESH) for executing energy simulations and applying schedules
  - Provide nice debugLog output and channel "SimulationsPerQuarter" to detect performance issues
- Introduce new implementation of `EnergyFlow` that uses linear constraint validation and optimization
- Implement for `Controller.Ess.Time-Of-Use-Tariff`, `Controller.Ess.EmergencyCapacityReserve`, `Controller.Ess.LimitTotalDischarge` and `Controller.Ess.GridOptimizedCharge` (ALPHA)
- Add config property "Version" to be able to switch between old (only ESS, but fast and well tested) and new (generic ESH but slower) implementation.
  - Attention: be sure to set `EnergyScheduler` (`Core.Energy`) and `Controller.Ess.Time-Of-Use-Tariff` to the same Version!
  - Old implementations are moved to `v1` packages and marked `@deprecated` and will be removed in one of the next versions of OpenEMS. Unfortunately right now this leads to some mixed code.

