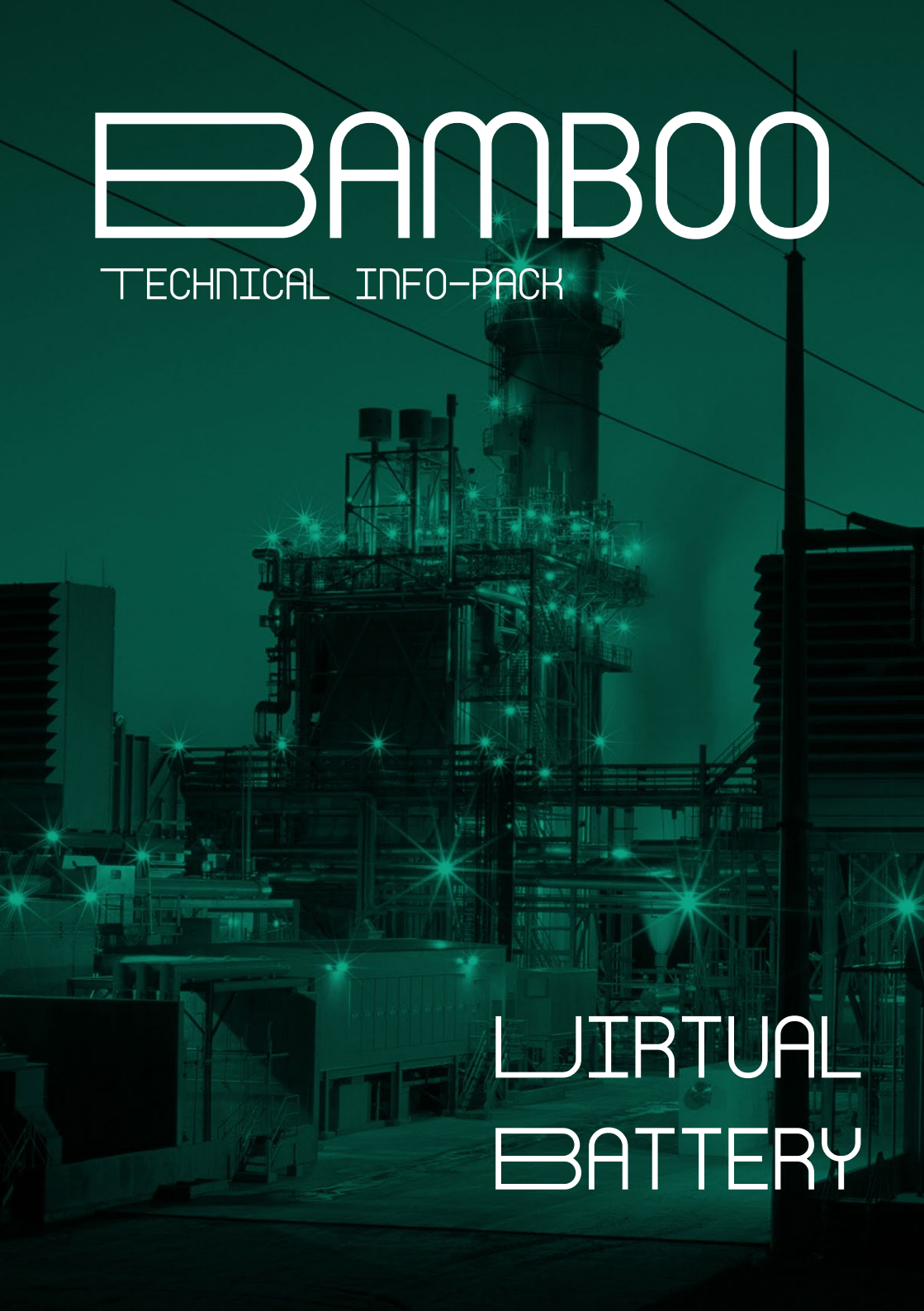
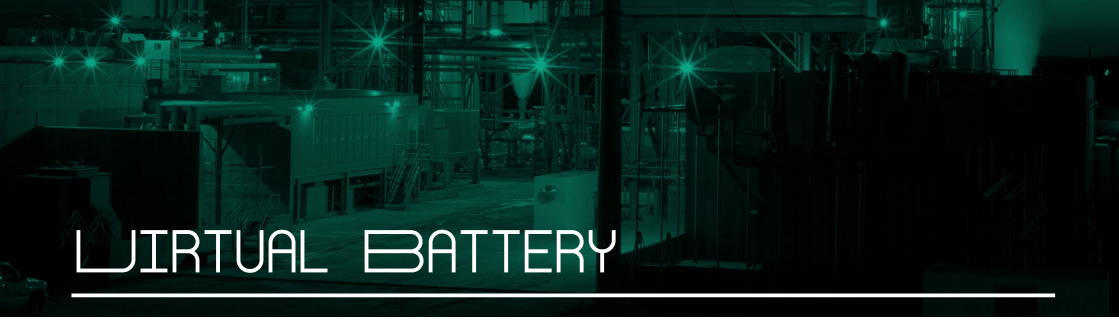
BAMBOO

TECHNICAL INFO-PACK



VIRTUAL BATTERY



VIRTUAL BATTERY

A concept for flexibility options analysis in industrial production processes

DESCRIPTION

The virtual battery concept allows analysis of how electricity and heat can be flexibly produced and used with regard to regional renewable electricity generation and regulatory frameworks.

BAMBOO aims to develop a **virtual battery concept**, where the plant and the operation of its energy production and consumption assets act as a virtual battery for the local grid. By using a surplus of renewable energy available in the local grid, bottlenecks in the transmission grid will be avoided. Thus, the virtual battery concept will contribute to grid stability in the long term.

The virtual battery helps electricity to be used optimally from the national grid versus on-site power generation by a **combined heat and power plant (CHP)**. It does this in line with regulatory frameworks, production requirements and the technical characteristics of energy provision. This optimisation concerns the operation of energy supply assets and also the scheduling of the production process.

POTENTIAL MARKETS AND END-USERS

The virtual battery concept is designed ad hoc according to the flexibility options that exist at the specific industrial site and it can be implemented in various energy-intensive industries. Within this context, various flexibility options and different sets of frame conditions can be analysed.

Four categories of **business cases** can be defined for the use of flexibility in energy-intensive industries:

- Electricity Bill Reduction.
- System Service Provision.
- Balancing Service Contract with an off-site variable renewable energy source (VRES).
- Electricity Bill Reduction with on-site VRES.

Energy flexibility potential is promising for industrial processes with:

1. High share of electricity costs in gross value added.
2. Their technical possibilities of load shedding or shifting in energy provision and consumption assets.

These industrial sectors are, for example, aluminium electrolysis, cement and raw mills, chlorine electrolysis, air separation, electric arc furnace, and pulp and paper production.

RESULTS

Results are currently under evaluation. However, a set of scenarios has been defined in differing in frame conditions (e.g. energy prices, maximum power consumption from the public grid, production amounts, regulatory settings, etc.). A **mathematical optimisation model** as well as an agent-based simulation model have been **set-up to analyse the impact of the frame conditions** on operation and flexibility. Thus, not only current energy conversion and supply technologies are considered, but also potential investments in energy storage systems or power-to-heat assets (e.g. electrode boilers and high-temperature heat pumps) have been taken into account in the analysis.

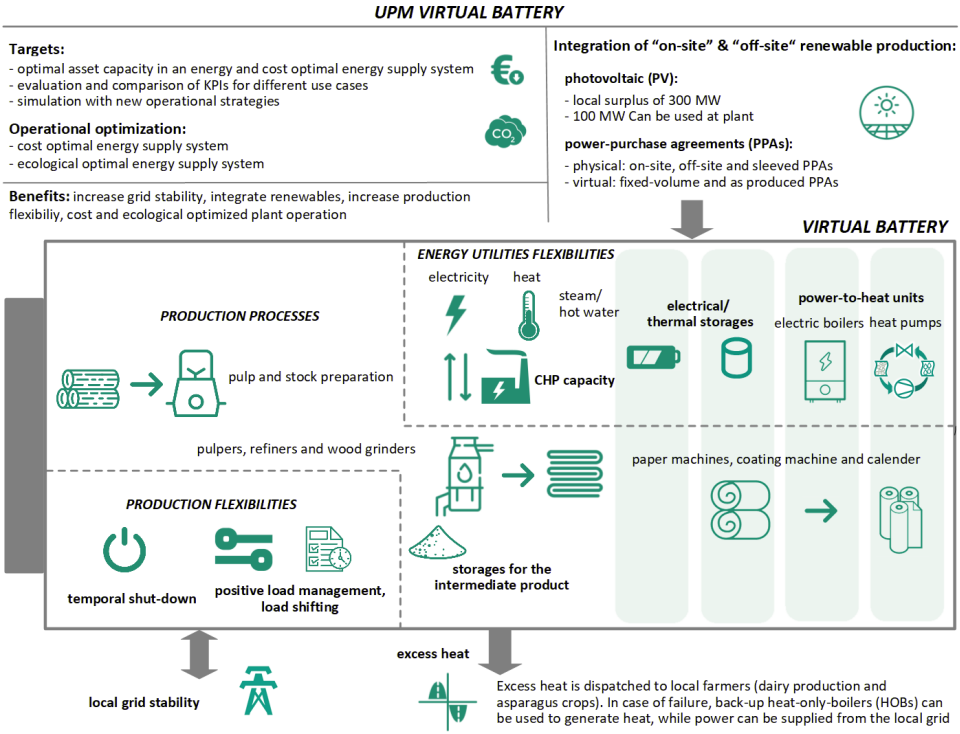


Figure 1. UPM Virtual Battery

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