XENDEE

"Effective Design of MaaS Agreements with State-of-the-Art Planning Methods"

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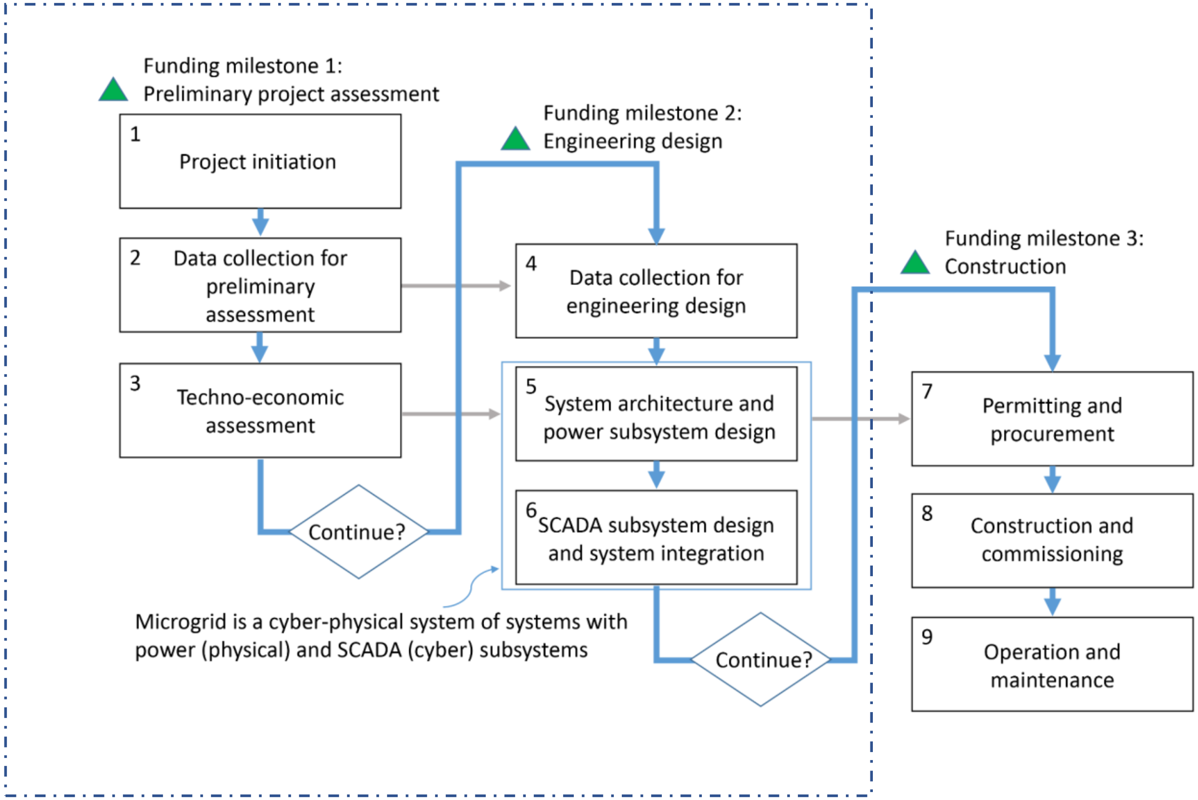
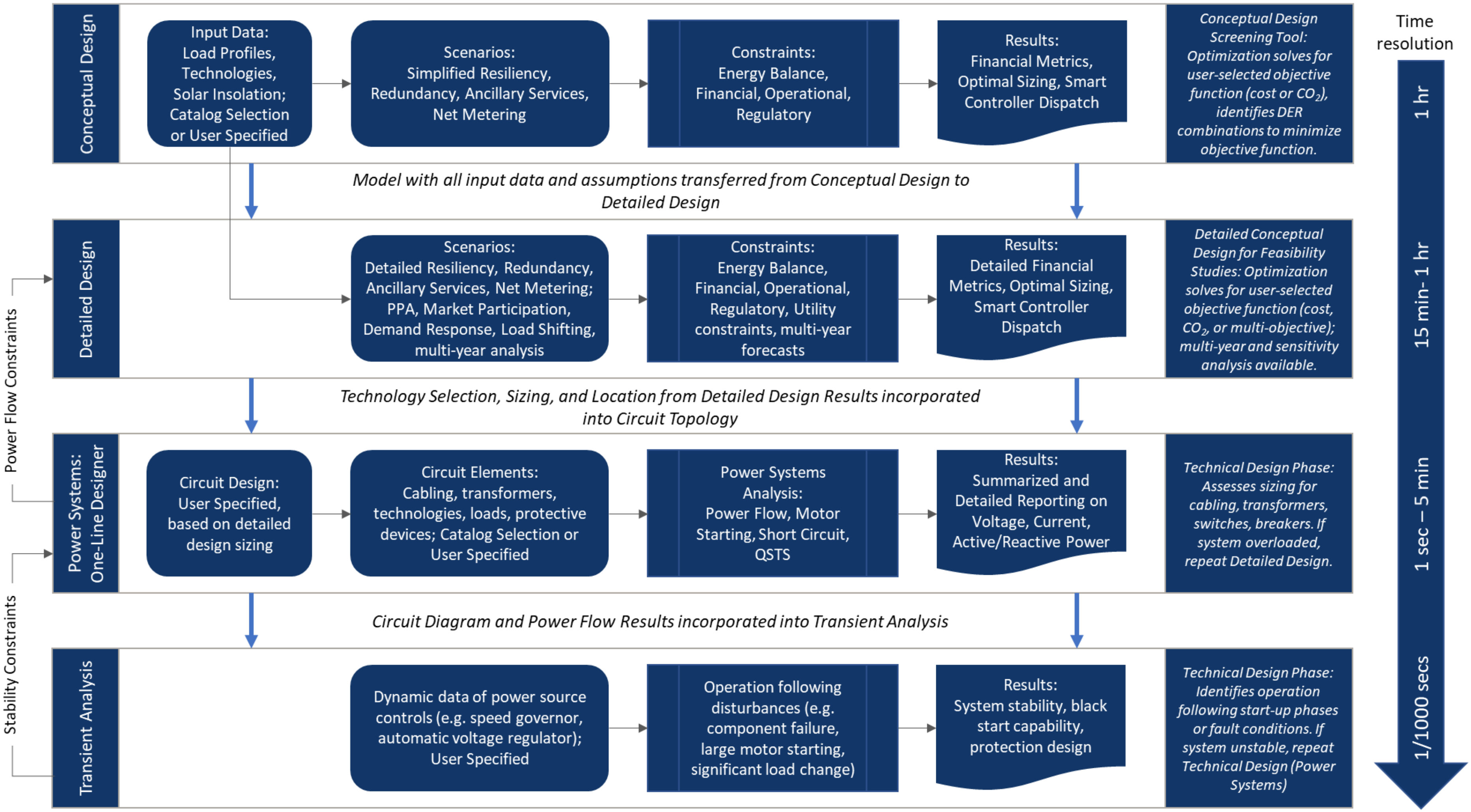
The Microgrid Implementation Process*

Design Makes up Two-Thirds of the Implementation Process



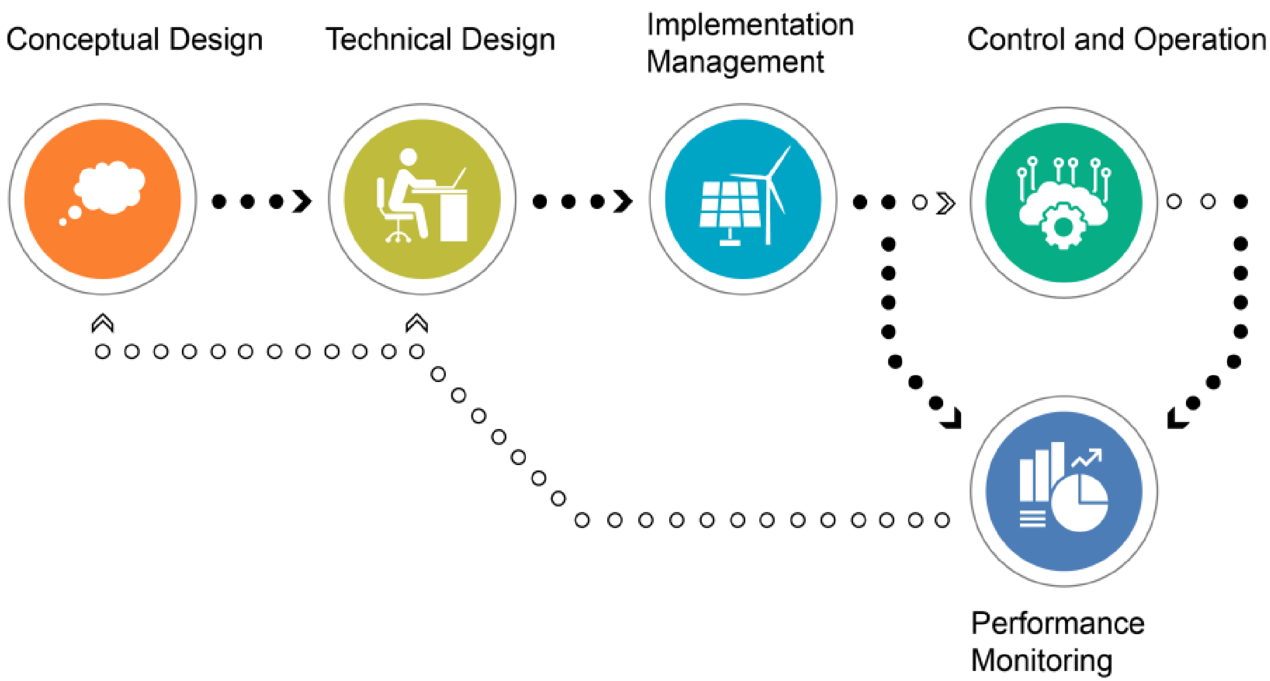
* Based on federal and Department of Defense microgrid projects

Microgrid Planning Steps



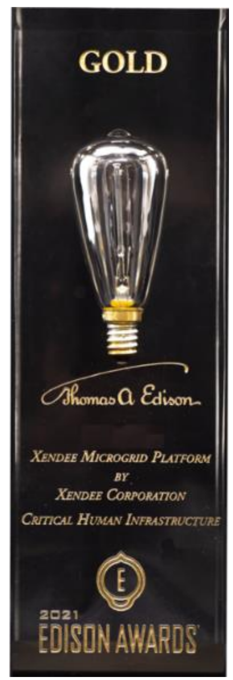
Holistic Platform for Planning ***and*** Operation

A single platform minimizes latency and maximizes continuity by removing unnecessary steps and facilitating coordination.



One Platform

XENDEE is an end-to-end solution for designing and operating Microgrid systems that intelligently optimizes design decisions as well as live operation and energy dispatch. This allows XENDEE to create reliable, bankable systems that reduce engineering costs, energy prices, and CO_2 emissions while also improving energy security and resilience to power outages.



Today's Focus:

Design Process

Conceptual Design

Drag-and-Drop Platform

User Inputs and Boundary Conditions

See previous slide

Modeled in XENDEE

Results

- Optimal technologies and operation
- Annual costs
- Investment costs
- Net present value, internal rate of return, etc.

→

Advanced Design (Techno-Economic)

Expert Functions

Issues and Problems

- Analysis over several years (changes in PV or battery performance, prices, etc.)
- Integration of network topologies and network parameters (heat/electricity exchange between nodes, etc.)

Modeled in XENDEE

Results (same as previous, but in addition):

- Investment and maintenance timing
- Energy flows between nodes in the cell, etc.

Detailed Design (Purely Technical)

Network Analysis

Issues and Problems

- *Network utilization (cables, transformers, etc.) in extreme situations (snapshot) and over the years (QSTS)*
- *Power flows in the millisecond range*
- *Islanding, stability, black start, etc.*

User Input

- Network topology, elements, and their specifications

Modeled in XENDEE

Results

- Optimal cable and transformer specifications
- Short-circuit currents, equipment utilization, etc.

Today's Focus:
Model building

Data Input

Existing Technologies:
- Heating
- Cooling
- Power

Tariffs:
- Power and Energy
- Fuel Delivery
- Net Metering

$/kW
$/kWh
$

Weather Data:
- Solar Irradiation
- Temperature
- At Least 1 Year

Load Data:
- Electrical, Thermal, Fuel
- At Least 1h Resolution
- At Least 1 Year

Constraints

General Conditions:
- Project Length
- Existing Technologies
- Interest Rate
- Power System Constraints
- Regulatory Boundaries
- Financing and Incentives
- Etc.

Possible DER Technologies and Infrastructure/Grid:
- Storage Technologies for Electricity, Heat, or Cool
- Solar Photovoltaic or Thermal Panels
- Heat Pump (air or geothermal)
- Hydrogen (electrolyzer, storage, fuel cell, hydrogen fueling station)
- Combined Heat and Power (biomass, gas, or oil)
- DC Component Inverters
- Electric Vehicles
- Cables, transformers

Objective Function
(Cost, CO_2, Resiliency, etc.)

Mathematical Optimization (MILP)

Optimal Technology Portfolio, Optimal Planned Operation, and Location

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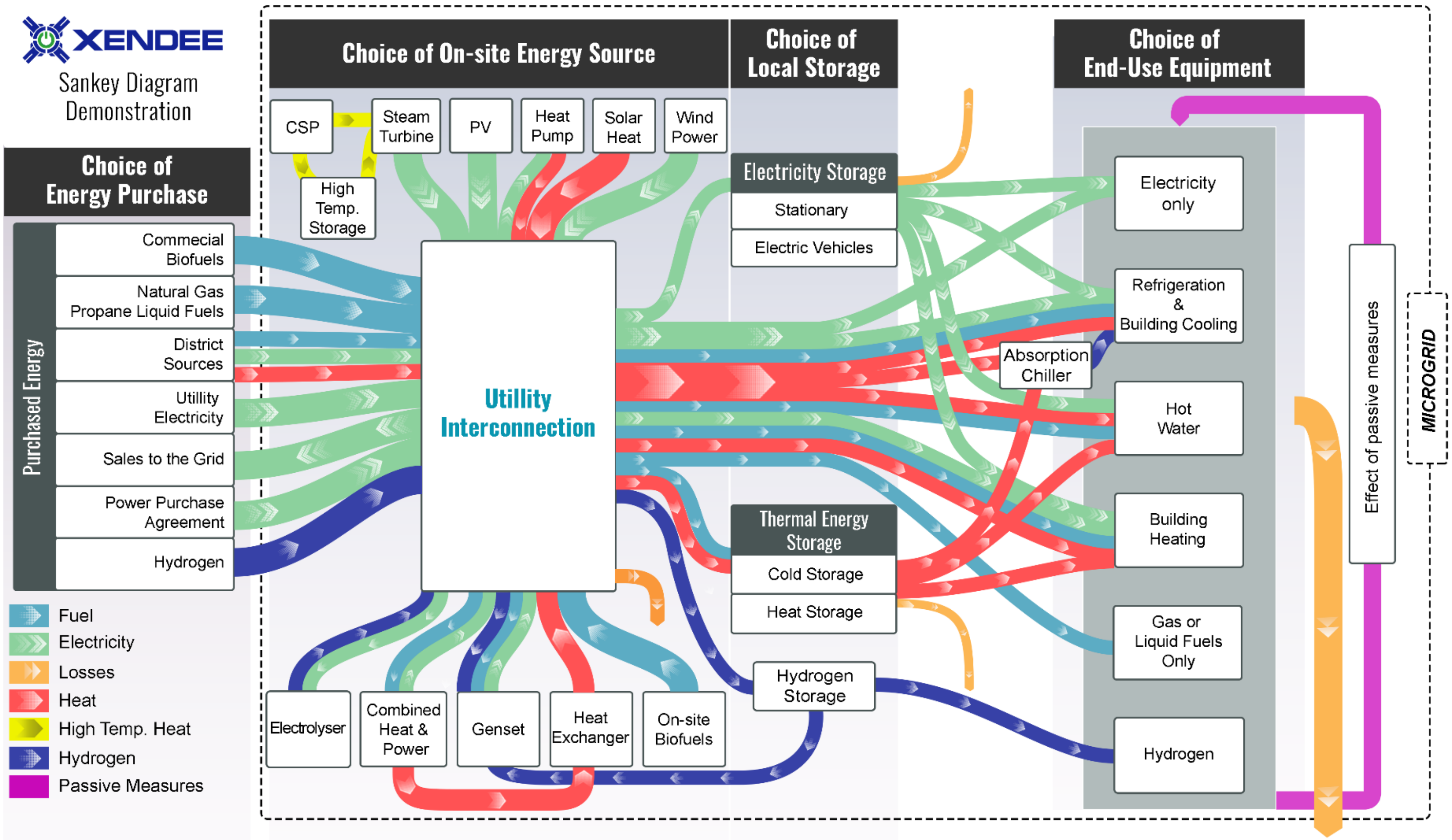
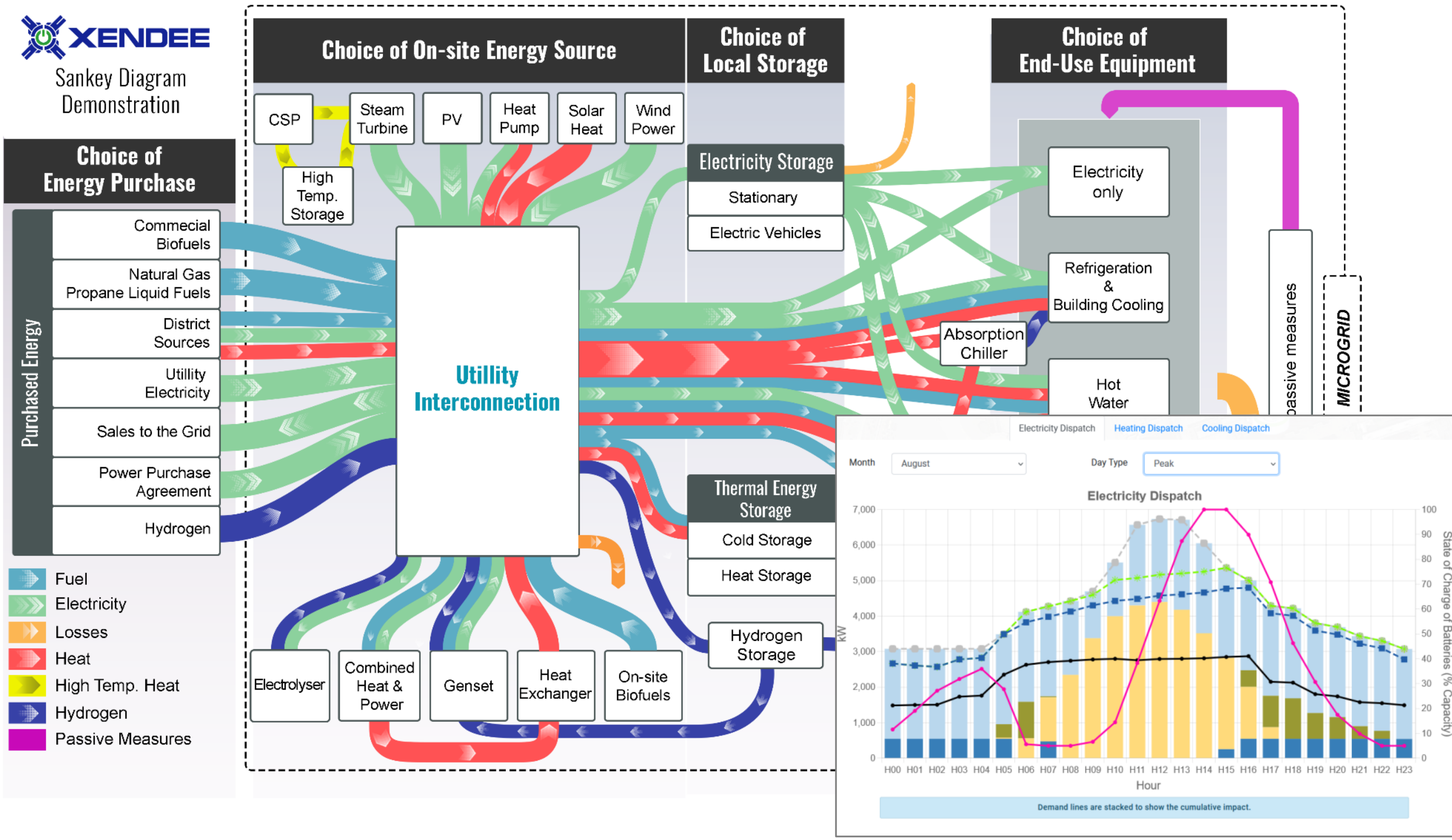
Optimized Investment Capacities and Dispatch Planning



Optimized Investment Capacities and Dispatch Planning



Real Life Case Study

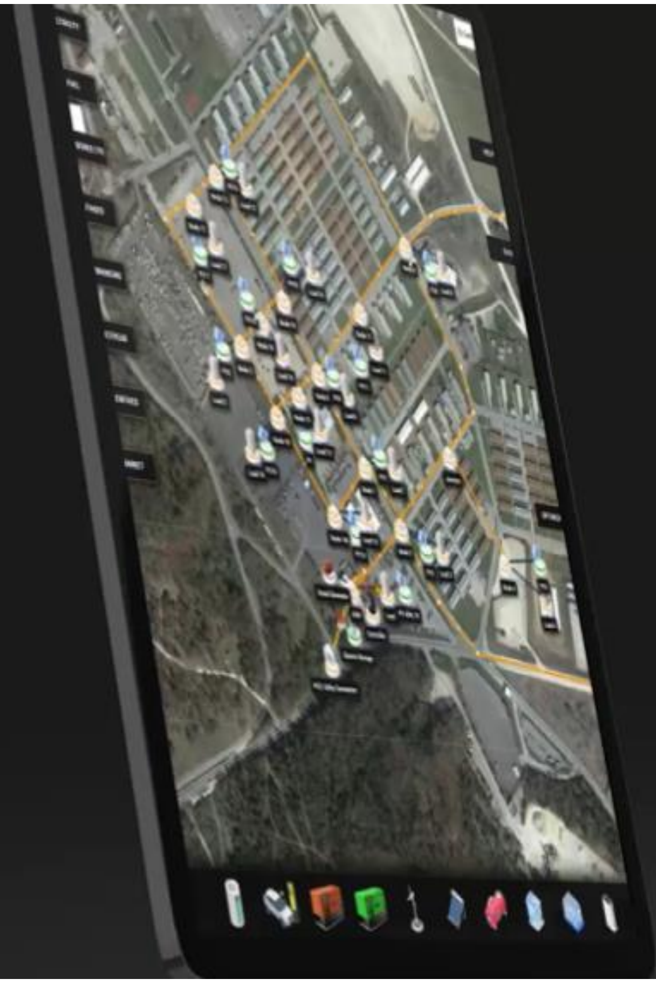
Greenfield Microgrid Modelled for MaaS

Objective: Minimize Costs and Maximize Profit

- 30+ buildings with rooftop PV space
- Connected through cables and transformers
- Multi-day resilience requirements
- Annual demand charge and renewable surcharge
- PV, batteries, backup generation, heat pumps

Real Life Case Study

Greenfield Microgrid Modelled for MaaS



https://youtu.be/fw39LNyaxJo

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Important Considerations for MaaS Modelling

1. Consider underlying topology and network

2. Use optimization approach that also considers optimal dispatch

3. Model impact of different financing schemes
(since they will impact the optimal solution)

4. Model changes over time in a multi-year setup

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Thank You

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