EEM22

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Assessment of the potential of local solar generation for providing ship shore power in the Norwegian harbor Port of Borg

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Ljubljana, 14th September

AGENDA

- Context
- Case study
- Scenarios
- Results
- Conclusions & Next steps

EEM22 conference 14th September 2022 Ljubliana, Slovenia

E-LAND

*Integrated multi-vector management system for **E**nergy is**LAND**s*

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Piloting Leader for E-LAND H2020

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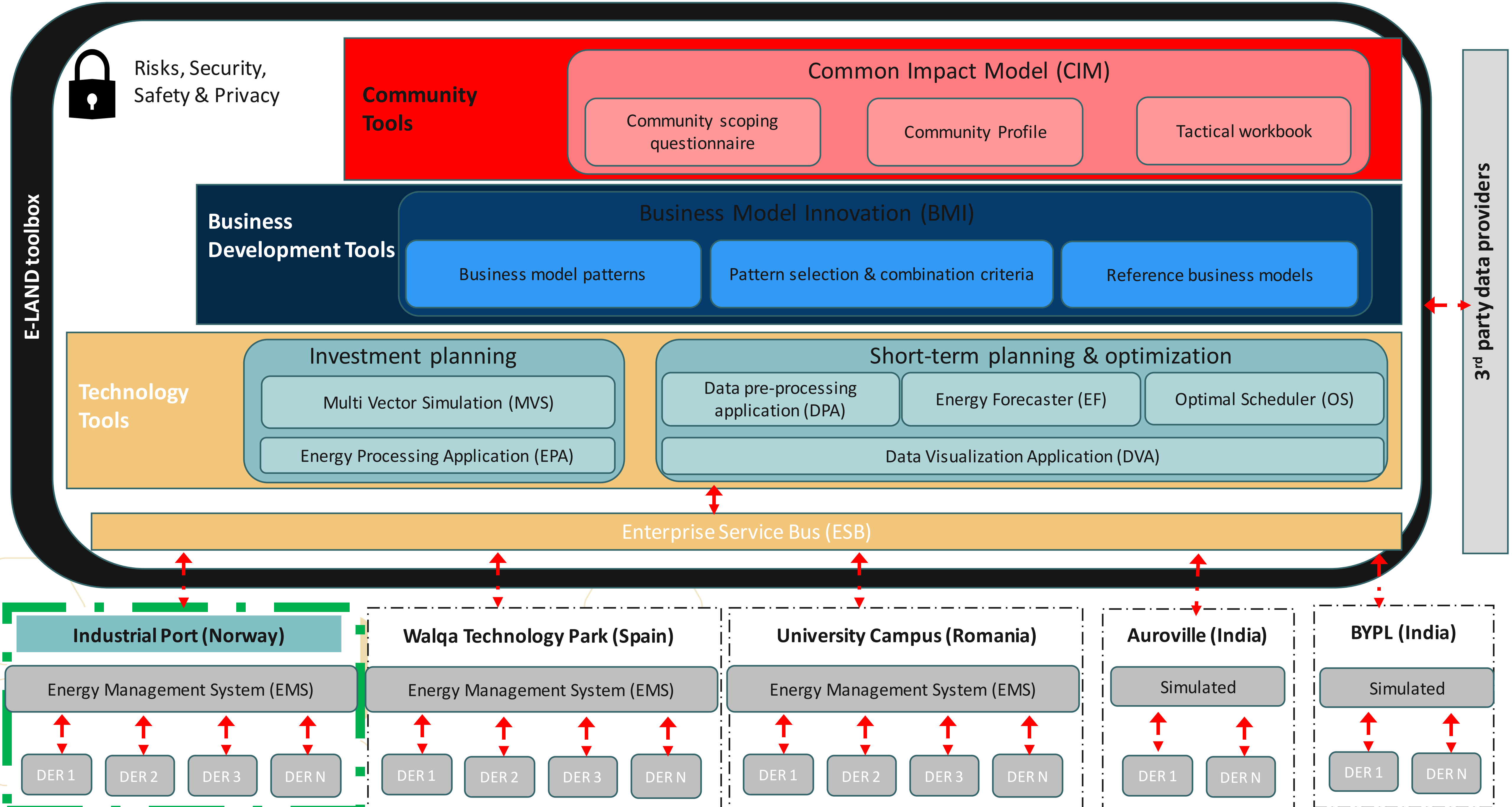
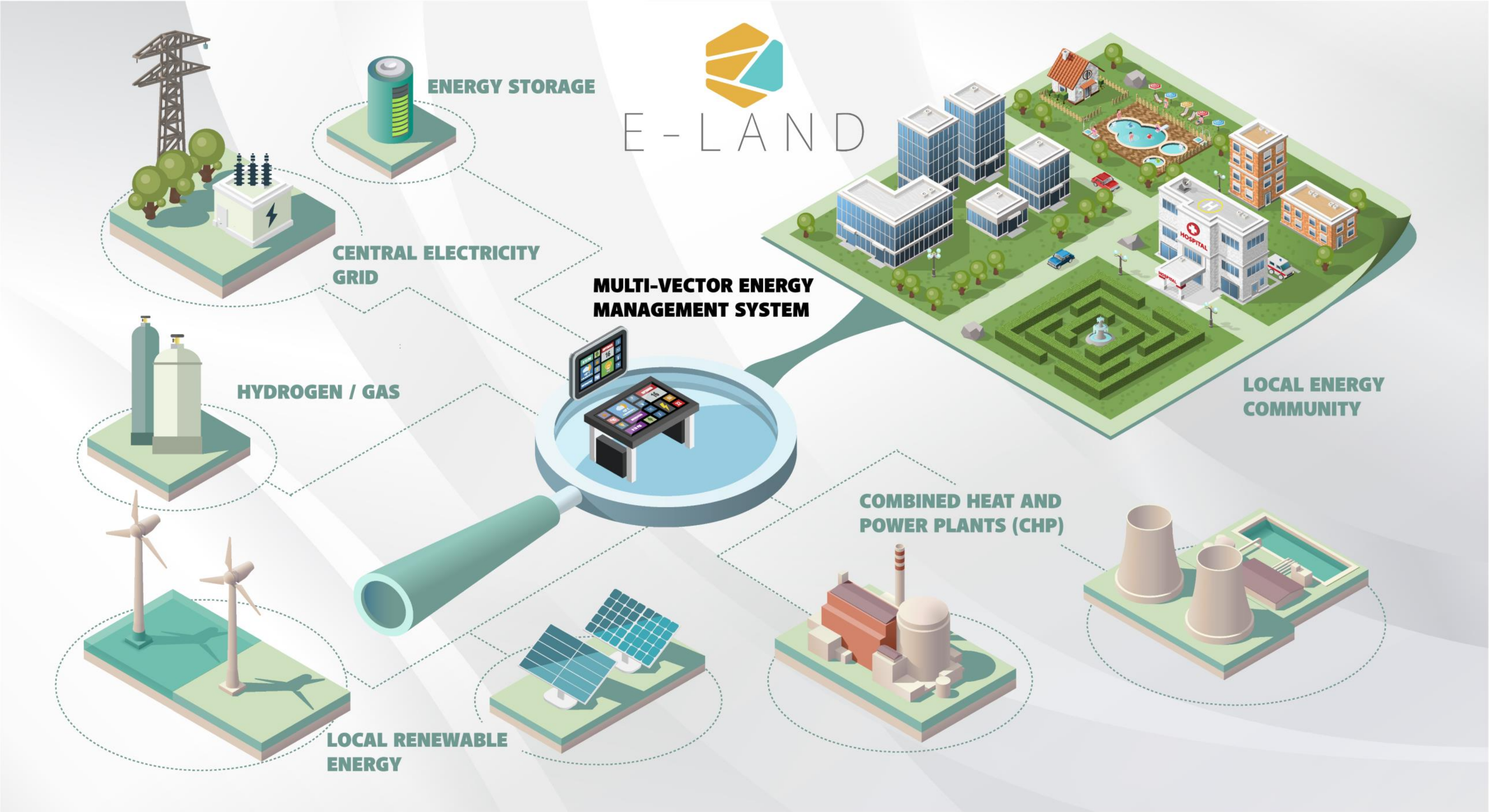
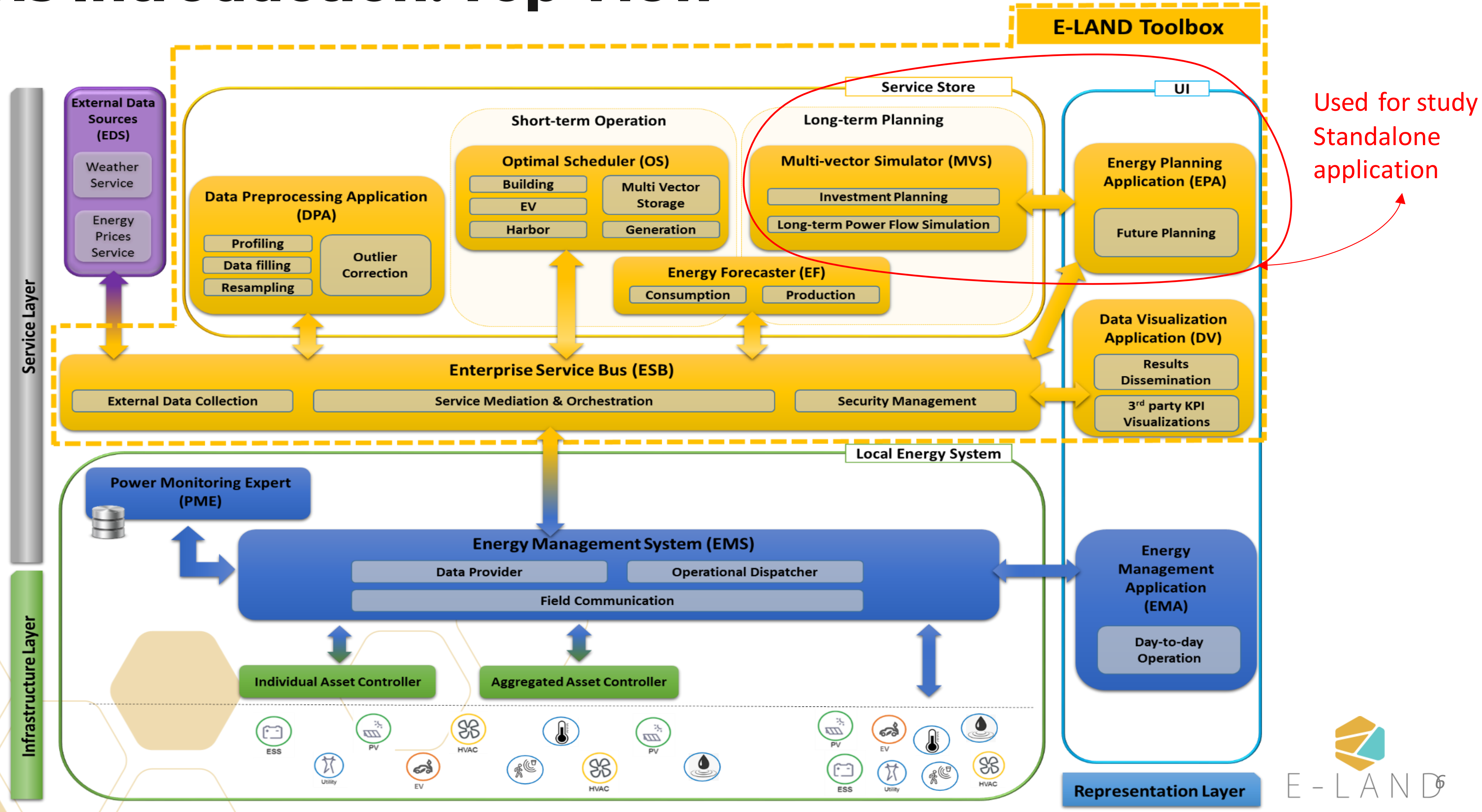

E-LAND toolbox
Risks, Security, Safety & Privacy
Community Tools
Common Impact Model (CIM)
Community scoping questionnaire
Community Profile
Tactical workbook
Business Development Tools
Business Model Innovation (BMI)
Business model patterns
Pattern selection & combination criteria
Reference business models
Technology Tools
Investment planning
Multi Vector Simulation (MVS)
Energy Processing Application (EPA)
Short-term planning & optimization
Data pre-processing application (DPA)
Energy Forecaster (EF)
Optimal Scheduler (OS)
Data Visualization Application (DVA)
Enterprise Service Bus (ESB)
3rd party data providers
Industrial Port (Norway)
Energy Management System (EMS)
DER 1
DER 2
DER 3
DER N
Walqa Technology Park (Spain)
Energy Management System (EMS)
DER 1
DER 2
DER 3
DER N
University Campus (Romania)
Energy Management System (EMS)
DER 1
DER 2
DER 3
DER N
Auroville (India)
Simulated
DER 1
DER N
BYPL (India)
Simulated
DER 1
DER N


E-LAND
ENERGY STORAGE
CENTRAL ELECTRICITY GRID
MULTI-VECTOR ENERGY MANAGEMENT SYSTEM
HYDROGEN / GAS
LOCAL ENERGY COMMUNITY
COMBINED HEAT AND POWER PLANTS (CHP)
LOCAL RENEWABLE ENERGY
HOSPITAL

Tools Introduction: Top View



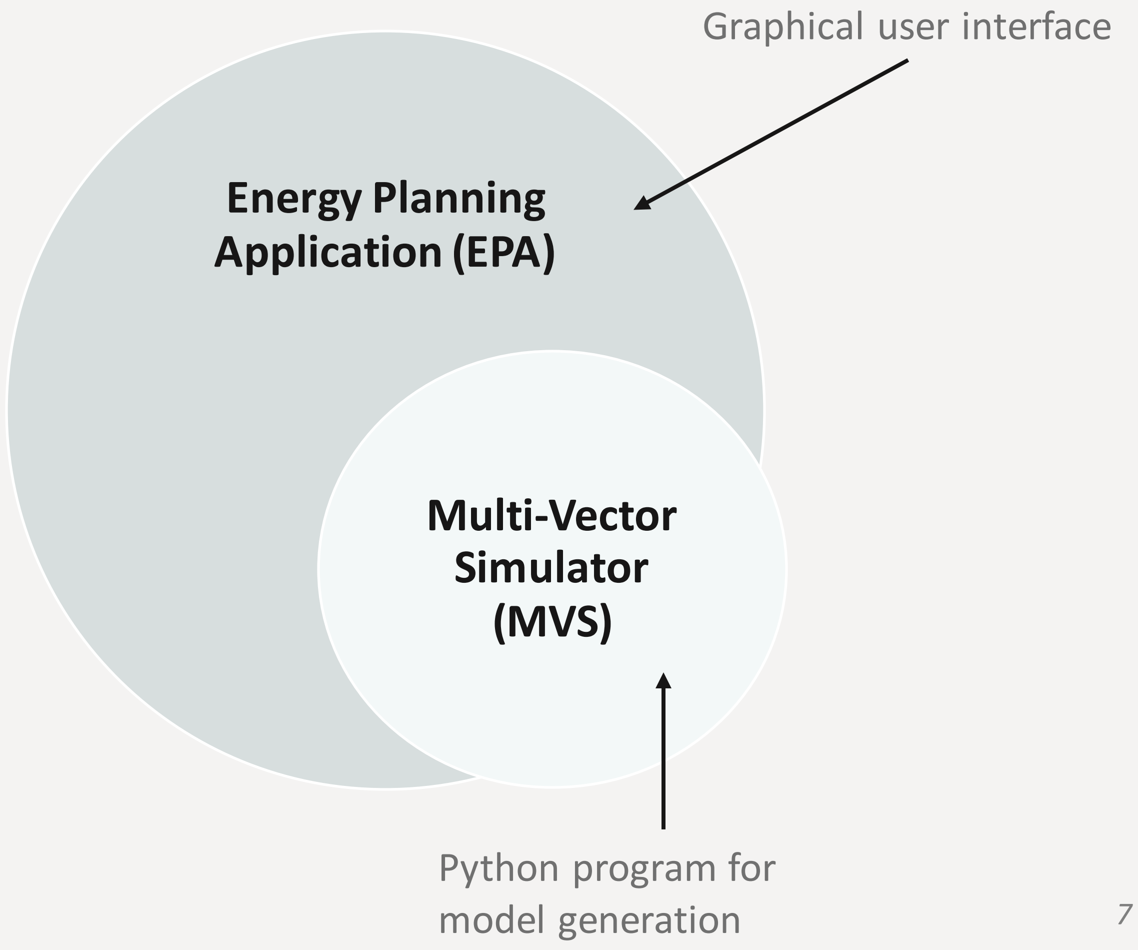
Investment planning tools by E-LAND MVS and EPA

Simulation and optimization of multi-vector energy systems:

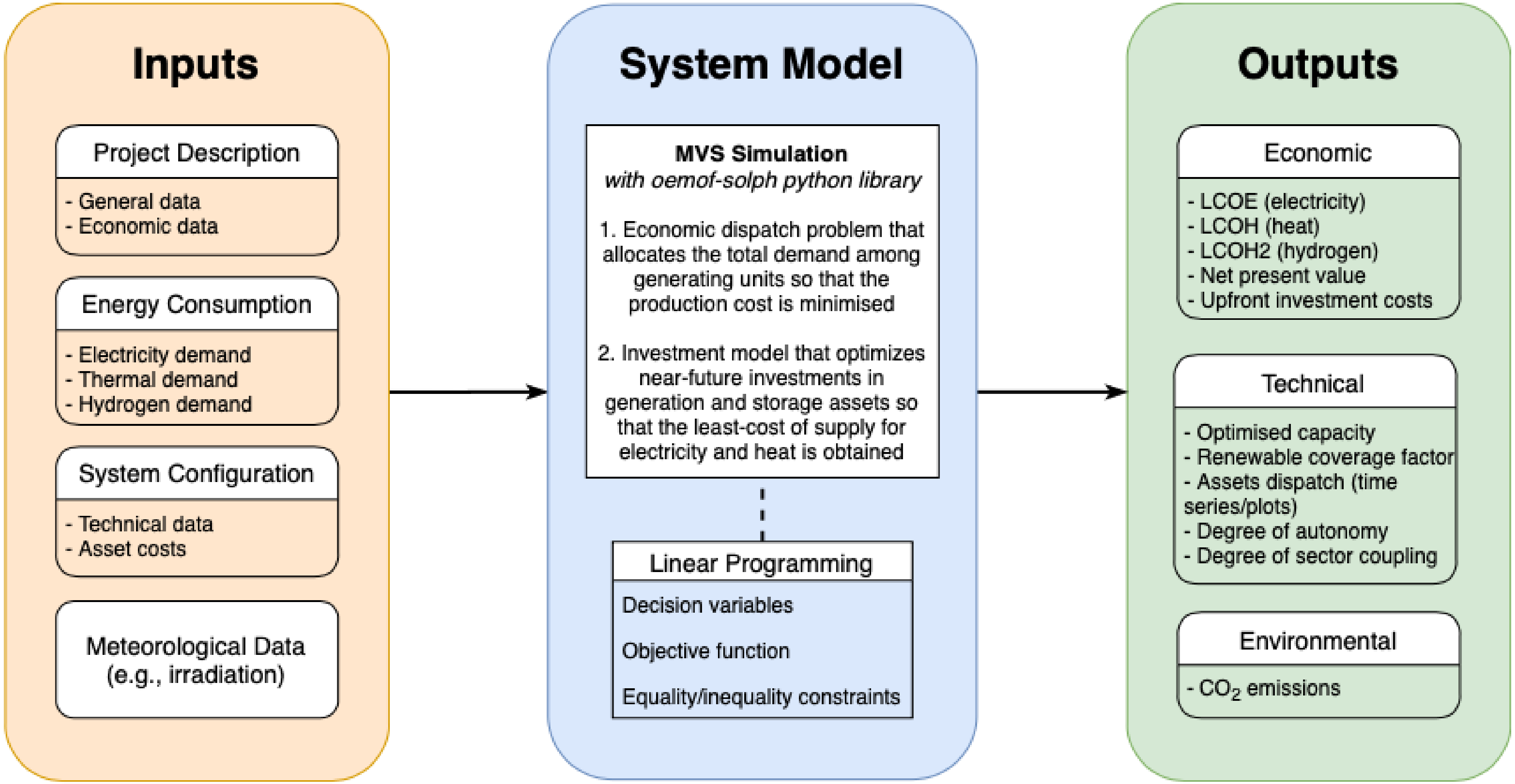
- ✓ Long-term investment planning
- ✓ Long-term dispatch optimization
- ✓ Performance evaluation

→ Optimal capacities
Optimal dispatch

→ Results in pre-feasibility analysis

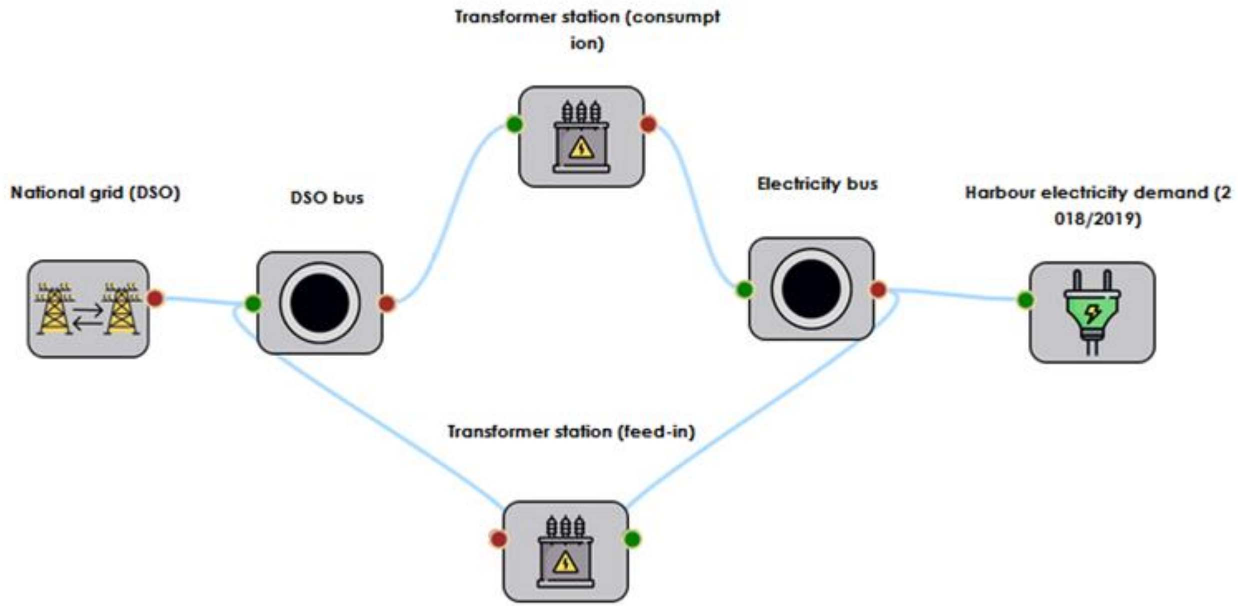


Flow chart of the Multi-Vector Simulator



Case Study

- The **impact of the installation of a PV system, including battery storage and ship shore power** on the energy system is examined.
- Port of Borg has planned for and invested in **1 MWp PV** during the last three years.
- Port of Borg is largely concerned with **PV power as a RES for the port**, as opposed to wind power due to the findings of the study done in 2018 funded by ENOVA



Input Data

- **Scenario 1 - business-as-usual (BAU) (2018) -** The harbour **electricity demand of 1.25 GWh p.a**. is fully covered through a **1,250 kVA bidirectional transformer station**. The transformer has an **efficiency of 96 %.**
- **Scenario 2 – status quo (2021)** with 1 MWp PV installed and 195 kWh/90 kW battery
- **Scenario 3 – ship shore** demand of 2MW with 1.95GWh p.a

a) Best-case scenario – 20 small ships (peak PV) & peak load 1,7 MW

b) Intermediate scenario – 20 small ships & 1 big (Moderate PV) & peak load at 2,03MW

c) Worst-case scenario – 20 small ships & 3 big (poor PV) & peak load at 2,07 MW

- **Scenario 4 – ship shore supply with new investments**

Tariffs	Value	Unit
Electricity bill: Electricity import tariff	0.54	NOK/kWh
Electricity bill: Monthly peak demand pricing	60	NOK/kW
Renewable share of electricity import	0.98	-
Feed-in tariff for electricity exports (PV)	0.432	NOK/kWh

Due to high Electricity prices now, the changes are not incorporated in this paper

Results

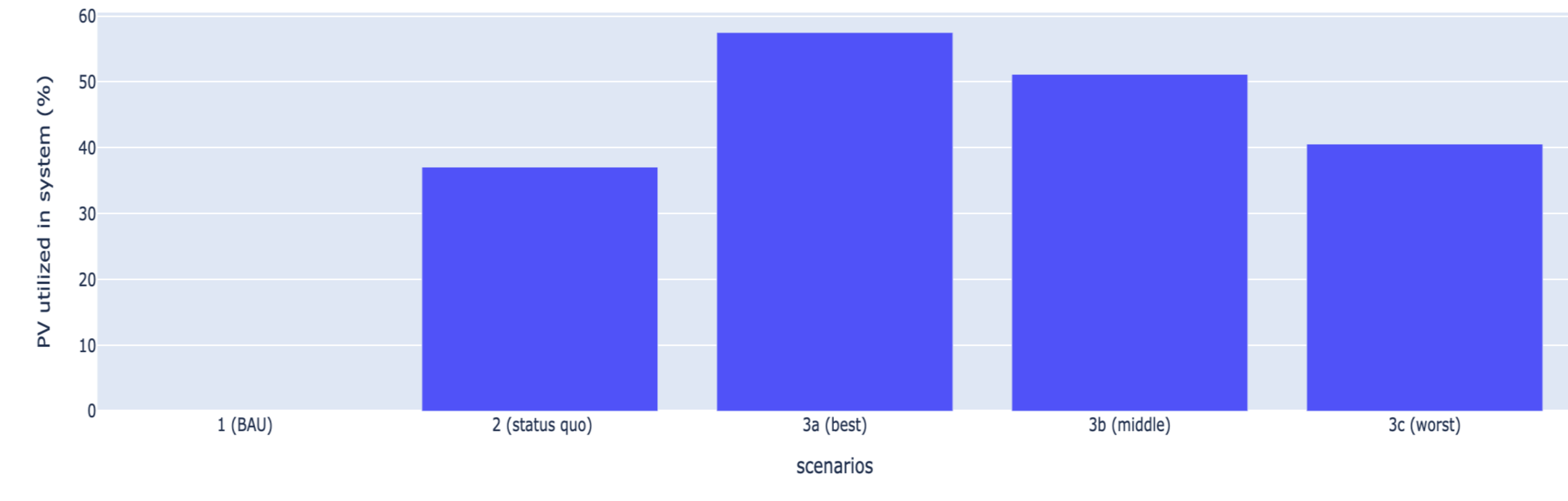
- **Scenario 1 - business-as-usual (BAU) (2018)**
- **Scenario 2 – status quo with 1 MWp PV installed (2021)**
- **Scenario 3 – ship shore demand with 1 MWp PV**

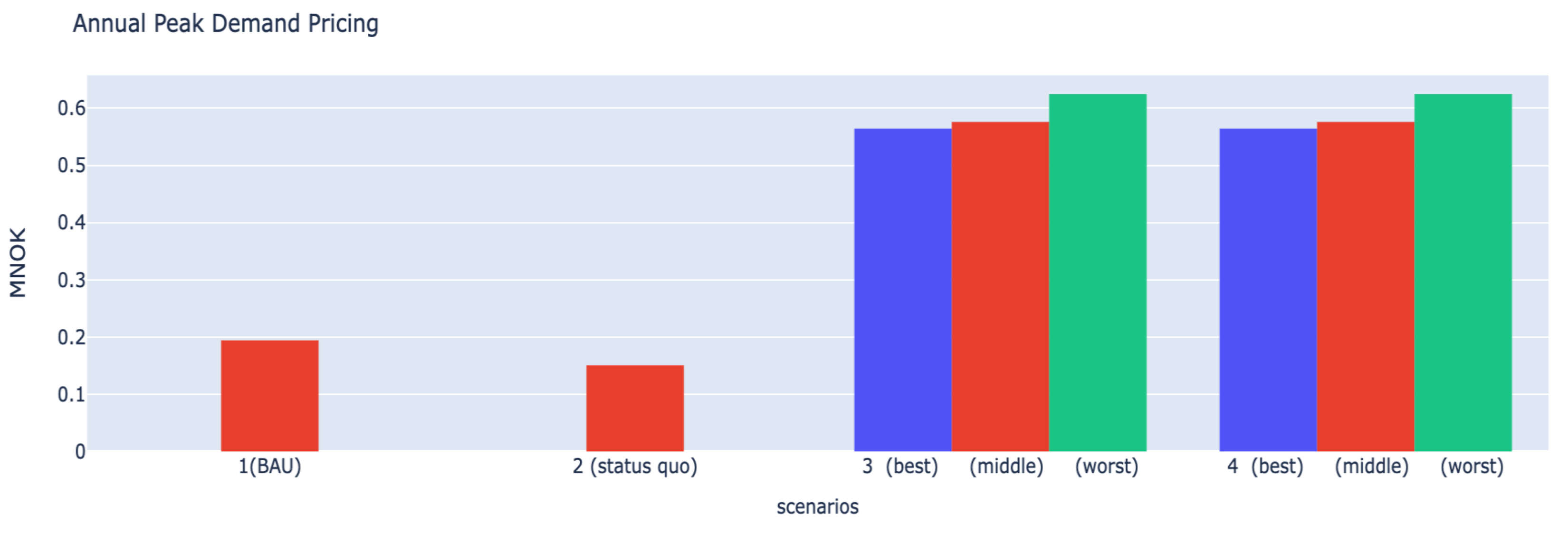
a) Best-case scenario

b) Intermediate scenario

c) Worst-case scenario

- **Scenario 4 – ship shore supply with new investments**





Conclusions & Next steps

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- **Compared to the 2018** energy supply costs, it has to be noted that the **investment into 1 MWp PV and 195 kWh battery** is **increasing the supply costs in the short term**, despite **decreasing the total energy bills**.

- The investment into ship-shore supply also becomes **more economically viable** when **more of the local energy generated is utilized locally**, as can be seen from the **LCOE decreasing in the best-case ship-shore demand scenario** (compared to the worst case) along with decreasing excess renewable electricity generation.

- The study indicates that **providing ship-shore power** to **increase the sustainability of maritime transport** is a financially interesting option for the port, **if a cost-covering tariff scheme for ship-shore power usage is introduced**, as the new PV and battery installation can be better utilized this way.

- A **techno-economical investment decision objective**, **no additional capacities** for the 1 MWp PV and 195 kWh battery are chosen.

NOTE: However, with the **changes in the electricity prices**, the investment planning outcome can change significantly, and therefore electricity price predictions as part of the investment planning are crucial for future scenario evaluation.

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THANK YOU.

Questions?

Visit: www. https://elandh2020.eu/

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