Local Energy Systems and Communities for Future Mobility Concepts: the Need for Real-life Test Beds

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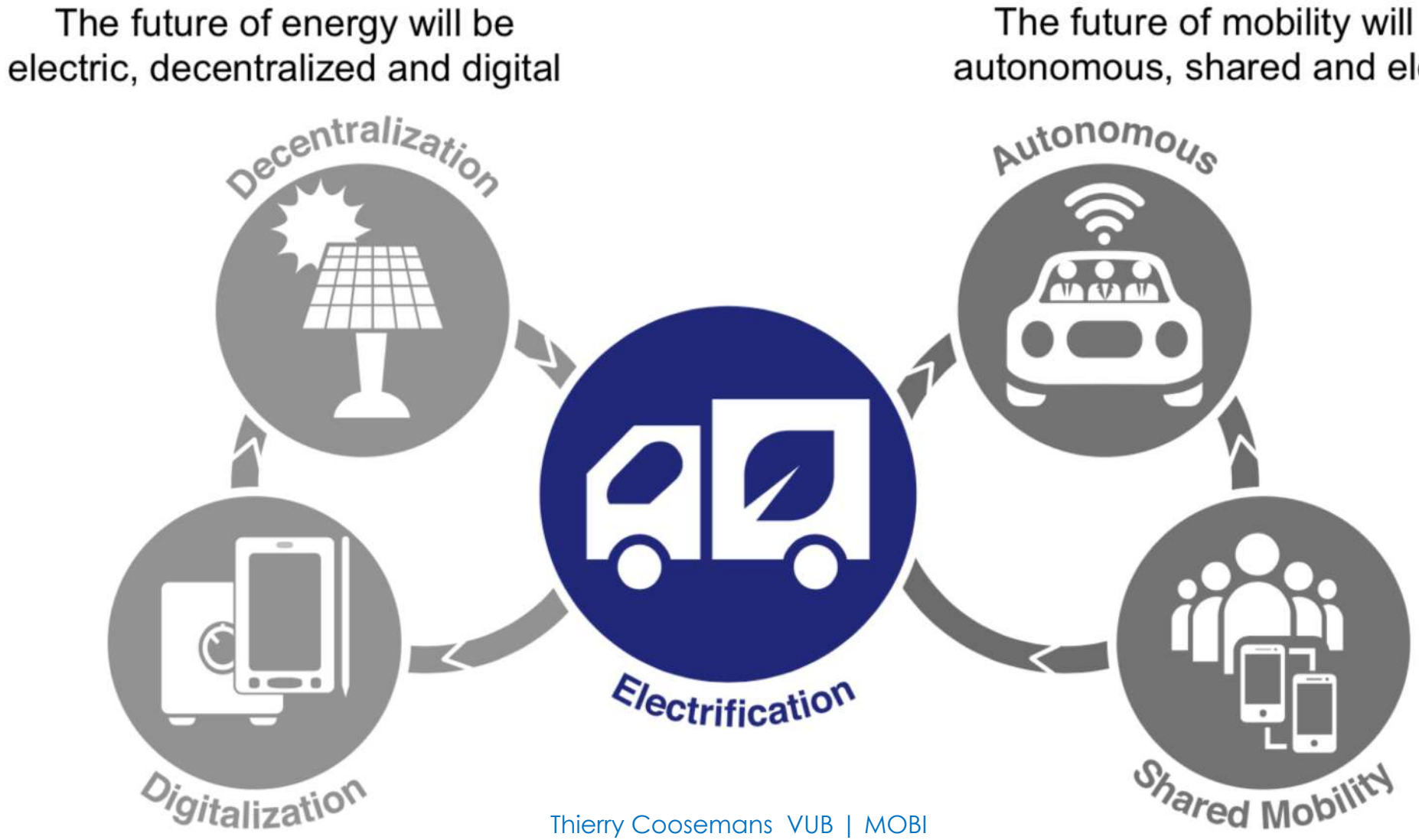
Electric Vehicle and Energy Systems: Two Transitions Lead to Integration



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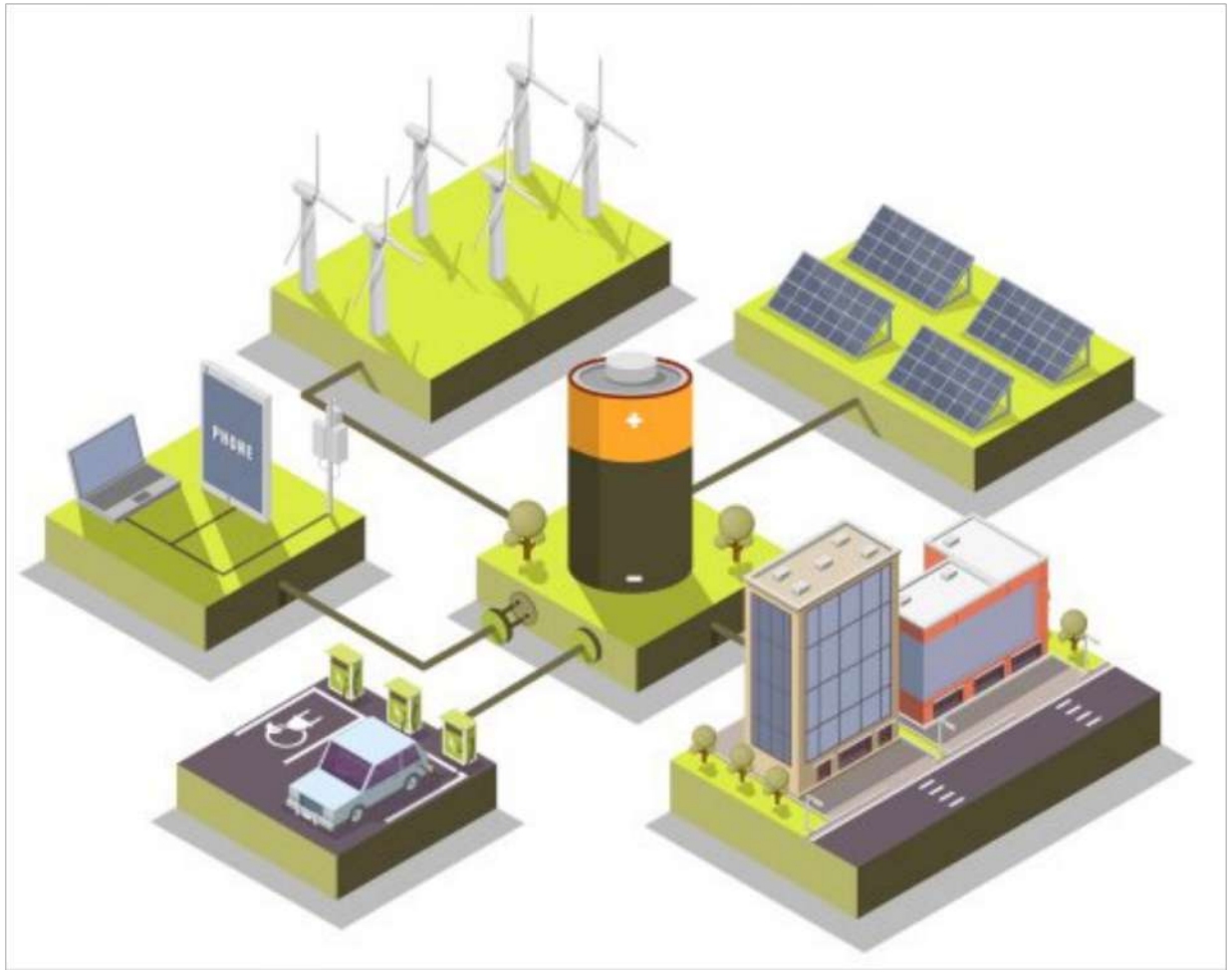
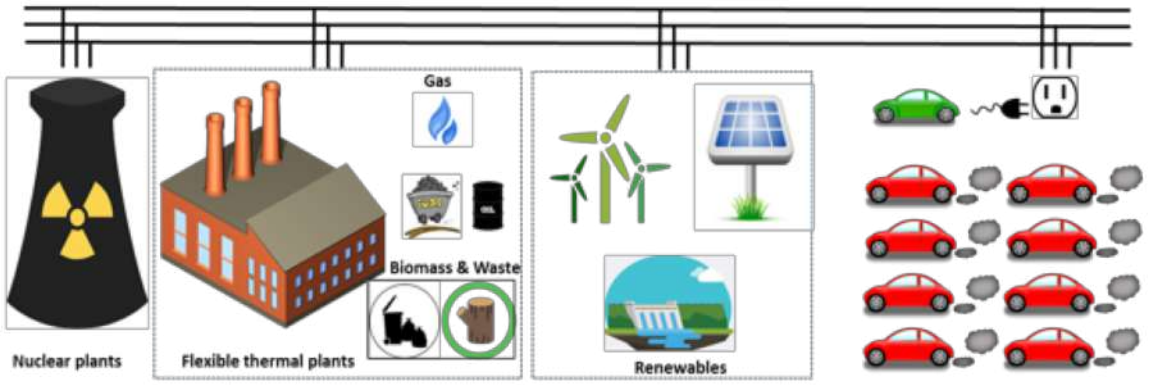


Energy Services With Electric Vehicles

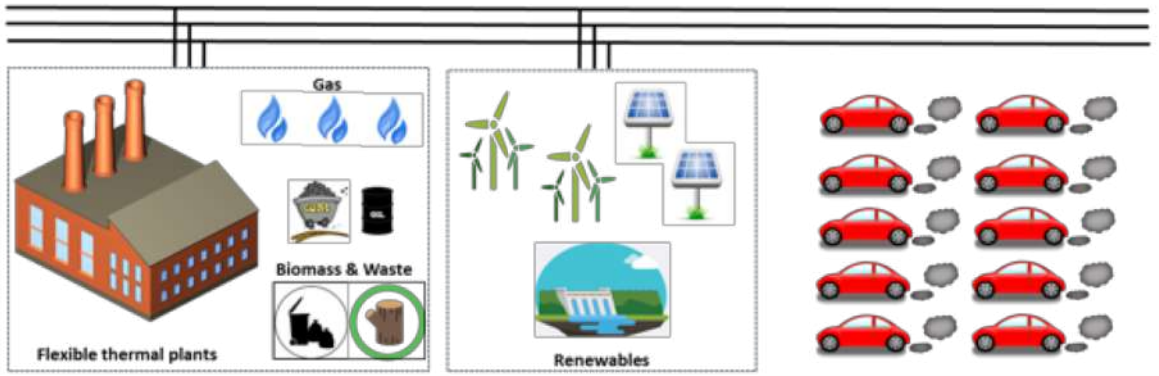
(A) Historic Scenario 2015



Electricity System:
Base 2015 => Total capacity = 19,4 GW ; Demand = 81,5 TWh;

Transport:
Total fleet = 5,6 M; EV Share = 1,7 % (incl. HEV)

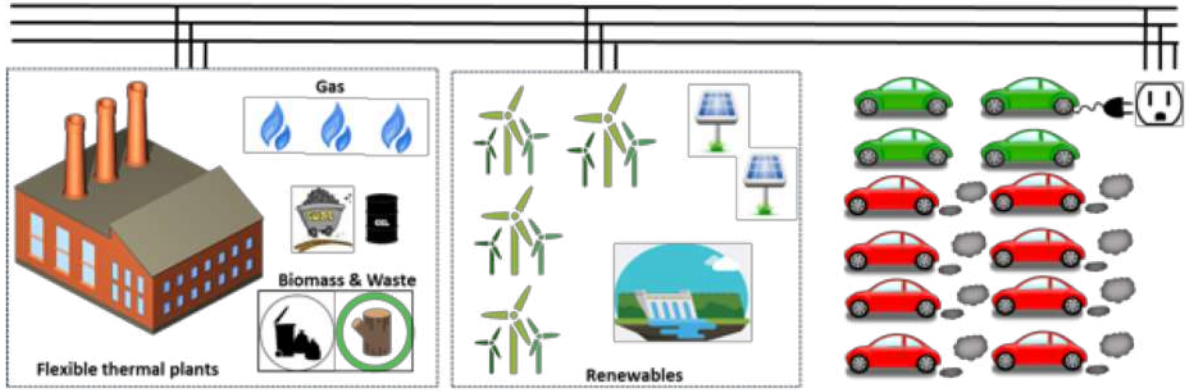
(B) Future Scenarios 2030 – Adapted from EU reference Scenarios 2016



Electricity System:
Ref2030 => Total capacity = 22,3 GW ; Demand - 98 TWh,

Transport:
Ref2030 => Total fleet = 6,4 M;

(C) Alternate scenario 2030 – High wind and EVs

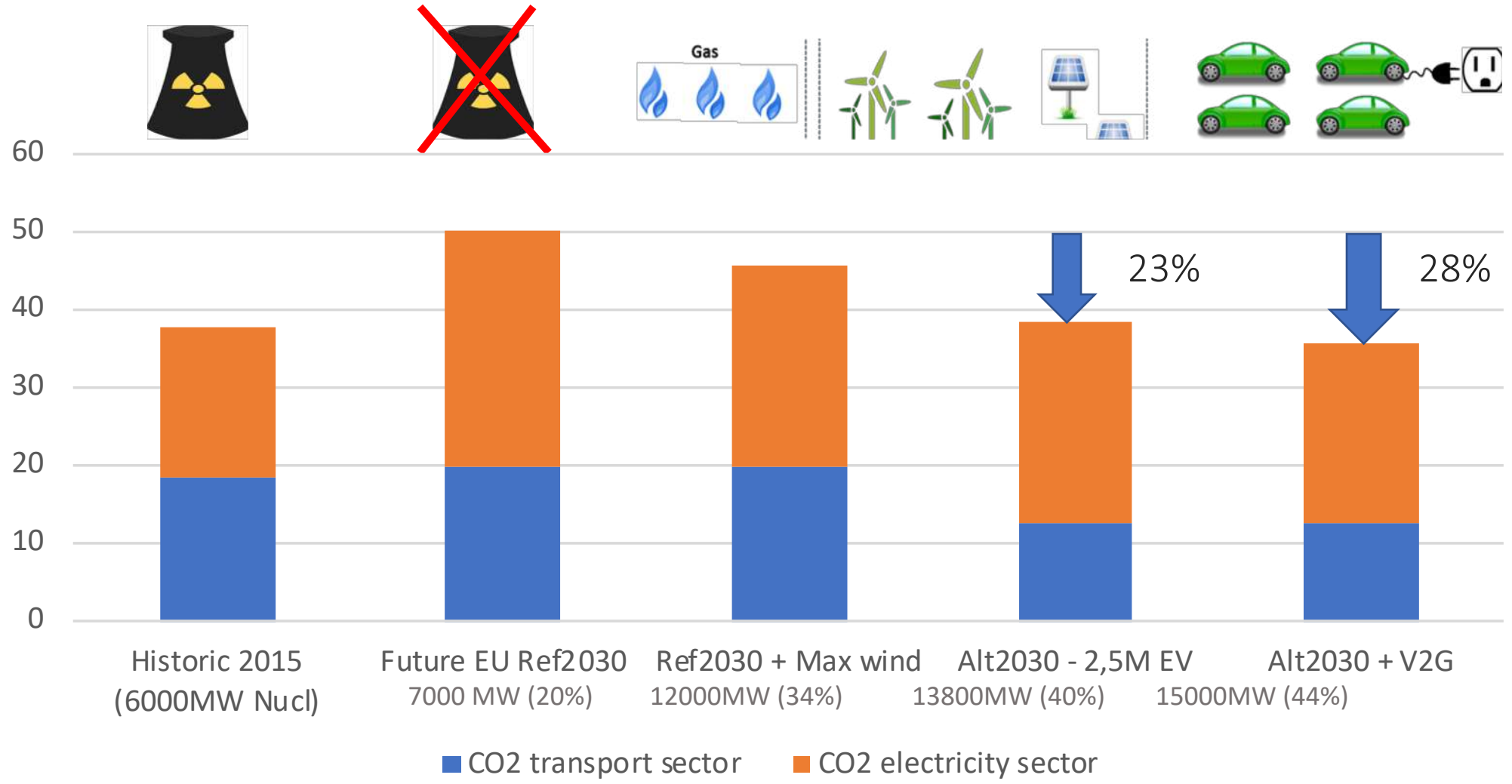


Electricity System:
Alt2030 => Wind capacity = 125% ... 300%

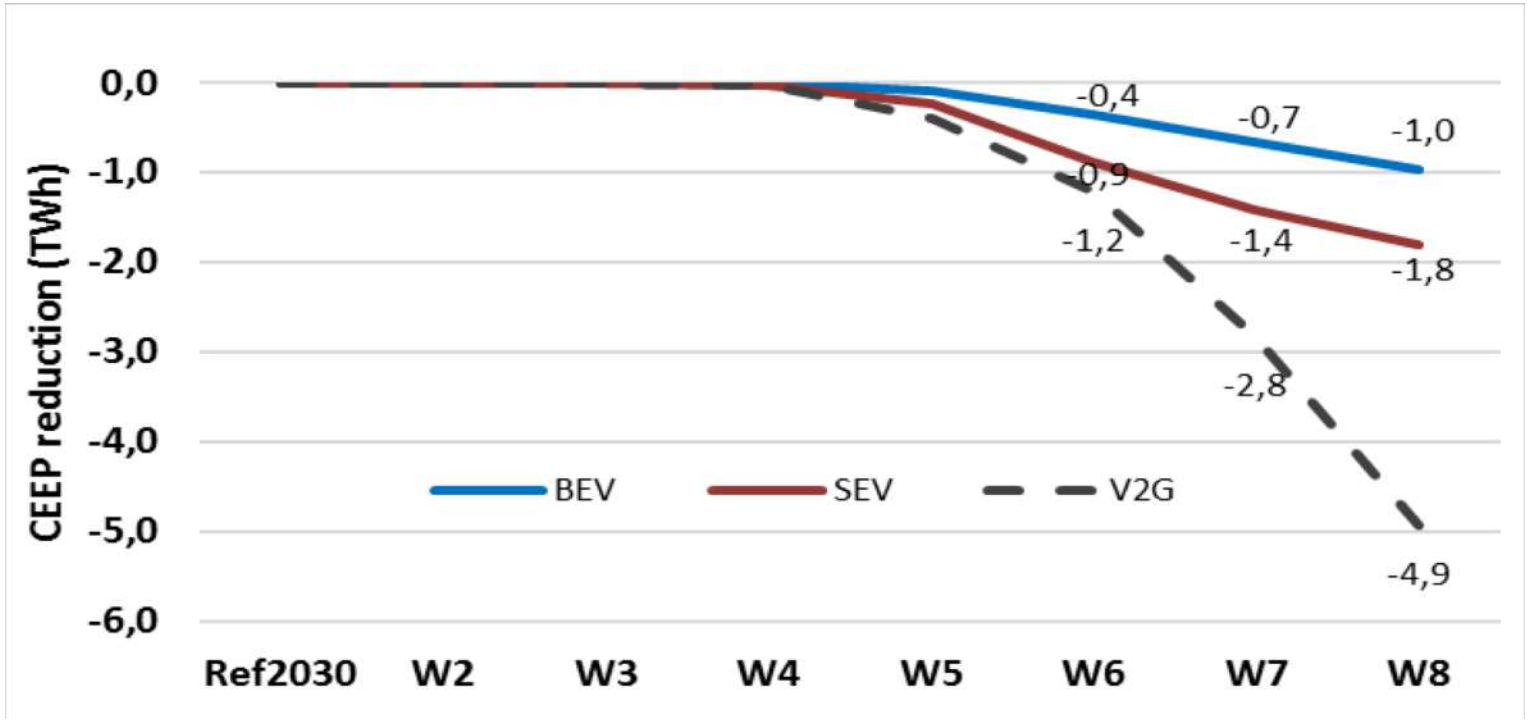
Transport:
Alt2030 => BEV replaces 2,5 M ICEs in ref scenario

- Three charging strategies
  - Night charge
  - Smart charge
  - V2G

Total CO_2 emissions of Transport and Electricity sector (Mt)



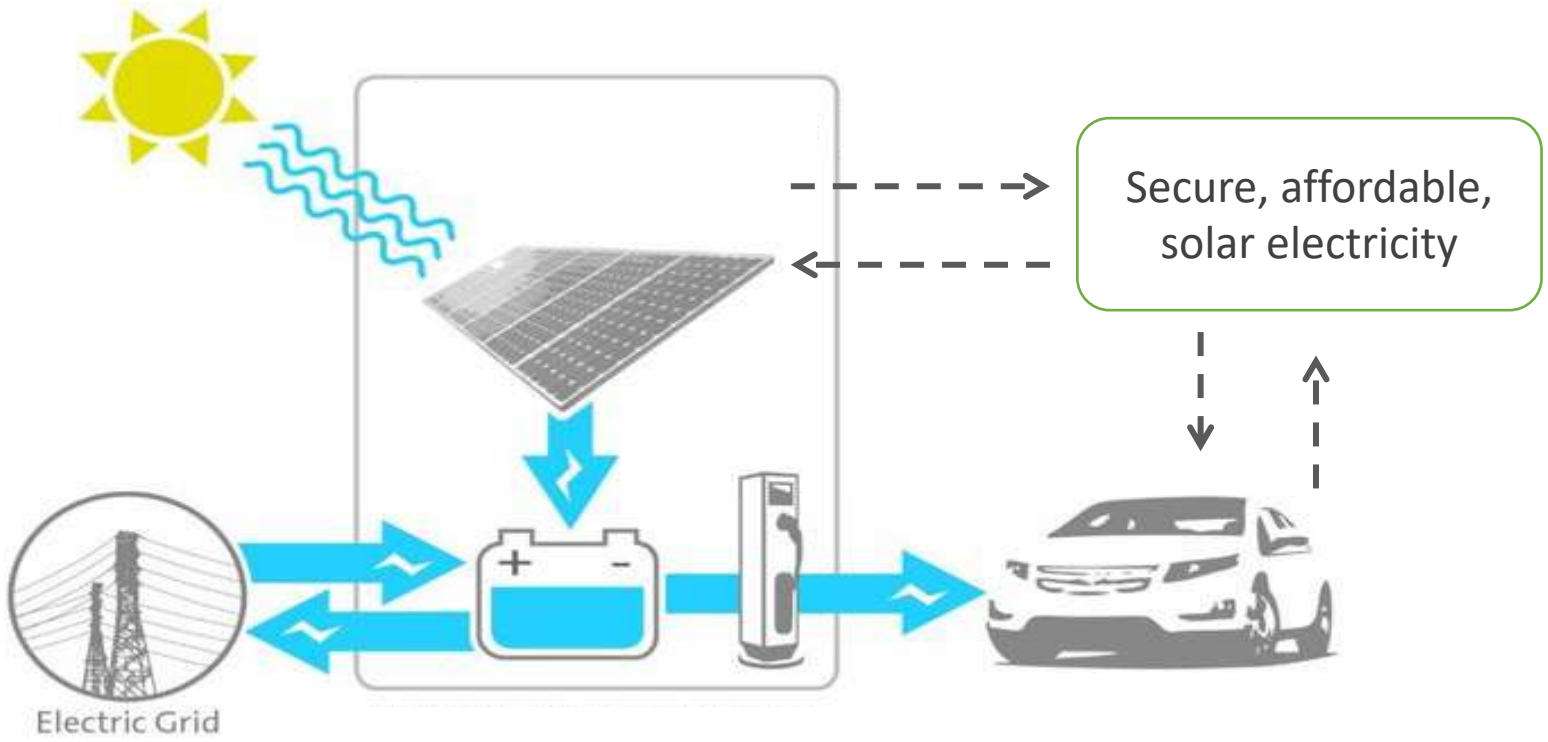
Reduction of Excess Wind Energy with Different EV Scenarios



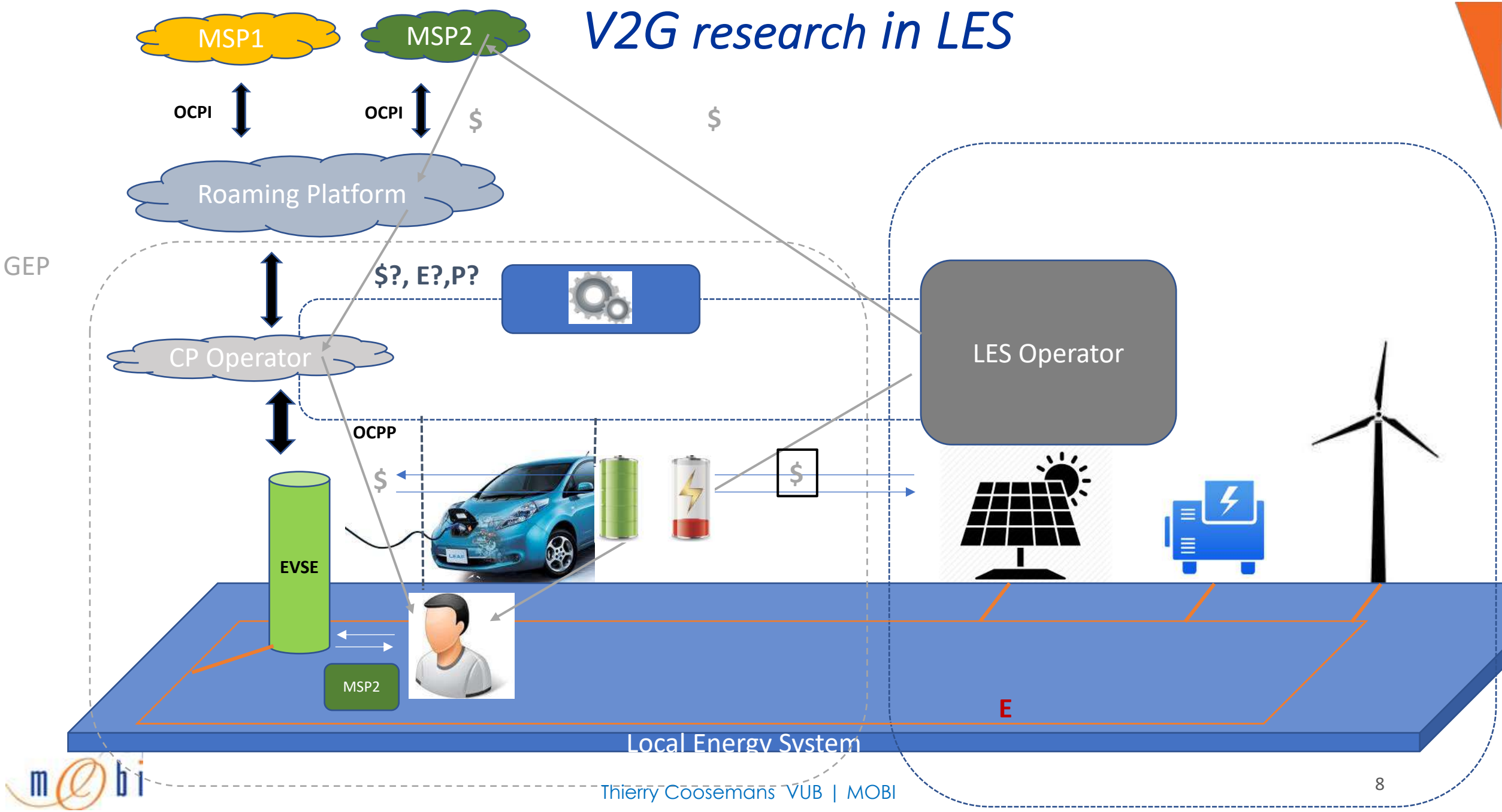
ICEs - 6.4 M ICEs
BEV – 2.5 M BEVs with night charging
SEV - 2.5 MBEVs with smart charging
V2G - 2.5 MBEVs with V2G charging

Critical excess energy (CEEP) – hourly excess production that could not be used or exported, which will be cut-off from the system

Optimization Opportunities for Local Energy Systems: Fast and Green Electrons for EV



V2G research in LES



V2G research in LES

• Challenges

-How to integrate **e-mobility** (light electric vehicles, passenger cars, trucks, busses and automated vehicle) local energy system management?

-How to **forecast** the demand-supply of electric vehicles?

-How to develop **charger technology** with **intelligent control** and **efficient communication** into a local energy system?

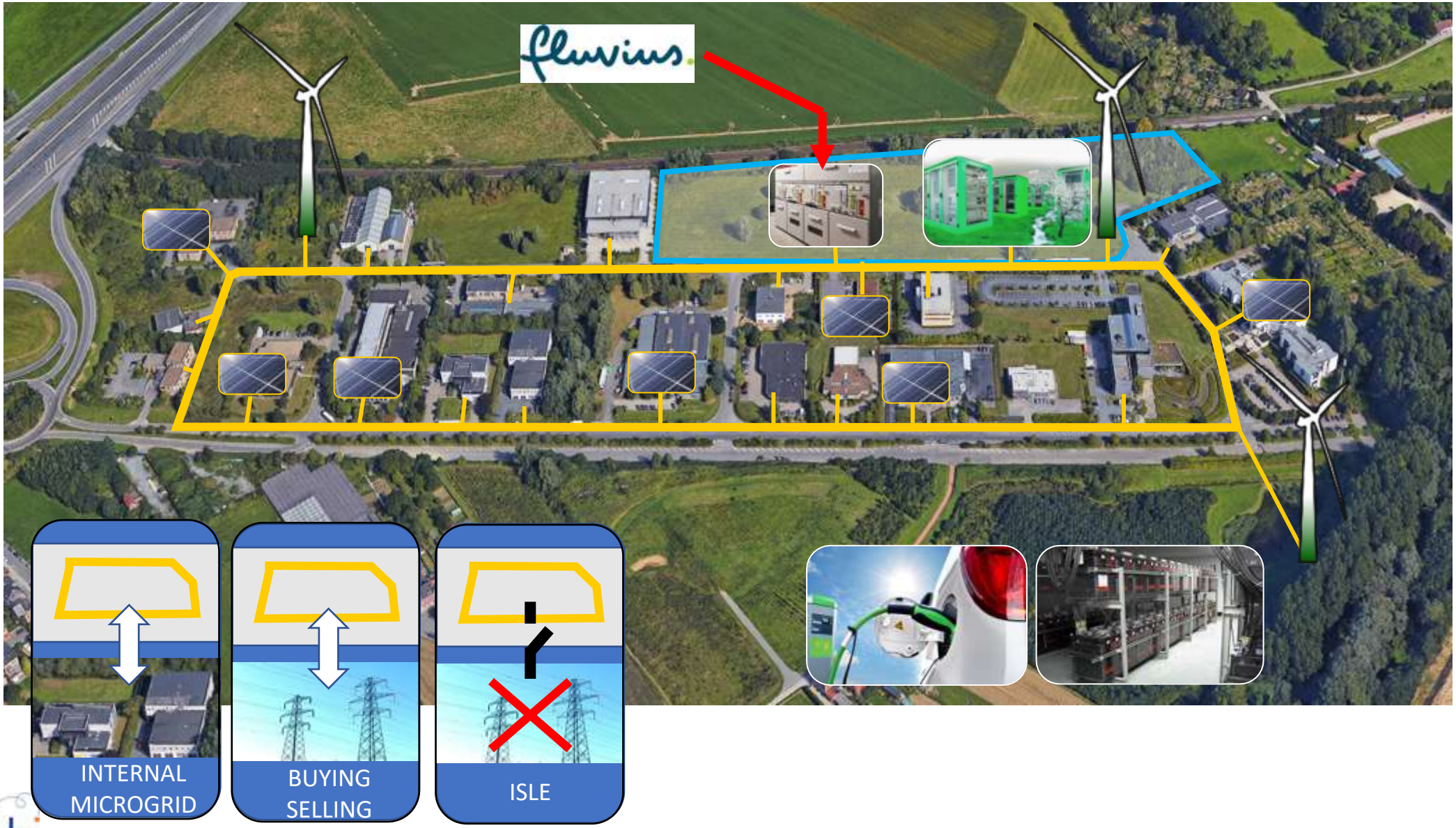
-How to **create profitable business cases** for al stakeholders, maintaining interoperability ?

-How should **regulations be adapted to** consider the implementation of safe, viable and secure V2G products and services?

Concrete Objectives

- **E-mobility integration in local energy systems** with maximal decarbonization through:
  - AC and DC smart and bi-directional charger development
  - Development of communication between local energy system and charge point operator
  - Development of intelligent algorithms for charge scheduling,
  - LES design tool and business models for smart-and bi-directional charging
  - Install fully interoperable and integrated V2G system for the customers
  - Recommend legal framework for roll out and operation

Local Energy Systems and V2G: Test Bed



Local Energy Systems and V2G: Test Bed

21 buildings
72 companies

ELECTRIC GRID

THERMAL GRID

Energy-Sustainability-Innovation-Research–Development-Large scale living lab/Multi disciplines-Contribution to Smart Energy Region

CO-2 NEUTRAL MICROGRID

BATTERY TO GRID

VEHICLE TO GRID

THERMAL GRID

GREEN DATACENTER

EXPERIMENTAL SURGERY ROOM

Key figures

- **50% Off Grid**
- **CO2 neutral**
- **Researchpark Zellik**
- 72 Companies
- 35.000m² building surface
- 2 km road
- Parking 400 vehicles
- **On-site production**
- 4 MW solar
- 9 MW Wind
- 2,5MW Generators
- 500 kW Cogeneration

- **Electric grid:**
- 20MW connection
- 3 km electric grid, including partial DC
- 100 charging stations

- **Thermal grid**
- 2 km
- 22 buildings
- Up to 4MW

- **Energy storage**
- 1,5MWh batteries
- 1MWh Borehole Thermal Energy Storage (BTES)


Station Zellik


Zellik
1,5km
1km

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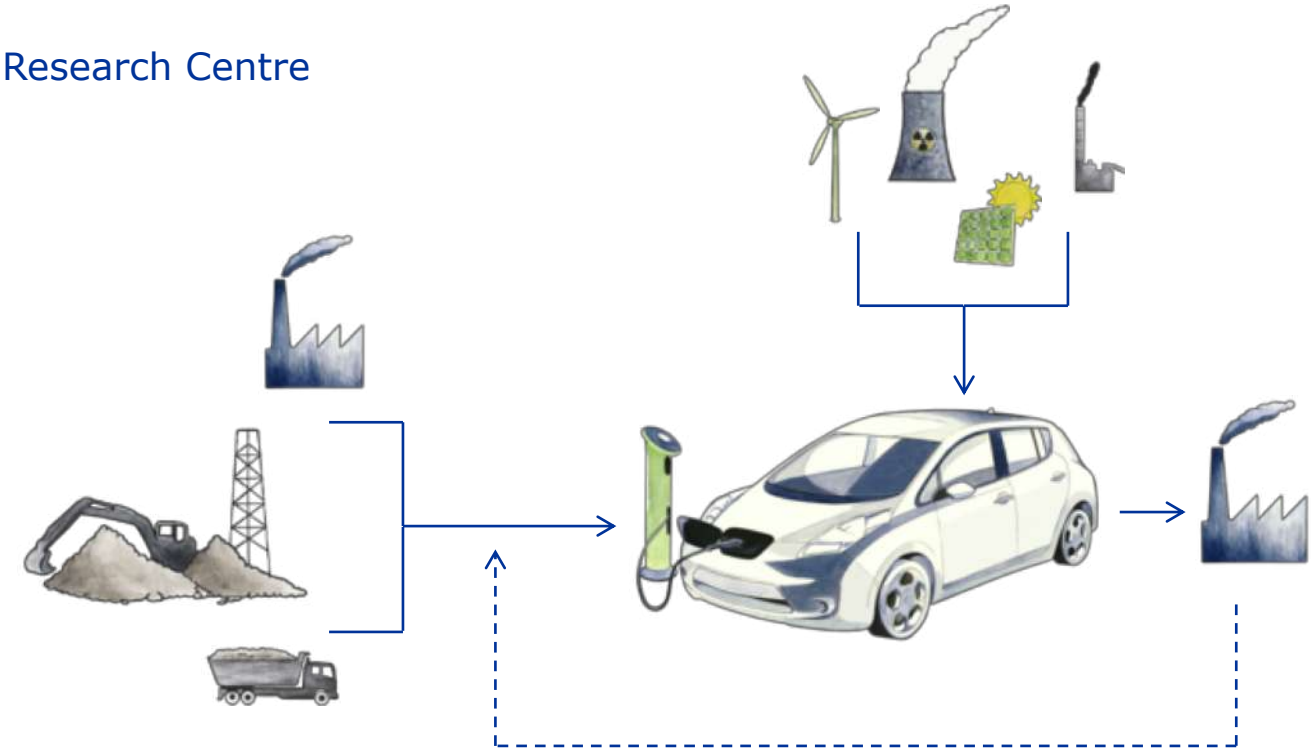

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