



TaRDIS

ENERGY USE CASE **Multi-level smart charging &** **Grid Balancing (EDP)**

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Multi-level smart charging & Grid Balancing



Energy Concept

The Baseline for Grid energy has two inconveniences:

- expensive energy cost for customer
- carbon intensive sourced.

Solution (I):

Build Energy Communities

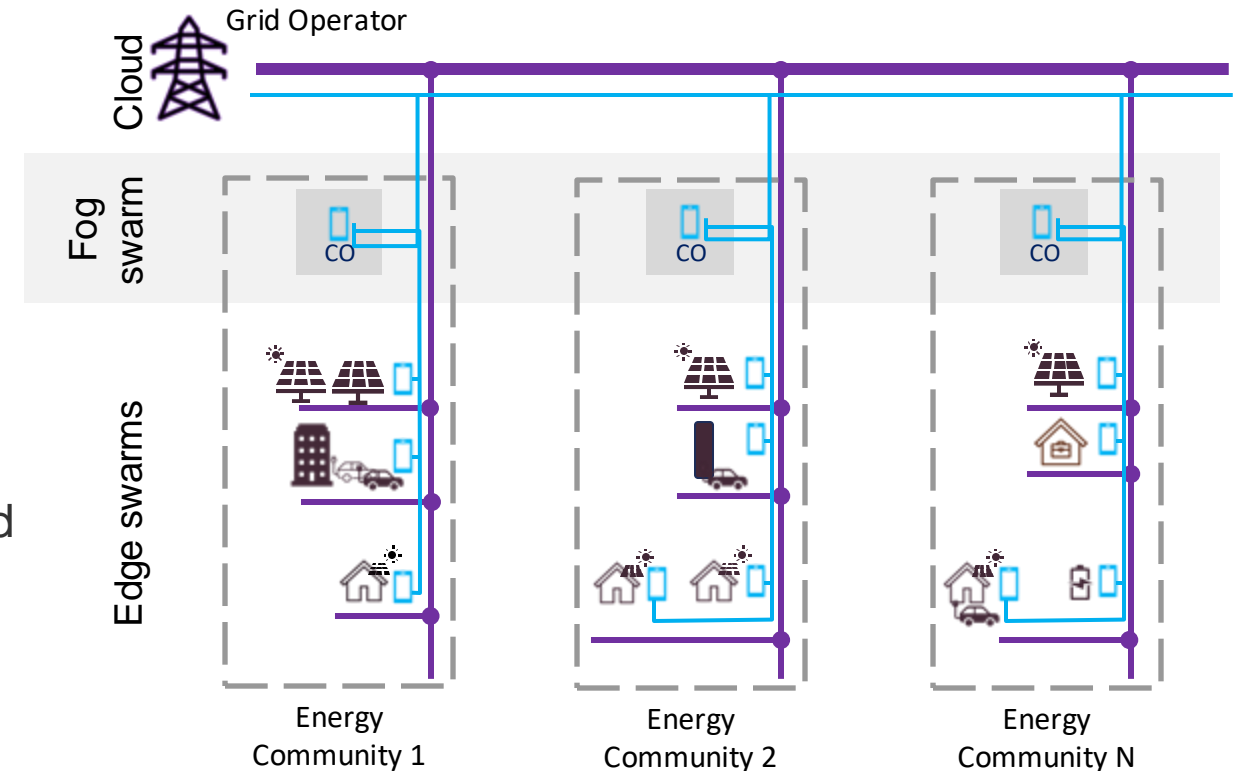
- Cheaper Energy since is coming from neighbour Renewables through micro-grids
- Almost carbon neutral
- Still can use main grid as backup

Inconveniences:

- Need a Community Orchestrator (CO) to managed deficit or surplus of energy and faults
- It Is complicated for the CO to manage all the members in the community

Solution (II):

Handle the peers in the Energy Community as a heterogeneous swarm and let them talk!



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What does the swarm need to work?

- **Forecast** each peer energy consumption and production:

Fedra, a tool that enables the decentralized federated learning of ML models that are deployed locally on several edge devices (NKUA).

- **Enable reliable communication** support:

Babel, Java framework designed for developing distributed protocols, serving as the communication backbone (NOVA)

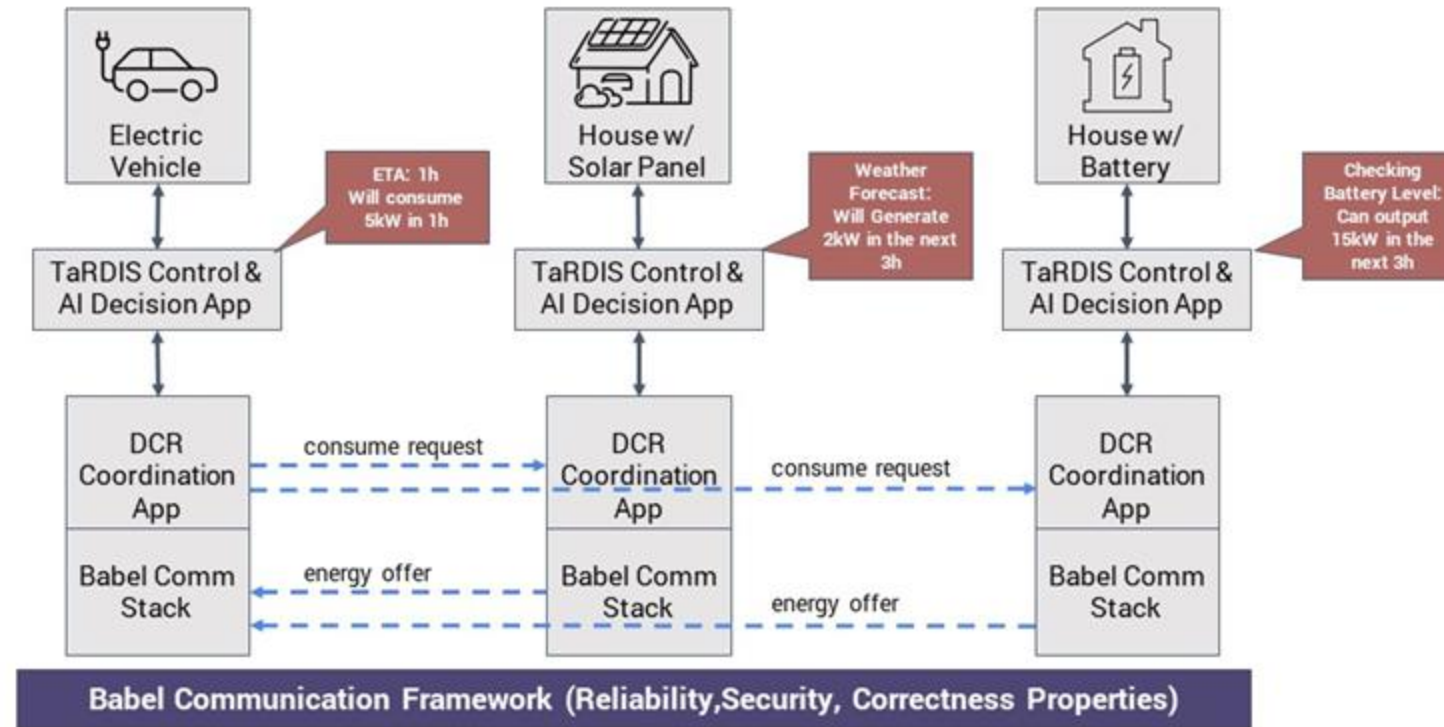
- **Assure security** within agreements:

IFChannel, an information flow analysis checks that secret data does not “flow” into less secret sources (DTU).

- **Swarm easily programmed**:

DCR choreographies, an event-based programming model (NOVA).

- **Fail safe!**



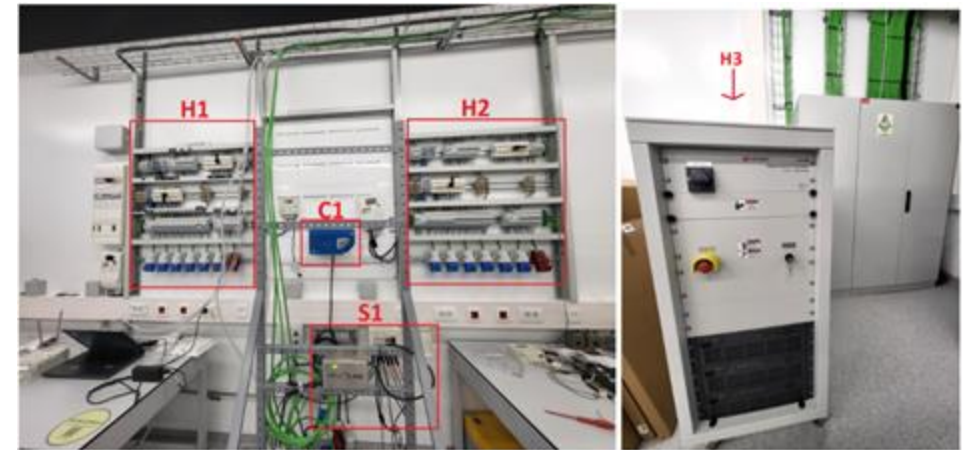
All of this is fulfilled by the TaRDIS toolbox!

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Impacts and benefits

- Energy use within the community could **reduce** by **>30%** electricity coming from **carbon intensive sources** through the grid.
- The application of swarms to Energy communities' management might **reduce faults by >60%**
- **The Customers are empowered** to choose the best trading option : self-consumption, buy from grid vs from neighbour, discharge EV to home...
- **The Retailer/Aggregator** is in fact the **CO** the advantages are:
 - 1- Moving its business from **HW** (home devices monitoring) to **SW** (overlay network management)– better margin and reducing asset management risk;
 - 2- **Trading** (risk) is moved to the final user;
 - 3- Ability to engage the storage elements, namely EVs, into **grid service** in a transparent way for customers.
- **The Grid Operators** will be able to improve QoS due to faster response of swarm agents at Fog level and better visibility about the resources available for grid service.



Use case testbed @ EDP LABELEEC Smartlab



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THANKS



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