SUSTAINABLE PLACES 2024

24 September 2024

Luxembourg

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY LIST

R2M SOLUTION

Energy communities

WORKSHOP

📅 **Date: Sept 24, 2024**

⏰ **Time: 14:00 – 15:30**

Energy Communities for Smart Energy Transition:
The examples of HESTIA, ACCEPT & SENDER

Hestia   SENDER   accept – active communities & energy prosumers for the energy transition

www.sustainableplaces.eu

Agenda

10 min	Workshop opening
10 min	The example of Hestia
10 min	The example of ACCEPT
10 min	The example of SENDER
40 min	Round table discussion, Q&A
10 min	Closing remarks

Energy Communities

... enable collective and citizen-driven energy actions to support the clean energy transition.

REPowerEU Plan – **objective**: 1 energy community per municipality with population > 10,000 by 2025.

EU Legislation

> **2019 – Clean energy for all Europeans package**: EU introduction to the concept of energy communities in its legislation

> **2023 – Amending Renewable Energy Directive**: energy communities in offshore wind and district heating and cooling networks; cooperation with local authorities through public procurement

> **2023 – Recast Energy Efficiency Directive**: potential of energy communities to develop renewable energy-based heating projects

> **2024 – Recast Energy Performance Directive**:
> requires: building renovation plans to report on the role of energy communities;
> recognises: renewable energy produced by an energy community as possible energy source for zero-emission buildings;
> requires: EU countries to put measures in place to ensure adequate information and training for all relevant market actors including energy communities.

source: https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumers-and-prosumers/energy-communities_en.

Our speakers

Andrea Martinez

SINLOC Sistema Iniziative Locali

Hestia

Antonis Papanikolaou

Hypertech

accept active communities & energy prosumers for the energy transition

Siward Zomer

energie samen

accept active communities & energy prosumers for the energy transition

Christian Kunze

SMART INNOVATION NORWAY

SENDER

Riccardo Toffanin

AEM

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Energy Communities for Smart Energy Transition:

The example of Hestia

Andrea Martinez

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Hestia

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Hestia

Main facts/context

- Project budget – EU funding
  € 7.514.042 - € 5.995.690
- Duration
  2020 – 2024 (47 months)
- Consortium
  19 partners from 9 countries
- Pilot use cases
  3 pilots in 3 countries

Hestia

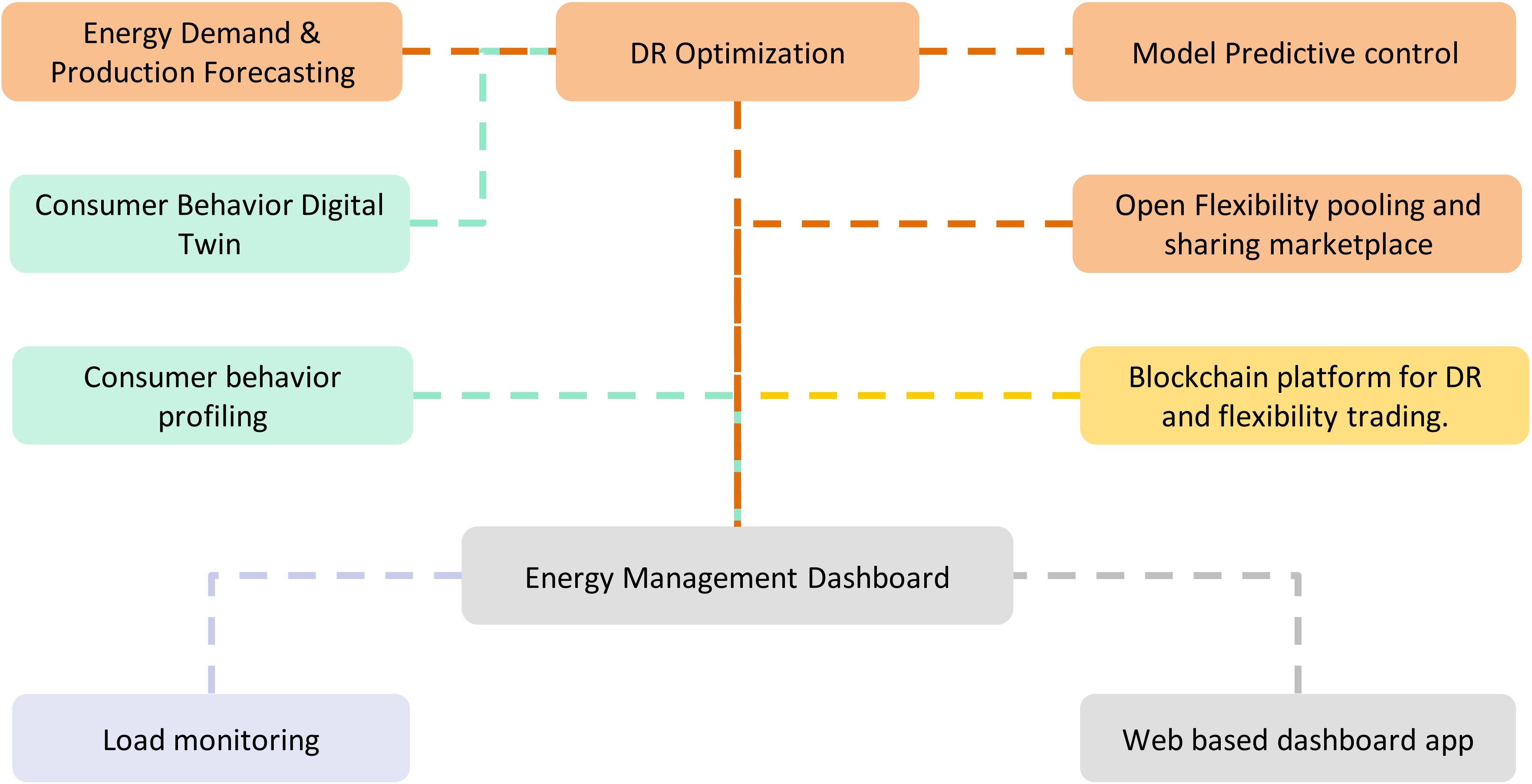
Key figures

- 15 DR-integrated services
- HESTIA IT platform
- 75 Households engaged
- 51 PV plants monitored
- 51 Private storage systems managed for load shifting
- 1 Shared storage system managed for load shifting
- 20+ Workshops and events
- 10+ Scientific papers

Hestia

DR integrated services

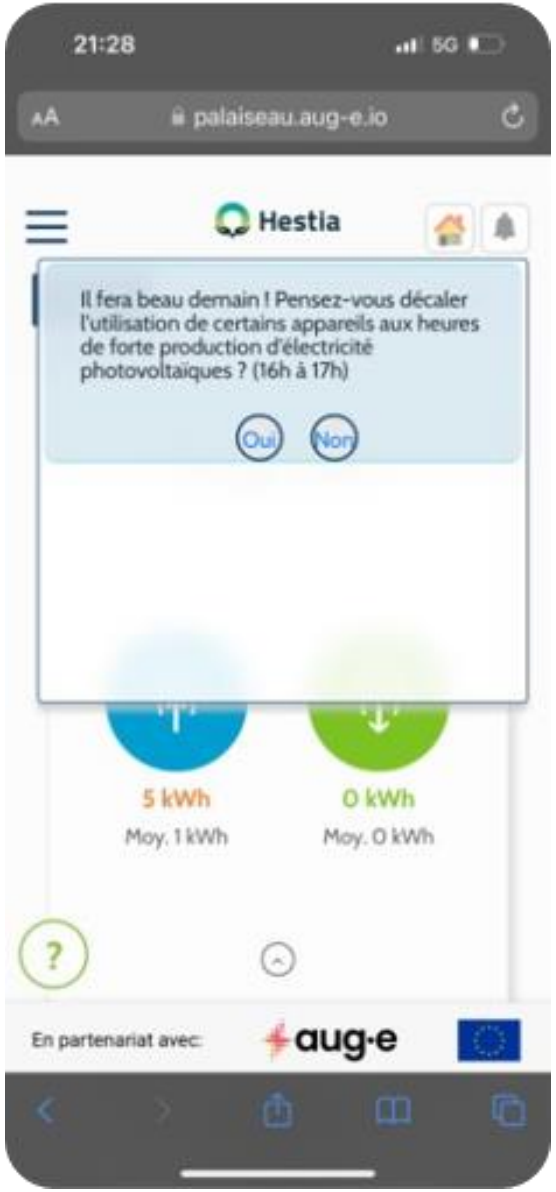
System of 15+ sub-services that enable predictive energy management



Hestia

HESTIA end users platform

- End users interact with the platform via a web-based mobile app
- Within the application, users receive personalized messages generated by the optimizer
- The messages suggest the best energy DR-related actions to take for each case
- The messages are personalized based on the individual user’s characteristics and habits



Hestia

Piloting DR in 3 use cases

	Personalized Messages	Private batteries control	Shared battery control
Italian Pilot • Maximize PV energy use and optimize storage to increase flexibility • Enable community trading and collective use of surplus PV	✓	✓	
Dutch Pilot • Shift electricity load and control batteries to improve self-consumption • Provide market flexibility through coordinated control of both household and community batteries	✓	✓	✓
French Pilot • Shift electricity load to prevent grid congestion • Utilize communication with households to shift load	✓		

Hestia

Users engagement

- The main objective was to **change people energy consumption habits** to reshape residential load profile and maximize renewable energy self consumption
- **Different engagement approaches** were experienced: in person workshops, social media communications, WhatsApp interactions, in App messages, gamification mechanisms
- **COVID-19** scenario forced to start engagement without proper in-person meetings in the first period decreasing engagement effectiveness
- It has been proven difficult to achieve DR actions only through technical interaction, **human-centered engagement strategies** must be an integrated part of the process of the smart energy transition

Synergies with other EU initiatives

Workshops with Sister Projects SENDER, ACCEPT, ReDream and iFLEX, and other related initiatives as Creators, Lightness, and LocalRES.

Active participation to the **BRIDGE initiative**, joining all working groups

Similar barriers are experienced by the initiatives tackling the energy flexibility topic at the following level:

- ❖ **Technology level**

  Lack of standardized communication protocols across service providers pose integration challenges

- ❖ **Market level**

  Inconsistent regulations across EU countries restrict cross-border collaboration and limit scalability of energy flexibility solutions

- ❖ **Users' engagement level**

  Continuous user involvement is required due to the absence of IoT-native devices that can be remotely controlled

HESTIA results' overview

DR services

- Validation demonstrated that households regularly accessing the HESTIA platform reduced their electricity grid consumption by 15%
- The main barrier to demonstrating cost and energy reduction is the quality and consistency of data streams collected from multiple devices

User engagement

- Limited cohort size and difficulty in maintaining participants engaged over a long period
- Digital divide required different approaches
- Gamification proved to be not successful

HESTIA integrated solution (DR services providing customized inputs to consumers)

While single DR services proved to be at least partly effective in increasing the users' electricity consumption habits, the HESTIA platform business model is non-viable, mainly due to:

- the flexibility market is not yet open to residential users in many EU countries
- the integrated solution relies on a complex service structure that is not fully marketable at the time being

Hestia

HESTIA takeaways

Economic Driver

The primary motivation for households to engage in energy flexibility mechanisms is economic, whether through **additional compensation or savings on energy bills**.

Motivational Driver

Environmental awareness and a sense of community serve as strong motivational factors.

Establishing a community project with initial incentives is key to fostering participation, but **long-term engagement depends on a regulatory framework that benefits the broader community**, not just individuals.

Technical Driver

Aggregators play a pivotal role in optimizing the value generated at the local level, acting as facilitators.

It is essential to **maintain the value chain by redistributing profits or reinvesting them in mutually agreed-upon social initiatives**.

Hestia

www.hestia-eu.com

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Energy Communities for Smart Energy Transition:

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ACCEPT demonstrations

Objectives	• Energy community self-sufficiency • DR execution & assessment • Citizen engagement & empowerment to become active players in energy market • Identification of innovative business models based on optimized operation of supply/demand assets
Testing period	12 Months (since October 2023)
UCs demonstrated	• 8/11 UCs demonstrated in real life conditions • 3/11 UCs simulated based on real-life data
Involved pilots	• Greece – 42 households • Spain – 36 households • Netherlands – 38 households • Switzerland – 33 households, 1 EV charger, 1 District Heating

ACCEPT testing activities

Control automation at Household level

Use cases:

Building level

- Virtual energy storage optimization
- Consumer demand-side flexibility forecasting
- Facilitation of Explicit Demand Response schemes

Community level

- Increase self-consumption at local level

Controlled electric loads:

- AC split units
- Electric water heaters

Households involved: 18

Testing period: Winter ’23-’24 - Early Fall ‘24 (still ongoing)

ACCEPT testing activities

Control Automation at Building level

Use cases involved:
- Facilitation of Explicit Demand Response schemes

Controlled electric loads:
- Building Heat-pump
- **Testing period:** March-April ‘24

District Heating control

Use cases involved:
- Optimal scheduling and operation of heating generation

Controlled electric loads:
- District heating heat pump
- **Testing period:** November-December ‘24

EV charging station control

Use cases involved:
- Day-ahead smart charging flexibility quantification

Controlled electric loads:
- 1 charging station & 1 electric vehicle
- **Testing period:** March ’24

ACCEPT testing activities

Simulated scenarios scenarios with real-life data

Use cases involved:

- Demand elasticity profiling/ forecasting/ aggregation
- Retailer day-ahead optimal pricing configuration
- Community-level P2P flexibility

Testing period: 2023-2024 (Data collection from all pilot sites)

Households involved: >25

ACCEPT Impact

Community Members

Cost savings proven through real-life testing of the ACCEPT solution in cost optimization scenarios

Min Cost savings: 2,1 %
Max Cost savings: 15%
Average Cost savings: 5,9%

Min self-consumption increase:
Max self-consumption increase:
Average self-consumption increase:

Under assessment

Easy smart living through control automation & indoor conditions monitoring (increase of comfort and convenience) using the ACCEPT citizen app

Control automation improving life quality: 78 %
Willingness to pay up front for such a system: 72%
Willing to use the solution frequently: 50%

ACCEPT Impact

Energy Communities

Increased untapped community flexibility supported by real-life testing of the ACCEPT solution

Min potential flexibility: 6%
Max potential flexibility : 73%
Average potential flexibility : 17,4%

Min activated flexibility: 3,5%
Max activated flexibility: 31%
Average activated flexibility: 9,3%

On average 58% of the forecasted flexibility was activated per consumer.

Recognition of new business opportunities & revenue streams through successful case studies of innovative DR strategies on community resources – Heat pumps, district heating, EV chargers

Increased awareness of the pivotal role of Energy Communities in the energy transition and wide perspective through the successful cooperation with EU partners

Strengthening of community collaboration and citizen interest through the ACCEPT activities

Beyond ACCEPT

"The Urban Community"

Murcia, Spain

*Participation in **HEU-DECODIT** seeking to create an energy services charter based on cross-sectorial data.*

- ACCEPT users from Spain to participate in DECODIT.
- Use of ACCEPT tools: **C-App** to be maintained and further developed.
- Partners involved: La Solar, MIW, QUE & AEM.

ECs being highly fostered in Spain. La Solar & MIW participate separately in the development of new RECs.

- RECs in need of solution to facilitate management and sustainability – Identified possibility to exploit ACCEPT tools in the new ECs developed, applying flexibility and digital solution.

"The Residential Suburb"

Capriasca, Switzerland

Strengthen energy communities by developing new business models that align with evolving regulations, including virtual communities.

Enhance demand-response strategies based on project outcomes for improved energy efficiency and grid stability.

Beyond ACCEPT

"The Smart Village"
Aspra Spitia, Greece

CHRONICLE

*Participation in **HEU-CHRONICLE** which will leverage the smart installations (software/hardware).*

- ACCEPT users from Greece to participate in CHRONICLE.

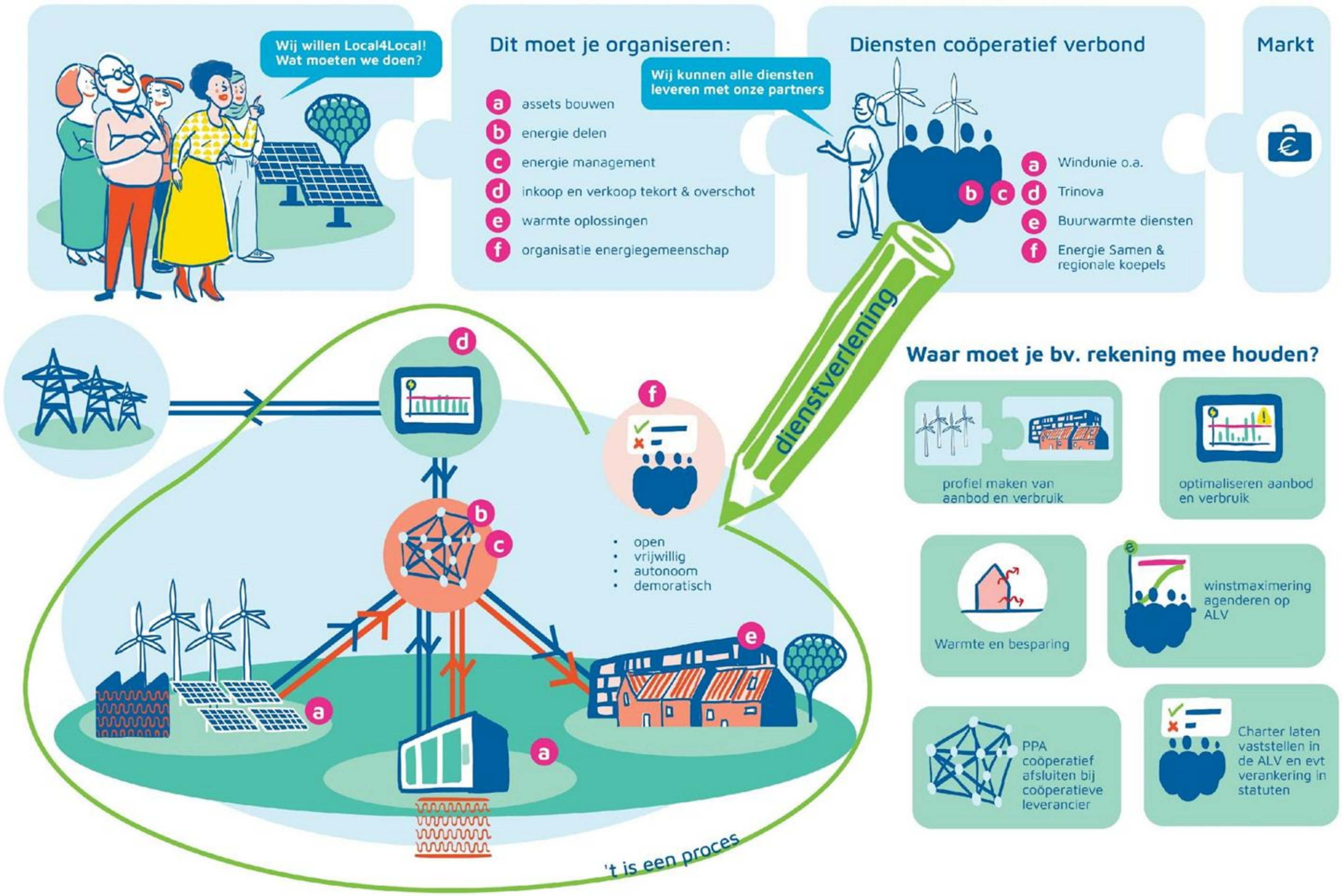
Possibility to exploit ACCEPT innovative solutions to create new products and services for PROTERGIA's, the Power and Natural Gas Business Unit of Mytilineos, business portfolio

"Smart City Project" Introduce Mytilineos' occupants of Aspra Spitia into a smarter way of living through ideas that are driven from circular economy models and innovative tools developed in ACCEPT.

Beyond ACCEPT

"The Ecological Neighbourhood"
Culemborg, Netherlands

Organise new markets!



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957781.

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Energy Communities for Smart Energy Transition:

The example of SENDER

Christian Kunze

SMART INNOVATION NORWAY

SENDER

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SENDER Concept & Objectives

As the EU moves towards sustainable energy, co-creation processes are the future for the design of energy service markets, turning customers into a new generation of collaborators and putting them at the heart of the energy sector.

SENDER will develop energy service applications for demand response (DR), home automation, convenience, and security mechanisms.

Consumer data will be collected and processed to identify typical consumption patterns, mirror them by digital twins (DTs) based on artificial intelligence technologies and aggregate the DTs' supply/demand characteristics. Therefore, the project will shift DR from a reactive to a proactive approach.

Statistical Data and Involved Partners

From 2020
To 2024

Project total cost	EU contribution	Website
6,759 M€	5,837 M€	www.sender-h2020.eu

Technologies and services deployed

Technologies for consumers	✓ Demand response ✓ Smart appliance ✓ Smart home
Grid technologies	✓ Micro-grid management and control tools ✓ Digital twins
Large-scale storage technologies	
Distributed storage technologies	✓ EVs ✓ Thermal Storage
Generation technologies	✓ PV
Market	✓ Electricity market ✓ Ancillary services

Project partners' countries

SENDER Demonstration Sites

Alginet, Spain	Weiz, Austria	Espoo/Tampere, Finland
Alginet Distribucion Energia Electrica Sociedad Limitada	Weizer Energy and Innovation Centre	VTT Technical Research Centre of Finland
Approx. 100 engaged households	Approx. 200 engaged households	Approx. 100 engaged households
• PV for self-consumption • HVAC system • Electric boiler	• PV for self-consumption • HVAC system • Electric boiler	• PV for self-consumption • HVAC system • Electric boiler • EV charging

SENDER Use Cases

UC 1: Explicit residential demand response

UC 2: Maximizing the use of RES

UC 3: Minimizing the electricity bill

UC 4: Remote monitoring and control of home devices

UC 5: Peer-to-peer trading

Legal / Regulatory Feasibility of SENDER Use Cases

Use Case	AUT	FIN	ESP
UC 1: Residential Explicit Demand Response			
UC 2: Maximise the use of Renewable Energy Sources			
UC 3: Minimise the electricity bill			
UC 4: Remote monitoring and control of household devices			
UC 5: Peer-to-peer trading			

SENDER Energy Community Core Objectives

Two regulatory documents for new/adapted legal frameworks submitted

Ten different types of stakeholders integrated in the co-creation activities

400 households on three demo sites involved

Ten percent relative improvement in load forecast errors

Five initiatives in synergy with other related EU projects

20% kWh of flexibility per household/year provided

SENDER Relevance for Energy Communities

1

Opportunity to better identify, exploit, and commercialize flexibility potential; take over the role of aggregators of their members´ assets.

2

Utilization of the benefits of dynamic pricing contracts.

3

Building and home automation allows for the integration of services to consumers and the creation of value by combining data and services across different sectors.

4

Fostering the potential to set-up local energy communities and cooperatives that put the consumer in its social context into the heart of the energy market – moving away from a mass market approach for anonymous users.

5

Customization of SENDER solutions to different types of energy communities during the exploitation phase due to its modular structure.

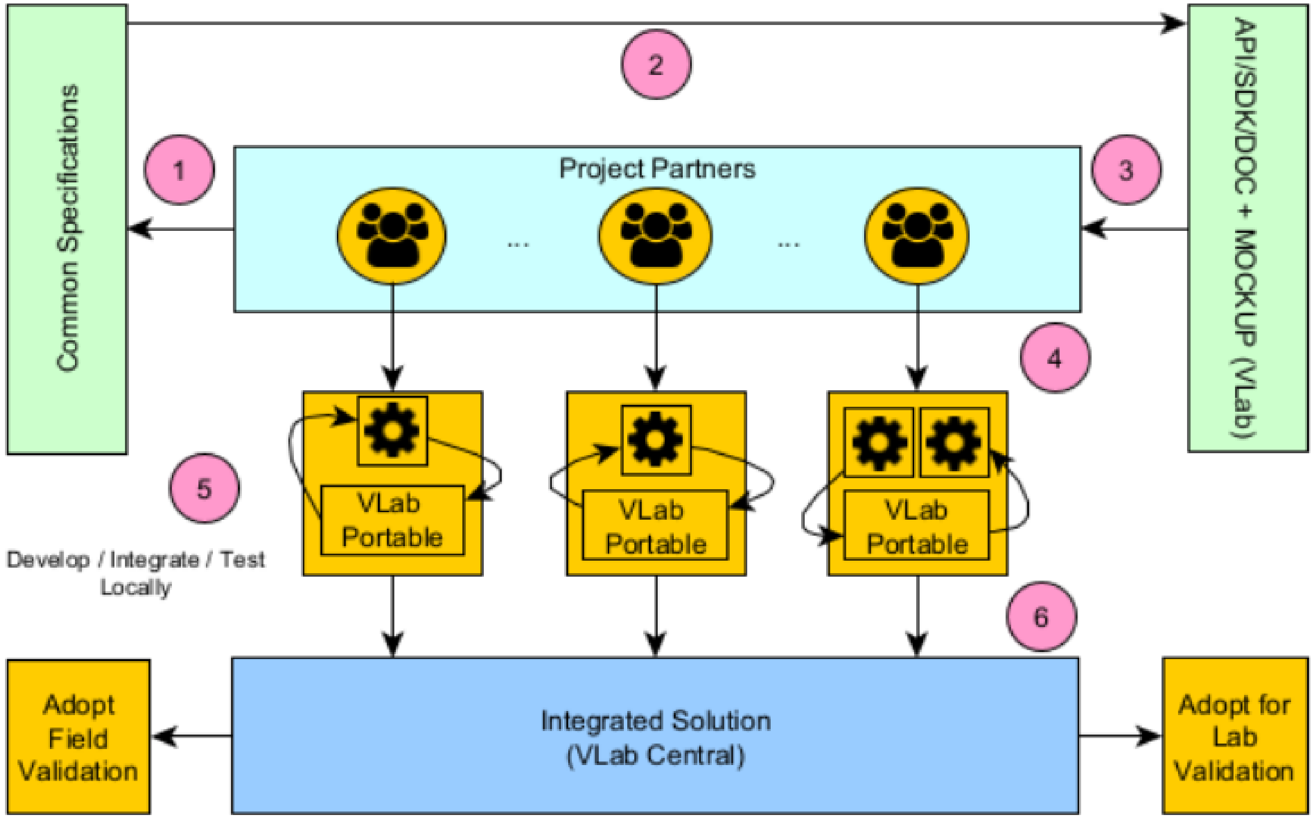
Selected Commercial Offerings for Energy Communities

Cleanwatts	Kiwigrid	Flecopower	Bamboo Energy	Electropionir
• Energy management for ECs • Energy optimization • Flexibility services via VPP • Handling of community settlements	• Energy management platform • Energy manager for smart homes • Services for aggregation and management of connected assets	• Direct marketing of RES • Aggregation of energy resources • Services to grid operators	• Market forecasts • Demand and flexibility forecasts • Bidding strategy for different energy markets • Access to intraday markets via real-time management	• Cooperative empowering of citizens • Pooling of investments for community owned solar plants

Recurring Commercial Offerings Covered by SENDER

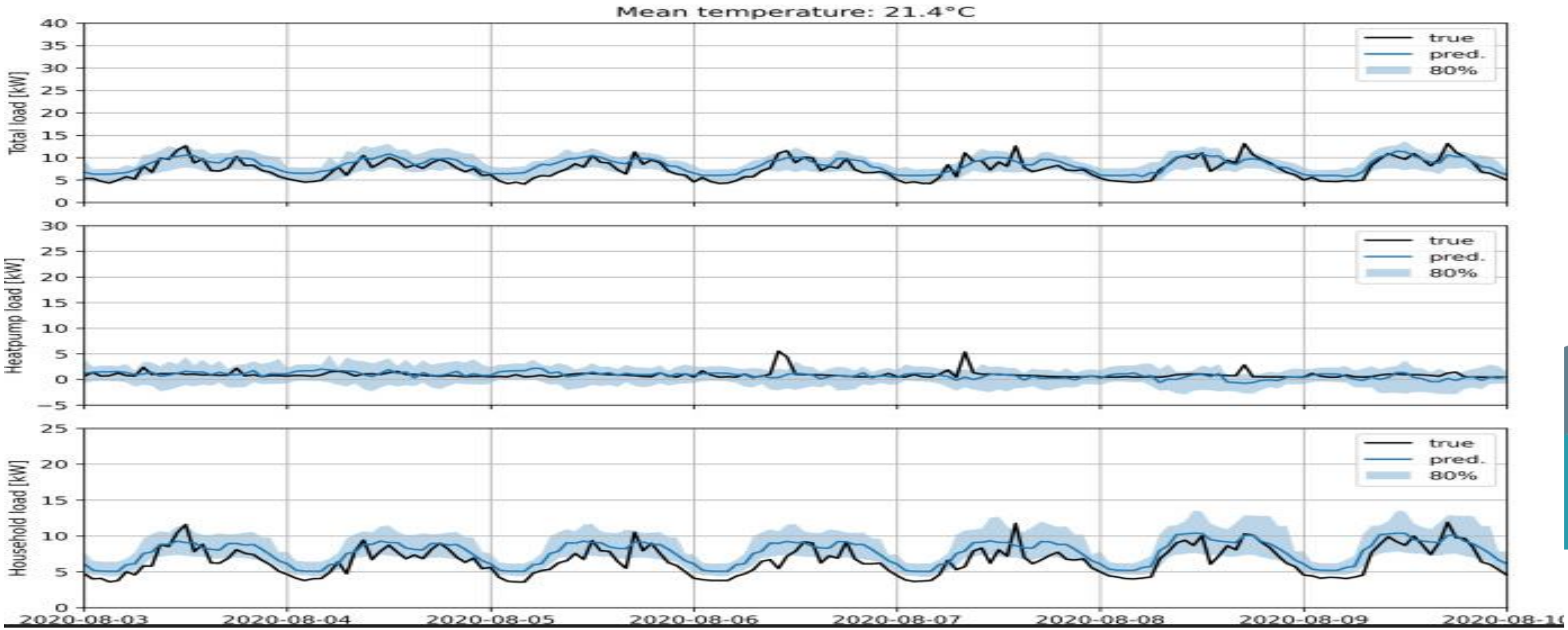
Energy Management Platform:
VIRTUAL LAB AND GLOBAL INTEGRATED PLATFORM (AIT)

- Support in achieving semantic interoperability by helping to foster a common understanding of the problem and the solution
- Providing a bigger picture view
- Bridging between the high-level requirements and their implementation
- Provisioning of the virtual mock-up environments for easy integration testing and support in development with dependencies from other partners
- The ecosystem of actors, sample actions, interfaces, APIs and client SDKs, and documentation that can reduce the development and integration time and efforts



Recurring Commercial Offerings Covered by SENDER

Supply and Demand Forecasting: Algorithm Tool (CRS4)



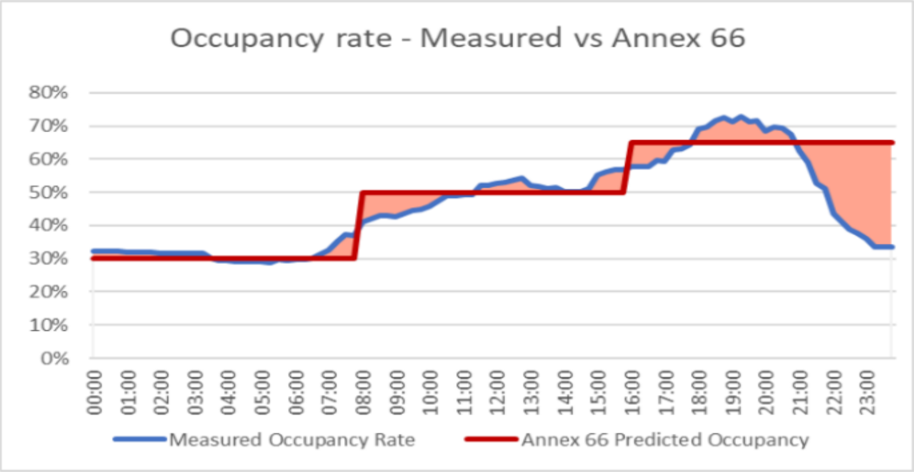
The proposed method produces probabilistic day-ahead hourly forecasts of total energy demand that outperform benchmarks and forecasts of electricity consumption components that are not only more accurate than benchmarks but also close to the accuracy achievable with models trained directly on individual load component data. (Source)

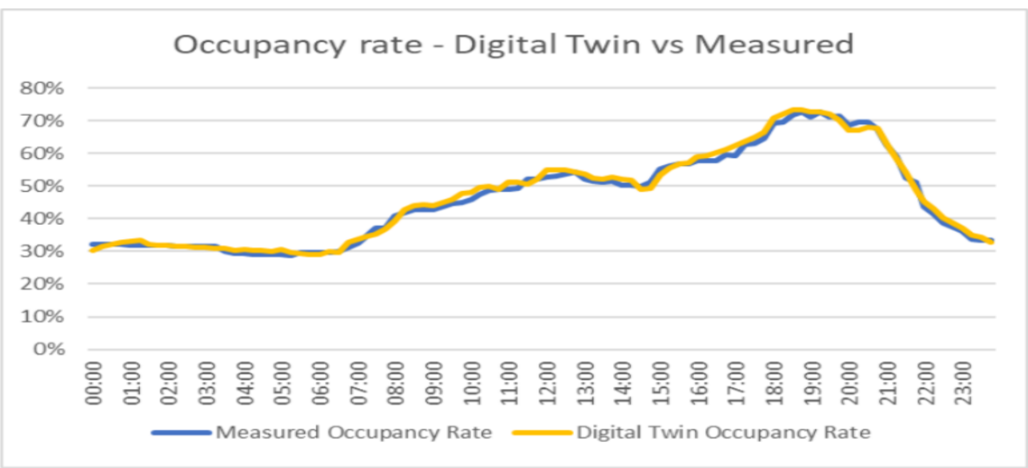
Recurring Commercial Offerings Covered by SENDER

Supply and demand forecasting: Consumer Digital Twin (PARA)

The DT was developed including an AI component, with a clear path of development beginning from the current Annex 66 statistical approach and from there towards a Deep Learning approach to satisfy the requirements of the SENDER solution, which was implemented using Artificial Neural Networks (ANN). The ANN technology applied is transferred from the Aeronautics sector, where a similar application was developed to model the behaviour and response of passengers in commercial long-haul flights.

The Sender DT prototype was successful, achieving a performance that closely … vith up to 2% deviation



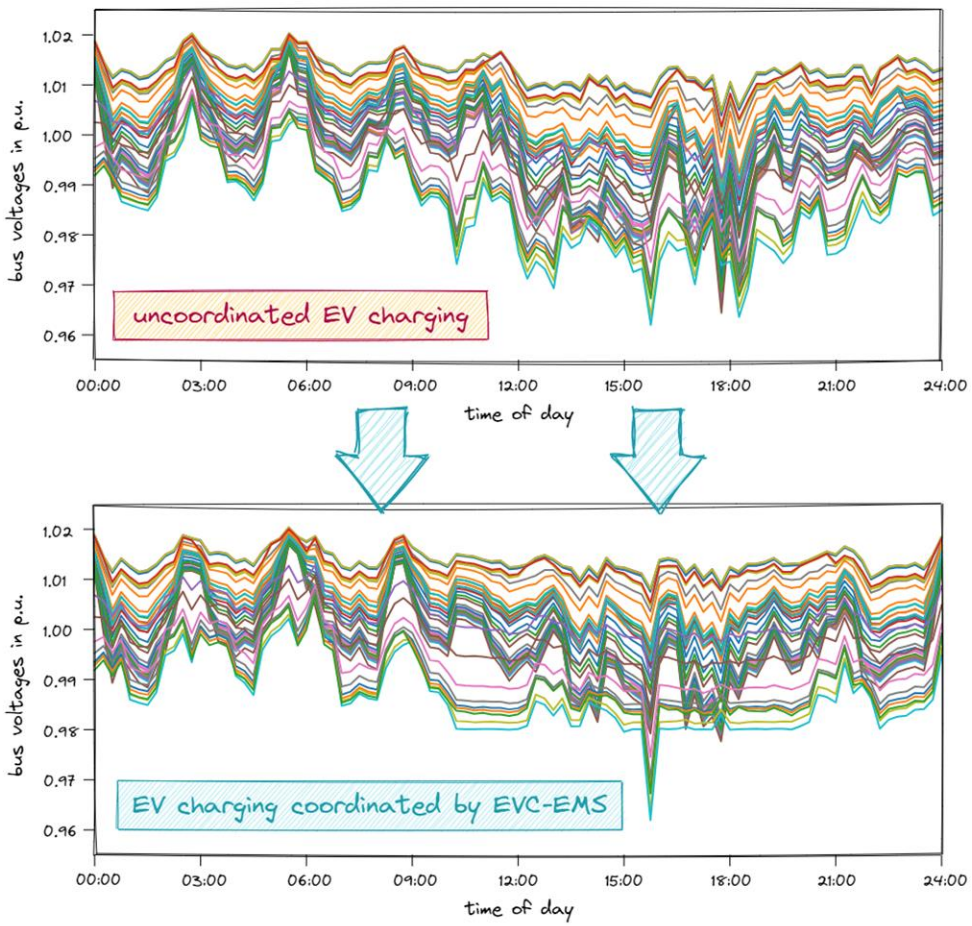


Recurring Commercial Offerings Covered by SENDER

SMART CHARGING EV EMS (TRIALOG)

Functional Testing of EVC-EMS

- ✓ EVC-EMS successfully utilized for a DR scheme for voltage control in LV distribution network
- ✓ deployed and connected to external system in the same way as in a real-world setup
- ✓ successfully integrated into a Fast DR program (based on OpenADR) , demonstrating the solution’s applicability for next generation DR schemes



Future Research Focus for an Expansion of SENDER Results

Integration of market price forecasts

Integration of energy efficiency measures

Integration of intraday electricity market solutions

Handling of community settlement procedures

Sender

Sustainable consumer engagement and demand response

Any question or comment?

Thank you!

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Questions?

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