STAKEHOLDER GROUP MEETING

20 January 2025,
Microsoft Teams

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Agenda

Time	Subject	Speaker
10:00 – 10:05 **5 min**	Welcome and introduction to the meeting	Alexandre Lucas, INESC TEC
10:05 – 10:25 **20 min**	Highlights of IEEE2030.5 InterSTORE developments, demonstration of UI LPC setup	Matjaz Juric, SUNESIS
10:25 – 11:00 **35 min**	IEEE2030.5 InterSTORE version applied in real use cases: Pilots Demonstration Results	Daniele Carta, JULICH
	German pilot (7 min)	Daniele Carta, JULICH
	Austrian pilot (7 min)	Nikolaj Candellari, CYBERGRID
	Italian pilot (7 min)	Alessandra Martino, ENEL X

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Agenda

Time	Subject	Speaker
	Portuguese pilot (7 min)	Pedro Matos, CAPWATT Alexandre Lucas, INESC TEC
	Spanish pilot (7 min)	Elyas Rakhshani, HESSTEC
11:00 – 11:25 **25 min**	Stakeholder's interaction session: Feedback on deployments, barriers, enablers of adoption and further use cases	slido
11:25 - 11:35	Q&A session	
11:35 – 11:40	Q&A and Wrap-up	Alexandre Lucas, INESC TEC

- LFE Project
- White Paper is out

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interstore

Open-source Interoperability Toolkit

Matjaz B. Juric,
SUNESIS

20 January 2025,
Microsoft Teams

sunesis

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Importance of IEEE 2030.5

Enabling Interoperability and Seamless Communication

- **Explanation:** IEEE 2030.5 provides a standardized, secure, and reliable communication protocol that allows diverse energy devices and systems to communicate with each other. This is crucial for a modern grid with increasing numbers of Distributed Energy Resources (DERs) like solar panels, batteries, and electric vehicles.
- **Importance:** Without a common language, these devices operate in silos, hindering their effective participation in grid operations. IEEE 2030.5 breaks down these communication barriers, enabling smoother integration, control, and data exchange. This leads to better coordination of resources, optimized grid performance, and reduced integration costs.
- **Think of it as:** A universal translator for the energy grid, ensuring everyone can understand and work together.

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Importance of IEEE 2030.5

Facilitating Grid Modernization and the Integration of Distributed Energy Resources (DERs)

- **Explanation:** As the energy landscape shifts towards more decentralized generation and consumption, managing a growing number of DERs becomes paramount. IEEE 2030.5 offers a robust framework for effectively managing and controlling these resources. It allows utilities and aggregators to communicate with DERs for various functions like demand response, voltage control, and frequency regulation.
- **Importance:** This standard is fundamental for building a smart grid that can handle the complexities of renewable energy integration. It allows for more flexible and responsive grid operations, improving grid stability and reliability, and reducing the reliance on traditional centralized generation.
- **Think of it as:** The blueprint for building a future-proof grid that can seamlessly incorporate and leverage the power of distributed energy.

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Importance of IEEE 2030.5

Enhancing Grid Stability, Reliability, and Resilience

- **Explanation:** By enabling real-time communication and control of DERs, IEEE 2030.5 plays a vital role in maintaining grid stability. It allows for faster responses to grid events, such as sudden changes in demand or generation. For example, during peak demand, utilities can use IEEE 2030.5 to activate demand response programs, reducing strain on the grid.
- **Importance:** This translates to fewer blackouts and brownouts, improved power quality, and a more resilient energy infrastructure capable of withstanding disruptions. This is crucial for maintaining critical services and minimizing economic losses due to power outages.
- **Think of it as:** A vital tool for keeping the lights on, even when faced with unpredictable energy demands or grid disturbances.

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Importance of IEEE 2030.5

Empowering Consumer Participation and New Business Models

- **Explanation:** IEEE 2030.5 can facilitate two-way communication between consumers and the grid. This opens up opportunities for consumers to actively participate in the energy market through demand response programs, energy storage, and even peer-to-peer energy trading.
- **Importance:** This can lead to lower energy costs for consumers, increased grid flexibility, and the development of innovative energy services and business models. It empowers consumers to become active participants in shaping the future of energy.
- **Think of it as:** Giving consumers a voice and the tools to actively manage their energy consumption and contribute to a more efficient grid.

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What we have done with IEEE 2030.5

- Originally, IEEE 2030.5 has been designed to work with XML and REST API.

- In Interstore, we have extended IEEE 2030.5 to:
  - Using cloud-native messaging NATS for
    - **Asynchronous**,
    - **Many-to-many** (instead of one-to-one),
    - **Secure** and
    - **High performance / low latency** communication.

  - Introducing JSON in addition to XML.

  - Developed an Interoperability Toolkit:
    - Legacy Systems Protocol Converter
    - Interoperable client/server for Distributed Energy Storage

Universal communication backbone

NATS = Neural Autonomic Transport System
Edge-Cloud-native messaging system

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Legacy Systems Protocol Converter

Legacy Systems Protocol Converter (LPC)

- Provides simple and configurable transformation between legacy protocols and IEEE 2030.5

Supported protocols:

- ModBus (serial and TCP)
- MQTT
- NATS (for IEEE 2030.5)

Supported IEEE 2030.5 formats

- XML
- JSON
- All 321 IEEE 2030.5 elements are supported

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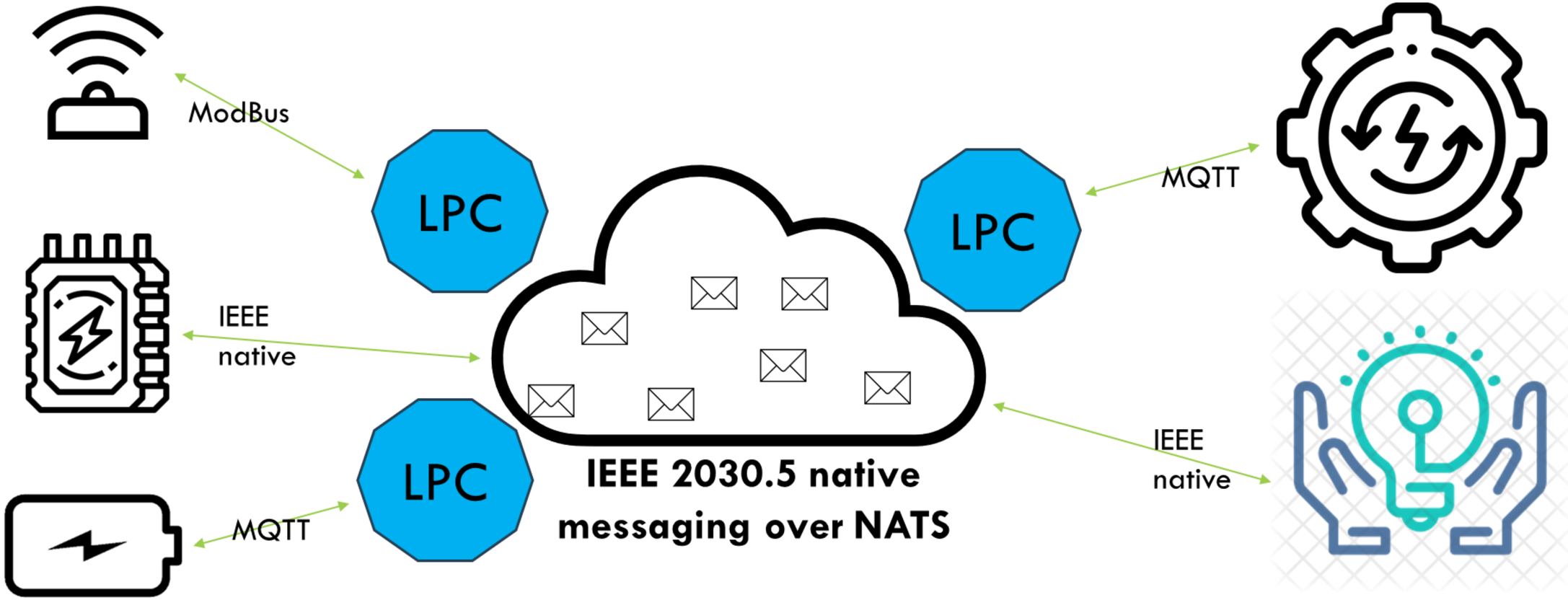

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Legacy Systems Protocol Converter

```json
{
  "datetime": "28-08-2023 12:00:35",
  "status": "active",
  "start": "28-08-2023",
  "duration": 900
}
```

```
transformations:
  - name: JSON IncomingEvent to XML IEEE2030.5 Event
    description: Example showing transformation of messages from JSON to XML
    connections:
      incoming-connection:
        - MQTT-connection
      incoming-topic: topic1
      incoming-format: JSON
      outgoing-connection:
        - NATS-connection
      outgoing-topic: event/myevent
      outgoing-format: XML
    to-outgoing:
      '<Event>
        <creationTime>$timestamp</creationTime>
        <EventStatus>
          <currentStatus>
            <lpc:mapping>
              <path type="integer">/status</path>
              <values>["scheduled", "active", "cancelled", "cancelled_with_r", "superseded"]</values>
            </lpc:mapping>
          </currentStatus>
          <dateTime>
```

```xml
<Event>
    <creationTime>1702909917932</creationTime>
    <EventStatus>
        <currentStatus>1</currentStatus>
        <dateTime>1693216835000</dateTime>
        <potentiallySuperseded>false</potentiallySuperseded>
    </EventStatus>
    <interval>
        <duration>900</duration>
        <start>1693216835000</start>
    </interval>
</Event>
```

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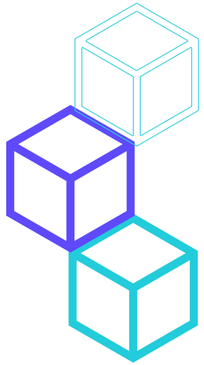
Legacy Systems Protocol Converter



Legacy Systems Protocol Converter (LPC) can run on any computer, embedded device or virtual machine:

- Docker

- Virtual machine
  - Execute Java JAR (requires OpenJDK JRE)
  - Linux, Windows, MacOS, etc.
    - Any OS that can run Java

- Custom build from source code

- Source code is available of GitHub
- Pre-built Docker available on Docker Hub

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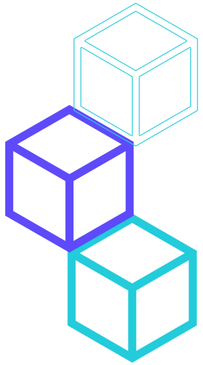

GitHub - Horizont-Europe-Inter

github.com/Horizont-Europe-Interstore/Legacy-Protocol-Converter

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divjad--- Merge pull request #2 from Horizont-Europe-Interstore/feature 92ecb8e · 2 months ago 29 Commits

config-examples	IEEE2030.5 schema validation added for messages	2 months ago
docs	ModBus requests support endianness for registers.	6 months ago
log-config	Release version	9 months ago
transformation-framework	IEEE2030.5 schema validation added for messages	2 months ago
.gitignore	Added dynamic reloading of configuration files.	8 months ago
Dockerfile	Changed Dockerfile and Connections.	3 months ago
LICENSE	Create LICENSE	9 months ago
Readme.md	IEEE2030.5 schema validation added for messages	2 months ago
legacy-protocol-converter.jar	ModBus requests support endianness for registers.	6 months ago
pom.xml	IEEE2030.5 schema validation added for messages	2 months ago

README MIT license

Legacy Systems Protocol Converter for IEEE2030.5

The Legacy Systems Protocol Converter (LPC), initially developed within the Horizon Europe Interstore project, acts as a middleware, allowing devices that use different communication protocols to exchange data with EMS systems that use the IEEE2030.5 standard. It supports:

About

No description, website, or topics provided.

Readme
MIT license
Activity
Custom properties
0 stars
2 watching
1 fork
Report repository

Releases 2

v1.1.0 Latest
on Nov 19, 2024

+ 1 release

Packages

No packages published

Contributors 2

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MBJuric Matjaz B. Juric

Languages

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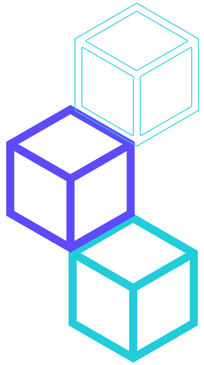

interstore/legacy-protocol-conv

hub.docker.com/r/interstore/legacy-protocol-converter

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Explore / interstore/legacy-protocol-converter

interstore/legacy-protocol-converter

By interstore • Updated about 12 hours ago

Legacy Protocol Converter is a framework designed to convert messages from one protocol to another.

IMAGE

0 413

Overview Tags

Legacy Protocol Converter

The Legacy Systems Protocol Converter, initially developed within the Horizon Europe Interstore project, acts as a middleware, allowing devices that use different communication protocols to exchange data with EMS systems that use the IEEE2030.5 standard. It supports:

- IEEE2030.5 communication: This is the primary function of the Legacy Protocol Converter. It can handle IEEE2030.5 messages in both JSON and XML formats.

Docker Pull Command

```
docker pull interstore/legacy-protocol-converter
```

Copy

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information contained ther

Interoperable client/server for Distributed Energy Storage

- Interoperable client library
  - Used by devices in order to generate IEEE2030.5 messages over NATS
- Interoperable server library
  - Used by EMS systems to receive and create IEEE2030.5 messages over NATS

Seamless interoperability using IEEE2030.5 and NATS:

- IEEE2030.5 is supported in XML and JSON formats

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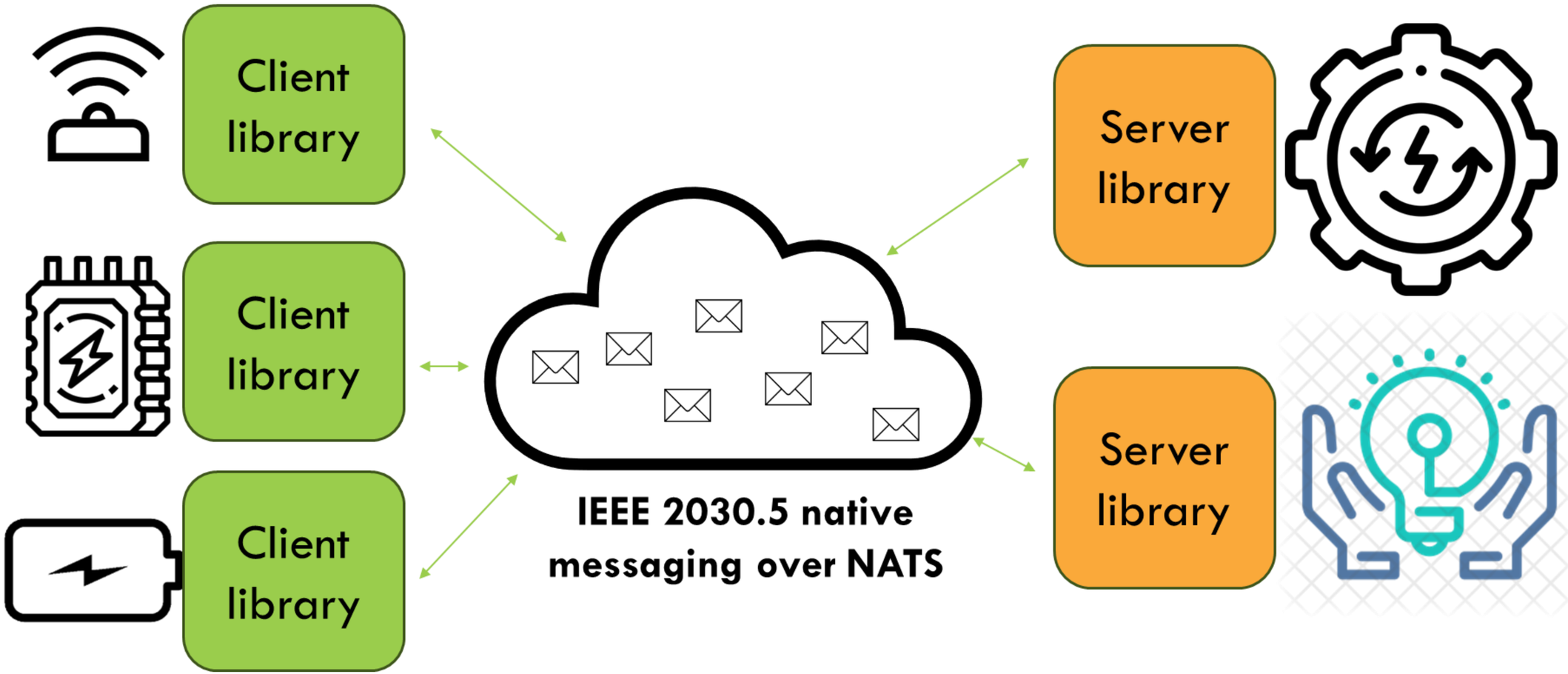

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Interoperable client/server for Distributed Energy Storage

- Client and server libraries are available on GitHub.

- They include all IEEE2030.5 data types
  - You have the choice to work with XML or JSON directly
  - Or use library native classes
  - 321 IEEE2030.5 data types are included

- Library written in Java.

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IEEE2030.5 InterSTORE version applied in real use cases:

Pilot Demonstration results – German pilot

Daniele Carta,
Forschungszentrum Jülich

20 January 2025,
Microsoft Teams

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German Pilot

Use cases

- UC3: Grid supporting BESS

- UC8: Multiphysics flexibility optimization for Home Management Systems and their global integration

PV FIELD
Sunny Tripower CORE2
1.1 MWp

High-energy battery
Tesla "Megapack"
500 kW / 2.5 MWh

High-power battery
Riello
1500 kW / 500 kWh

Heat pump
Viessmann Vitocal
200 kW

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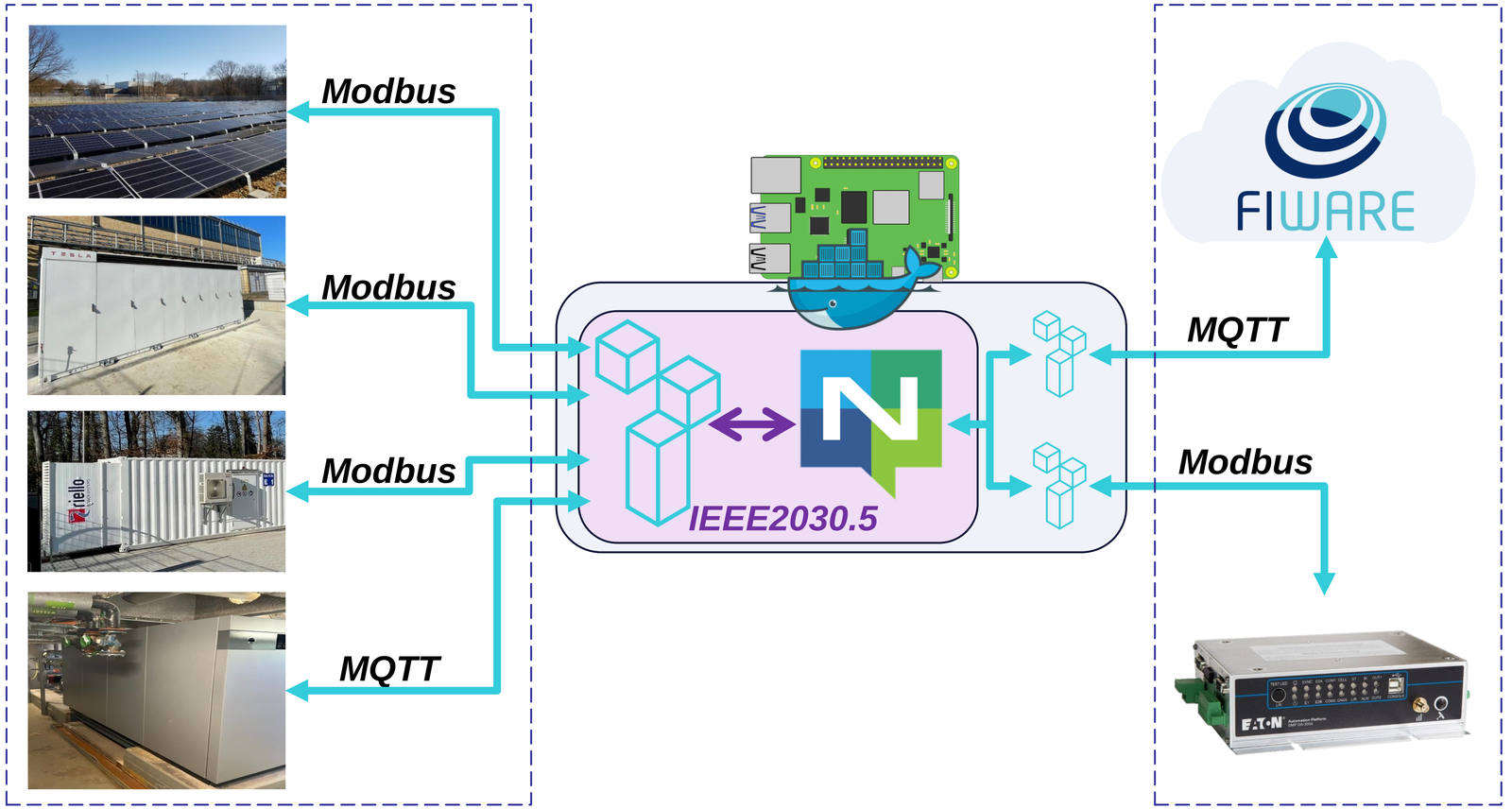
German Pilot

Overview of architecture

- IEEE 2030.5 over NATS – Legacy Protocol Converter
  - Raspberry Pi with docker container
- Link between DER and EMS
  - Hybrid flexibility (BESS, HP, PV)
  - FIWARE-based ICT platform
  - Commercial EMS
- Interface between different protocols
  - Modbus and MQTT



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German Pilot

Modbus to IEEE2030.5 – DER capabilities – Type: 80 (Storage and generation)

“Each unique DER instance SHALL link to a *DERCapability* instance”

Code mode	Mode name	Mandatory /Optional	Attribute		
			Solution 1	Alternative 1	Alternative 2
0	Charge mode	M	rtgMaxChargeRateW/ setMaxChargeRateW	**rtgMaxW**/ setMaxW	rtgMaxWh or rtgMaxAh
1	Discharge mode	M	rtgMaxDischargeRateW/ setMaxDischargeRateW	**rtgMaxW**/ setMaxW	
4	opModFixedPFAbsorbW (Fixed Power Factor Setpoint when absorbing active power)	M	**rtgMinPFOverExcited**/ setMinPFOverExcited		
6	opModFixedVar (Reactive Power Setpoint)	M	**rtgMaxVar** /setMaxVar		
20	opModMaxLimW (Maximum Active Power)	M	**rtgMaxW**/setMaxW		
24	opModVoltWatt (Volt-Watt Mode)	M			
4	opModFixedPFAbsorbW (Fixed Power Factor Setpoint when absorbing active power)	O	rtgMinPFUnderExcited/ setMinPFUnderExcited		
6	opModFixedVar (Reactive Power Setpoint)	O	rtgMaxVarNeg/setMaxVarNeg		
20	opModMaxLimW (Maximum Active Power)	O	rtgMaxVA/setMaxVA		

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German Pilot

Modbus to IEEE2030.5 – DER capabilities – LPC implementation

```
    message: '{
"DER": [
{
    "description": "Riello BESS Inverter 1 NetMan",
    "DERCapability": {
      "DERType": {
        "value": 80
      },
      "modesSupported": {
      },
      "rtgMaxVA": {
      },
      "rtgMaxVAR": {
      },
      "rtgMaxW": {
      },
      "rtgMinPF": {
      },
      "rtgVNom": {
      }
    },
    "StateOfChargeStatusType": {
    }
  }
],
"mirrorMeterReadingList": {
}
```

Code mode: 0/1

Mode name: Charge mode/Discharge mode

Attribute: rtgMaxW

```
},
"rtgMaxW": {
  "value": {
    "lpc:mapping": {
      "path": "79",
      "type": "int16"
    }
  },
  "powerOfTenMultiplier": {
    "value": 2
  },
  "uom": {
    "value": 38
  }
},
```

Reading value: Modbus register 79

Powerofthenmultiplier: -2 (100 W)

Measurement unit: 38 (W)

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German Pilot

IEEE2030.5 – DER control

“Controls are invoked using the event object which has an associated start time and duration”

Object	Attribute	Format	Description
DERControlBase	opModFixedVar*	FixedVar	Specifies the delivered or received reactive power setpoint. The context is determined by refType and should be one of %setMaxW, %setMaxVar, or %statVarAvail.
DERControlBase	opModFixedW	SignedPerCent	Specifies a requested charge or discharge mode setpoint as a percentage of setMaxChargeRateW (if negative) or setMaxW/setMaxDischargeRateW (if positive), in hundredths.

***adaptation needed since the control board requests values in percentage**

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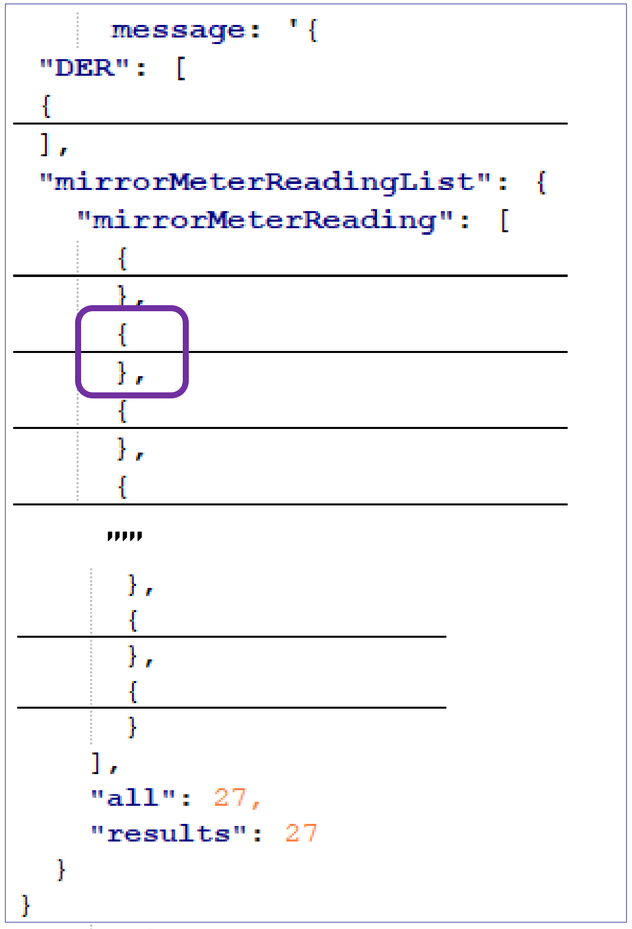
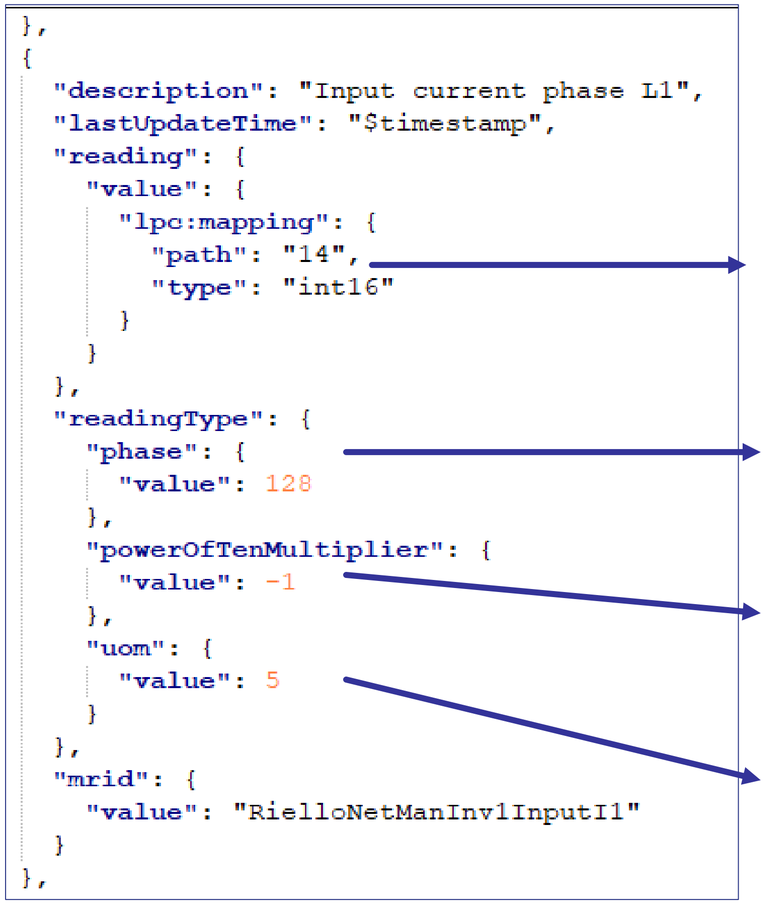
German Pilot

Modbus to IEEE2030.5 – Mirror meter reading – LPC implementation





Monitored quantity: input current

Reading value: Modbus register 14

Phase: 128 (Phase A)

Powerofthenmultiplier: -1 (0.1A)

Measurement unit: 5 (A)

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German Pilot

IEEE2030.5 to MQTT

```
message: '{
    "voltage": {
      "nominal": {
      },
      "input": {
      },
      "output": {
      },
      "bypass": {
      }
    },
    "current": {
      "input": {
      },
      "output": {
      }
    },
    "power": {
    },
    "frequency": {
    },
    "temperature": {
    },
    "soc": {
    }
  }
  '
```

```
"current": {
  "input": {
    "ph1": {
      "value": {
        "lpc:mapping": {
          "path": "mirrorMeterReading/3/reading/value",
          "type": "int16"
        }
      },
      "multiplier": {
        "lpc:mapping": {
          "path": "mirrorMeterReading/3/readingType/powerOfTenMultiplier/value",
          "type": "int16"
        }
      }
    },
    "ph2": {
    },
    "ph3": {
    }
  },
  "output": {
  }
},
```

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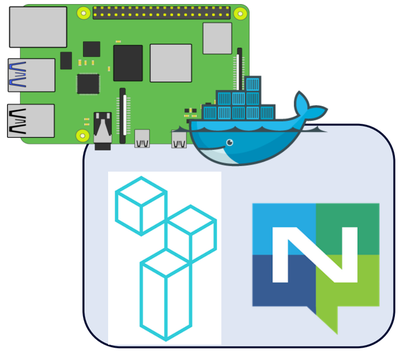
German Pilot

Example of configuration files available for Riello battery



- Network manager (monitor)
  - Riello_NetMan_inv1
  - Riello_NetMan_inv2
  - Riello_NetMan_inv3
- Janitza (monitor)
  - Riello_Janitza_input
  - Riello_Janitza_output
  - Riello_Janitza_self
- Energy manager (control)
  - Riello_EneMan_inv1
  - Riello_EneMan_inv2
  - Riello_EneMan_inv3
- PQI (monitor)
  - RielloPQI

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interstore

THANK YOU!

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IEEE2030.5 InterSTORE version applied in real use case: Pilot Demonstration results – Austrian Pilot

Nikolaj Candellari
CyberGrid

20 January 2025,
Microsoft Teams

CyberGrid

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ENERGY COMMUNITY DIETACH

Goal: maximize the value of the generated energy with new approaches

The community in upper Austria is in full operation since 01.03.2023 and has today 63 participants.

number	devices	
103	counter point	
38	PV systems	Approx. 700kWp
65	consumer	
24	With heat pump	
13	With heat pump for warmwater	
19	With heat pump for heating	
13	With Electric car charging station	

Number participating in the project	devices	*numbers are changing due to additional participants
14*	PV system	
7*	batteries	3kW*

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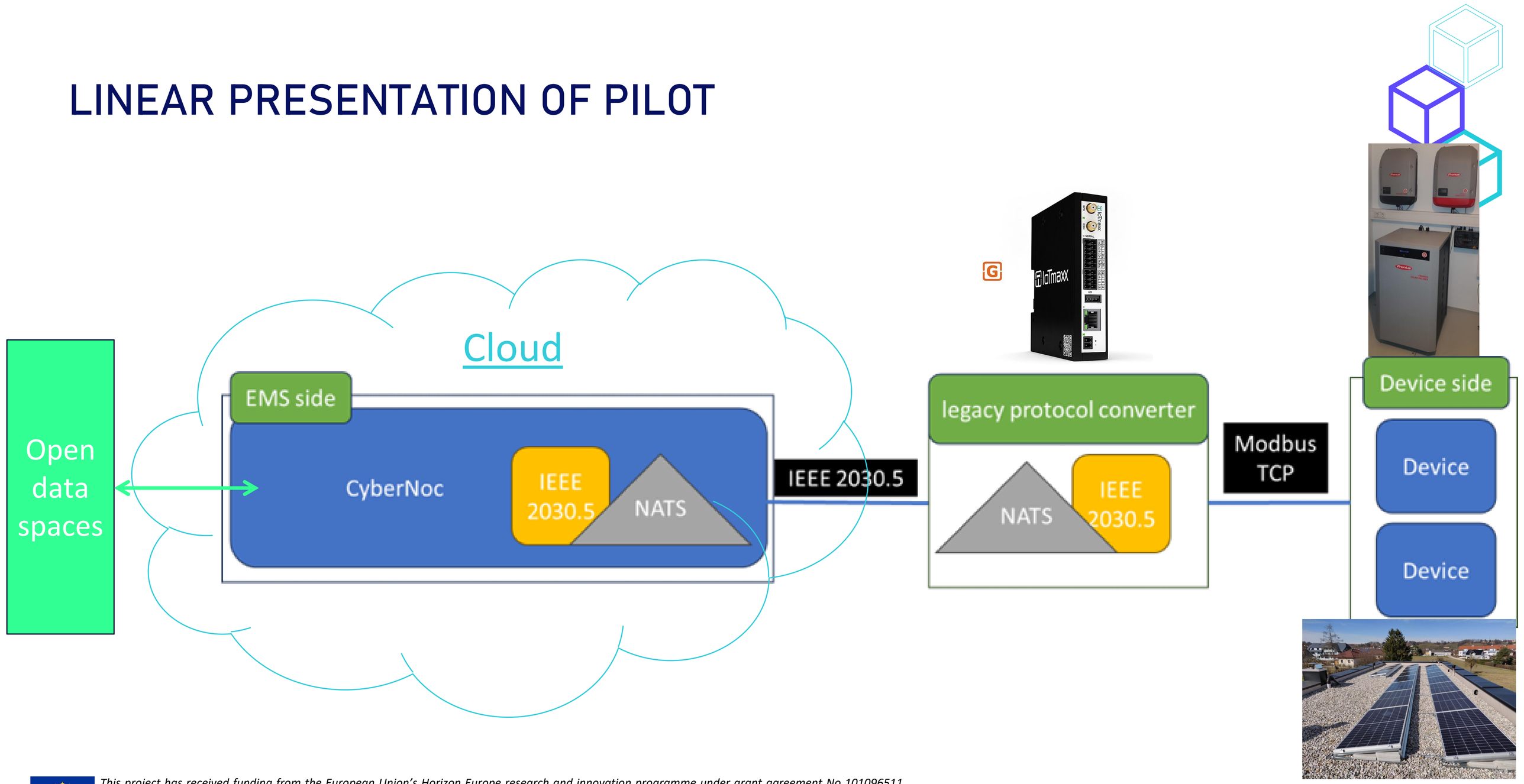
LINEAR PRESENTATION OF PILOT



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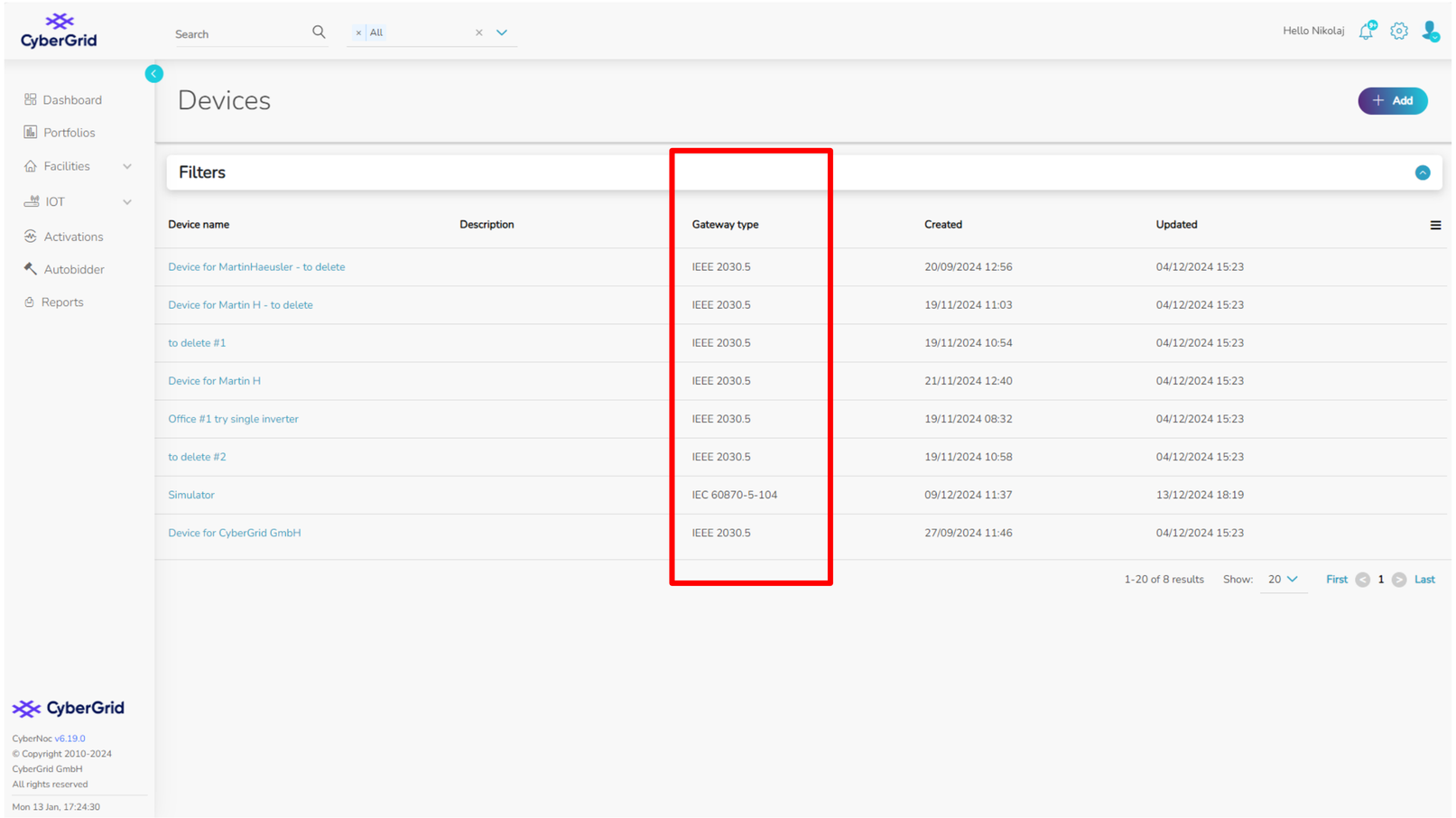
CyberNoc
Flexibility Management

- Utilization of flexibility by active customers
- Scalable pooling of all assets like RES, BESS, EV
- Automated bidding of flexibility on ancillary services markets
- Value stacking by multi-marketing of BESS including Intraday markets
- Balance group optimization and energy communities
- Closed-loop-control to fight deviations
- Transparent accounting per asset

CLIENT-SERVER LIBRARY IN CyberNoc

CyberGrid deployed client-server library in CyberNoc – our flexibility management platform. This allows us to communicate via IEEE2030.5 over NATS natively.



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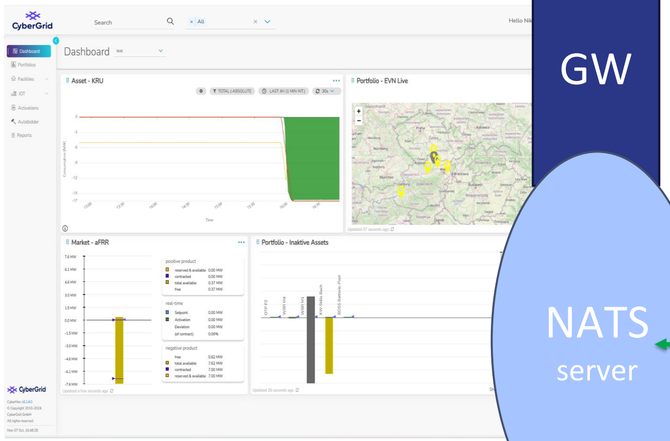
FULL COMMUNICATION CHAIN

communication protocol used:

IEEE2030.5 over NATS | LPC | Modbus TCP (or other that the inverter is speaking)

AWS

InterSTORE instance of CyberNoc



GW

NATS server

VPN tunnel

APN

APN connection via sim card

Home router

Modbus TCP via local network

Exact protocol specifics?
How to do the mapping in LPC?

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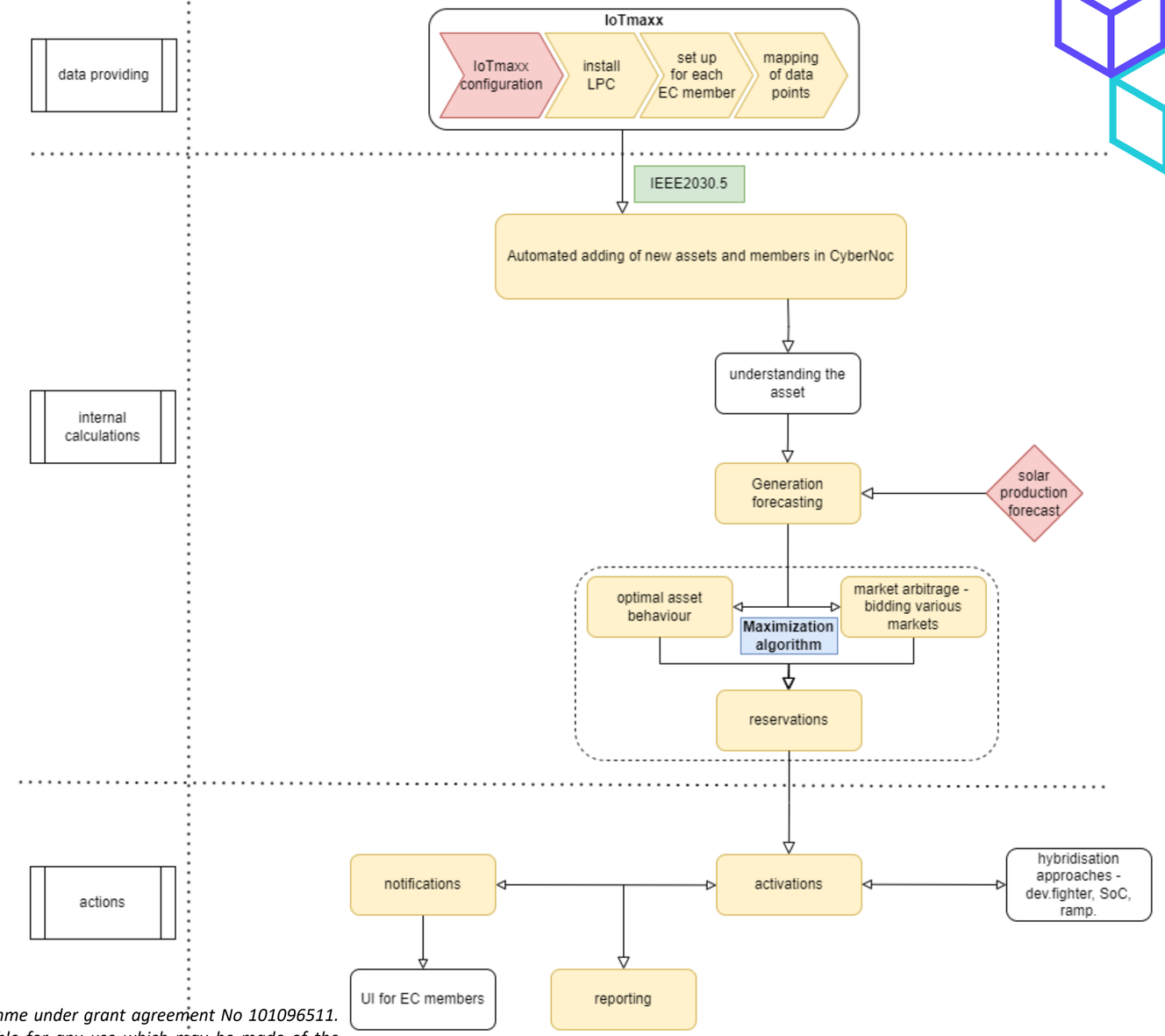
ENERGY COMMUNITY TOOLKIT

Optimization algorithm focused on maximizing the produced energy by allocating energy for the needs of community members and offering the rest on energy markets.

- First step is to receive asset data and use it to understand their functioning.
- Second, upon receiving solar production forecast, the prediction of each asset energy generation is calculated.
- From the generation forecast optimal asset behavior is set and/or balancing service bids are created.
- In case any of the bids are accepted the reservations are made in CyberNoc.
- In time of activation the signals are sent from CyberNoc towards asset.



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BUT FIRST TESTING (IN SMART GRID LAB)

As the nature of the pilot is research-focused, deployments are not risk free. To avoid unpleasantries the following steps were taken:

- Extensive testing of new protocol (and other developments) in lab environments.
- Contracting local installer for implementations.
- Setting up monitoring system (logging).
- Prepare for LPC reconfiguration and other troubleshooting remotely (APN).

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interstore

THANK YOU!

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IEEE2030.5 InterSTORE version applied in real use case: Pilot Demonstration results – Italian pilot

Alessandra Martino
Enel X

20 January 2025,
Microsoft Teams

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Agenda

- Architecture overview, assets , platforms involved and data flows
- IEEE 2030.5 implementation and deployment (interface between different protocols)and Assets typologies
- How we implemented IEEE2030.5 protocol with LPC converter
- Link between DER and EMS and Flex service implemented
- Conclusions

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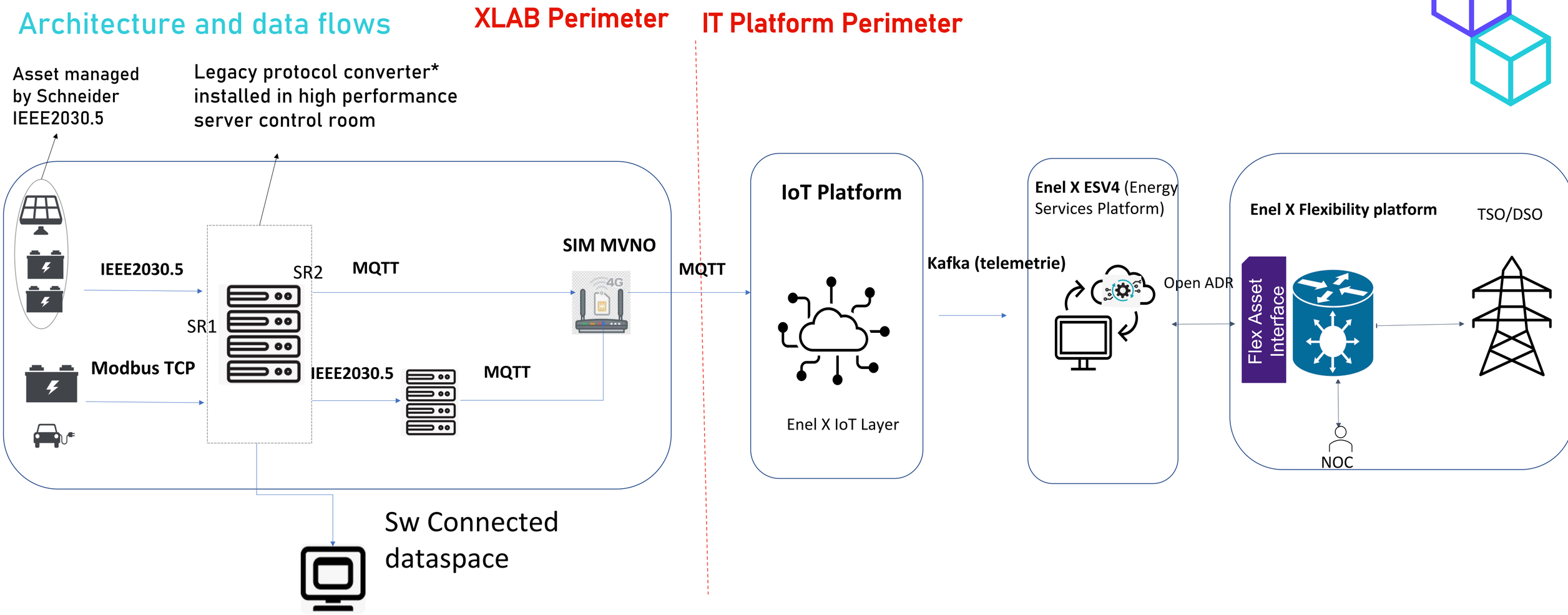
Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Architecture and data flows



- SR1: ETH process internal network 10.40.160.X/24
- SR2: Wireless Network with SIM MVNO to (192.168.X.X) management network
- *LPC GATEWAY manage registration and authentication infocert certificate to connect to IoT platform following third party connection platform

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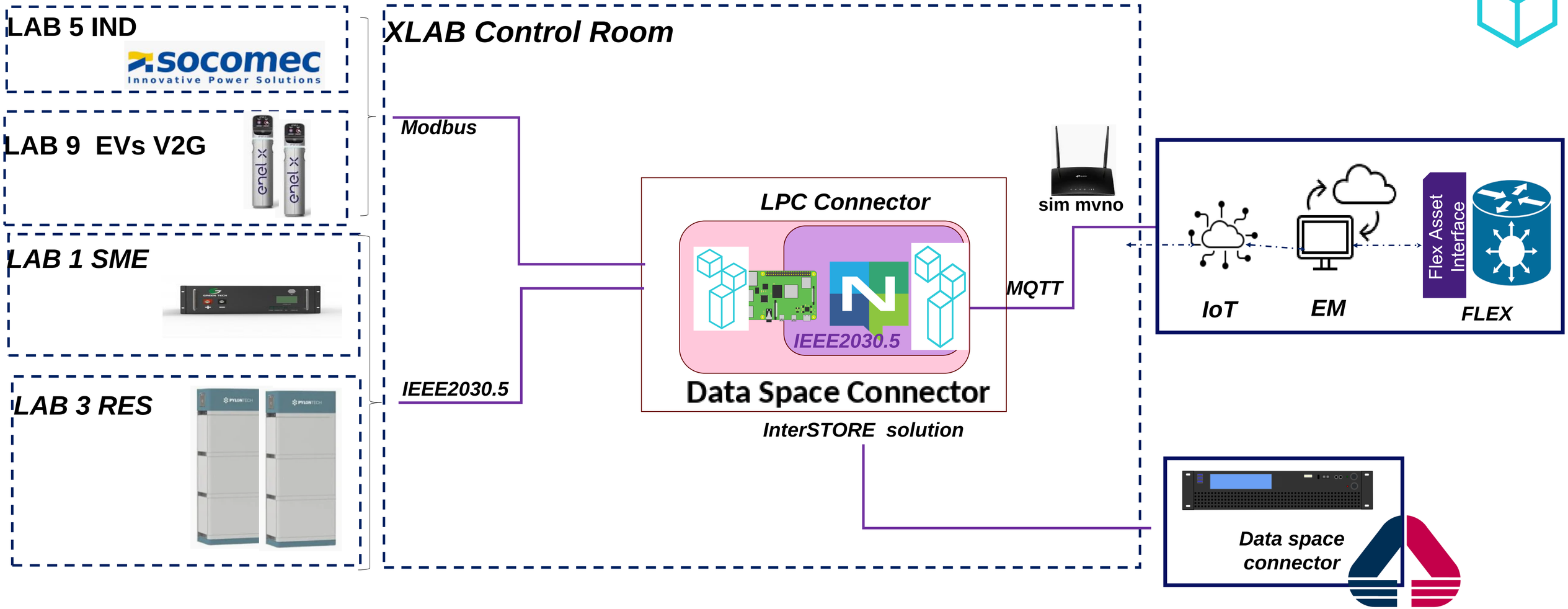
Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Overview of the architecture



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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

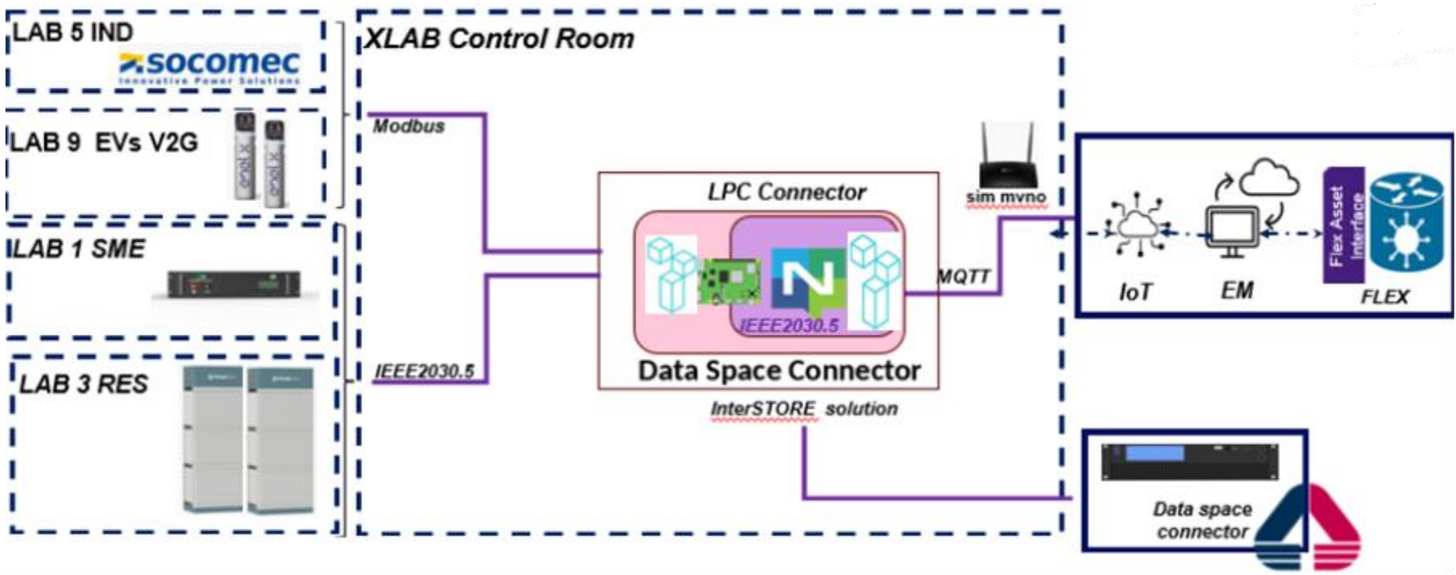
Main highlights

IEEE2030.5 over NATS- Legacy Protocol Converter

- ❑ High performance server in the LAB

LINK between DER and EMS

- ❑ Hybrid Flexibility (PV+ Storage Residential, PV+ Storage C&I, PV+Storage Industrial, V1G/V2G EV chargers)
- ❑ EMS platform
- ❑ Algorithms development
- ❑ Flex platform



Interface between different protocols

- ❑ Modbus
- ❑ Mqtt
- ❑ IEEE2030.5

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Assets list

LAB	ASSET	SIZE	TYPOLOGY	DATA PROTOCOL	Variables
5-INDUSTRIAL	3 SUN PV Panels	102kWp (125kWp in Bifacial way)	Bifacial Panels	IEEE2030.5	
5-INDUSTRIAL	SOCOMEC storage	132 kVA- 274kWh	Lithium-Battery	MODBUS	
1-RESIDENTIAL	3SUN PV Small	2X3,7kWp= 7,4 (9 kWp in bifacial way)	Bifacial panels	IEEE2030.5	
1-RESIDENTIAL	Pylontec	4X 4,8 kW	Li-Ion Battery	IEEE2030.5	
3-SMALLC&I	3 Sun PV Panels	2x12kWp= 24 kWp (29kWp in bifacial way)	Bifacial panels	IEEE2030.5	
3-SMALLC&I	Greentech storage	1X5,5kW	super capacitor energy intensive	IEEE2030.5	
9-Mobility	Residential EV Charger ChadeMO	-/+15kW	ChaDAmo	MODBUS	

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS
IEEE2030.5 Variables

IEEE2030.5 Variables mapping for data flows

- **DER**

Package (function set)	Object (resource name)	Attribute	format	Values	Description
DER	ActivePower	value	Int16	-	Value in watts (uom 38).
DER	ReactivePower	value	Int16	-	Value in volt-amperes reactive (var) (uom 63).
DER	StateOfChargeStatusType	value	PerCent	-	The value indicating the state (percent data type).

- DERControl

Package (function set)	Object (resource name)	Attribute	format	Values	Description
DER	DERControlBase	opModFixedVar	FixedVar	[0..1]	Specifies the delivered or received reactive power setpoint. The context is determined by refType and should be one of %setMaxW, %setMaxVar, or %statVarAvail.
DER	DERControlBase	opModFixedW	SignedPerCent	[0..1]	Specifies a requested charge or discharge mode setpoint as a percentage of setMaxChargeRateW (if negative) or setMaxW/setMaxDischargeRateW (if positive), in hundredths.
DER	DERControlBase	opModTargetVar	ReactivePower	[0..1]	Specifies a target reactive power in var. Useful for aggregators as individual DERs may not be able to maintain a target setting.
DER	DERControlBase	opModTargetW	ActivePower	[0..1]	Specifies a target output power in watts. Useful for aggregators as individual DERs may not be able to maintain a target setting.

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Monitor – LPC-data collecting

- Decoding Modbus messages in the LPC (SOCOMEC and EV chargers)

Modbus to IEEE2030.5

```
version: 1.0.0
connections:
  - name: Conn_SOCOMEC
    type: Modbus
       host: 10.40.160.182
    port: 502
  - name: Conn_NATS
    type: NATS
    host: nats://localhost
    port: 4222
    reconnect: true
  - name: Conn_NATS_2
    type: NATS
    host: nats://localhost
    port: 6222
    reconnect: true
```

```
transformations:
  - name: Test
    connections:
           incoming-connection:
      - Conn_SOCOMEC
     outgoing-connection:
      - Conn_NATS
     outgoing-topic: event/send
    to-outgoing:
          to-topic: event/send
      message:
       <DER>
          <datetime>$timestamp</datetime>
          <StateOfChargeStatusType>
                <lpc:mapping>
                  <path type="int16">4483</path>
                </lpc:mapping>
          </StateOfChargeStatusType>
       </DER>
```

IEEE2030.5 to MQTT

```
interval-request:
      interval: 3000
      request:
       modbus-function-code: 3
        modbus-device-id: 1
        modbus-registers:
     - register-address: 4483
            type: int16
  - name: Test_2
    connections:
      incoming-connection:
        - Conn_NATS
      incoming-topic:
event/send
      outgoing-connection:
```

```
- Conn_NATS_2
      outgoing-topic: event/final
    to-outgoing:
      to-topic: event/final
      message: |-
         {
     "device_type": "mqtt-
client",
            "thing_id": "pippo",
            "data": {
               "tags": [
                {
                 "name": "SOC",
       "timestamp": "$timestamp",
            "trendId": "1234567",
               "value": {

"lpc:mapping": {
                    "path":
"DER/StateOfChargeStatusType",
                  "type": "int16"
                      }
                  }
                 }
                ]
               }
            }
timestamp: 2024-11-
28T13:56:21.022Z
```

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Example : *MODBUS-IEEE2030.5 variables reading «SOC» SOCOMEC*

```
version: 1.0.0
connections:
  - name: Conn_MQQT
    type: NATS
    host: nats://localhost
    port: 4222
  - name: Conn_SOCOMEC
    type: Modbus
    host: 10.40.160.182
    port: 502
transformations:
  - name: EESS Socomec XLab5 MB MQTT
    connections:
      incoming-connection:
        - Conn_SOCOMEC
      outgoing-connection:
        - Conn_MQQT
      outgoing-format: JSON
    to-outgoing:
      to-topic: event/send
      message: |-
         {
          "device_type":"mqtt-client",
          "thing_id":"Storage_Lab5",
          "data": {
            "tags":[
             {
              "name":"SOC",
              "timestamp": $timestamp,
              "trendId": "1234567",
              "value": {
                "DER": [
                {
                  "description": "SOC Socomec",
                  "StateOfChargeStatusType": {
                    "value": {
                      "lpc:mapping": {
                         "path": "4483",
                         "type": "int16"
                      }
                    }
                  }
                }
               ]

             }
            }

           ]
          }
         }
    interval-request:
      interval: 3000
      request:
        modbus-function-code: 3
        modbus-device-id: 1
        modbus-registers:
          - register-address: 4483
            type: int16
timestamp: 2024-09-24T12:51:55.666Z
```

```
2024-12-04 16:04:19,285 INFO -- si.sunesis.interoperability.lpc.transformations.configuration.Configuration --  Reading configuration: Test_Finale_Gennaro.yaml {}

2024-12-04 16:04:19,349 INFO -- si.sunesis.interoperability.lpc.transformations.configuration.Configuration --  Validating messages for transformation: EESS Socome
c XLab5 MB MQTT {}
2024-12-04 16:04:19,416 INFO -- si.sunesis.interoperability.lpc.transformations.transformation.TransformationHandler --  Transformation: EESS Socomec XLab5 MB MQTT
 {}
2024-12-04 16:04:19,574 INFO -- org.eclipse.jetty.server.handler.ContextHandler --  Started o.e.j.w.WebAppContext@2e554a3b{/,jar:file:/app/legacy-protocol-converte
r.jar!/webapp,AVAILABLE} {}
2024-12-04 16:04:19,699 INFO -- org.eclipse.jetty.server.AbstractConnector --  Started ServerConnector@5669c5fb{HTTP/1.1, (http/1.1)}{0.0.0.0:9094} {}
2024-12-04 16:04:19,700 INFO -- org.eclipse.jetty.server.Server --  Started Server@15dcfae7{STARTING}[10.0.9,sto=0] @4083ms {}
2024-12-04 16:04:19,701 INFO -- EeApplication --  KumuluzEE started successfully {}
2024-12-04 16:04:22,424 INFO -- si.sunesis.interoperability.lpc.transformations.transformation.TransformationHandler --  Publishing Modbus interval request {}
2024-12-04 16:04:22,470 INFO -- si.sunesis.interoperability.lpc.transformations.transformation.TransformationHandler --  Transformed message: {
  "device_type": "mqtt-client",
  "thing_id": "Storage_Lab5",
  "data": {
    "tags": [
      {
        "name": "SOC",
        "timestamp": 1733328262445,
        "trendId": "1234567",
        "value": {
          "DER": [
            {
              "description": "SOC Socomec",
              "StateOfChargeStatusType": {
                "value": 940
              }
            }
          ]
        }
      }
    ]
  }
} {}
2024-12-04 16:04:24,857 INFO -- org.eclipse.jetty.server.Server --  Stopped Server@15dcfae7{STOPPING}[10.0.9,sto=0] {}
2024-12-04 16:04:24,944 INFO -- org.eclipse.jetty.server.AbstractConnector --  Stopped ServerConnector@5669c5fb{HTTP/1.1, (http/1.1)}{0.0.0.0:9094} {}
2024-12-04 16:04:25,048 INFO -- org.eclipse.jetty.server.handler.ContextHandler --  Stopped o.e.j.w.WebAppContext@2e554a3b{/,jar:file:/app/legacy-protocol-converte
r.jar!/webapp,STOPPED} {}
```

SCADA VALUE: Battery State of Charge 94,0 %

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Example : *MQTT-IEEE2030.5-MODBUS **Active Power** setpoint SOCOMEC*

```
version: 1.0.0
connections:
  - name: Conn_SOCOMEC
    type: Modbus
    host: 10.40.160.182
    port: 502
  - name: Conn_NATS
    type: NATS
    host: nats://localhost
    port: 4222
    reconnect: true
  - name: Conn_MQTT
    type: MQTT
    host: http://ax3v62h9b8tp2.iot.eu-central-1.amazonaws.com/
    port: 883
    reconnect: true
transformations:
  - name: MQTTtoIEEE2030
    description:
    connections:
      incoming-connection:
        - Conn_MQTT
      outgoing-connection:
        - Conn_NATS
    to-outgoing:
      to-topic: event/send
      message:
        <device_type>mqtt-client</device_type>
        <thing_id>testWriteSoc</thing_id>
          <data>
            <tags>
              <element>
                <name>P_SET</name>
                <timestamp>$timestamp</timestamp>
                <trendId>010203</trendId>
                <value>6300</value>
              </element>
            </tags>
          </data>
```

```
  - name: IEEE2030toModbus
    description:
    connections:
      incoming-connection:
        - Conn_NATS
      incoming-topic: event/send
      outgoing-connection:
        - Conn_SOCOMEC
      outgoing-topic: event/final
    to-outgoing:
      to-topic: event/final
      modbus-function-code: 6
      modbus-device-id: 1
      modbus-registers:
        - register-address: 4354
          type: int16
      message:
       <DER>
         <datetime>$timestamp</datetime>
         <DERControlBase>
           <opModTargetW>
             <ActivePower>
               <lpc:mapping>
                 <path type="int16">data/tags/element/value</path>
               </lpc:mapping>
             </ActivePower>
           </opModTargetW>
         </DERControlBase>
       </DER>
timestamp: 2024-11-29T12:00:00.000Z
```

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

```
version: 1.0.0
connections:
  - name: Conn_NATS
    type: NATS
    host: nats://localhost
    port: 4222
  - name: Conn_SOCOMEC
    type: Modbus
    host: 10.40.160.174
    port: 502
transformations:
  - name: EESS Pylontech XLab3 MB NATS
    connections:
      incoming-connection:
        - Conn_SOCOMEC
      outgoing-connection:
        - Conn_NATS
      outgoing-format: JSON
    to-outgoing:
      to-topic: event/send
      message: |-
         {
          "device_type":"nats-client",
          "thing_id":"Storage_Lab3",
          "data": {
            "tags":[
             {
              "name":"SOC",
              "timestamp": $timestamp,
              "trendId": "1234567",
              "value": {
                "DER": [
                {
                  "description": "SOC Pylontech",
                  "StateOfChargeStatusType": {
                    "value": {
                      "lpc:mapping": {
                        "path": "40081",
                        "type": "int16"
                      }
                    }
                  }
                }
               ]

             }
            }

           ]
          }
         }
    interval-request:
      interval: 3000
      request:
        modbus-function-code: 3
        modbus-device-id: 230
        modbus-registers:
          - register-address: 40081
            type: int16
timestamp: 2024-09-24T12:51:55.666Z
```

Example :IEEE2030.5 –READING «SOC» PYLONTEC LAB3

```
"device_type": "nats-client",
"thing_id": "Storage_Lab3",
"data": {
  "tags": [
    {
      "name": "SOC",
      "timestamp": 1733331872324,
      "trendId": "1234567",
      "value": {
        "DER": [
          {
            "description": "SOC Pylontech",
            "StateOfChargeStatusType": {
              "value": 17
            }
```

Scada value

BATTERY 1 - LAB. 3.1		
	INFO BATTERIA	
STATO CARICA	17	%

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Italian Pilot – UC9: Management of EV charging and BESS clusters as HESS

Conclusions

- ✓ Deploying IEEE2030.5 protocol with LPC establish a common interface
- ✓ Flex services were implemented on different kind of assets/customers to support DSO/TSO in network services
- ✓ V2G Chargers are included in available assets aggregation
- ✓ Flexibility availability developed in EMS and ready to supply offers to the Flex platform and to the market

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interstore

THANK YOU!

Alessandra Martino,
alessandra.martino2@enel.com

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IEEE2030.5 InterSTORE version applied in real use case: Pilot Demonstration results – Portuguese Pilot

Alexandre Lucas, INESCTEC
Pedro Matos, CAPWATT

20 January 2025,
Microsoft Teams

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Portuguese Pilot

Use cases

- UC5: Hybrid storage higher performance and flexibility provision

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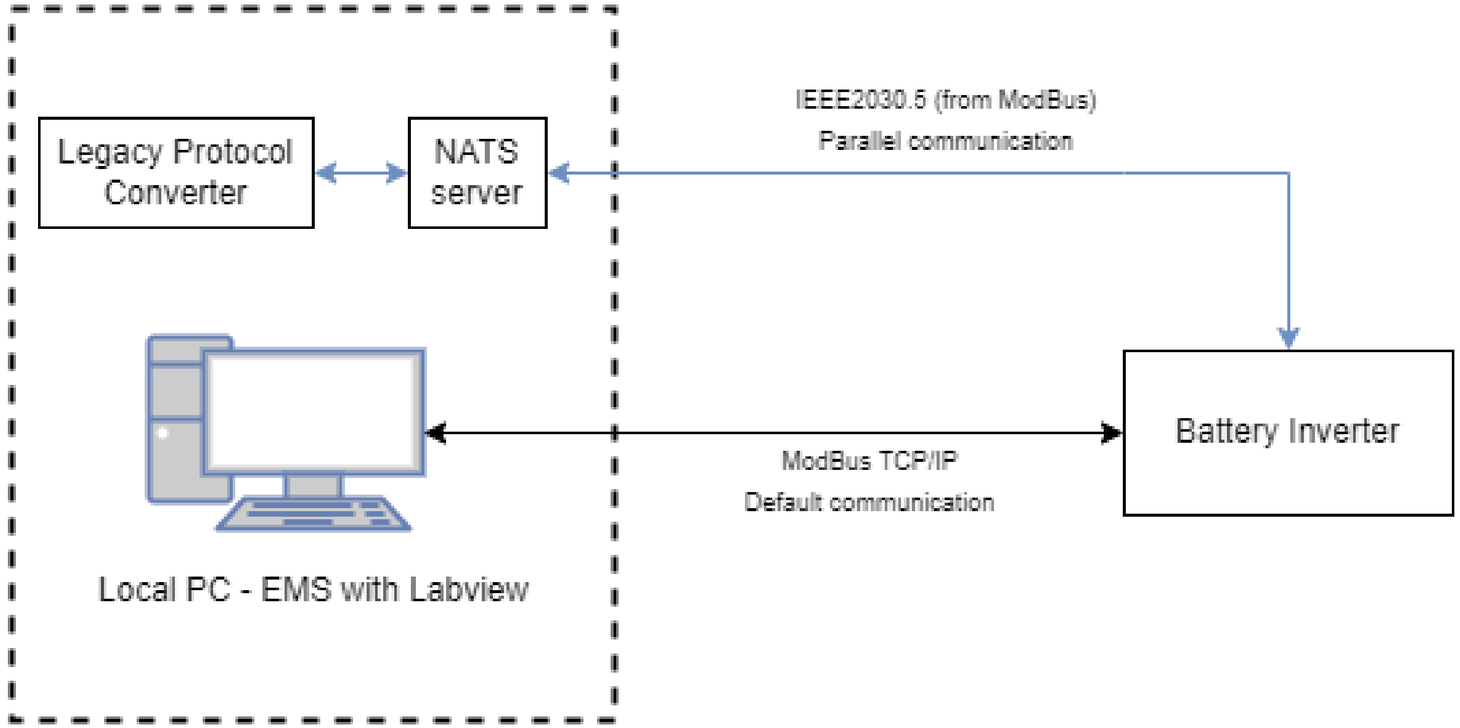
Portuguese Pilot – UC5: Hybrid storage performance and flexibility provision

Overview of activities and developments

- Successful installation of the IEEE 2030.5 legacy protocol converter on the computer unit that controls the hybrid energy storage system;



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Portuguese Pilot – UC5: Hybrid storage performance and flexibility provision

Overview of activities and developments

- Message example (Power, current, frequency)

```
2024-12-12 16:31:43,028 DEBUG -- si.sunesis.interoperability.modbus.AbstractModbusRequestHandler --  Sending Modbus request to device: 1 {}
2024-12-12 16:31:43,053 DEBUG -- si.sunesis.interoperability.lpc.transformations.transformation.ModbusHandler --  Bytes: [0, 16] {}
2024-12-12 16:31:43,054 DEBUG -- si.sunesis.interoperability.lpc.transformations.transformation.ModbusHandler --  Registers: [16] {}
2024-12-12 16:31:43,055 DEBUG -- si.sunesis.interoperability.lpc.transformations.transformation.ObjectTransformer --  path: 27, value: 5001 {}
2024-12-12 16:31:43,056 DEBUG -- si.sunesis.interoperability.lpc.transformations.transformation.ObjectTransformer --  path: 29, value: 0 {}
2024-12-12 16:31:43,056 DEBUG -- si.sunesis.interoperability.lpc.transformations.transformation.ObjectTransformer --  path: 32, value: 16 {}
2024-12-12 16:31:43,057 INFO -- si.sunesis.interoperability.lpc.transformations.transformation.TransformationHandler --  Transformed message: {
  "lastUpdateTime": 1734021103054,
  "EventStatus": {
    "Grid frequency": 5001,
    "Output active power": 0,
    "potentiallySuperseded": false
  },
  "interval": {
    "Input 1 current": 16
  }
} {}
2024-12-12 16:31:43,057 DEBUG -- si.sunesis.interoperability.lpc.transformations.transformation.TransformationHandler --  Publishing message to topic: capwatts with message: {
  "lastUpdateTime": 1734021103054,
  "EventStatus": {
    "Grid frequency": 5001,
    "Output active power": 0,
    "potentiallySuperseded": false
  },
  "interval": {
    "Input 1 current": 16
  }
} {}
2024-12-12 16:31:43,058 DEBUG -- si.sunesis.interoperability.nats.AbstractNatsRequestHandler --  Publishing message: {
  "lastUpdateTime": 1734021103054,
  "EventStatus": {
    "Grid frequency": 5001,
    "Output active power": 0,
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Portuguese Pilot – UC5: Hybrid storage performance and flexibility provision

KPI list and pilot expected values

ID	Name	Description	Target	Current Value
17	Data valorisation cases	Number of cases developed with data valorisation (for example including information about longevity, maintenance, pay-back or ROI,…)	4	4
18	HESS performance	Optimization in cost reduction / lifetime extension /energy supply due to HESS when compared to an ESS with only one single battery	>0%	>0%
10	IEEE verification	Number of assets successfully integrating the IEEE2030.5 standard	10	10
19	Data Spaces	Number. of shared services/files subscribed	20	20

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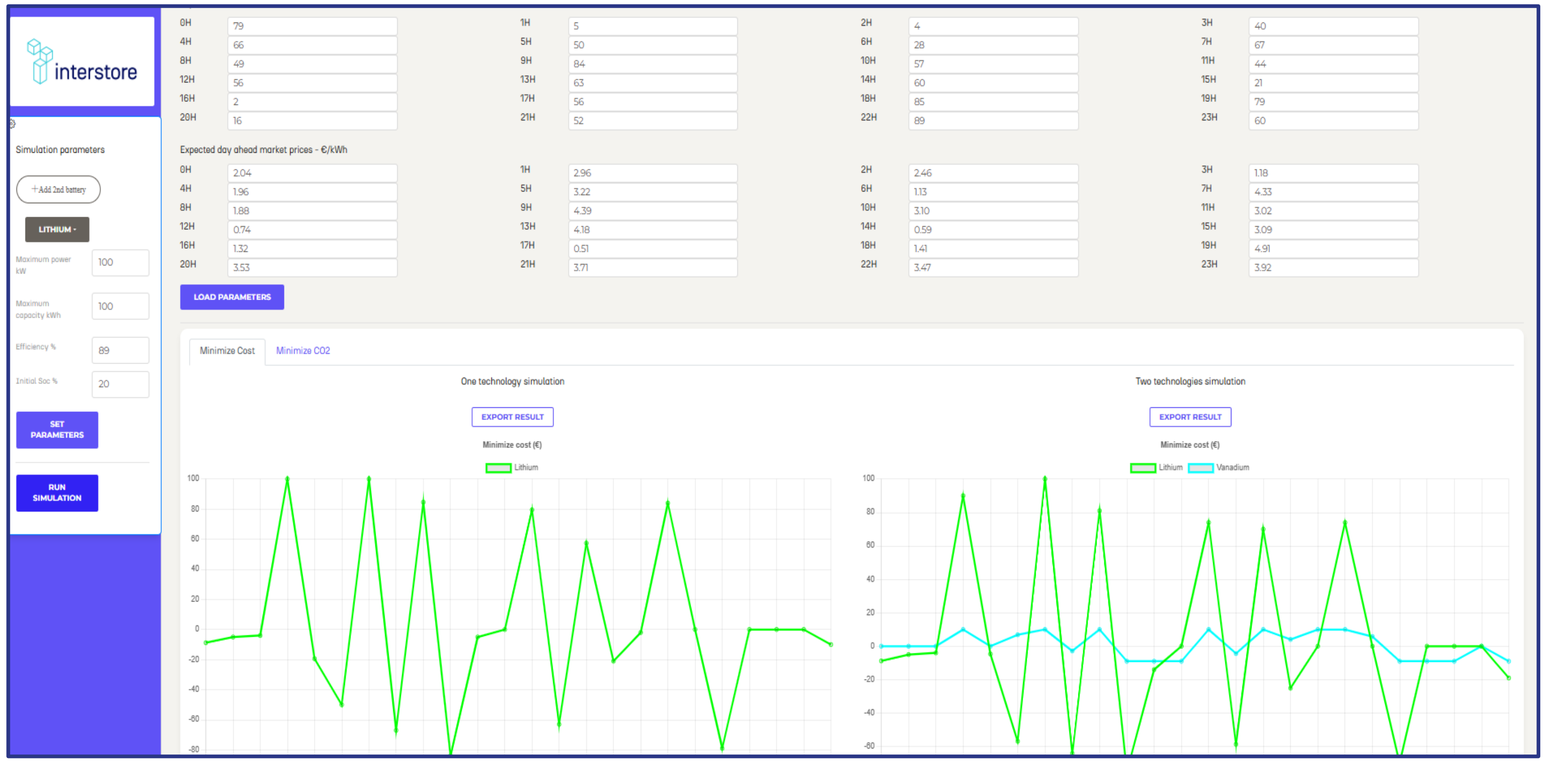
Portuguese Pilot – UC5: Hybrid storage performance and flexibility provision

- UC05 – Preliminary Results

- InescTEC is publishing everyday the optimal cost dispatch of the Hybrid storage system
- CapWatt is sharing with InescTEC the data from the actual Battery Operation
- InescTEC compares the cost of both dispatches

- WebApp of the InescTEC algorithm



http://interstore-dev.inesctec.pt:3000/admin/home

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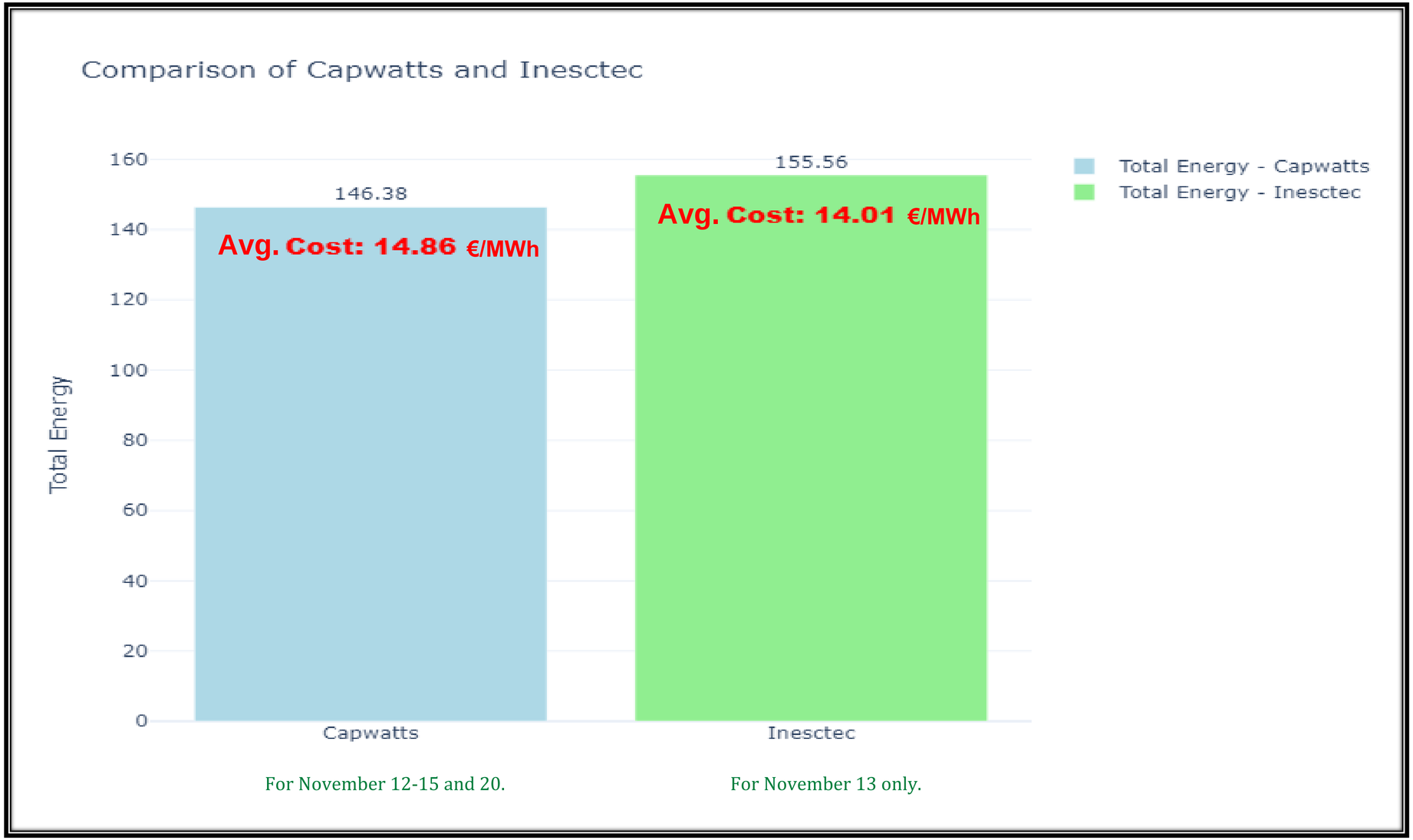
November 2024



For November 12-15 and 20.

For November 13 only.

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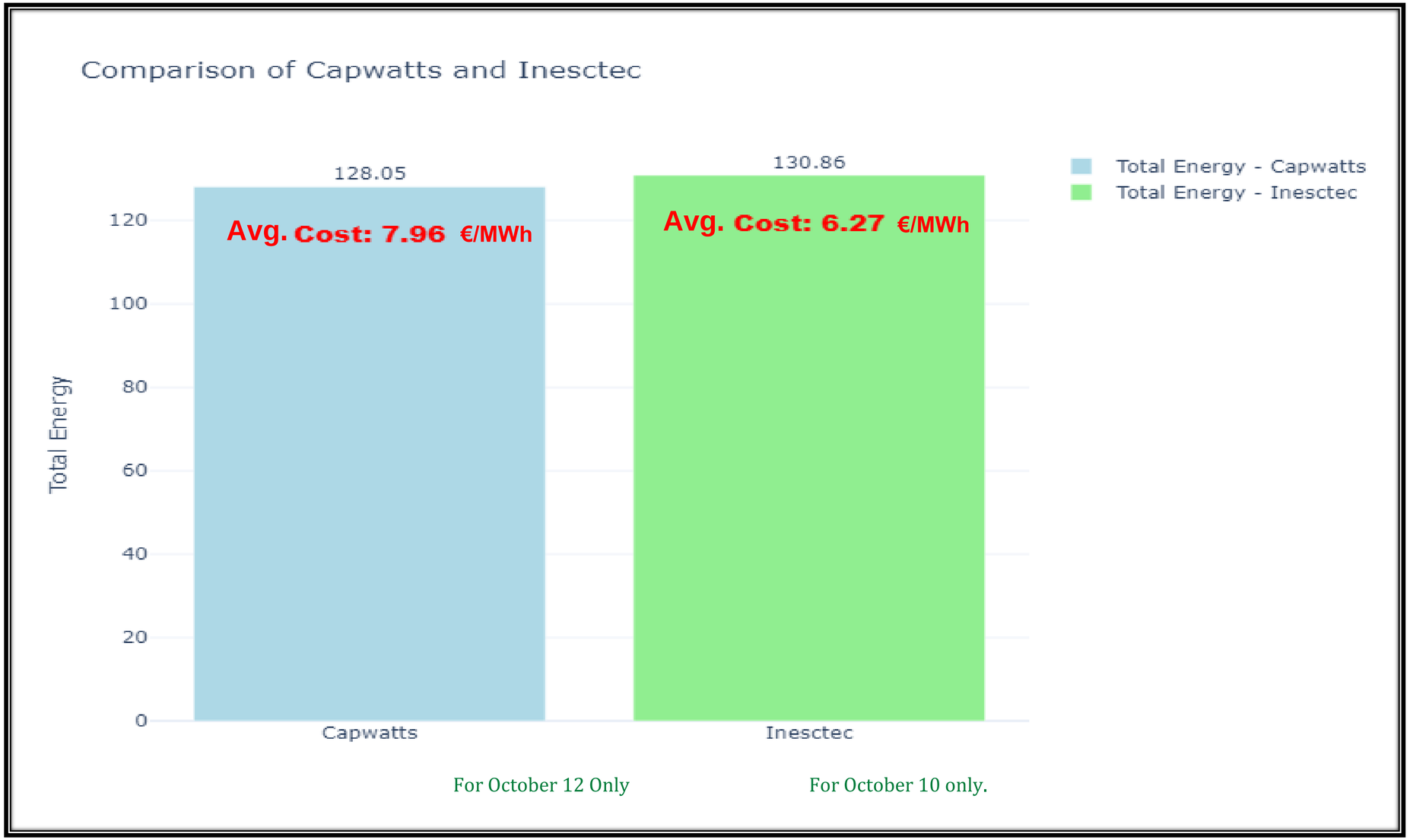
October 2024



For October 12 Only

For October 10 only.

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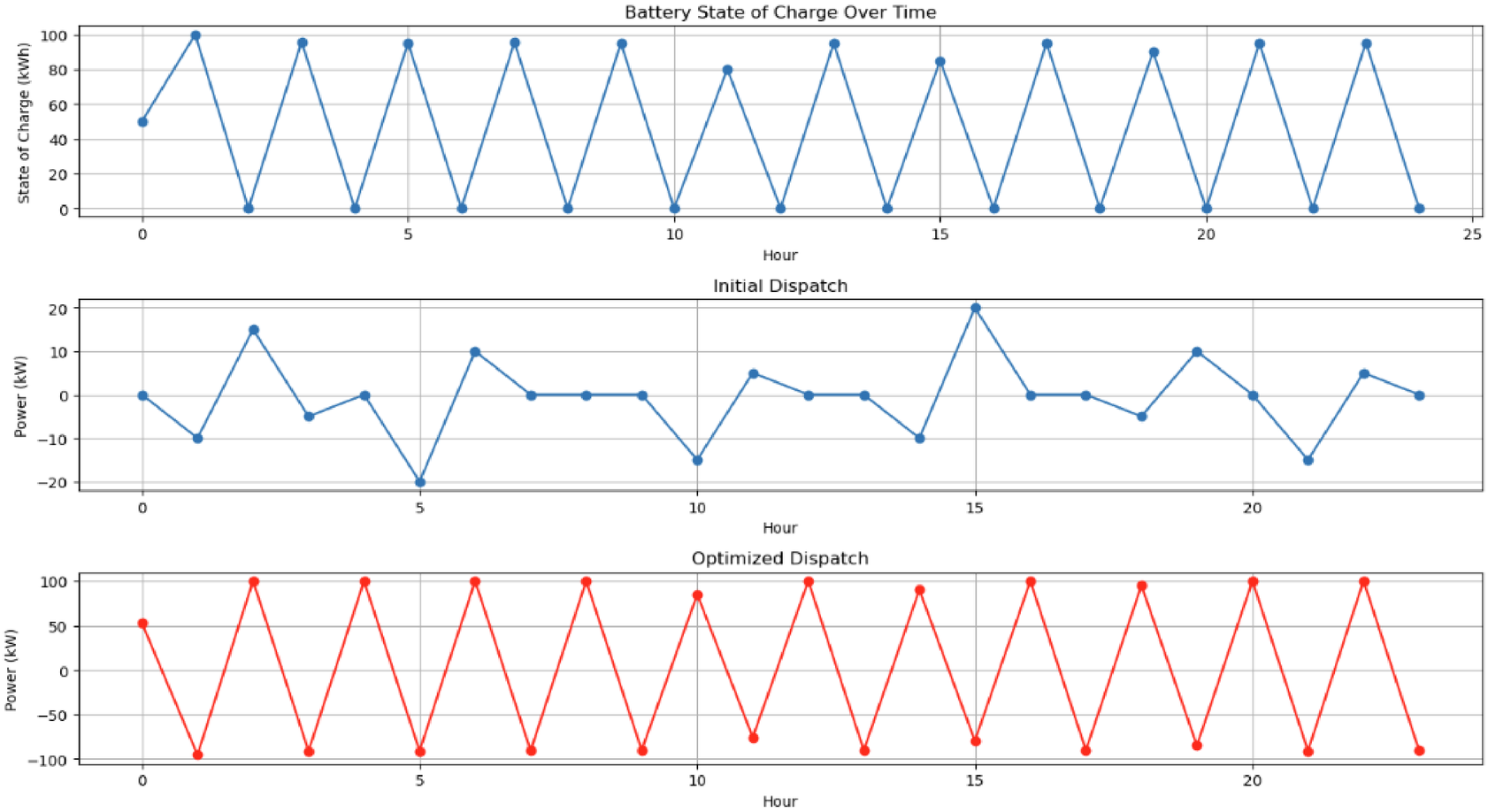
Portuguese Pilot – UC5: Hybrid storage performance and flexibility provision

Flexibility availability being assessed every day for both batteries based on the InescTEC dispatch and being made available as a service in the Data Space

```
Hour 23: Charge Flexibility = 0.00 kW, Discharge Flexibility = 90.49 kW, State of Charge = 0.00 kWh
```



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Portuguese Pilot – UC5: Hybrid storage performance and flexibility provision

- Success in deploying the IEEE2030.5 legacy protocol converter (LPC).
- In the assessed days, the optimal dispatch confirms lower prices for the Hybrid storage system
- Flexibility availability correctly assessed and to be shared with the Aggregator platform CyberNOC

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THANK YOU!

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Alexandre Lucas (INESCTEC), alexandre.lucas@inesctec.pt

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IEEE2030.5 InterSTORE version applied in real use case: Pilot Demonstration results – Spanish Pilot, GridLab in Valencia

Elyas Rakhshani, HESStec

20 January 2025,
Microsoft Teams

HYBRID ENERGY STORAGE SOLUTIONS

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Spanish Pilot

HESStec Lab facilities in Valencia

- 1.5 MW of connected power systems
- Circulating capacity up to 500 kW with hybrid storage (Battery+UCAP)
- Managed by the INMS® as EMS platform
- Flexible platform emulating different type of events/scenarios

Objectives:

1) Demonstration of High-Impact Use Cases: UC4 and UC7 for testing **the IEEE2030 protocol and LPC on HESS platform providing fast (high-power) services.**

2) Integration of different Distributed Energy Resources (DER)

3) Hybrid Energy Storage Solutions

4) Development of Hybrid Distributed Energy Management Systems (HyDEMS) with new interoperable toolkit including SoF.

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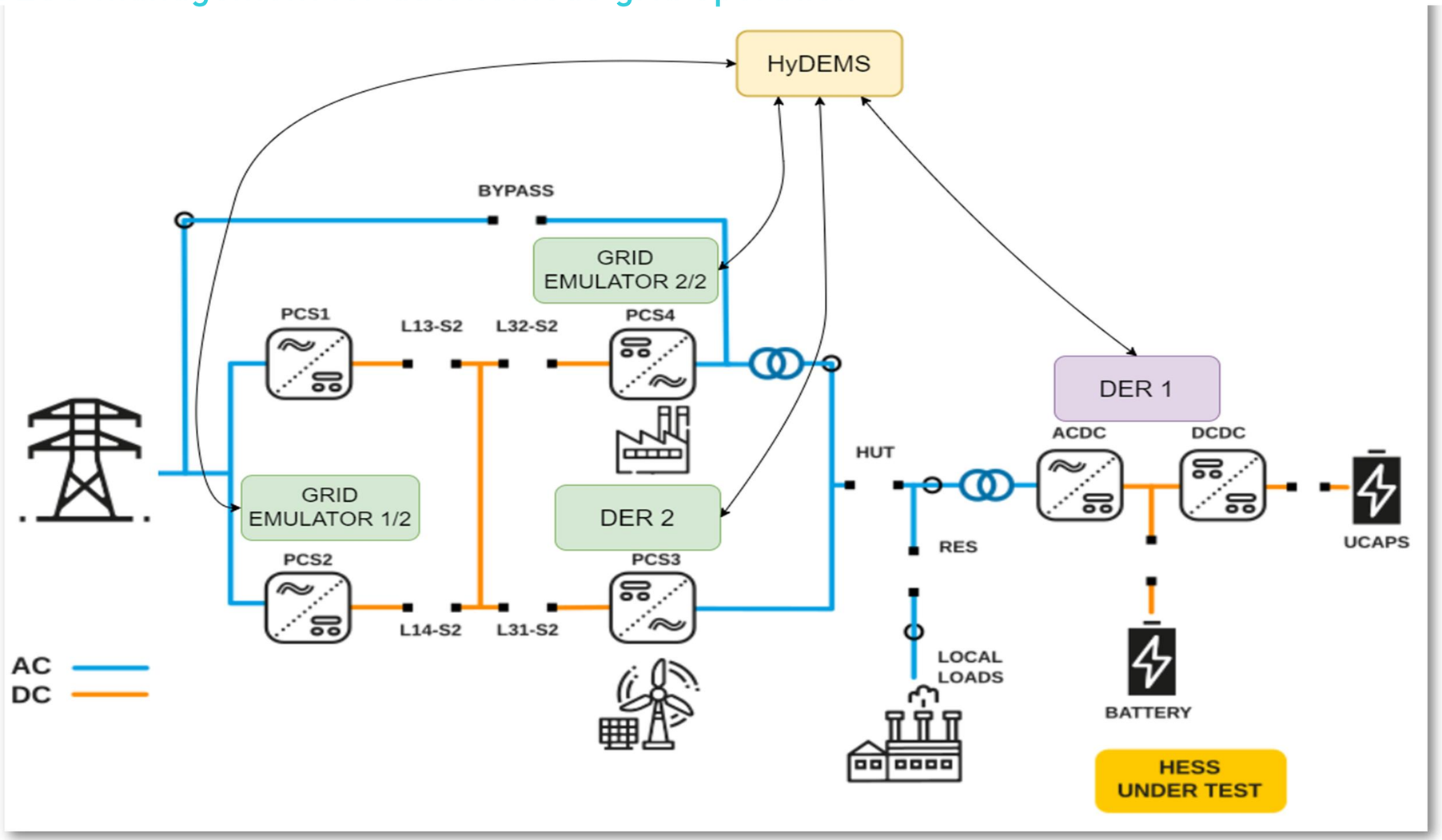
Advanced Grid Lab – Spain (HESStec)

- UC7: Adaptive BESS management for autonomous grid operation



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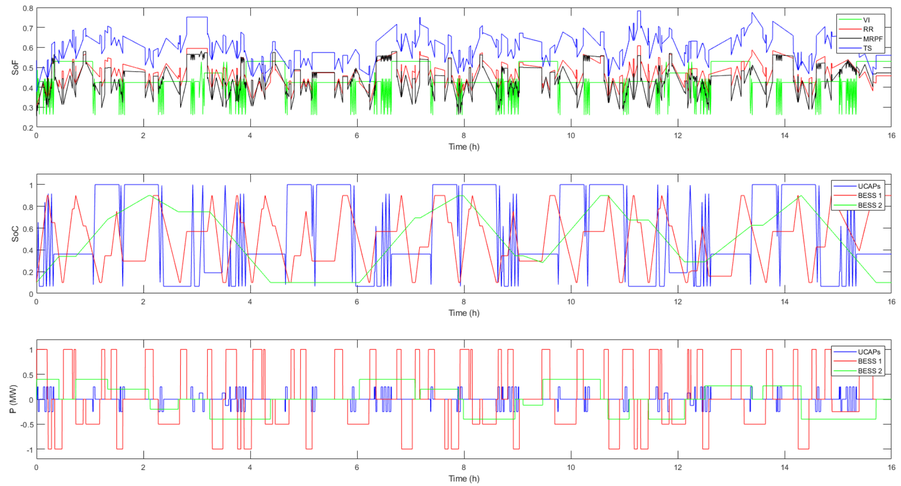
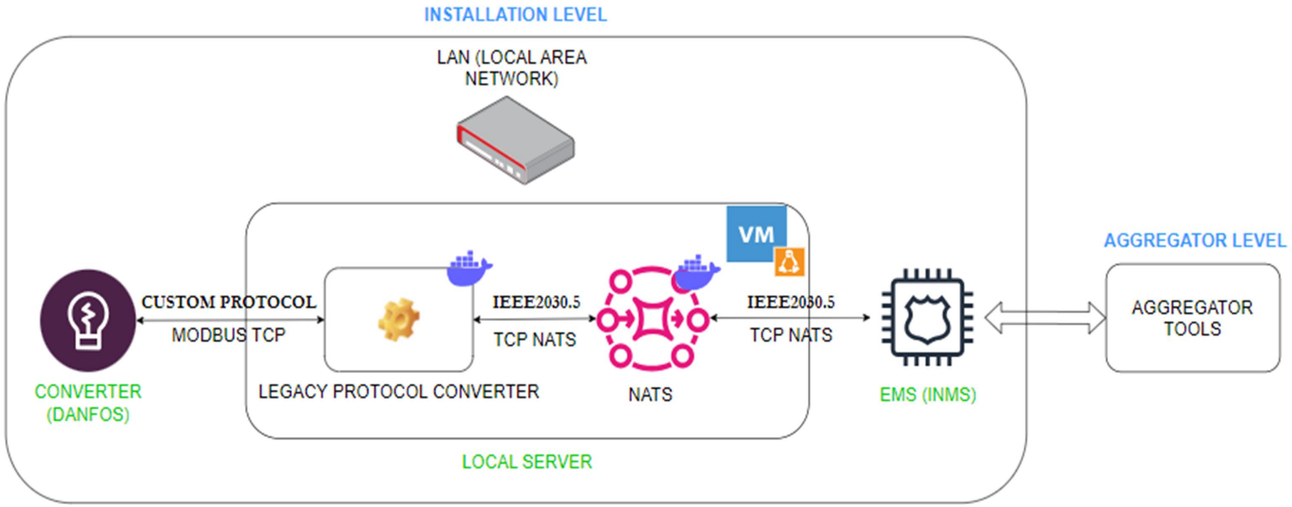
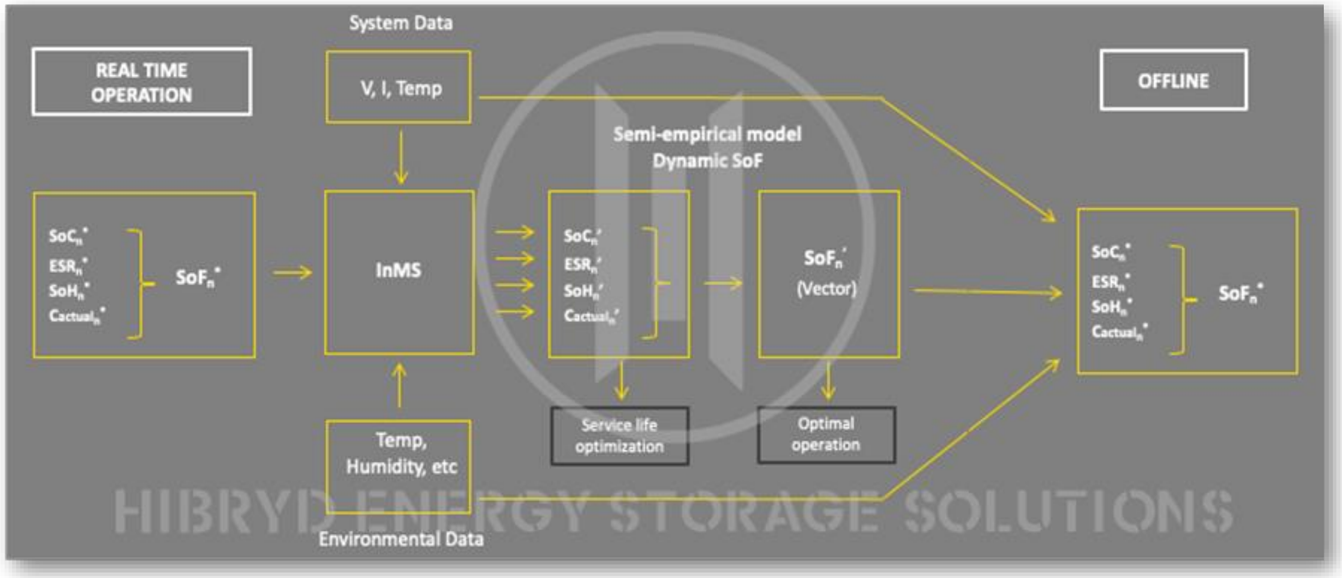
Advanced Grid Lab – UC7

Overview of activities and developments

1. Site developments and necessary software updates successfully finished.
2. Bidirectional LPC architecture is deployed and tested.
3. Current focus:
   - ✓ Real time monitoring is enabled.
   - ✓ Hybridization with UCAP and Batteries is ready.
   - ✓ Developments of interoperable toolkit with SoF is under progress.

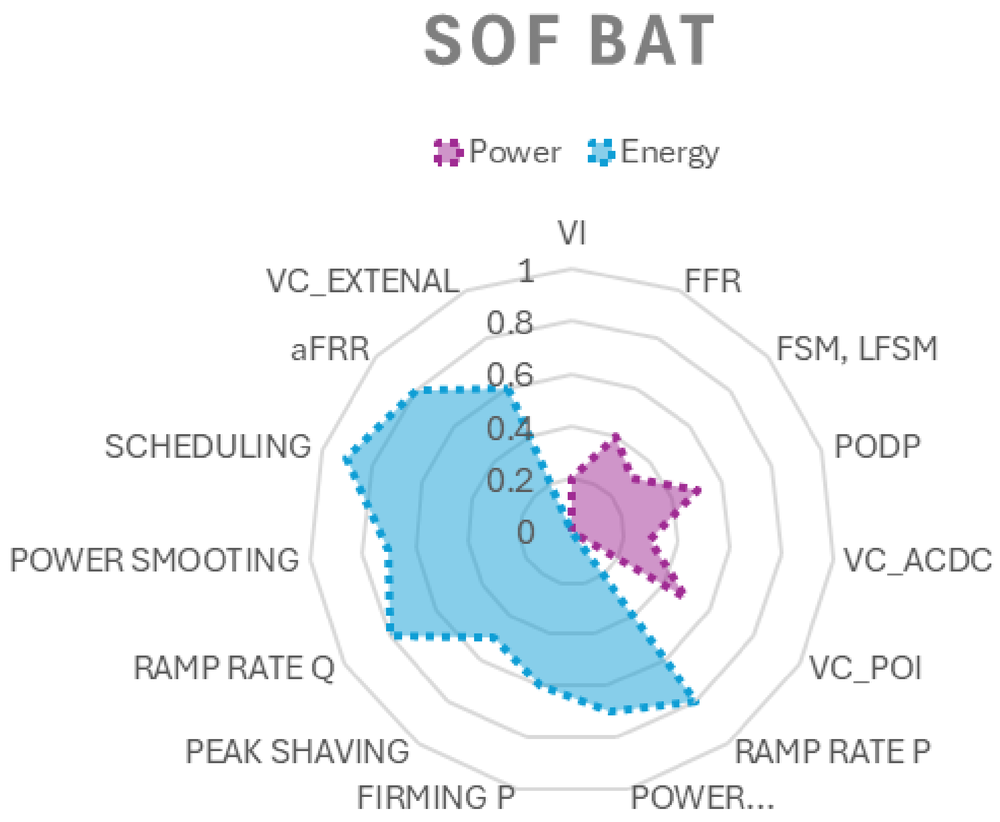


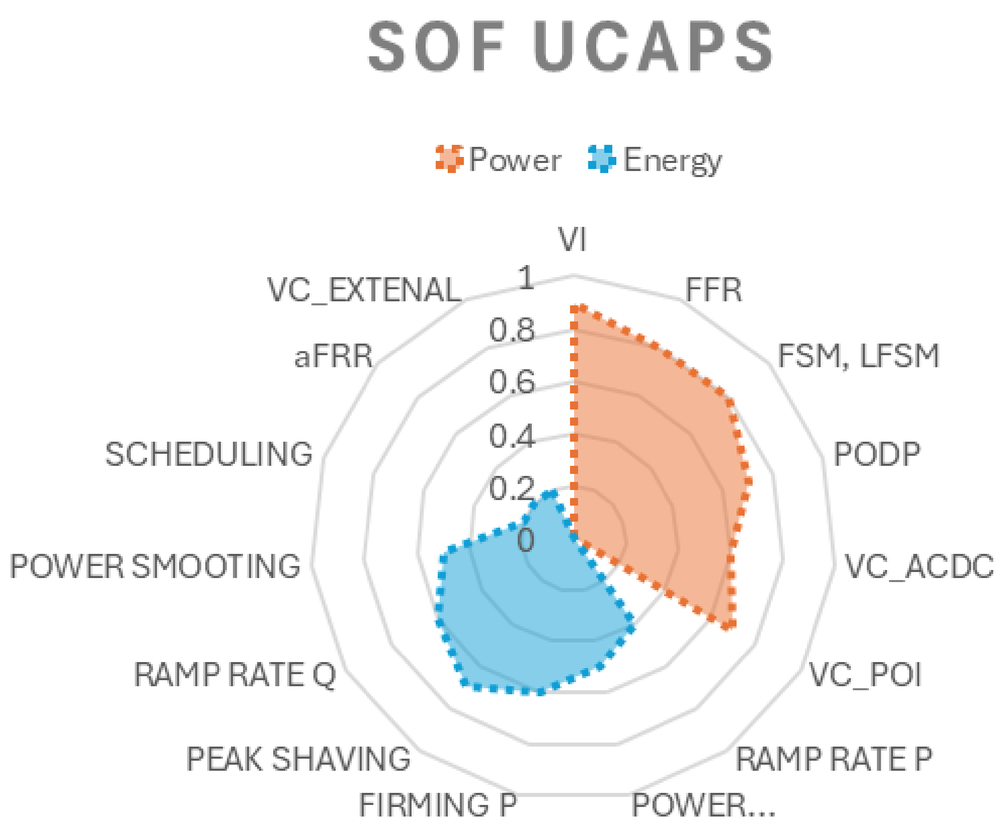




Spanish Pilot

- ✓ **SoF implementation for different services:**





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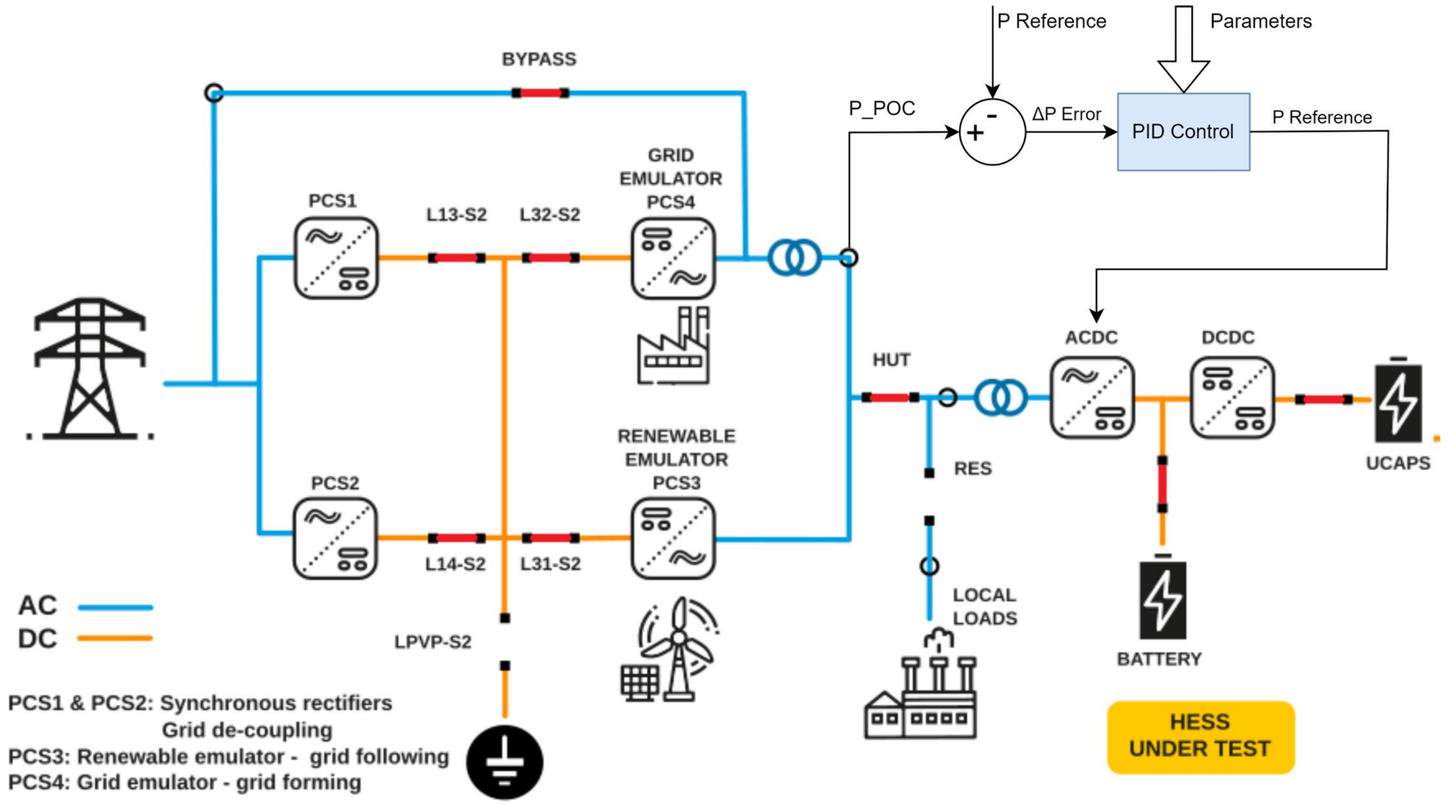
Spanish Pilot

T3.3 FPS test at the platform level

Service objectives:

- Fix the Power at the POC.
- Measure the transient in POC.
- Compare power measure signals using LPC and HESStec approach.



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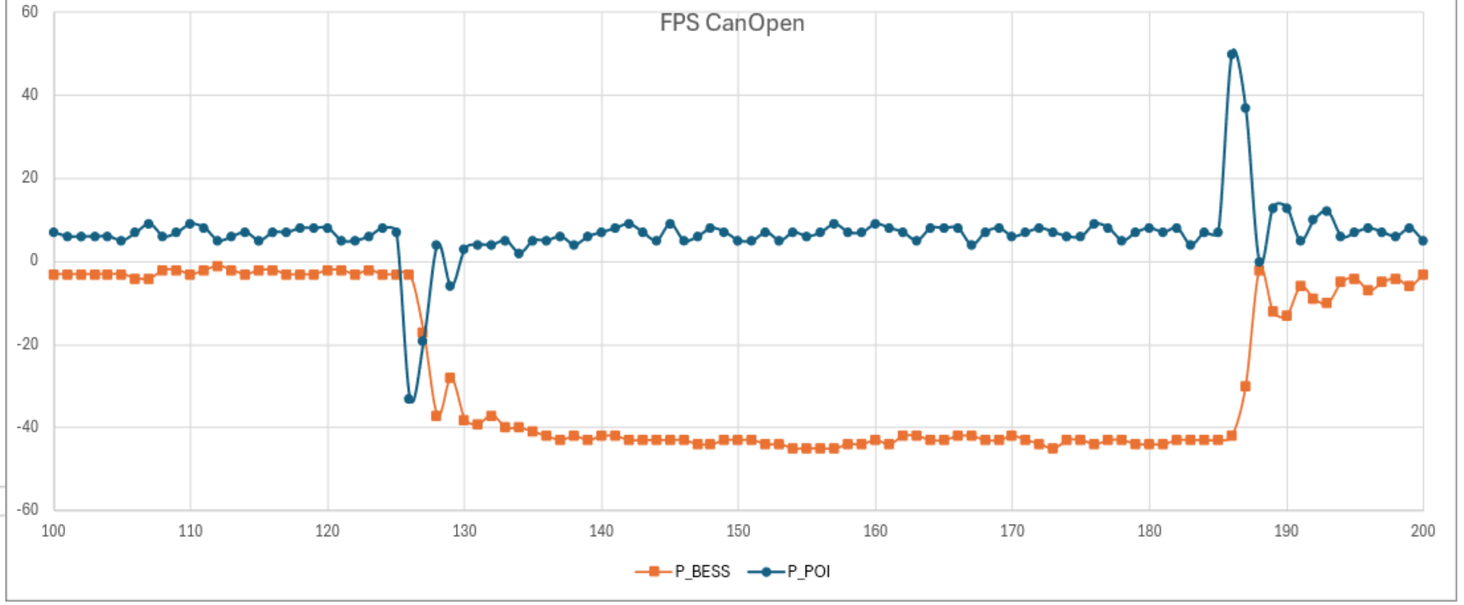
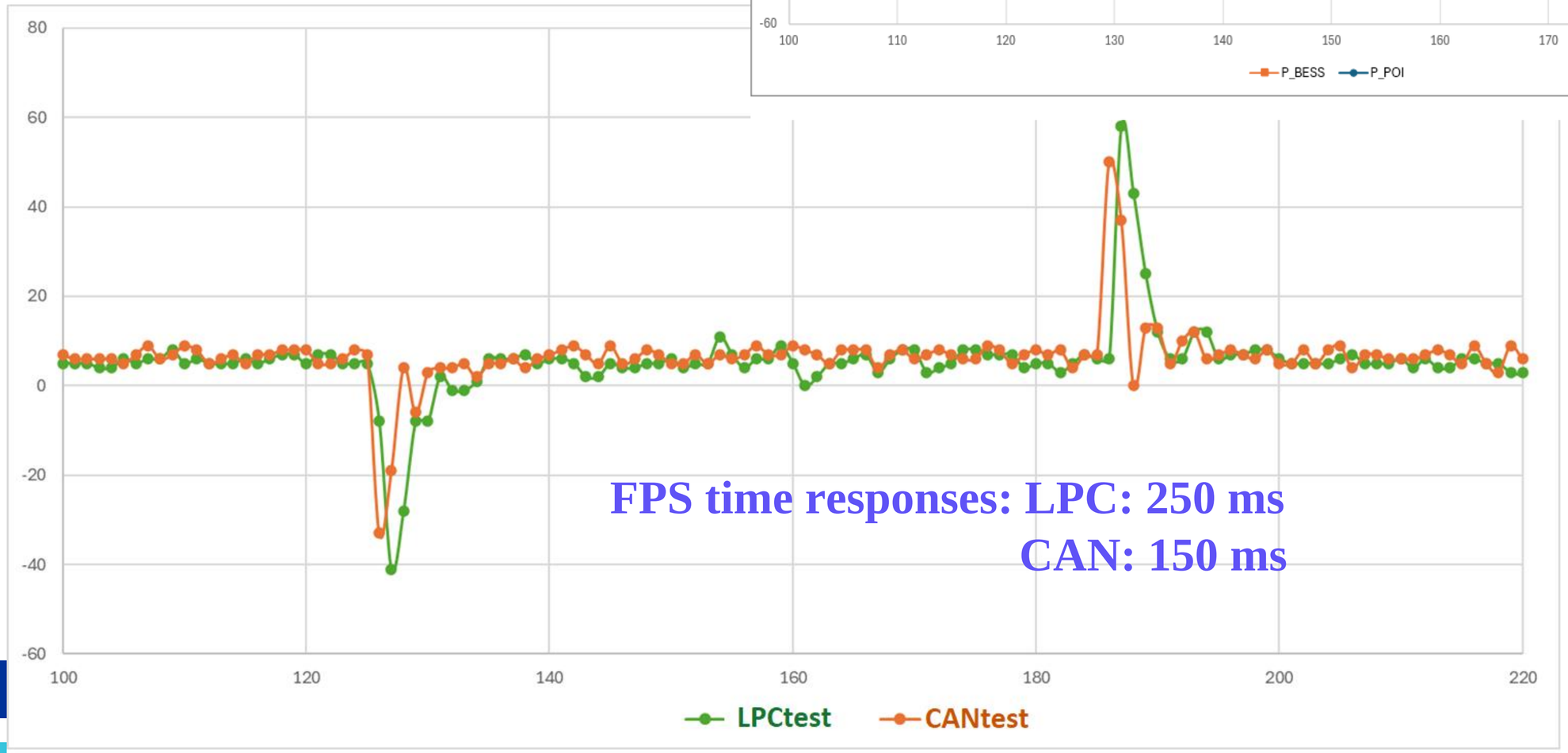
Spanish Pilot

T3.3 FPS test

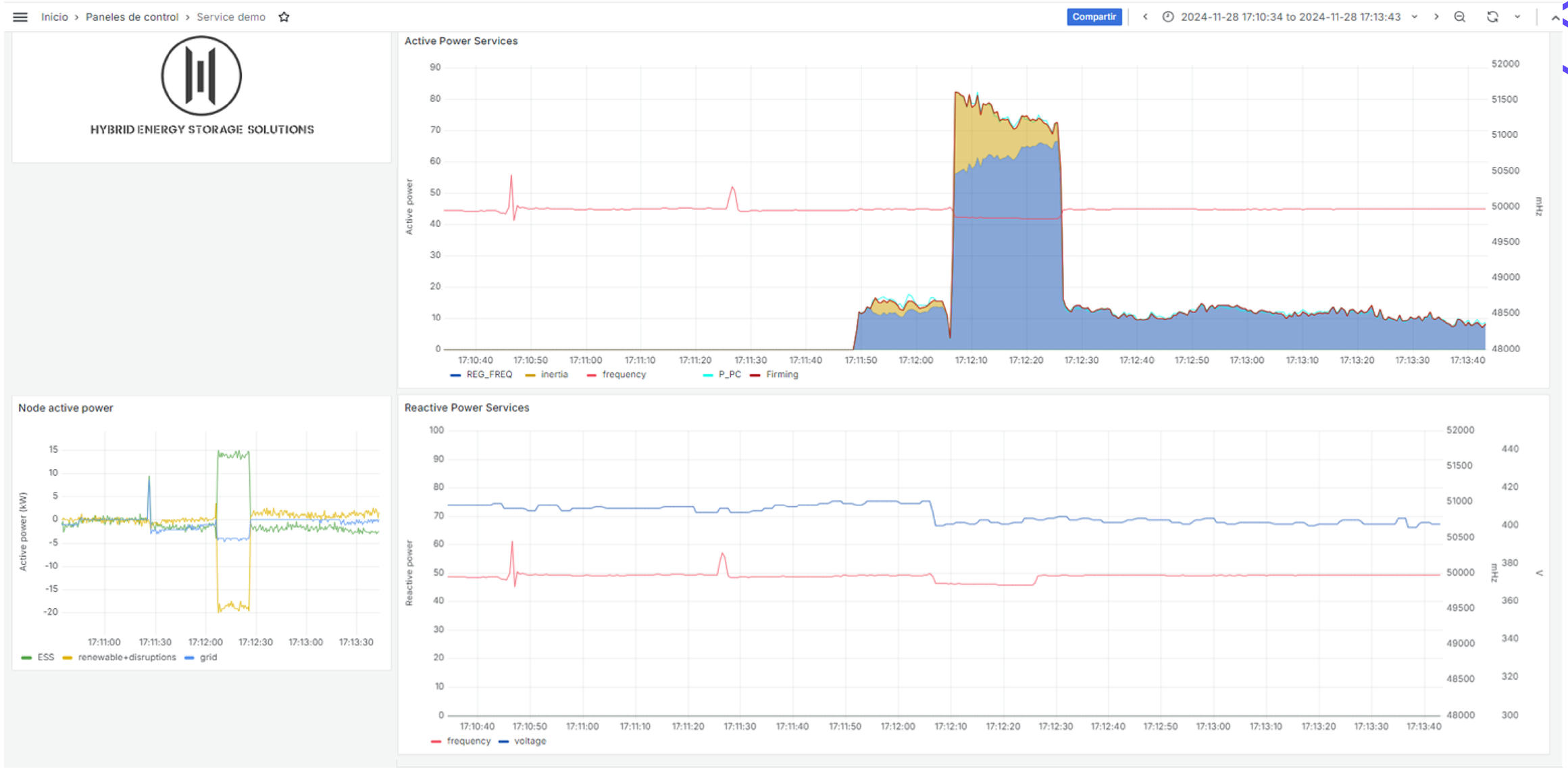




FPS time responses: LPC: 250 ms
CAN: 150 ms

Spanish Pilot

✓ **Real time monitoring is enabled.**



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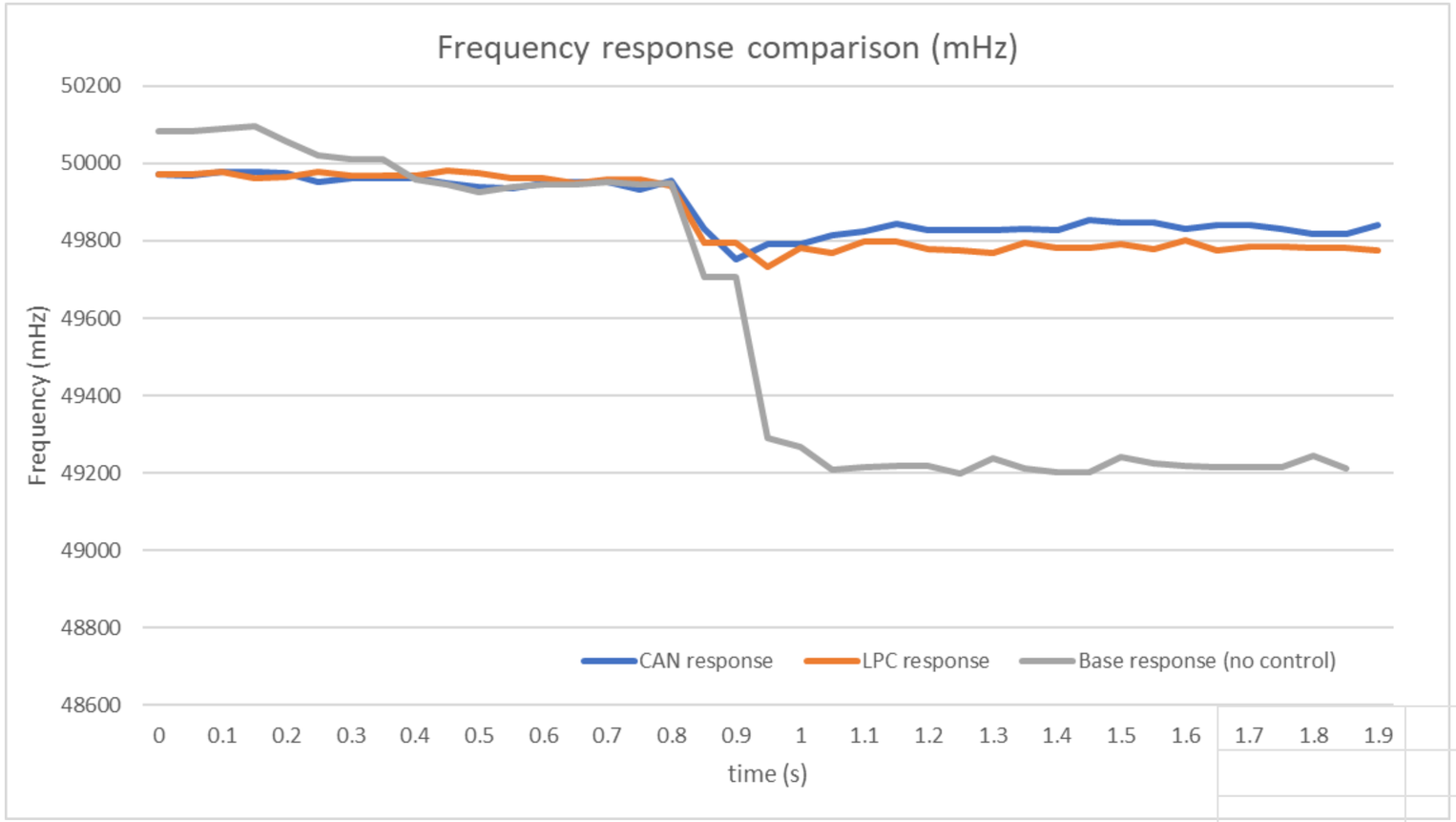
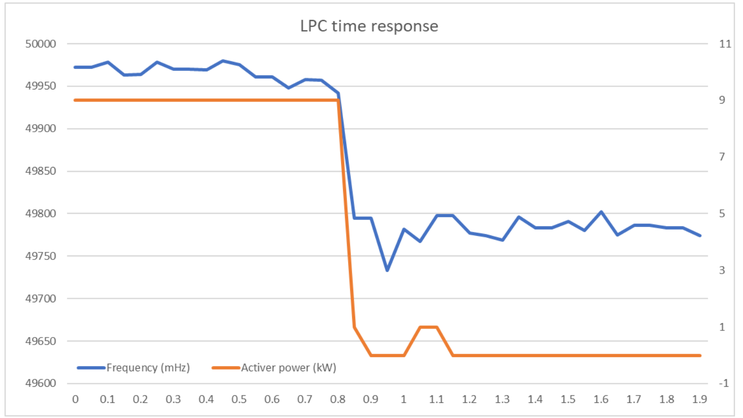
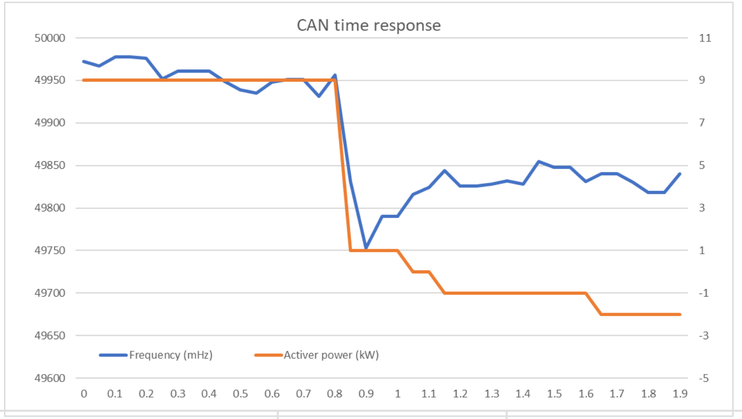
Spanish Pilot

T3.3 VI test







	CAN	Closed Loop
Time response (ms)	< 50	< 50
Nadir (Hz)	49.753	49.733
RoCoF in 0.5 s (Hz/s)	0.244	0.362

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PILOT NAME – UCx

KPI list and pilot expected values

KPI number	KPI Name	Pilot current value	Pilot expected Value	Comments
KPI3	Battery capacity	100 kWh	185 kWh	5.0104 kWh UCAP + 180 kWh for Battery
KPI4	Diversity of DER	2	2	DERS used and tested only in Grid Lab Valencia
KPI5	Asset management monitored by EMS	2	2	Assets in Grid Lab
KPI10	Number of DER assets and EMS tested with IEEE2030.5	1	1	DER1 with grid forming capability in UC7
KPI12	Time data savings	x	x	
KPI13	Monitoring	2	2	Number of monitored storage devices for SoF calculation
KPI14	Time response	0.5 s	0.25 s	total time response for fast services, VI, PFR, PFR
KPI15	System NADIR	49.5 Hz	49.75 Hz	Nadir value for PFR test (or VI) using LPC
KPI16	System ROCOF	1 Hz/s	0.4 Hz/s	for VI test using LPC

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Stakeholder’s interaction session: Feedback on deployments, barriers, enablers of adoption and further use cases

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Q&A

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Wrap-Up

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