ISGA IT Solutions

Keep the Energy at the right place!

ENERGY KEEPER

H2020-LCE-2016-SGS
Grant agreement n° 731239.
EU contribution: 3,995,255 €
Duration : 01/2017 – 12/2019
Coordinator: Lithuanian Energy institute
www.energykeeper.eu

The overall aim of the EnergyKeeper project is to **design, develop and test** a novel, scalable, sustainable and cost competitive **flow battery based on organic redox active materials**. A **100kW** redox flow battery with a capacity of **350 kWh** will be constructed and equipped with an interoperable **Battery Management System** enabling plug and play integration into a **Smart Grid**.

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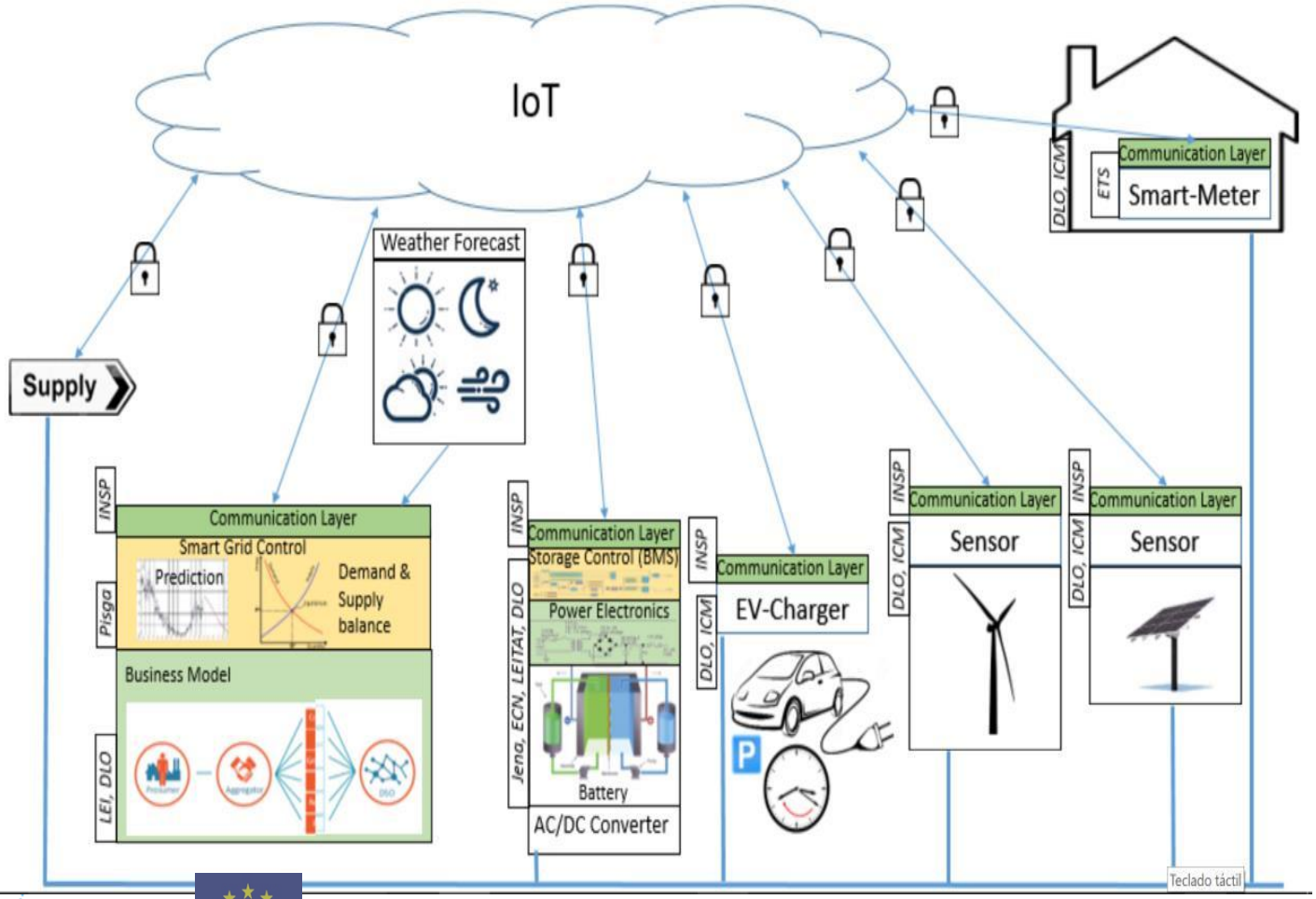
Sustainable Grid Storage Solutions



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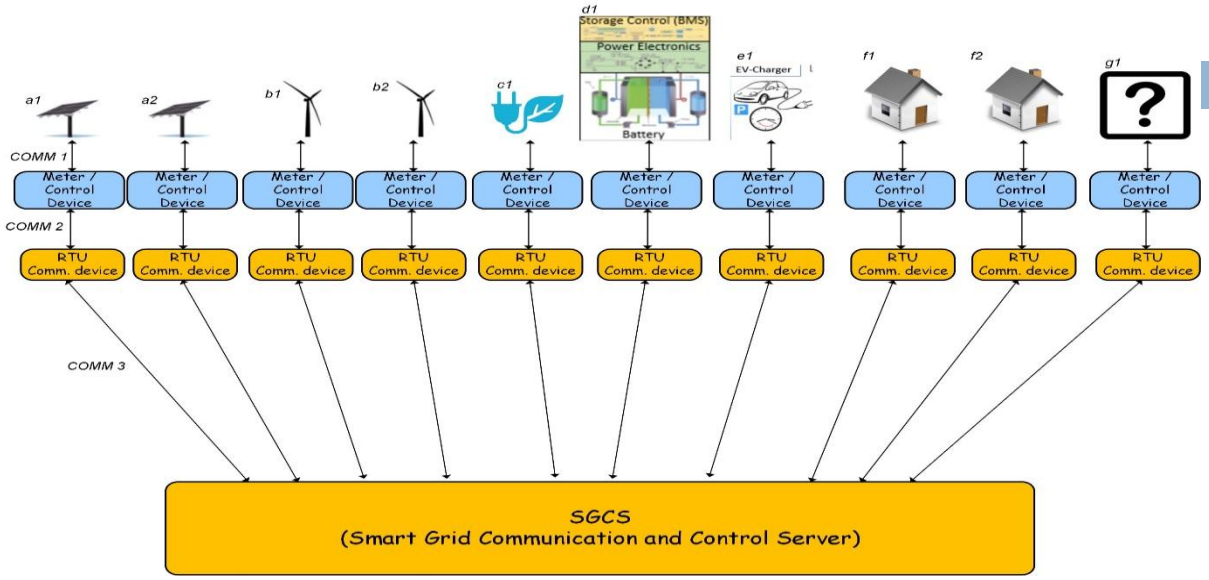
Acronym

Acronym or symbol	Explanation
SGCS	Smart Grid Control System
EES	Electric Energy Storage
GUI	Graphical User Interface
RES	Renewable Energy System
RTU	Remote Terminal Unit
SSL	Secure Socket Layer
TCP/IP	Transmission Control Protocol / Internet Protocol
MQTT	Message Queue Telemetry Transport

Overall system architecture



Local - COMM1 – Communication between a prosumer and metering/control device.
Short - COMM2 – Communication between metering/control device and RTU (Gateway)
Wide -COMM3 – Communication between RTU (Gateway) and SGCS (Smart Grid Centeral Server)

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Message Queue Telemetry Transport MQTT Protocol

- Communication between the central application and RTU‘s using open source MOSSKITO tool .

- Traffic between SGCS and RTU’s, based on MQTT broker managing all communication processes according MQTT standard .

- Each RTU is communicating with the server in TCP/IP Encapsulated MQTT Protocol. supportying Client and Subscriber modes and will attempt to connect on a predefined time intervals

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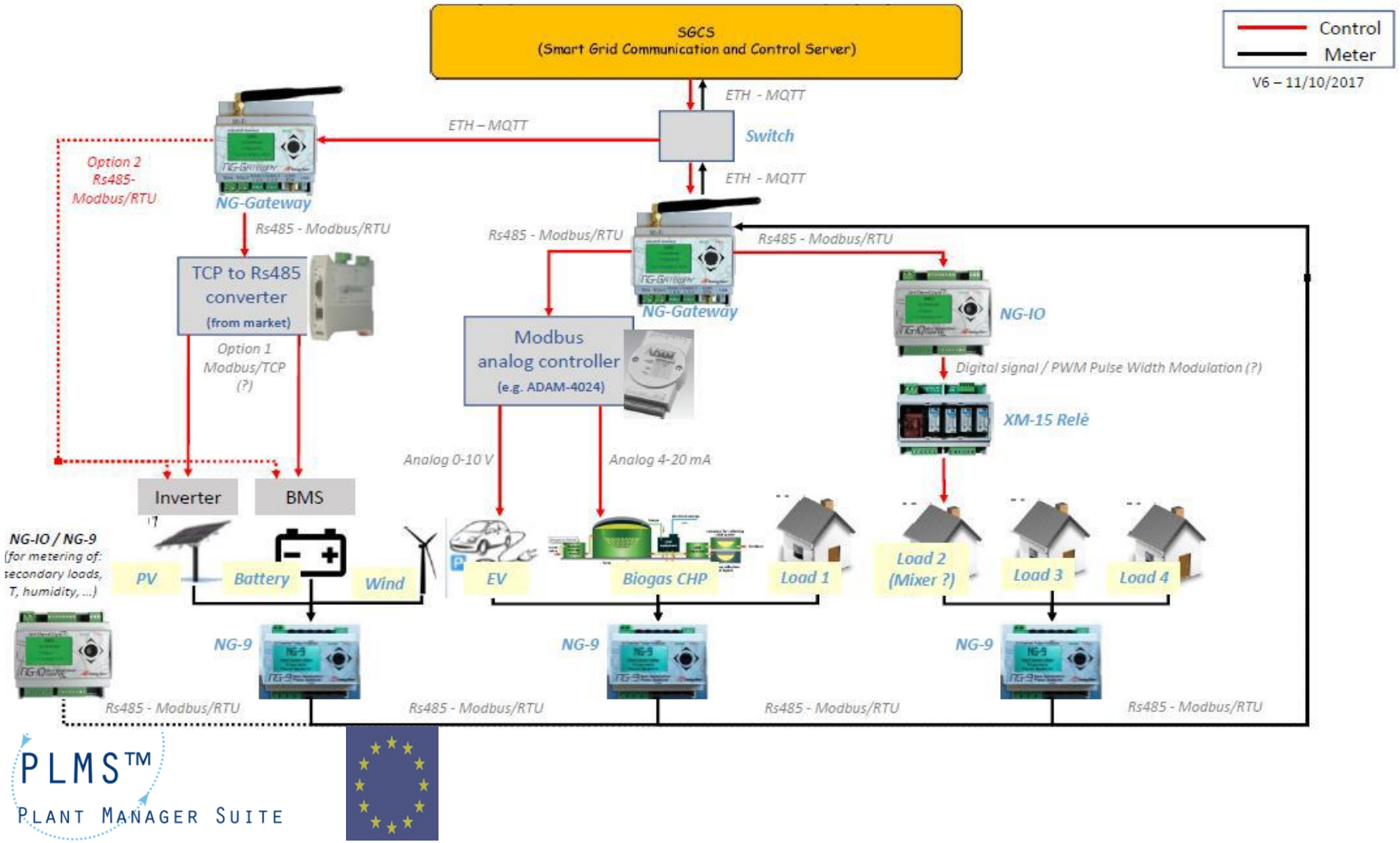
Test site deployment



Application major sections

SGCS main sections :

- **Communication server –**Connection with RTU's (Field Gateways) using the MQTT Over TCP/IP protocol.

- **Monitor and Control server** – Administration /Configuration tool, Monitoring tool, Users tool, Devices tool all with a Human Machine Interface (HMI).
- **Business Models services** – Implementation of the business logic algorithms.

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Communication

- Local Communication - RS485 and MODBUS RTU - All the local communications work with a RS-485 hardware physical layer and, on top of it, a standard MODBUS RTU communication protocol.
- Wide communications - Internet, using (MQTT) Message Queue Telemetry Transport over (TCP/IP) Transmission Control Protocol/Internet Protocol

MQTT - Messages Types

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MQTT 4 messages types:

- Instant Parameters
- Trend
- Historical Data
- Control Command

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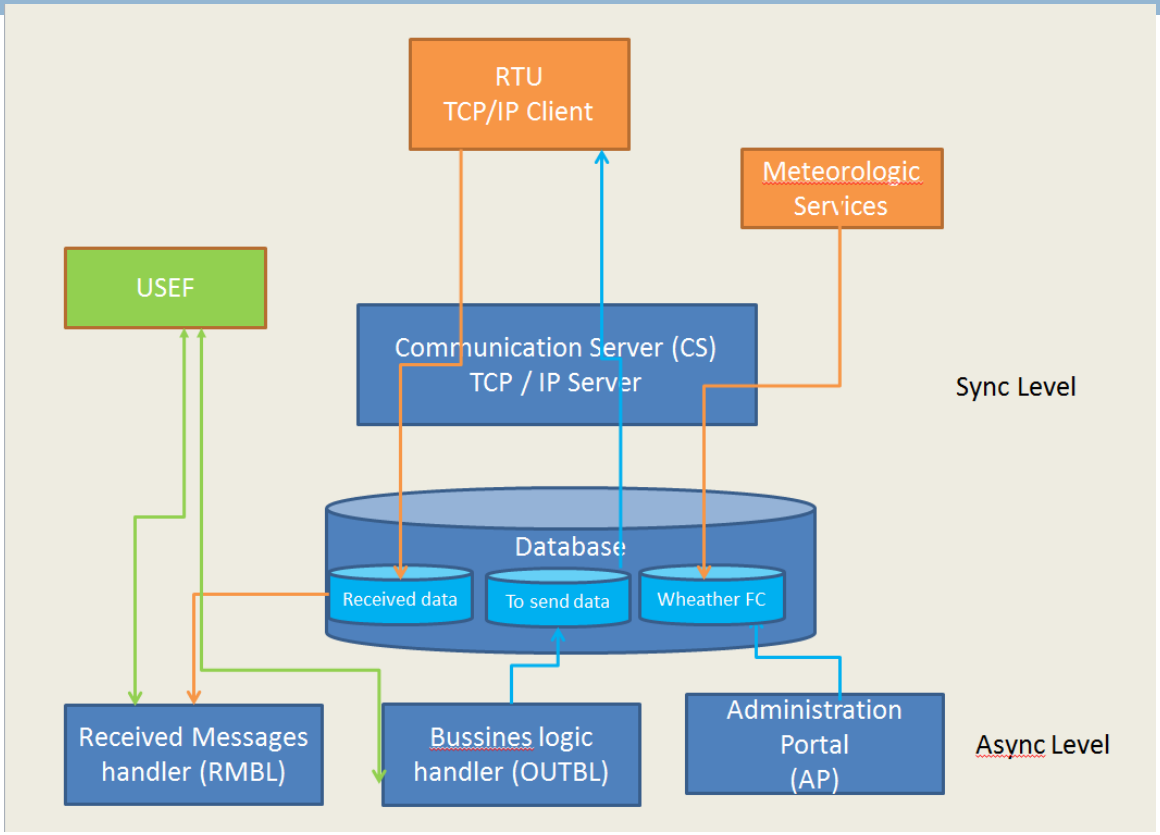
Smart Grid Control System Software blocks



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Software Blocks

RTU - communicate with the server in TCP/IP Encapsulated MQTT Protocol.

RTU will always be in Client mode and will attempt to connect on'a fixed Interval time.

CS - handling the traffic between SGCS and RTU's. On incoming messages. On outgoing messages the server is searching the Send data table for available messages to the RTU.

Database –. Received data and to send data. And sync processes to work in different levels of autonomy.

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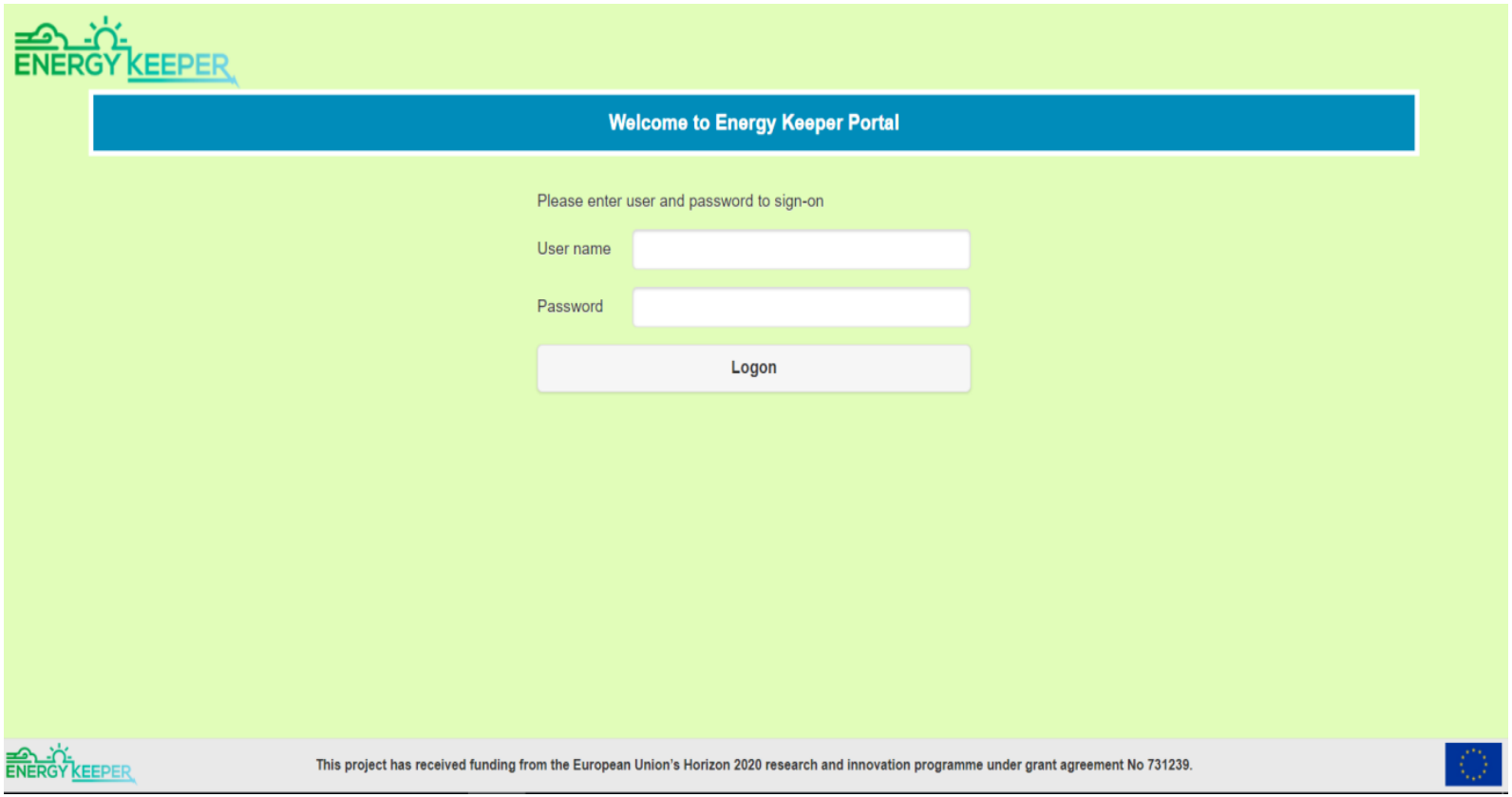
SGCS Login screen



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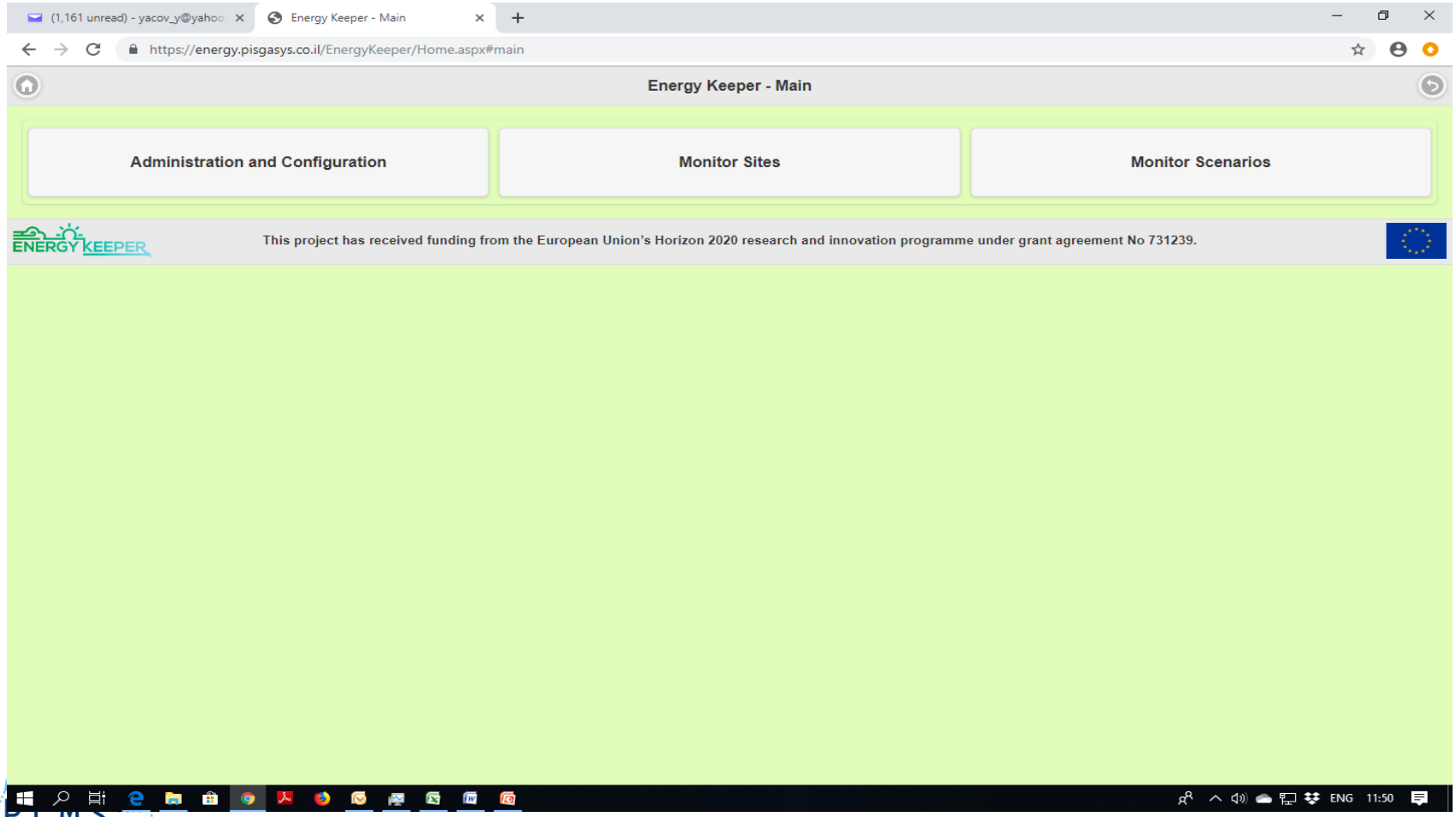
SGCS Main screen



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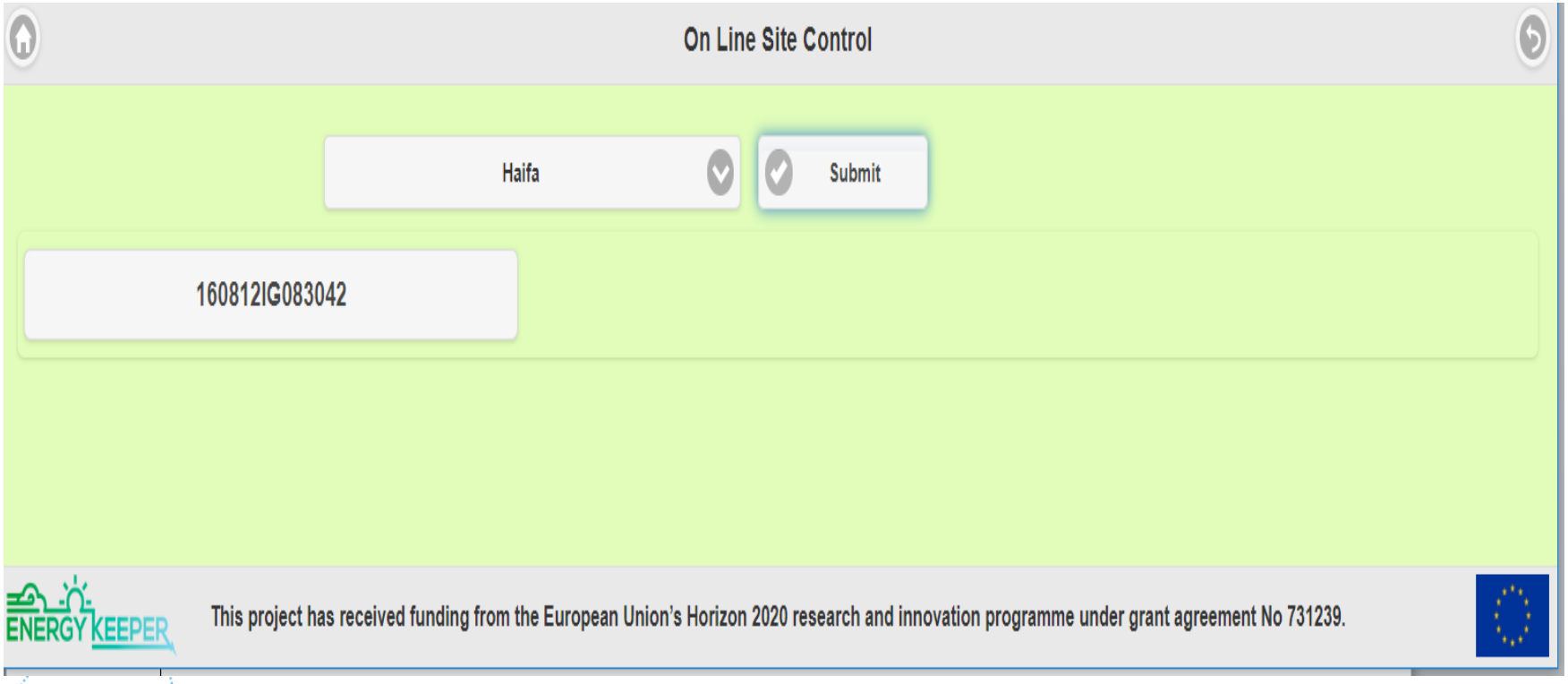
SGCS Select Gateway



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SGCS Select Device

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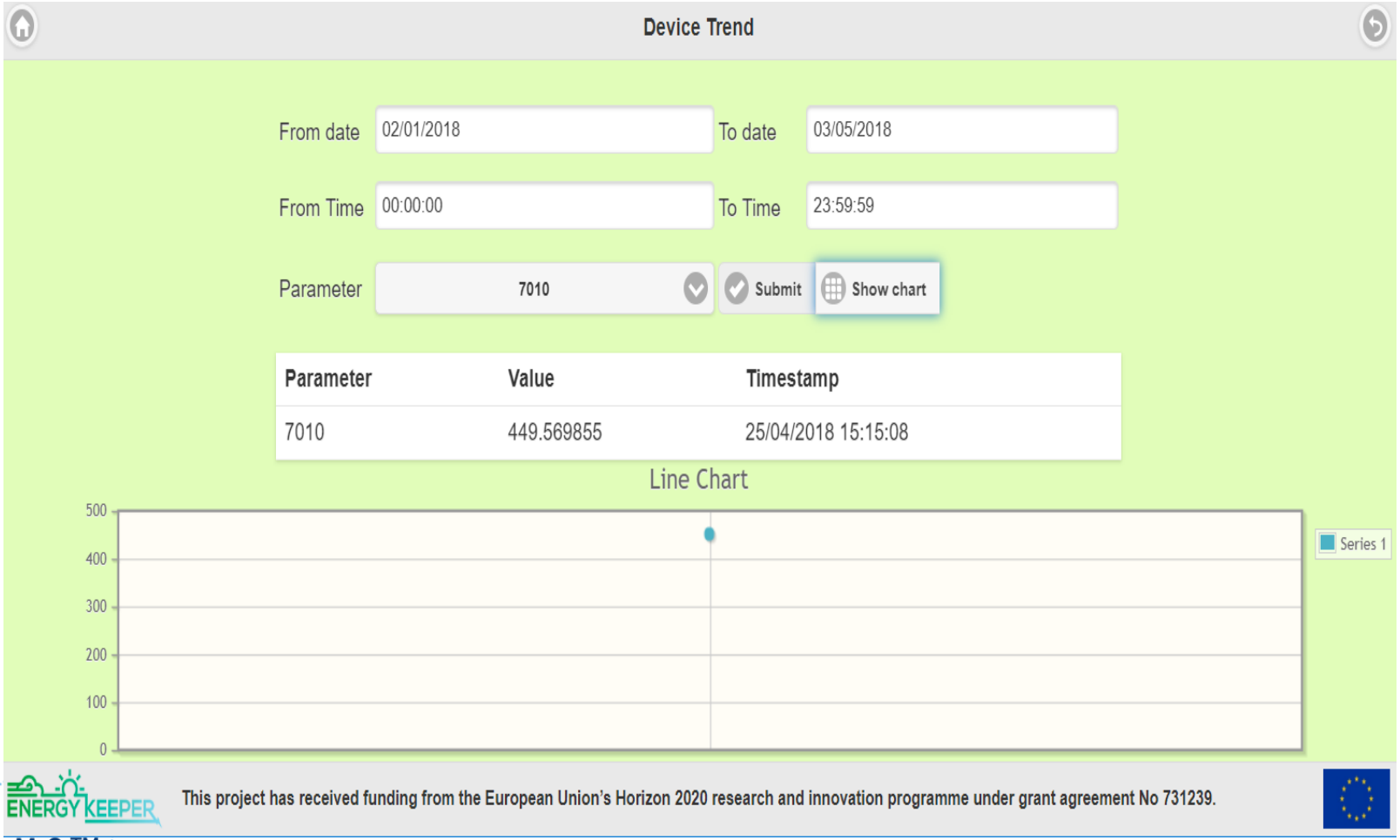
SGCS Device Data



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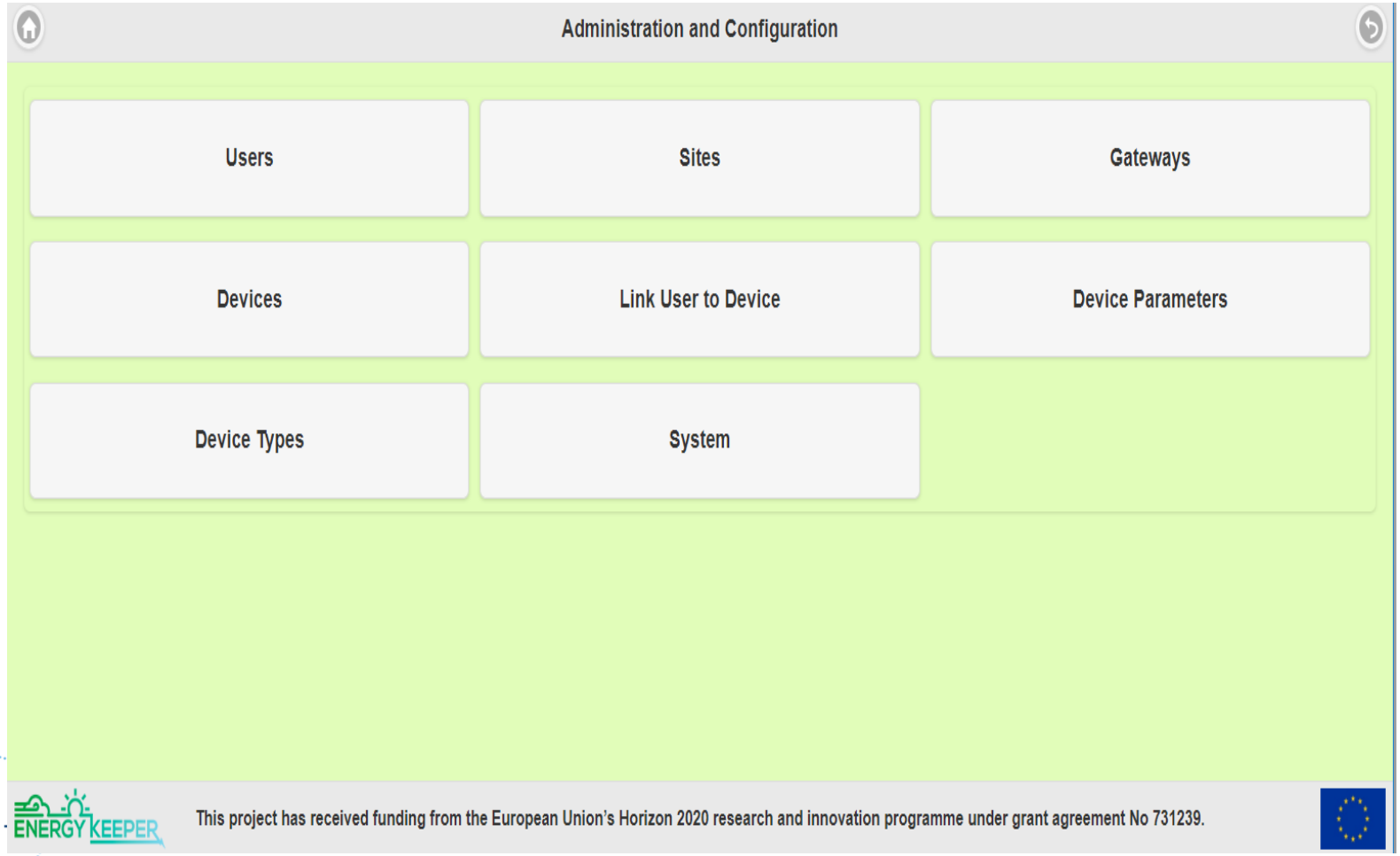
SGCS Administration Configuration



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Site Configuration

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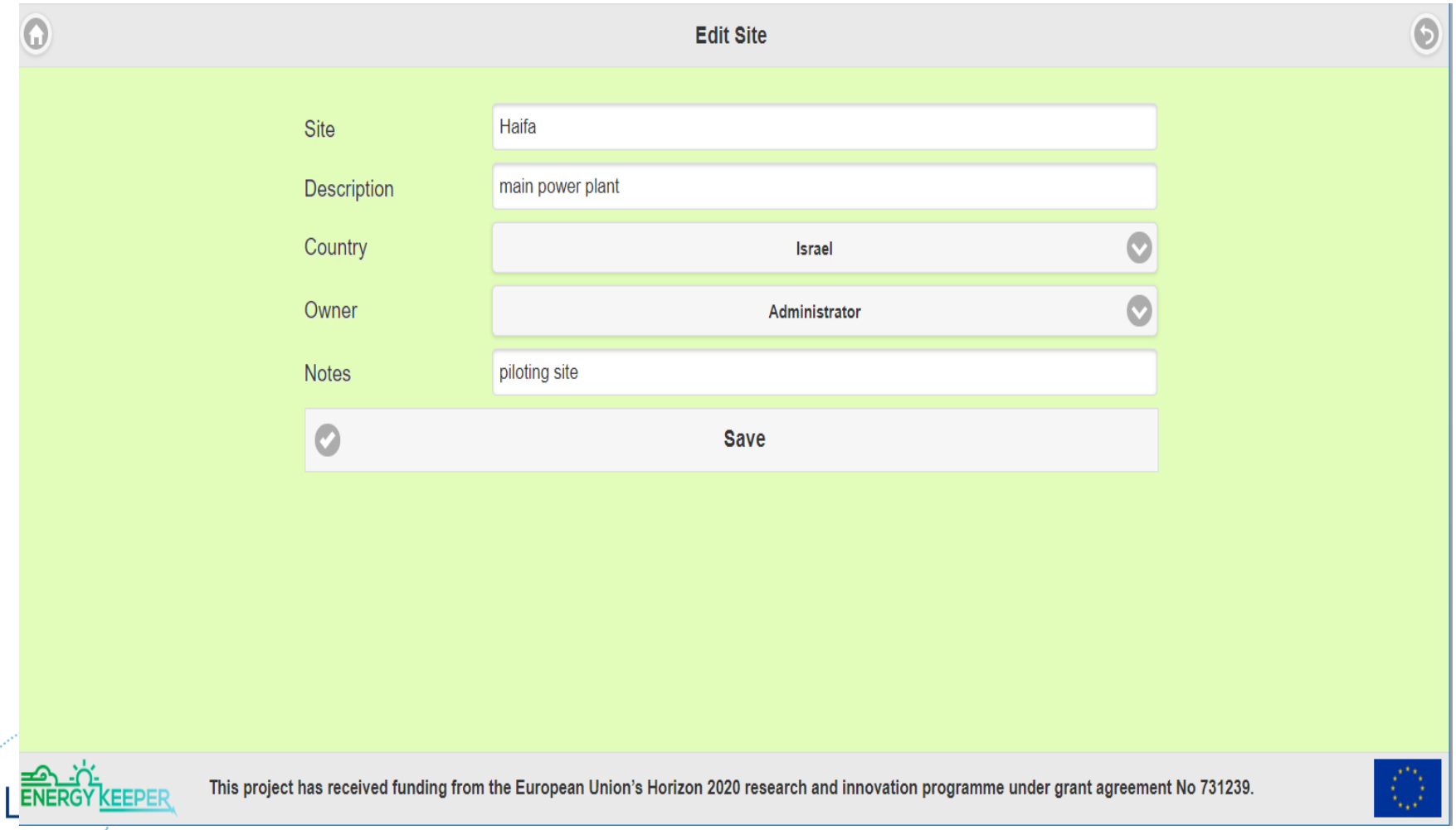
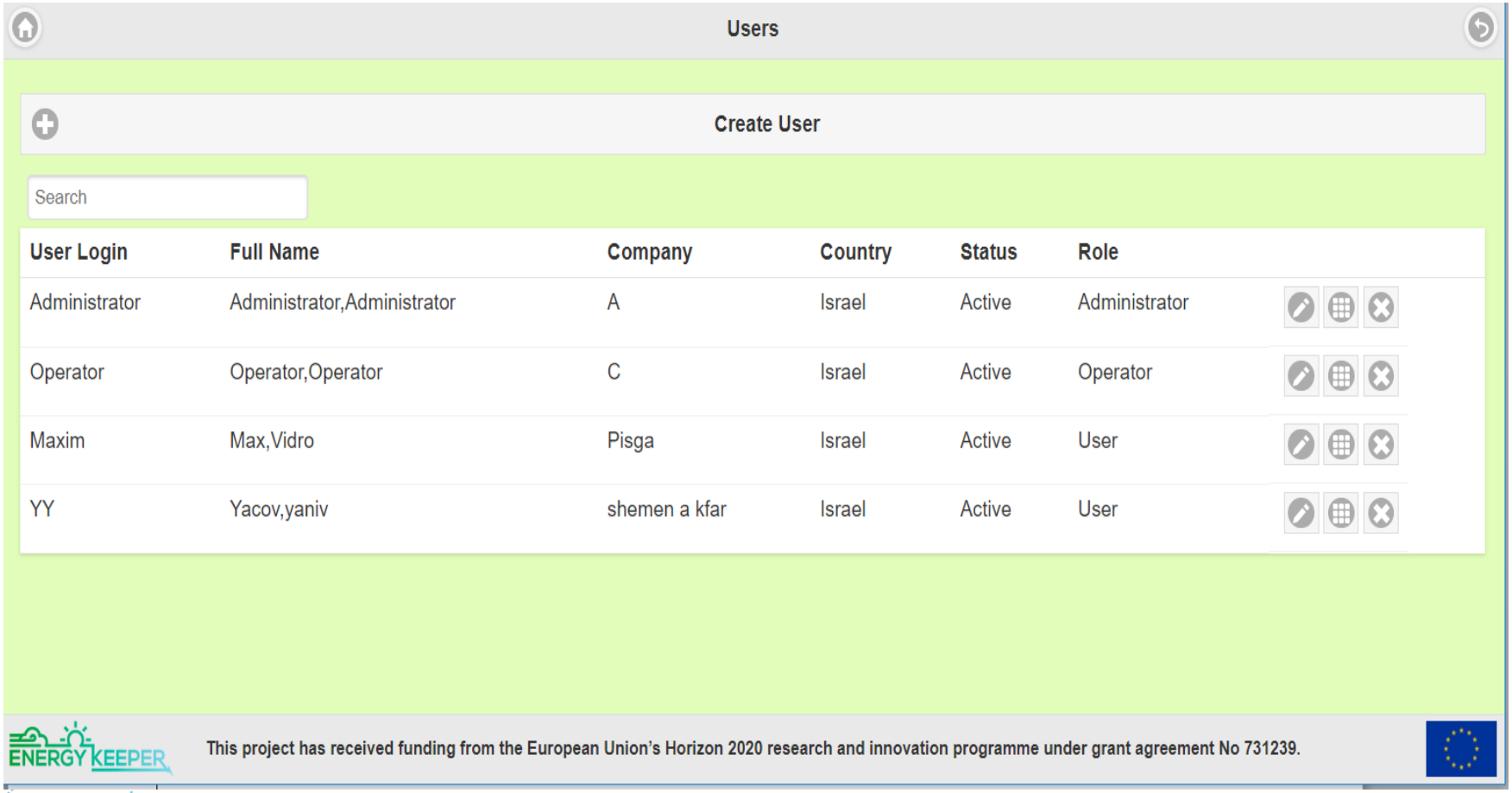
Site Edit



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 731239.

Users Configuration



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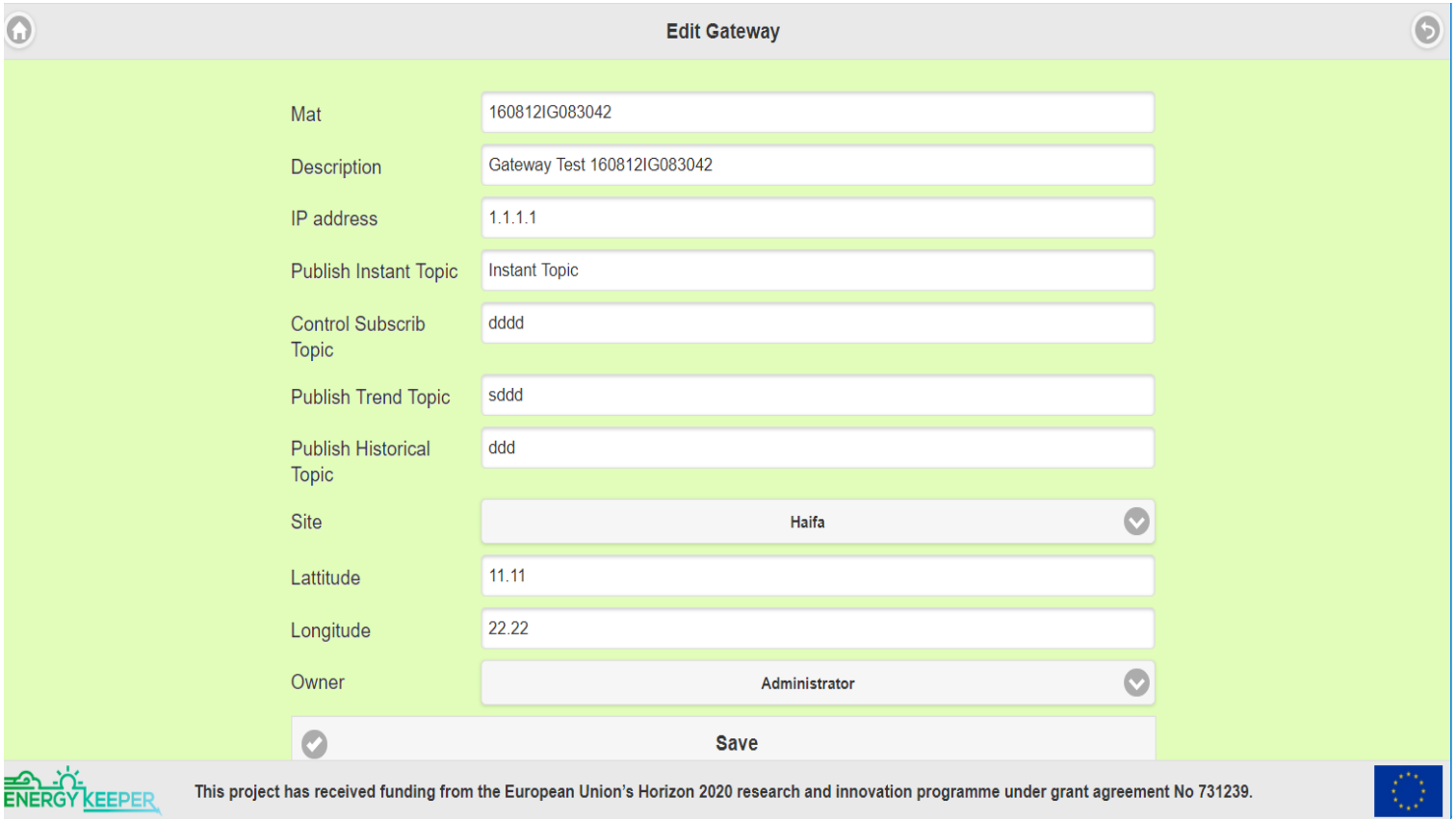
Gateway/site Edit



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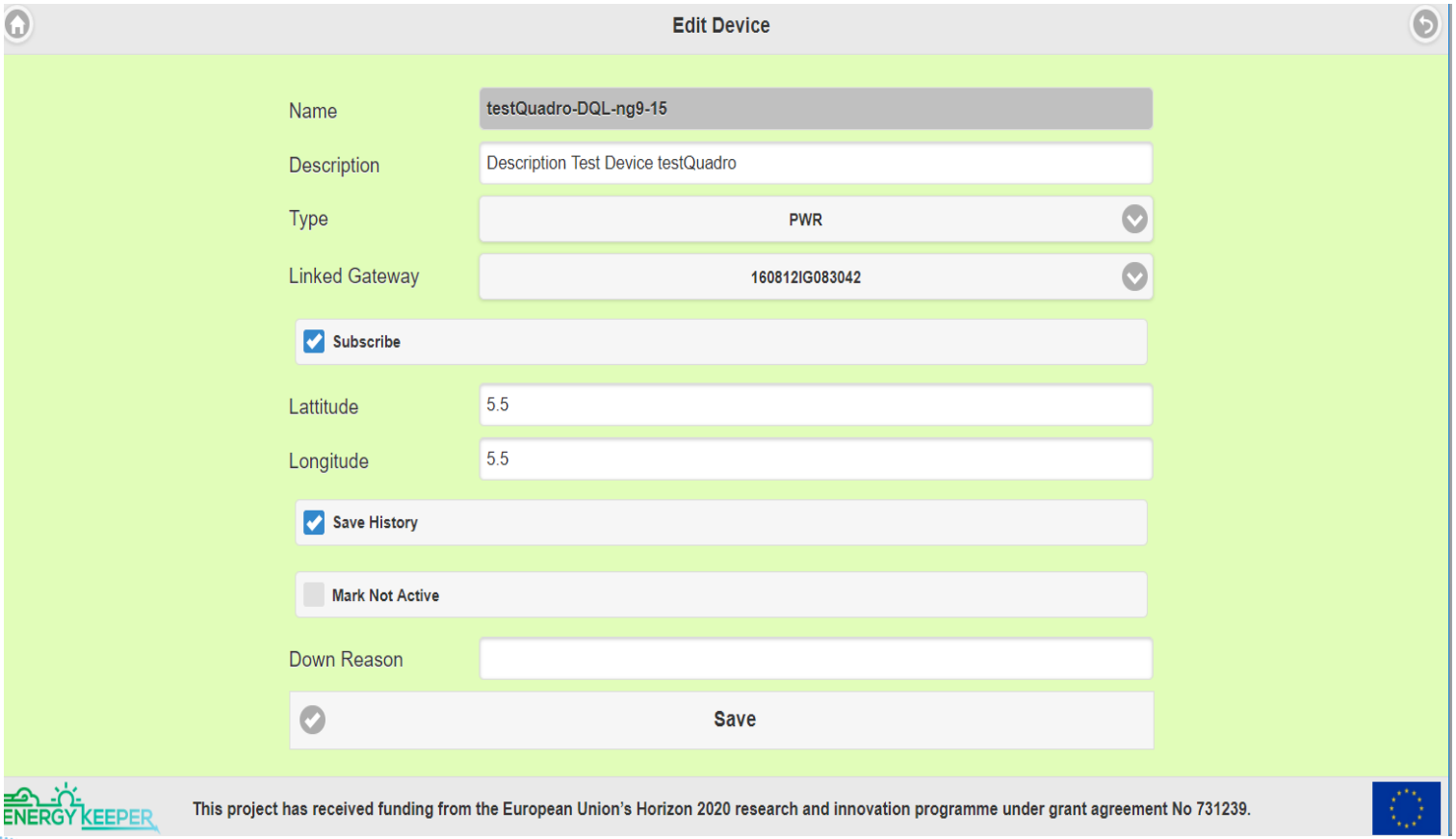
Device Edit



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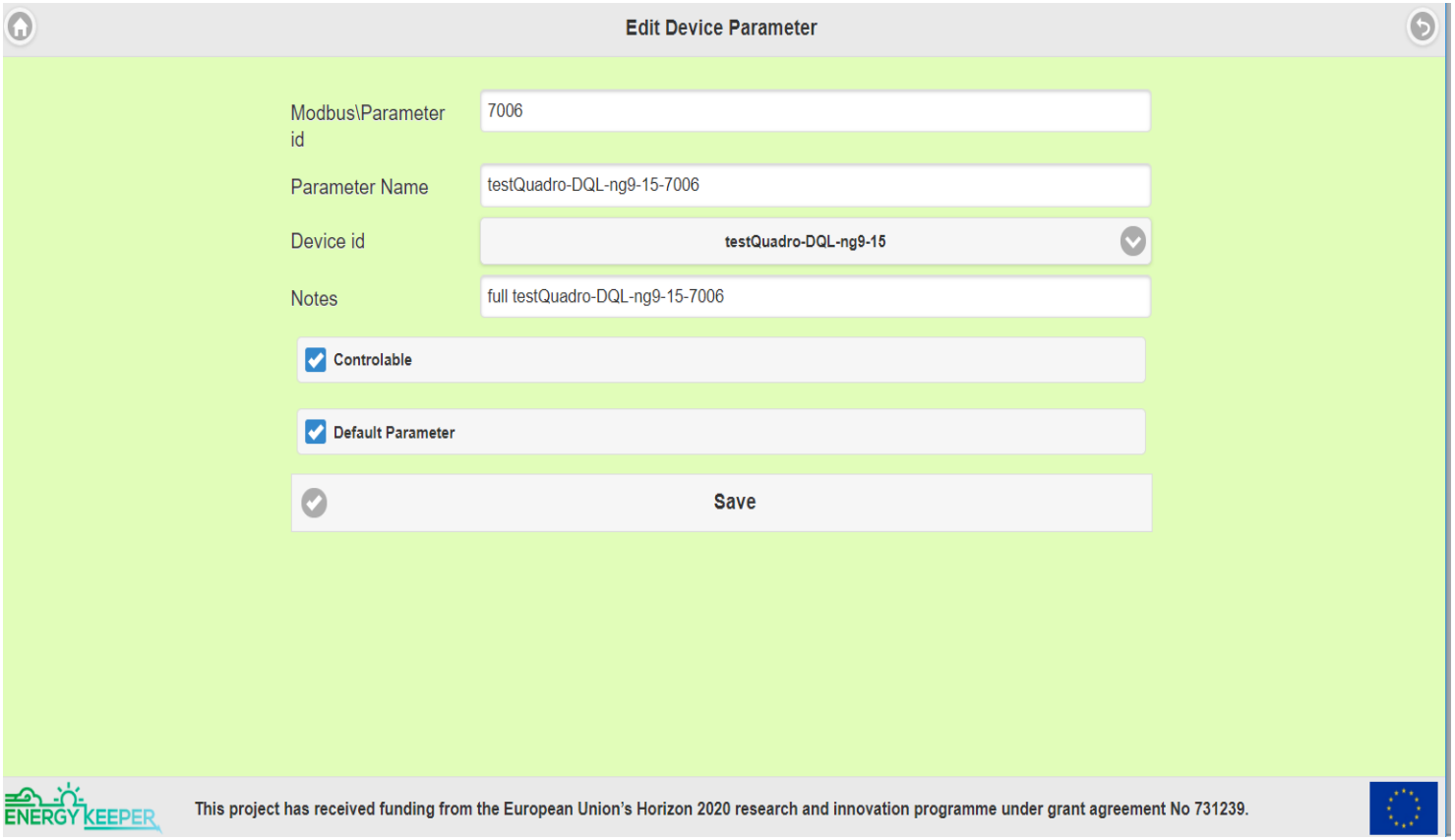
Edit Device parameters



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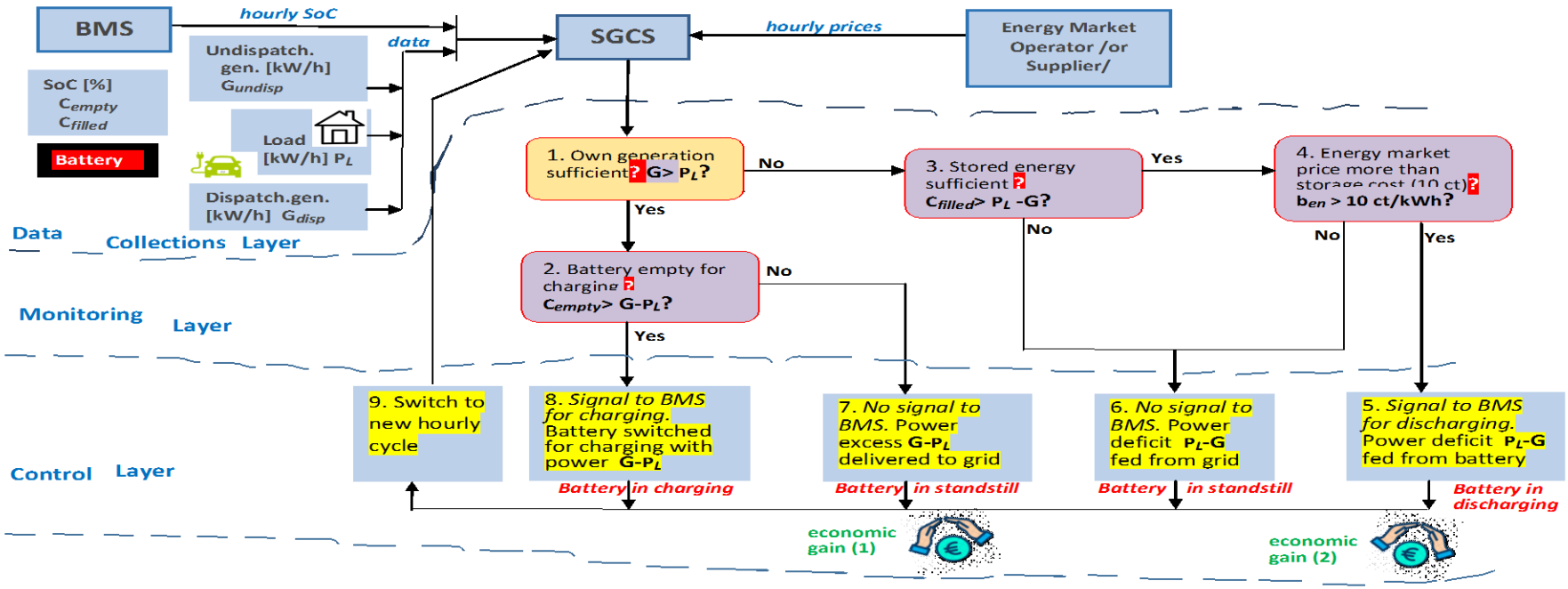
Community Business Model ACRRES - 11

Operational logic and algorithm (of WHAT-IF-type) for Community business model „ACRRES-11“



LEGEND: xxbbxx - Executive action of Smart Grid Control Server (SGCS)

Xxxxxxx ? - WHAT-IF action of BMS

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Community Business Model
ACRRES - 11

SGCS considerations while performing atomization of this model :

- Optimal economic gains and efficient use of the energy with relation to its Generation, Consumption, Production Cost and Market Price.

Optimal use of the Battery storage for best use considering the following:

- Self energy generation (G) and energy consuming (L) (block 1)
- Battery availability for charge (Block 2)
- Battery state of charged-Deliver/ sale the extra energy to the Grid.(Block 3)
- Market Price and energy storage cost (Block 4)

Total Generation

Total Generation – G (block 1.3 1.4)

- On the community we have prosumers that are generating energy and as a group named Generation /production.
- The total energy G is the sigma of all prosumers and it represent on the chart as 1.3 and 1.4 block
- The prosumers (members) of this group are: Wind turbine Total (1-2-3), PV, Mixers , CO-Digester , CHP , Bioethanol Plant

Inputs Loads [1.2]

Inputs Loads [1.2]

- On the community we have consumers that are consuming energy and as a group named Loads /consumers.
- The total energy L is the sigma of all consumers and it represent on the chart as 1.2 block
- The consumers (members) of this group are: Molaris and Greenhouse

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Battery (1.1)

Battery [1.1]

- The battery is the energy storage we using for store, use and sale energy.
- On receiving its State Of Charge and with relation to the other conditions we control the energy uses by Charge or Discharge the battery

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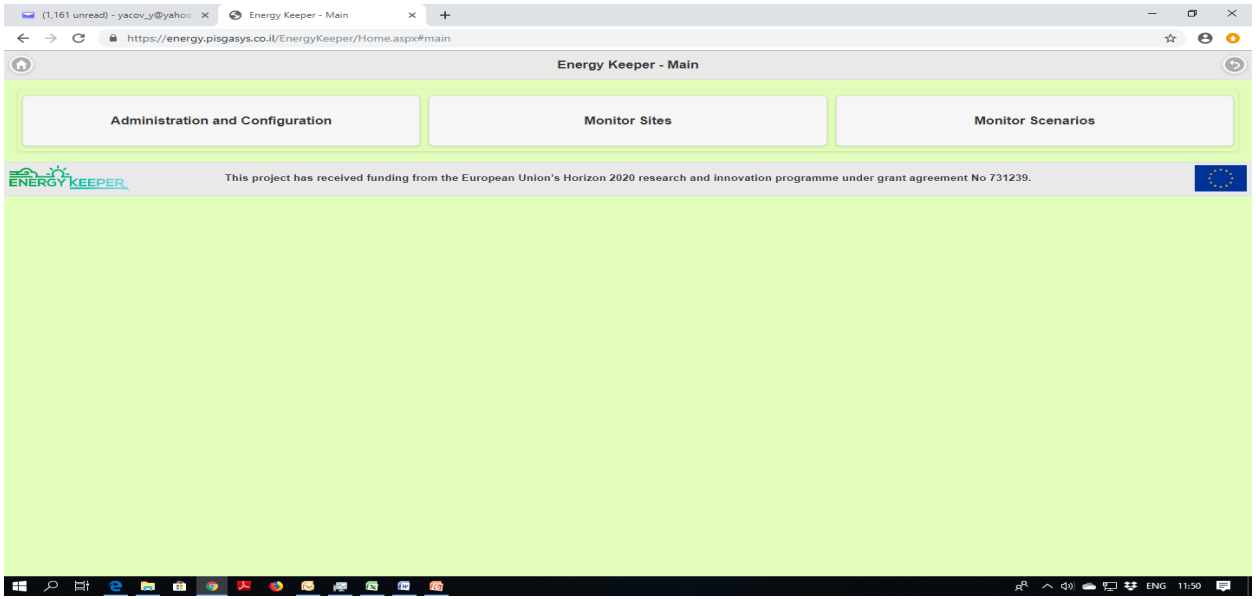
Monitor ACRRES -11



Screen shoot 1 – Energy Keeper Main

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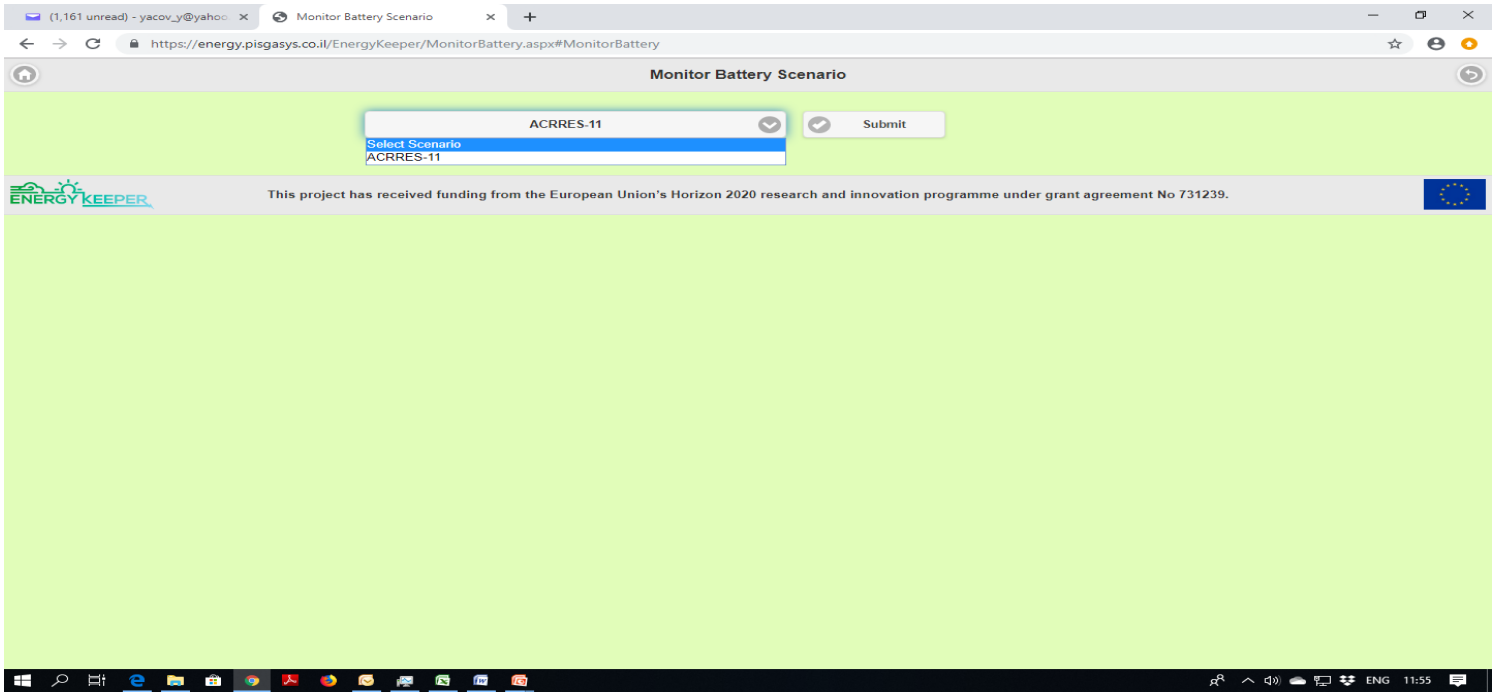
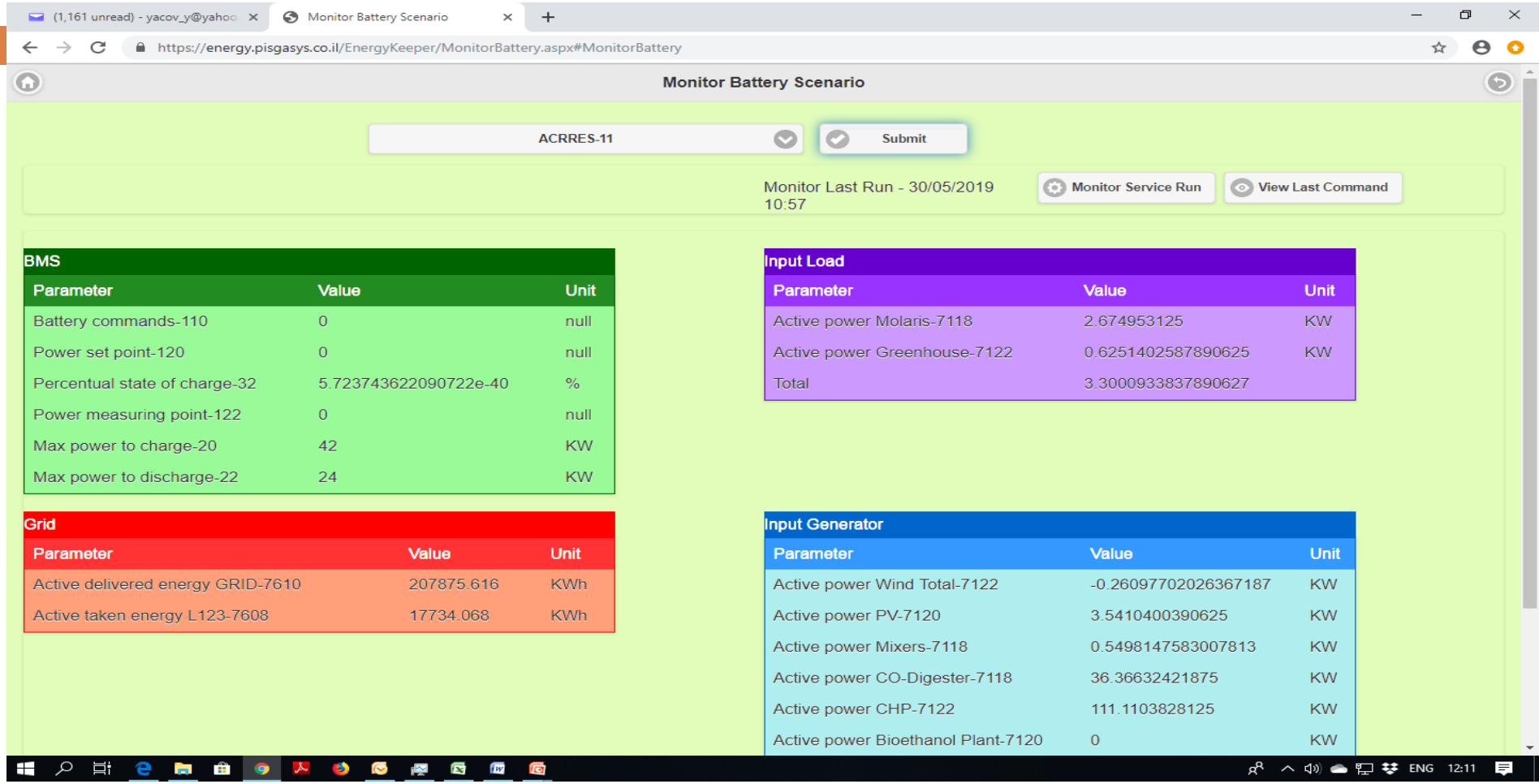
Monitor ACRRES -11



Monitor ACRRES -11



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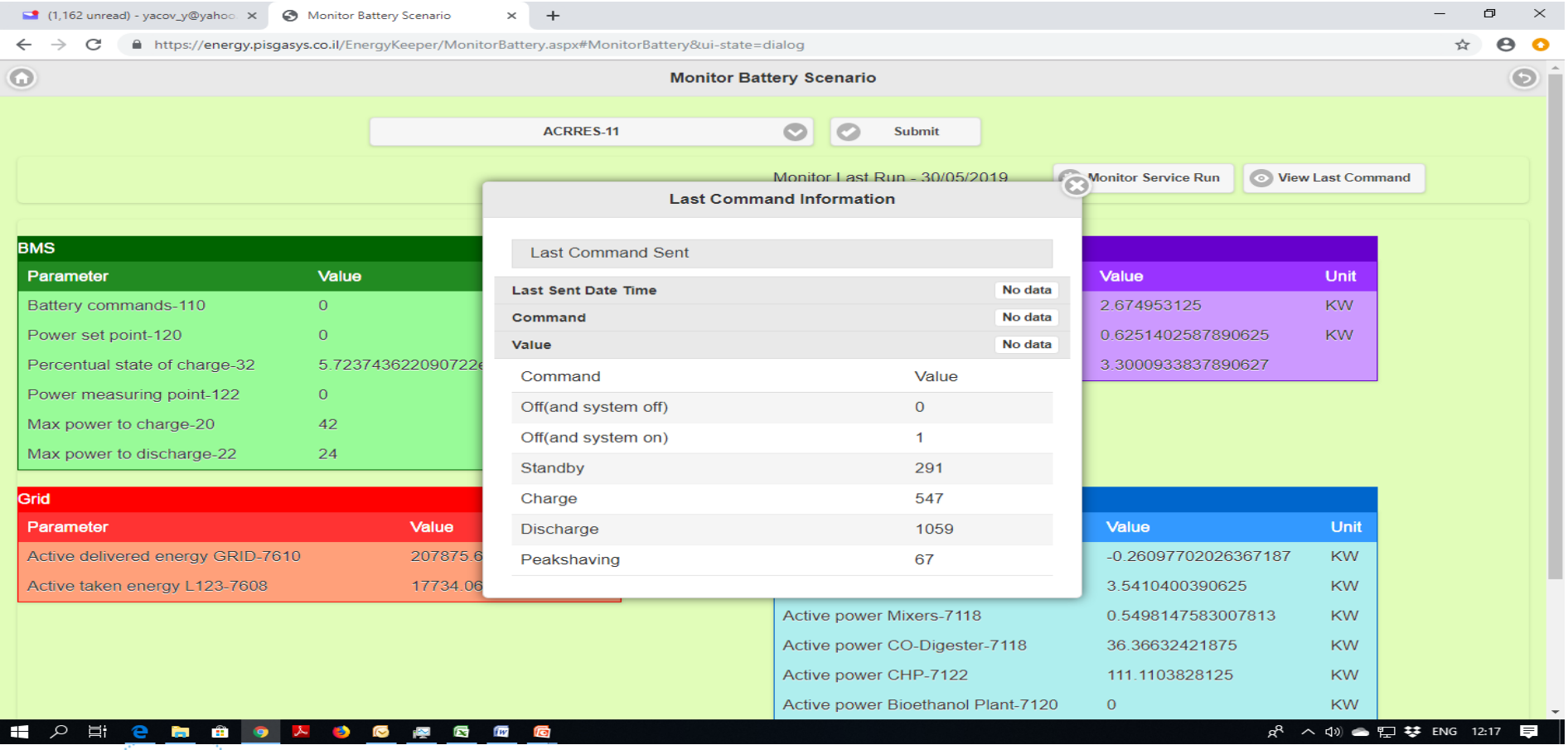
Monitor ACRRES -11



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Battery (1.1)Parameters configuration

	Name	Gateway MAT	Device ID	Parameter ID		Topic
1	C empty	180605IG133924	cabinet001BMS01	Percentual state of charge-32	%	Yes
2	C fild	180605IG133924	cabinet001BMS01	Percentual state of charge - 32	%	Yes
3	Battery commands	180605IG133924	cabinet001BMS01	Battery commands - 110	word	Yes
4	Power set point	180605IG133924	cabinet001BMS01	Power set point -120	word	Yes
5	Power measuring point	180605IG133924	cabinet001BMS01	Power measuring point - 122	word	Yes

Generation (1.3 1.4) Parameters configuration

	Name	Gateway MAT	Device ID	Parameter ID		TOPIC
1	Wind turbine Total (1-2-3)	180605IG133924	cabinet001NG9.2	Active power wind Total -7122	KW	Yes
2	PV	180605IG081828	cabinet002NG9.2	Active power PV-7120	KW	Yes
3	Mixers	180605IG081828	cabinet002NG9.1	Active power Mixers-7118	KW	Yes
4	CO-Digester	180605IG133924	cabinet001NG9.2	Active power CO-Digester-7118	KW	Yes
5	CHP	180605IG133924	cabinet001NG9.1	Active power CHP-7122	KW	Yes
6	Bioethanol Plant	180605IG133924	cabinet001NG9.2	Active power Bioethanol Plant-7120	KW	Yes
	Total GENERATION -G	SGCS			KW	New

Loads (1.2)
Parameters configuration

	Name	Gateway MAT	Device ID	Parameter ID		Topic
1	Molaris	180605IG081828	cabinet002NG9.2	Active power Molaris-7118	KW	Yes
3	Greenhouse	180605IG081828	cabinet002NG9.1	Active power Greenhouse-7122	KW	Yes
	Total Load PL	SGCS			KW	New

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Energy Market (1.5) Parameters configuration

Name	Gateway MAT	Device ID	Parameter ID		Topic	Note
Storage Cost	SGCS			Euro ct	New	Fix Price 10 KWh
Energy Market Price ,	SGCS			Euro ct	New	Fix Price 12 KWh In future it shouldbe imported Table
Economic gain 1	SGCS			Euro	New	Economic gain is Total KWh * (Market Price –Cost Price)
Economic gain 2	SGCS			Euro	New	Economic gain is Total KWh * (Market Price –Cost Price)

THANK YOU

THANK YOU

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