



H2020-LCE-2016-SGS

Grant agreement n° 731239.

EU contribution: 3,995,255 €

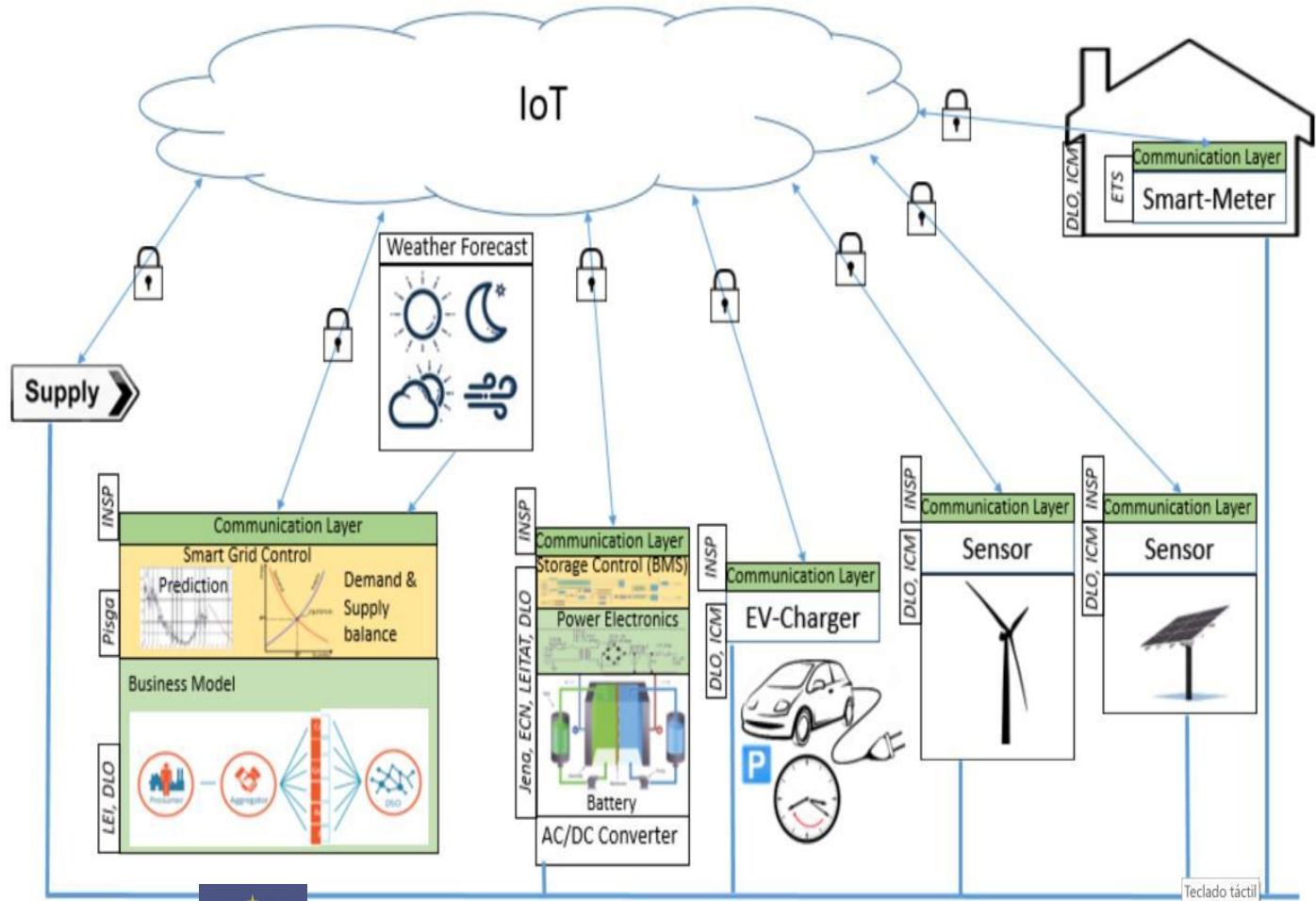
Duration : 01/2017 – 12/2019

Coordinator: Lithuanian Energy
institute

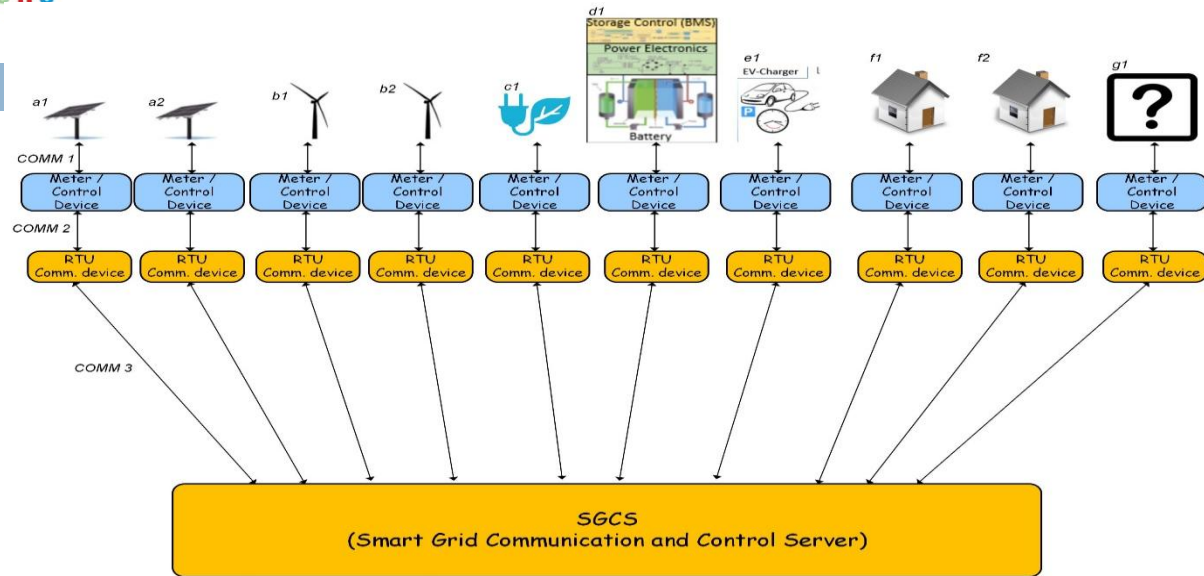
www.energykeeper.eu



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**.



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



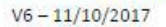
Local - COMM1 – Communication between a prosumer and metering/control device.

Short - COMM2 – Communication between metering/control device and RTU (Gateway)

Wide -COMM3 – Communication between RTU (Gateway) and SGCS (Smart Grid Central Server)

- 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. supporting Client and Subscriber modes and will attempt to connect on a predefined time intervals





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.

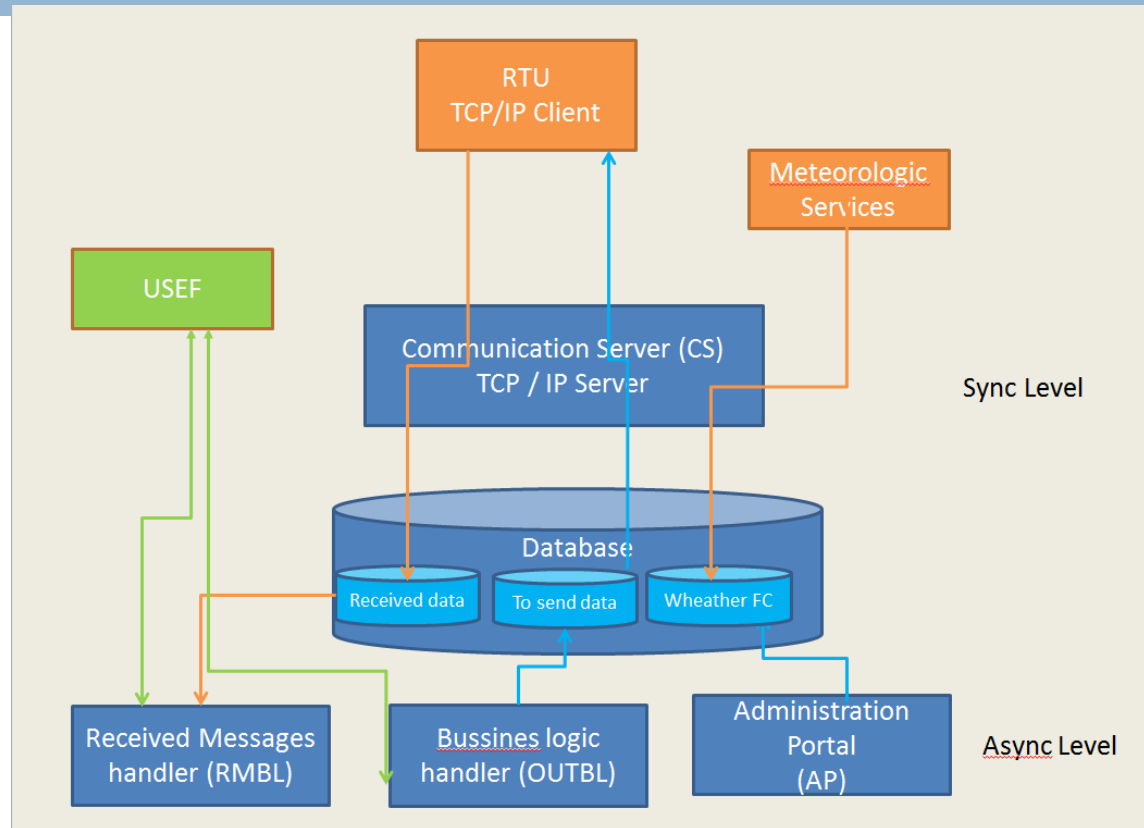
- Local Communication - RS485 and MODBUS RTU - All the local communications work with a RS-485 hardware physical layer and, on top of it, a standard MODBUS RTU communication protocol.
- Wide communications - Internet, using (MQTT) Message Queue Telemetry Transport over (TCP/IP) Transmission Control Protocol/Internet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

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MQTT 4 messages types:

- Instant Parameters
- Trend
- Historical Data
- Control Command

Smart Grid Control System Software blocks

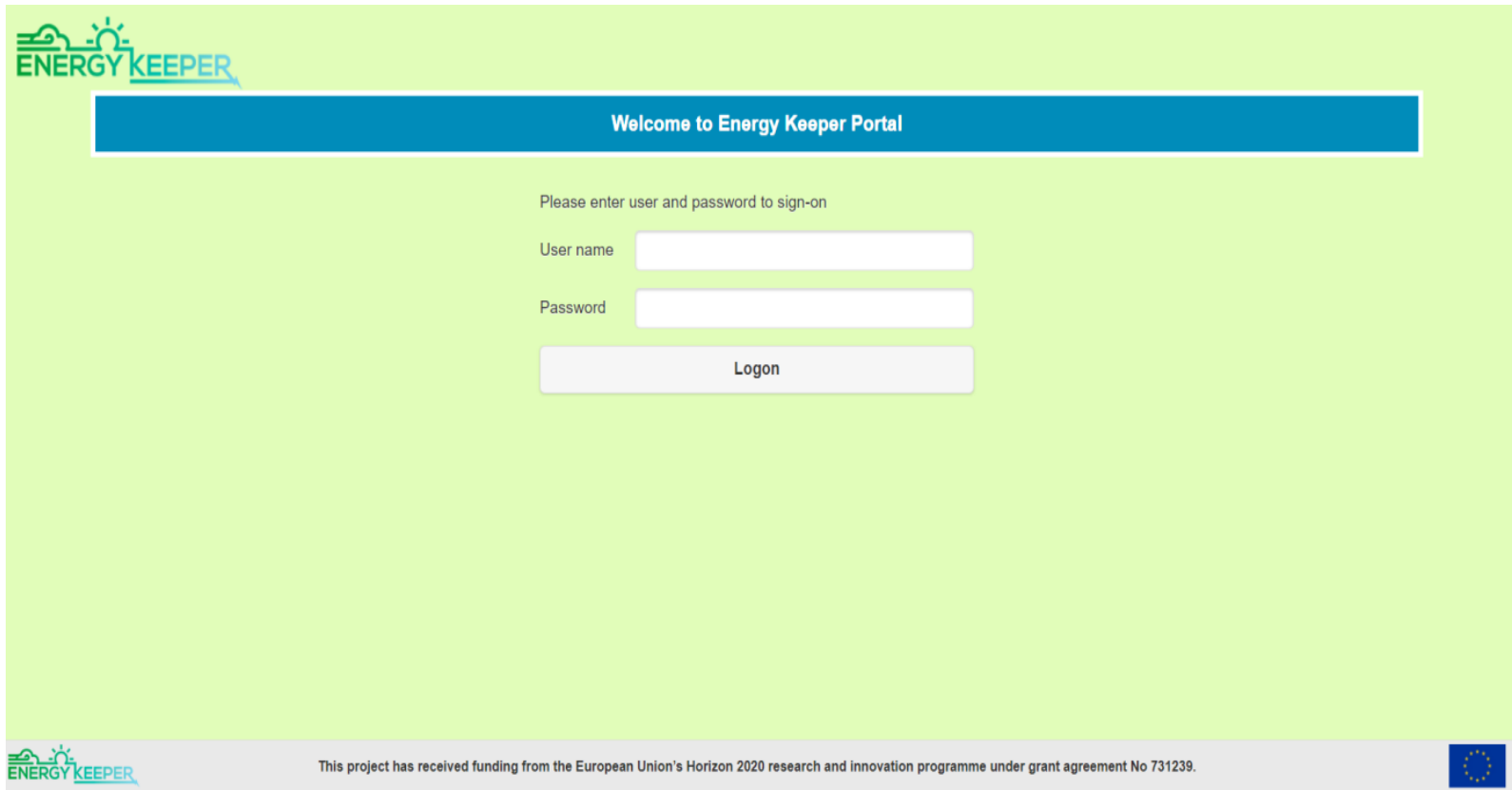


RTU - communicate with the server in TCP/IP Encapsulated MQTT Protocol.

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.

The login screen for the Energy Keeper Portal. It has a light green background. At the top left is the 'ENERGY KEEPER' logo. Below it is a blue banner with the text 'Welcome to Energy Keeper Portal'. In the center, there is a prompt 'Please enter user and password to sign-on'. Below this are two input fields: 'User name' and 'Password'. A 'Logon' button is positioned below the password field. At the bottom, there is a grey footer bar containing the 'ENERGY KEEPER' logo on the left, a funding statement in the center, and the European Union flag on the right.

ENERGY KEEPER

Welcome to Energy Keeper Portal

Please enter user and password to sign-on


User name

Password

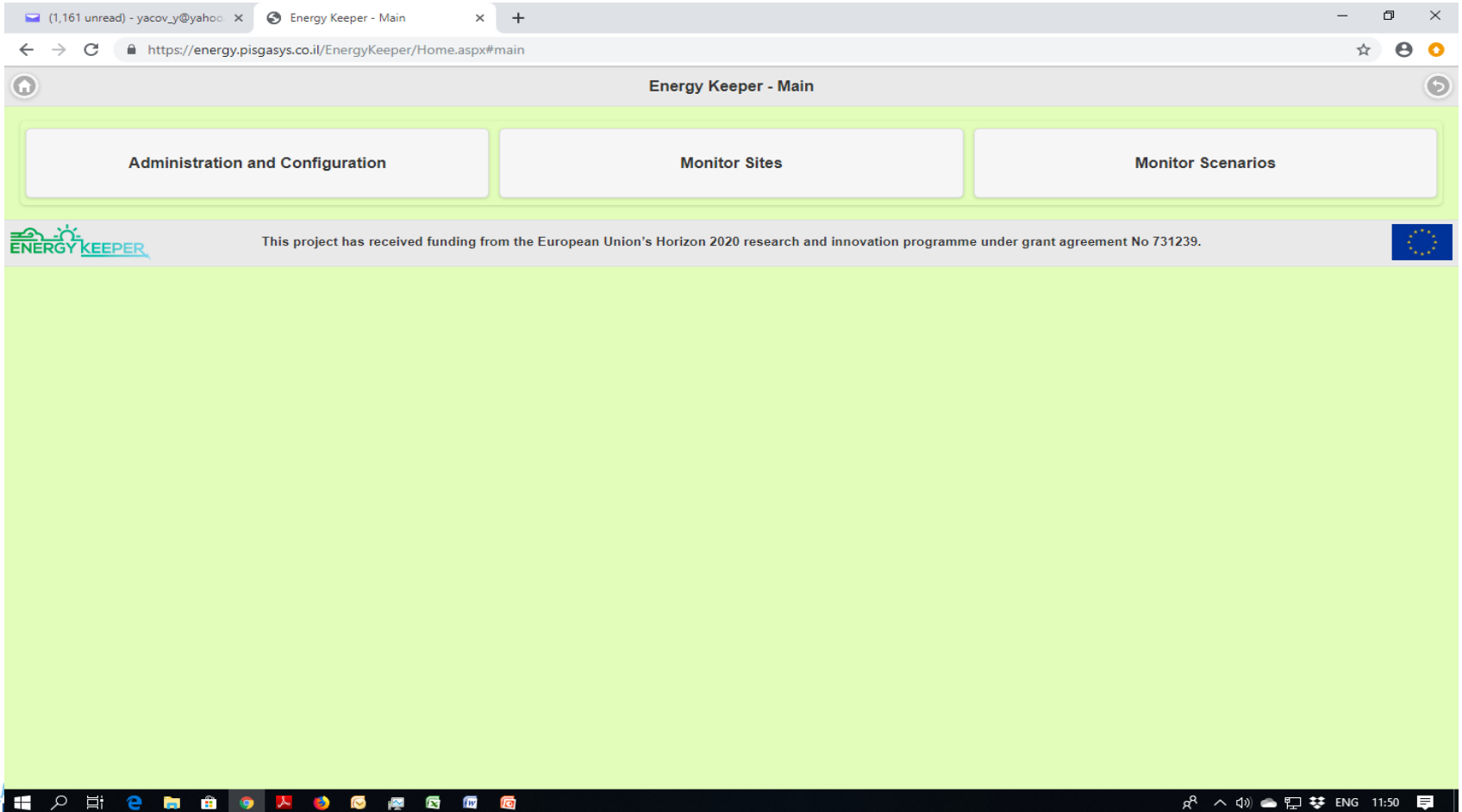
Logon



ENERGY KEEPER


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SGCS Main screen




On Line Site Control


Haifa

Submit

160812IG083042



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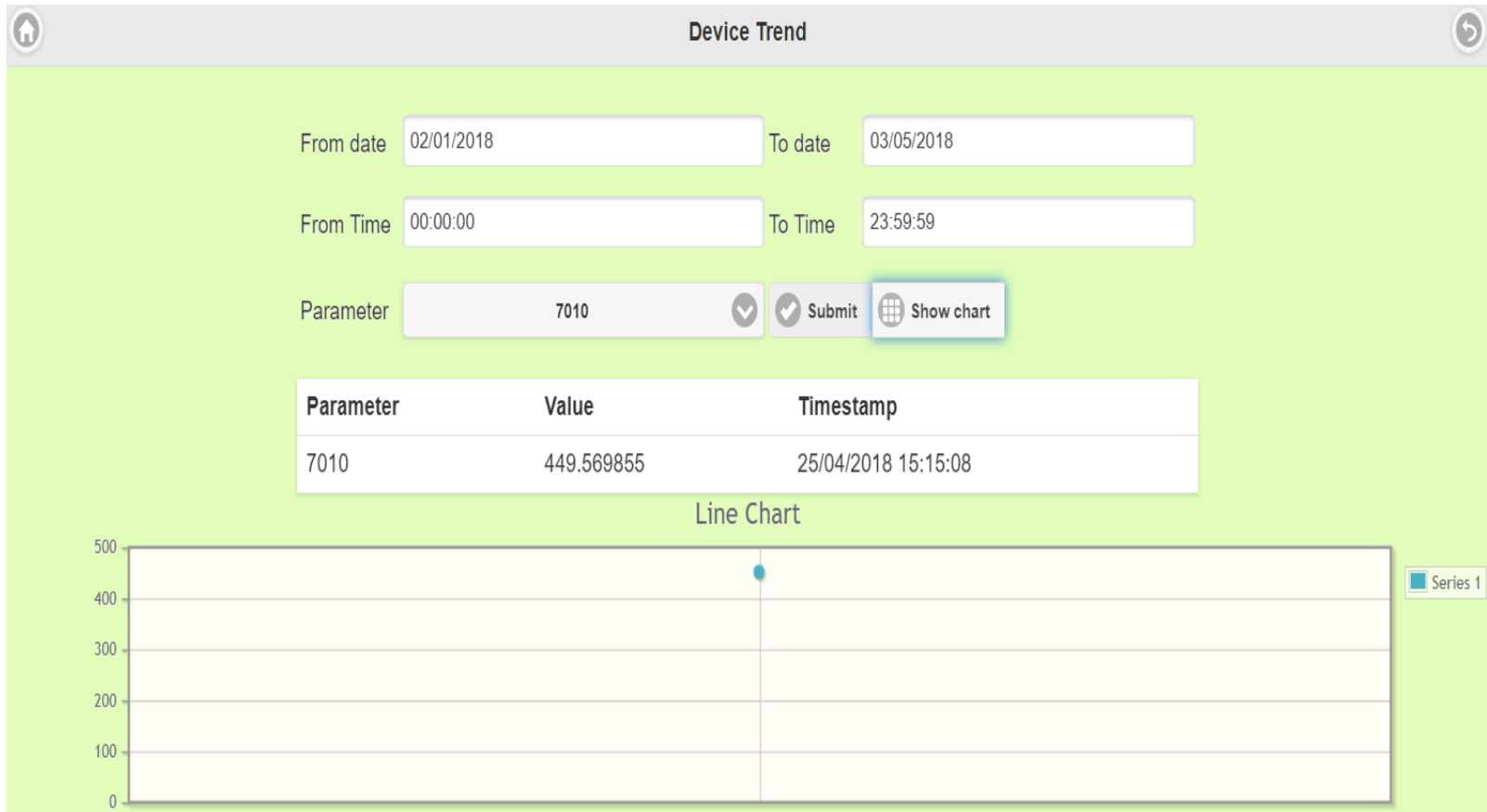
SGCS Select Device



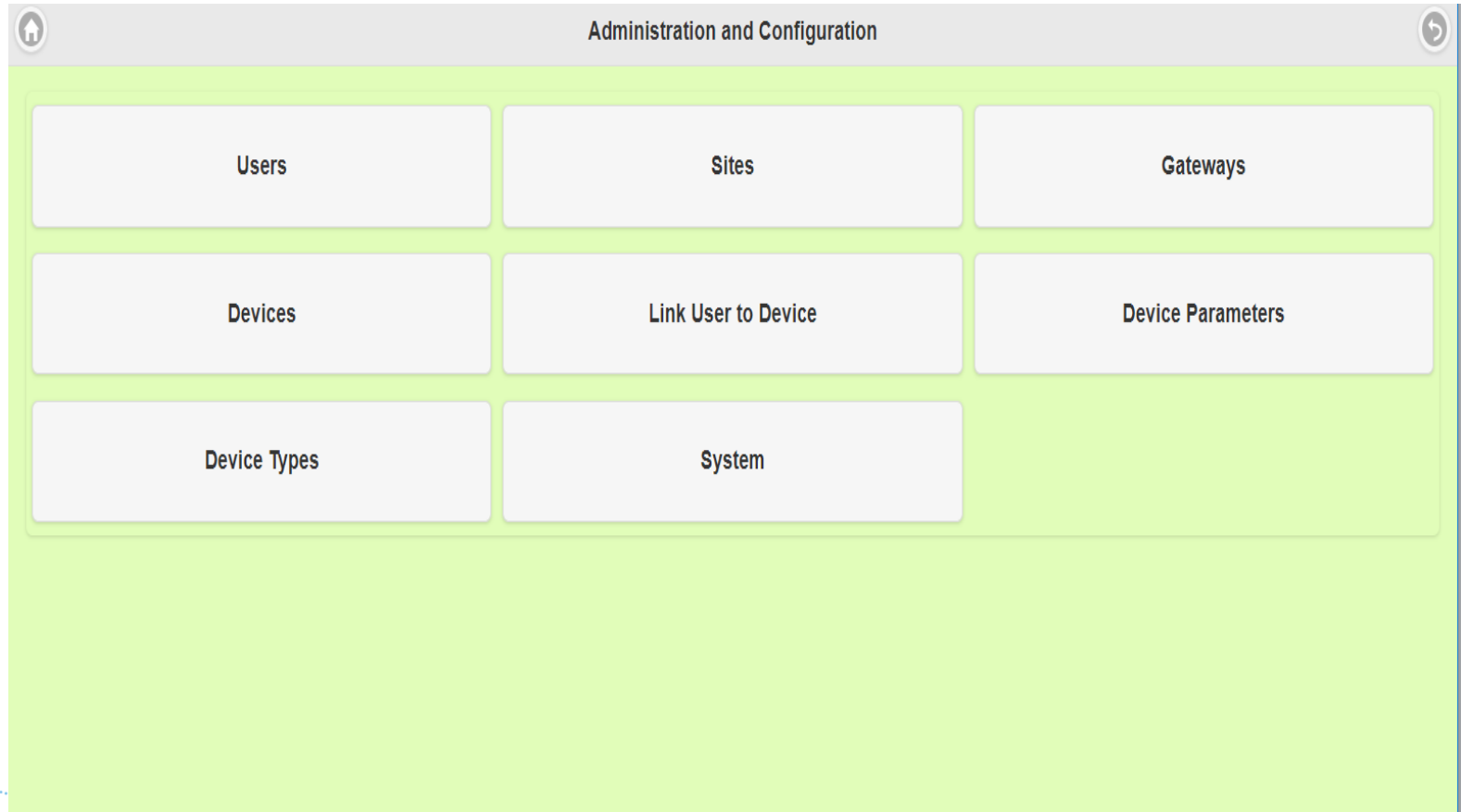
Gateway Control



Device : testQuadro-DQL-ng9-15 	Device : test456-DQL-ng9-66 	Device : testQuadro-DQL-ng9-16 
Parameter : 7006	Parameter : 3388	Parameter : 7008
Value : 228.02	Value :	Value : 228.2083
01/01/1970 02:02:32	11/04/2018 13:02:12	01/01/1970 02:02:32
Send Message	Send Message	



SGCS Administration Configuration





Sites





Create Site



Site	Description	Country	Owner	
Haifa	main power plant	Israel	Administrator	  
test haifa	test owner	Botswana	Maxim	  
test owner site 1	test owner site 1	Azerbaijan	User	  
yacov vilage	kfar azar	Israel	YY	  





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Site Edit


**Edit Site**


Site	<input type="text" value="Haifa"/>
Description	<input type="text" value="main power plant"/>
Country	<input type="text" value="Israel"/> 
Owner	<input type="text" value="Administrator"/> 
Notes	<input type="text" value="piloting site"/>
<input checked="" type="checkbox"/> Save	

Users Configuration
















Users






Create User


User Login	Full Name	Company	Country	Status	Role	
Administrator	Administrator,Administrator	A	Israel	Active	Administrator	  
Operator	Operator,Operator	C	Israel	Active	Operator	  
Maxim	Max,Vidro	Pisga	Israel	Active	User	  
YY	Yacov,yaniv	shemen a kfar	Israel	Active	User	  







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Gateway/site Edit




Edit Gateway


Mat	<input type="text" value="160812IG083042"/>
Description	<input type="text" value="Gateway Test 160812IG083042"/>
IP address	<input type="text" value="1.1.1.1"/>
Publish Instant Topic	<input type="text" value="Instant Topic"/>
Control Subscrib Topic	<input type="text" value="dddd"/>
Publish Trend Topic	<input type="text" value="sddd"/>
Publish Historical Topic	<input type="text" value="ddd"/>
Site	<div>Haifa</div>
Latitude	<input type="text" value="11.11"/>
Longitude	<input type="text" value="22.22"/>
Owner	<div>Administrator</div>
<div> Save</div>	




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Device Edit



Edit Device



Name

testQuadro-DQL-ng9-15

Description

Description Test Device testQuadro

Type

PWR

Linked Gateway

160812IG083042

☒ Subscribe

Latitude

5.5

Longitude

5.5

☒ Save History

☐ Mark Not Active

Down Reason


☒ Save




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Edit Device parameters



Edit Device Parameter



Modbus\Parameter id7006

Parameter NametestQuadro-DQL-ng9-15-7006


Device idtestQuadro-DQL-ng9-15

Notesfull testQuadro-DQL-ng9-15-7006


☒ Controlable

☒ Default Parameter

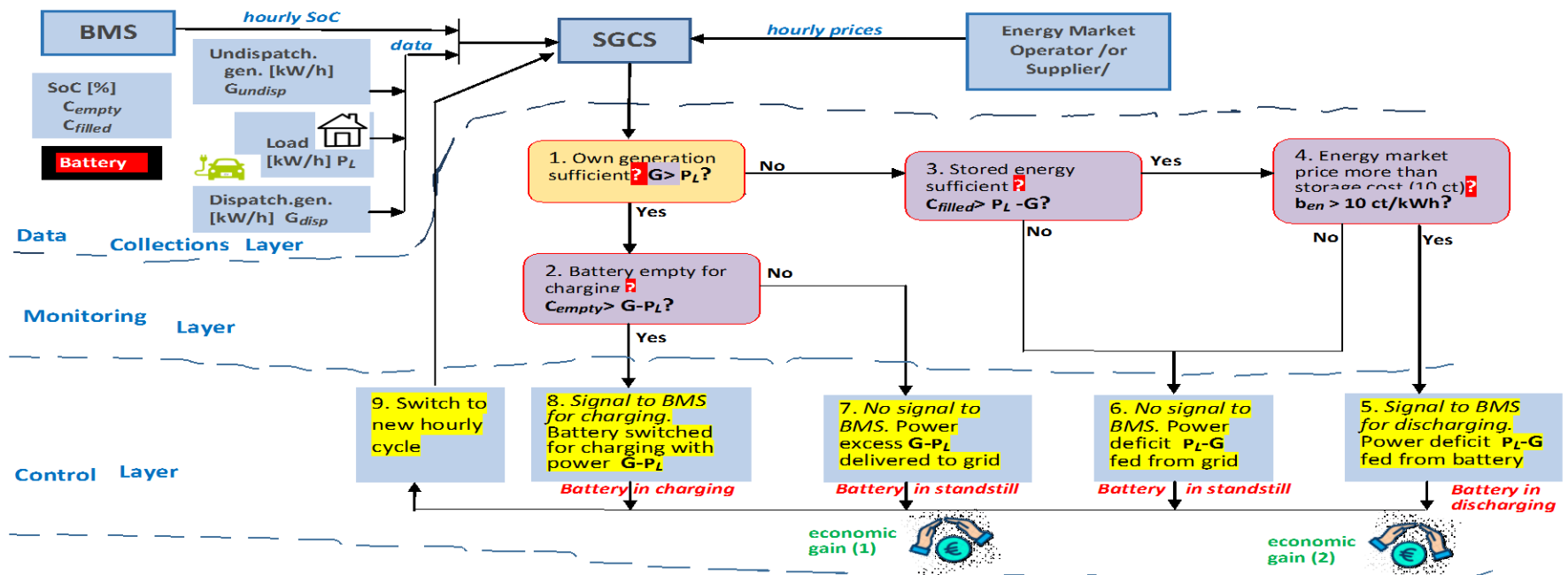
☒ Save

ENERGY KEEPER

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



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

XXXXXX ? - WHAT-IF action of BMS

A.Klementavicius (LEI) EnergyKeeper-project 2019-05-30

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 – 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]

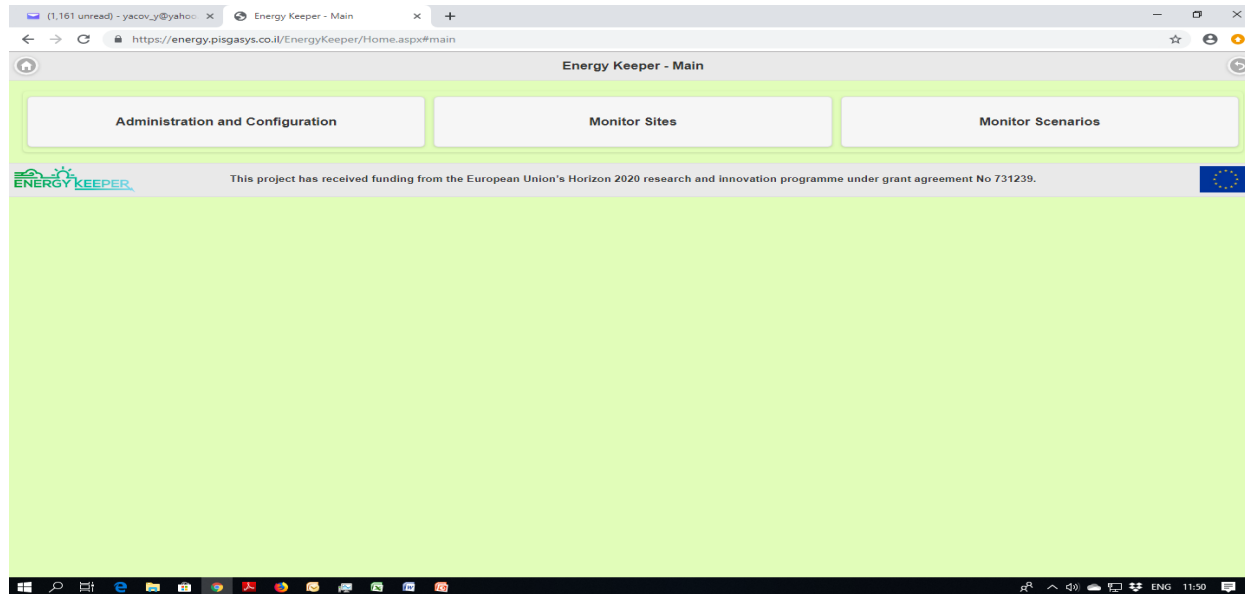
- On the community we have consumers that are consuming energy and as a group named Loads /consumers.
- The total energy L is the sigma of all consumers and it represent on the chart as 1.2 block
- The consumers (members) of this group are: Molaris and Greenhouse



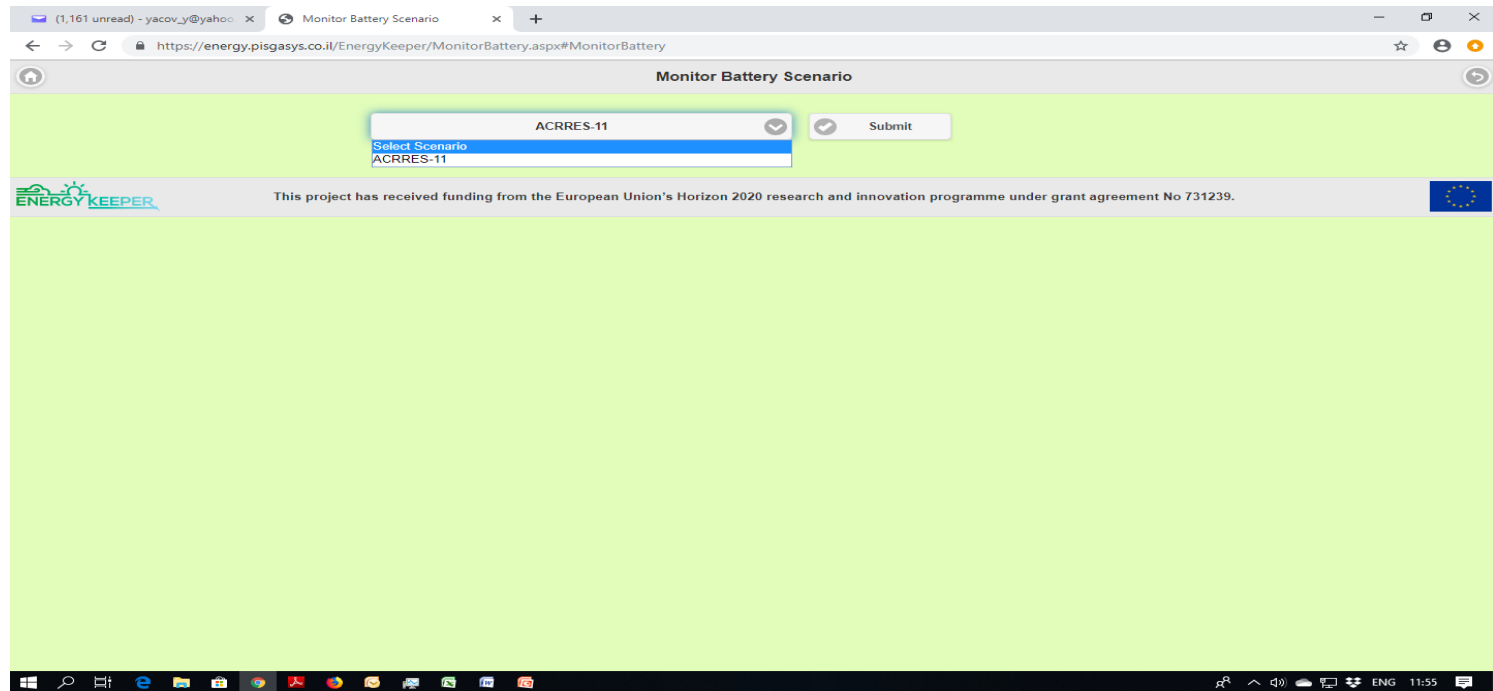
2 software engineers for system development.

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



Screen shoot 1 – Energy Keeper Main



(1,161 unread) - yacov_y@yahoo.com X Monitor Battery Scenario X +

https://energy.pisgasys.co.il/EnergyKeeper/MonitorBattery.aspx#MonitorBattery

Monitor Battery Scenario

ACRRES-11

Monitor Last Run - 30/05/2019 10:57

BMS

Parameter	Value	Unit
Battery commands-110	0	null
Power set point-120	0	null
Percentual state of charge-32	5.723743622090722e-40	%
Power measuring point-122	0	null
Max power to charge-20	42	KW
Max power to discharge-22	24	KW

Input Load

Parameter	Value	Unit
Active power Molaris-7118	2.674953125	KW
Active power Greenhouse-7122	0.6251402587890625	KW
Total	3.3000933837890627	

Grid

Parameter	Value	Unit
Active delivered energy GRID-7610	207875.616	KWh
Active taken energy L123-7608	17734.068	KWh

Input Generator

Parameter	Value	Unit
Active power Wind Total-7122	-0.26097702026367187	KW
Active power PV-7120	3.5410400390625	KW
Active power Mixers-7118	0.5498147583007813	KW
Active power CO-Digester-7118	36.36632421875	KW
Active power CHP-7122	111.1103828125	KW
Active power Bioethanol Plant-7120	0	KW

Monitor Battery Scenario

ACRRES-11

Monitor Last Run - 30/05/2019

Last Command Information

Last Command Sent

Last Sent Date Time	No data
Command	No data
Value	No data

Command	Value
Off(and system off)	0
Off(and system on)	1
Standby	291
Charge	547
Discharge	1059
Peakshaving	67

Parameter	Value
Battery commands-110	0
Power set point-120	0
Percentual state of charge-32	5.7237436220907226
Power measuring point-122	0
Max power to charge-20	42
Max power to discharge-22	24

Value	Unit
2.674953125	KW
0.6251402587890625	KW
3.3000933837890627	

Parameter	Value
Active delivered energy GRID-7610	207875.6
Active taken energy L123-7608	17734.06

Value	Unit
-0.26097702026367187	KW
3.5410400390625	KW
0.5498147583007813	KW
36.36632421875	KW
111.1103828125	KW
0	KW

Active power Mixers-7118	0.5498147583007813	KW
Active power CO-Digester-7118	36.36632421875	KW
Active power CHP-7122	111.1103828125	KW
Active power Bioethanol Plant-7120	0	KW

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

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