

Renewable Energy for Self-Sustainable Island Communities

# SUSTAINABLE PLACES 2023

Energy Communities : Heterogeneous Data Management



Ignacio Lazaro Francisco Javier Diez

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#### **REACT Renewable Energy for self-sustAinable island Communi**Ties

#### **Purpose of the project**

- Island energy independency through maximal exploitation and integration of existing and emerging **RES** and **energy storage**
- ICT cloud-based solution
- **DR** strategy: planning and managing real-time generation and load forecasting
- Digitalised smart grids→ high flexibility, stability, and maximisation of RES
- User-engagement & large-scale replication

#### **Pilot Sites**

- La Graciosa, Canary Islands, SP
- Aran Islands, Galway, IR
- San Pietro Island, Carloforte, IT
- + 5 follower islands



## Main challenges

- Social and technical barriers to the deployment of RES and its integration.
- Unlock DR and flexibility potential to maximise the use and storage of intermittent RES
- Engagement of end consumers as active participants in DR strategy and modelling.
- Piloting the REACT solution demonstrating its potential to maximise energy autonomy, reduce GHG emission and energy (> 60%), achieve at least 10% of energy savings.
- Develop viable plans and business models for the large-scale replication on 5 follower islands

#### **PARTNERS:** 23, 11 countries

- COORD: VEOLIA (Spain)
- **OP:** ESB Networks, Fenie Energia, AIELPA (Asociación de Inst. Electricos Canarias)
- MARKET: SEAI (Energy Authority of Ireland), Udaras na Gaeltachta , R2M, Comune di Carloforte, Comet Gesinco
- **TECH:** Mitsubishi Electric, Fraunhofer ISE, Suministros Orduña, Midac, Electrochaea
- **RESEARCH**: Tekniker, National Univ. of Ireland, Austrian Institute of Technology, Uppsala Universitet, Teesside University, Panepistimio Aigaiou, Universite de La Reunion, Institute Mihajlo Pupin





## **REACT Platform Architecture**



## **REACT Platform Data Repositories**

- Historical **Data** : TICK Stack (Time Series DB) + RDBMS
- Semantic Repository









#### Semantic Data Model : Schema

### Semantic Data Model : REACT Ontology

Specifications

- <u>REACT Ontology w3id.org</u>
- Heat Pump Ontology (HPOnt) w3id.org

**Linked Open Vocabularies** 

- LOV REACT
- LOV HPOnt

AIOTI <u>Ontology Landscape</u> Portfolio : Catalogue of Ontologies for Semantic Interoperability









### Semantic Data Model : DPL

### **Data Point List**

- Population of semantic data model
- Adaptation to a user-friendly format: Excel
- List of all measures available in the three pilots of the project.
- It is updated with the installation, modification or removal of any device.
- There is a person responsible for each pilot to keep the excel file corresponding to the pilot's data point list up to date.



## Semantic Data Model : Data Point List

	Identifier of the device in	Identifier of the gateway	Unique identifier of the	Method used for sampling	Type of access of each data	Measurement type that given	Unit of measurement
	charge of sending the collected	connected to the device	facility where the		point	sensor provides / Control action	(Empty = no unit;
	Free input	Free input	Free input	Select from the list	Select from the list	Select from the list	Select from the list
	Device_id	Gateway_id	Location_facility_id	sampling_method	access_type	Measurement_id	unit_id
1	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	accumulated	Read	eAcGridIn	W-HR
2	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	accumulated	Read	eAcGridIn	W-HR
3	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	accumulated	Read	eAcGridIn	W-HR
4	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	accumulated	Read	eAcGridOut	W-HR
5	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	N/A	Read	vAcGrid	V
6	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	N/A	Read	vAcGrid	V
7	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	N/A	Read	vAcGrid	V
8	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	N/A	Read	iAcGrid	А
9	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	N/A	Read	iAcGrid	А
10	VIC-GXHQ2022MFGP6-30	VIC-100000080b08ba6	LG4	N/A	Read	iAcGrid	А
11	VIC-GXHQ2022MFGP6-227	VIC-1000000080b08ba6	LG4	N/A	Read	fAcGrid	HZ
	1	1	1	1	1		





### Semantic Data Model : Ontology Instantiation



## Semantic Data Model : RDF



SUSTAINABLE



## **Ontology in Use**





REACT-GRAPH <u>The REACT Ontology</u> <u>(react2020.github.io)</u>

## **Ontology in Use : Link between Data Repositories**

Service/Tools	Relevant Data				
Energy Demand Forecasting Service	Energy consumed in the building for training models				
Energy Production Forecasting Service	PV Production total capacity for scalability of the PV forecast for each building				
Optimization Service	Max grid import, Max grid export				
Battery Energy Control Dispatching	Storage total capacity, Max charge power, Max discharge power . Gateway Id in charge of the control actions execution				
Thermal Building Models	Technical characteristics of Heat Pumps. Gateway Id in charge of the control actions execution				
Web & mobile app	Equipment of the installations, measurements monitored				



### **Time Series Database : Assets Real Time**



## **Relational Database : Optimization**

#### FORECAST

#### correact\_db\_weather\_observations

id : int(10) unsigned

- weather\_location\_id : int(10) unsigned
- app\_temp : decimal(6,2)
- city\_name : varchar(40)
- clouds : tinyint(4)
- s country\_code : varchar(3)
- datetime : datetime dewpt : decimal(4,1)
- dewpt : decimal(4,1)
  dhi : decimal(8,3)
- dni: decimal(8,3)

#### o react\_db production\_forecast\_values

@ id : int(10) unsigned @ location\_id : varchar(10) # load\_type\_id : tinyint(5) unsigned @ timestamp\_start : datetime # value : decimal(15,3) @ created : datetime # timestamp\_start\_local : datetime # timestamp end local : datetime

#### o react\_db demand\_forecast\_values

id:int(11)
device\_id:varchar(30)
location\_id:varchar(10)
load\_type\_id:int(11)
timestamp\_start:datetime
timestamp\_end:datetime
value:decimal(15,3)
created:datetime
timestamp\_start\_local:datetime
timestamp\_end\_local:datetime



#### OPTIMIZATION





react\_db control\_actions
control\_action\_id : bigint(20) unsigned
gateway\_id : char(100)
timestamp : bigint(20)
device\_id : char(100)
request\_id : char(100)
control\_id : char(250)
value : char(250)
sent\_status : smallint(6)

CONTROL





## Any Questions?





### THANK YOU FOR YOUR ATTENTION

Francisco Javier Diez

francisco.diez@tekniker.es



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