Intelligent systems for optimization and self-management of renewable energy microgrids applied to industrial areas.

universidad SANJORGE GRUPO SANVALERO

SUDOE Interreg IV B

UE / EU - FEDER / ERDF

OptimaGrid

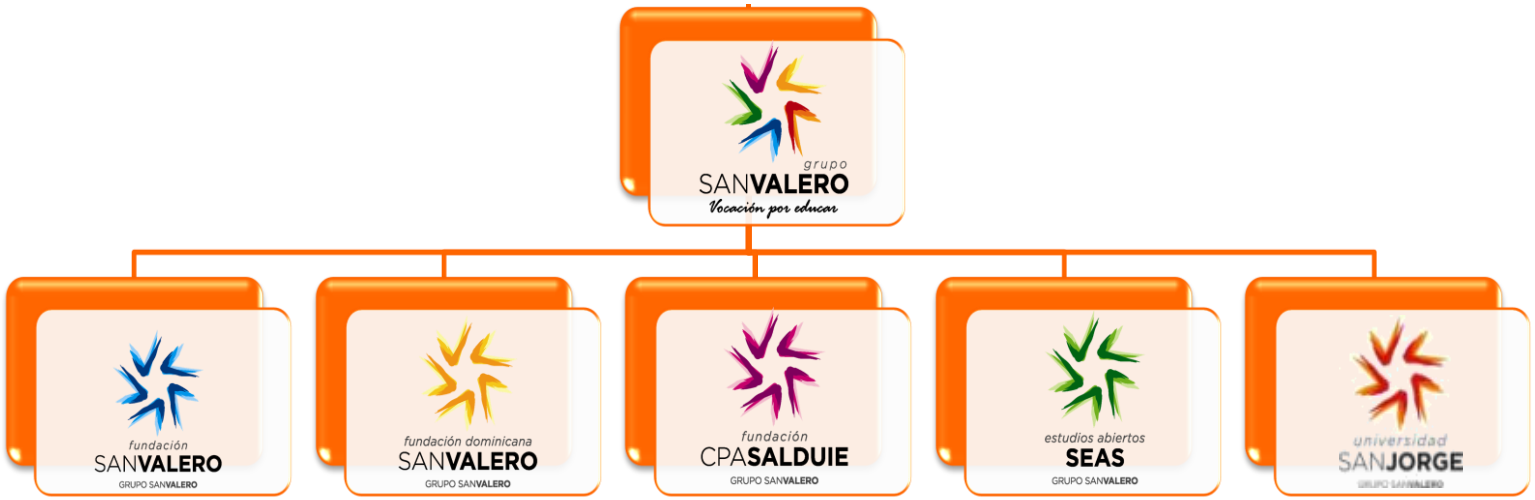
Project results

- Introduction and objectives
- Summary of main task forces
- Indicator and Conclusions

Pedro Larraz
Universidad San Jorge

San Jorge University

EL GRUPO SAN VALERO



San Jorge University

UNA APUESTA AMBIENTAL

universidad SANJORGE

INSTITUTO DE INVESTIGACIÓN DEL **MEDIO AMBIENTE Y LA SOSTENIBILIDAD**

GREEN campus

GOOD ENVIRONMENTAL PRACTICES AT SAN JORGE UNIVERSITY

San Jorge University

UNA APUESTA AMBIENTAL

OPTIMAGRID, Sistemas inteligentes de optimización y autogestión de micro-redes con energías renovables aplicados a áreas industriales en la zona SUDOE (SOE2/P2/E322).

RURALGRID, Estudio de viabilidad de implementación de energías renovables a través de microrredes en los pueblos del Pirineo (RURALGRID). (CTPP14/11).

FENIX, Finding regional environmental life cycle assessment information on packaging waste management though flexible software and databases.

DOMOTIC, Demonstration of models for optimization of technologies for intelligent construction. (LIFE + 09 ENV/ES/000493).

DOMOTIC - Demonstration of Models for Optimization of Technologies for Intelligent Construction

- Validate a model of innovation in domotic installations
- Concentration on public buildings with high visitor flow
- 3 pilot-buildings:
  - **Secondary Education Centre of San Valero Foundation in Zaragoza**
  - **Campus of San Jorge University in Zaragoza**
  - Environmental Resources Centre of Castilla y León; PRAE in Valladolid

DOMOTIC - Demonstration of Models for Optimization of Technologies for Intelligent Construction

Network of european models of energy efficiency

http://www.network.lifedomotic.eu/in dex_en.html

Platform for owners and users of (public and private) buildings with high visitor flow

- International good practice examples
- Guideline for investment costs and realistic saving potentials
- Exchange of experience with plant operators

You can be member of the First European Nertwork of Energy Efficiency too.

DOMOTIC

El Proyecto

El proyecto ha definido, diseñado, desarrollado e implementado **sistemas de control inteligentes de la energía** que han permitido la **gestión en tiempo real** de una **microred de distribución** de energía eléctrica aplicada a un área industrial con elevado porcentaje de penetración de energías renovables, **capaz de ser autogestionable energéticamente**, con el fin cambiar el concepto contaminante asociado a áreas industriales, por otro concepto de áreas industriales ecológicas y capaces de desarrollar tecnología propia.

Estos modelos aplicados a zonas industriales permitirán a la vez que **incrementar el uso de energías renovables**, **disminuir consumos energéticos y optimizar los sistemas** para la **reducción de emisiones** de CO2, beneficiando al entorno y a todas aquellas empresas y entidades que alojadas en áreas industriales del SUDOE.

El Proyecto OptimaGrid

OBJETIVOS

- Creación de **una base de datos** en la que se recojan todas las áreas industriales de la zona SUDOE objeto de estudio.

- **Guía de buenas prácticas**, en la cual se recogerán las medidas a aplicar por parte de los casos de estudio, con el fin de aplicar medidas de ahorro y eficiencia energética.

- Elaboración de **material formativo y divulgativo**, para la sensibilización de las áreas industriales sobre temas medioambientales.

- **Estudio del potencial renovable** existente en cada uno de los casos de estudio seleccionados, teniendo en cuenta todos los existentes: solar, eólico, biomásico, etc.

- **Promoción de actividades de I+D** en las áreas industriales, en temas de almacenamiento de energía.

- **Guía de buenas prácticas** sobre medidas a aplicar a las áreas industriales tipo, **para la integración de energías renovables.**

- **Concienciación** de las áreas industriales sobre temas medioambientales.

- **Publicaciones científicas.**

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OptimaGrid

Results presentation

TASK FORCE GT2

Jesús Simón
Fundación del Hidrógeno de Aragón

GT2-Clasification

D1. Database (web)

Database which covers all SUDOE industrial areas, classified according to the types identified from the point of view of similarity of micro-grid.

CONCLUSIONS

GOOD FOR TRANSVERSAL ACTIVITIES

NOT ENOUGH INFORMATION FOR TECHNICAL ACTIVITIES

SUDOE	Industrial area (cam)	Town	Type	Activity	Address	Email	Phone nu	Web	Geographical coordina	Geographical coordina	Industrial area surface	Plot ar (m2)	Electri supply	Electrical power (kW)	Electrical energy consumed	Comm ion (	Optic fiber
Andalucía	Polígono Industrial Puente del Río	ADRA	Industrial	Actividades de servicios (talleres, concesionarios, supermercados)	-	-	-	-	3.675.959	-298.525	29429			Sí	-	-	No
	Polígono Industrial La Azucarera	ADRA	Industrial	Supermercados y empresas dedicadas a la comercialización de materiales relacionados con la construcción y el sector agrícola	-	-	-	-	3.674.770	-299.860	35104			Sí	-	-	No
	Polígono Industrial La Curva/ Sector Industrial L.C. Paez	ADRA	Industrial	Talleres e industrias relacionados con el sector servicios (talleres de mecánica, carpintería metálica, imprenta gráfica) y con el sector agrícola (venta de productos fitosanitarios, almacenaje de productos hortofrutícolas)	-	-	-	-	3.675.750	-297.512	76112	250		Sí	-	-	Sí
	Polígono Industrial La Curva/ Sector Industrial 2 Polígono 1	ADRA	Industrial, Agropecuaria	Actividades relacionadas con el sector agrícola	-	-	-	-	3.676.030	-298.198	15400			Sí	-	-	No
	Sector I - 1 PRALC	ADRA	Industrial		-	-	-	-	36.761.588	-2.985.580	75433			Sí	-	-	
	Polígono Industrial La Rambla de El Cobre/ U.E.5-P.R.-L.C.	ADRA	Industrial, Terciaria	Actividades relacionadas con el sector agrícola y sector servicios (carpintería de madera, herrería,	-	-	-	-	3.675.910	-298.325	17694			Sí	-	-	No
	Sl-3-A	ADRA	Industrial		-	-	-	-	36.748.883	-2.998.960	10869			Sí	-	-	
	Terdiquera	ALBOX	Industrial	Industriar del mármol.	-	-	-	-	3.738.547	-218.000	364000	1000		Sí	-	-	No
	Polígono Industrial Hubchar/ El Majón	ALHAMA DE ALMERIA	Industrial, Terciaria	Carpintería y talleres varios	-	-	-	-	3.695.640	-254.093	36000	400		Sí	-	-	No
	El Puche / Sector 20	ALMERIA	Industrial		-	-	-	-	3.685.732	-243.015	536000			Sí	-	-	No
	Polígono Industrial La Celulosa	ALMERIA	Industrial		-	-	-	-	3.683.683	-244.383	50000			Sí	-	-	No
	Polígono Industrial San Carlos	ALMERIA	Industrial, Terciaria		-	-	-	-	36.854.168	-2.454.847	20000			Sí	-	-	No
	Avenida de Monserrat	ALMERIA	Industrial		-	-	-	-	3.683.828	-244.589	66000			No	-	-	No
	Parque de Innovación y Tecnología de Almería (PITA)	ALMERIA	Parque Tecnológica	Empresas innovadoras y entidades de I+D+i y empresas de servicios avanzados.	-	-	-	-	36.879.585	-2.328.533	988285	2739		Sí	-	-	Sí

GT2-Clasification

D2. Descriptive and qualitative report with the common components which compounds each of the test cases identified

- SUDOE Region
- Industrial area
- City
- Tipology
- Activity
- Address
- Email, phone, etc
- Geographycal coordinates
- Surface used (m2)

- Electrical supply
- Power (kW)
- Energy consumed (MWh)
- Connection to the grid (kV)
- Optical fiber

- Technological Park (FHa)
- Port (ESTIA)
- Chemical Industry (AICIA)
- Petrochemical Industry (IST)
- Car industry(CENER)
- Iron and steel Industry (USJ)
- Rural microgrid for irrigation pumping (CIRCE)
- Industrial area with small workshops and industrial stores (CIRCE)
- Food – agro alimentary Industry(San Vicente del Raspeig)
- Textile industry (San Vicente del R.)

GT2-Clasification

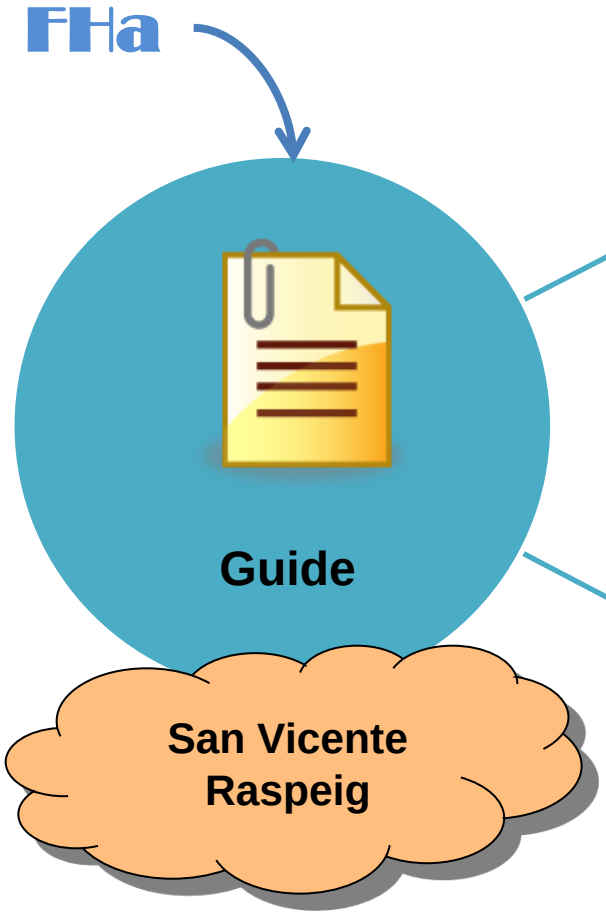
D3. Descriptive and qualitative report with consumption patterns of each type of test cases identified

Finally, we have achieved information of:

- Technological Park: Walqa Technological Park (Huesca) *(FHa)*
- Port: Port of Bayonne (Port area of Tarnos) *(ESTIA)*
- Chemical industry: Polo Químico de Huelva *(AICIA)*
- Petrochemical Industry: Fuel storage Plant of Mitrena (Mitrena peninsula) *(IST)*
- Car Industry: Different companies in the automotive sector in Navarra *(CENER)*
- Iron and Steel Industry: Villalonquejar industrial area (Burgos) *(USJ)*
- Rural: irrigation pumping (Aragón) (CIRCE)
- Generic case: Industrial area with small workshops and industrial stores (CIRCE)
- Food industry: Almendras Llopis (San Vicente)
- Pavement industry: Pemarsa (San Vicente)

GT2-Clasification

D4. Good practice Guide. D5. Training material.



Good habits

- Solutions for people.
- Behaviour of employees and workers.

Solutions

- Solutions for equipments, buildings and installations
- Add new equipment and/or modify the building or the installation

GT2-Clasification

GT2-Clasification

Solutions

- thermal conditioning
- lighting
- equipment and machinery
  - High efficiency motors
  - Regulation of engine
  - Boilers
  - Compressors
  - Furnaces and dryers
  - Cold rooms
  - Tips on office equipment
  - Tips on air
  - Ventilation Tips

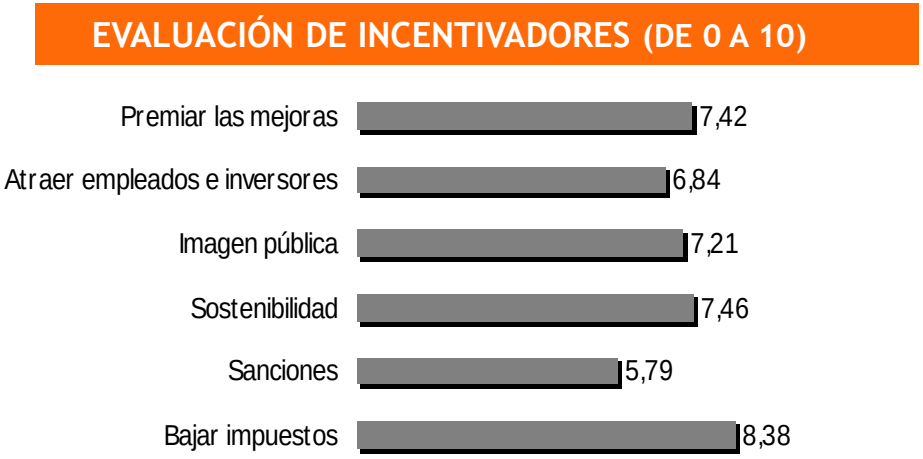
GT2-Clasification

D6. Survey

Base: Polígono Castanell (San Vicente del Raspeig)

Conclusiones:

- 1 de cada 4 empresas invertirá en eficiencia energética. Principal inhibidor de empresas no inversoras la inversión inicial.
- Incentivadores propuestos empresas:



- Sólo un 11,18% empresas usan EERR (8,55% solar)
- Tecnologías de mayor proyección próximos 10 años (encuestas a especialistas sector): tecnologías de enfriamiento, construcción bioclimática, energía solar concentración, vehículo eléctrico, mini – eólica, solar FV.

GT2-Clasification

D7. “Micro – grid “ computer models

Short description of models and tools:

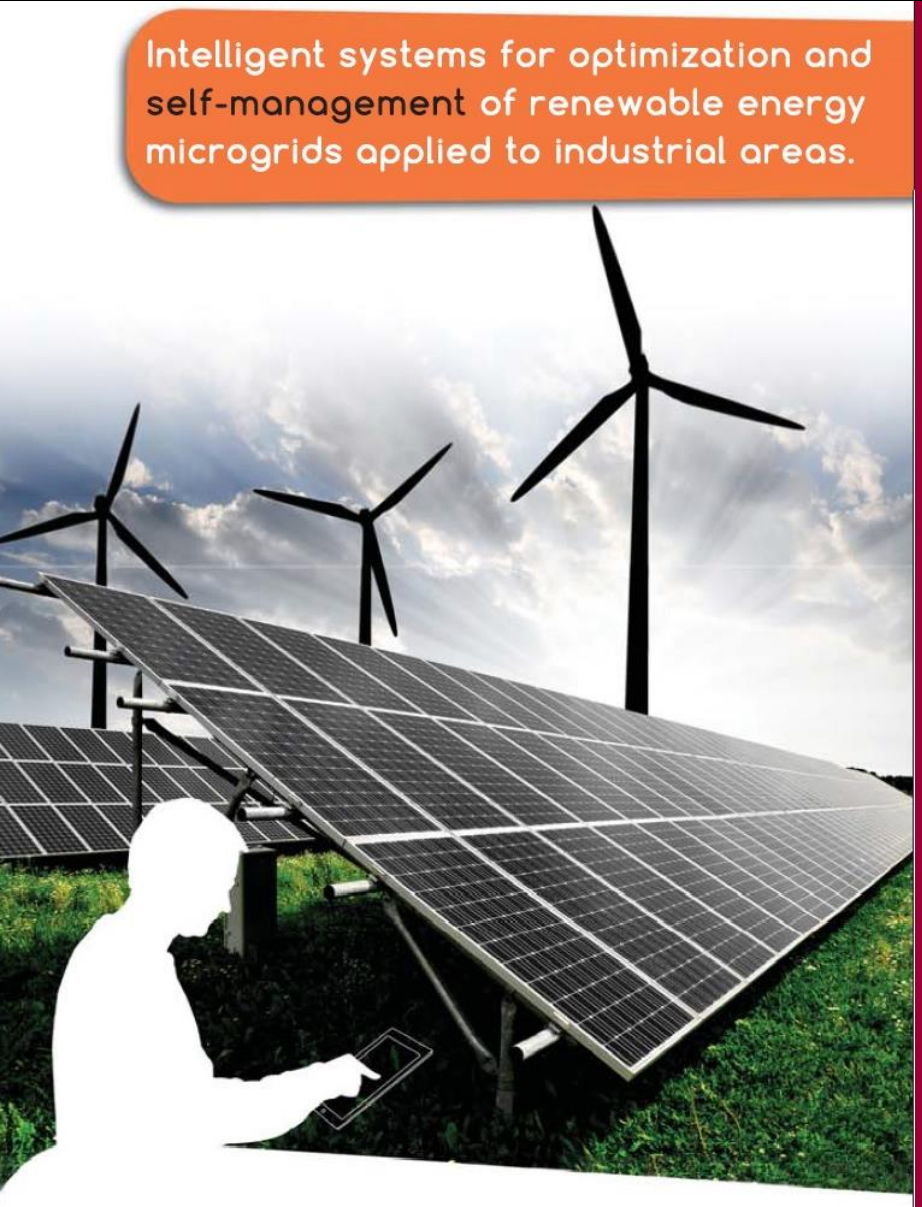
- Model of microgrid at Walqa Technology Park
- Model of microgrid at Sangüesa (CENER installations)
- Model of microgrid at Port of Bayonne
- Model of Rural microgrid for irrigation pumping (Aragón)
- Model of Industrial area with small workshops and industrial stores (Aragón)
- Model of AICIA microgrid facility.

Description of the software used → **HOMER (NREL)**

↓

SIZING

↳ **Initial step for the simulation in GT3**



OptimaGrid

Results presentation

TASK FORCE GT3

Gabriel García
CENER

universidad SANJORGE GRUPO SANVALERO

SUDOE Interreg IV B

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GT3. Implementation of micro-grids with high penetration of renewable energies

ACTIONS

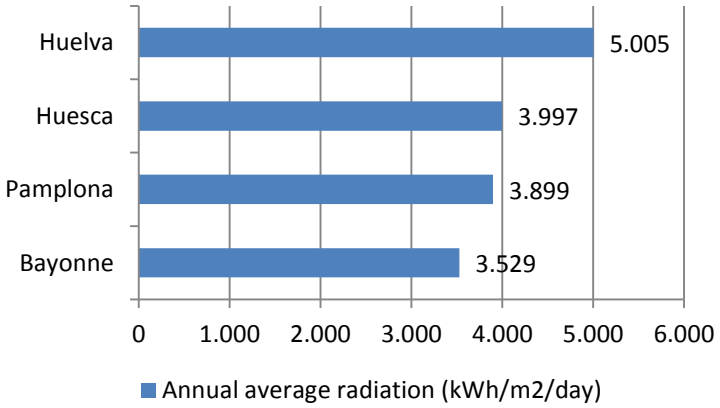
1. Evaluation of natural resources
2. Simulation of mini-grids with high penetration of renewable energies
3. Simulation of mini-grids with energy storage systems to manage energy
4. Validation of models with experimental data
5. Implementation of an ecological labeling for industrial areas

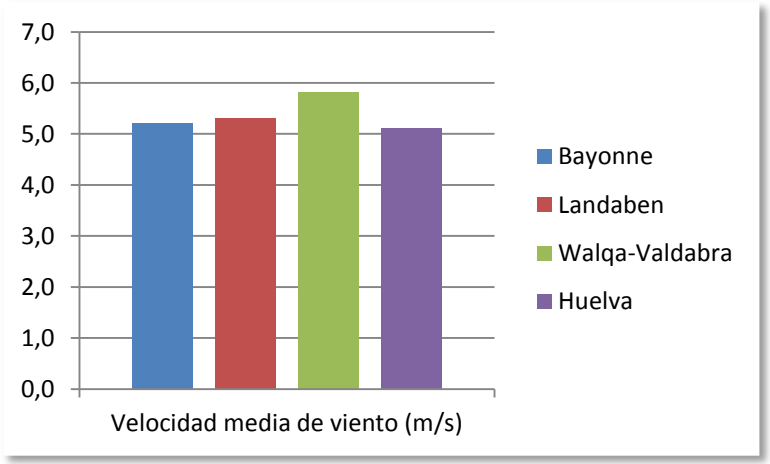
GT3. Implementation of micro-grids with high penetration of renewable energies

1. Evaluation of natural resources

Case studies:

- Port of Bayonne
- Walqa Technological Park
- Landaben Industrial Area
- Valdabra Pumping Station
- Huelva Chemical Park





GT3. Implementation of micro-grids with high penetration of renewable energies

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Ha FUNDACIÓN PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGÍAS DEL HIDRÓGENO EN ARAGÓN

aicia

INSTITUTO SUPERIOR TÉCNICO
Universidade Técnica de Lisboa

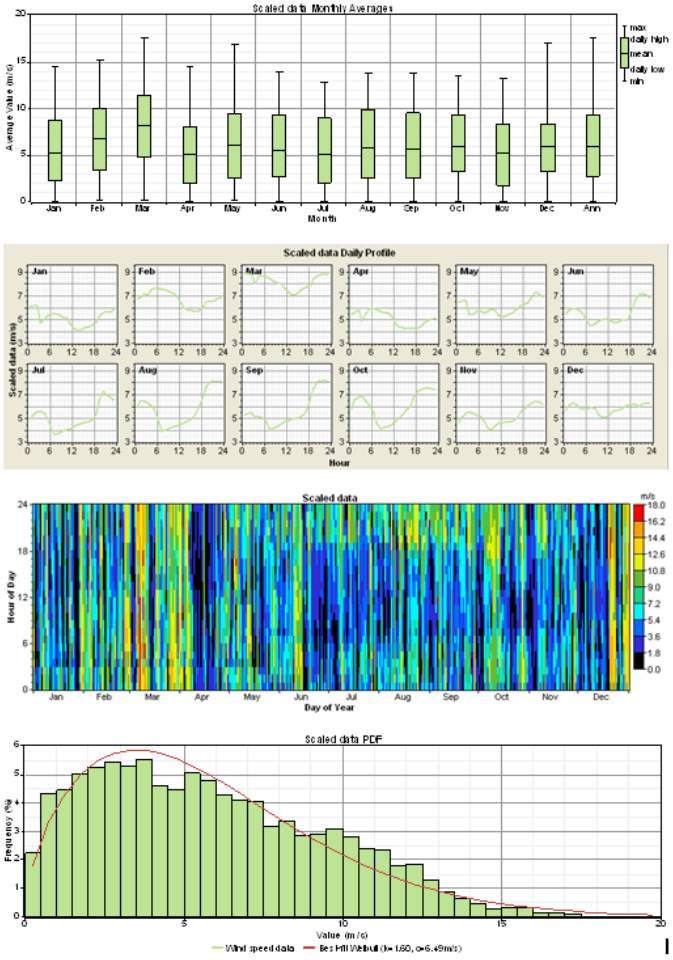
ESTIA
ECOLE D'INGENIEURS
CCI BAYONNE PAYS BASQUE

circe

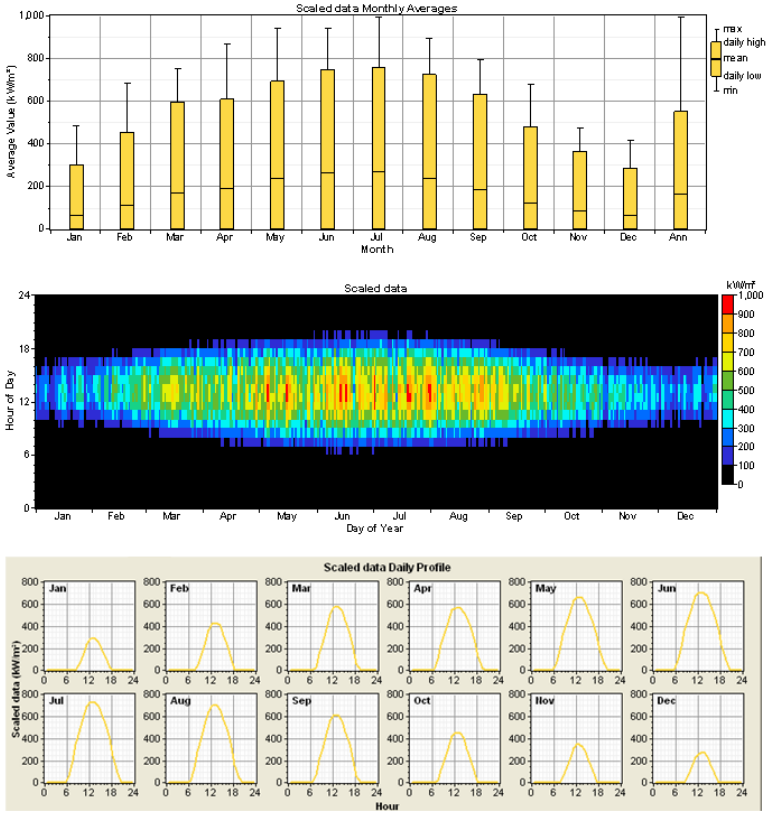
CENER

AYUNTAMIENTO DE SAN VICENTE DEL RASPEIG

Wind resource



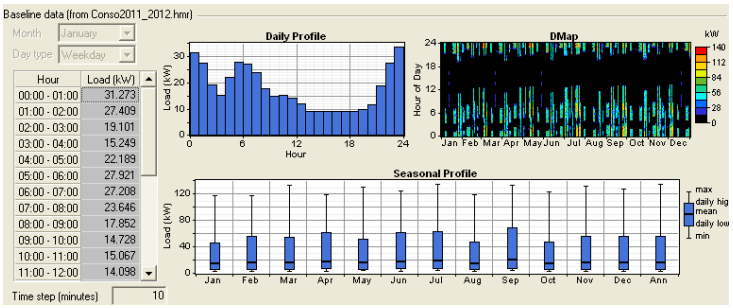
Solar resource



GT3. Implementation of micro-grids with high penetration of renewable energies

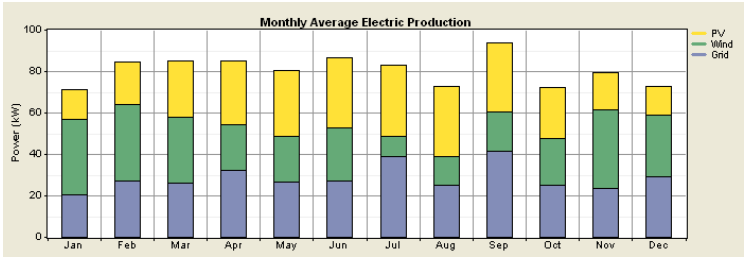
2-3. Simulation of mini-gris with and without energy storage

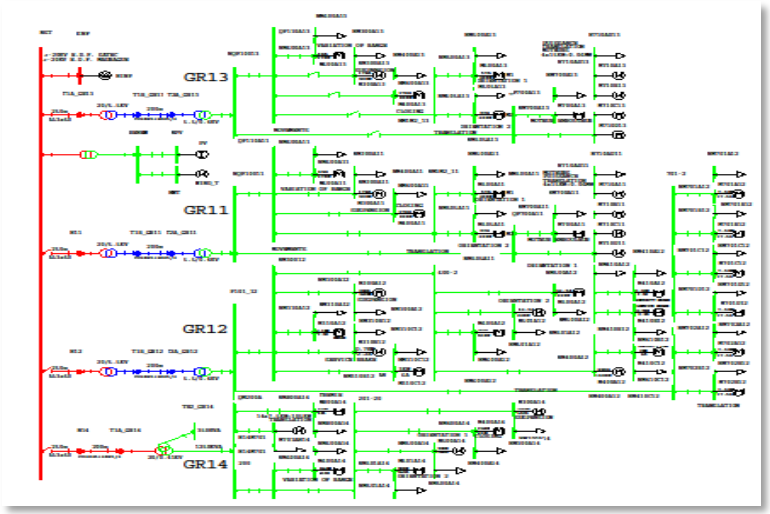
Port of Bayonne



CRANE 12

Anemometer JRI

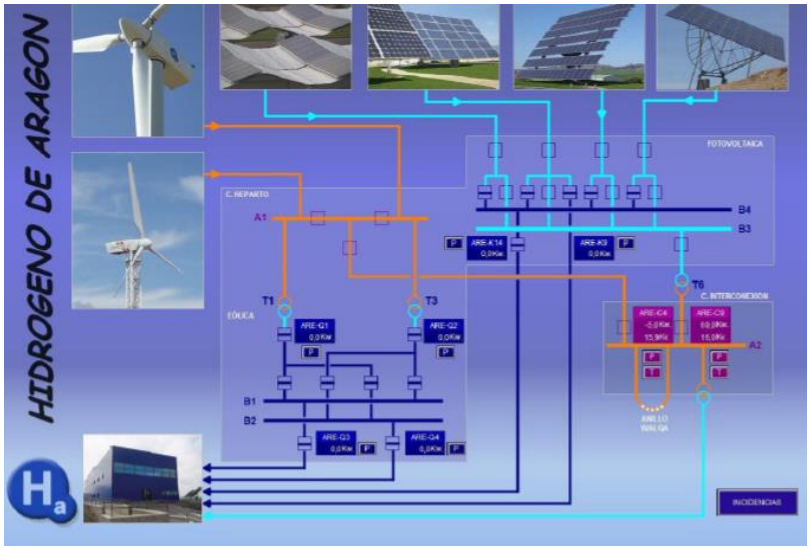


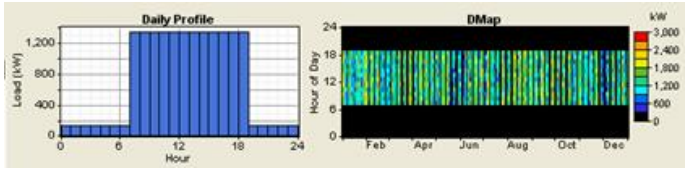


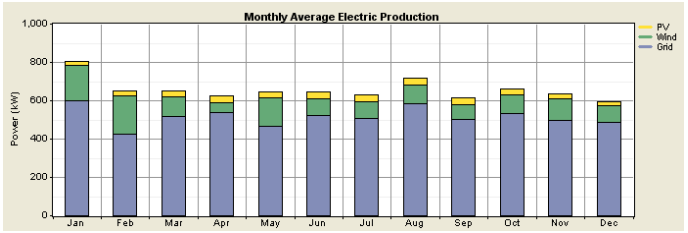
GT3. Implementation of micro-grids with high penetration of renewable energies

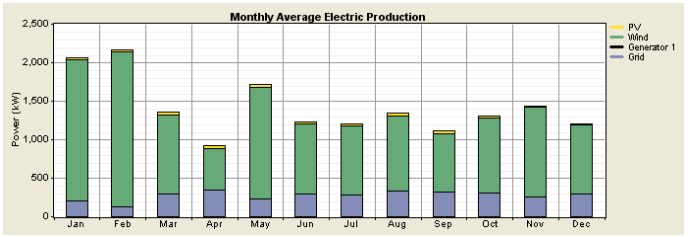
2-3. Simulation of mini-gris with and without energy storage

Walqa Technological Park





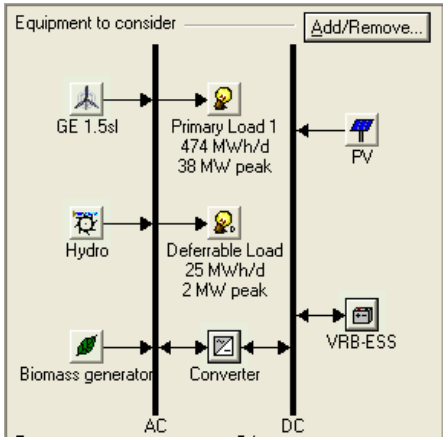




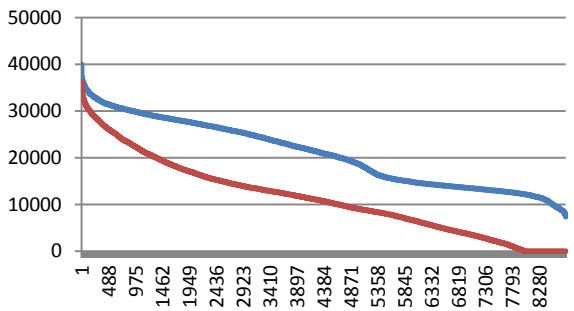
GT3. Implementation of micro-grids with high penetration of renewable energies

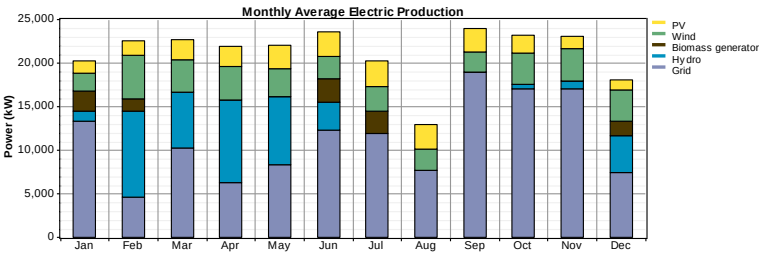
2-3. Simulation of mini-gris with and without energy storage

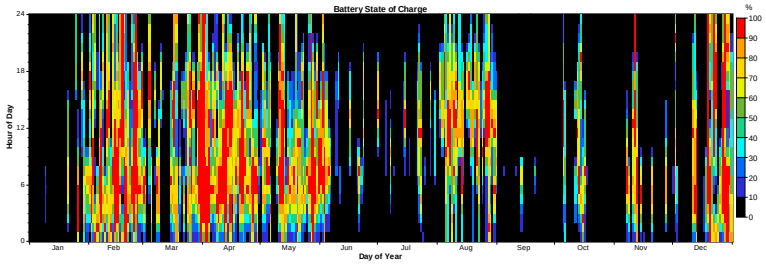
Landaben Industrial Area



PV	Wind	Hydro	Biomass	Initial capital (M€)	Operating cost (M€/yr)	Total NPC (M€)	COE (c€/kWh)	Renewable fraction
				35.0	10.2	165.3	7.1	32%
				20.0	11.7	169.3	7.3	17%
				15.0	12.3	172.4	7.4	15%
				55.0	9.4	175.6	7.5	36%
				0.0	**13.9**	**177.5**	**7.6**	**0%**
				40.0	10.9	179.5	7.7	22%
				35.0	**11.5**	**182.4**	**7.8**	**20%**
				72.5	8.9	185.9	8.0	41%
				20.0	13.1	187.7	8.1	5%
				57.5	**10.3**	**189.2**	**8.1**	**27%**
				52.5	10.9	192.4	8.3	25%
				92.5	**8.1**	**196.4**	**8.4**	**46%**
				37.5	12.5	197.4	8.5	10%
				77.5	9.5	199.4	8.6	32%
				72.5	10.2	202.6	8.7	30%
				57.5	11.7	207.5	8.9	15%



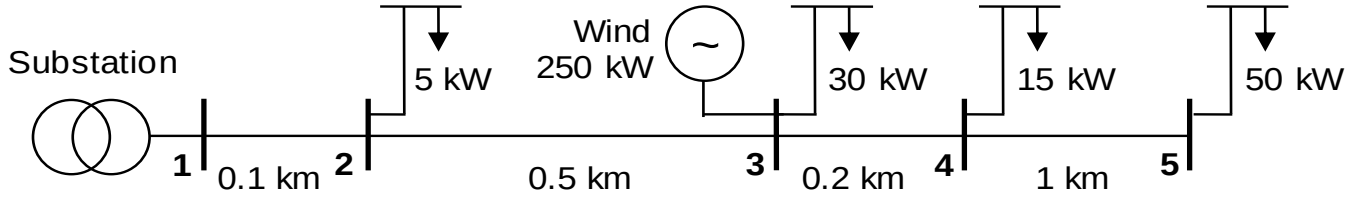


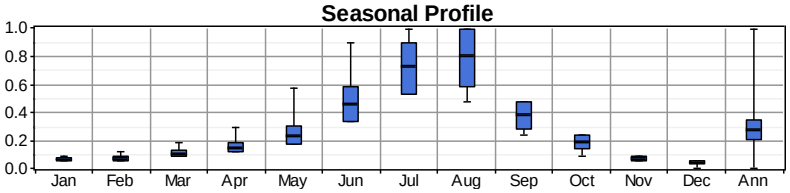


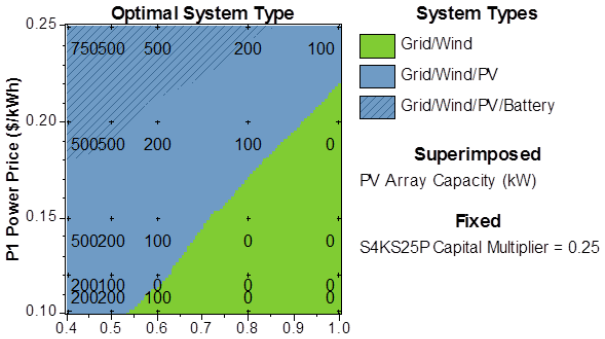
GT3. Implementation of micro-grids with high penetration of renewable energies

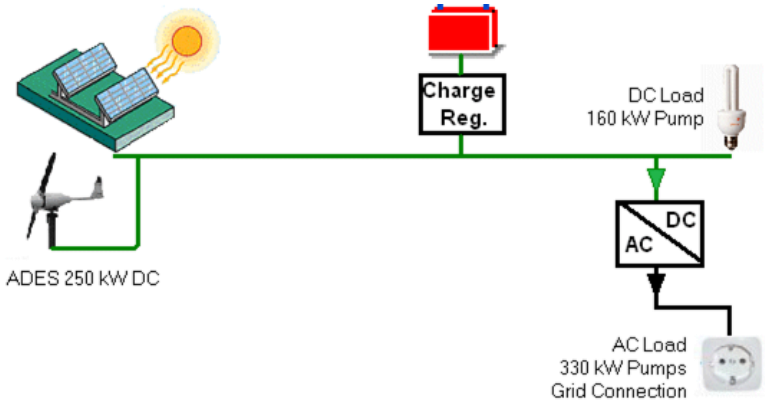
2-3. Simulation of mini-gris with and without energy storage

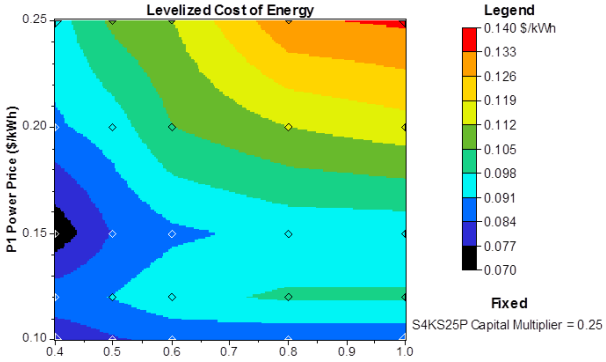
Valdabra Pumping Station







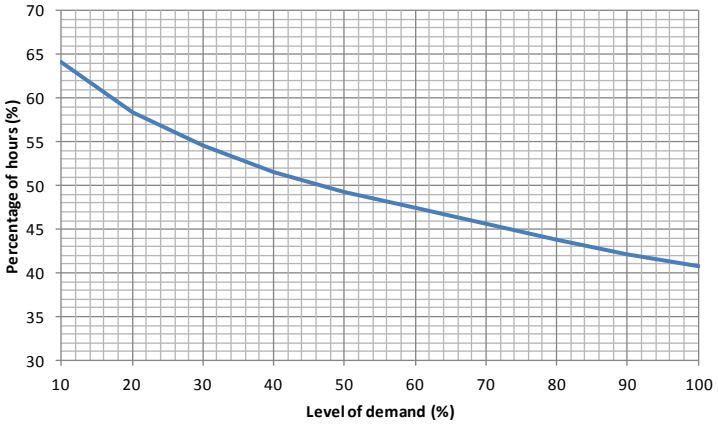


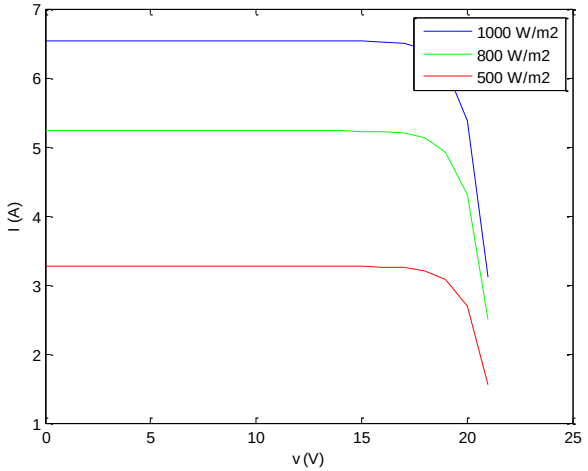


GT3. Implementation of micro-grids with high penetration of renewable energies

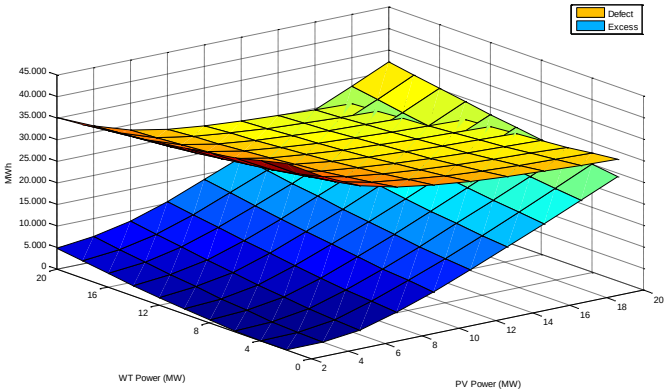
2-3. Simulation of mini-gris with and without energy storage

Huelva Chemical Park



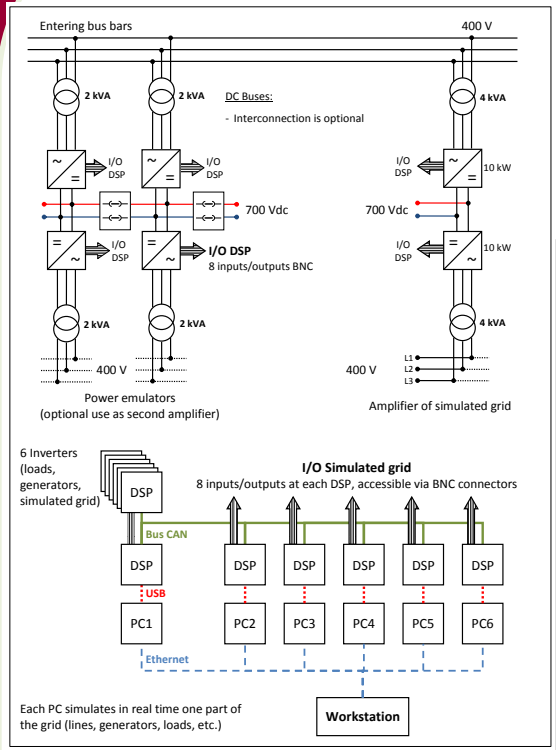


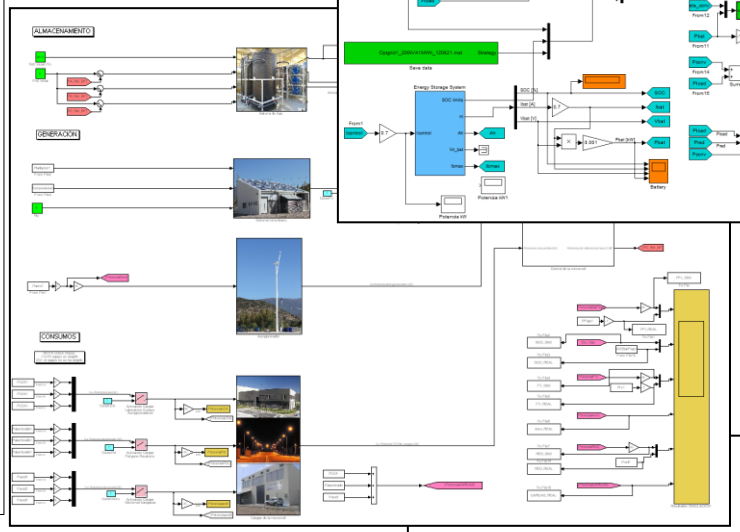
Wind farm power (MW)	Photovoltaic field power (MW)										
	0	2	4	6	8	10	12	14	16	18	20
0	50,1	55,7	62,6	70,5	76,3	80,3	83,3	85,6	87,5	89,1	90,4
2	51,7	57,7	65,1	73,2	78,9	82,9	85,9	88,2	90,1	91,6	93,0
4	53,4	59,8	67,6	75,7	81,4	85,4	88,4	90,7	92,6	94,2	95,5
6	55,2	61,8	69,7	77,9	83,7	87,7	90,7	93,0	94,9	96,5	97,9
8	56,7	63,5	71,6	79,8	85,6	89,7	92,8	95,1	97,0	98,7	100
10	58,1	65,0	73,3	81,5	87,4	91,6	94,6	97,0	99,0	100	100
12	59,3	66,4	74,8	83,2	89,1	93,3	96,4	98,8	100	100	100
14	60,5	67,7	76,2	84,7	90,7	94,9	98,0	100	100	100	100
16	61,6	68,9	77,6	86,1	92,2	96,4	99,6	100	100	100	100
18	62,6	70,1	78,8	87,5	93,6	97,9	100,0	100	100	100	100
20	63,6	71,2	80,0	88,7	94,9	99,2	100,0	100	100	100	100

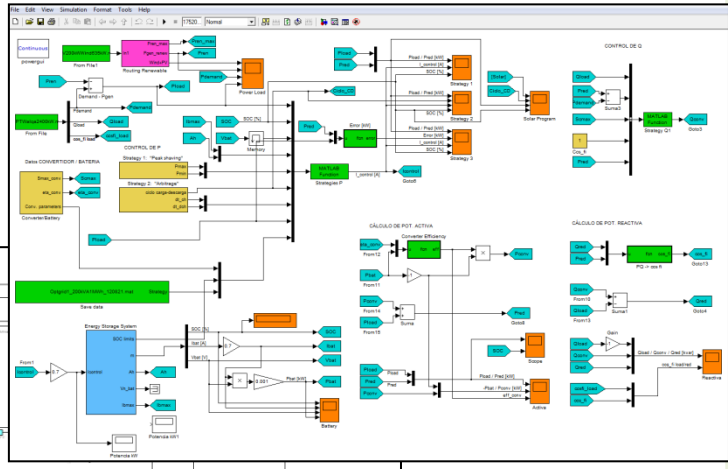


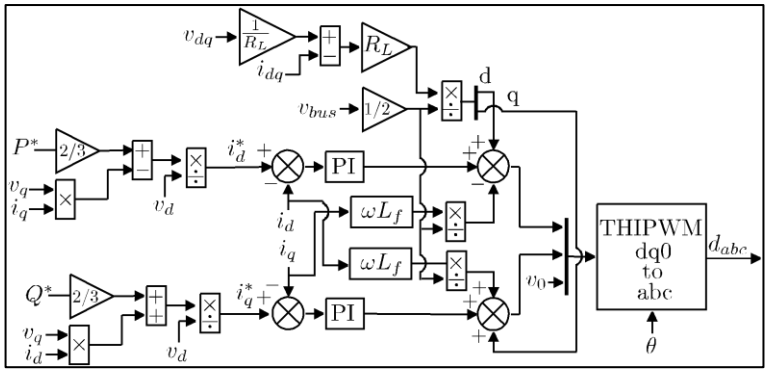
GT3. Implementation of micro-grids with high penetration of renewable energies

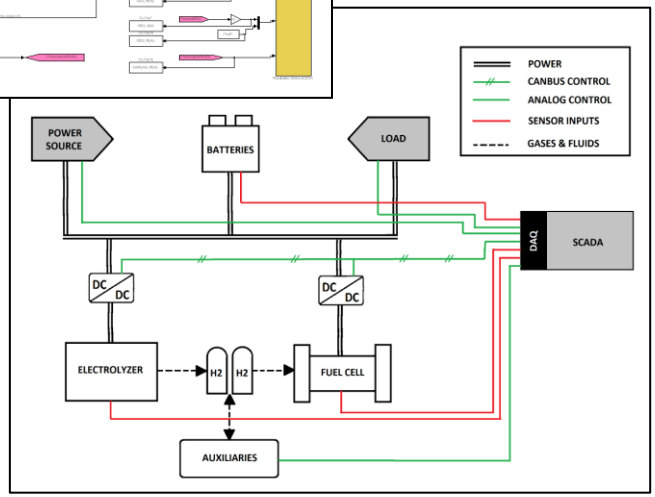
4. Validation of models with experimental data











GT3. Implementation of micro-grids with high penetration of renewable energies

5. Implementation of an ecological labeling for industrial areas

State-of-the-art of a wide range of environmental and energy labels, as well as legislation on energy at national and EU level

Description of certification and labeling schemes

Intelligent systems for optimization and self-management of renewable energy microgrids applied to industrial areas.

OptimaGrid

Results presentation

TASK FORCE GT4

Moisés Friginal
Universidad San Jorge

universidad SANJORGE GRUPO SANVALERO

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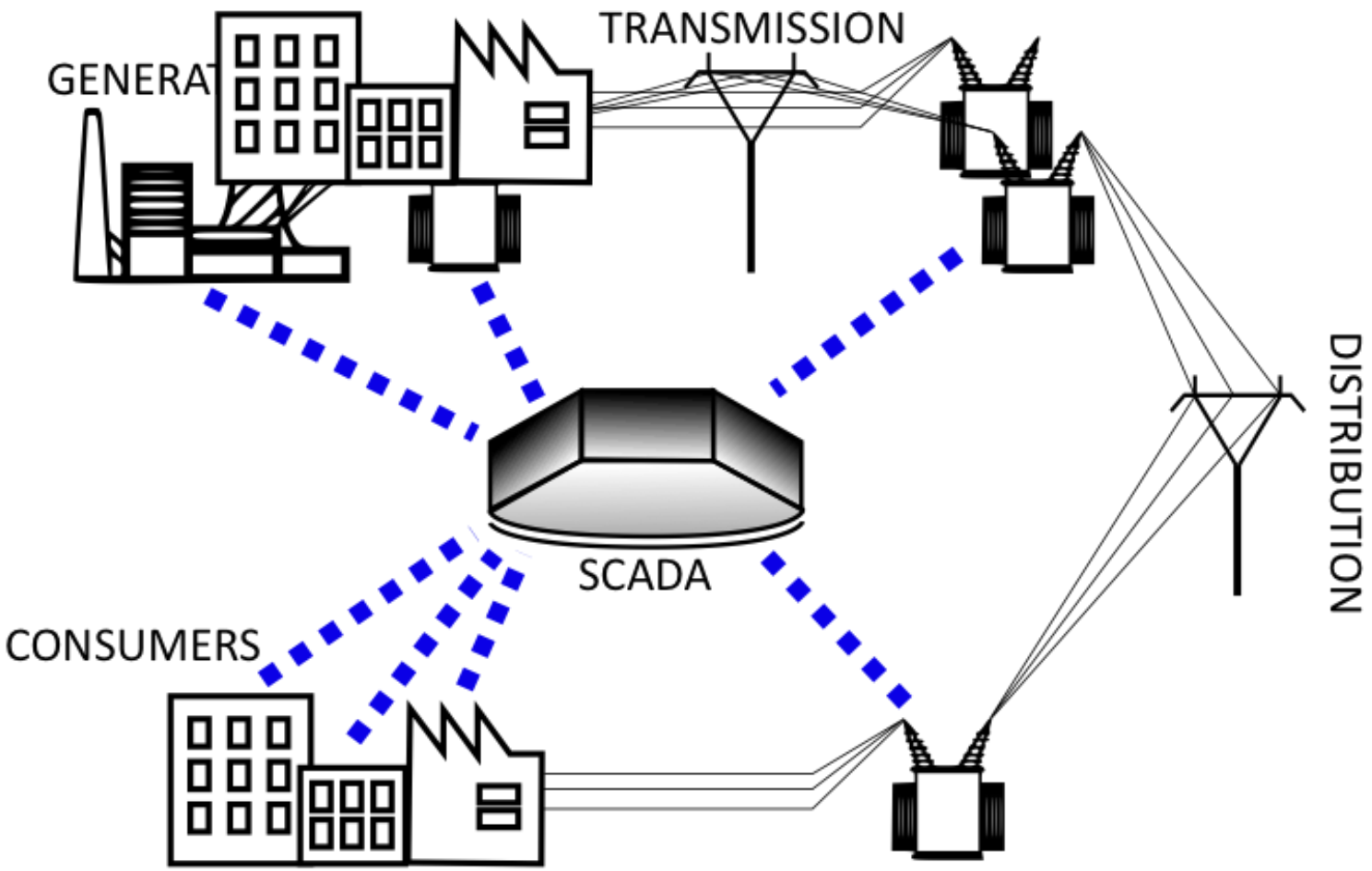
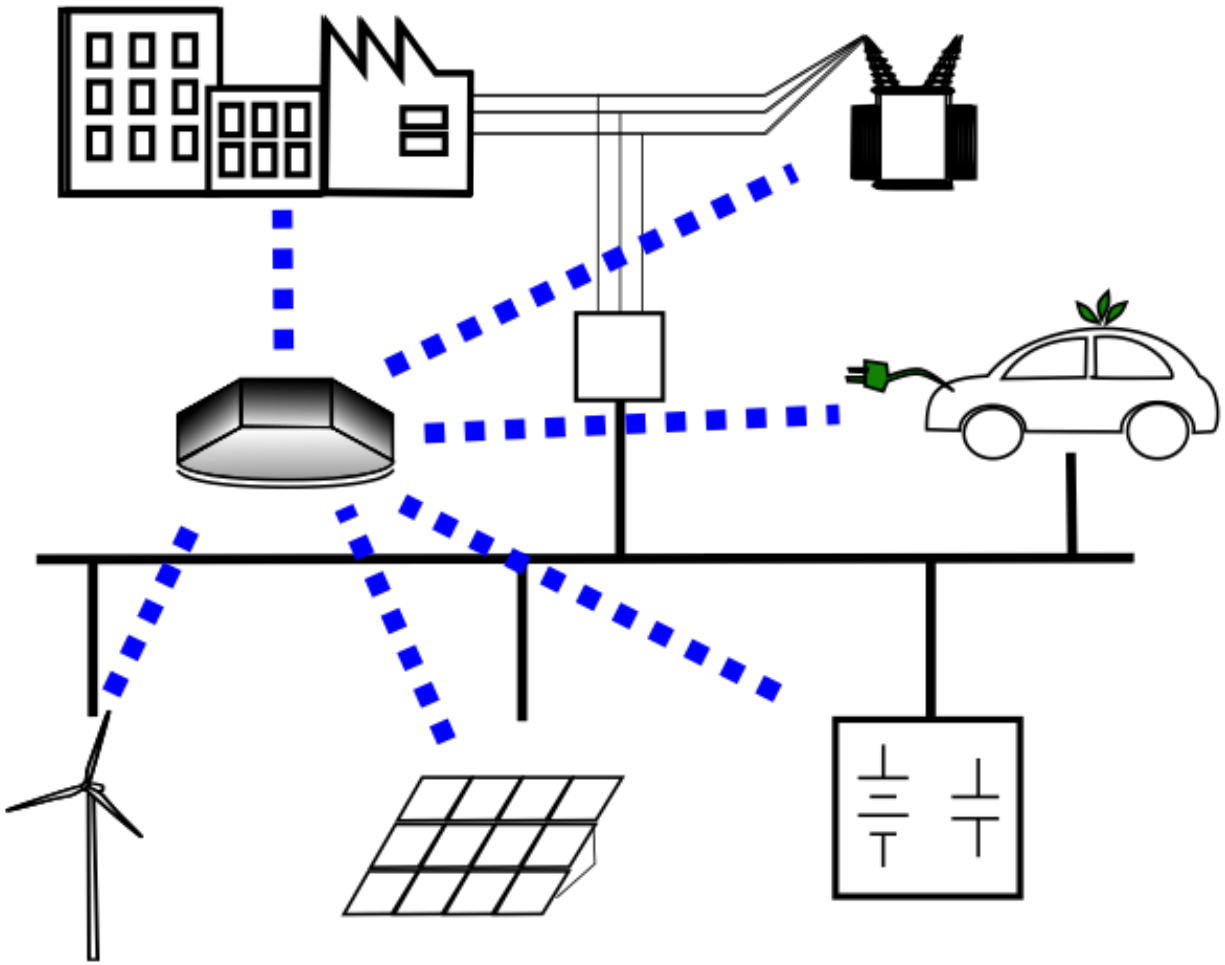
GT4

Design, development and implementation of *Renewable Energy Consumption Optimization Center* (RECOC)

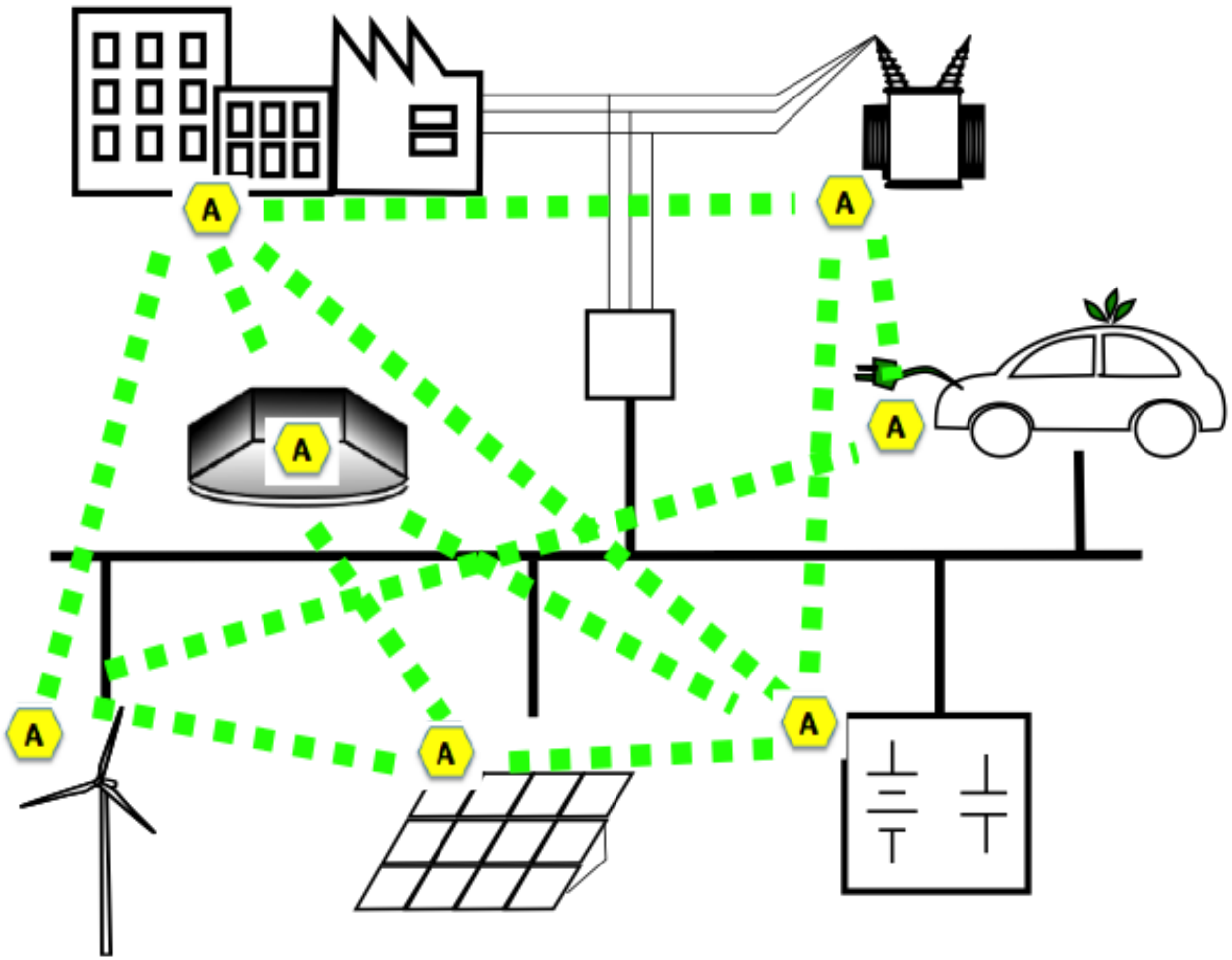
Conventional Grid



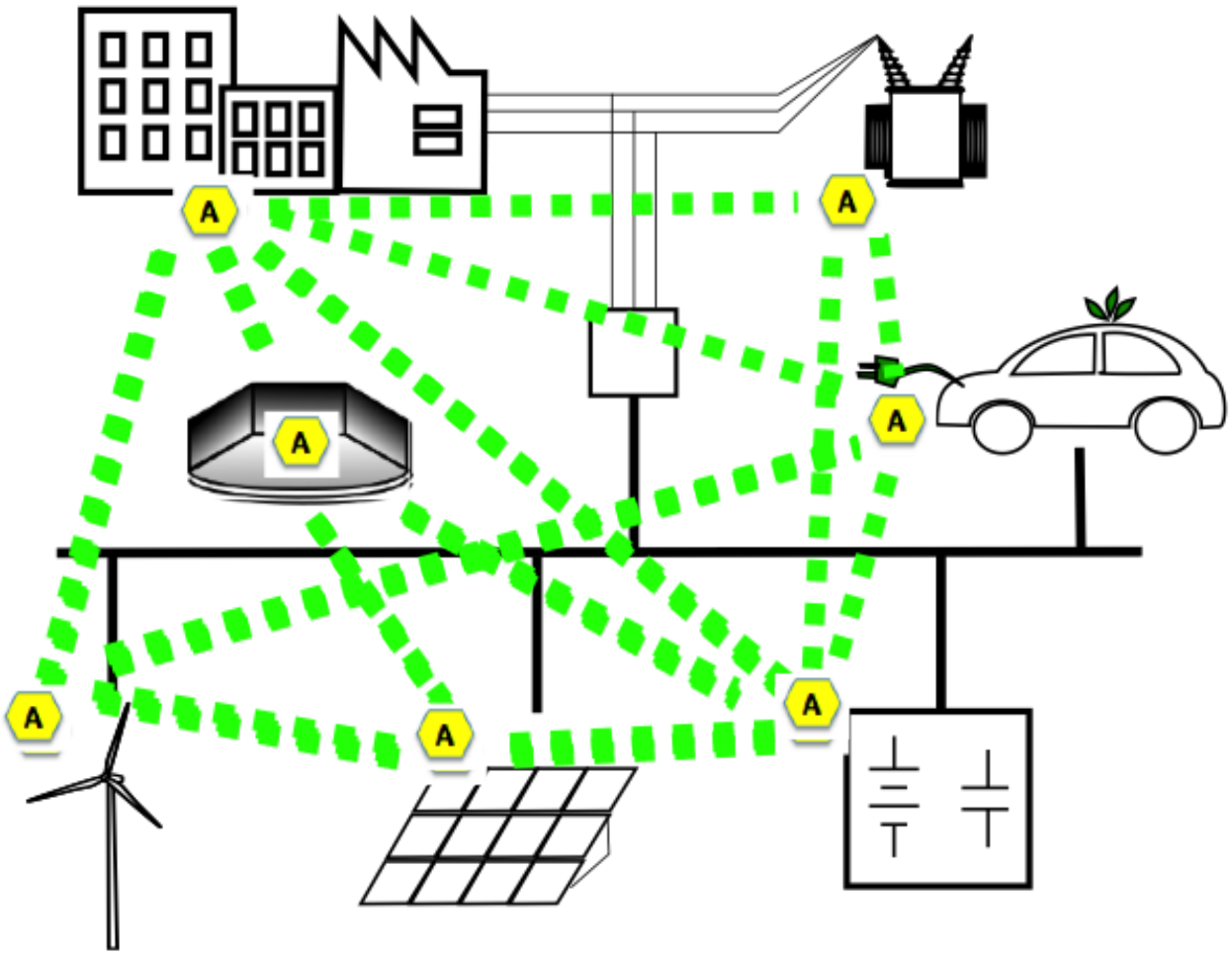
Microgrid



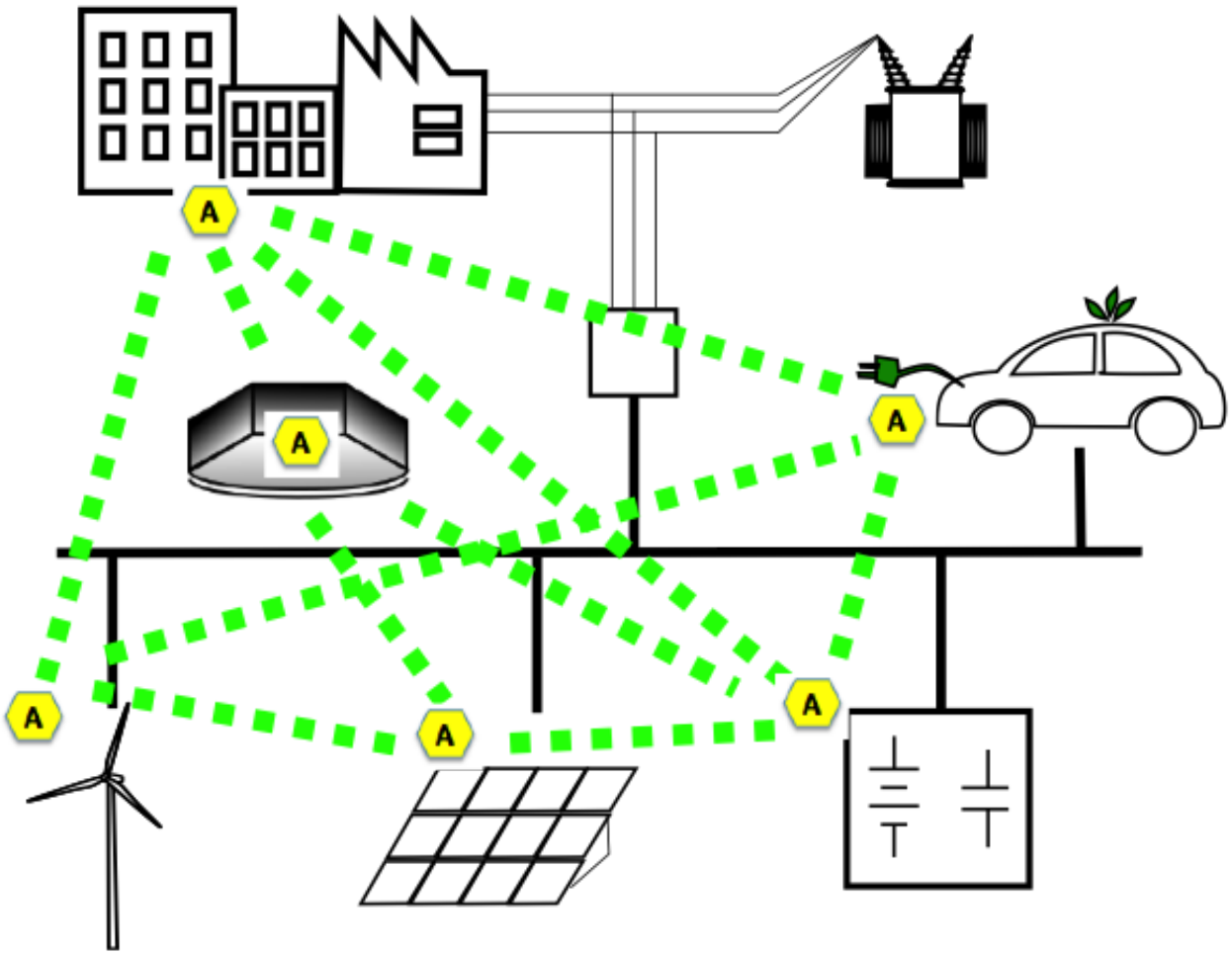
Smartgrid



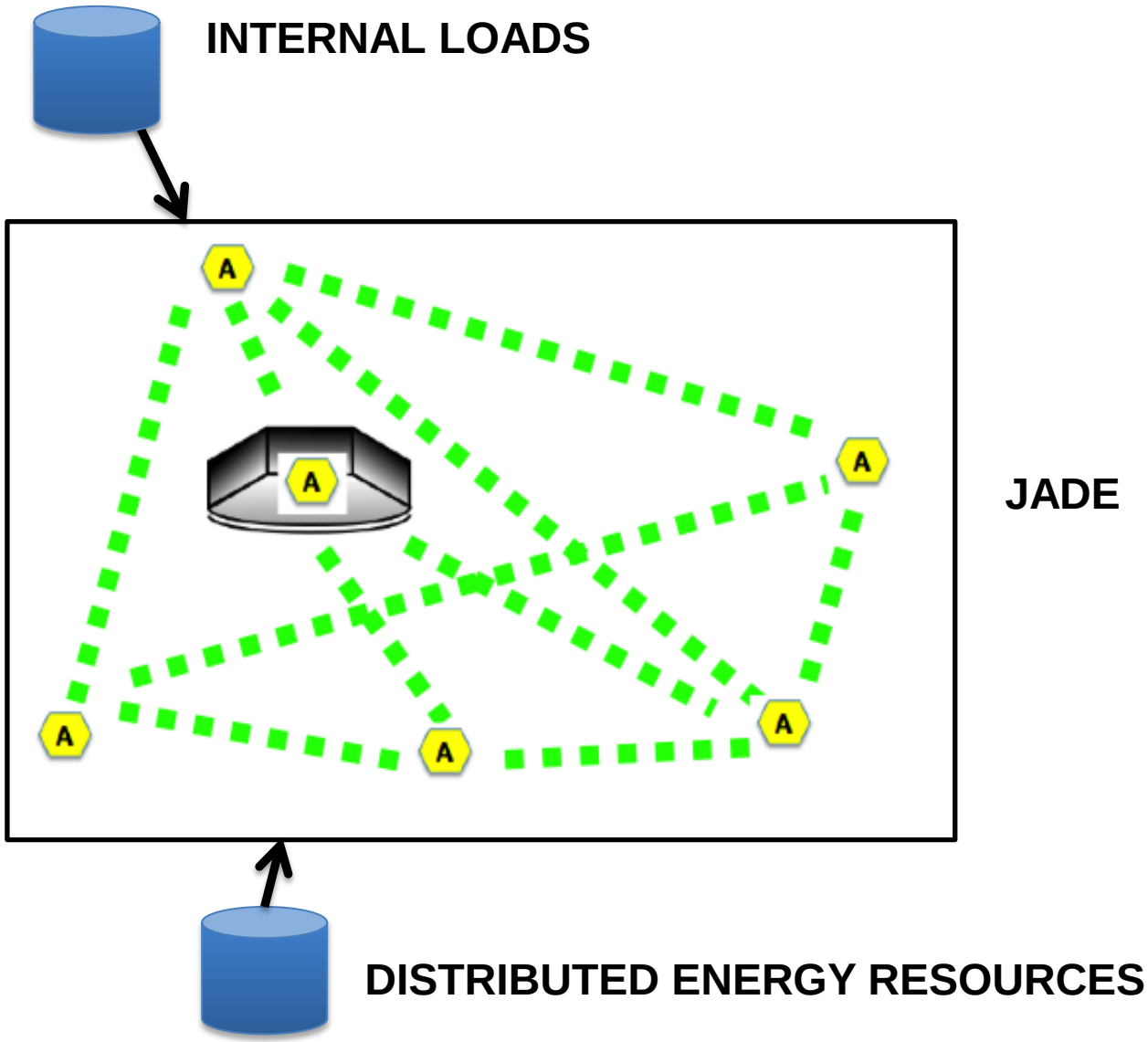
Smartgrid



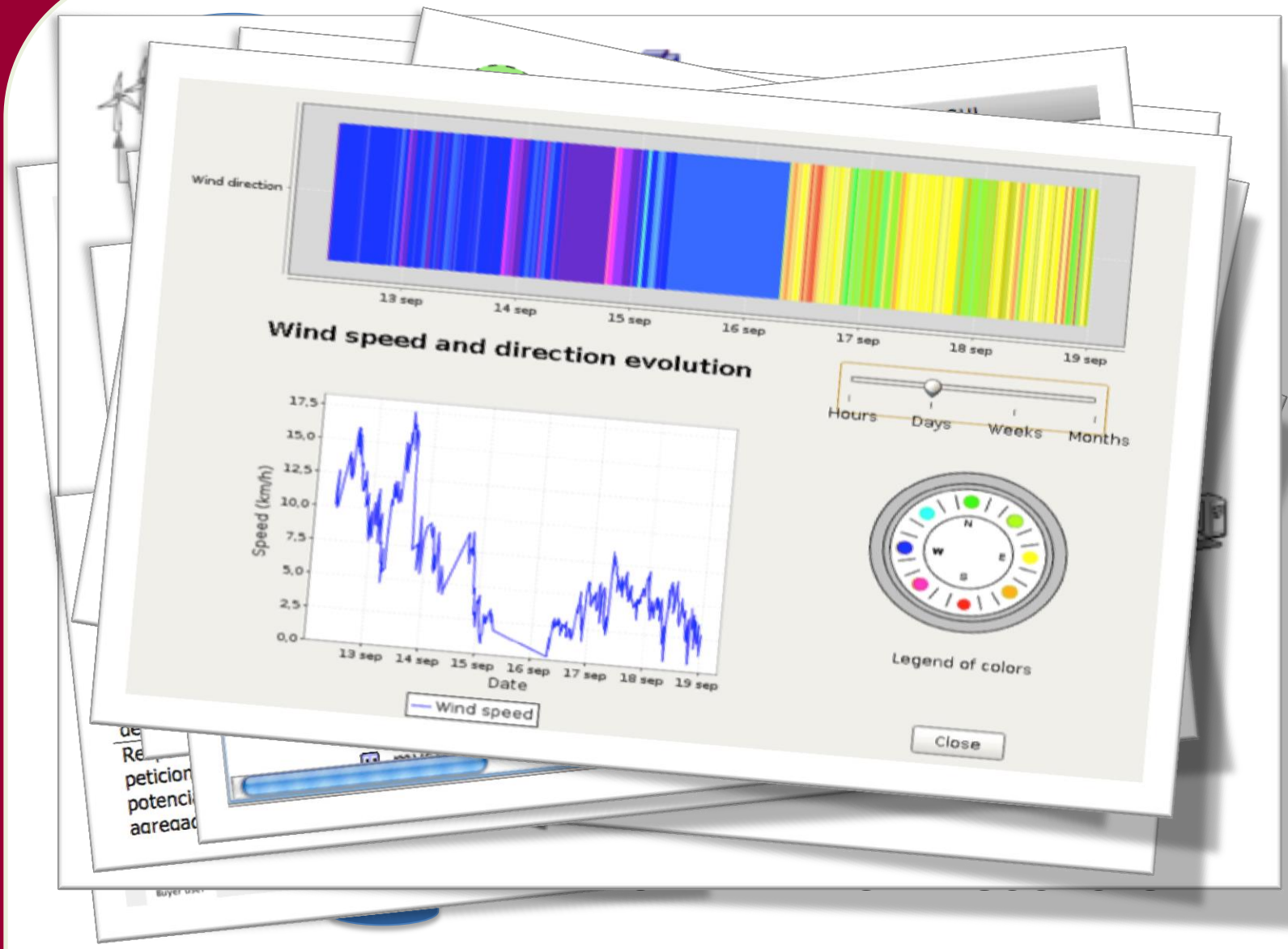
Smartgrid



OptimaGrid



OptimaGrid


Wind direction
13 sep
14 sep
15 sep
16 sep
17 sep
18 sep
19 sep
Wind speed and direction evolution
Hours
Days
Weeks
Months
Speed (km/h)
17,5
15,0
12,5
10,0
7,5
5,0
2,5
0,0
Date
Wind speed
Legend of colors
Close

GT4: DELIVERABLES

D15 CONTROL SYSTEM REQUIREMENTS
D16 COMMUNICATION ARQUITECTURE
D17 CONTROL UNIT DESIGN
D18 IMPLEMENTATION ALTERNATIVES
D19 TECHNICAL DOCUMENTATIONS

Intelligent systems for optimization and self-management of renewable energy microgrids applied to industrial areas.

OptimaGrid

Results presentation

CONCLUSIONS

David Chinarro
Universidad San Jorge

universidad SANJORGE GRUPO SANVALERO

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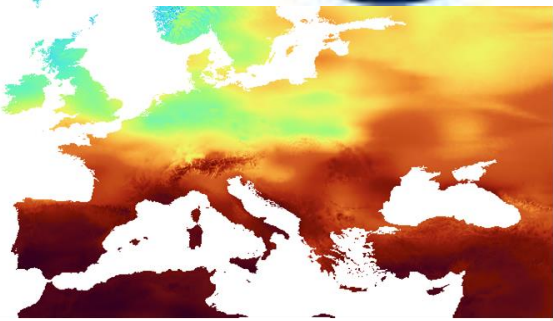
recipients of project results



EUROPEAN SOUTHWEST
AUTONOMOUS TOWNS AND REGIONS: **30**
SURFACE AREA: **770,120 KM²**
POPULATION **61.3 MILLION**

Transversal cooperation

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ESTIA — ECOLE D'INGENIEURS — CCI BAYONNE PAYS BASQUE

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AYUNTAMIENTO DE SAN VICENTE DEL RASPEIG

iea International Energy Agency

IEA HIA 64th EXECUTIVE COMMITTEE Meeting, 2011, Copenhagen, Denmark

walqa Parque Tecnológico

Ciemat ceder — centro de desarrollo de energías renovables

AYUNTAMIENTO Soria — Soria ¿Qué? cero

GIMACES

USJ

G·E·B·E — GESTOR DE BALANCES ENERGÉTICOS EN REDES CON GENERACIÓN DISTRIBUIDA INTELIGENTE

endesa

gasNatural fenosa

edp

eDF

bifi — Instituto Universitario de Investigación Biocomputación y Física de Sistemas Complejos — Universidad Zaragoza

UNIVERSITAS Miguel Hernández

GEeitEma.
Universidad de Valencia

knowledge transfer to industrial areas

Port de Bayonne, 2012.
Ionel Vechiu (ESTIA), Jean-Claude Demange ((Port de Bayonne), Stephane Kreckelbergh (ESTIA).

AYUNTAMIENTO DE
SAN VICENTE DEL RASPEIG
Innopark- Centro Polifuncional Servicios a Empresas

El 83% de las empresas de San Vicente tienen planes de eficiencia energética

DISEMINATION and EVENTS

http://www.optimagrid.eu/

2011, July , Bidart. Séminaire thématique « Ingénierie électrique, automatique et Energies Renouvelables»

Upshots

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deliverables

D1_DATABASE
D2_DESCRIPTION_TEST_CASES
D3_CONSUMPTION_PATTERNS
D4_GOOD_PRACTICES_GUIDE
D5_TRAINING_MATERIAL
D6_SURVEYS
D7_MICRO_GRID_COMPUTER_MODELS
D_08-12_RESULTS_MODELS
D_13_EVOLUTION_OF_RD_ACTIVITIES
D_14_TRAINING_GUIDE
D15 CONTROL SYSTEM REQUIREMENTS
D16 COMMUNICATION ARQUITECTURE
D17 CONTROL UNIT DESIGN
D18 IMPLEMENTATION ALTERNATIVES
D19 TECHNICAL DOCUMENTATIONS

Good practices guide for businesses

Energy saving guide in industrial areas

¿Han realizado alguna acción de eficiencia?	Respon-dientes	Respuestas				
		Total	Hostel.	Servicio	C. mayor	Industria
Ninguna	4,61	1,52	-	2,90	1,10	-
Productos eficientes	84,21	27,77	21,28	28,99	27,47	28,45
Reducir fugas, aprovechar luz...	56,58	18,66	14,89	18,84	20,88	18,10
Aislamiento (materi. construcción)	50,00	16,49	19,15	16,91	19,78	12,07
Redimensión de necesidades	36,18	11,93	12,77	11,11	12,09	12,93
Limitación de horarios	30,26	9,98	8,51	11,11	6,59	11,21
Sensores de presencia	29,61	9,76	19,15	8,21	6,59	11,21
Vehículos eléctricos	11,18	3,69	2,13	1,93	5,49	6,03
Otra	0,66	0,22	2,13	-	-	-
Total	-	100	100	100	100	100

Analysis of business surveys. Sant Vicent del Rapeig

El Ayuntamiento de Sant Vicent creará un punto de asesoramiento sobre energías renovables para facilitar su implantación en las empresas y comercios

PRESS


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Interreg IV B
lacronicavirtual.com
periódico digital independiente
Costa
Comunicaciones
OptimaGrid
AUGPEE
Asociación Uruguaya de Generadores Privados de Energía Eléctrica
aragón investiga
CIENCIA
INNOVACIÓN
NOTICIAS
AGENDA
ARAGON INVESTIGA
El proyecto Optimagrid ha pr
optimización y autogestión de
navarrainnova
Jornada CENER sobre micror
HERALDO
DE ARAGON
INSTITUTO SUPERIOR
REVISTA DE LA ENERGÍA
Noticias » Actualidad
Microrredes en áreas industriales
Noticias
Actualidad
ECOticias.com
20minutos.es
SOLARNEWS
InnD
VALENCIA
LA VANGUARDIA
Alican
economia.c
Rinnovabili.it
IL QUOTIDIANO SULLA SOSTENIBILITA' AMBIENTALE
Optimagrid, e le aree industriali diventano
energeticamente indipendenti

Innovation

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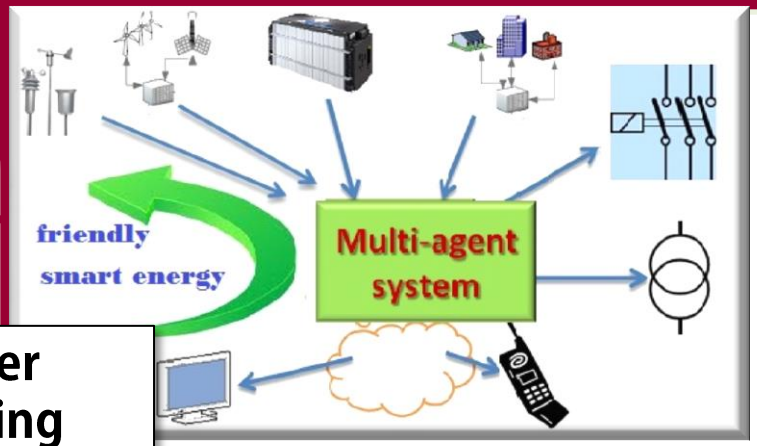

Computer Engineering

StationENR. ESTIA

Wind energy and hydrogen integration. FHa, AICIA, CENER

Automotive and microgrid integration. CIRCE

CENER

Batteries for microgrid

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Training

Training activities have been carried out directly in the business environment, coinciding with events convened

Partners Center are already conducting courses and grades on issues related to the project, so there is a mutual involvement between OPTIMAGRID and Center are easy implemented.

- ❑ **8 Grade Final Projects in Electrical and Computer Engineering**
- ❑ **1 Master Final Project**
- ❑ **2 Doctoral Thesis**
- ❑ **22 direct jobs**

New training plans in Energy and Environment to be carried out by some of partners

International conferences

The 5th Energy Storage Forum
Europe 2012
12 - 14 June
Rome

Conference of Luxembourg
Role of Energy Storage in Micro-grids
Raquel Garde Aranguren,CENER

ICSTCC 2012
16th International Conference on System Theory, Control and Computing
Joint Conference SINTES 16, SACCS 12, SIMSIS 16

Sizing and dynamic analyses of a micro-grid supplying a harbor industrial area
S. Kreckelbergh, I. Vechiu

ICREPQ 11 INTERNATIONAL CONFERENCE ON RENEWABLE ENERGIES AND POWER QUALITY, GRAN CANARIA

Microgrids for the Optimal Use of Renewable Energy in Mediterranean Countries.
D. Chinarro **(USJ)**

IGC
COLOGNE 2012
DOWN TO EARTH

32nd International Geographical Congress

26-30 August 2012

Scientific contributions

- ***Probabilistic model for distributed generation expansion in distribution power network.*** *C. Ponce-Corral, H. Bludszuweit, and J.A. Domínguez-Navarro, Proceeding EA4EPQ, 2011*
- ***Control of a Hybrid Energy Storage System Using a Three Level Neutral Point Clamped Converter.*** *Aitor Etxeberria_y, Ionel Vechiu_, Sylvain Baudoin_, Haritza Camblongz and Jean-Michel Vinassay, Innovative Smart Grid Technologies (ISGT Europe), 2011.*
- ***Improved wind forecasting with wavelets,*** *J.A. Domínguez-Navarro, H. Bludsweit, , J.L. Bernal-Agustín, and R. Dufo, EA4EPQ proceding , 2012*
- ***Development of a fuel cell-based system for refrigerated Transport.*** *Raquel Garde, Fernando Jiménez, Tomás Larriba,, Gabriel García, Mónica Aguado, Manuel Martínez, Energy Procedia, 2012*
- ***Comparison of Three Topologies and Controls of a Hybrid Energy Storage System for Microgrids. Etxeberria,*** *I. Vechiu, H. Camblong, J.-M. Vinassa, Energy Conversion and Management, 2013*
- ***A Multi-Agent-System Architecture for Smart Grid Management and Forecasting of Energy Demand in Virtual Power Plants.*** *Luis Hernández and Carlos Baladrón and Javier M. Aguiar and Belén Carro and Antonio Sánchez-Esguevillas and Jaime Lloret and David Chinarro and Jorge J. Gómez and Diane Cook, IEEE Communications, 2013*

Conclusions

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Fundación para el Desarrollo de las Nuevas Tecnologías del Hidrógeno en Aragón

aicia

Instituto Superior Técnico Universidade Técnica de Lisboa

ESTIA ECOLE D'INGENIEURS CCI BAYONNE PAYS BASQUE

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CENER

Ayuntamiento de San Vicente del Raspeig

innovation

sustainability

European Commission

today's jobs for clean future

OptimaGrid

THANKS
MERCI
OBRIGADO
GRACIAS POR SU ATENCIÓN

Optimagrid has ended, but our endeavor keeps targeted to sustainable energy