



IV CONGRESO

**SMART GRIDS**

Madrid 23 Noviembre 2017

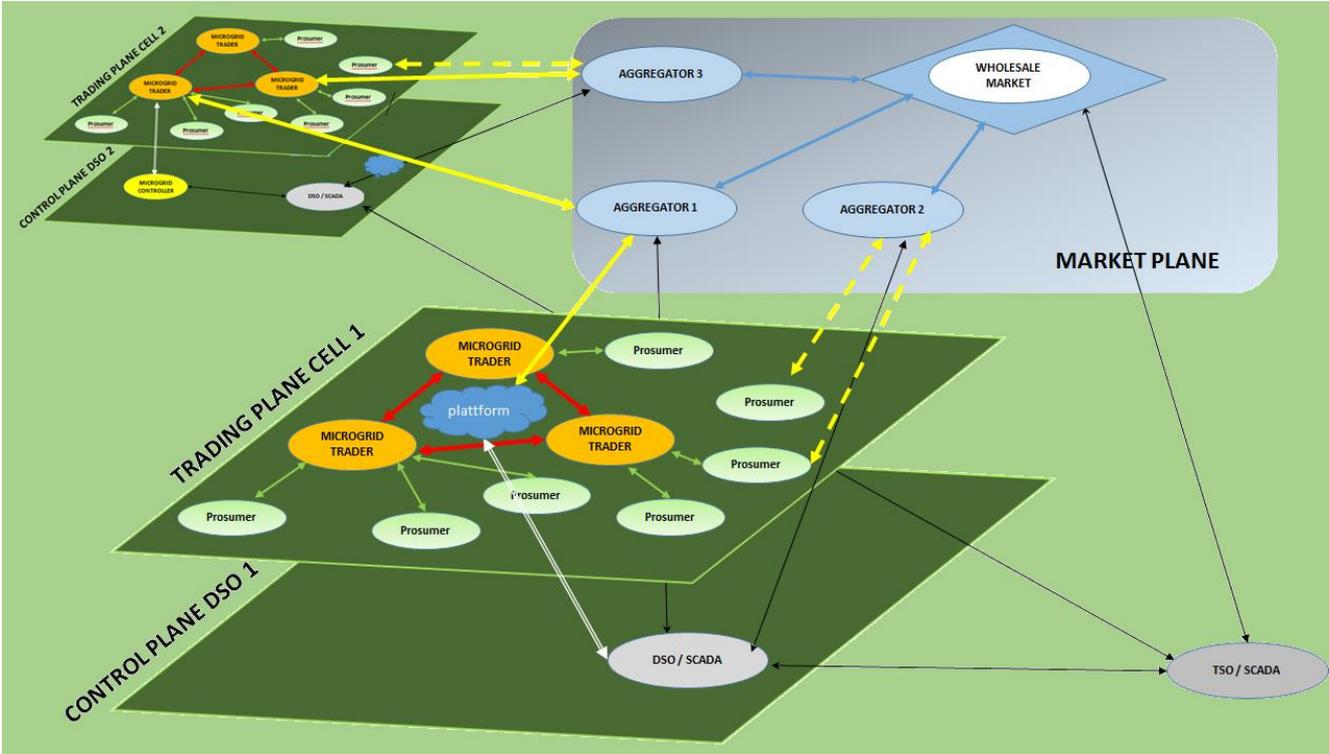
**PROYECTO P2P SMARTTEST: PLATAFORMA  
DE SIMULACION DE INTERCAMBIO DE  
ENERGIA EN REDES DISTRIBUIDAS  
SIGUIENDO EL ESQUEMA P2P**

Cecilio Sarobe

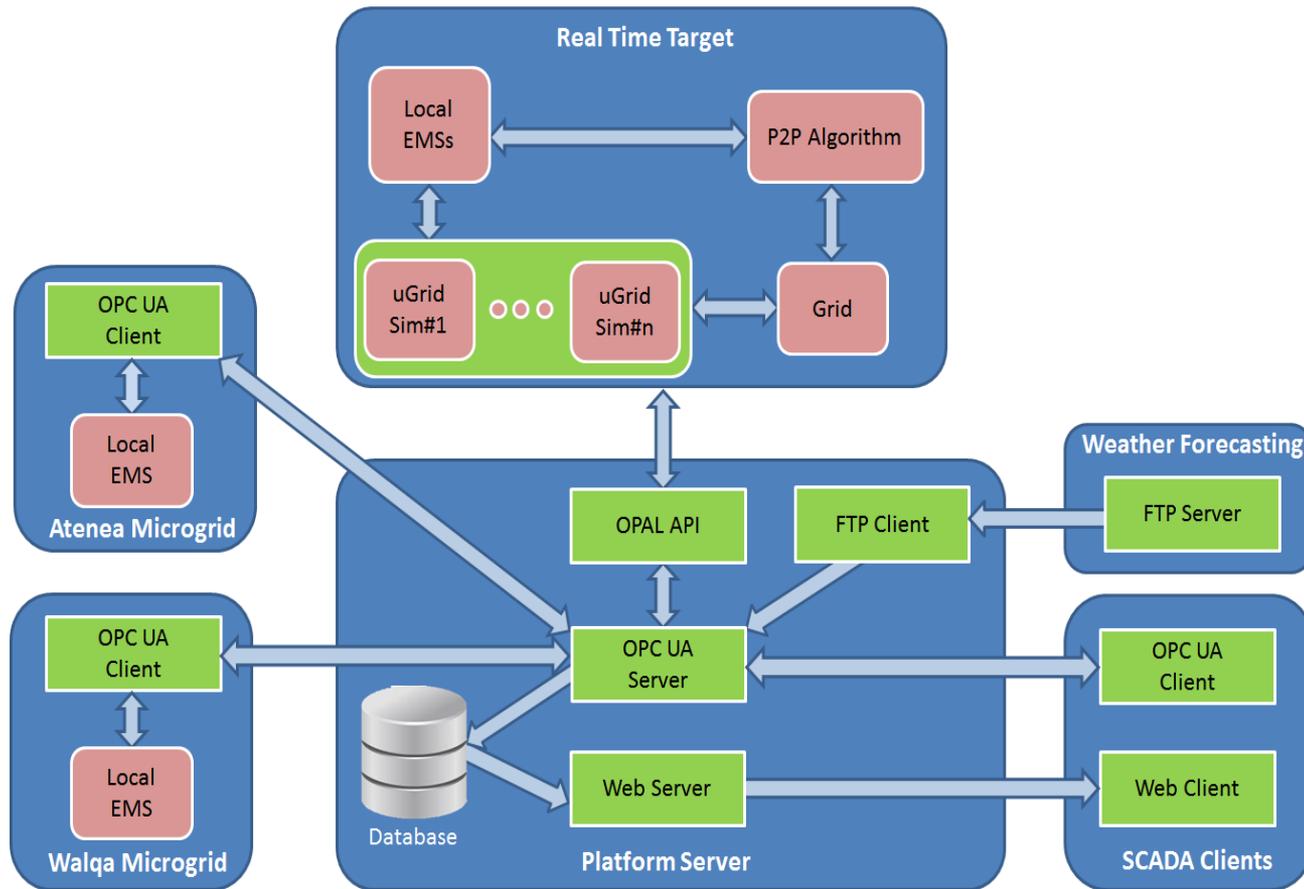
Dpto. Integración en Red de EE.RR.

Centro Nacional Energías Renovables  
(Cener)

# EL PROYECTO

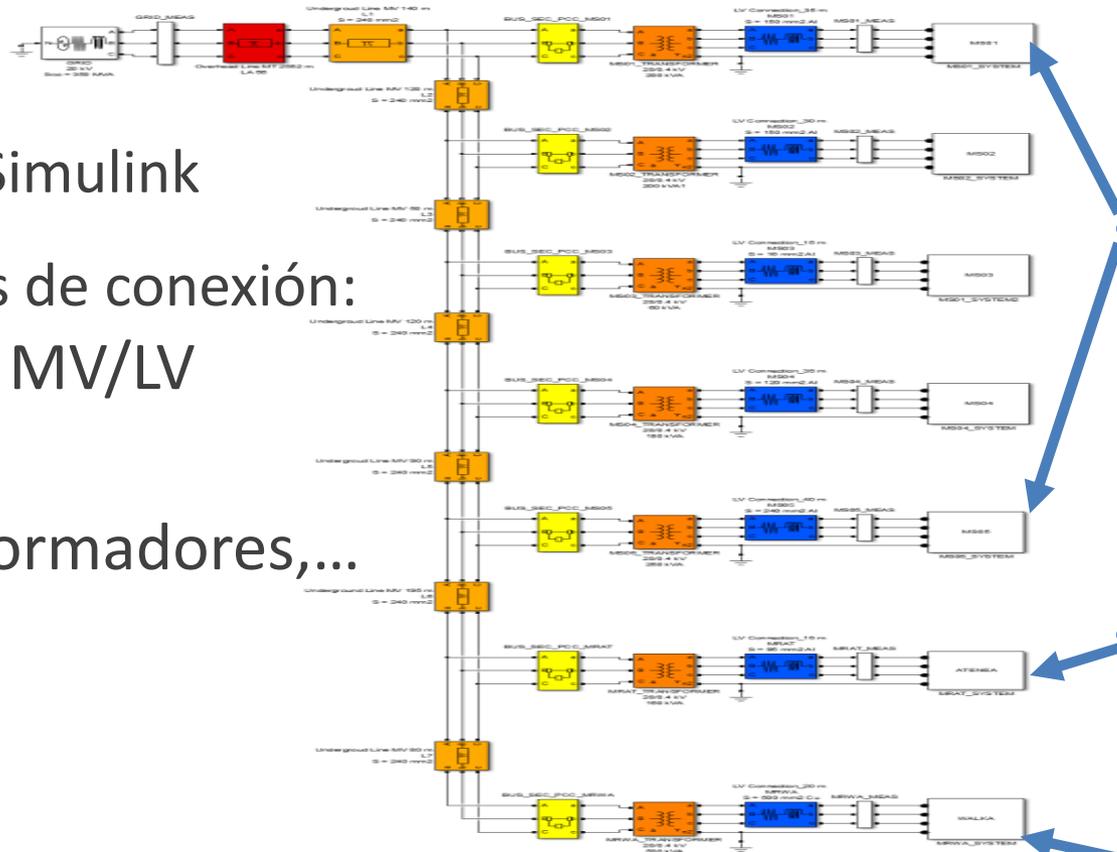


# ARQUITECTURA DE LA PLATAFORMA DE ENSAYOS



# RED SIMULADA

- Modelos Simulink
- Elementos de conexión:
  - Lineas MV/LV
  - Celdas
  - Transformadores,...



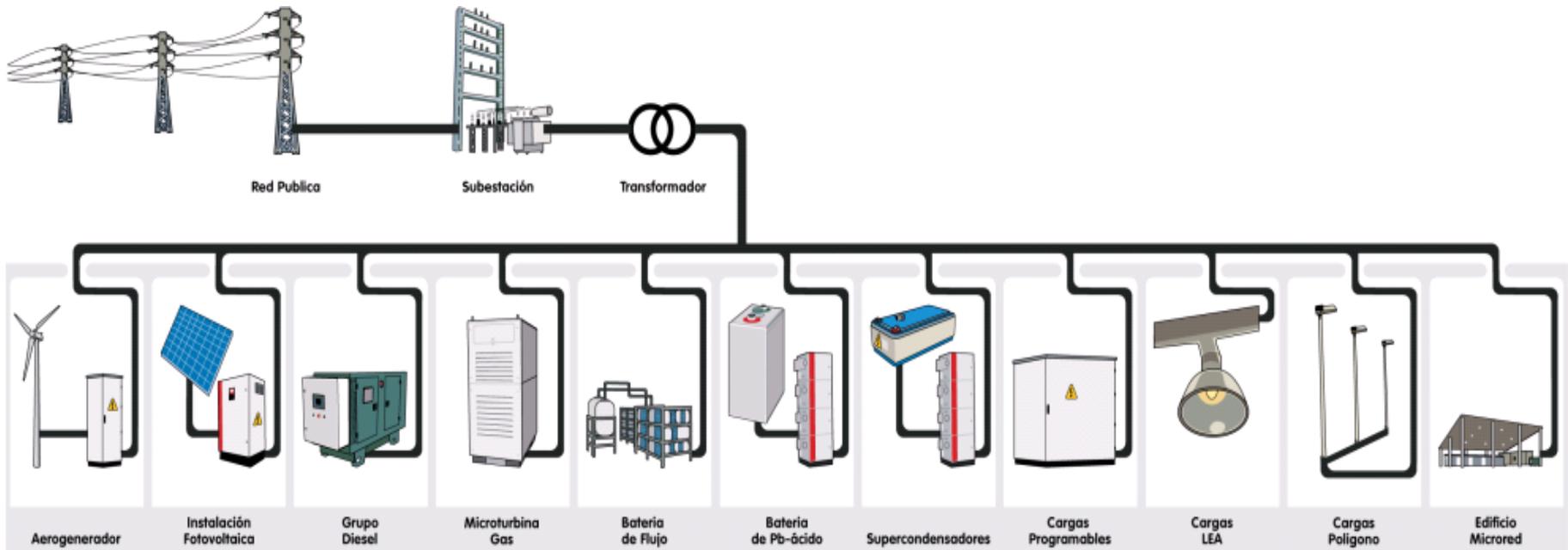
5 Microrredes simuladas

CENER –  
ATENEA  
(Real)

Walga (Real)



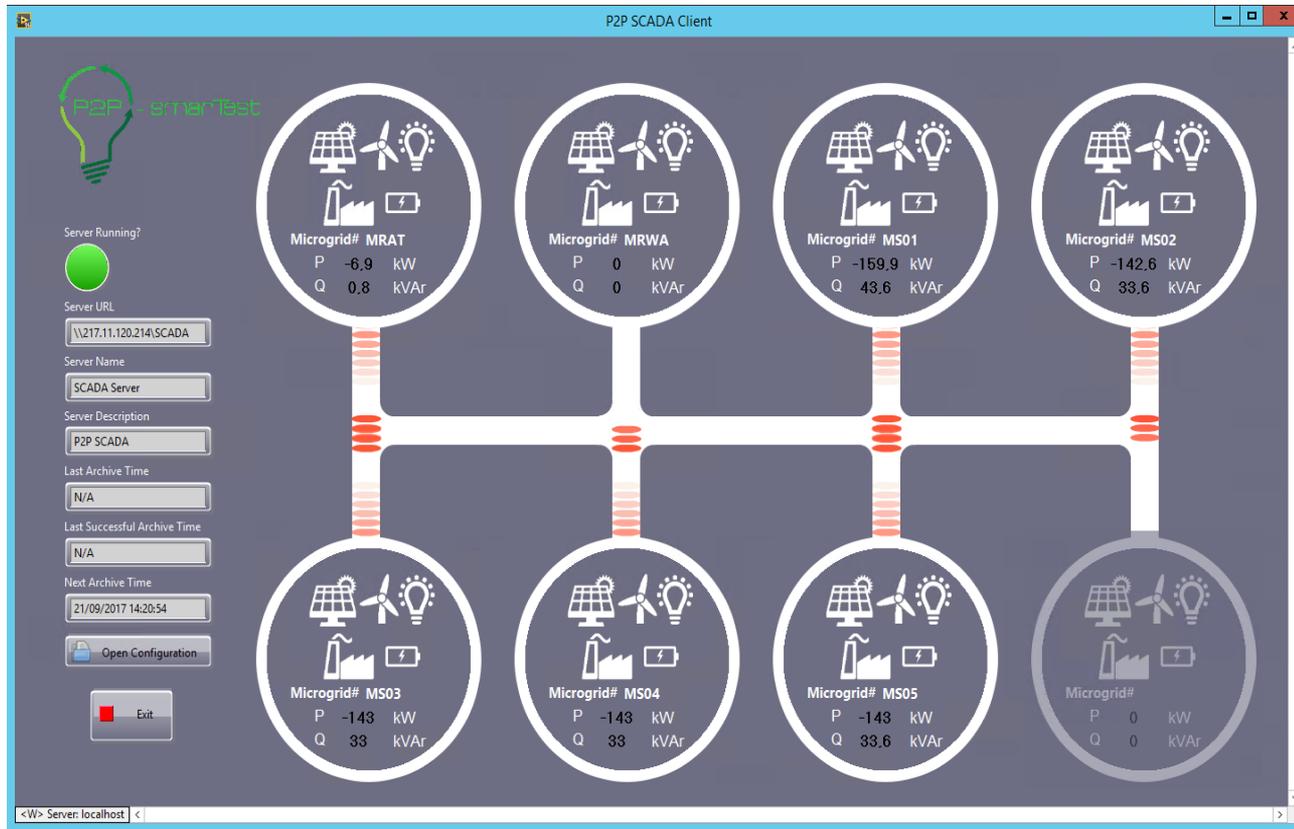
# CENER - ATENEA MICRO GRID



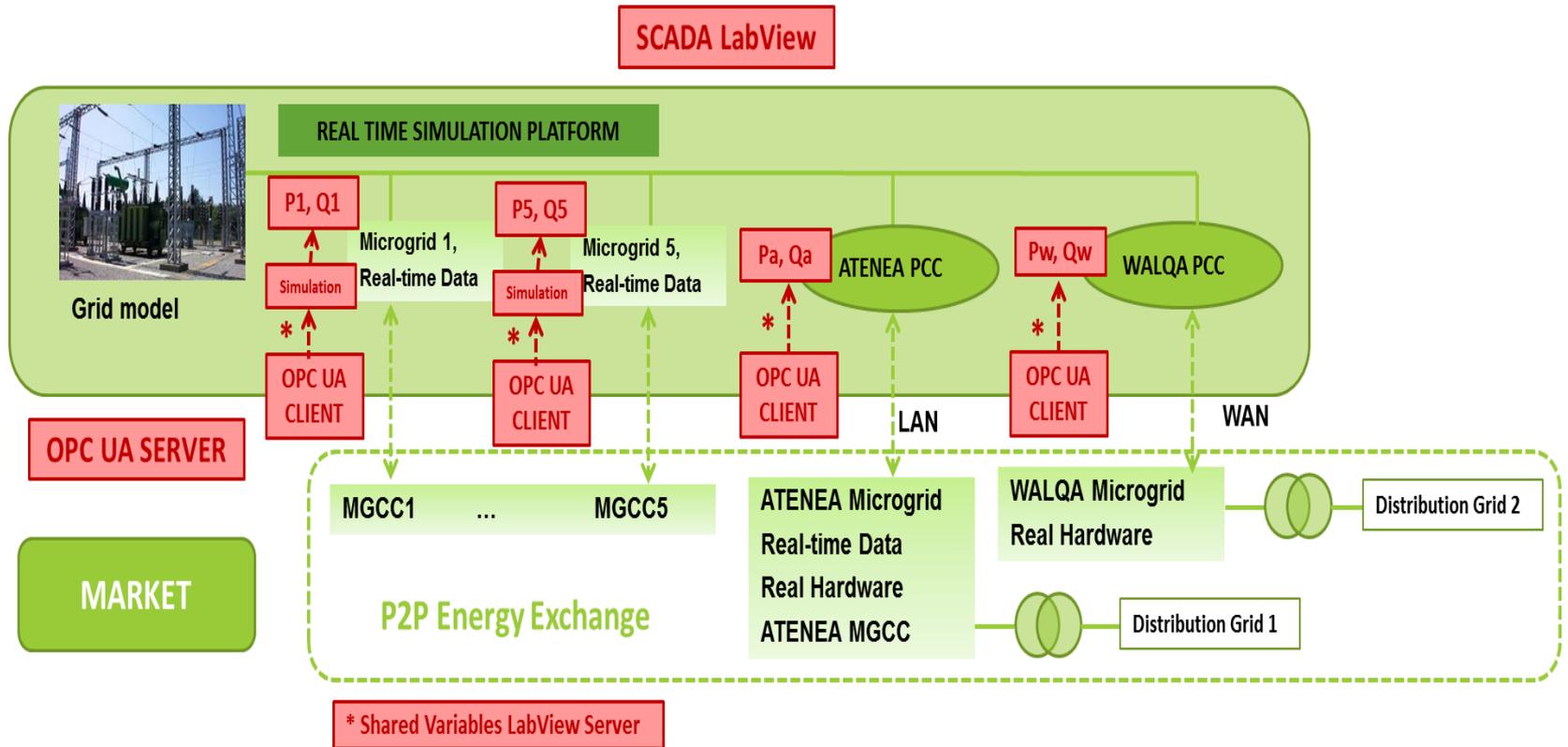
- Laboratorio de ensayo de microrredes con generación, carga, almacenamiento y estrategias configurables



# INTERFAZ DE USUARIO (SCADA)



# ESQUEMA DE ENSAYOS



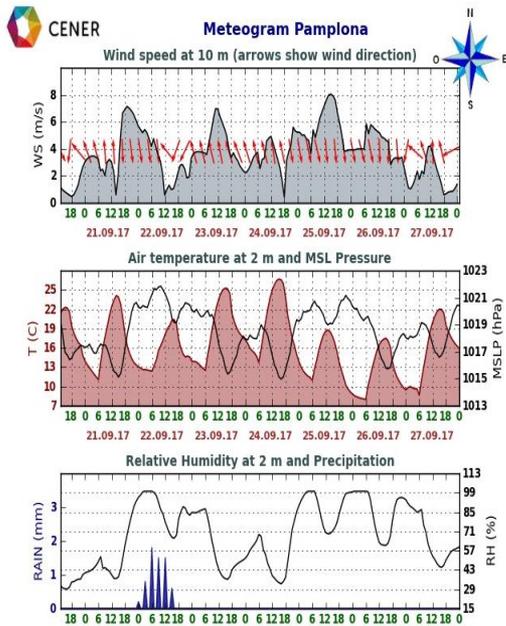
# ENSAYOS PLANTEADOS

- Day-Ahead Energy trading
- Real Time Energy trading

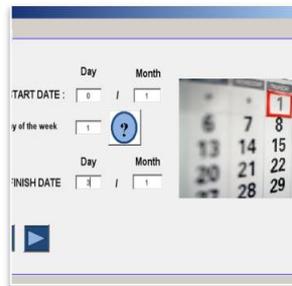


# FLUJO DE EJECUCION DE ENSAYOS

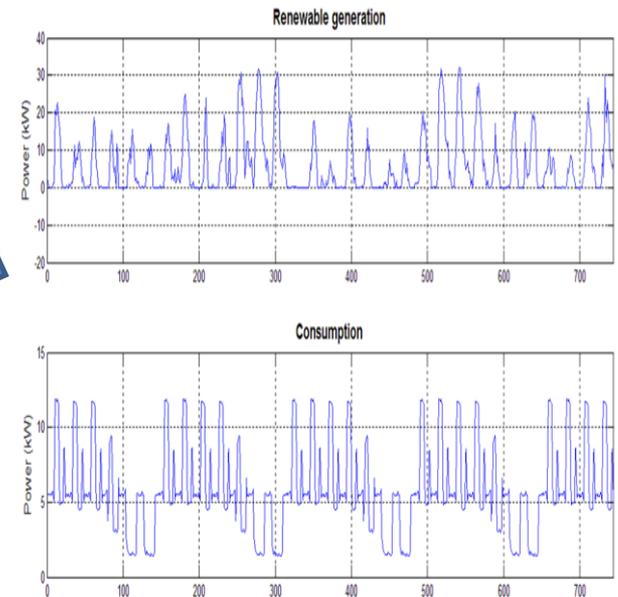
## PREDICCION DE RECURSO RENOVABLE



## PREDICCION DE CONSUMOS BASADOS EN FECHA DE ENSAYO



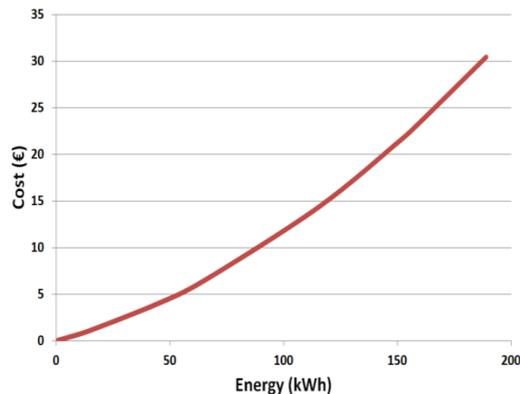
## GENERACION DE PERFIL DE POTENCIA GENERADA y DE DEMANDA



# FLUJO DE EJECUCION DE ENSAYOS

TABLA DE CONSIGNAS DE POTENCIA ACTIVE Y COSTE PARA TODAS LAS MICRORREDES

CURVA DE COSTE DE ENERGIA



ALGORITMO P2P

$$C^* = \min_{\{e_i^{(e)}\}, \{E_{i,j}\}} \sum_{i=1}^M C_i (E_i^{(e)} + \epsilon_i^{(s)} - e_i^T A^T E_i^{(b)}) + \sum_{i=1}^M e_i^T A^T \gamma (E_i^{(b)})$$

Energy bids and prices

The diagram shows four Microgrid Traders arranged in a square. Bidirectional arrows between adjacent traders represent the exchange of energy bids and prices. The central text includes the constraint equation:  $E_i^{(g)} + e_i^T A^T E_i^{(b)} = E_i^{(e)} + e_i^T A E_i^{(s)}$  and the inequality constraint:  $E_i^{(e)} + e_i^T (A E_i^{(s)} - A^T E_i^{(b)}) \geq 0, \forall i$ .

SOLICITUD DE SERVICIO DE GESTION DE DEMANDA

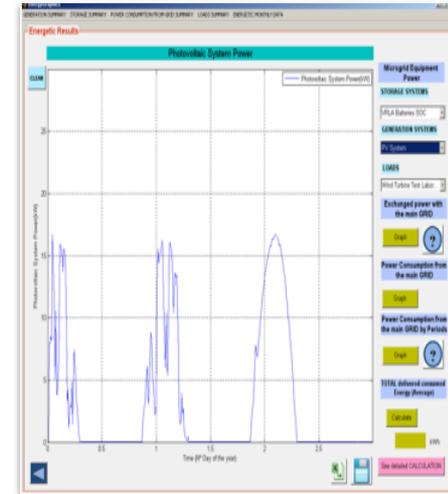
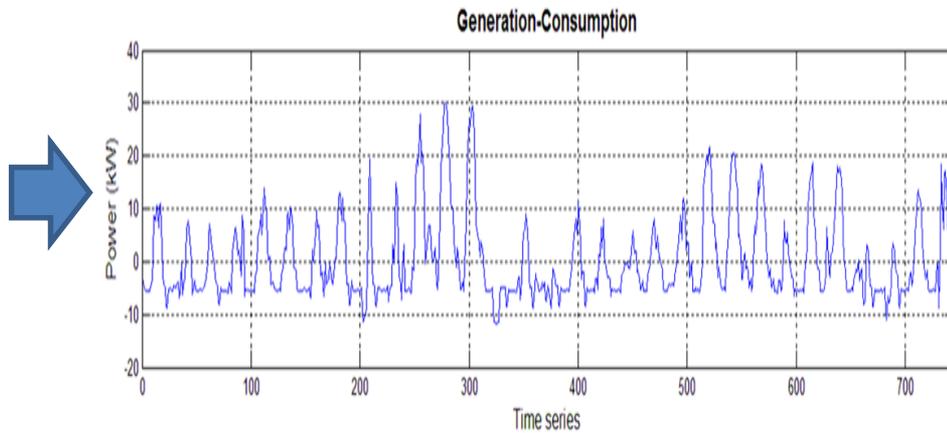
0:00:00	0	0	0	0	0			
1:00:00	0	0	0	0	0			
2:00:00	0	0:00:00	0	0	0			
3:00:00	0:00:00	1:00:00	0	0	0			
4:00:00	1:00:00	2:00:00	0	0	0			
5:00:00	2:00:00	3:00:00	0	0	15,132			
6:00:00	3:00:00	4:00:00	0	0	18,403			
7:00:00	4:00:00	5:00:00	0	0	6,1501			
8:00:00	5:00:00	0	0	0	0,36428	0,14443		
9:00:00	1:00:00	0	0	0	0	3,5328		
10:00:00	2:00:00	0	0	0	4,191	4,3954		
11:00:00	3:00:00	0	15,132	0	3,646	1,8638	13,803	
12:00:00	4:00:00	0	18,403	0	6,1501	3,617	13,364	13,535
13:00:00	5:00:00	0	0	0,36428	0,14443	3,779	13,396	13,523
14:00:00	7:00:00	0,043917	0	0	3,5328	3,732	13,036	13,496
15:00:00	8:00:00	3,402	9,4191	0	4,3954	3,638	0	13,582
16:00:00	9:00:00	8,5998	13,646	1,8638	13,803	13,71	0	10,506
17:00:00	10:00:00	9,6602	13,617	13,364	13,535	3,444	0	6,5931
18:00:00	11:00:00	9,5683	13,779	13,396	13,523	3,297	0	6,5241
19:00:00	12:00:00	9,5635	13,732	13,036	13,496	3,444	0	6,5485
20:00:00	13:00:00	9,4699	13,638	0	13,582	3,297	0	6,6141
21:00:00	14:00:00	9,7415	13,341	0	13,71	3,297	0	6,5282
22:00:00	15:00:00	9,7491	13,442	0	10,506	3,341	0	6,6581
23:00:00	16:00:00	8,7997	13,444	0	6,5931	3,425	0	6,12947
	17:00:00	3,368	13,297	0	6,5479	5,515	0	
	18:00:00	3,3345	13,34	0	6,5241		0	
	19:00:00	3,3948	13,425	0	6,5485		0	
	20:00:00	3,344	9,5515	0	6,6141		0	
	21:00:00	3,3766	0	0	6,6581		0	
	22:00:00	3,4339	0	0	6,5282		0	
	23:00:00	0,070972	0	0	0,12947		0	



# FLUJO DE EJECUCION DE ENSAYOS

MICRORREDES  
EJECUTAN LAS  
CONSIGNAS

MEDIDA Y ANALISIS DE LOS  
RESULTADOS DE  
EJECUCION POR PARTE DE  
LAS MICRORREDES





# III CONGRESO **SMART GRIDS** Madrid 18-19 Octubre 2016

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**ENERGÍAS RENOVABLES**  
FUNDACIÓN CENER-CIEMAT

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