CENTRO DE ENERGÍA

FACULTAD DE CIENCIAS
FÍSICAS Y MATEMÁTICAS
UNIVERSIDAD DE CHILE

Jeju 2011 Symposium on microgrids

Huatacondo's Microgrid

and

the Social SCADA Concept

Source: Red Dot Design Concept 2010

Lorenzo Reyes, Universidad de Chile

May 2011

AGENDA

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- Introduction
- Huatacondo's microgrid
- Operation data
- Social SCADA
- Further developments
- Conclusions

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Rural Electrification

- Long distances to the grid
- Small loads
- One technology
- Mostly diesel based
- No security systems
- Hybridation?
- Future grid connection?

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HUATACONDO'S MICROGRID / **POWER SCHEMATIC**

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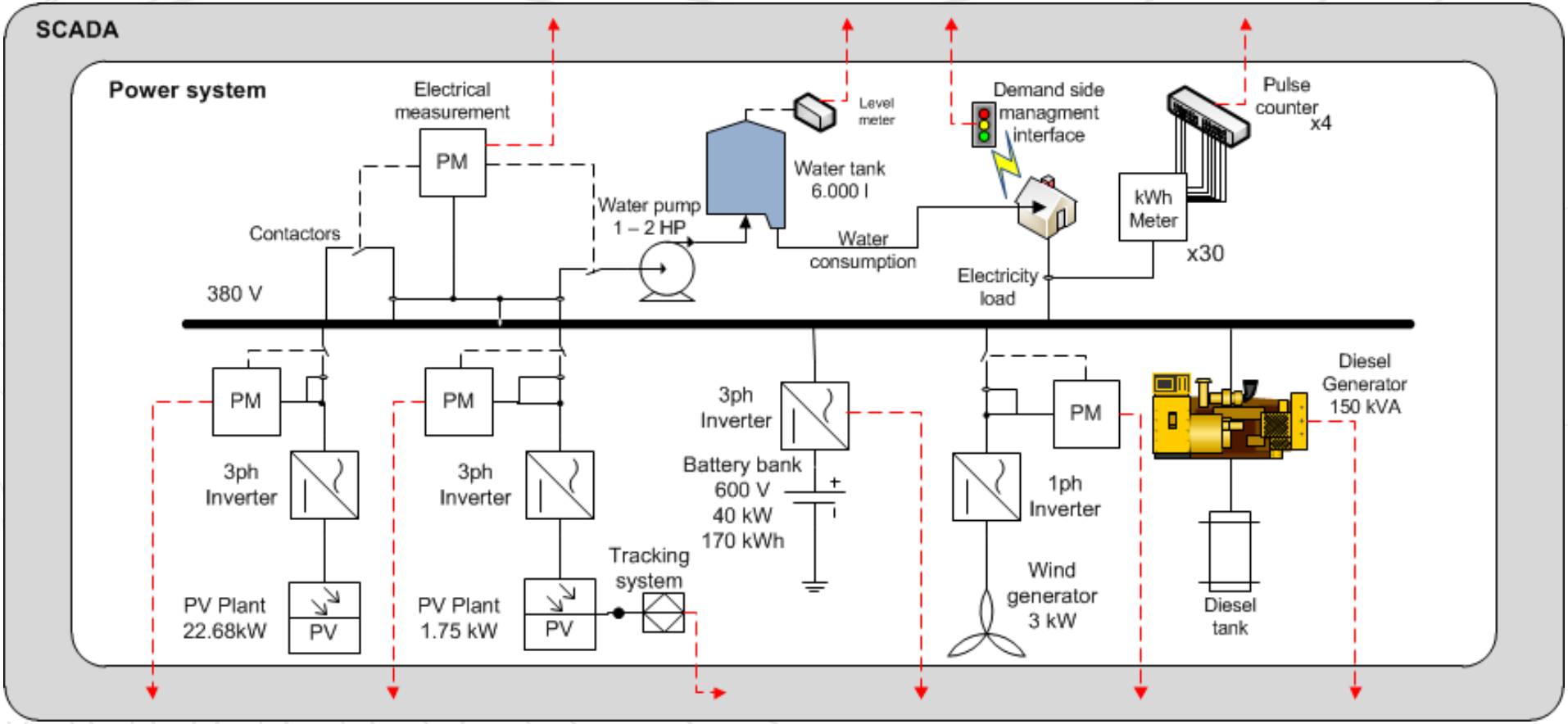

HUATACONDO'S MICROGRID / **SCADA**

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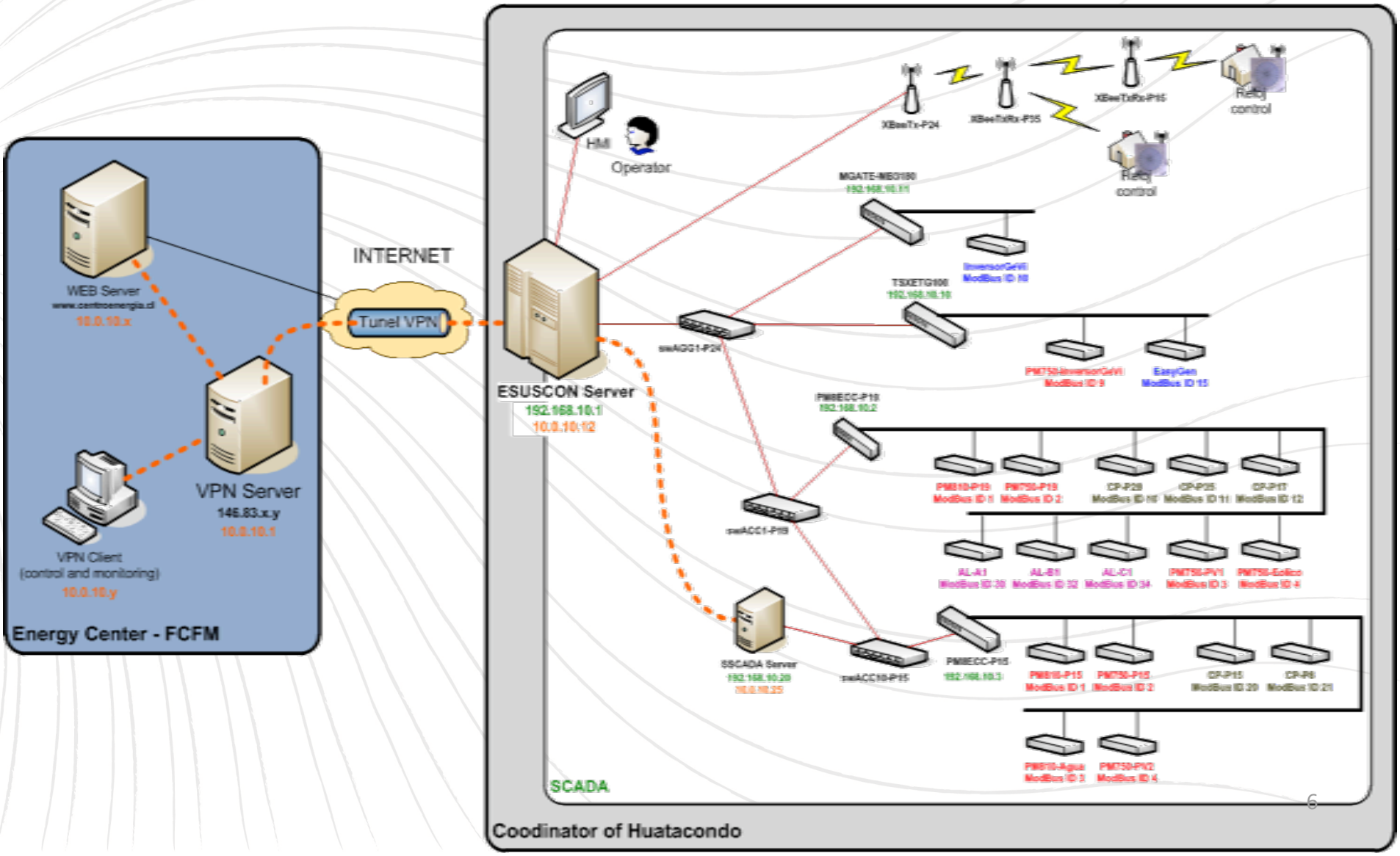

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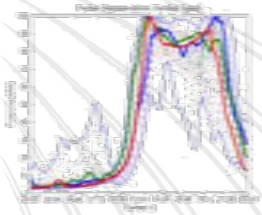
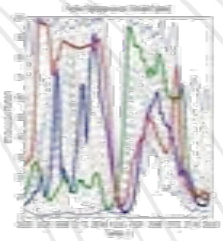
Weather and simulation data

Measured data

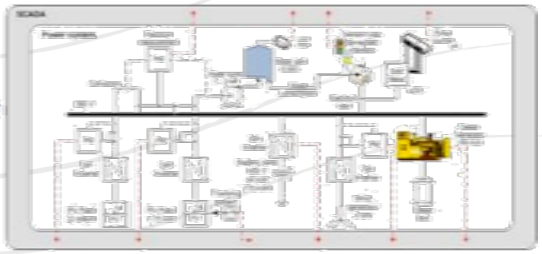
ΔT = 15m





Optimization

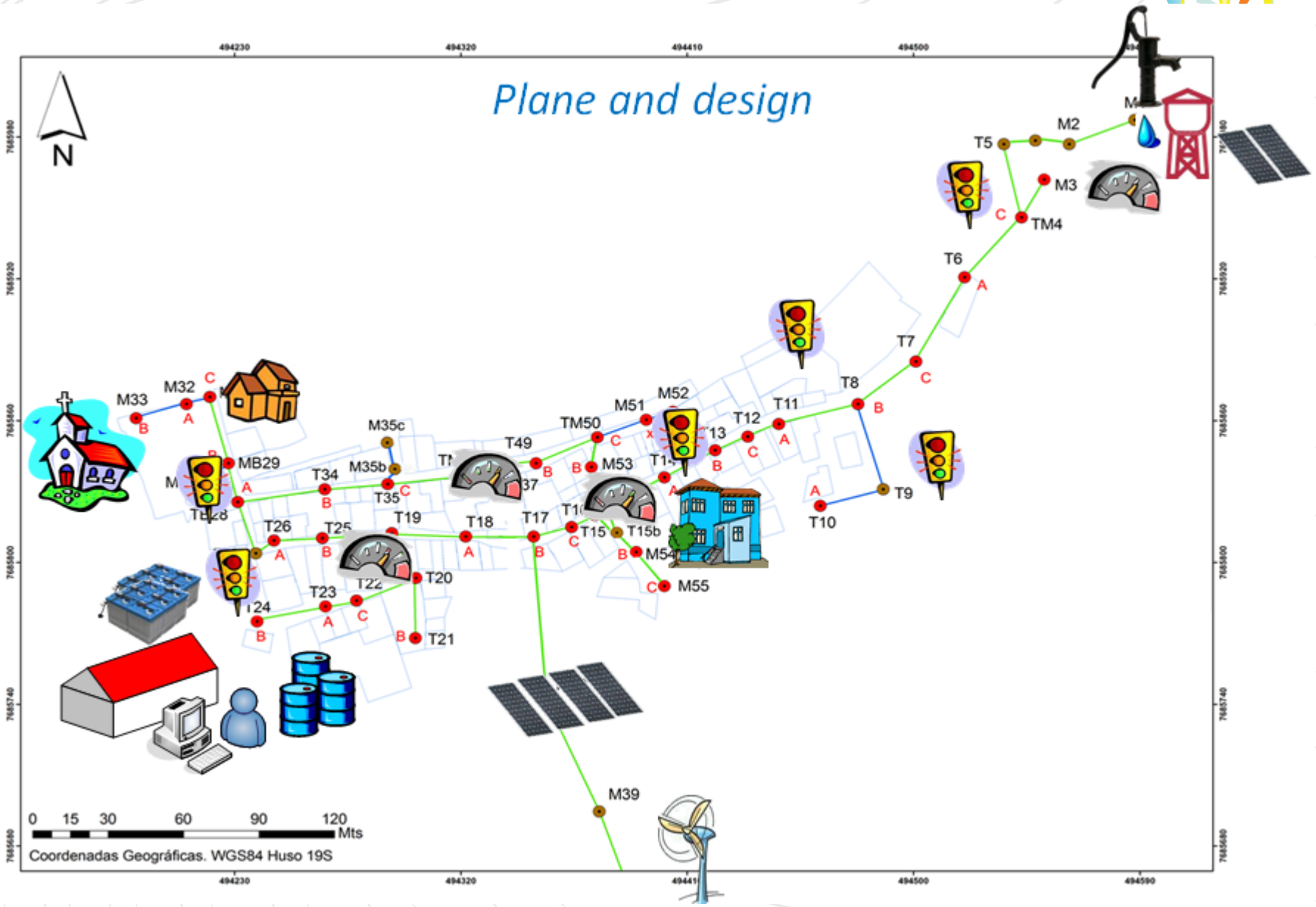
UC + OPF + DSM



Set points and DSM signals

Historical data

HUATACONDO'S MICROGRID / **SYSTEM TOPOLOGY**



HUATACONDO'S MICROGRID / **PV POWER PLANT**

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- 22.68kW
- 84 PV panels
- 168m^2
- 18º azimut angle
- 1 axis tracking system
- 3 monophase inverters
- 1200 Wp/m^2
- MPPT

HUATACONDO'S MICROGRID / **PV POWER PLANT**

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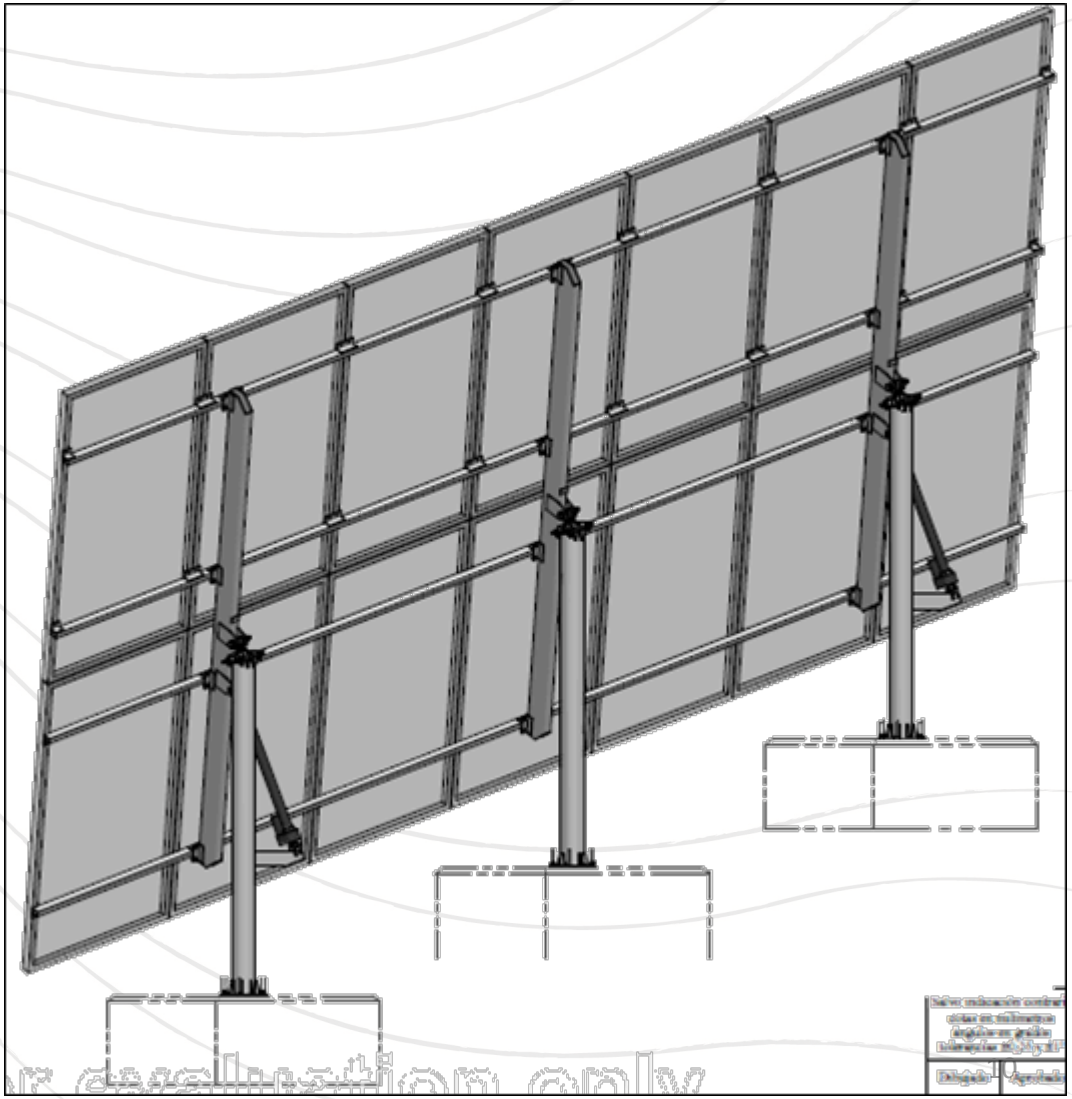
- 2 linear actuators
- No sensors
- Centralized control
- Position feedback
- Intelligent relay local control
- Mechanical constraints considered on EMS



HUATACONDO'S MICROGRID / **STORAGE SYSTEM**

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- 96 lead-acid batteries
- Charge and discharge
- Droop curves P-f, Q-V
- MODBUS RTU
- IGBT VSC
- 40 kVA
- Dynamic SOC modeling

HUATACONDO'S MICROGRID / **WIND GENERATOR**

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- 3kW
- 12m high
- 8 m/s average
- Bird of prey protection
- 1ph – 3ph inverter
- MPPT

HUATACONDO'S MICROGRID / **COMMUNITY WORK**

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HUATACONDO'S MICROGRID / **COMMUNITY WORK**

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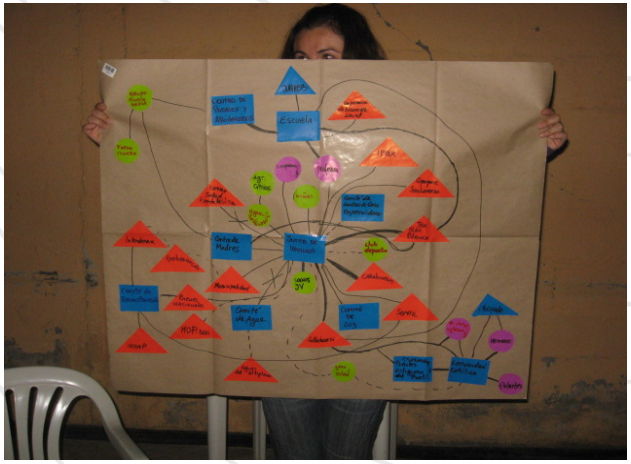

- Dream's map
- FODA matrix
- Sustainability indicators
- Training
- Maintenance
- Energy efficiency plan

HUATACONDO'S MICROGRID / **DEMAND SIDE MANAGMENT**

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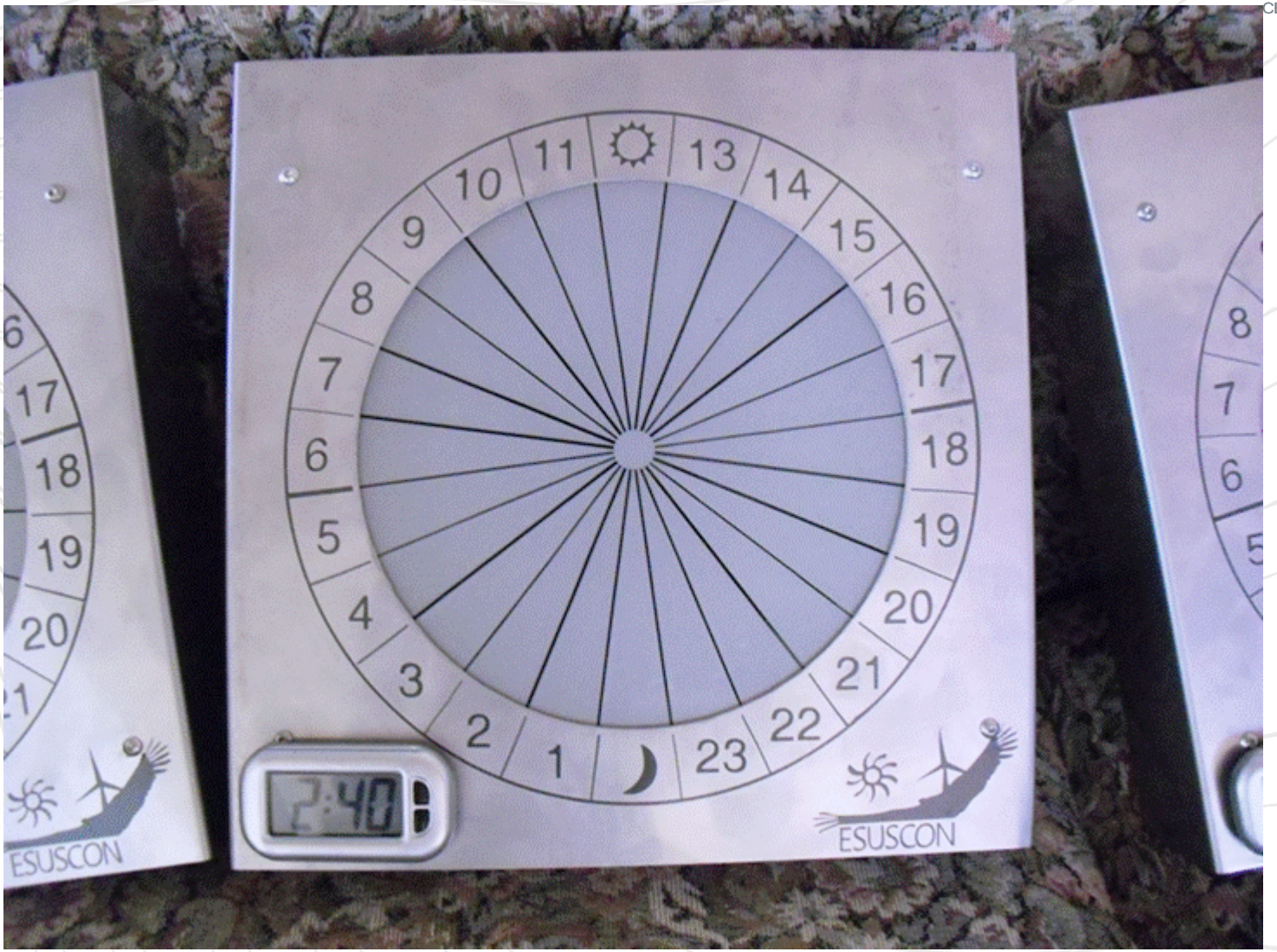

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OPERATION DATA / **MAY**

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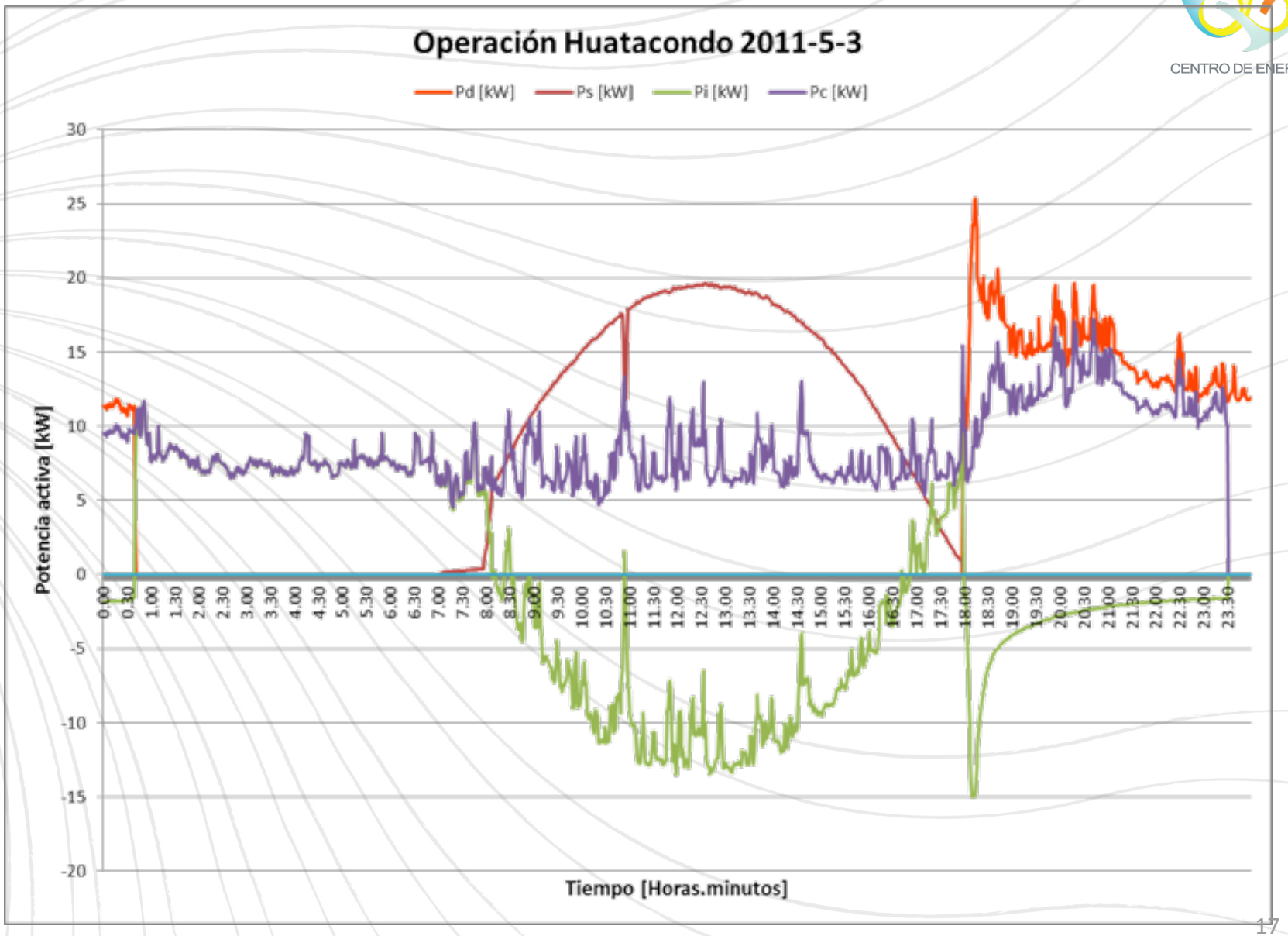

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SOCIAL SCADA / **ENERGY FOR COMMUNITY SERVICE**

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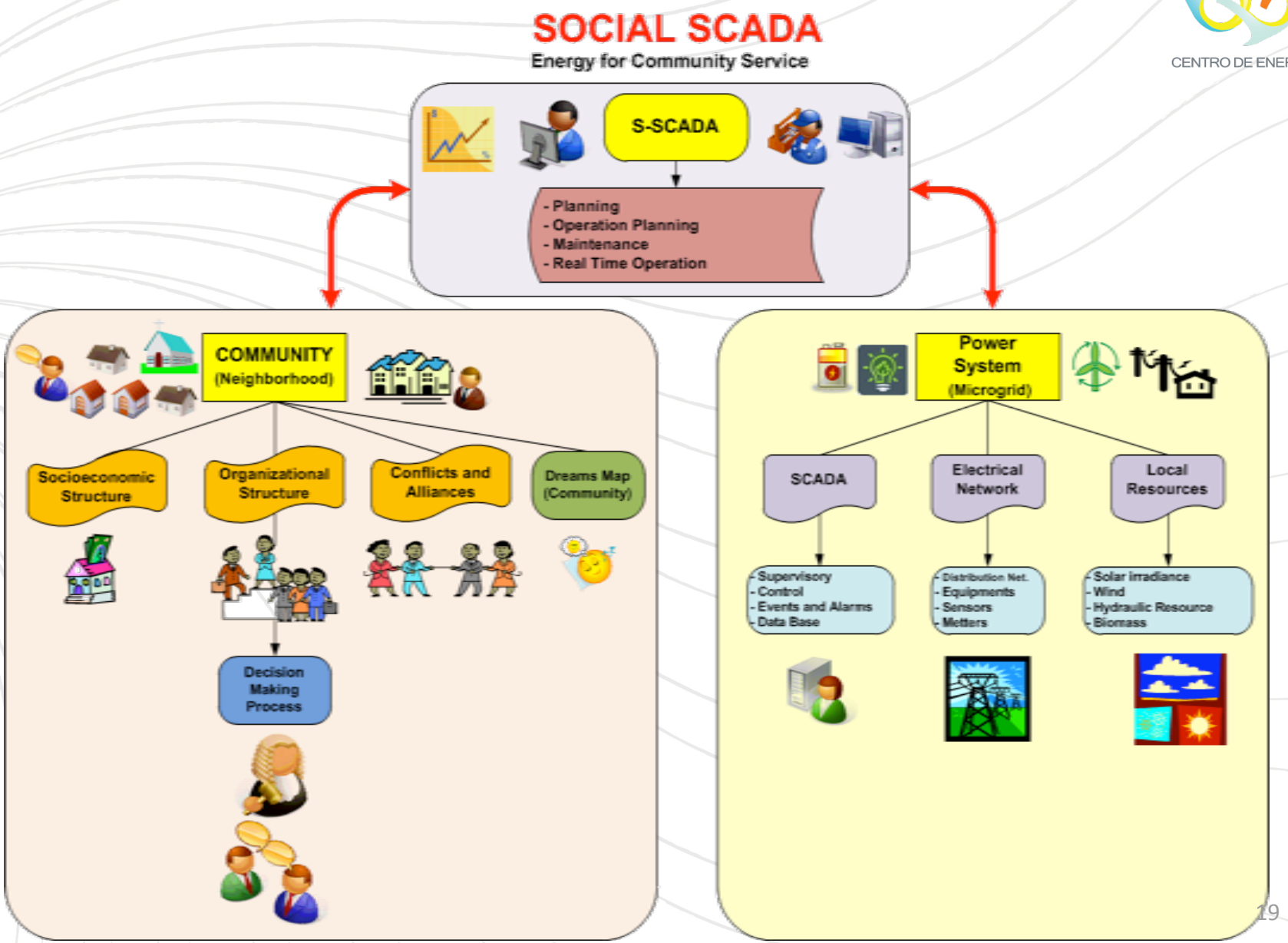

SOCIAL SCADA / **COMMUNICATION**

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Supervision

SSCADA Server

Optimizator

Servidor OPC

Historical data

TCP/IP

ESUSCON Server

MODBUS TCP, MODBUS RTU

Local control

Generation units and loads

SOCIAL SCADA / **IMPLEMENTATION**

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SOCIAL SCADA / **IMPLEMENTATION**

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SOCIAL SCADA / **INTERFACE**

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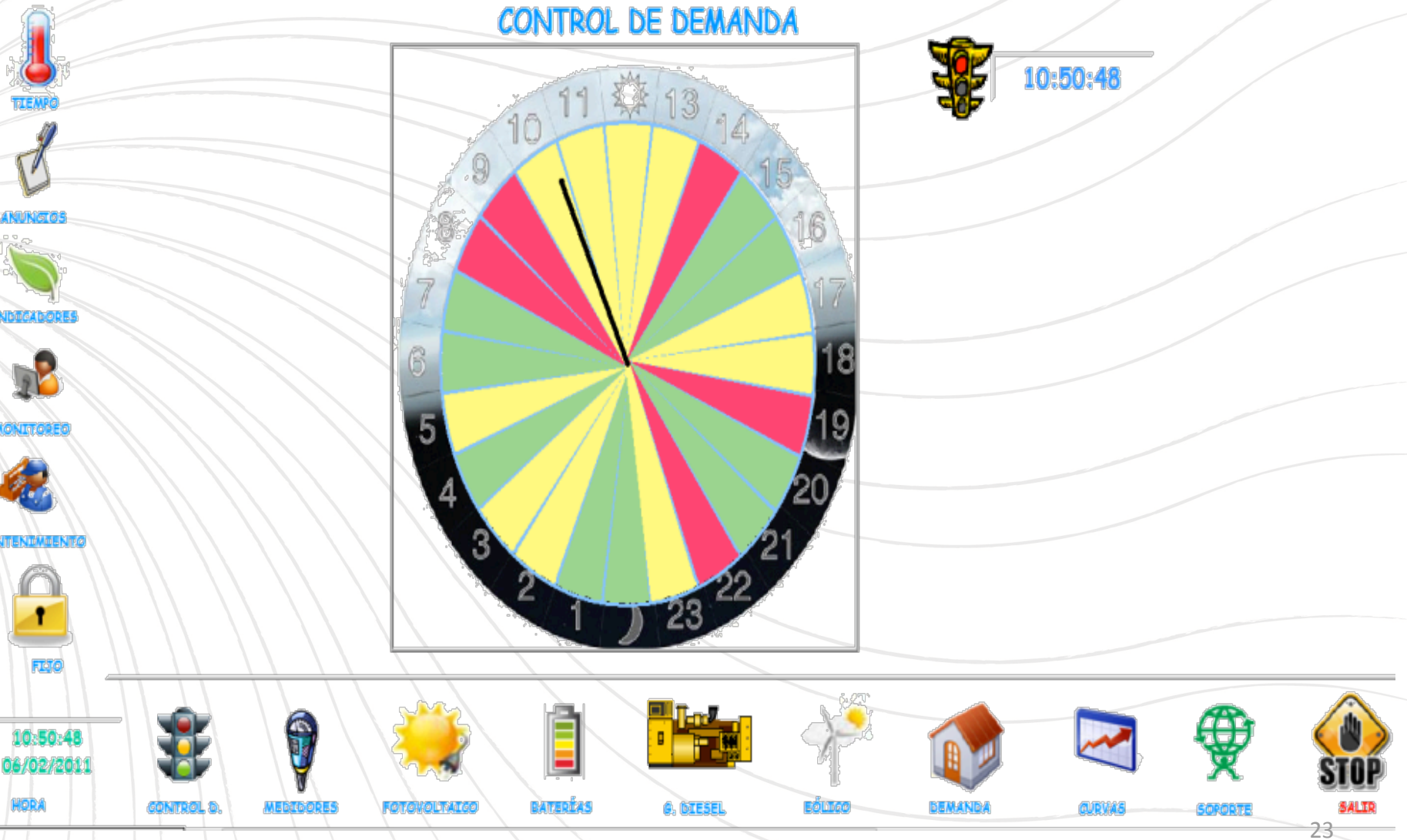

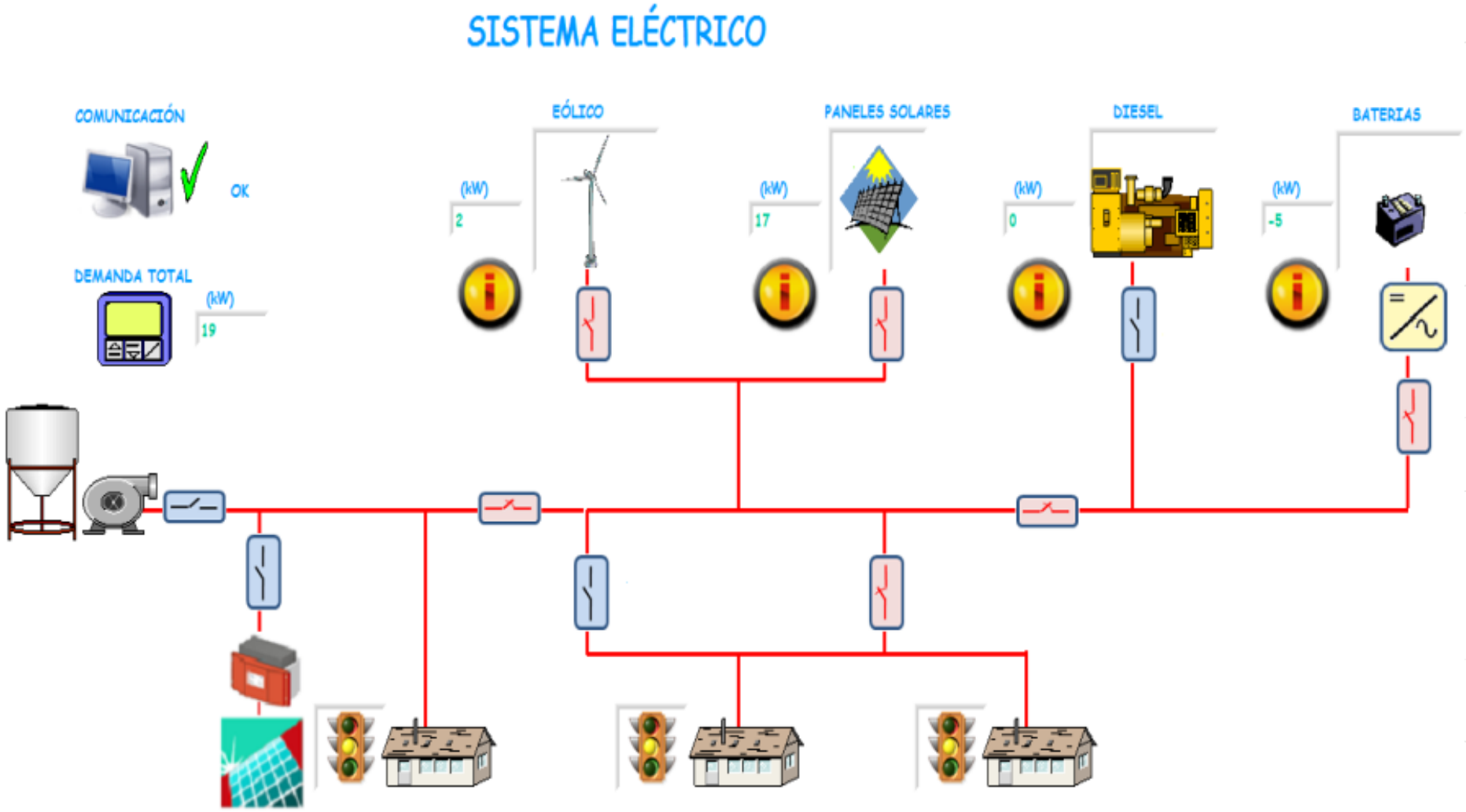
SISTEMA ELÉCTRICO
COMUNICACIÓN
OK
DEMANDA TOTAL
(kW)
19
EÓLICO
(kW)
2
PANELES SOLARES
(kW)
17
DIESEL
(kW)
0
BATERIAS
(kW)
-5

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FURTHER DEVELOPMENTS / **GRID CONNECTIVITY**

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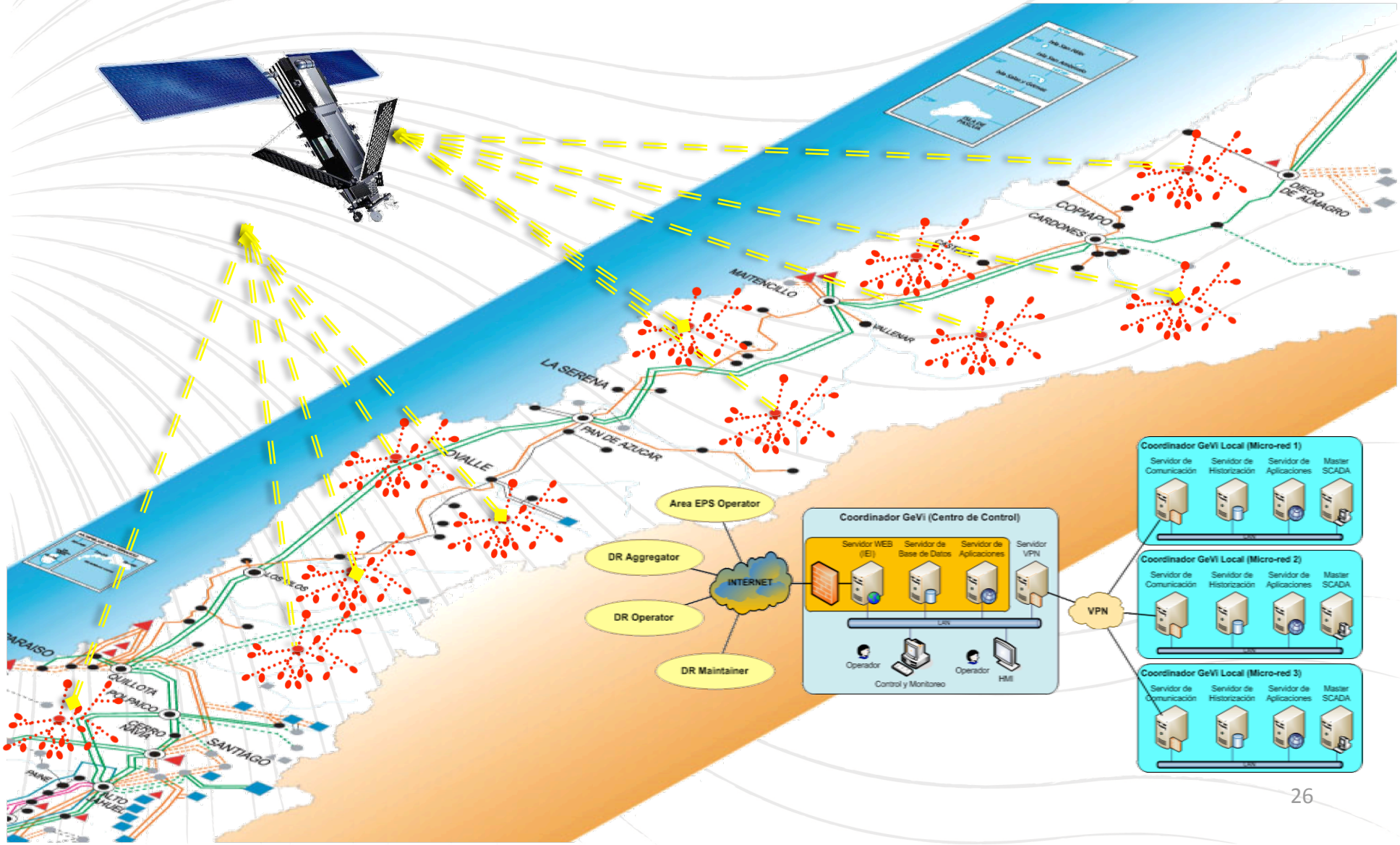

FURTHER DEVELOPMENTS / **PLUG & PLAY MICROHYDRO**

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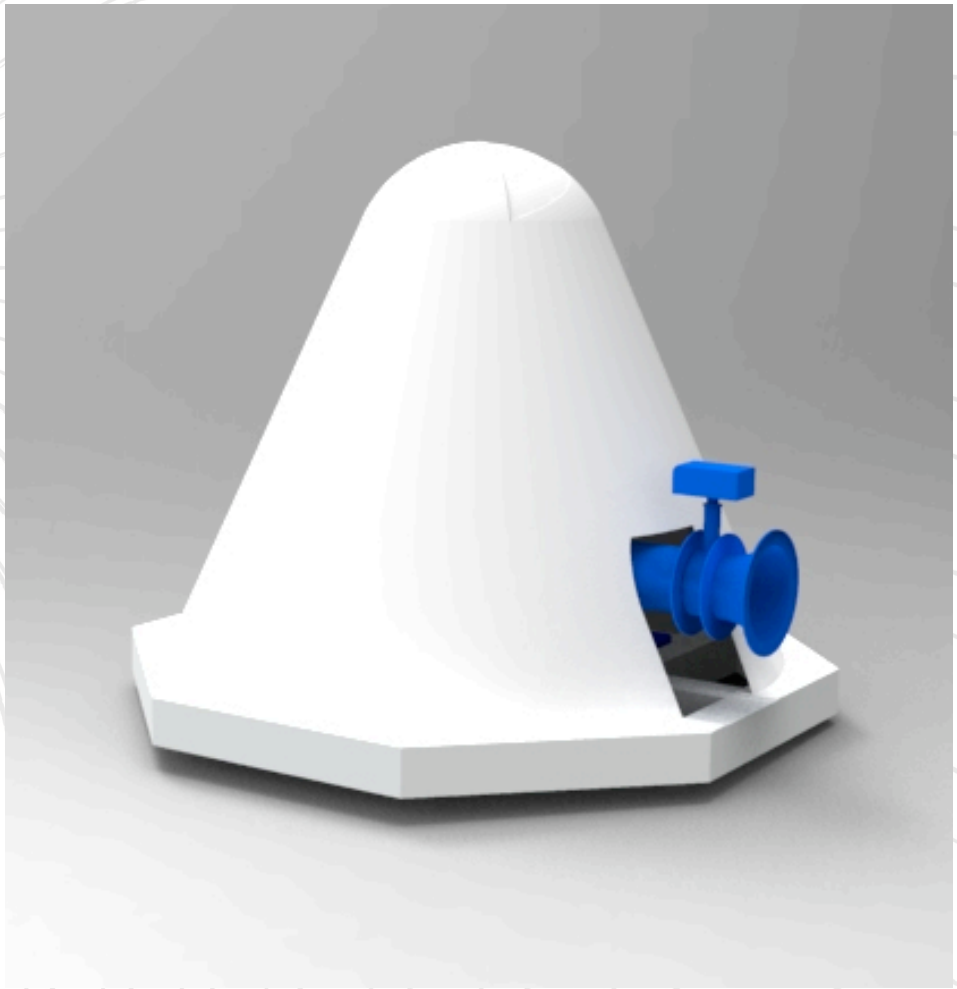

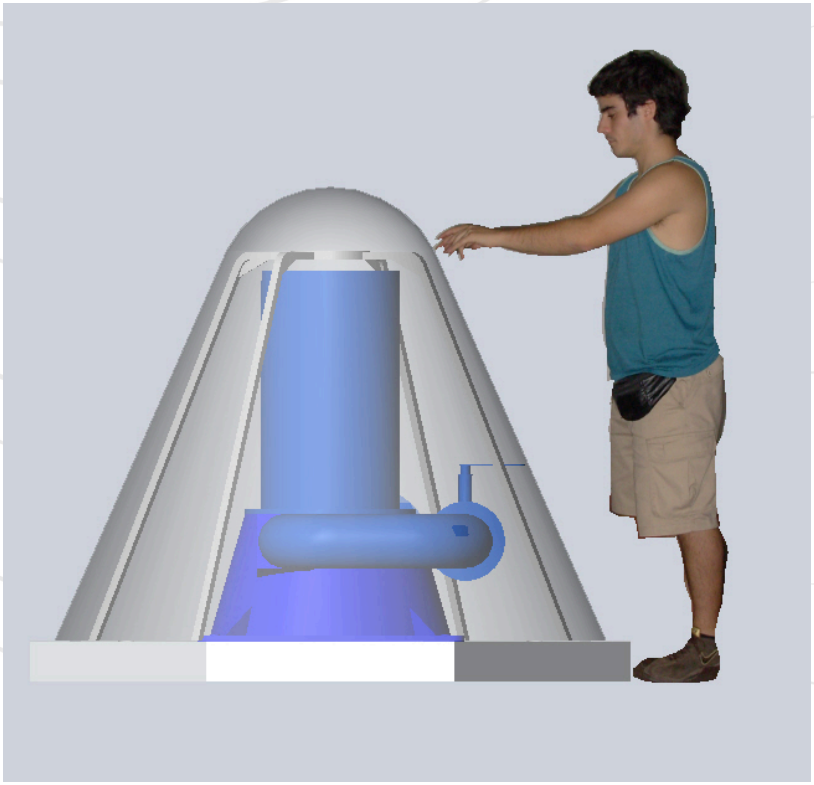

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CONCLUSIONS

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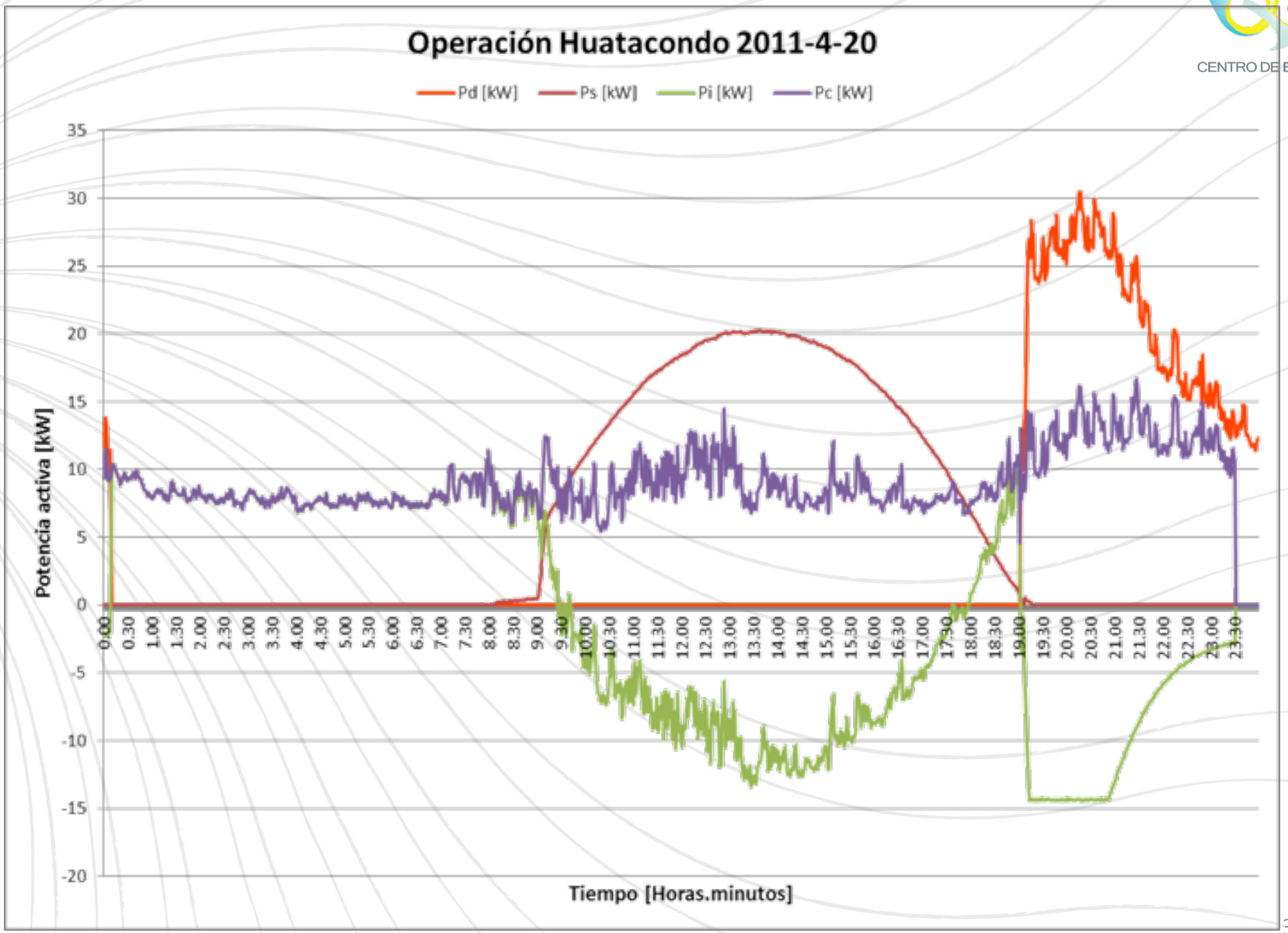
- The EMS provides the on-line set-points for generation units while minimizing the operational cost and considering the forecast of renewable resources, load, solar tracking and water consumptions.
- The installed system reduces the consumption of diesel (without solar tracking and wind energy) in 50% and without tracking, the solar power plant reaches a plant factor of 28%.
- Huatacondo project may become the first micro-grid development at country level. There is a high potential of duplicate the project in other isolated communities.
- To hand over the project to the community, but entitle them with the ownership, management and responsibilities of the project can only be achieved when the community is participating actively in the process of decision making of relevant aspects of the technology to introduce. They become familiar with the technology as well as how to relate the components to their local reality.
- More engagement and enrolment in the energy system has been developed since the Social SCADA implementation (send maintenance reports, monitoring energy consumption and electrical variables from generator units).

OPERATION DATA / **APRIL**

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