

osi[®]soft[®]
USER CONFERENCE
2008
AMSTERDAM

Empowering Business in **Real Time.**

PI Infrastructure for the Enterprise.

Adding value from Combined Cycle to Nuclear Power Plants

Miguel Chavero
CMDS IT Manager

Agenda



- 1.- IBERDROLA Overview
- 2.- PI History
- 3.- Combined Cycle Strategy
- 4.- Applications Developed
- 5.- Future Scope
- 6.- Conclusions & key lessons learned
- 7.- Questions and Answers

Agenda

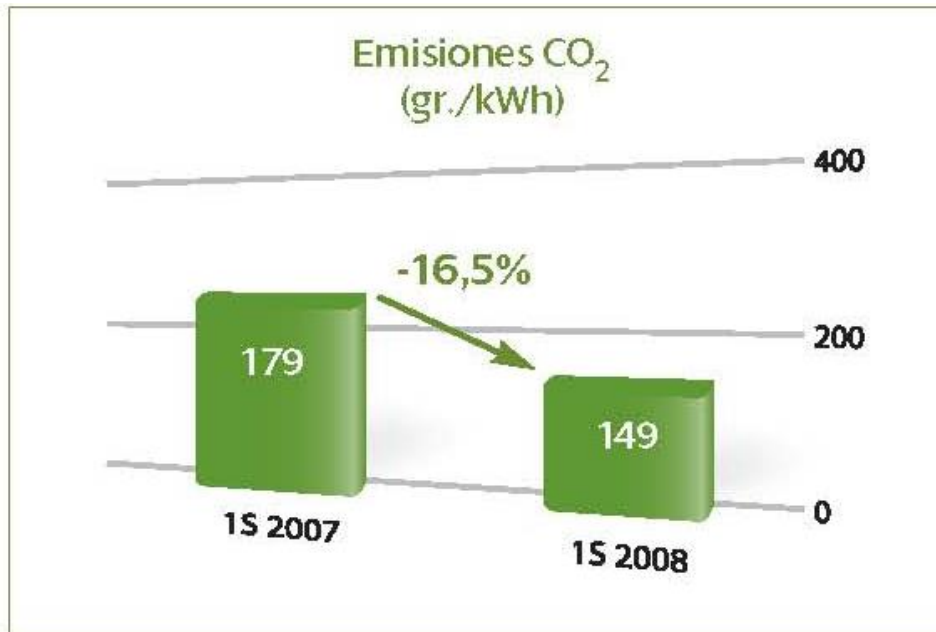


- 1.-** IBERDROLA Overview
- 2.-** PI History
- 3.-** Combined Cycle Strategy
- 4.-** Applications Developed
- 5.-** Future Scope
- 6.-** Conclusions & key lessons learned
- 7.-** Questions and Answers

IBERDROLA OVERVIEW



- Electric Power
- The most
- One of the
- Europe
- €52 Billion
- €5.5 Billion
- Shareholder



l distribution.
Spain
companies in

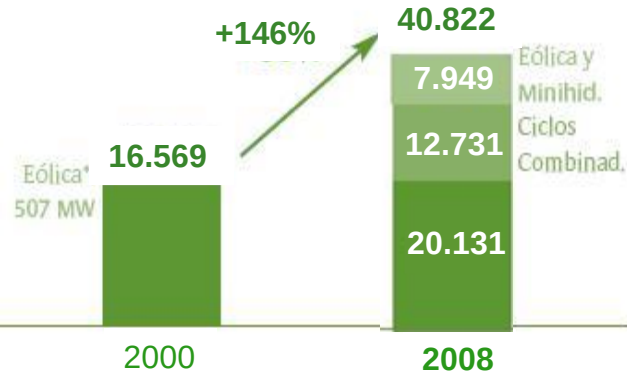
in 5 years

IBERDROLA OVERVIEW



Installed Capacity

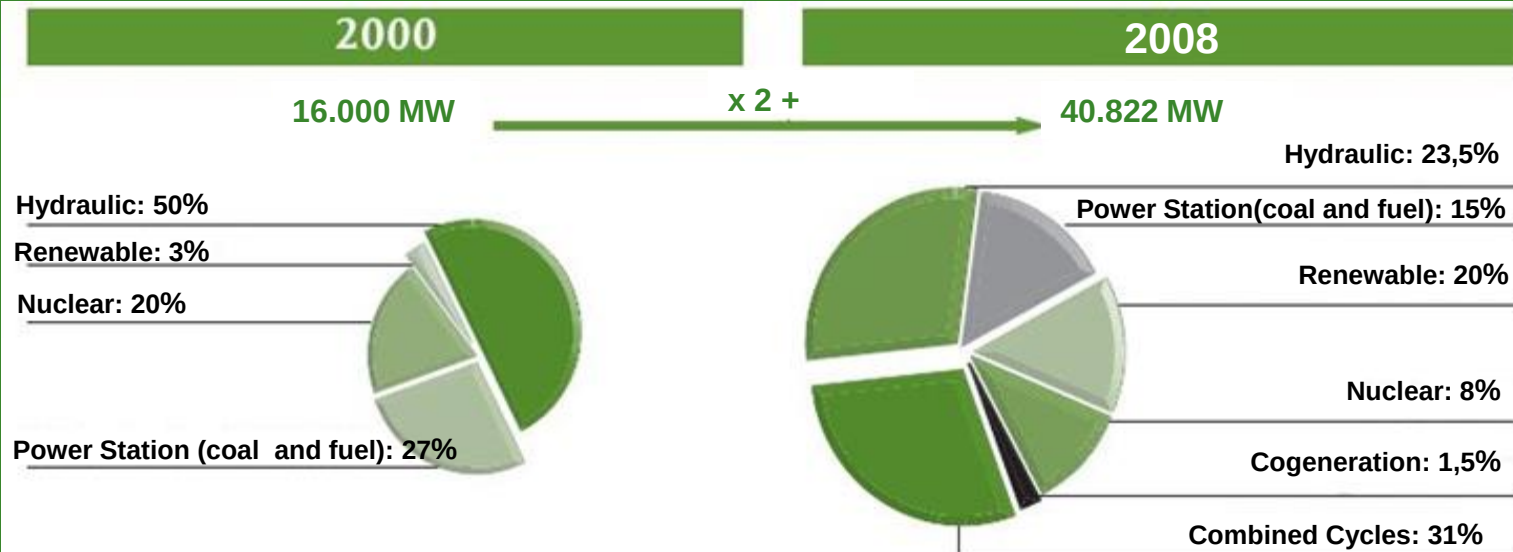
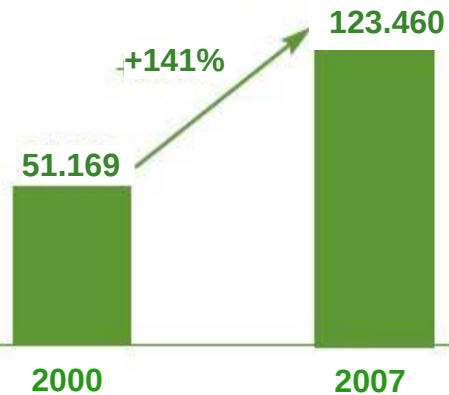
Capacidad instalada Grupo (MW)



* Consolidación por puesta en equivalencia

Total Production

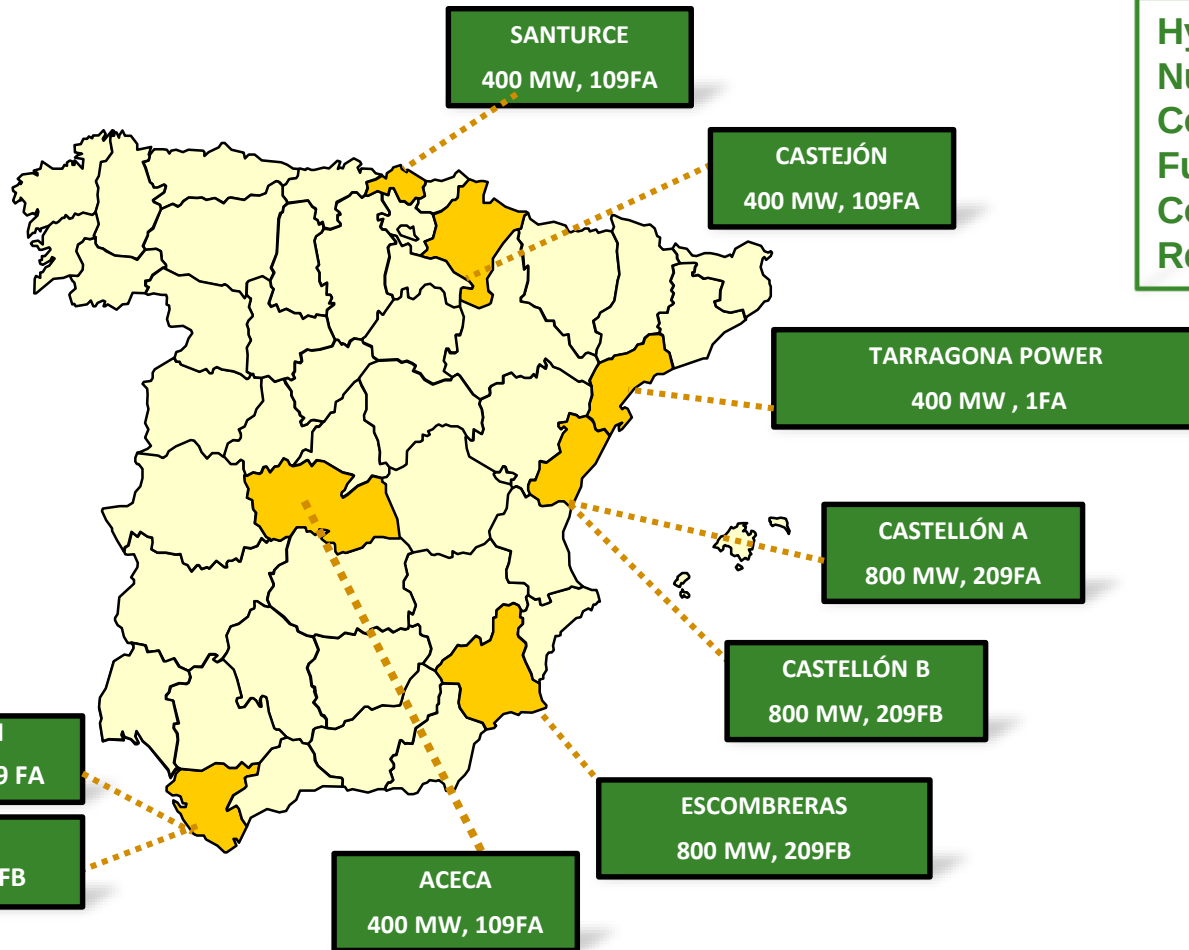
Producción Grupo (GWh)



IBERDROLA in Spain



We lead the construction of combined cycle power plants on Spain...



Hydraulic:	8839 MW
Nuclear:	3344 MW
Coal:	1253 MW
Fuel Oil:	1803 MW
Cogen.:	380 MW
Renewable:	4725 MW

...5.600 MW since 2007

We lead electric private producer in México



Combined Cycles

Enertek	120 MW
Monterrey	1.040 MW
Altamira III y IV	1.036 MW
La Laguna II	500 MW
Altamira V	1.121 MW
Tamazunchale	1.135 MW

Eolic

Oaxaca	100 MW
--------	--------

... near 5.000 MW contracted power

IBERDROLA in the world



IBERDROLA + Scottish Power

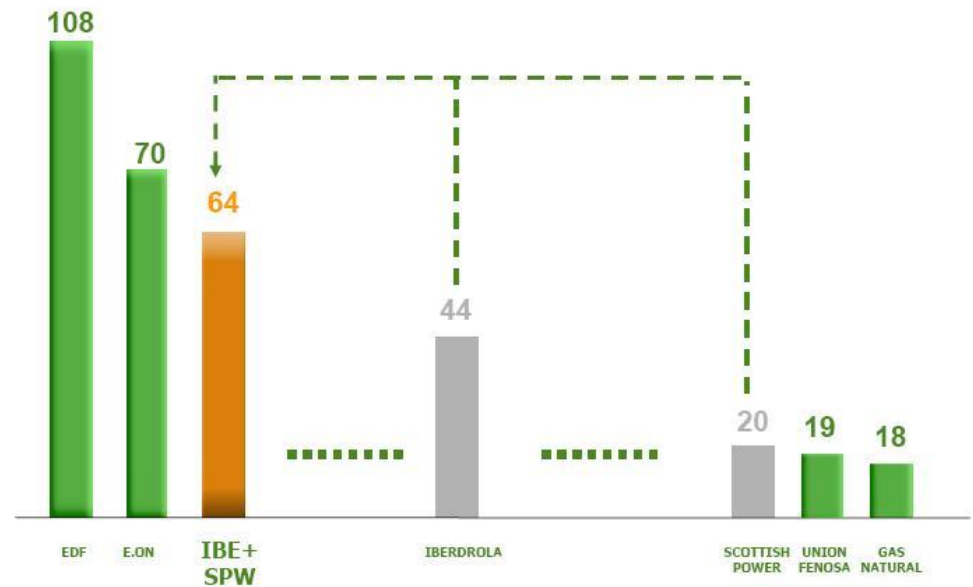


60.000 Million Euros Total Value

Renewable World Leader



3rd European Utility



IBERDROLA in the world

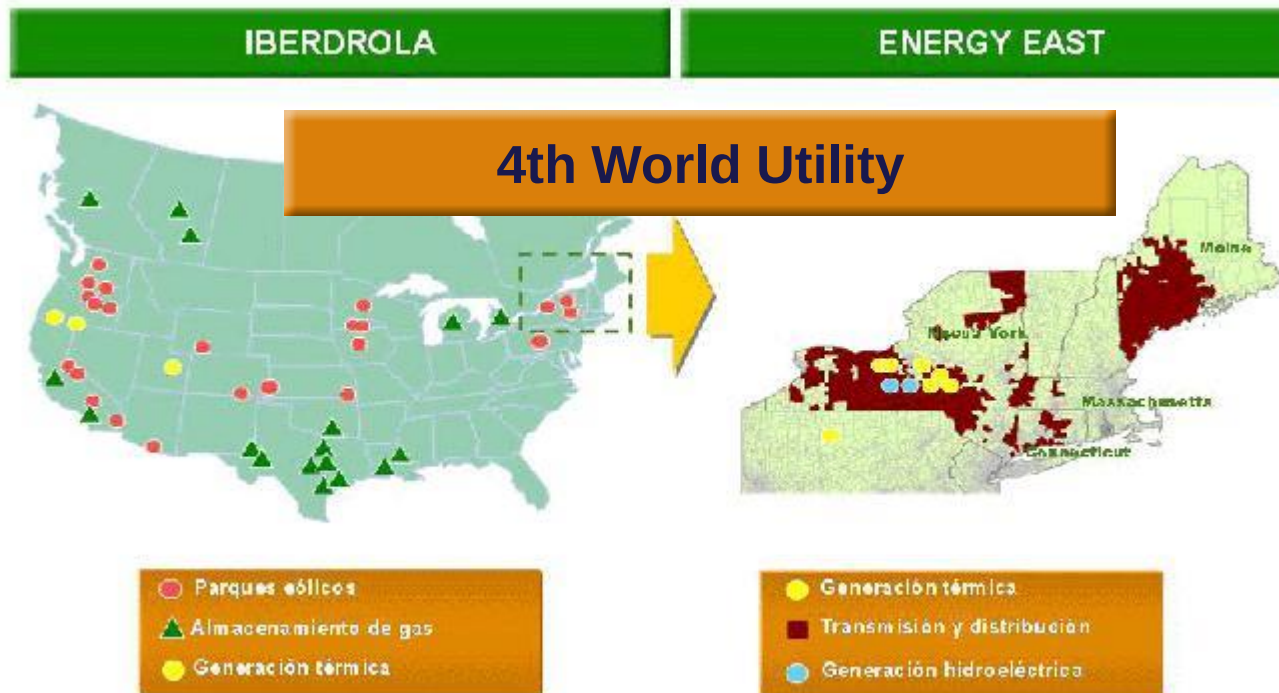


IBERDROLA + Energy East



65.000 Millions Euro Total Value

Up to 42.000 MW Installed Capacity



Agenda



- 1.-** IBERDROLA Overview
- 2.-** PI History
- 3.-** Combined Cycle Strategy
- 4.-** Applications Developed
- 5.-** Future Scope
- 6.-** Conclusions & key lessons learned
- 7.-** Questions and Answers

- Started on 2002.
- Actual Installations:
 - 8 PI Systems on Spain's Combined Cycle.
 - 4 PI Systems on Mexican's Combined Cycle.
 - 1 PI System on Latvia's Combined Cycle.
 - 3 PI Systems on CMDS.
 - 1 PI System on Distribution Bussiness.
 - 1 PI System on Renovable Bussiness.
- Future Installations:
 - 3 PI Systems on Spain's Coal Power Plants.
 - 1 PI System on Spain's 100% Owned Nuclear Power Plant

Agenda



- 1.-** IBERDROLA Overview
- 2.-** PI History
- 3.-** Combined Cycle Strategy
- 4.-** Applications Developed
- 5.-** Future Scope
- 6.-** Conclusions & key lessons learned
- 7.-** Questions and Answers

Technology Center for Combined Cycles since 2002



MAIN GOALS

- Maximize efficiency, availability and reliability
- Support power plants to:
 - O&M in an optimum way
 - Minimize costs
 - Unify technology management



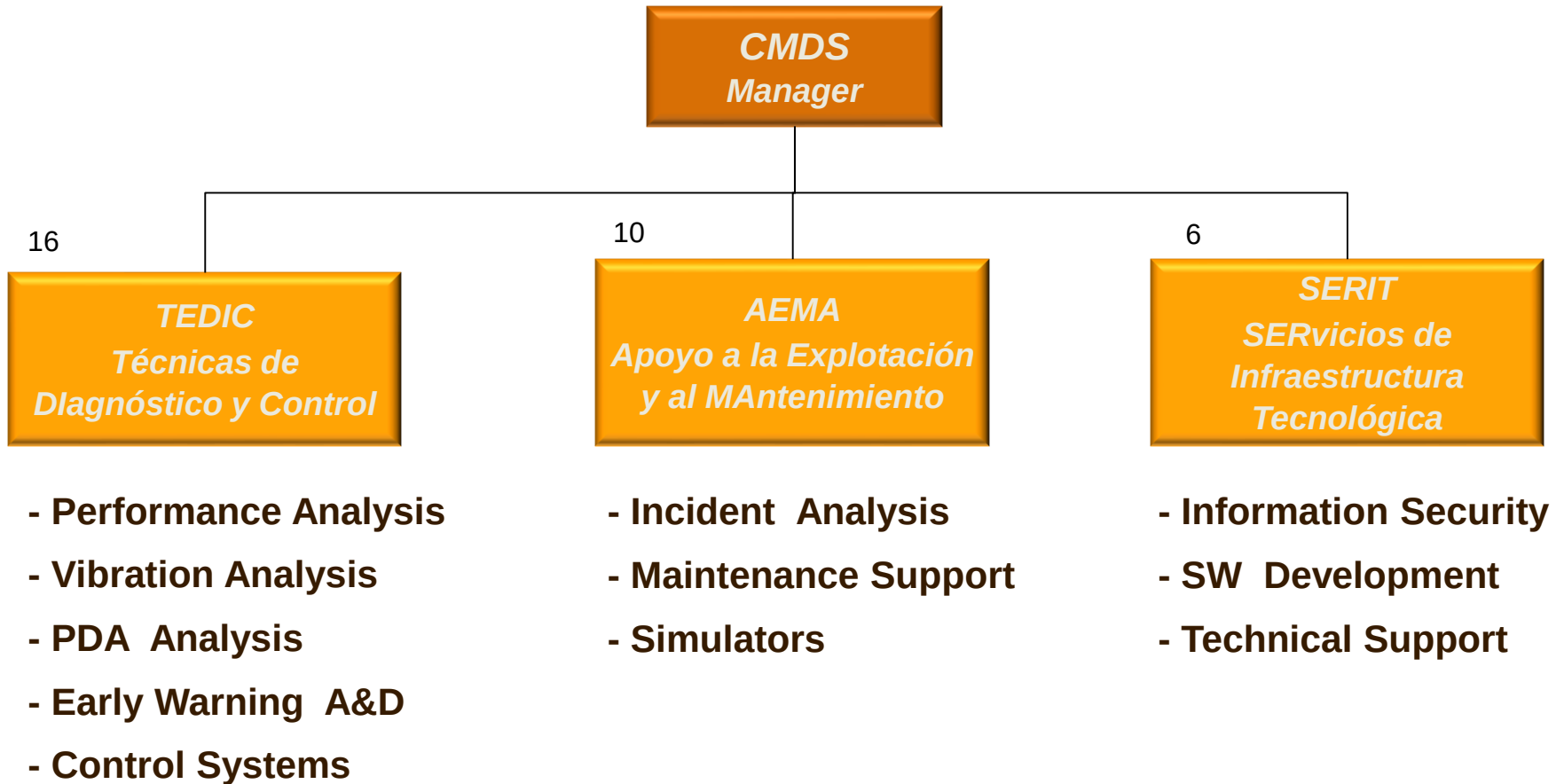
POWER PLANTS O&M OPTIMISATION

ADDITIONAL PROFITS

- Common O&M model for all stations : Fleet approach
- O&M on-site and on-line support
- Share operational experiences and best practices
- Center of Excellence
- Reduce OEM dependency



CMDS Organization



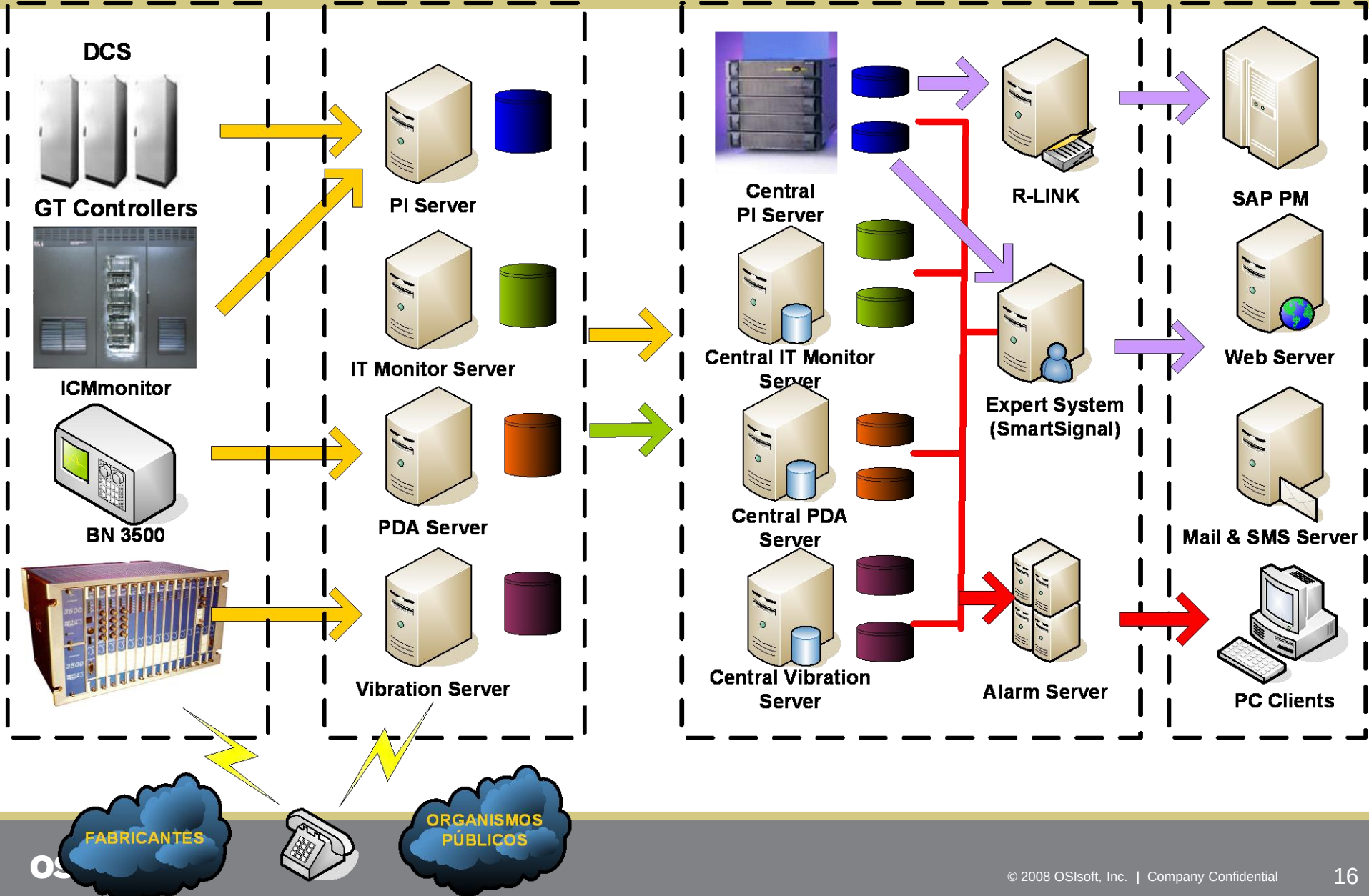
CMDS Lay-Out

Process Network

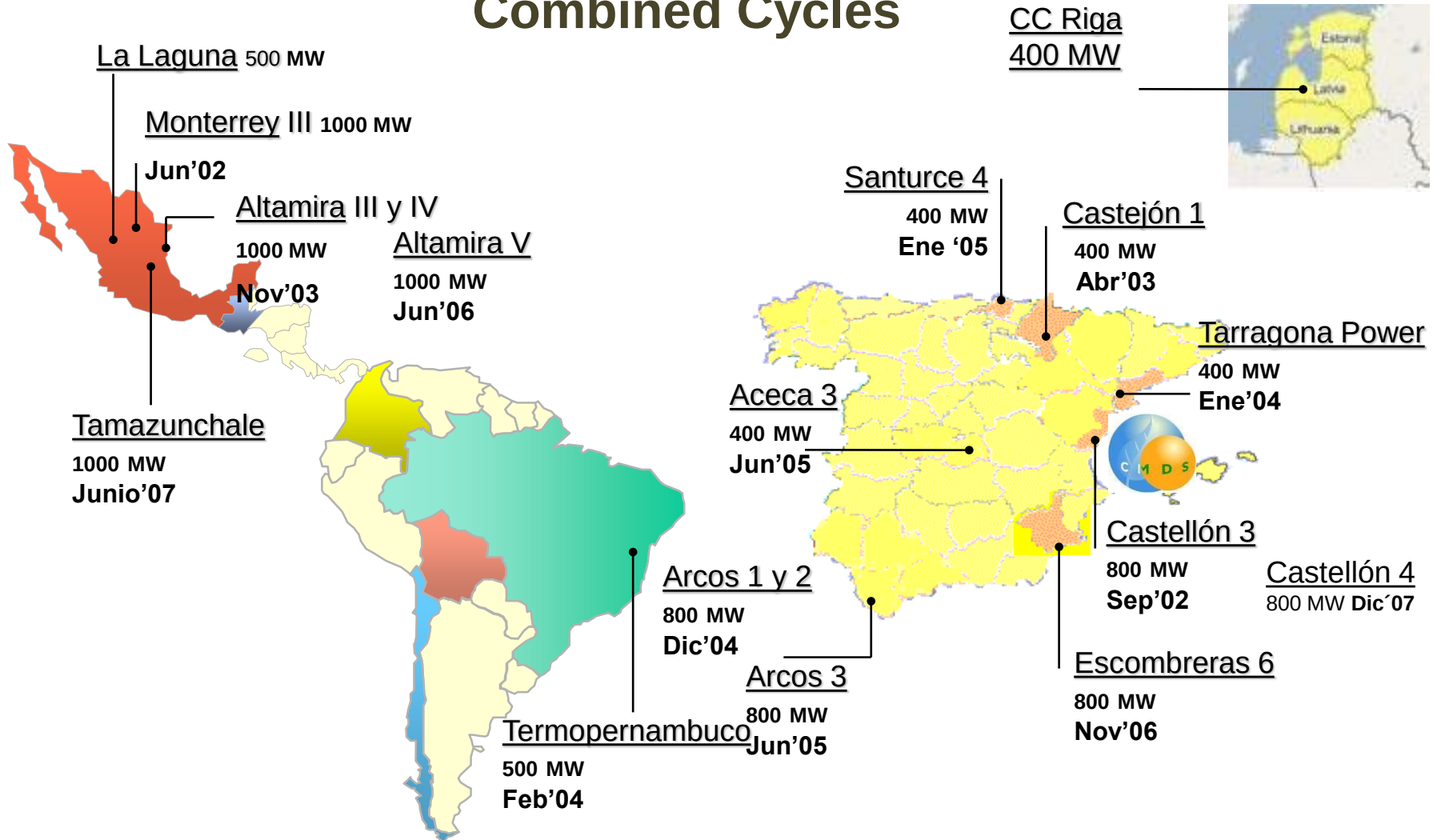
"On-Site" M&D Network

CMDS Network

Business Network



Combined Cycles



Agenda



- 1.- IBERDROLA Overview**
- 2.- PI History**
- 3.- Combined Cycle Strategy**
- 4.- Applications Developed**
- 5.- Future Scope**
- 6.- Conclusions & key lessons learned**
- 7.- Questions and Answers**

Applications Developed



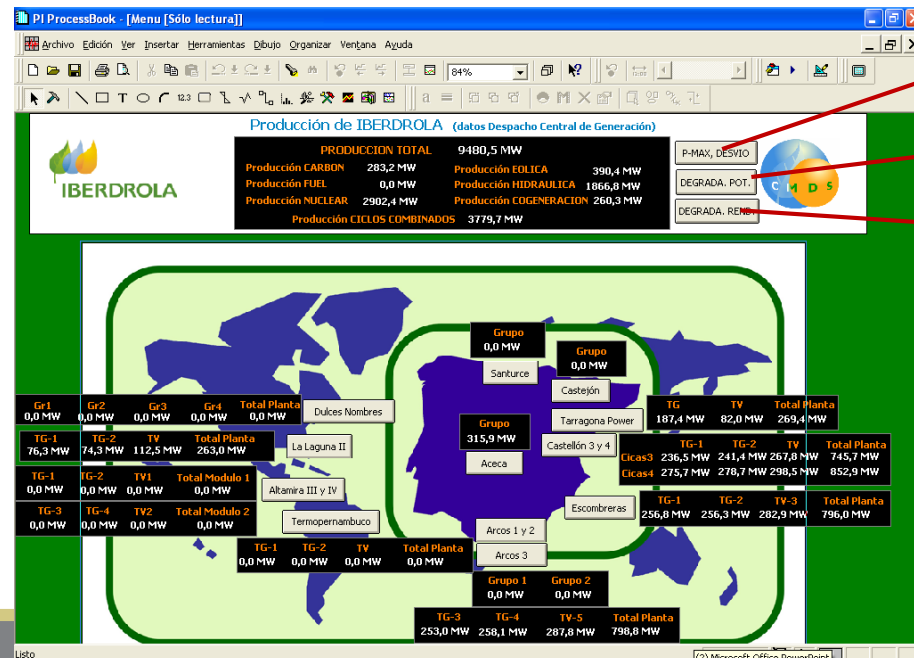
- Performance Tracking
- Contract Tracking
- System Advisor
- AEM (Advanced Equipment Monitoring)
- IT Doctor
- GE M&D Connection
- SAP Connection (PM & BW Module)
- EMS Connection (Dispatching Center)
- Daily Inspections
- Others.....

Applications Developed



● Performance Tracking

1. Overall Power Degradation (from Base Line)
2. Overall Heat Rate Degradation (from Base Line)
3. Expected Output Power
4. Gas Consumption Deviation (from Expected)



3,4

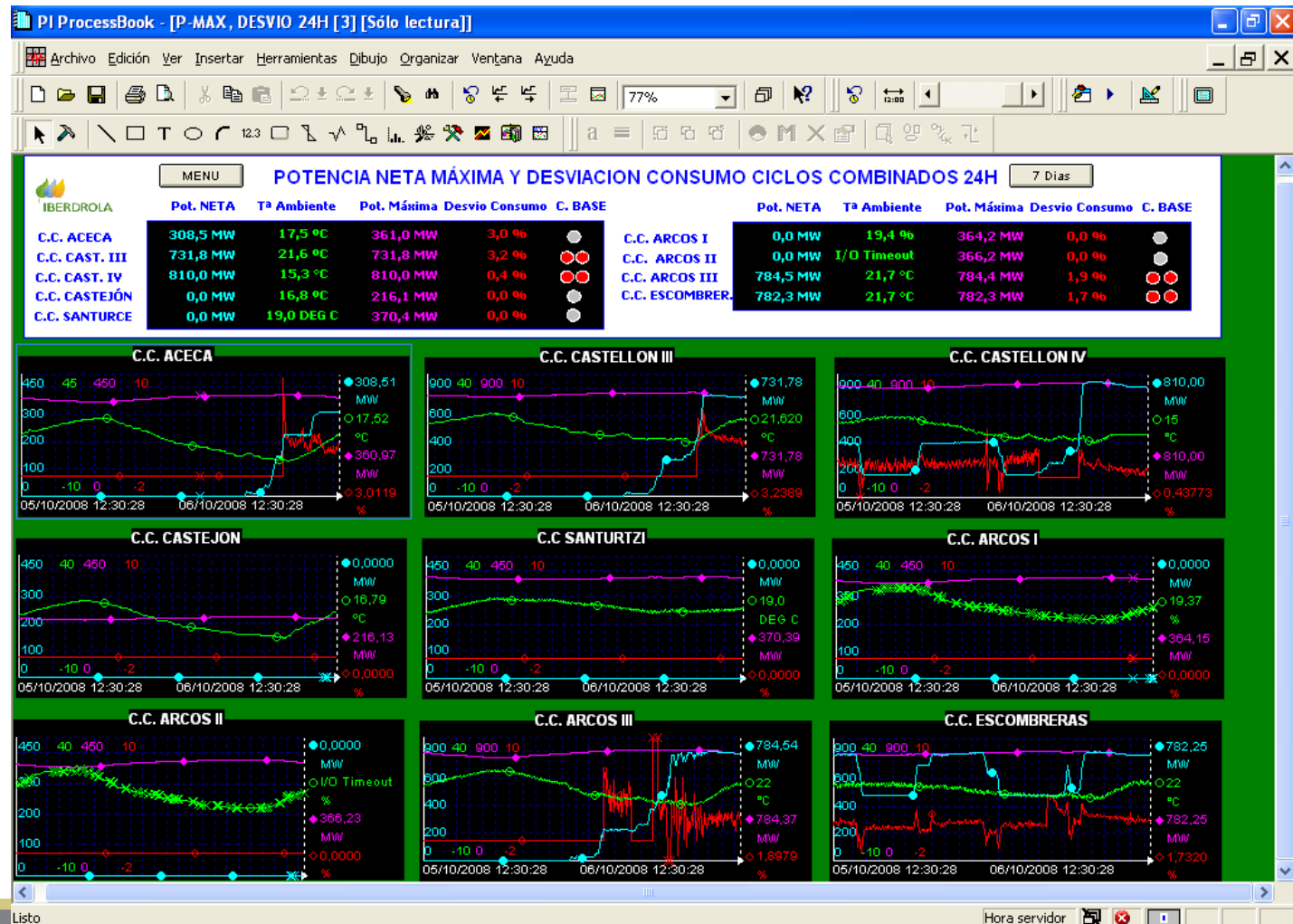
1

2

Applications Developed

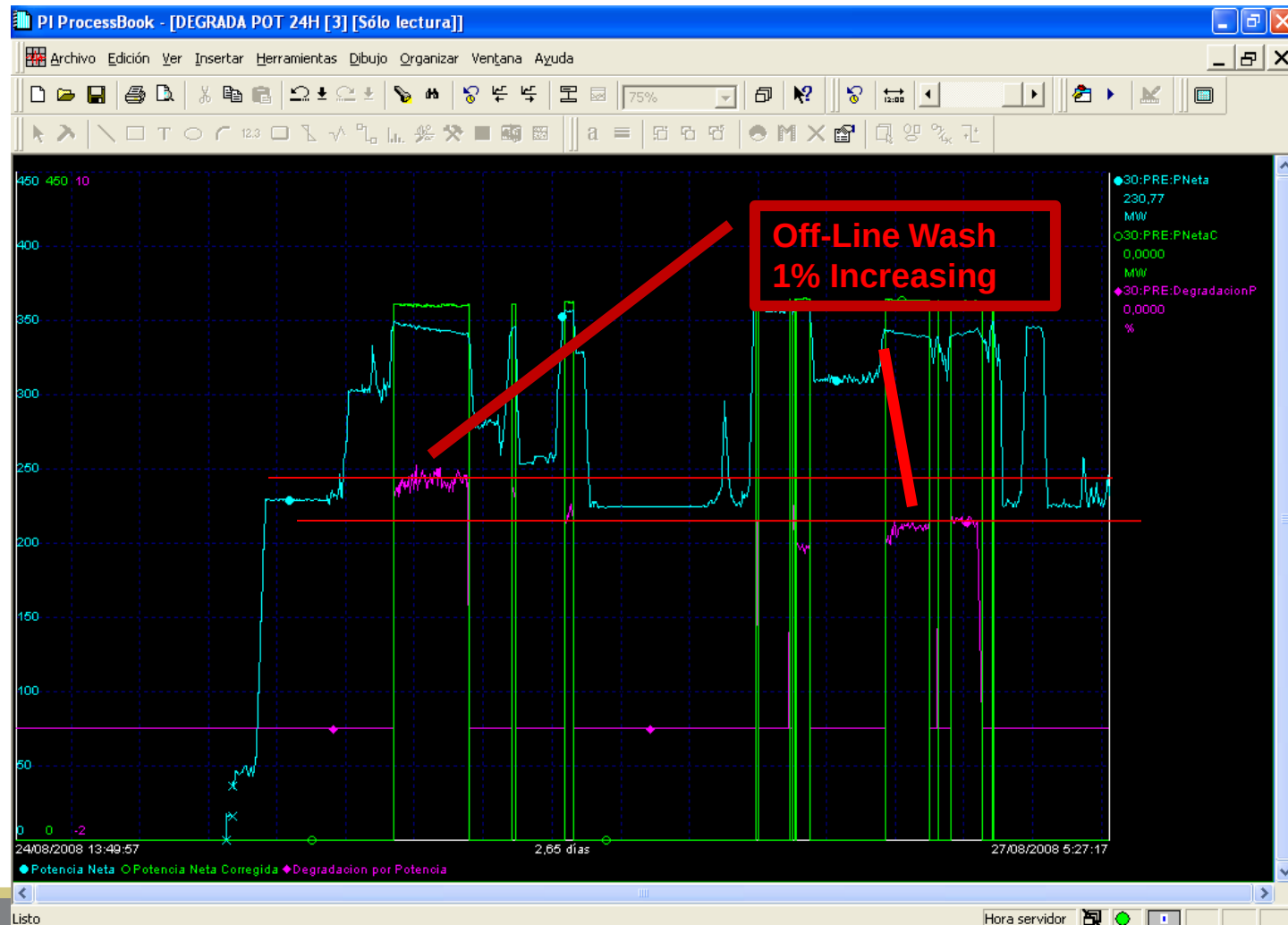


● Performance Tracking



Applications Developed

● Performance Tracking

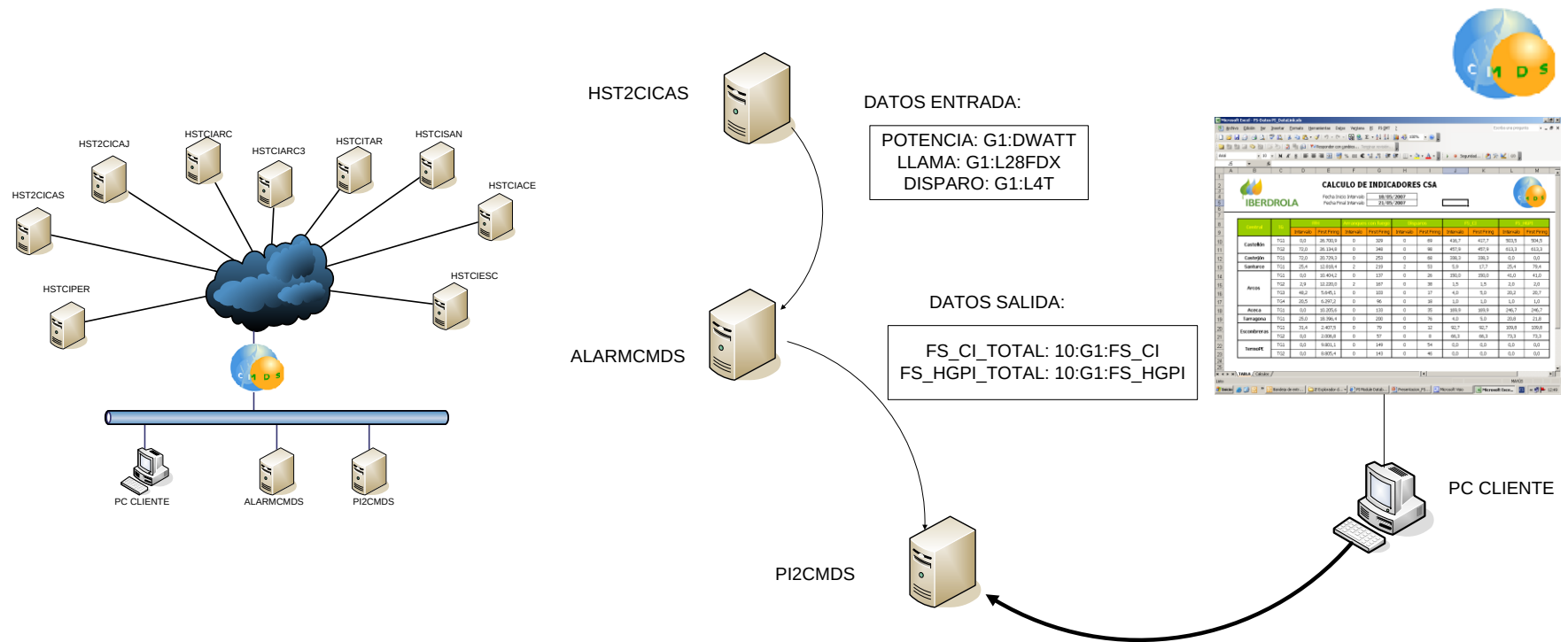


Applications Developed



● Contract Tracking

— Maintenance Contract Tracking – FS App – Lay-Out

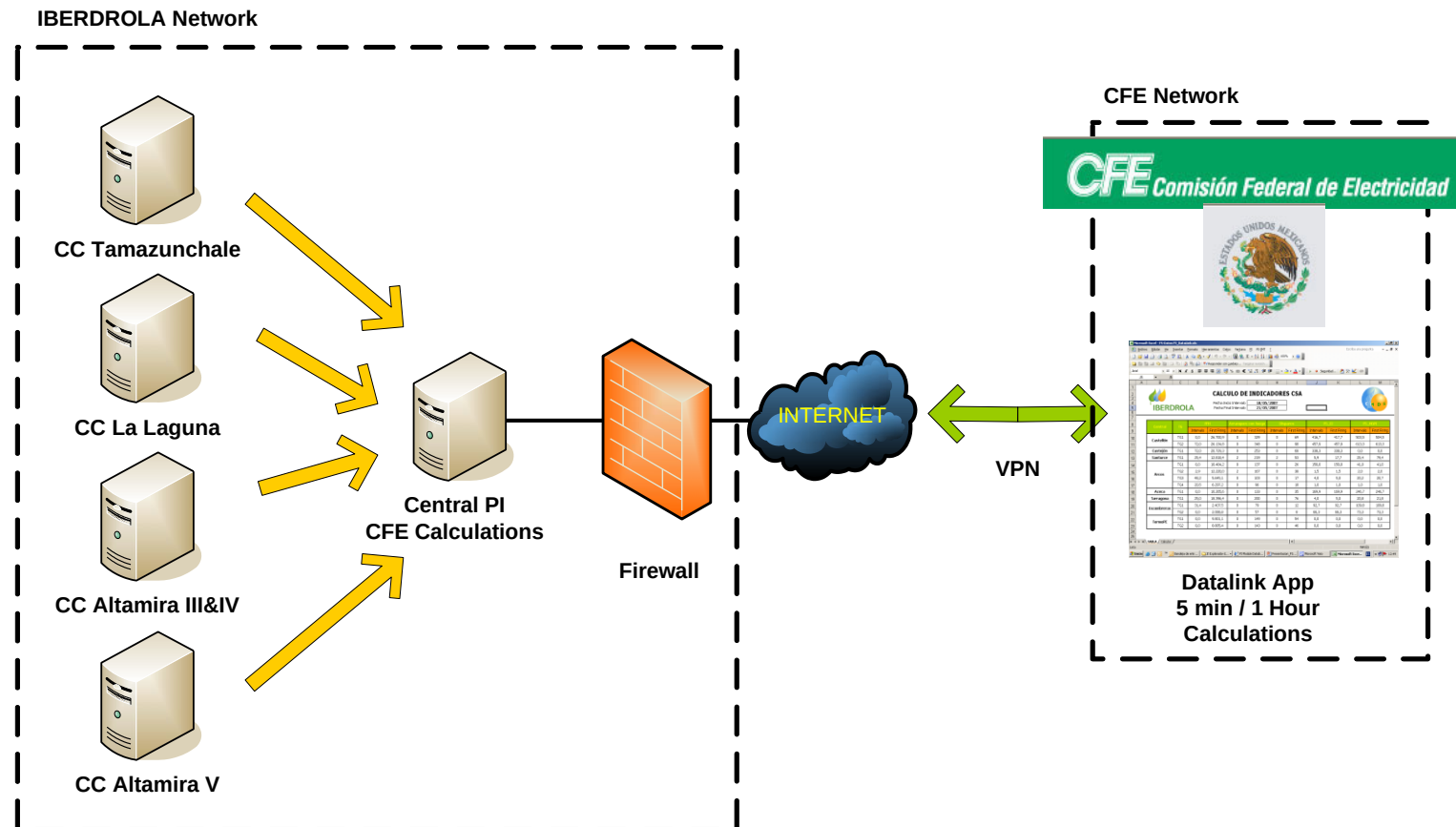


Applications Developed



● Contract Tracking

– Energy Contract Tracking – PI-CFE App – Lay-Out



- Contract Tracking

- Energy Contract Tracking – PI-CFE App – Lay-Out
 - Only applies for Mexican Power Plants
 - Long term energy contract with CFE (Mexican Government)
 - Is mandatory to provide real time calculations to CFE
 - First Option was developed using non OSI tools...it was a nightmare!!!
 - After moving to ACE calculations, we get congratulations from CFE!!!!

- System Advisor

- Trip Notify

- GT/ST Trip recognition
 - GT Runback recognition
 - Email and SMS to O&M staff
 - Email to General Electric M&D on Atlanta
 - This E-Mail supports common trip avoid process
 - Reduction of TTR (Time to Trip Recognition) from 30 min to 5 min

Applications Developed



- System Advisor
 - Trip Notify - Details

DISPARO en la TG2 del CC de ESCOMBRERAS - Mensaje (HTML)

De: stcmds@iberdrola.es
Para: md.center@ps.ge.com
CC: STCMD5; OPCMD5; alfonso4.sanchez@ge.com; richard.quintal@ps.ge.com
Asunto: DISPARO en la TG2 del CC de ESCOMBRERAS
Enviado el: miércoles 20/06/2007 7:35
Datos adjuntos: iberdrola_logo.bmp (22 KB)

"This is an automatic message generated by IBERDROLA M&D to support the common trip avoid process. There is a problem in the TG2(298475) . Please revise it and call back to 34 964 55 77 19 with recommendations"



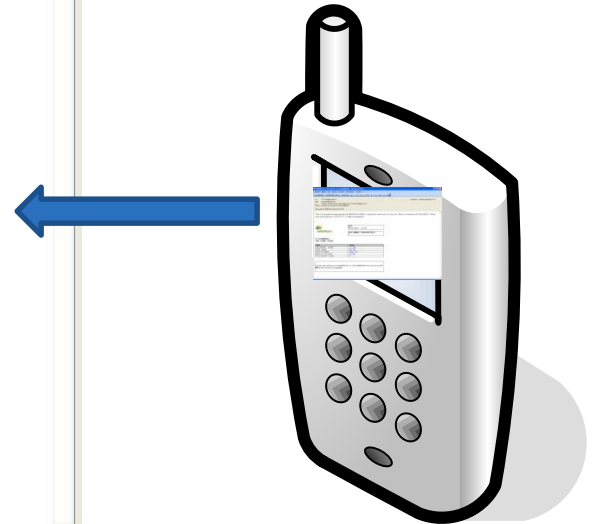
DATE
20/06/2007 7:34:09

TRIP NUMBER (CONTADOR HKVI)
9

CC ESCOMBRERAS
TRIP SIGNAL VALUES

ITEM	VALUE
TG2(298475) power:	177 MW
Total power:	267 MW
Turbine speed:	2998 rpm
Generator breaker:	Closed
Trip counter value:	8

A trip has been produced on TG2(298475) from CC ESCOMBRERAS when the load was **177 MW** and the machine was **engaged**



Applications Developed



- System Advisor
 - Start-Up Notify
 - Email and SMS to O&M staff

Six Phases

Diff Time

NOTIFICACION ARRANQUE TG1 CCC CASTEJON - Mensaje (HTML)

De: stcmds@iberdrola.es
Para: STCMDS
CC: OPCMDS; Doblado Goberna, Manuel; alvaro.ceteck@grupocivera.com; STCMDS; Martin Mas, Manuel De; Martinez Fernandez, David
Asunto: NOTIFICACION ARRANQUE TG1 CCC CASTEJON
Enviado el: Lunes 02/07/2007 5:22
Datos adjuntos: iberdrola_logo.bmp (22 KB)

 FECHA
02/07/2007 5:21:34

NÚMERO DE ARRANQUE
(CONTADOR MKVI)
259

CICLO COMBINADO DE CC CASTEJON
DATOS EN EL MOMENTO DEL ARRANQUE

HITO	HORA	Duración Etapas
Inicio del Rodaje	02/07/2007 2:30:03	0 s
Encendido:	02/07/2007 2:46:10	0h 16m
FSNL:	02/07/2007 2:52:41	0h 6m
Acoplamiento:	02/07/2007 2:54:20	0h 2m
Inicio Admisión Vapor:	02/07/2007 3:14:58	0h 20m
Vapor 100%:	02/07/2007 4:26:00	1h 12m
Mínimo Técnico:	02/07/2007 5:21:14	0h 55m

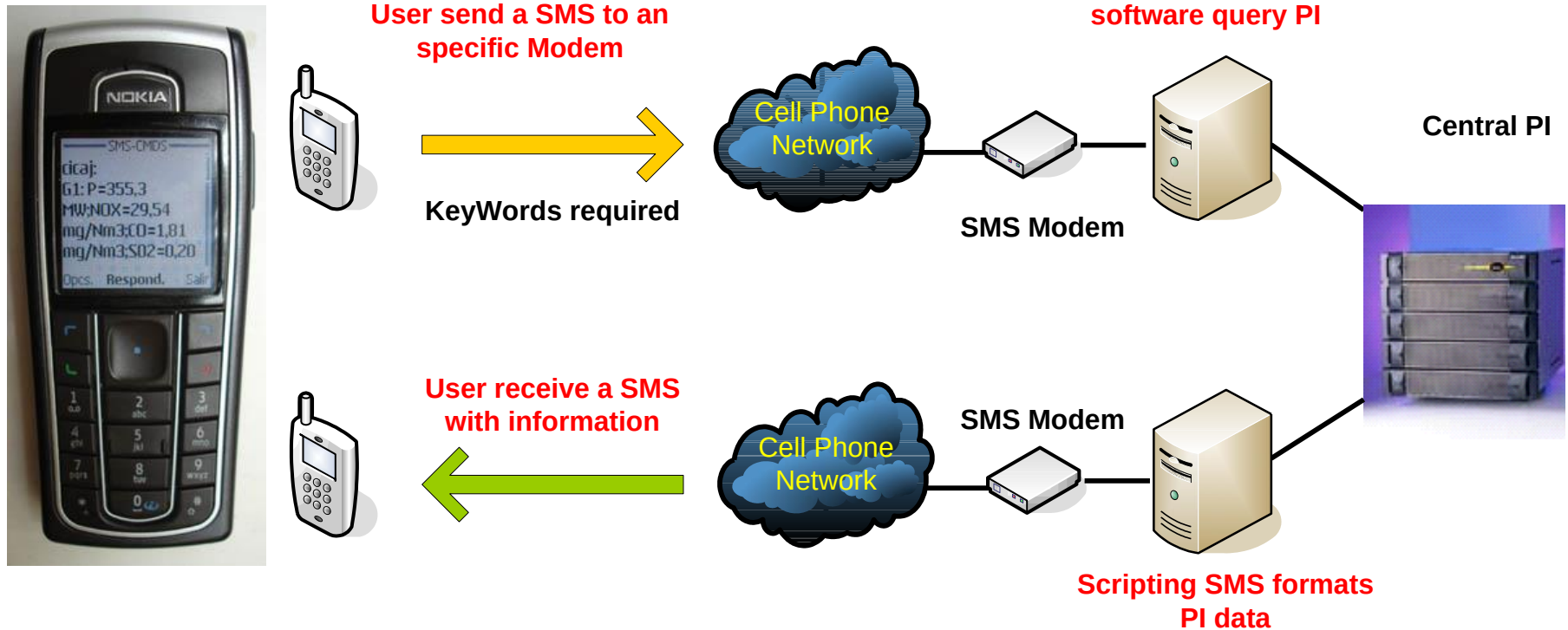
Se ha completado el arranque de la TG1 de CC CASTEJON en 2h 51m.

- System Advisor

- On-Demand Notify
 - On-Demand queries by cell phone
 - Get Real time data from selected GT
 - Output Power
 - Emissions
 - Overall performance

Applications Developed

- System Advisor
 - On-Demand Notify – Lay-Out

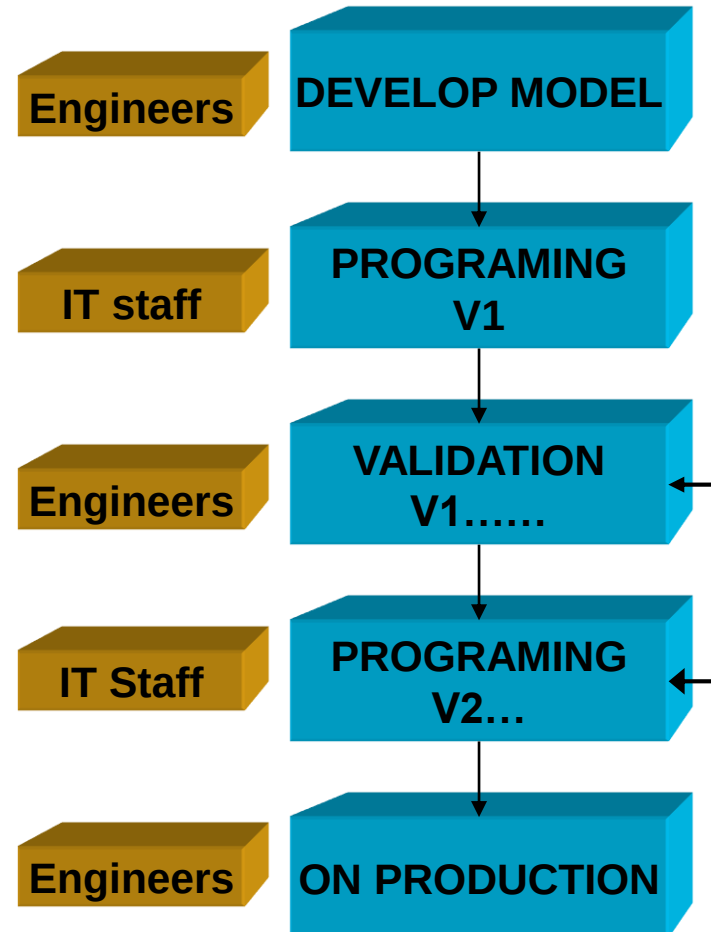
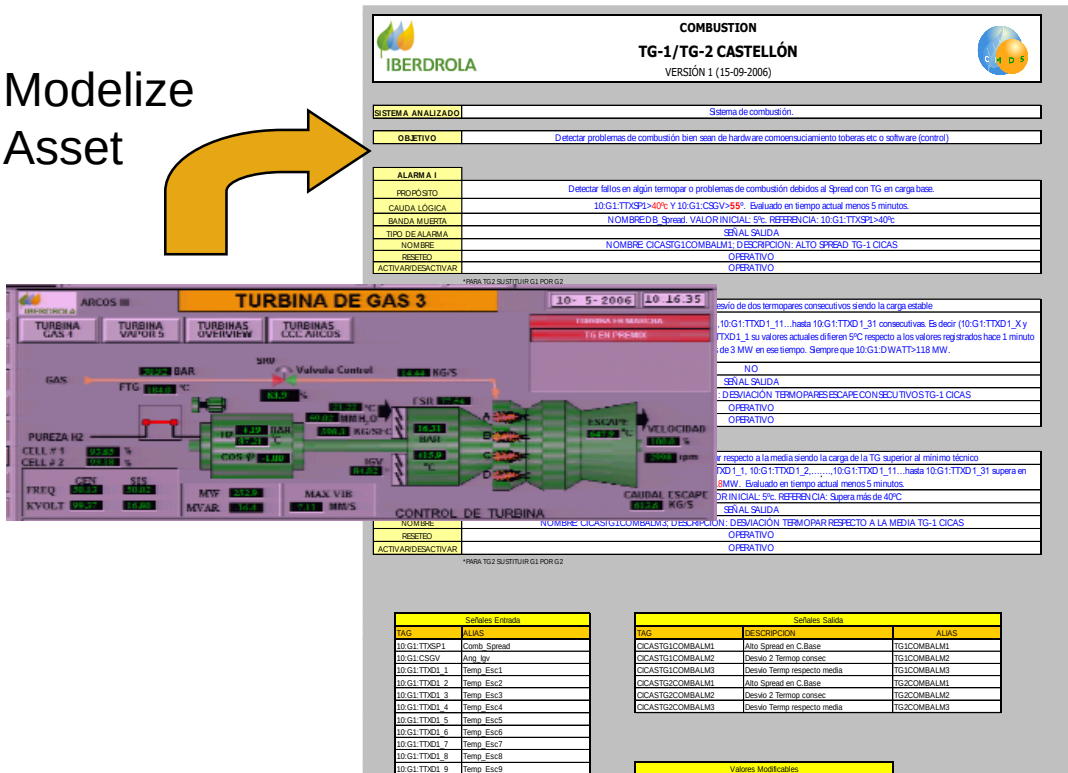
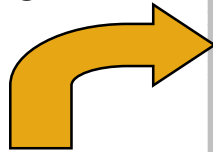


Applications Developed



- AEM (Advanced Equipment Monitoring)
 - Developing Process

Modelize
Asset

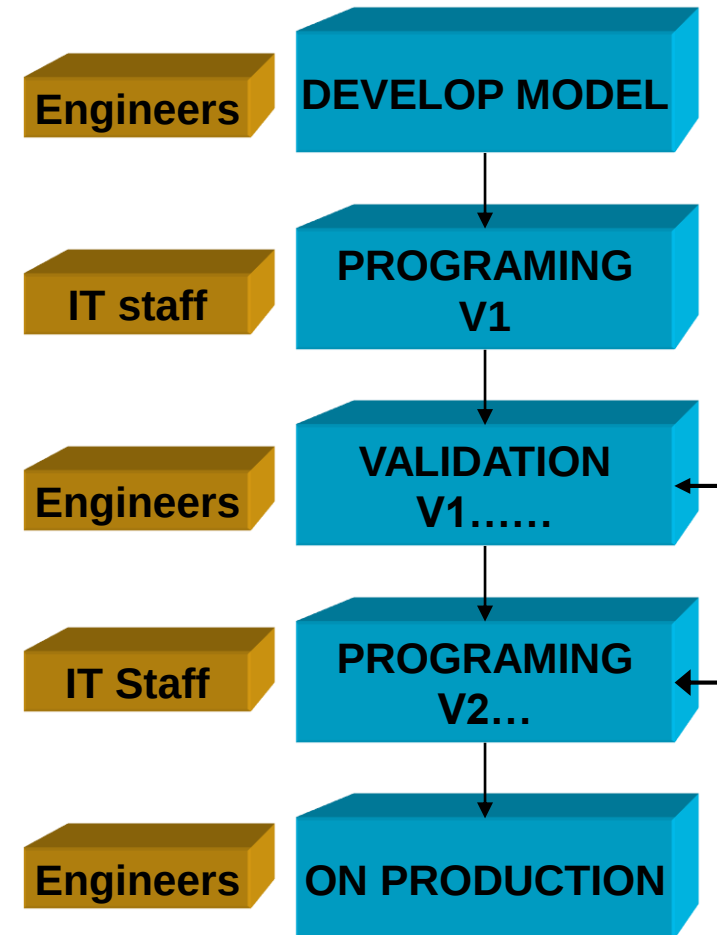


Applications Developed



● AEM (Advanced Equipment Monitoring)

- Models in place
 - Combustion System
 - Generator Monitoring System
 - Generator Hydrogen System
 - Atomizing Air System
 - Proximitors - Vibration Sensors
 - Condensate System
 - HP Attenuation System
 - HP - IP Feedwater Pumps
 - Steam Turbine Sealing System
 - Steam Turbine Exhaust System
 - Steam Process System
 - Turning Gear System

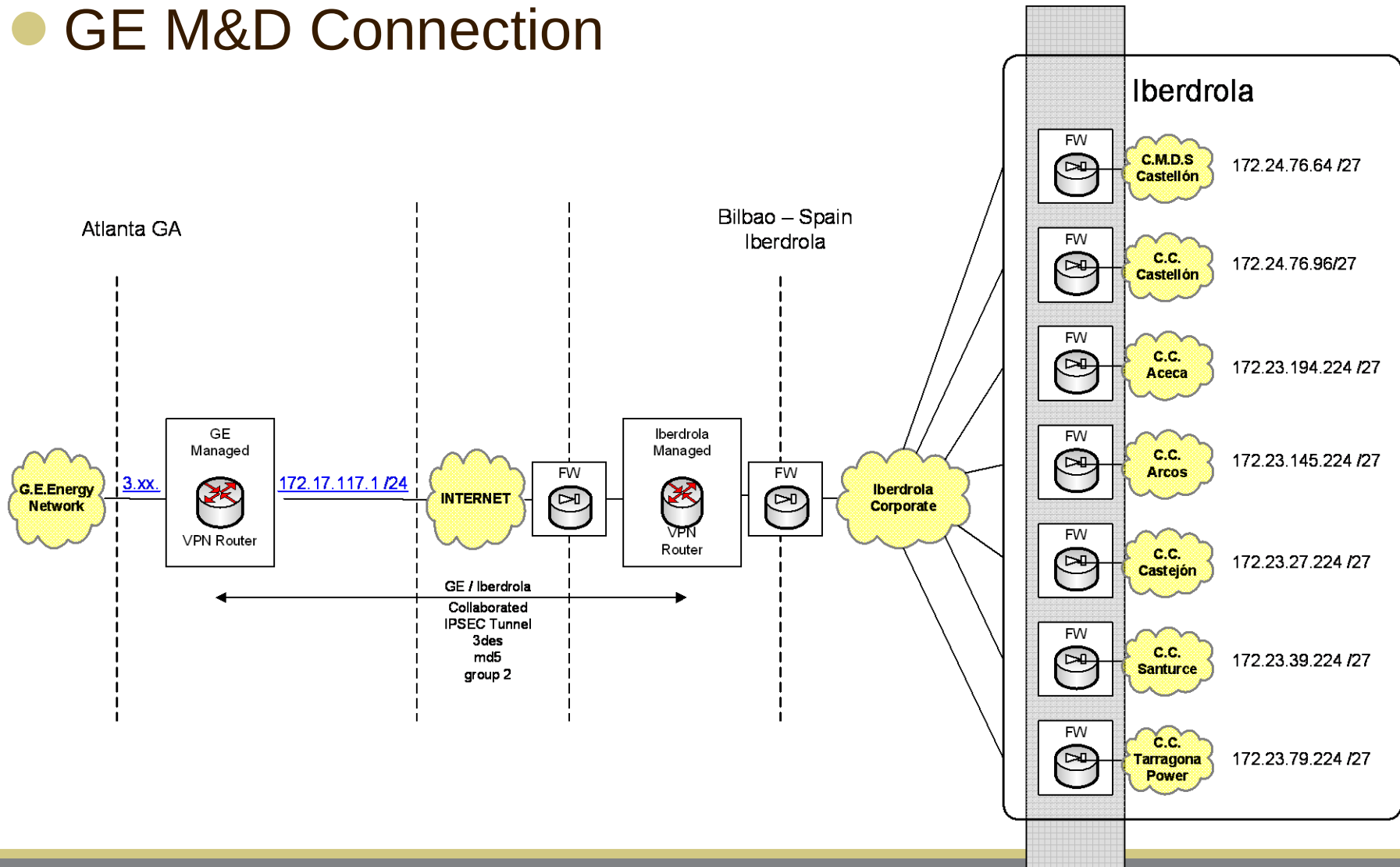


The screenshot displays the Iberdrola CMD5-NETMON software interface. The top menu bar includes options like Archivo, Edición, Ver, Insertar, Herramientas, Dibujo, Organizar, Ventana, and Ayuda. The main window is titled "ALARMAS" and contains several tabs: "Estado Servidores", "Alarmas Comunicaciones", "General", "Antivirus Servidores", "Estado Red", and "Alarmas Servidores". The "General" tab is active, showing a map of Spain with various monitoring points labeled: CILAL, CIALT, CIPER, CISCAN, CICAJ, CITAR, CICAS, CMDS, CIACE, CIESC, and CIARC. Below the map, there are status indicators for "General - Perin - Control".

At the bottom, a detailed connection diagram for the "CASTEJON" plant is shown. The diagram includes components such as Pict-0, Pict-1, HSTOCAJ, HOR444600, DCS, AW001, HMI 1, HMI 2, HMR, GT, and ST. It also features a "TCP Response" graph and a "CPU %" graph. The diagram is labeled "Diagrama conexión detallado Historian" and "DIAGRAMA GENERAL".

Applications Developed

● GE M&D Connection



Applications Developed

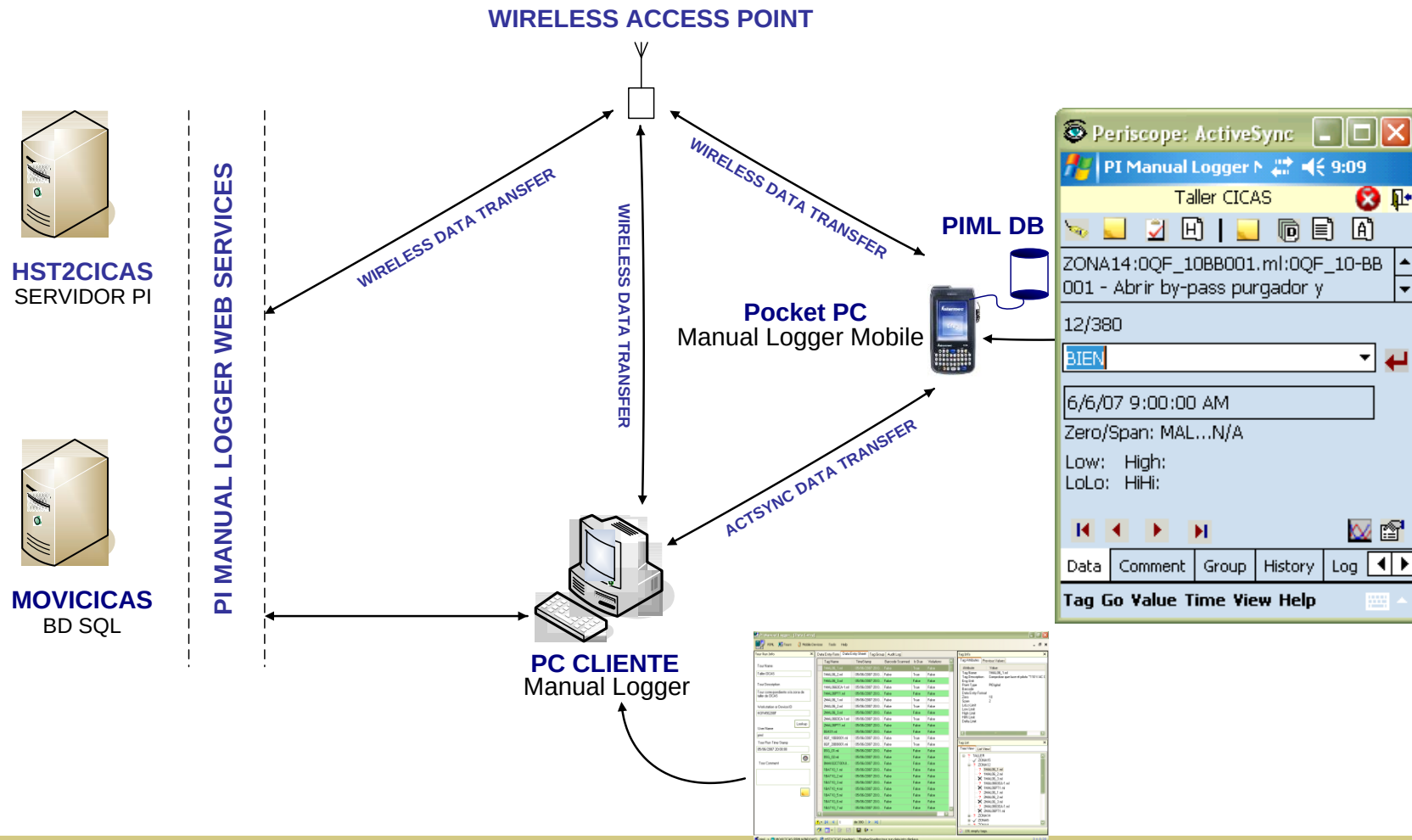


- SAP Connection (PM & BW Module)
 - Connection to PM (Plant Maintenance)
 - Using R-LINK
 - Transferring running hours
 - Connection to BW (Business Warehouse)
 - Using PI-OLEDB with some enhancements
 - Transferring raw data and KPI's.

- EMS Connection (Dispatching Center)
 - Bi-Directional connection using OPC Protocol
 - PI-OPC Server on CMD5 side
 - XISCO ICCP Server on EMS Side
 - Transferring different type of data:
 - In-Daily generation Output Power by Technology
 - Out-Gas Consumptions
 - In-Daily Market Prices
 - Out-Expected Output Power

Applications Developed

● Daily Inspections



Agenda



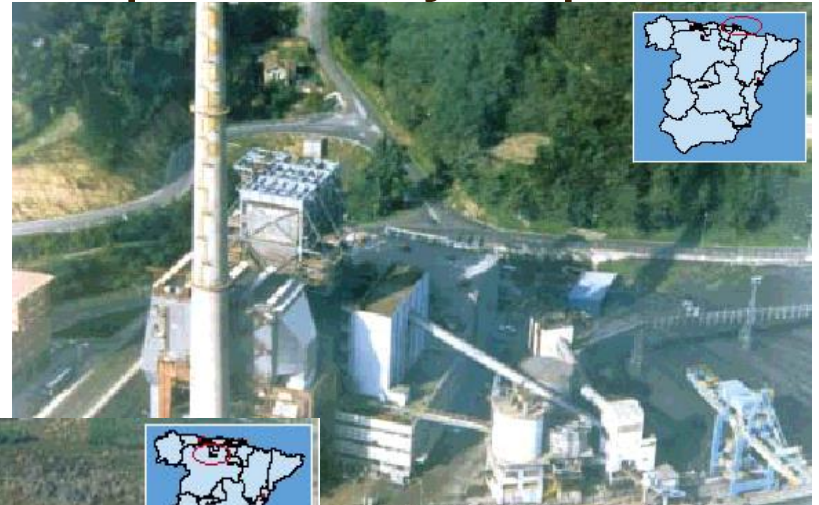
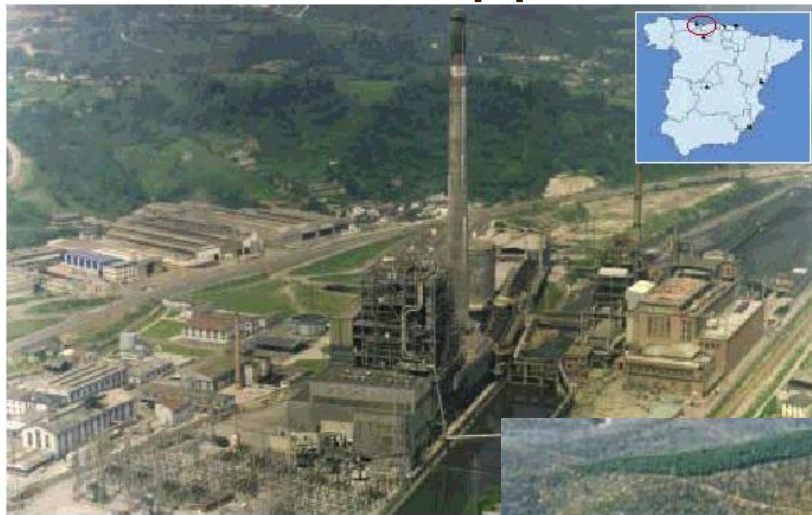
- 1.-** IBERDROLA Overview
- 2.-** PI History
- 3.-** Combined Cycle Strategy
- 4.-** Applications Developed
- 5.-** Future Scope
- 6.-** Conclusions & key lessons learned
- 7.-** Questions and Answers

Future Scope

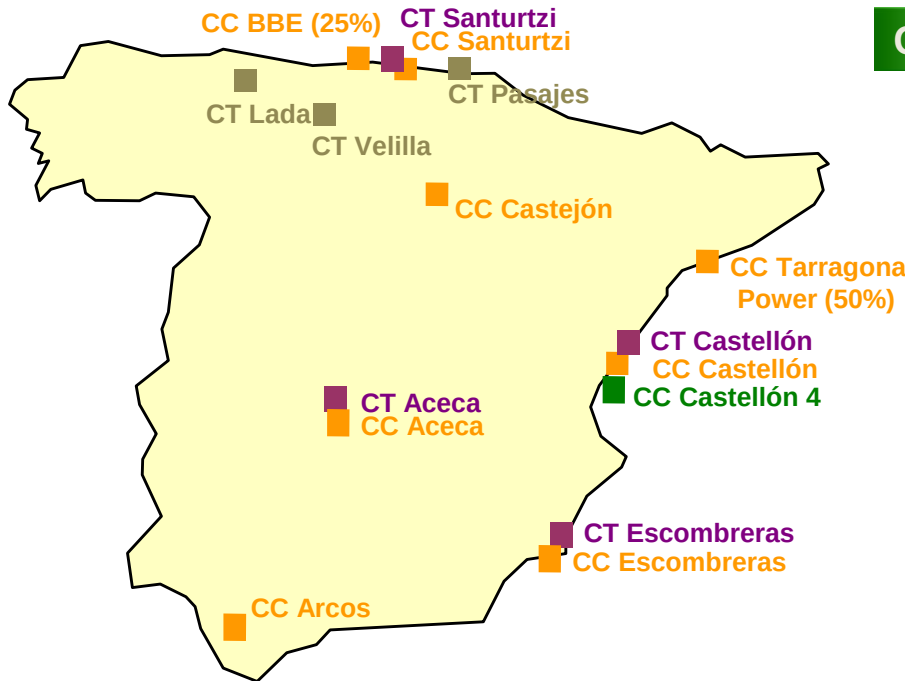


Future Scope

- Coal Power Plants
 - 3 new PI Systems (CT Lada, Velilla & Pasajes)
 - 100% Applications Developed easily exportable



Future Scope



Potencia Instalada (MW) (*)

	Ciclos Combinados	→	4.735 MW
	Fuel Gas	→	2.889 MW
	Carbón	→	1.247 MW

(*) Datos de potencia instalada a 31-08-2007

Ciclos combinados

	<u>MW</u>	<u>P.e.S.</u>
Arcos 1	396	(2004)
Arcos 2	379	(2004)
BBE (25%)	795	(2003)
Castejón	386	(2003)
Castellón 3	793	(2002)
Santurtzi 4	382	(2004)
Tarragona	407	(2003)
Aceca 3	359	(2005)
Arcos 3	818	(2005)
Escombreras 6	820	(2006)
Castellón 4	829	(2007)

F.O. / Gas

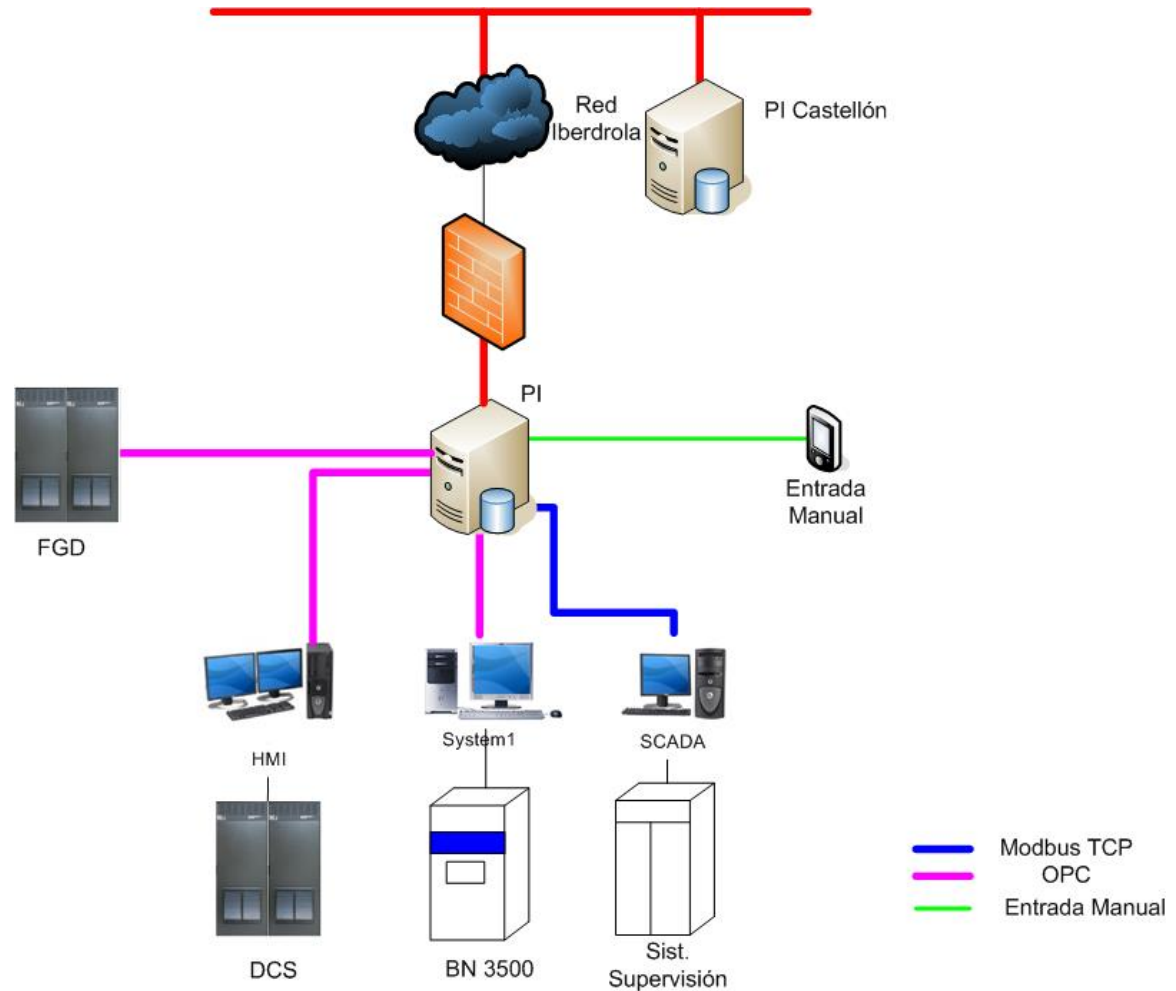
	<u>MW</u>	<u>P.e.S.</u>
Aceca 1 (50%)	314	(1969)
Aceca 2 (50%)	314	(1970)
Castellón 1	542	(1972)
Castellón 2	544	(1974)
Escombreras 4	276	(1966)
Escombreras 5	278	(1968)
Santurtzi 1	376	(1969)
Santurtzi 2	543	(1972)

Carbón

	<u>MW</u>	<u>P.e.S.</u>
Lada 3	156	(1967)
Lada 4	358	(1981)
Pasajes	217	(1967)
Velilla 1	155	(1964)
Velilla 2	361	(1984)

Future Scope

- Coal Power Plants
- Lay-Out



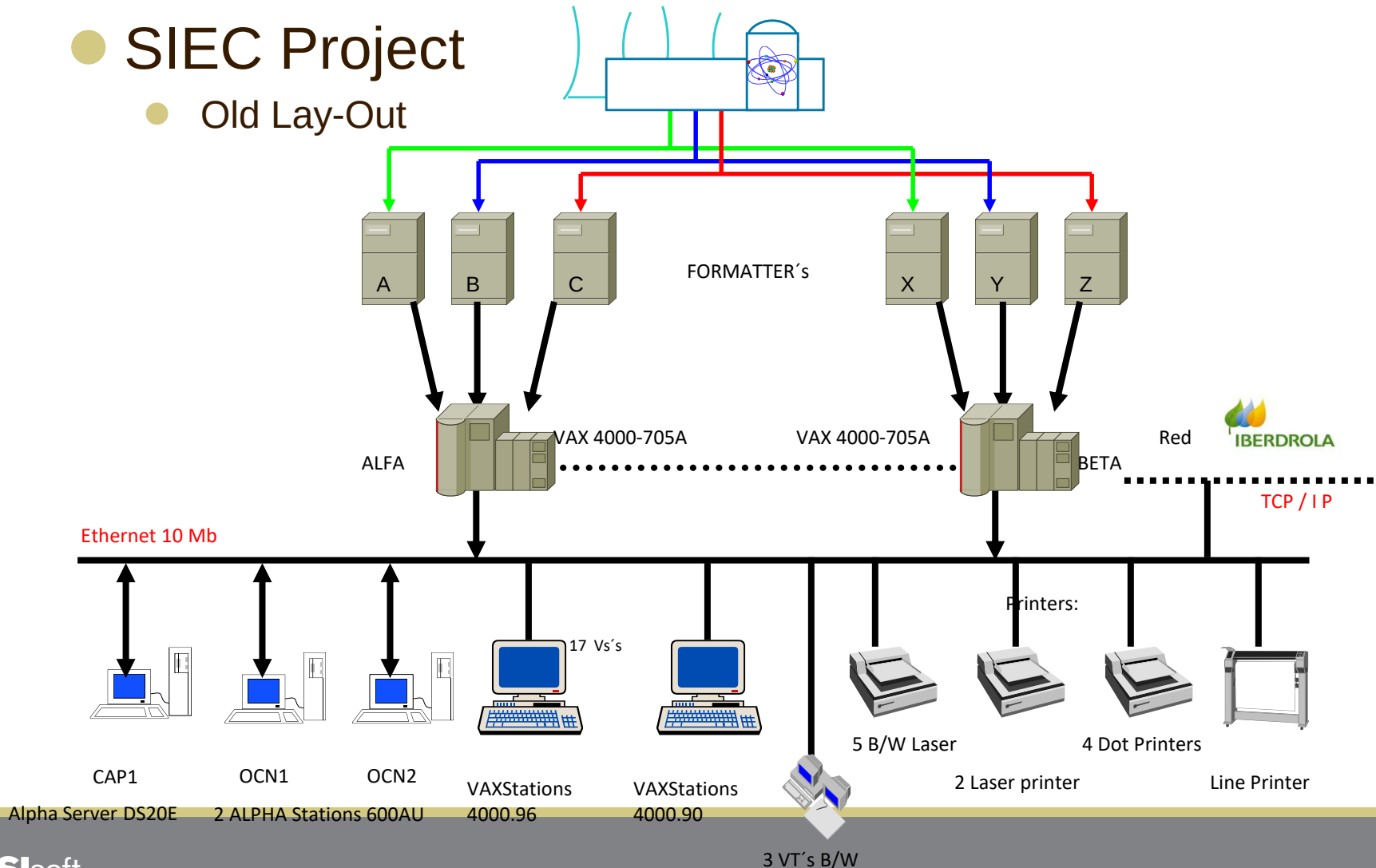
- Nuclear Power Plants
 - 1 new PI System (CN Cofrentes)
 - 80% Applications Developed easily exportable



- CN Cofrentes
 - SIEC Project
 - Sistema Integrado Eris Computador
 - ERIS: Emergency Response Information System
 - Main Functions:
 - No CONTROL, just supervision.
 - TRA: Transient Analysis
 - CAPOTE, CAPRICORE
 - Scram Log, SOE, Regulatory Compliance (Salem/Comsalem), etc...

Future Scope

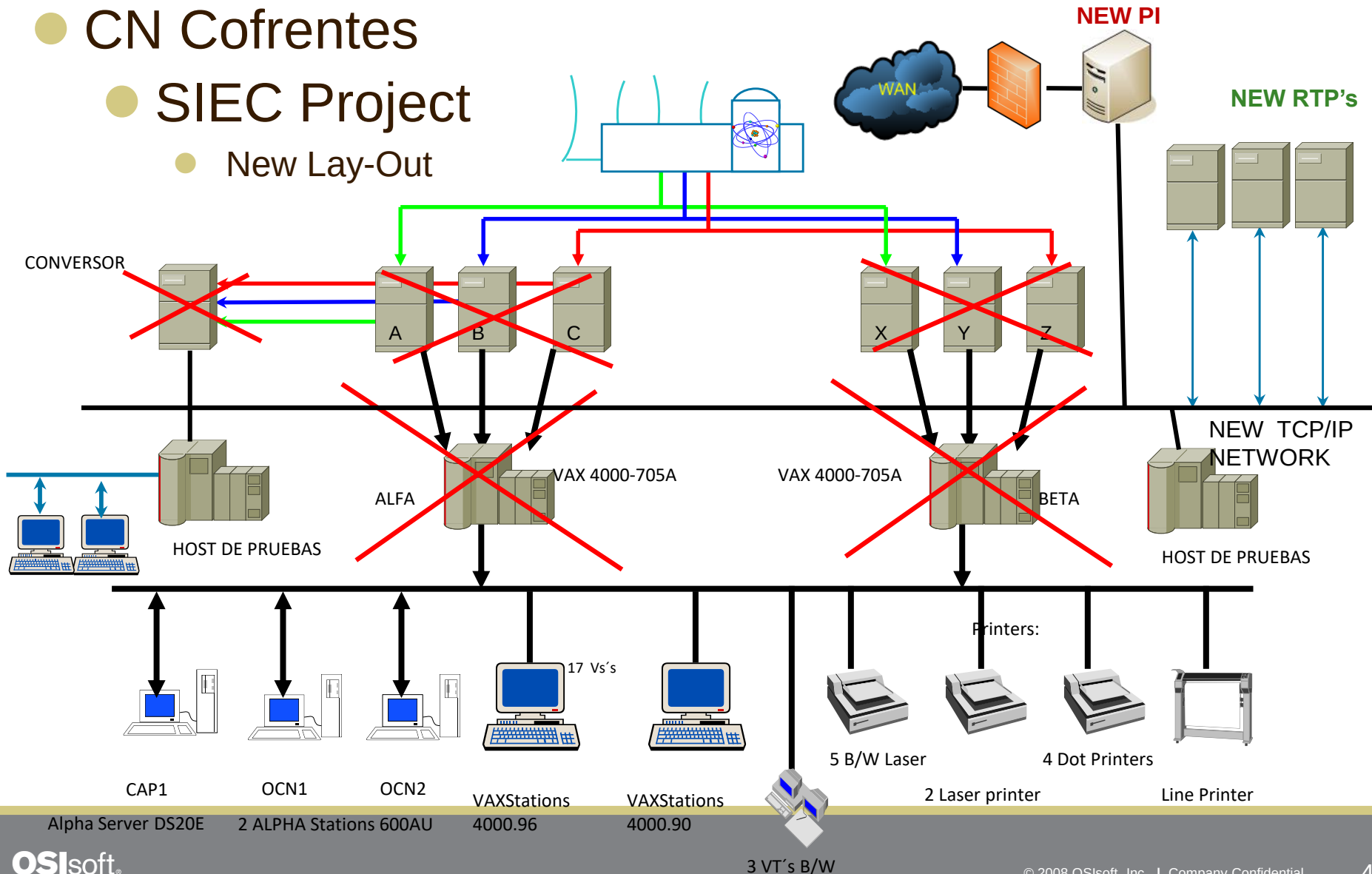
- CN Cofrentes
- SIEC Project
 - Old Lay-Out



- CN Cofrentes
 - SIEC Project Concerns
 - Maintenance problems
 - Obsolescence and lack of spare parts
 - Proprietary protocols (NUMAC, Analogic)
 - Low storage capacity
 - Non user-friendly HMI
 - Unability to exchange data with other systems

Future Scope

- CN Cofrentes
- SIEC Project
 - New Lay-Out



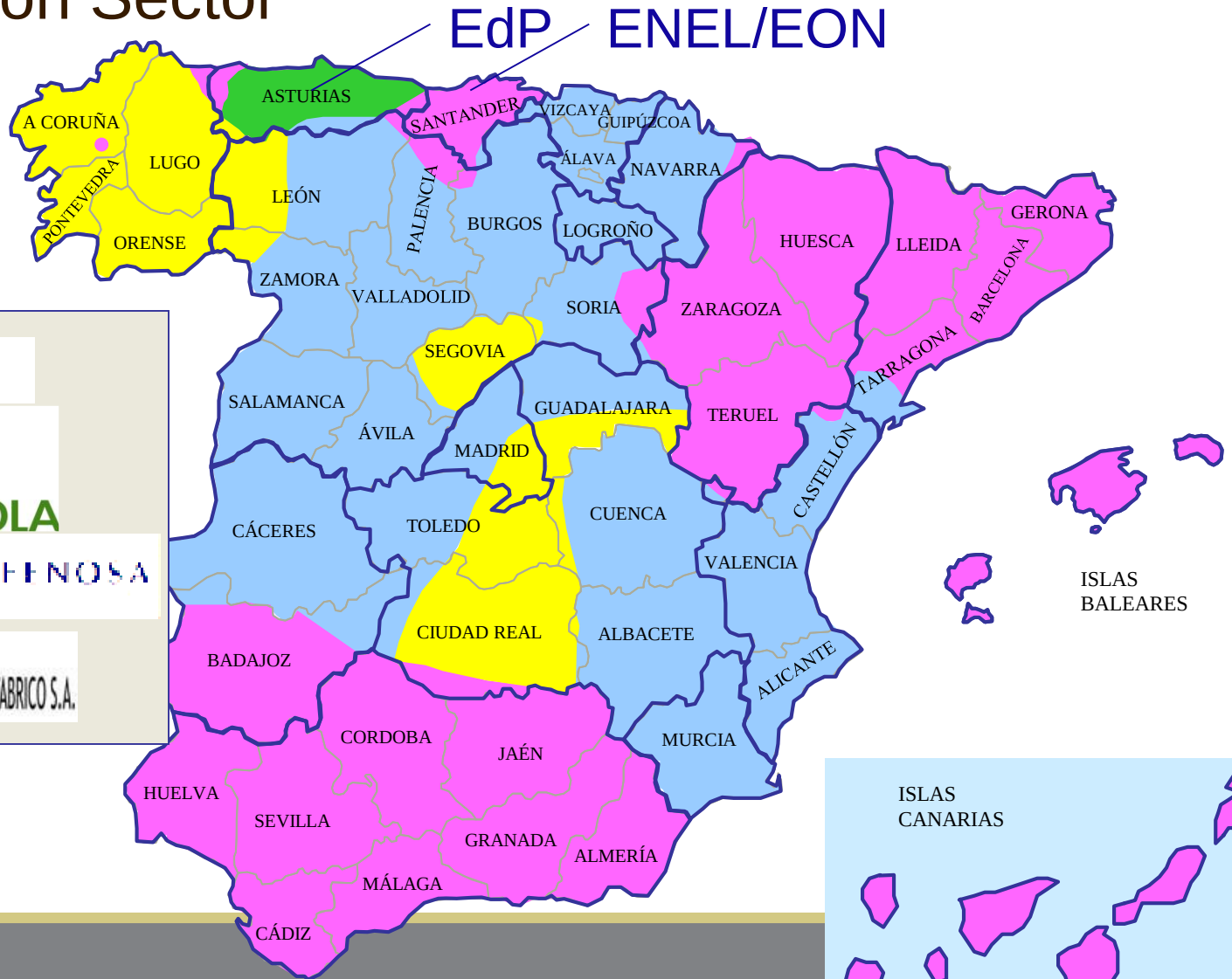
Future Scope

- Distribution Business
 - 1 PI System (North Area)
 - 50% Applications Developed easily exportable

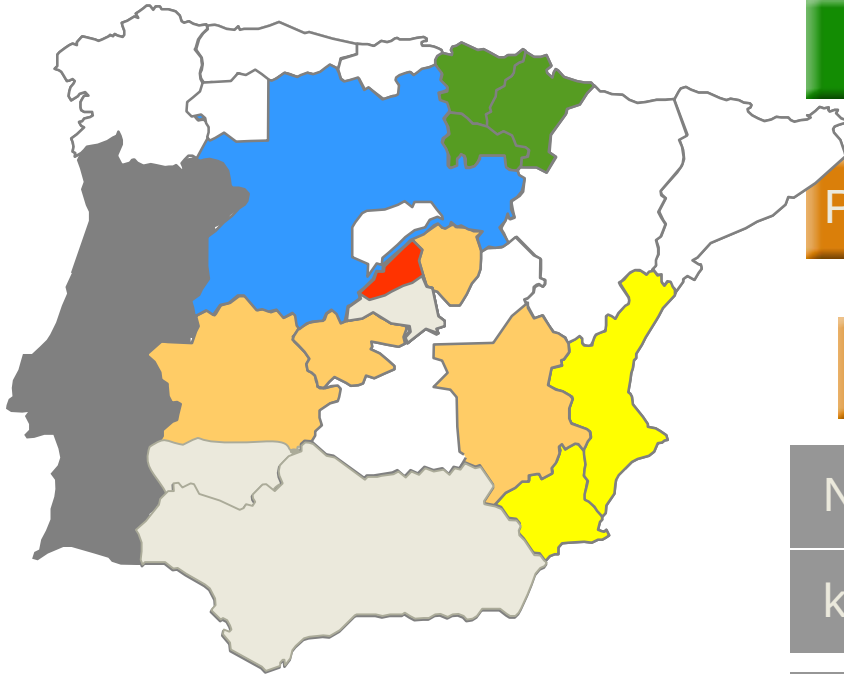


Future Scope

● Distribution Sector



● Key Data



- Región Este
- Región Madrid
- Región Centro
- Región Norte
- Región Oeste

Customers : 10,2 MM

Population served : 20 MM

Surface : 192.335 km²

Number of substations : 847

kms of lines : 219.126

Transformation centres: 75.187

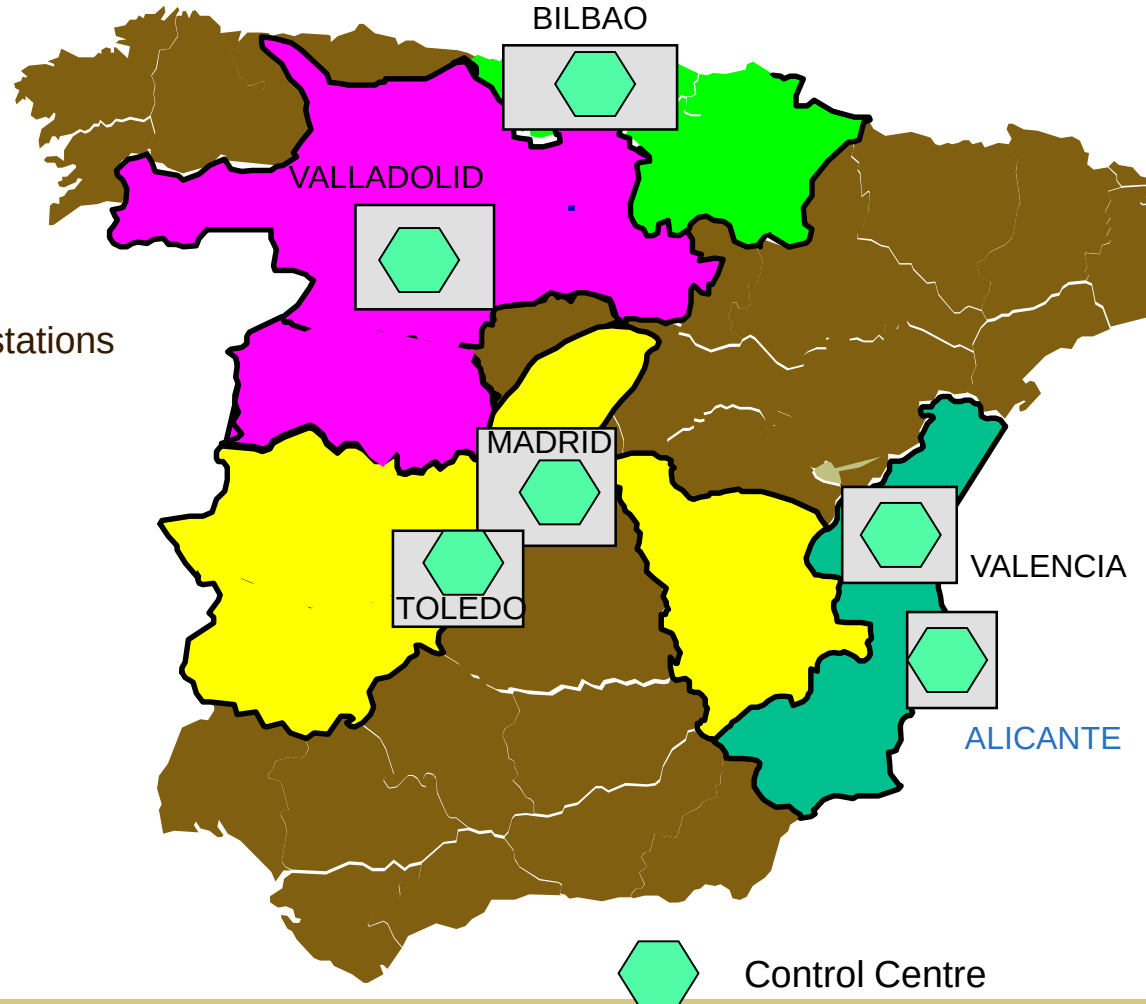
Network voltages:

Meshed: 132, 66, 45, 30

Radial: 20, 15, 13, 11

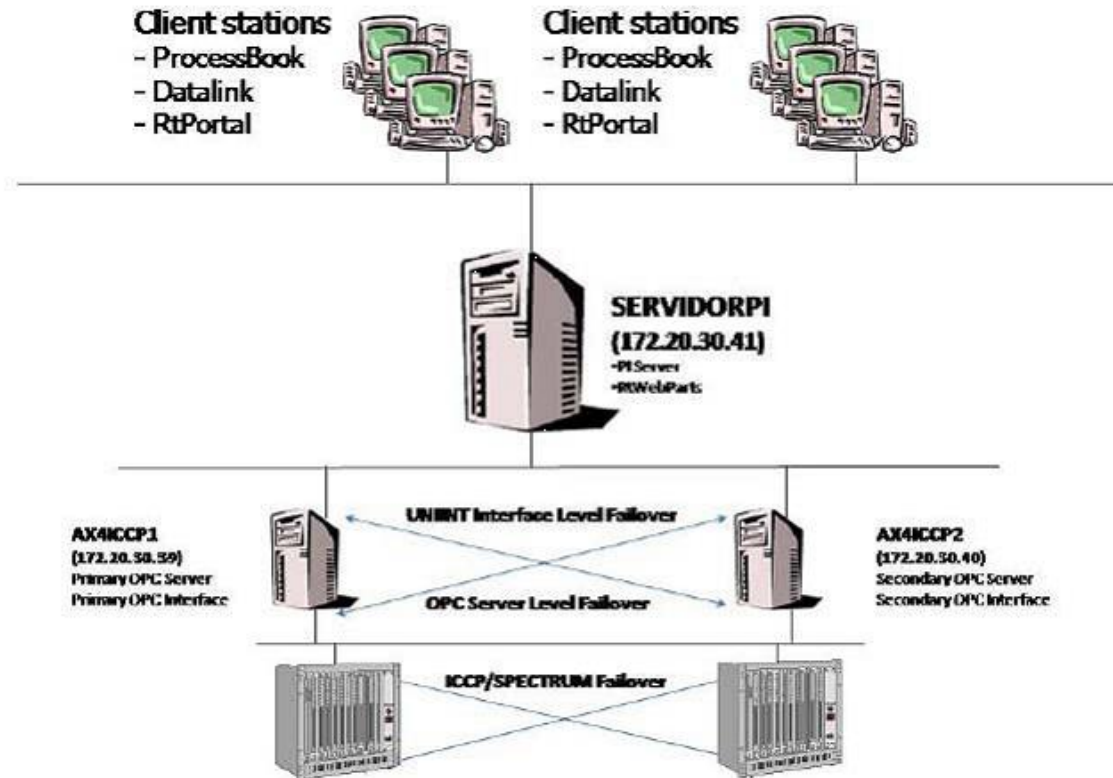
● Distribution Business

- 950 Substations and 2000 secondary substations (out of 70.000) telecontrolled: 3.000 RTUs
- > 300.000 RTU points (45.000 Analogs)
- 6 Systems of equivalent size



- PI-Project: Distribution Business
 - Actually Deployed on COD-Bilbao (North)
 - 5000 points from SPECTRUM (using ICCP)
 - Upgrading to 30.000 points actually.
 - Future:
 - Expand to all COD's
 - Up to 180.000 Points.
 - Using OPC developed by Siemens
 - Rate: 5 seconds.

● PI-Project: Distribution Business



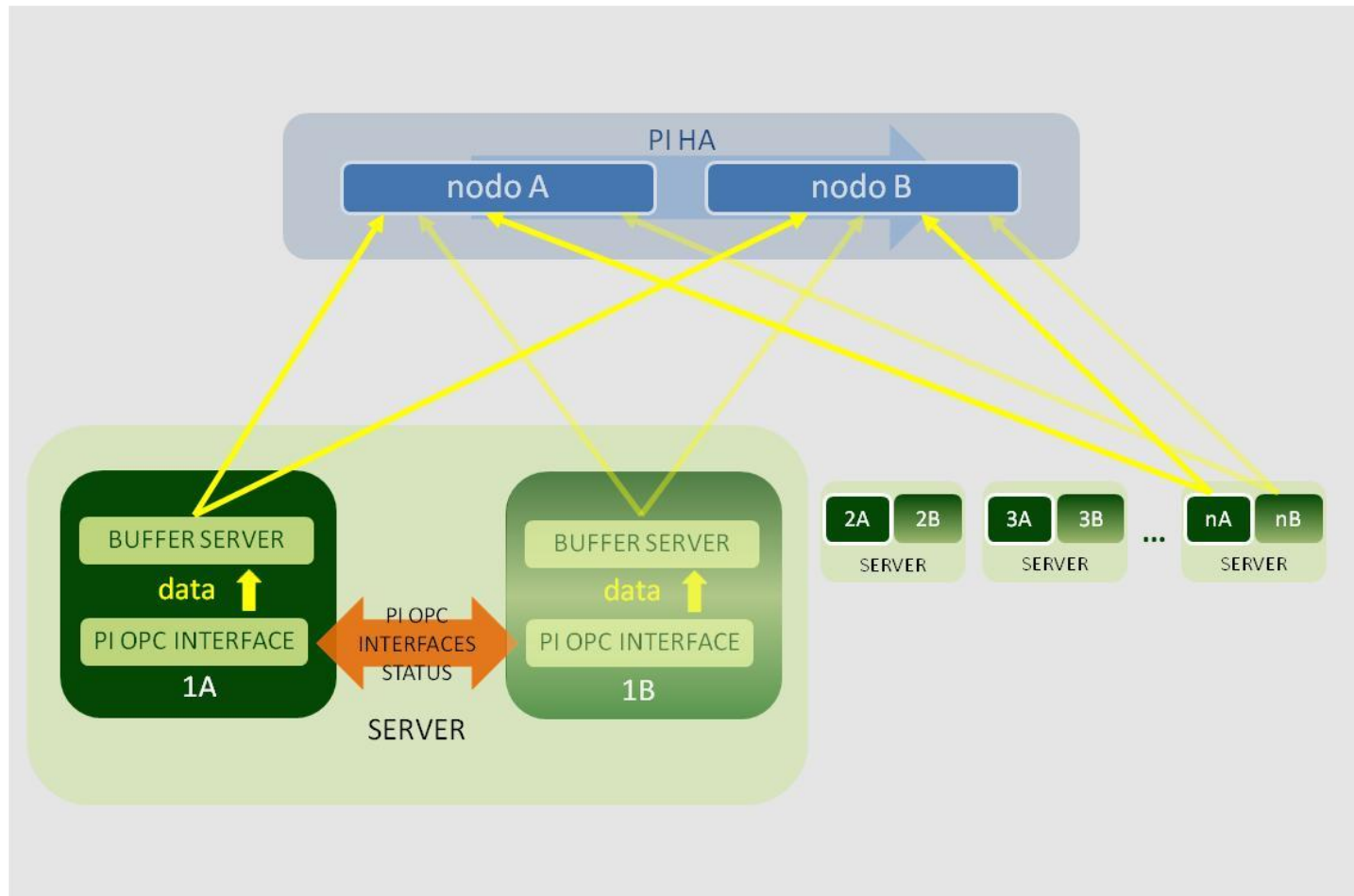
- PI-Project: Distribution Business
 - Main Functions:
 - Historical Analysis (Customer Complains)
 - Energy Flows (P,Q)
 - RCA
 - High Voltage Data
 - Expanding to Medium Voltage and System Operator Info

Future Scope

- Renewable Business
 - 1 PI System (CORE-Toledo)
 - 50% Applications Developed easily exportable



- Renovable Business



- PI Project: Renovable Business
 - Actually 150.000 Points
 - Wind Power, Mini-hydro, Solar and others.
 - OPC Redundant Interfaces
 - SCADA developed by our engineering company (IBERINCO).
 - Future Integration
 - Thermo-Solar power plant (under construction)
 - 10.000 Points
 - Integration through PI to PI

Agenda



- 1.-** IBERDROLA Overview
- 2.-** PI History
- 3.-** Combined Cycle Strategy
- 4.-** Applications Developed
- 5.-** Future Scope
- 6.-** Conclusions & key lessons learned
- 7.-** Questions and Answers

Conclusions

● One Combined Cycle 2x1

(2 Gas Turbines, 1 Steam Turbine):

- $\approx$ 350 M€ Investment
- Gas Prices Increasing
- Equipment Prices Increasing
- Environmental concerns increasing



***OPTIMIZATION
IS A MUST***



Conclusions

- 6 years PI System experience over Combined Cycle Technology:
 - ***ROI $\approx$ 2,5 Years***
 - Increasing efficiency $\rightarrow$ 1%-2%
 - Increasing availability $\rightarrow$ 0,1%-0,5%
 - Easily exportable to another business
- Opening the platform for all users = A lot of value
- Focus on business drivers (take your time!!!)
- Event based monitoring
- Success requires cooperation between operations, maintenance and engineering

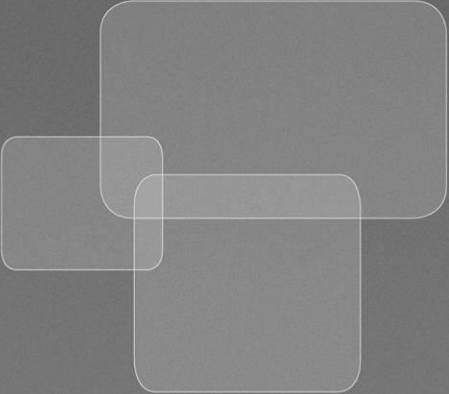
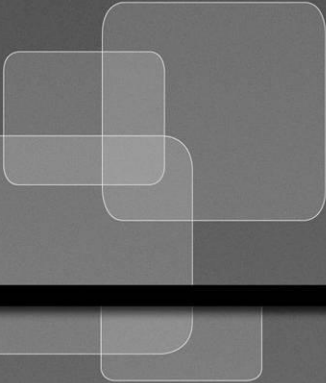
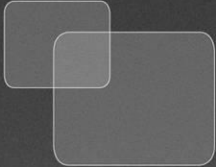


Agenda



- 1.- IBERDROLA Overview**
- 2.- PI History**
- 3.- Combined Cycle Strategy**
- 4.- Applications Developed**
- 5.- Future Scope**
- 6.- Conclusions & key lessons learned**
- 7.- Questions and Answers**

OSIsoft®
USER CONFERENCE
2008
AMSTERDAM



THANK YOU