



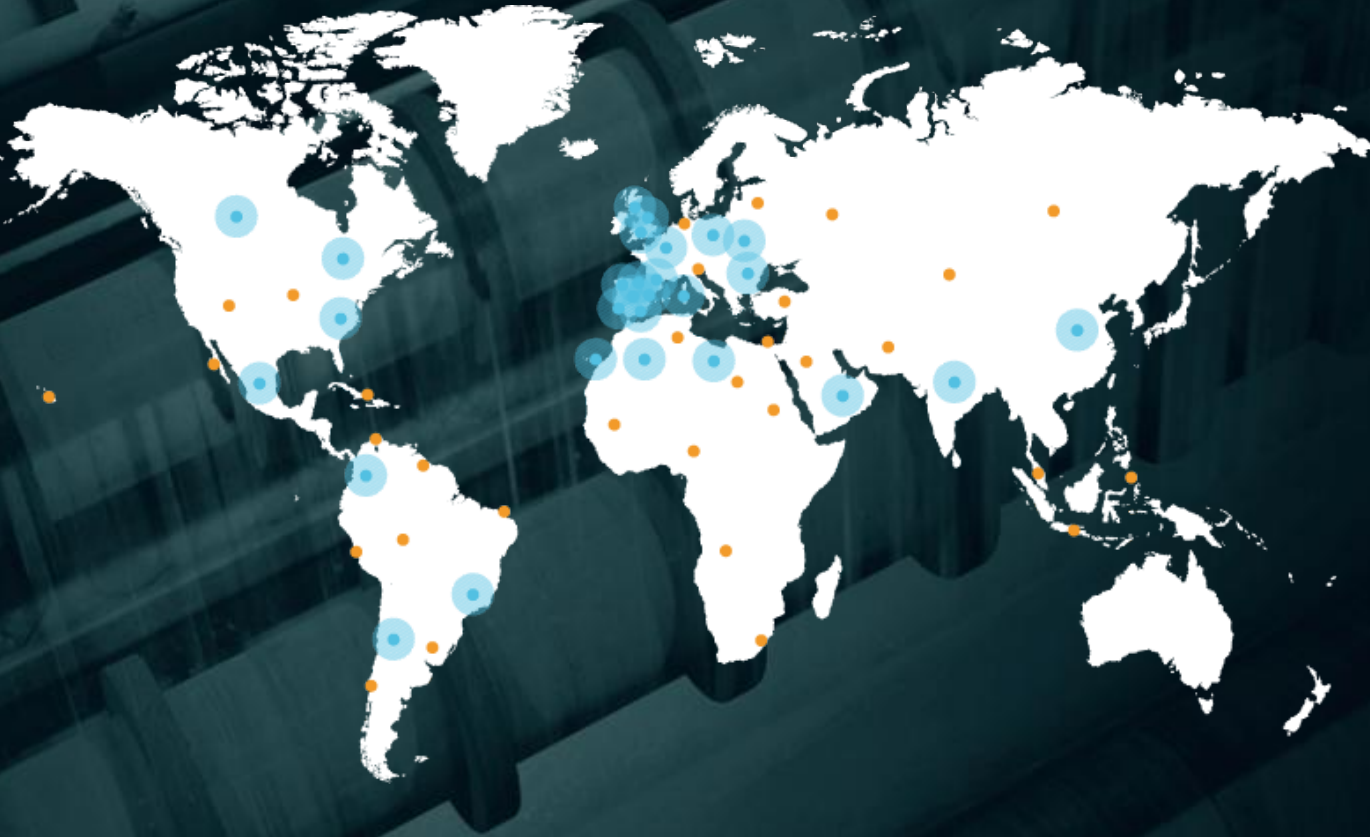
Ingeniería, Arquitectura, Consultoría

Rasgos fundamentales

Servicios profesionales

Desde 1957

Excelencia, Innovación y Compromiso



- Bélgica
- Brasil
- Canadá
- Chile
- China
- Colombia
- Emiratos Árabes
- España
- Estados Unidos
- India
- Libia
- Marruecos
- México
- Polonia
- Portugal
- Reino Unido
- Rumania

16 países con oficinas

120 países con proyectos

300 m€

de contratación total del grupo

80 m€

de contratación en servicios con suministro

73%

Actividad internacional en servicios profesionales

2.500

personas

Áreas de actividad:

CS / Consultoría y Sistemas

IE / Industria y Energía

AE / Arquitectura y Edificación

INF / Infraestructuras

TL / Telecomunicaciones

MA / Medio Ambiente

AA / Análisis Avanzados

TK / Llave en Mano

SN / Servicios nucleares



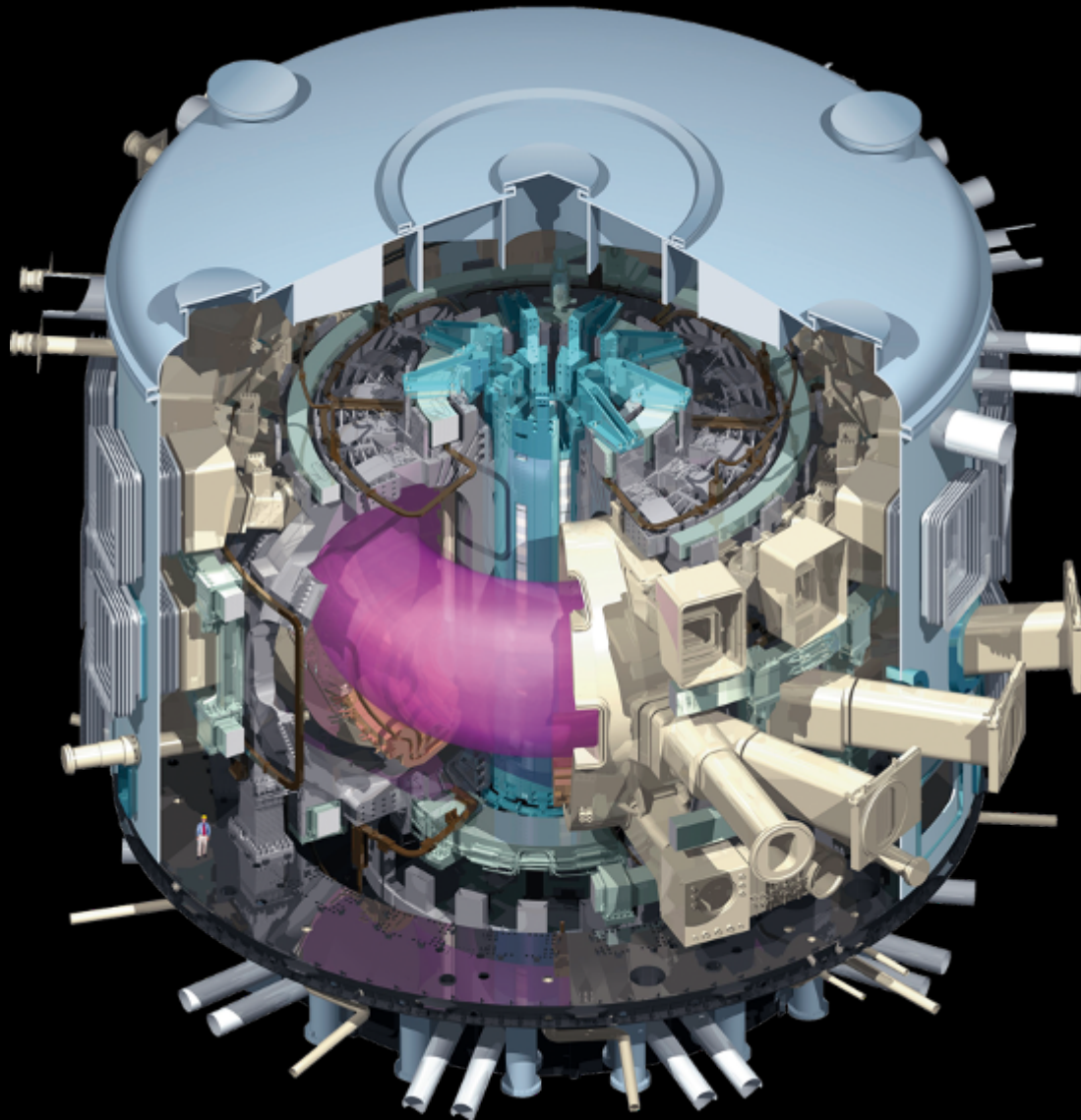
Energía

Algunos encargos

An aerial photograph of a large-scale construction site, likely for a nuclear power plant. The ground is a mix of light-colored soil and concrete. Numerous rectangular concrete structures, possibly containment domes or reactor vessels, are arranged in a grid-like pattern across the site. The structures are light grey and have a slightly domed top. The overall scene is one of active construction and industrial planning.

SERVICIOS NUCLEARES

- › Pruebas de resistencia
- › Gestión de vida
- › Ingeniería para futuras centrales de fusión



- ITER (2011)
- Cadarache (Francia)
- Reactor de fusión nuclear
- Diseño
- Estudios de seguridad sísmica
- Obra Civil

CICLO COMBINADO DE ÚLTIMA GENERACIÓN EN BREMEN (ALEMANIA)

› 440 MW. Alta eficiencia y flexibilidad

› Las turbinas pueden trabajar de forma integrada con otras fuentes renovables (solar, eólica, etc.)

ENERGÍA SOLAR EN NEVADA (EEUU)

- › Tecnología de torre central y campo solar de helióstatos. 110 MW.
- › La torre central alcanzará 199 metros de altura

450 PARQUES EÓLICOS

- › Proyectos en México, Rumanía, Brasil, Polonia, EEUU o Kazajistán, entre otros
- › Proyectos básicos y constructivos
Dirección de obra
- › Análisis y ejecución de cimentaciones complejas

CENTRAL HIDROEÓLICA DE “EL HIERRO”

› Una isla energéticamente autosuficiente y un modelo que pueda ser exportable a cualquier isla del planeta

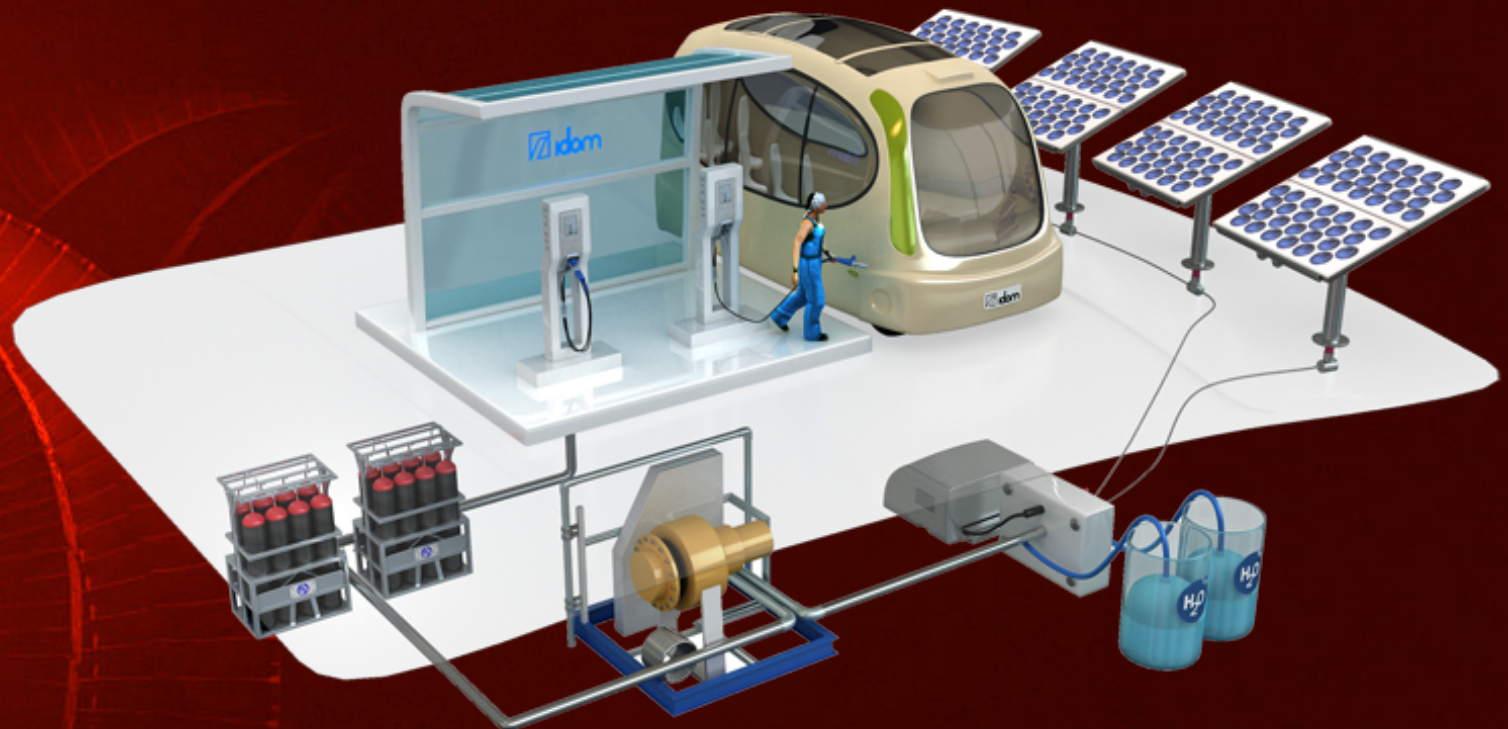


Energía
Innovación

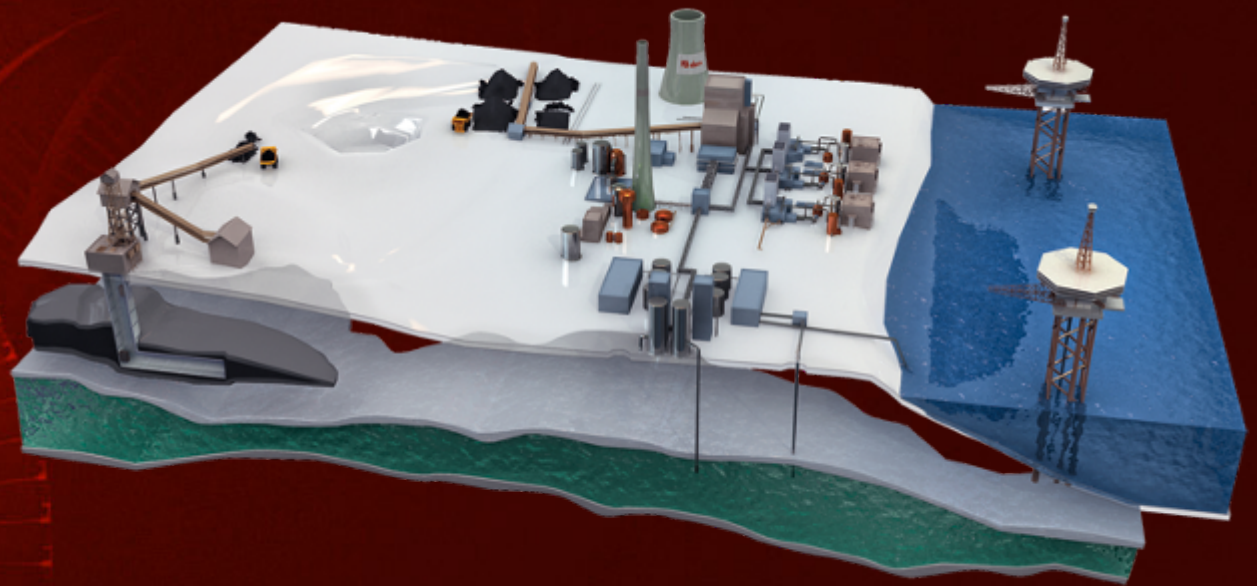
- Central Hidroeólica (2010)
- Isla de El Hierro
- Autoabastecimiento
- Reserva de la Biosfera



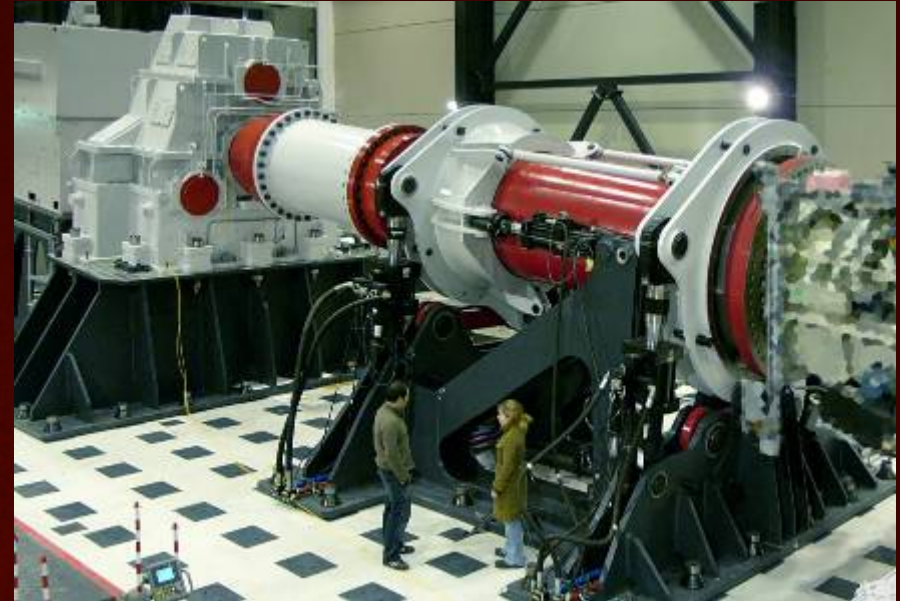
- Propulsión por hidrógeno (2009)
- Transporte público energéticamente eficiente
- CDTI



- Captura de CO2 (2010)
- Oxidación
- Plan Europeo de i+d
- Endesa



- CENER (2008)
- Aerogeneradores
- Laboratorio para trenes de potencia
- Proyecto, gestión del proyecto y dirección de obra



Energía

PLANTA SOLAR HIBRIDADA CON BIOMASA, Lleida

PLANTA SOLAR HIBRIDADA CON BIOMASA

En el término municipal de Les Borges Blanques (Lleida), se está construyendo la primera planta termosolar del mundo hibridada con biomasa a escala comercial. La central tendrá una potencia nominal medida en bombas del generador eléctrico de 25 Mwe y generará 98.000 MWh/año. Se ubica en una finca que es atravesada por la línea de alta velocidad entre Madrid y Barcelona de modo que el campo solar queda a ambos lados de la vía.

La planta está siendo promovida y será explotada por la UTE Termosolar Borges, S.L, formada por las empresas Abantia y Comsaemte. Jurídicamente, esta nueva inversión se encuentra en el marco de las centrales eléctricas que emplean fuentes de energía renovable (Real Decreto RD 661/2007 del 25 de Mayo), es decir, enmarcada en el régimen especial, por lo que tiene acceso a la prima que hace viable la ejecución de plantas termosolares de estas características.

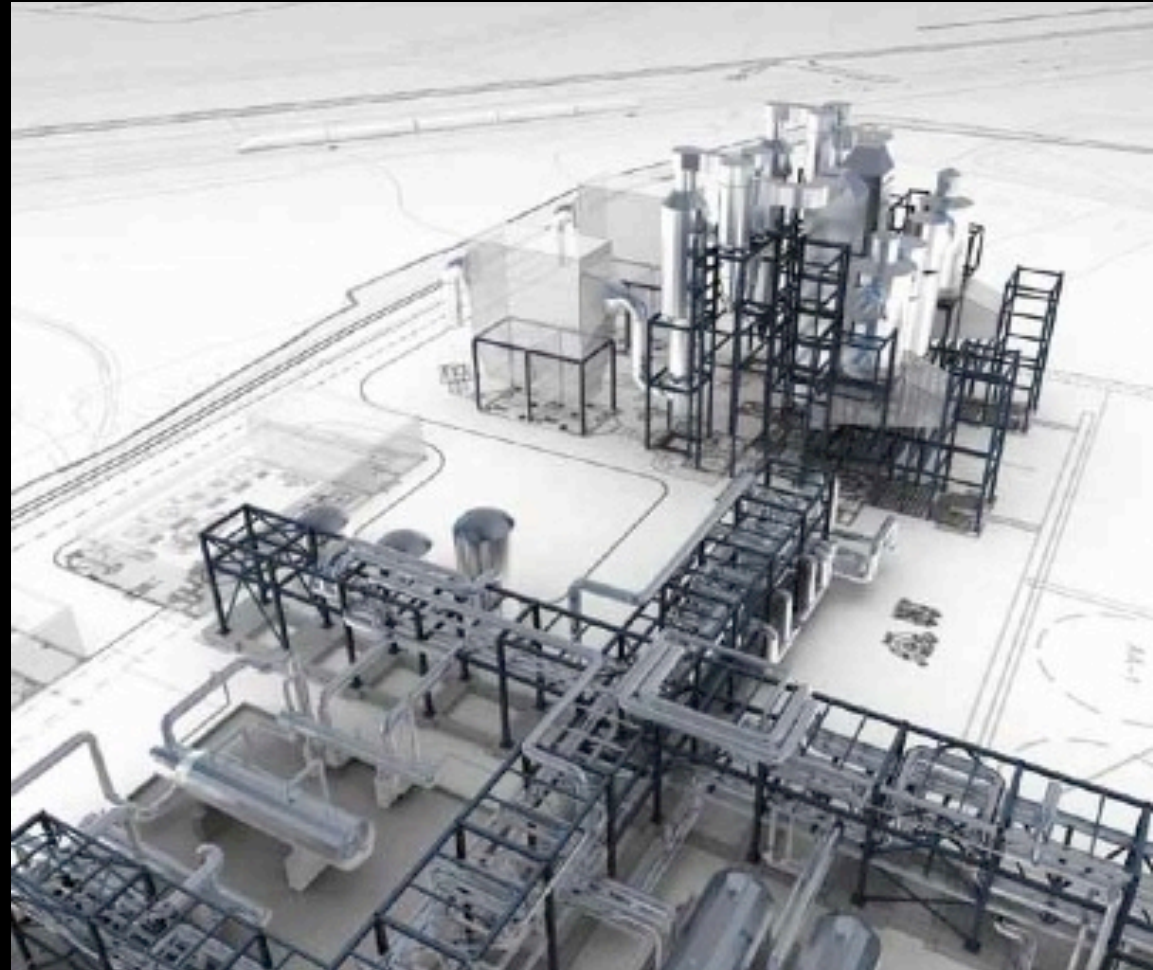
El Campo Solar

- 56 lazos paralelos de 6 colectores cilindroparabolicos (CCPs)
- Tubos absorvedores formados por un tubo interior de acero, cubierto por un tubo de vidrio que mantiene un vacio que hace de aislante termico, para garantizar el aislamiento del fluido caloportador
- Espejos cilíndricos parabólicos formados por vidrio de bajo contenido en hierro de 4mm y una capa de alta reflectividad en la parte posterior.
- Colectores siguen la trayectoria del sol de Este a Oeste
- Colectores: 100 m de longitud distribuidos en filas de 15 m.



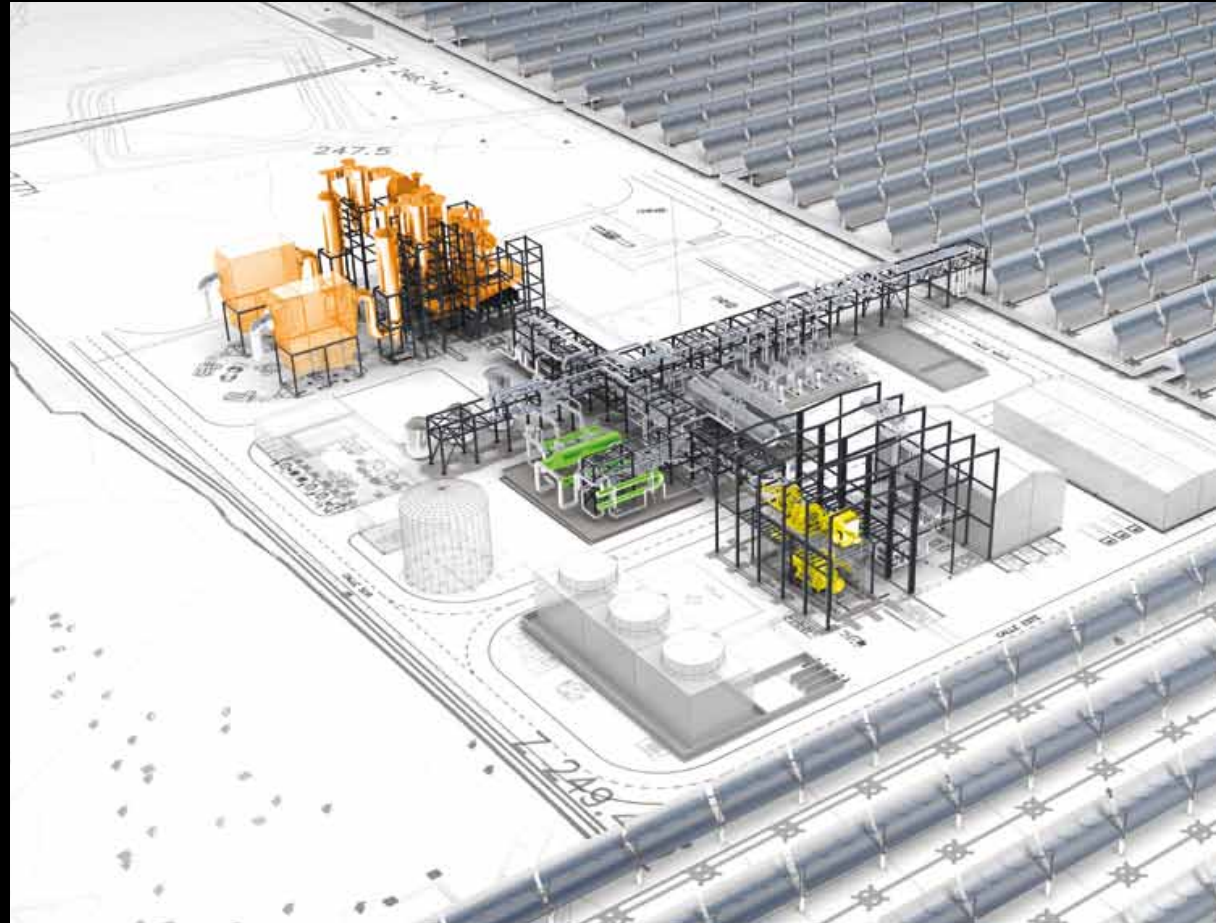
Calderas de Biomasa

- 2 Calderas de Biomasa de 22 MWt más una de 6 MWt a Gas Natural
- Las calderas de Biomasa disponen asimismo de quemadores de gas natural de 10MWt c/u
- Biomasa de origen forestal y cultivo energético
- Producción a partir de gas natural no supera 15%



Disposición de los equipos

- Disposición en serie de cilindros parabólicos y sistema de calentadores auxiliares para permitir el uso híbrido de las calderas
- Ciclo de Potencia basado en esquema de un ciclo de *Rankine* con calentamiento intermedio
- Sistema de Aceite Térmico compuesto por bombas, dos vasos de expansión para absorber las variaciones de volumen de aceite térmico y una bomba auxiliar



Operación

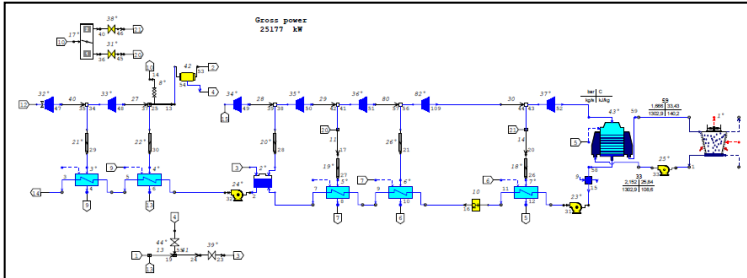
- Tres modos básicos de operación: *Solar* (diurno), *Mixto* (diurno), *sólo biomasa* (nocturno)
- Estos modos se combinan en diferentes grados de carga de la turbina según la gráfica.



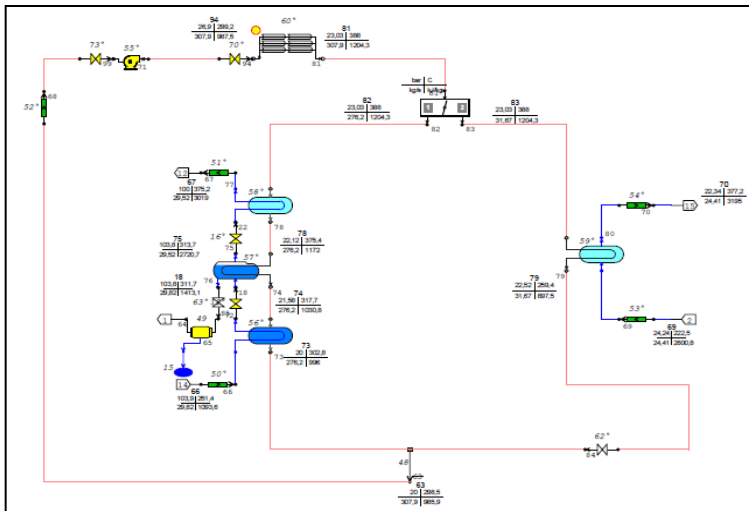
Tratamiento del Agua

- Agua bruta utilizada:
500.000m³ / año
- Sometida a tratamientos
de filtración y depuración
para adquirir calidad
necesaria



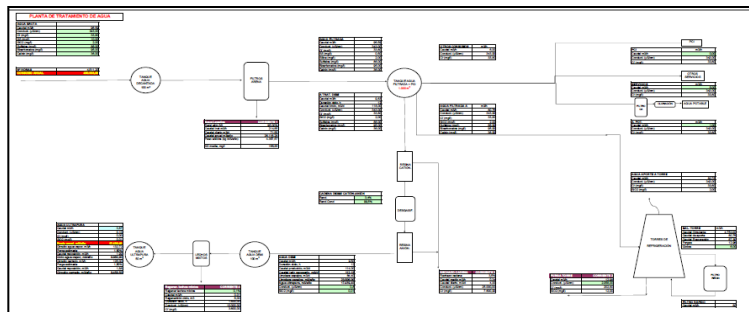


- Mass & Energy Balance for the Solar cycle and Biomass support.
- Water balance
- Definition of operational modes, i.e. Hybridization, Solar, Biomass, Transitions.
- PBD & Process Flow Diagrams.
- Preliminary P&ID's
- Basic plant lay – out and preliminary piping routing.
- Preliminary shape and volume of main buildings and rack's
- Preliminary equipment list.
- Preliminary line list.
- Piping classes definition
- Preliminary valve list.
- Valve classes and technical specification
- Preliminary instrument list.
- Preliminary consumer list.
- Preliminary single line diagram.
- DCS architecture
- General design criteria for Mechanical, electrical, I&C and civil disciplines.



TEAM INVOLVED IN THE ACTIVITY

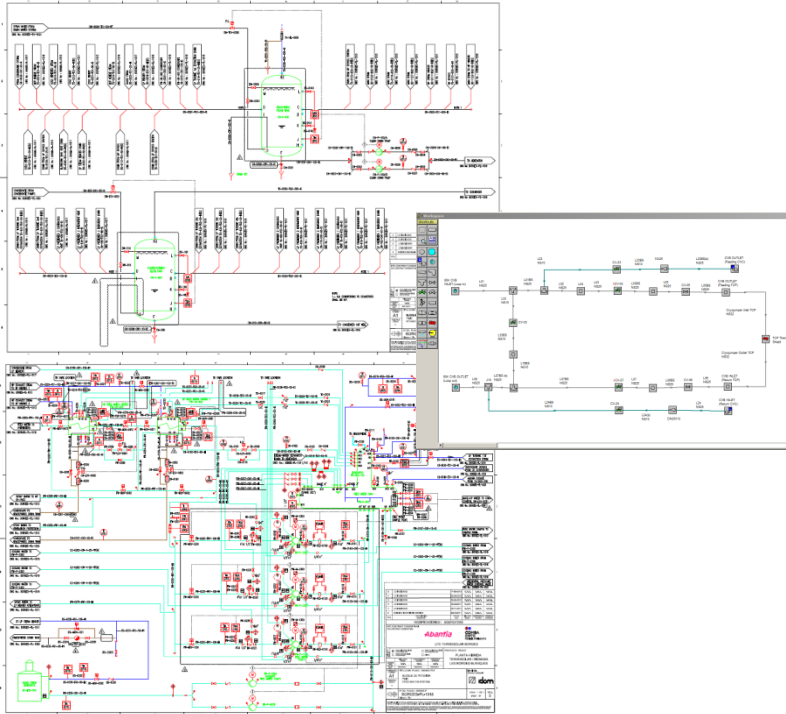
- 1 Senior Process Engineer
- 1 Senior Mechanical & Piping Engineer + 1 Junior Mechanical Engineer
- 1 Senior Electrical Engineer
- 1 Senior Instrumentation & Control Engineer
- 2 Drafters or designers



SPECIFIC COMPUTER TOOLS AVAILABLE FOR THE ABOVE ACTIVITIES

- 1 Thermoflow.
- PDMS / PDMS diagrams
- AutoCad
- Excel, Word, etc.

DETAILED PROCESS ENGINEERING



TEAM INVOLVED IN THE ACTIVITY

- 2 Senior Mechanical Engineers + 1 Junior mechanical engineer
- 1 Environmental Engineer
- 2 Drafters

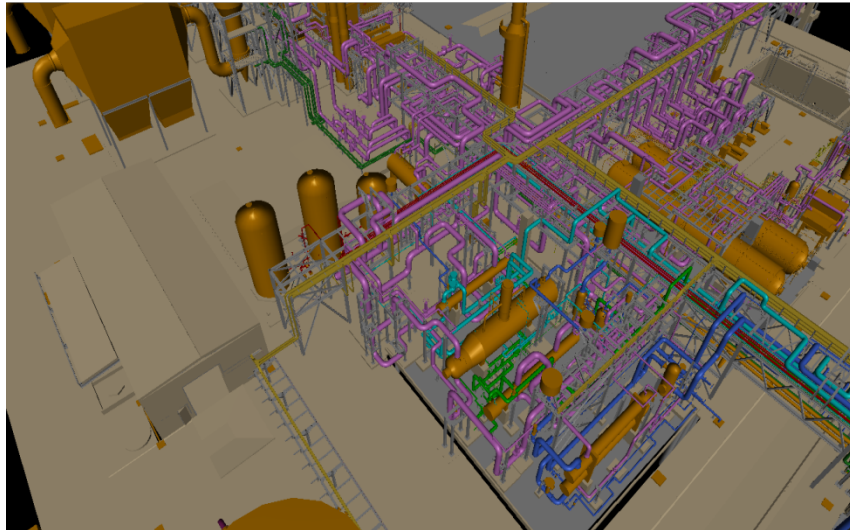
SPECIFIC COMPUTER TOOLS AVAILABLE FOR THESE ACTIVITIES

- Thermoflow
- AFT Arrow, Impulse and Fathom. Pipe Flo.
- Excel, etc.

- P&ID consolidation, including control loops, size and Tag of lines, valves, insulation type, heat exchangers, vessels, pumps, etc. Limits of supply. Examples of systems:

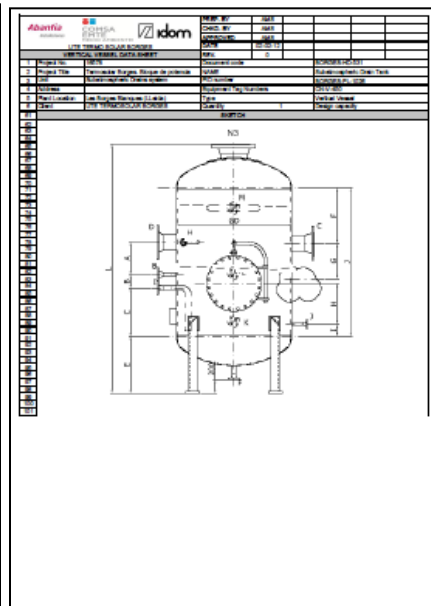
- HP & LP Steam.
 - Feed water system
 - Condensing system
 - Preheaters.
 - Drain system
 - Steam generator purge system
 - HTF Solar Field
 - HTF Expansion System
 - HTF Cold header and Hot Header.
 - HTF Biomass Heaters.
 - Stem generation
 - Closed cooling system
 - Circulation water system
 - Chemical dosing system
 - Water treatment system.
 - Waste treatment and disposal system
 - Demineralized water system.
 - Fire protection.
 - Compressed Air system
-
- Mass & Energy balance and water balance consolidation.
 - Heat exchangers thermal design.
 - Process piping sizing. Pressure drop analysis.
 - Sizing of process vessels.
 - Sizing of control valves and pressure relief valves
 - Pumps sizing.
 - Chemical dosing system definition. Vessels and pumps capacity, etc.
 - General facilities capacity determination: compressed air, HVAC.
 - Hazard areas classification.
 - Operation and maintenance manuals.

DETAILED MECHANICAL ENGINEERING



- Design and sizing for the elaboration of data sheets of static and rotating equipment:
 - HTF Shell and tube heat exchangers.
 - Cooling water heat exchangers.
 - HTF purification system condenser, spiral exchanger, etc.
 - HTF Pumps.
 - Feed water pumps., condensate pumps.
 - Circulating water pumps
 - Diverse pumps: closed cooling, demineralized, waste water, fire, etc.
 - HTF Expansion vessels, Pressure vessels for steam cycle, and diverse storage tanks.
- Preparation of technical specification for the above equipment and other skid type supplies:
 - Water treatment plant.
 - Cooling towers.
 - Chemical dosing system.
 - Fire protection system.
 - Nitrogen system
 - Instrument and plant compressed air.
 - HVAC.
 - HTF heaters
 - Other auxiliaries.
- Issuance of mechanical assembly specification

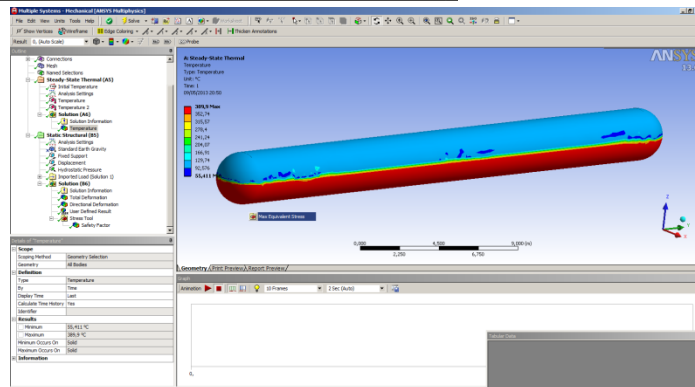
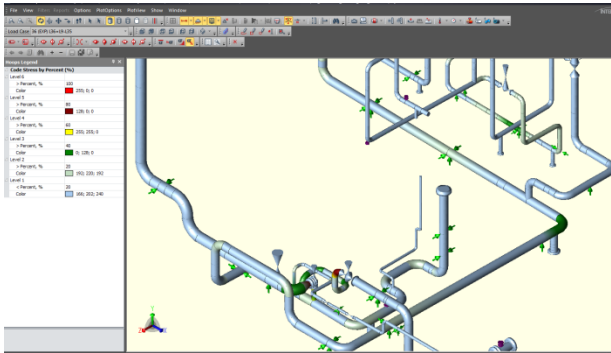
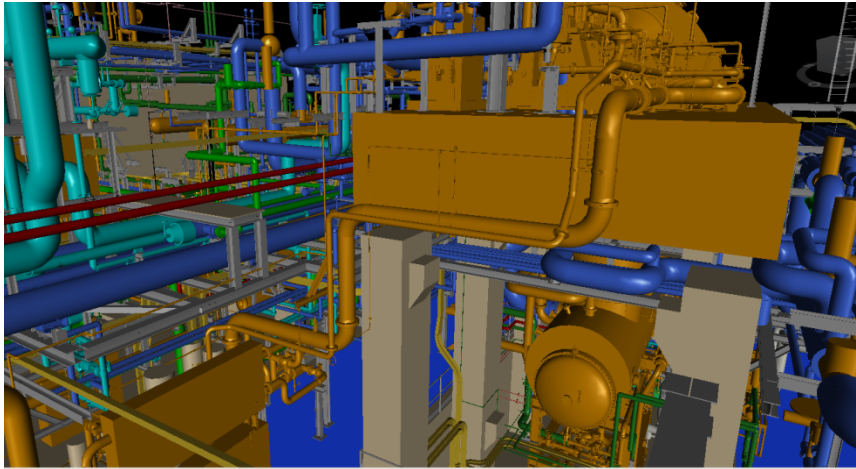
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33	Project Risk Management	idom	
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48	Project Suspension	idom	
49	Project Resumption	idom	
50	Project Re-evaluation	idom	
51	Project Re-approval	idom	
52	Project Re-issuance	idom	
53	Project Re-approval	idom	
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59	Project Re-approval	idom	
60	Project Re-issuance	idom	



- TEAM INVOLVED IN THE ACTIVITY**
- 2 Senior Mechanical Engineers + 1 Junior mechanical engineer
 - 1 Environmental Engineer
 - 2 Drafters

- SPECIFIC COMPUTER TOOLS AVAILABLE FOR THESE ACTIVITIES**
- Thermoflow
 - AFT Arrow, Impulse and Fathom. Pipe Flo.
 - ANSYS.
 - Excel, etc.

DETAILED PIPING ENGINEERING



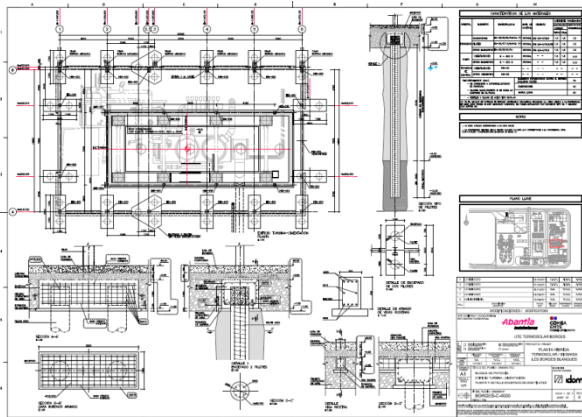
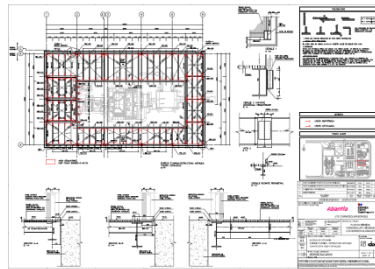
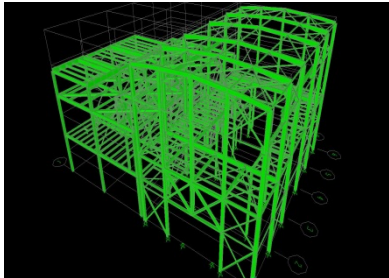
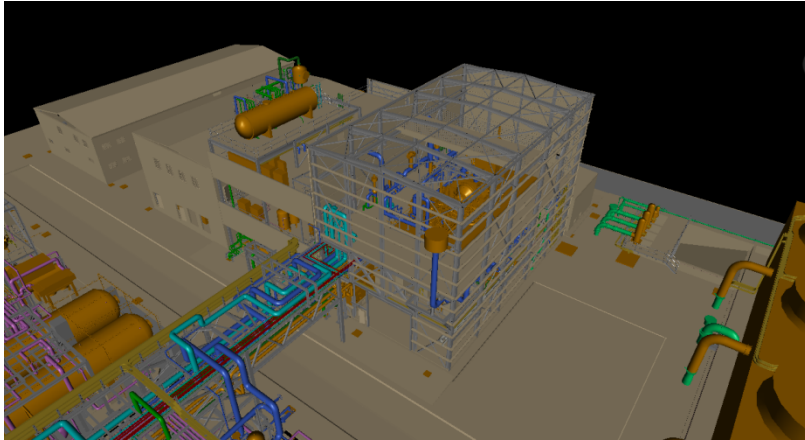
- Line list including process data, size, insulation, PED classification, etc.
- Manual valve , motorized valves, relief valves, control valves lists.
- Pipe supports list.
- Material take off issuance.
- Plan drawings for piping layout.
- Isometric drawings for each line of the plant, including Tags, dimensions, in line elements, list of materials, coordinates, support sand instruments list.
- Complete pipe support static design and drawings for pipes above NS>2" or requiring flexibility analysis. The rest will be based on typical drawings. The drawings include list of materials, dimensions , thermal movements and maximum reactions.
- Design and drawings of auxiliary structures for piping support.
- Piping design criteria .
- Stress analysis of piping systems with pipe sizes above 2" and T>150°C or NS<2" and T>250°C and always for NS>12" whatever the temperature. The analysis includes the determination of maximum reactions at vessels, structures and equipment, the analysis of required load cases (Thermal, seismic, wind, settlements, turbine trips, steam hammer, relief valve transients or other dynamic effects.). Thickness calculations, etc.
- Technical specification for steam blowing and pipe flushing.
- Procurement specification for pipe procurement and construction.
- Technical specification of valves, filters, and other miscellaneous.
- Elaboration of 3D model in PDMS platform and other deliverable formats.

TEAM INVOLVED IN THE ACTIVITY

- 2 Senior Mechanical Engineers + 3 pipe stress engineers
- 2 Structural engineers
- 7 PDMS designers + 2 drafters.

SPECIFIC COMPUTER TOOLS AVAILABLE FOR THESE ACTIVITIES

- Caesar II
- PDMS, MDS
- ANSYS, SAP 2000



- Design and calculation of the main equipment foundations:
 - Steam turbine pedestal
 - Step up transformer and auxiliary transformers
 - Biomass heaters
 - Pumps
 - Heat exchangers
 - Expansion vessels
 - Storage tanks
 - Cooling towers
 - Biomass handling facilities, etc.
- Architectural and structural design of the plant diverse buildings:
 - Turbine building
 - Mechanical and electrical building
 - Warehouse and workshop building
 - WTP and Fire protection Building, etc.
- Buried drainage networks.
- Urbanization drawings
- Structural design and drawings for the pipe racks .
- Procurement specification of the civil and structural works.
- Quality plan for civil works

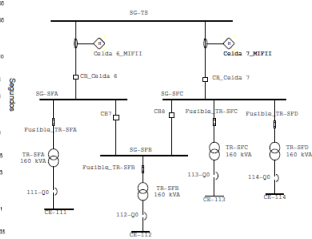
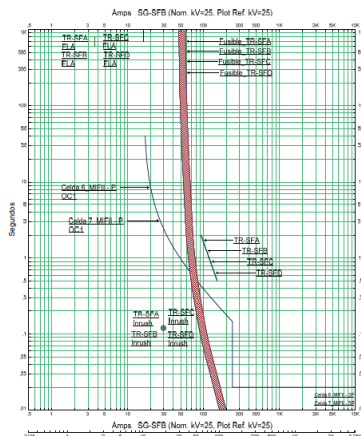
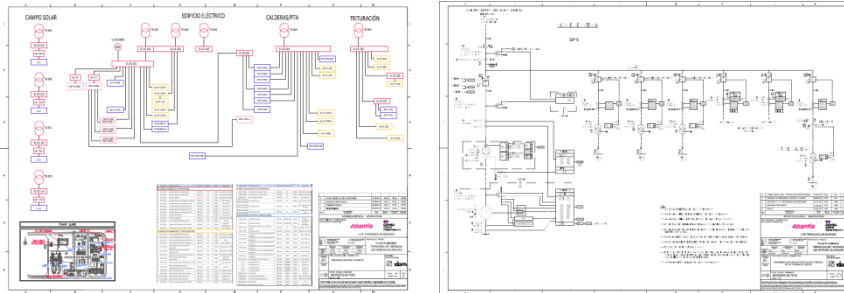
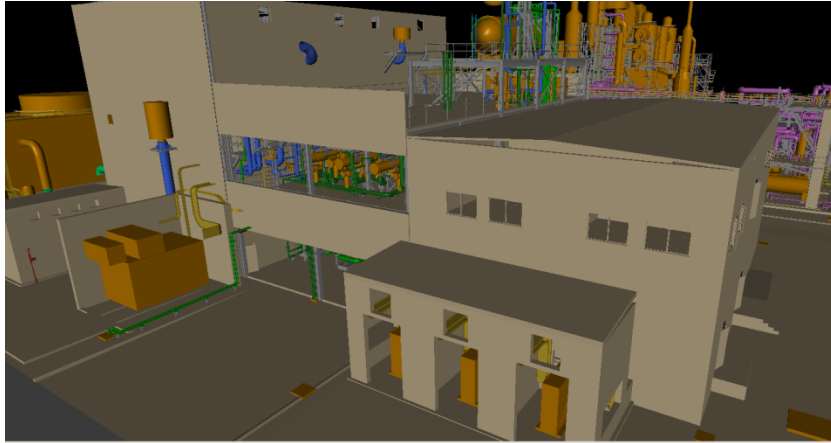
TEAM INVOLVED IN THE ACTIVITY

- 1 Junior Architect
- 4 senior structural engineers
- 3 drafters

SPECIFIC COMPUTER TOOLS AVAILABLE FOR THESE ACTIVITIES

- CYPE
- PDMS
- SAP 2000

DETAILED ELECTRICAL ENGINEERING



- Consumer list.
- Electrical equipment list
- Cable list
- Classic electrical engineering calculations, e.g.
 - Short circuit, load flow, and motor start
 - Earthing grid
 - Lighting and sockets.
 - Transformer tap changer
 - Protection coordination
 - Conductors sizing
 - Distribution transformers
 - UPS / VDC system
- Schemes and drawings:
 - Single line diagrams (General, protection, MV, LV, DC, UPS, MCC's)
 - Equipment lay out
 - Underground raceways and cable trays. Mounting schemes
 - Earthing and lightning protection grids.
- Technical specifications:
 - Transformers
 - Switchgears, distribution panels and auxiliary panels
 - Emergency generator, UPS and VDC
 - Control and MV and LV cables
 - MCC's
 - Lightning protection system

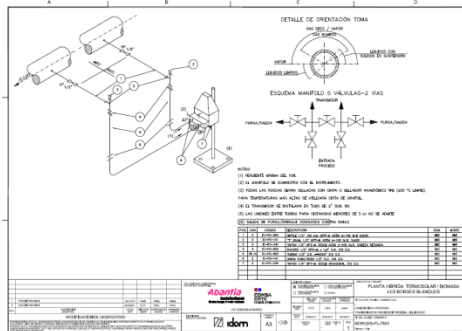
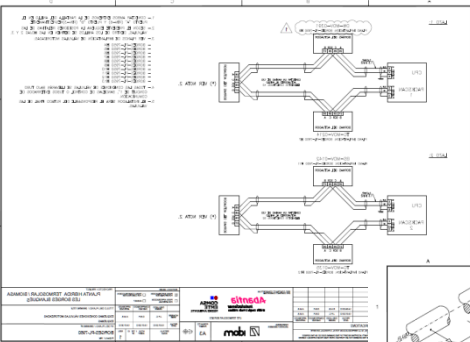
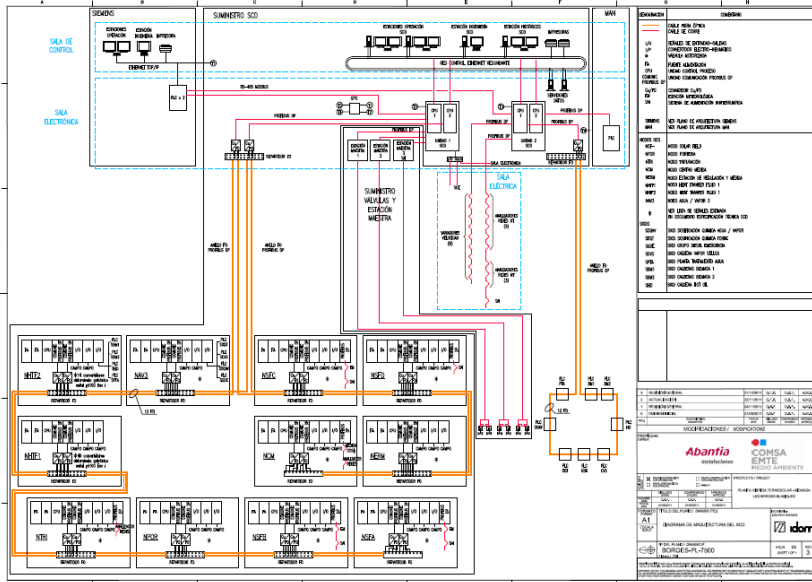
TEAM INVOLVED IN THE ACTIVITY

- 3 Senior electrical engineers + 2 Junior Electrical engineers.
- 2 Drafters

SPECIFIC COMPUTER TOOLS AVAILABLE FOR THESE ACTIVITIES

- ETAP
- Excel & Access

DETAILED INSTRUMENTATION & CONTROL ENGINEERING



- DCS Architecture diagram.
- Instrument and automatic valves list.
- Hardwired signal list.
- Communicated signal list.
- Hook up's list and MTO.
- Instrument and distribution boxes lay out.
- Pneumatic consumer lay out and connection schemes.
- Cable list.
- Field instruments connection scheme.
- Drawings of panels and equipment lay out in control room.
- DCS data base elaboration (with interlocks and set points).
- Functional descriptions of logic diagrams and control loops.
- Technical specification of the DCS system.
- Data sheets and technical specification of instruments (Pressure, temperature, flow, level, analyzers, etc.).
- Data sheet and technical specification for sampling system and laboratory.
- Technical specification of control cables.
- Design of DCS computer screens.
- Technical specification of the Instrumentation system assembly .

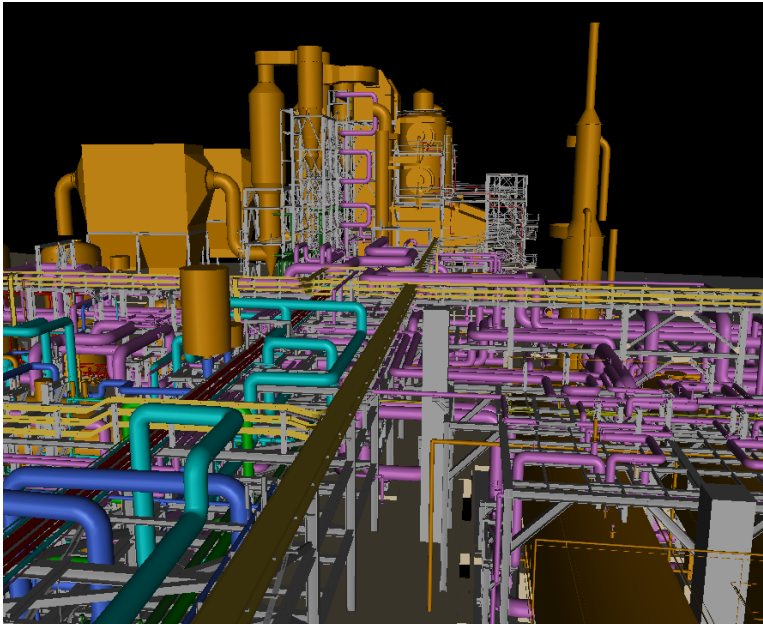
- ### TEAM INVOLVED IN THE ACTIVITY
- 2 Senior I&C Engineers + 1 Junior I&C engineer
 - 1 Drafters

- ### SPECIFIC COMPUTER TOOLS AVAILABLE FOR THESE ACTIVITIES
- INTOOLS
 - Excel, Access

GENERAL PLANT ENGINEERING



- Preparation of 3D model in PDMS and deliverance of weekly 3D models in Naviswork format.
- Assistance to procurement, consisting of:
 - Proposal of supplier list for each equipment / service.
 - Technical evaluation of supplier's bid. Clarification of suppliers questions, participation in technical meetings, etc.
 - Elaboration of evaluation report with final technical recommendation
 - Activation of suppliers activities. Revision of suppliers engineering activities and technical documentation.
- Supervision during construction phase provided through the permanent presence of the requested supervisors at construction site.
- Assistance during start up and commissioning.
- Assistance during official legalization and concession of permits . Preparation of official projects and official issuance to the local administration.



- TEAM INVOLVED IN THE ACTIVITY**
- Site supervisors . As requested by client, one per discipline.
 - 1-2 Start up engineer.
 - PDMS designers



Gracias