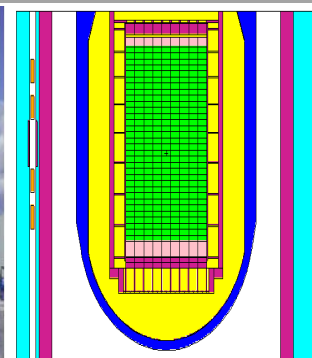
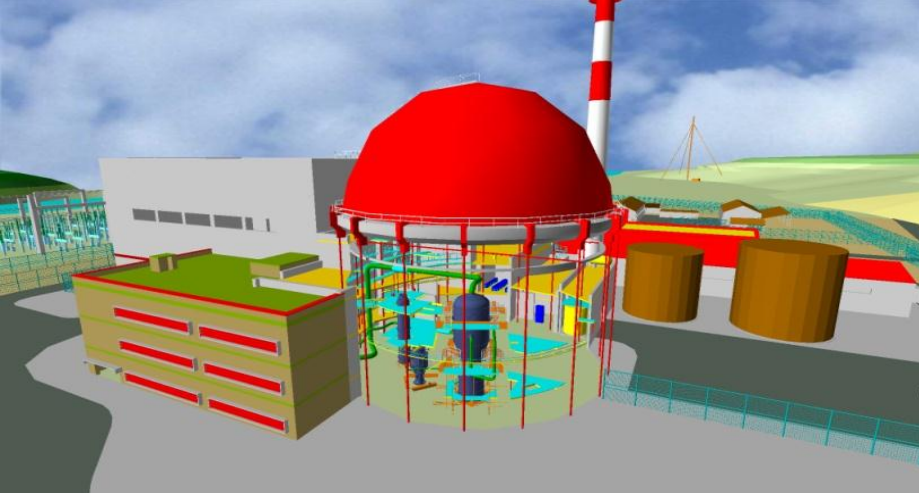


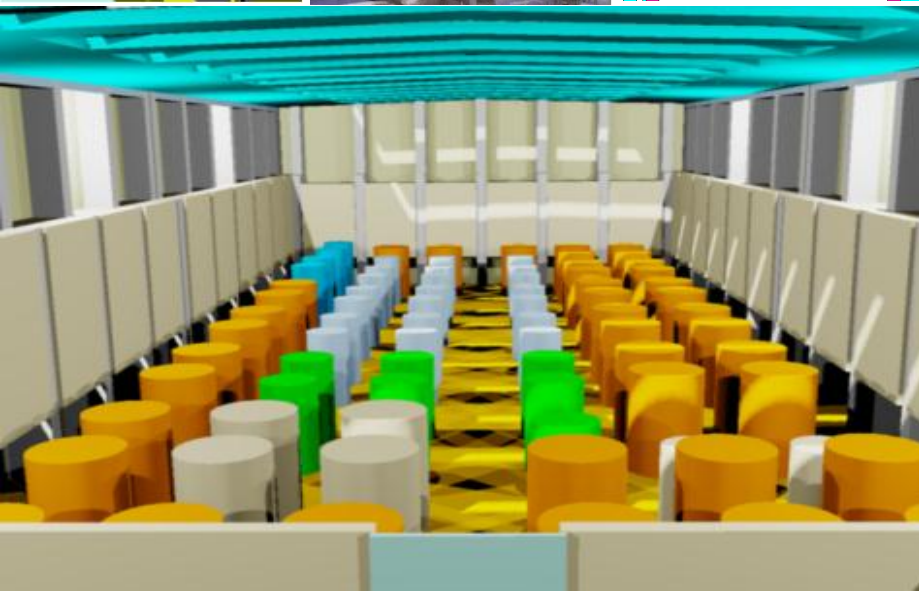
engineering





# Nuclear division

*October 2015*



# ÍNDICE



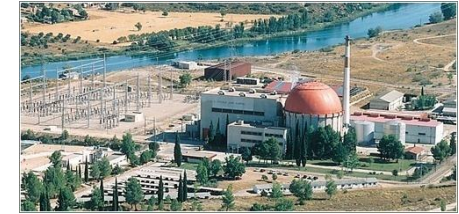
1. BACKGROUND
2. ORGANIZATIONAL STRUCTURE
3. TEAM CAPABILITIES
4. RELEVANT PROJECTS

# 1. BACKGROUND



## GNF a top gas & power Utility

- 170 years of experience
- 27 countries
- 15,960 staff
- More than 20 million customers
- 15.4 GW installed capacity
- 409,774 GWh gas distribution

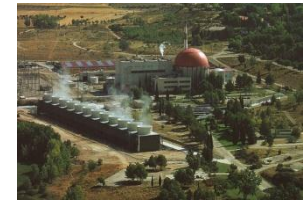


## GNF is the owner of the following NUCLEAR Power Plants:

- Jose Cabrera NPP (100%)
- Trillo NPP (34,5%)
- Almaraz NPP 1 and 2 (11,29%)



## A solid experience in energy engineering



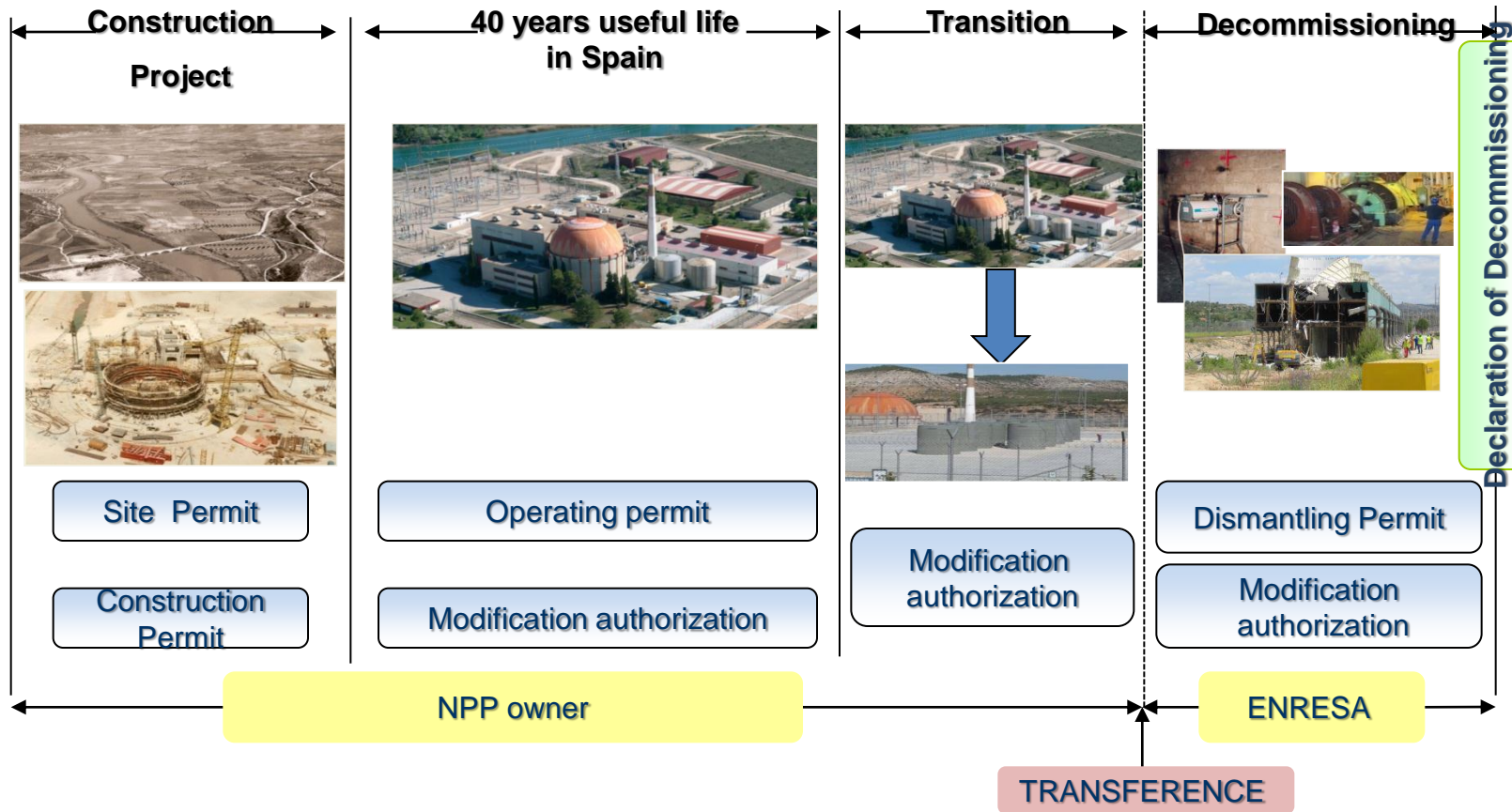
**GAS NATURAL  
FENOSA ENGINEERING**

- Solar power plants
- Nuclear power plants
- LNG plants
- Transport and distribution of electricity and gas
- Energy Efficiency
- Environmental services

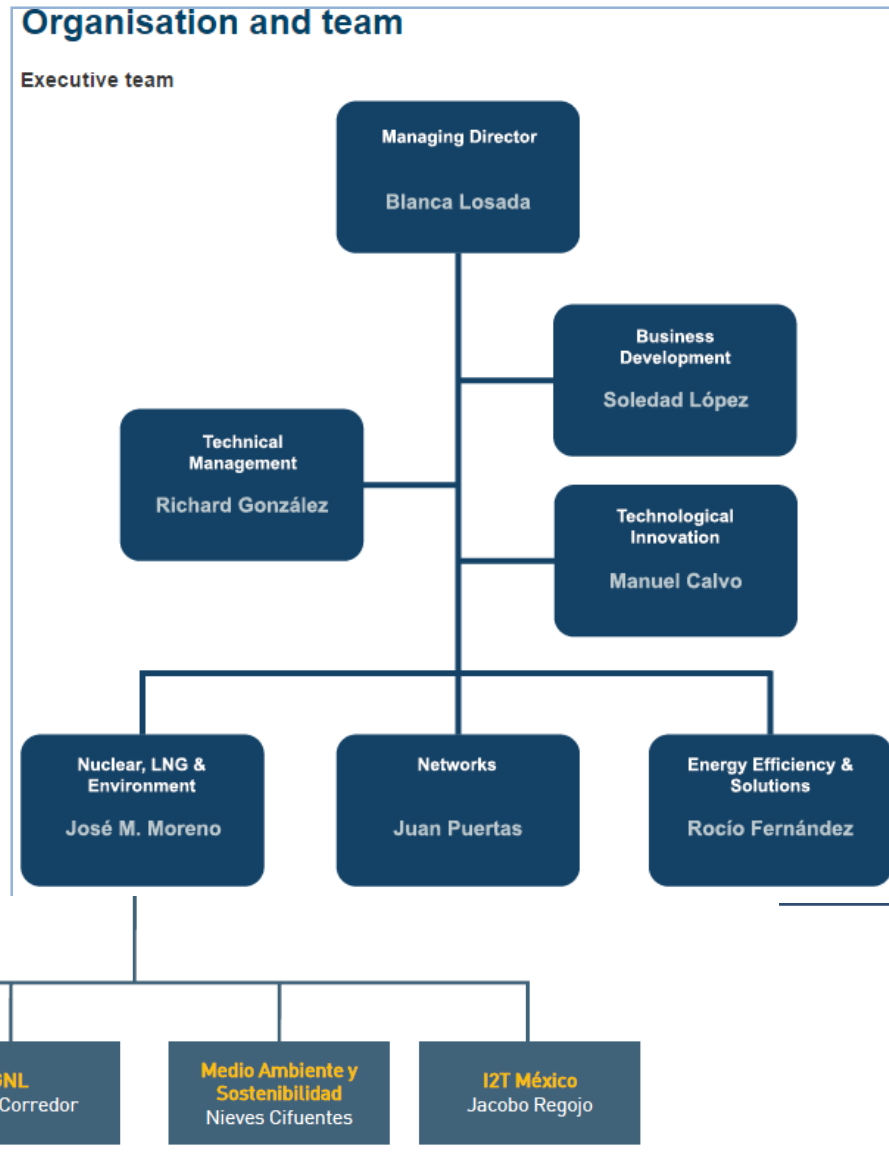
# 1. BACKGROUND



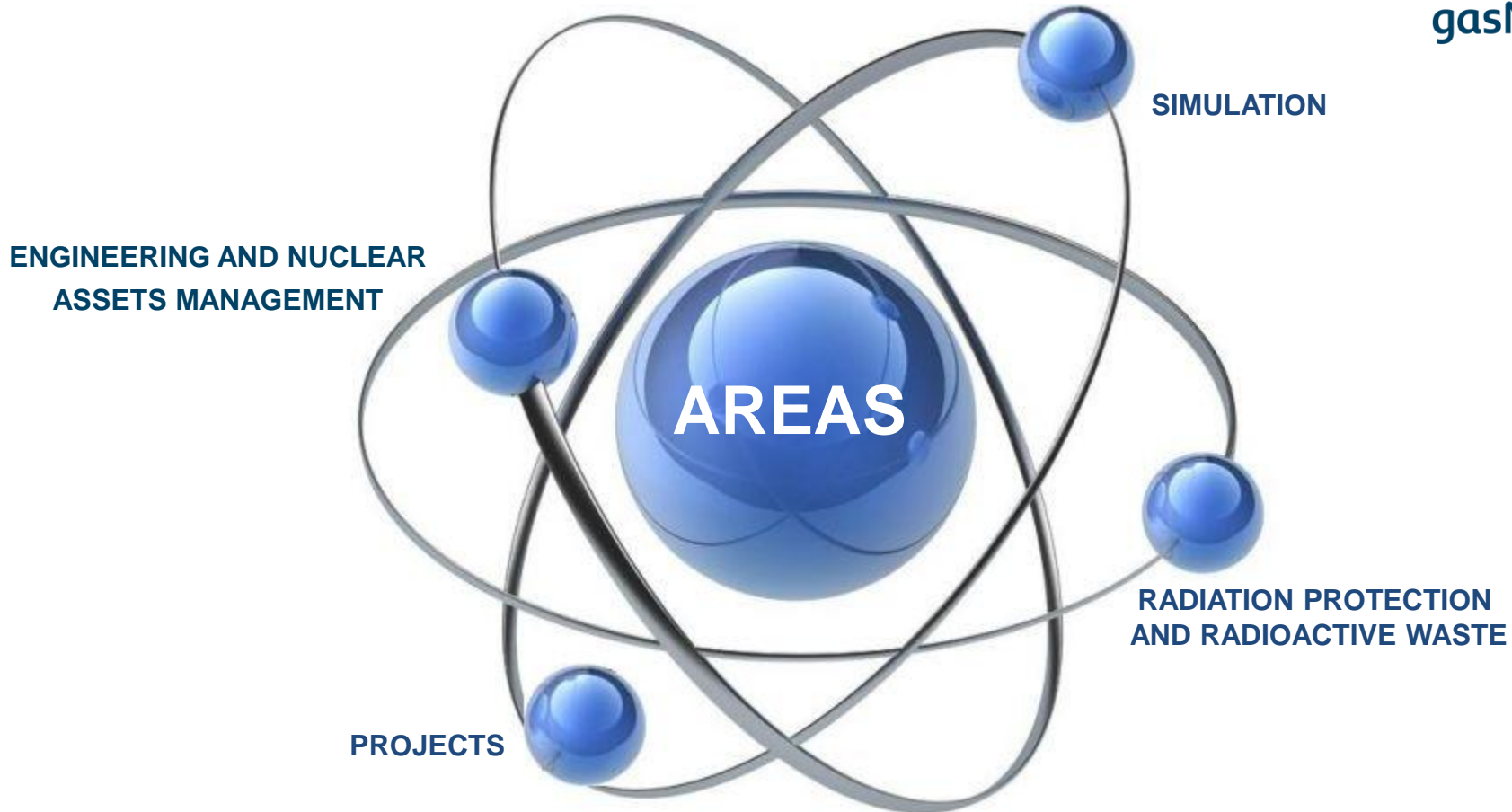
The Nuclear Division of Gas Natural Fenosa Engineering has a wide experience in plant operation and engineering and in the **whole life cycle support** of nuclear installations.



# 2. ORGANIZATIONAL STRUCTURE



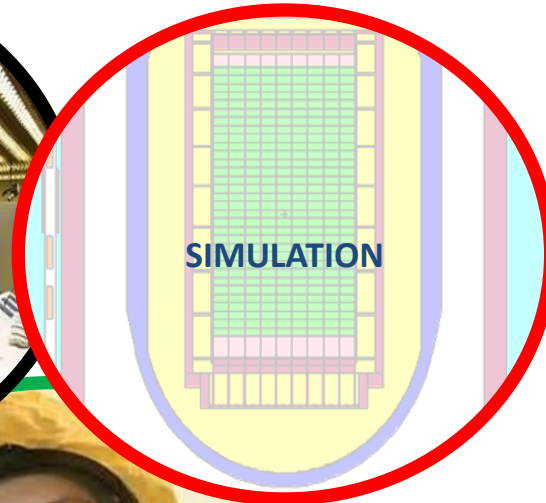
## 2. ORGANIZATIONAL STRUCTURE



Staff: 37 nuclear engineers, technicians and specialists

Conventional engineering and construction support of other divisions of the company

# 3. TEAM CAPABILITIES



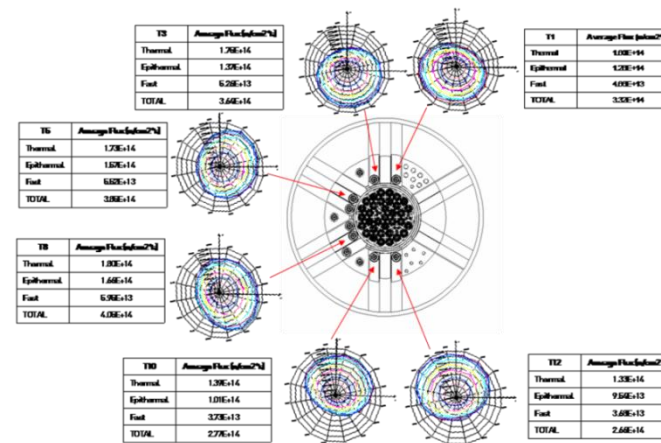
RELEVANT PROJECTS



SIMULATION

# Simulation

- Design modifications
- Availability and reliability analyses
- Thermal hydraulic analyses
- 3D Computerized Fluid Dynamics
- Neutronic calculations
- Transients Analysis
- Operation Conditions (PLS)
- Operation Procedures
- Fuel engineering

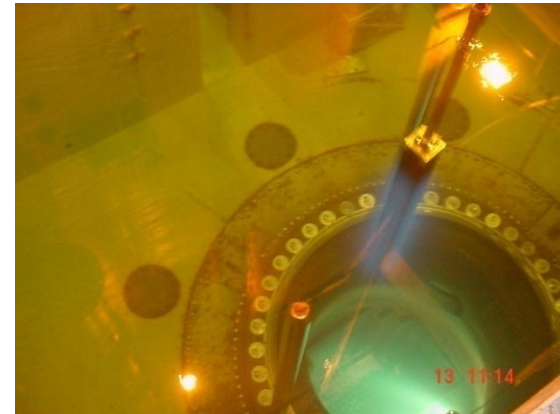




## Support to facilities



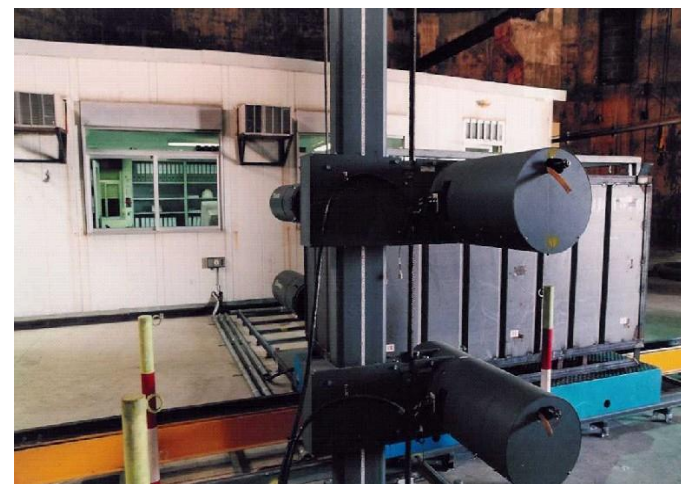
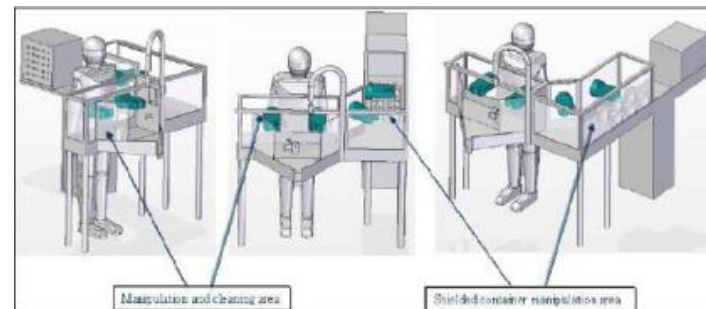
- Operation Technical Office
- Maintenance Technical Office
- Management and Expedition of radioactive waste
- Support to Emergency drills
- Radiological supervision
- Supervision of assemblies and construction
- Training and Operation





# Spent Fuel and radioactive waste management

- High activity waste characterization
- Radioactive waste management
- Radiological characterization
- Materials Clearance
- Waste volume reduction and recycling
- Decontamination techniques
- Management plans
- Annual reports
- Evaluation of waste stores
- Spent fuel characterization

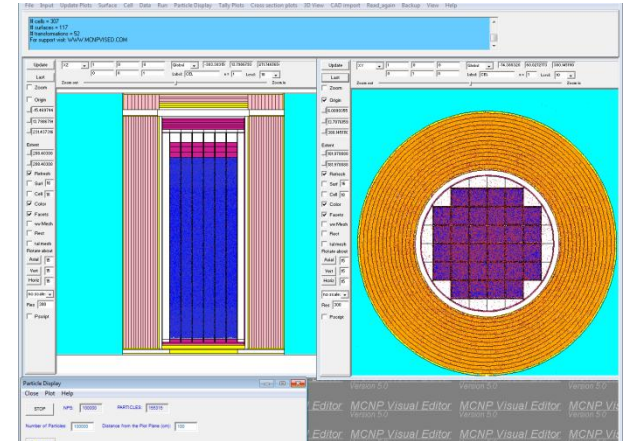




# Radiation Protection



- Studies for dose minimization (ALARA)
- Shielding designs
- Radiological environmental impacts
- Environmental radiological monitoring
- Meteorological reports
- Radiological reports
- Emergency plans
- Training

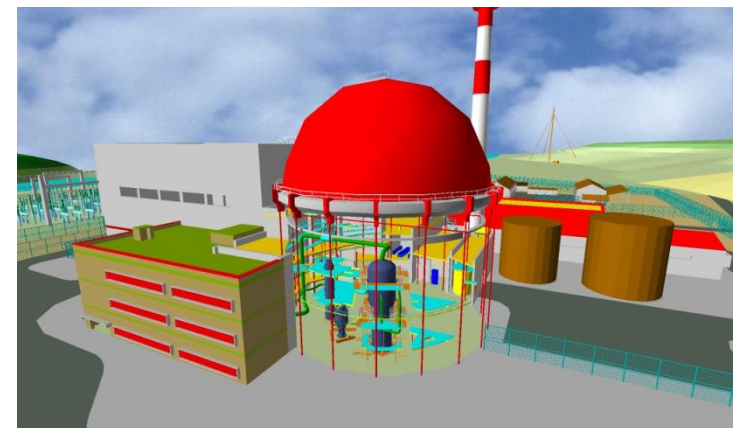




# Decommissioning



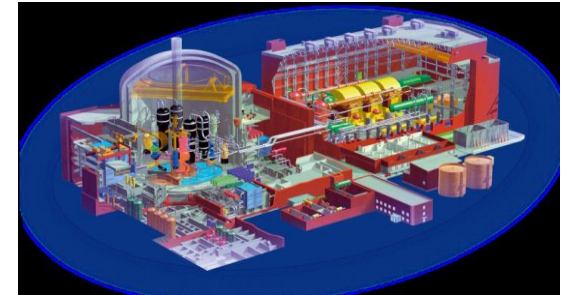
- Characterization of the site and restoration plan.
- Licensing
- Environmental Impact Study
- Basic and detail engineering
- Inventory Data Base and 4D model
- Interference simulation
- Preparation of Specifications
- Quality Assurance
- Materials management
- Radiation protection





## New projects

- Previous activities
- Project Organization
- Activities for Previous Permits
  - Geotechnical and Seismic Studies
  - Hydrological studies
  - Atmospheric Diffusion studies
  - System refrigeration studies
  - Energy Evacuation studies
  - Environmental Impact studies
- Site permit Documentation
  - Descriptive report
  - Site Characterization
  - Organization, QA, activities and resources
- Site permit





NUCLEAR  
TECHNOLOGY  
AND  
ENGINEERING

## New projects

- Tender preliminary evaluation
- Environmental Impact Study
- Construction Authorization
- Basic & detailed Engineering
- Purchase of equipment
- Construction
- Tests and start up
- Geological and Seismic Risk Analysis
- Authorization





4

## Relevant Projects

# 4. RELEVANT PROJECTS



Some of the most relevant **NATIONAL** projects in which GNF Engineering has taken part are:

- **ENRESA**

- Jose Cabrera NPP Dismantling: Basic & Detailed engineering, project management.
- High level activity waste storage engineering. Detail engineering
- Dry cask buffer storage engineering. Detail engineering
- Support engineering for spent fuel storage
- Engineering support for radioactive waste management plan and support reports development
- Spanish Nuclear power plants spent fuel and special Waste Data Base Development

- **ALMARAZ NPP – TRILLO NPP**

- Support for Almaraz-Trillo nuclear power plants in thermo-hydraulic and neutron areas
- Support to PSA
- Support to characterization, management and storage of spent fuel.
- Support to Radiation Protection and Waste Management
- Support To the human factors area of the Trillo NPP program
- Technical consulting in sever accident
- Operating Experience management. Life management



- **UFG**

- Nuclear generation technologies

- **VANDELLÓS II NPP – ASCÓ NPP  
COFRENTES NPP – GAROÑA NPP**

- Operating Experience – Management Oversight and Risk Tree (MORT) Evaluation
- Radioactive waste treatment: Wood (Ascó NPP) and Scrap Metal (Garoña) Clearance Project

- **CSN**

- Radiological Protection support and shielding calculations
- OCDE - FIRE Project

- **UNESA**

- Sectorial groups (Radioactive waste, END) support

- **CSN – UNESA – ENUSA - ENRESA**

- Research Project: Development of Radioactive Waste Management Guide

- **ELCOGAS**

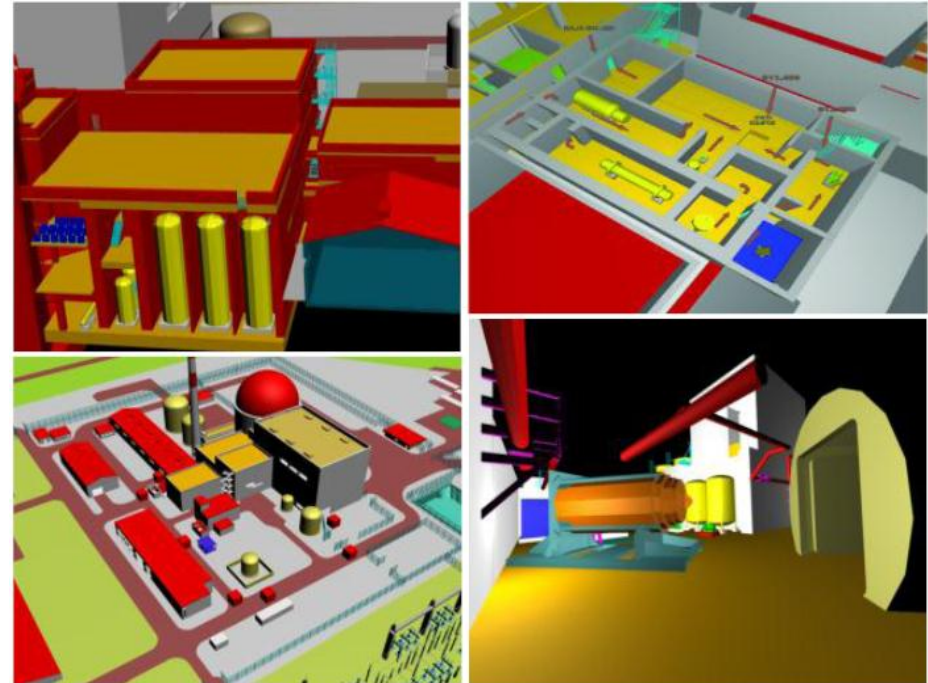
- Operating experience

# 4. RELEVANT PROJECTS



## José Cabrera NPP: Decommissioning Engineering

- **Client:** ENRESA
- **Scope:**
  - Direction and Project Management
  - Evaluation of the plant Operating History
  - Characterization of the site and restoration plan
  - Licensing: Documentation and client support
  - Environmental Impact Study
  - Basic and detail engineering
  - Inventory Data Base and 4D model
  - Preparation of Specifications
  - Quality Assurance
  - Support during execution
  - Materials management
  - Radiological protection
- **Period:** 2003/2017



## 4. RELEVANT PROJECTS



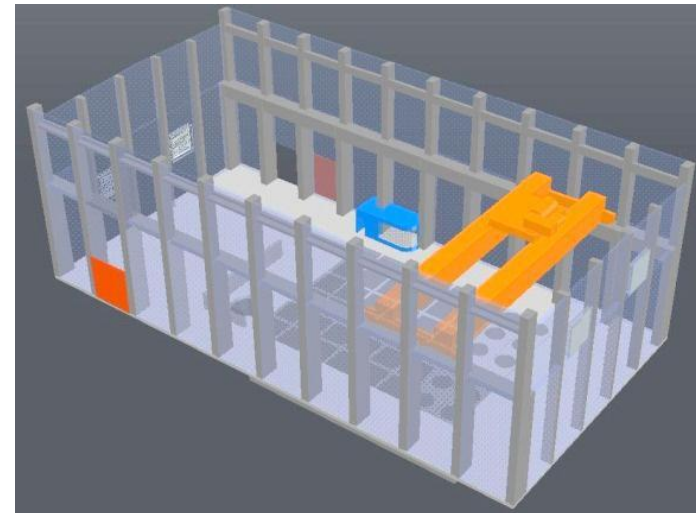
### Dry cask buffer storage. CTS Project

- **Client:** ENRESA
- **Description:** Dry cask buffer storage detail engineering for the CTS.
- **Scope:**
  - Basic engineering
  - Detail engineering



### High level activity waste storage. CTS project

- **Client:** ENRESA
- **Description :** High level activity waste storage for the CTS.
- **Scope :**
  - Basic engineering
  - Detail engineering



# 4. RELEVANT PROJECTS



## José Cabrera NPP Independent spent fuel storage facility (ATI)

- **Client:** UFG/ENRESA
- **Description:** ATI Construction
- **Engineering Phase Scope :**
  - Site Selection
  - Site Characterization
  - Preliminary design
  - Environmental Impact study (conventional & radiological)
  - Risk Analysis
  - CSN Licensing and Permits
  - Constructive project
  - Plant Design Modifications
  - Specifications Preparation
  - Offers Comparative
- **Construction Phase Scope :**
  - Works management, execution supervision, Commissioning Tests.



## José Cabrera NPP: Spent fuel movement

- **Description:** Extraction, movement and spent fuel storage
- **Scope:**
  - Fuel characterization
  - Analysis of Load Plan
  - Interferences and risks study
  - Design modifications
  - Adjustment procedures
  - Radiological studies (dose)
  - Shielding Design
  - Maneuver Optimization
  - Tests
  - Support to project direction
  - Supervision

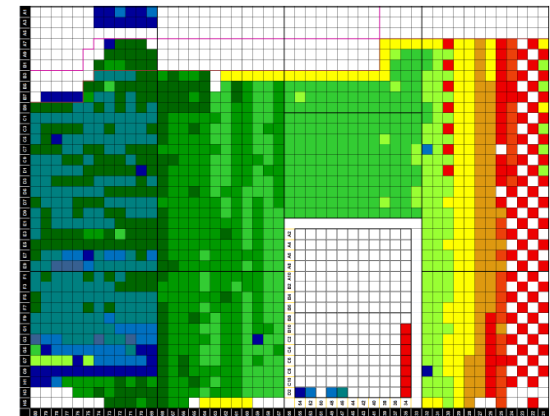
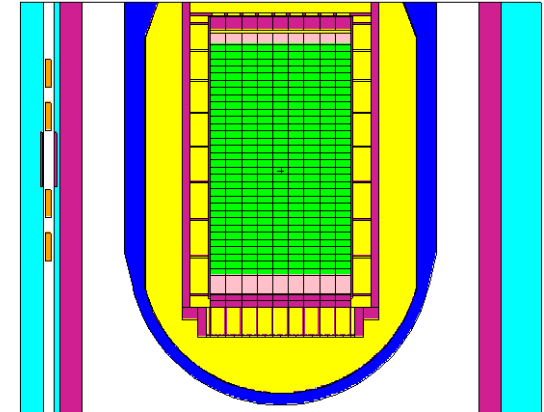


# 4. RELEVANT PROJECTS



## Specialized advisory for Almaraz – Trillo NPP

- **Client:** Almaraz – Trillo NPP
- **Description:** Technical advisory and specialized services for Almaraz – Trillo Fuel Department.
- **Scope:**
  - Thermo-hydraulics analysis
  - Neutron Analysis. MCNP model development for Trillo NPP and Almaraz NPP
  - Probabilistic Safety Analysis
  - Spent Fuel characterization, management and storage : Database development, Waste Management Plan design
  - Radiation Protection and Waste Management support
  - Human Factor support
  - Severe Accident support



# 4. RELEVANT PROJECTS



## C.N José Cabrera: Management of lightly contaminated scraps

- **Cliente:** UFG/ENRESA
- **Descripción:** Management of heterogeneous waste (scraps) of warehouse III in Jose Cabrera NPP
- **Engineering Phase Scope :**
  - Viability study
  - Methodological development
  - Selection of decontamination techniques
  - Licensing
  - Specifications Preparation
  - Offers comparison
  - Design Modifications
  - Procedures development
- **Execution Phase Scope :**
  - Project Management
  - QA/QC, Health & Safety
  - Operational Tests
  - Execution Supervision
    - *Segregation*
    - *Decontamination*
    - *Clearance*
  - RP Supervision
  - Waste Conditioning
  - Expedition
  - Documentation
- **Dates:** 2003-2006



Estimated Volume: 1.500 m<sup>3</sup>



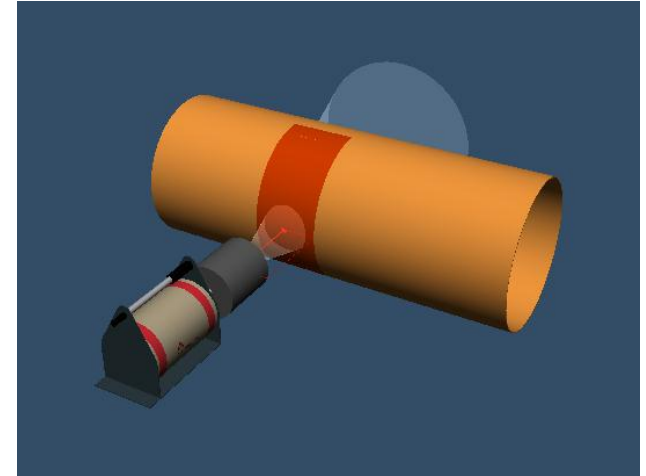
Radioactive waste vol.: 260 m<sup>3</sup>

# 4. RELEVANT PROJECTS

Specialized advisory for ENRESA



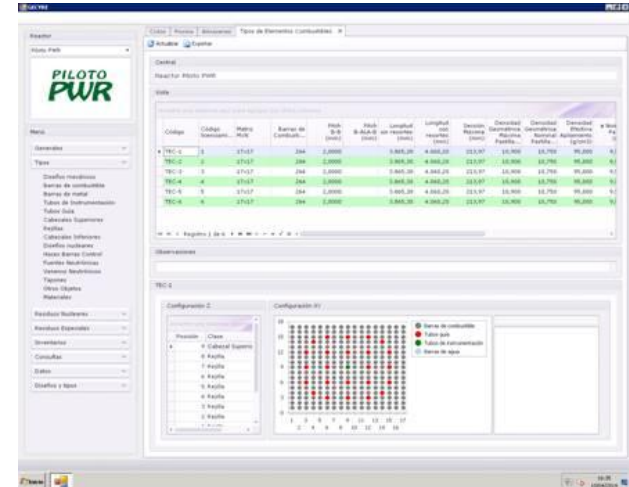
- **Client:** ENRESA
- **Description:** Technical advisory and specialized services for the ILW Department.
- **Scope:**
  - ILW characterization: clearance methodology, procedure development and Box-Counter and ISOCS start-up in Garoña NPP (condenser tubes) and Zorita NPP (CMDs, drum, big-bag y big parts)
  - Isotopic revision of El Cabril Storage Facility
  - Characterization methodology development of special waste for Spanish NPP.
  - El Cabril Storage Facility Waste Management plan Development.



# 4. RELEVANT PROJECTS

## Specialized advisory for ENRESA

- **Client:** ENRESA
- **Description:** Technical advisory and specialized services for the Fuel Department.
- **Scope:**
  - Support engineering, license, calculations, design revision, etc. Spent Nuclear Fuel Temporary Storage Facilities and Special Waste.
  - Design, Development and Implementation of the Spent Fuel and Special Waste Database of the Spanish NPP.



# 4. RELEVANT PROJECTS

## Root cause analysis (RCA)



- **Clients:** Nuclear Power Plants : JOSÉ CABRERA NPP, SANTA MARÍA DE GAROÑA NPP, ASCÓ NPP, VANDELLÓS II NPP, COFRENTES NPP

Regulatory body : CONSEJO SEGURIDAD NUCLEAR (CSN)

Others: ELCOGAS Thermal Power Plant

- **Description** : RCA Courses  
RCA Studies

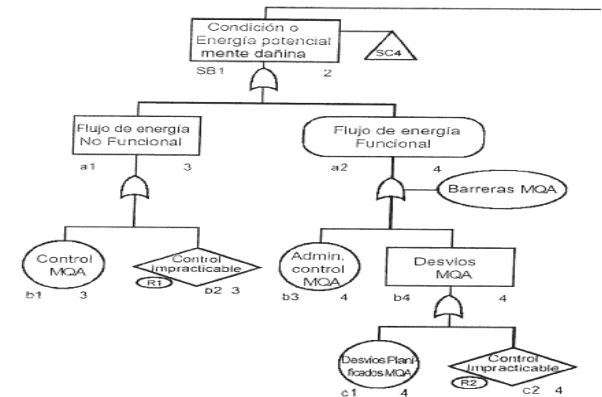
- **Scope:**

- RCA Courses:

- Root Cause Analysis
    - Human Performance Enhancement System Methodology (HPES)
    - Management Oversight and Risk Tree Methodology (MORT)

- RCA Analysis:

- By means of HPES and MORT methodology, analysis of Reportable Events (ISNS), Non conformities, relevant situations ....



# 4. RELEVANT PROJECTS



Some of the most relevant **INTERNATIONAL** projects in which **GNFE** has taken part are:

- **DUKOVANY NPP**
  - Operating Experience support, QA
- **SOUTH UKRAINE NPP**
  - Updating of plant Chemistry Management
  - Quality Assurance System improvement
- **BOHUNICE NPP (Slovakia)**
  - Dismantling projects
  - Quality system improvement
- **KOZLODUY NPP (Bulgaria)**
  - Mobile unit for personnel radiological control for access to controlled area
  - Resins conditioning facility
  - Fuel and reactor pools decontamination equipment and procedures
- **CEA**
  - Joules Horowitz experimental reactor, project in simulation area
- **FUSION FOR ENERGY (F4E)**
  - Technical Assistance
- **EPRI**
  - ZIRP PROJECT “ Zorita internals reactor project” consisting on the extraction of reactor internals plates for testing material behavior after fuel cycling of the plant, currently in dismantling process

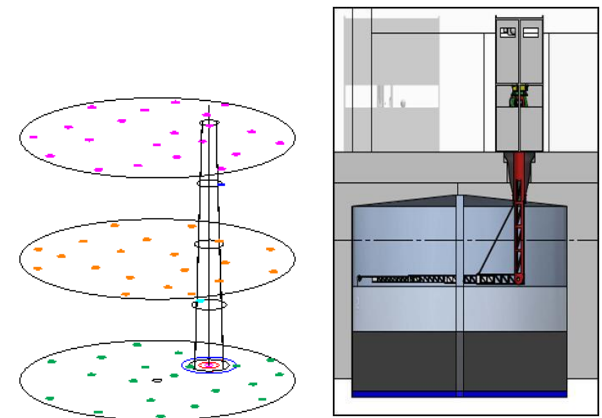
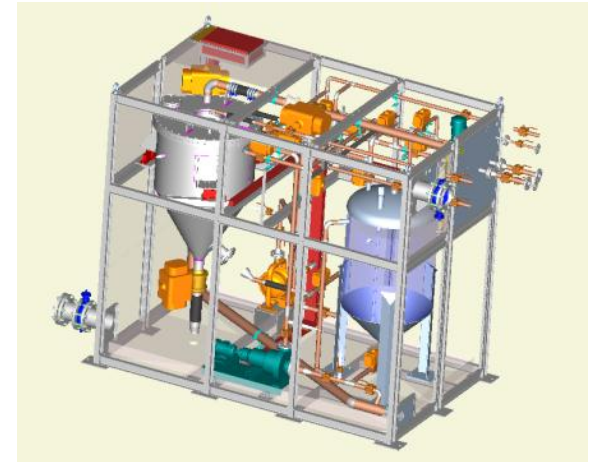


# 4. RELEVANT PROJECTS



## Decommissioning Projects of Kozlodut NPP Units 1 and 2

- **Client:** BERD
- **Final Beneficiary:** Kozloduy NPP (Bulgaria)
- **Consortium:** Equipos Nucleares (ENSA)/GNFe
- **Description :**
  - Project 1: Cleaning and decontamination system of fuel and reactor pools of both units
  - Project 2: Mobile unit for radiological control of personnel for access to the controlled zone
  - Project 3: Facility for the extraction of tanks and immobilization in solid cement matrix of ionic exchange resins of medium and low activity
- **Scope:** Provision of engineering and design, equipments, tests, start up, operation and training procedures
- **Dates:** 2003 – Ongoing
- **Related opportunities:**
  - Extraction system Safety Study
  - Resins characterization Project

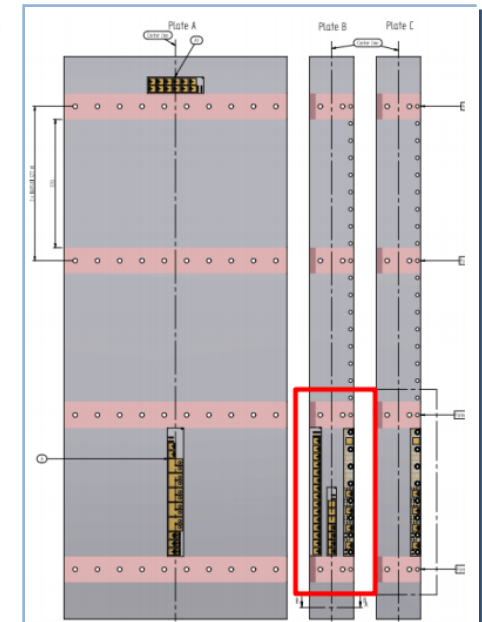
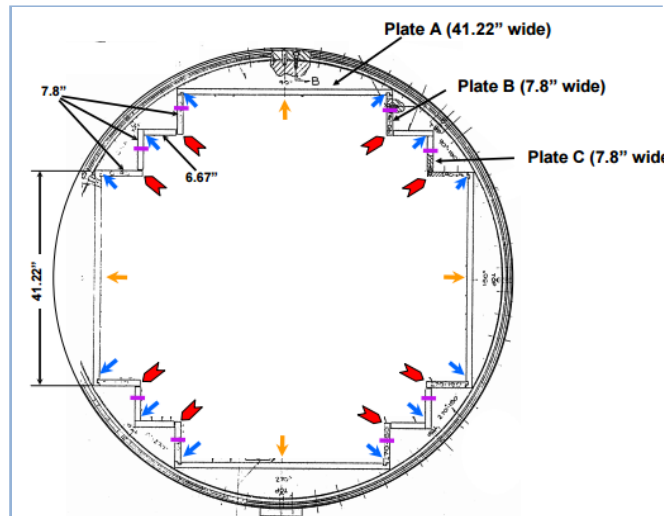


# 4. RELEVANT PROJECTS



## Zorita Internals Research Project. ZIRP

- **Client:** EPRI
- **Objective:**
  - Characterize the effects of neutron irradiation on the mechanical and microscopic properties of stainless steel materials irradiated under service conditions to increase the understanding of fluence effects at end of service life (40, 60 years and beyond)

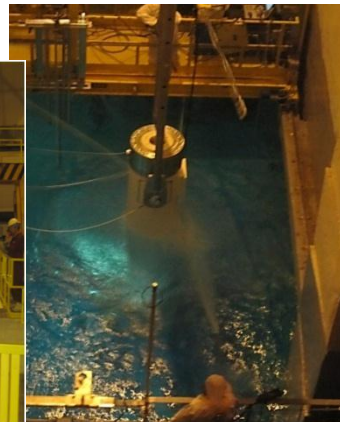
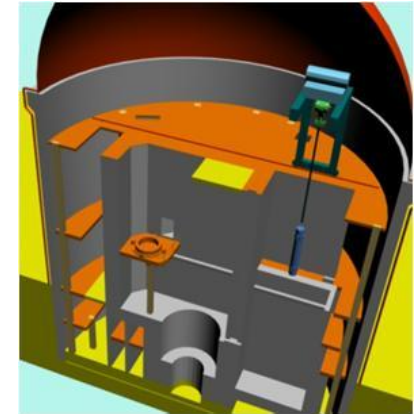


# 4. RELEVANT PROJECTS



## Zorita Internals Research Project. ZIRP

- **Scope:**
  - Project Management (Phase 1 – Spain)
  - Radiation and Temperature detail analysis
  - Cask transfer 3D simulations
  - On-site activities procedure development
  - On-site activities coordination
  - On-site activity supervision
  - Final reports





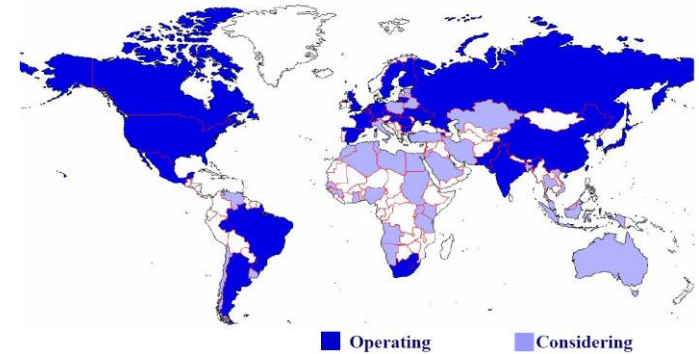
# 4. RELEVANT PROJECTS



New designs and constructive projects alertness

- **Scope:**

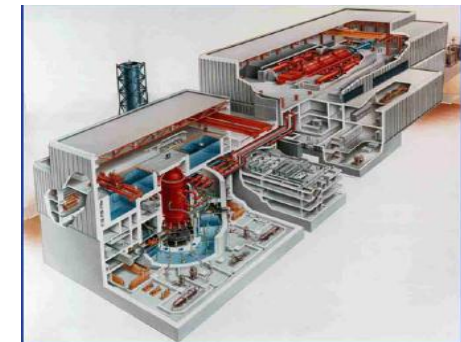
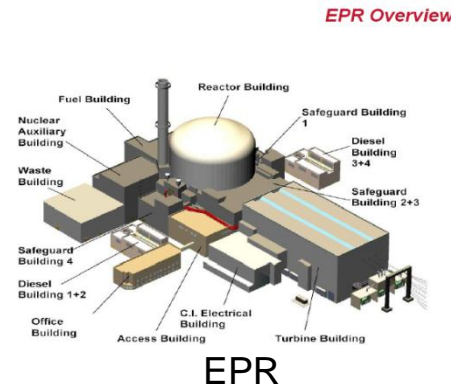
- New technologies development and approval (GIII and GIII +): AP1000 (W), EPR (Areva), ABWR (GE), ...
- Licensing processes in the main countries of the OECD
- Licensing evolution in Spain
- Countries with nuclear programs
- Projects in construction
- Potential threats



| Operation | Construction | Planned | Proposed |
|-----------|--------------|---------|----------|
| 436       | 43           | 108     | 266      |



AP1000



ABWR

## 4. RELEVANT PROJECTS



### Sectorial Reference Center (CEIDEN-UNESA)

- **Description:** GNFe is an engineering and construction sectorial representative in CEIDEN fission R+D technology platform (together with other utilities, Spanish Regulatory Body (CSN), ENRESA, ENSA, Ministry of Industry and Spanish nuclear engineering companies )
- At UNESA, GNFe is reference center within the following areas:
  - Probabilistic Safety Assessment
  - Human Factors
  - Accident Analysis
  - Radiation Protection
  - Waste Management





**Thank you**

engineering