

**Nuclear energy, electricity for everyone**



## **NUCLEAR POWER MIDDLE EAST & NORTH AFRICA 2010**

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# **Case Study of Nuclear Power Experience in Spain**

**Antonio González Jiménez**  
Studies and Technical Support Director

[www.foronuclear.org](http://www.foronuclear.org)

## What is the Spanish Nuclear Industry Forum?

- ▢ Non profit organisation founded in 1962
- ▢ Organisation of the Spanish companies working in the field of non-belic applications of nuclear energy
- ▢ Co-ordination forum of common interest activities
- ▢ Opinion expression channel
- ▢ Main areas of activity
  - ▢ Communication
  - ▢ Education
  - ▢ Publications
  - ▢ Documentation
  - ▢ Studies and technical support
  - ▢ Memberships support
  - ▢ Lobbying

## Members of the Spanish Nuclear Industry Forum

- **Electrical Utilities:**  
ENDESA, HC Energía, IBERDROLA, GAS NATURAL FENOSA
- **Nuclear Power Plants:**  
ALMARAZ, ASCÓ, COFRENTES, GAROÑA, TRILLO, VANDELLÓS II
- **UNESA - Asociación Española de la Industria Eléctrica**
- **Other Companies:**  
AMPHOS XXI, APPLUS/NOVOTEC, AREVA España, COAPSA CONTROL, EMPRESARIOS AGRUPADOS, ENSA, ENUSA Industrias Avanzadas, GENERAL ELECTRIC, GHESA Ingeniería y Tecnología, GRUPO DOMINGUIS, INITEC, MINERA DE RÍO ALAGÓN, PROINSA, SIEMSA, TAMOIN POWER SERVICES, TECNATOM, TÉCNICAS REUNIDAS, WESTINGHOUSE

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## Spanish Nuclear Facilities



## Spanish Nuclear Power Plants

<b>IN OPERATION</b>	<b>CAPACITY (MWe)</b>	<b>REACTOR TYPE</b>	<b>NSSS SUPPLIER</b>	<b>INITIAL CUOPLING TO GRID</b>
STA. MARÍA DE GARONA	466	BWR	General Electric	1971
ALMARAZ I	977	PWR	Westinghouse	1981
ALMARAZ II	980	PWR	Westinghouse	1983
ASCÓ I	1032	PWR	Westinghouse	1983
ASCÓ II	1027	PWR	Westinghouse	1985
COFRENTES	1092	BWR	General Electric	1984
VANDELLÓS II	1087	PWR	Westinghouse	1987
TRILLO	1066	PWR	Siemens KWU	1988

<b>UNDER DECOMMISSIONING</b>	<b>CAPACITY (MWe)</b>	<b>REACTOR TYPE</b>	<b>NSSS SUPPLIER</b>	<b>SHUT DOWN</b>
VANDELLÓS I	500	GCR	CEA	July 1970
JOSÉ CABRERA	150	PWR	Westinghouse	April 2006

## Spanish NPPs shareholders

Sta. María de Garoña	Nuclenor 100% (*)
Almaraz I	Iberdrola 53% Endesa 36% Gas Natural Fenosa 11%
Almaraz II	Iberdrola 53% Endesa 36% Gas Natural Fenosa 11%
Ascó I	Endesa 100%
Ascó II	Endesa 85% Iberdrola 15%
Cofrentes	Iberdrola 100%
Vandellós II	Endesa 72% Iberdrola 28%
Trillo	Iberdrola 48% Gas Natural Fenosa 34,5% HC Energía 15,5% Nuclenor 2% (*)

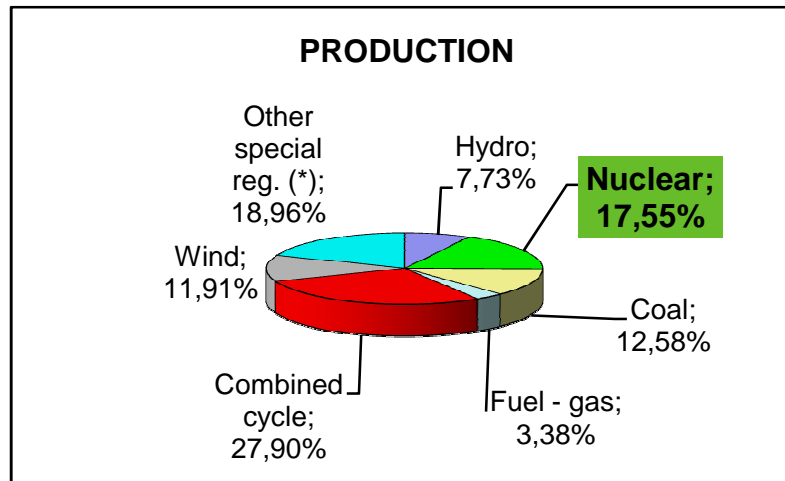
(\*) Nuclenor is owned by Iberdrola 50% and Endesa 50%

## Spanish electrical system in 2009

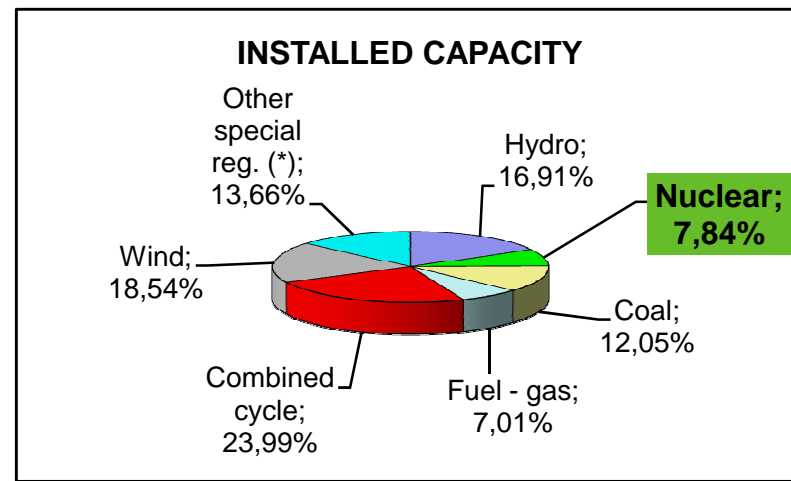
**Production**  
**Capacity**

Total: 300.683 GWh  
Total: 98.514 MW

Nuclear: 52.765 GWh  
Nuclear: 7.728 MW



**PRODUCTION**



**INSTALLED CAPACITY**

(\*) Co-generation, mini-hydro, biomass, waste

**Source:** in-house data with UNESA & REE information

## Spanish nuclear industry development

- Spain began to show interest in nuclear energy in the late 1940's
- In 1951 the Nuclear Energy Council (JEN) was created: paramount importance to the country's nuclear development
- After U.S. President Eisenhower speech "Atoms for Peace" at the 1953 UN General Assembly, the right climate created to study the convenience of introducing this promising energy into Spain
- In 1964 the Nuclear Energy Law was approved
- Safety and regulation activities were entrusted to the Nuclear Safety Council (CSN) created in 1980
- The research and management activities of radioactive waste were entrusted to the National Radioactive Waste Company (ENRESA) created in 1985



## Spanish nuclear industry development

### **First Stage: Decade of the 1960's**

▀ Construction of José Cabrera NPP

Santa María de Garoña NPP

Vandellós I NPP



▀ “Turn-key” projects with participation by Spanish engineering, construction and assembly companies, and electrical equipment manufacturers

▀ High level qualification employment created

▀ Technological development for the general industrial improvement

## Spanish nuclear industry development

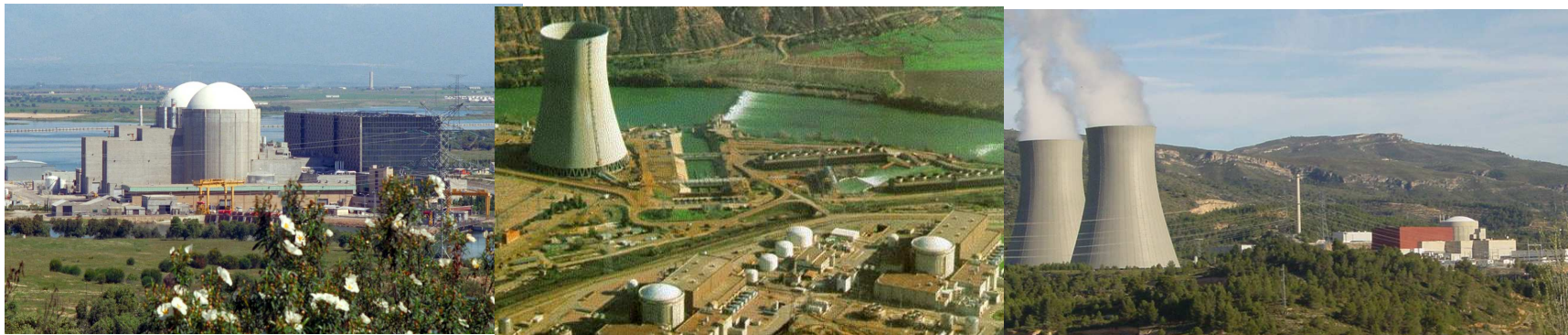
### Second Stage: Decade of the 1970's

Construction of Almaraz NPP (Units I & II)

Ascó NPP (Units I & II)

Cofrentes NPP

Contracting by components projects with participation by Spanish engineering and equipment goods companies



## Spanish nuclear industry development

### Third Stage: End of the decade of the 1970's and start of the decade of the 1980's

- Construction of Vandellós II NPP

Trillo I NPP

- Spanish nuclear industry consolidation and maturity

- Completely new building factories construction: major components  
nuclear fuel

- Specialized services: training and in-service inspection



## Maturity achieved

### In the decade of the 1980's:

📊 20,000 direct jobs (5,000 highly qualified) + 100,000 indirect jobs

📊 Domestic participation in NPPs construction (%)

	First stage	Second stage	Third stage
Equipment	24	50	75
Engineering	60	75	100
Construction	70	100	100
Assembly	80	100	100
<b>Global</b>	<b>43</b>	<b>75</b>	<b>85</b>

## Spanish nuclear industry activities

- ▀ Electricity utilities: NPPs owners and operators
- ▀ Front-end of the nuclear fuel cycle
  - ▀ Uranium ore exploration
  - ▀ Fuel assemblies manufacture
- ▀ Major nuclear components manufacture
- ▀ Equipment goods and services supply
- ▀ Construction and assembly companies
- ▀ Engineering services: construction support & NPPs O&M
- ▀ Specialized services companies
- ▀ Back-end of the nuclear fuel cycle
  - ▀ Nuclear facilities dismantling
  - ▀ Radioactive waste and spent fuel management

## Spanish nuclear industry structure

### Electricity utilities: NPPs owners and operators

Endesa

HC Energía

Iberdrola

Gas Natural Fenosa

### Engineering companies: engineering services construction support O&M support

Empresarios Agrupados

Westinghouse Technology Services

Técnicas Reunidas

Iberdrola Ingeniería y Construcción

Socoin



## Spanish nuclear industry structure

▀ NSSS suppliers: no domestic company

Multinational companies subsidiaries: Areva

General Electric – Hitachi

Westinghouse - Toshiba

▀ Equipment goods suppliers: main equipment: SG's, presurizers

cranes

valves

pipings

heat exchangers

Equipos Nucleares

Ringo Válvulas

Vector Valves

▀ Nuclear fuel manufacturer: Enusa Industrias Avanzadas

## Spanish nuclear industry structure

### Construction and assembly companies

Coapsa

Siemsa - GES

Proinsa – Grupo Eulen

Tamoin

### Specialized services companies

Tecnatom

Grupo Dominguis

Amphos XXI



## International projection

- ▀ 30,000 direct and indirect jobs (40% degree qualified)
- ▀ Participation in numerous international projects
  - ▀ Operating nuclear power plants O&M support
  - ▀ New nuclear power plants construction projects
  - ▀ Experimental facilities
- ▀ Capacities for a 5% participation in a world nuclear programme
- ▀ ITER Project – European Legal Entity in Barcelona:
  - ▀ start-up at the end of 2006

## International projection

- ▀ **Nuclear fuel supply:** ENUSA exported 50% of its fuel assembly production to 5 foreign countries in 2009
- ▀ **Heavy main components manufacturing:** ENSA exports over 80% of its production, participating in different projects in China, Japan, United States, Europe...
- ▀ **Engineering services:** the Spanish engineering companies participate with around 20% of their nuclear activities in programs in China, Brazil, Romania, Bulgaria, USA DOE 2010 Programme...
- ▀ **Specialized services companies**

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**Thank you for your attention**



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