The Spanish nuclear program started in 1960. First plant in operation was in 1968.
NUCLEAR INDUSTRY IN SPAIN
# SPANISH NUCLEAR POWER PLANTS

<table>
<thead>
<tr>
<th>PHASE</th>
<th>Plant name</th>
<th>Supplier</th>
<th>Output (MWe)</th>
<th>Operation since</th>
<th>Phase</th>
<th>situation</th>
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</thead>
<tbody>
<tr>
<td>1st Generation</td>
<td>J. Cabrera</td>
<td>PWR-W</td>
<td>160</td>
<td>1968</td>
<td>1st</td>
<td>decommissioning</td>
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<tr>
<td></td>
<td>Sta. Mª Garoña</td>
<td>BWR-GE</td>
<td>486</td>
<td>1971</td>
<td>1st</td>
<td>operation</td>
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<tr>
<td></td>
<td>Vandellos 1</td>
<td>GCR</td>
<td>400</td>
<td>1972</td>
<td>1st</td>
<td>decommissioning</td>
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<tr>
<td>2nd generation</td>
<td>Almaraz 1</td>
<td>PWR-W</td>
<td>981</td>
<td>1981</td>
<td>2nd</td>
<td>operation</td>
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<td></td>
<td>Almaraz 2</td>
<td>PWR-W</td>
<td>988</td>
<td>1983</td>
<td>2nd</td>
<td>operation</td>
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<tr>
<td></td>
<td>Ascó I</td>
<td>PWR-W</td>
<td>1.032</td>
<td>1983</td>
<td>2nd</td>
<td>operation</td>
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<tr>
<td></td>
<td>Cofrentes</td>
<td>BWR-GE</td>
<td>1.092</td>
<td>1984</td>
<td>2nd</td>
<td>operation</td>
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<tr>
<td></td>
<td>Ascó II</td>
<td>PWR-W</td>
<td>1.027</td>
<td>1985</td>
<td>2nd</td>
<td>operation</td>
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<tr>
<td>3rd generation</td>
<td>Vandellós 2</td>
<td>PWR-W</td>
<td>1.087</td>
<td>1987</td>
<td>3rd</td>
<td>operation</td>
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<td></td>
<td>Trillo</td>
<td>PWR-KW</td>
<td>1.067</td>
<td>1988</td>
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<td></td>
<td>TOTAL IN OPERATION</td>
<td></td>
<td></td>
<td></td>
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<td>7.760</td>
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</table>
SPANISH NUCLEAR POWER PLANTS

Sta. María de Garoña

Almaraz I y II

Ascó I y II

Cofrentes

Vandellós

Trillo
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
  - Ascó NPP
  - Cofrentes NPP

- Contracting by components with participation by Spanish engineering and equipment suppliers.
SPANISH NUCLEAR INDUSTRY DEVELOPMENT

Third Stage: decade of the 1980’s

• Construction of:
  • Vandellós II NPP
  • Trillo I NPP

• Spanish nuclear industry consolidation

• Construction of totally factories construction:
  • Major components
  • Nuclear fuel

• Specialized services: training and in-service inspection
## Localization Phases of Spanish Nuclear Plants during Construction

<table>
<thead>
<tr>
<th>Date</th>
<th>1st PHASE</th>
<th>2nd PHASE</th>
<th>3rd PHASE</th>
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<tr>
<td>Localization Content</td>
<td>Late 60’s 3 reactors</td>
<td>Mid 70’s 5 reactors</td>
<td>Early 80’s 2 reactors</td>
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<tr>
<td>Main Equipment</td>
<td>45%</td>
<td>75%</td>
<td>85%</td>
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<tr>
<td>Engineering</td>
<td>25%</td>
<td>50%</td>
<td>90%</td>
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<tr>
<td>Construction</td>
<td>70%</td>
<td>80%</td>
<td>90%</td>
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<tr>
<td></td>
<td>75%</td>
<td>100%</td>
<td>100%</td>
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</table>

Spanish suppliers reached technical maturity back in the 80’s
SNGC: 主要设施

Juzbado (ENUSA)

Maliaño (ENSA)

Zaragoza (RINGO)

Madrid (TECNATOM)
SNGC MEMBERS: Main Facilities
2006, Alliance between
- ENSA
- ENUSA
- TECNATOM

March 2008, RINGO
RINGO Incorporation

July 2008. Consortium Kick-off. JV set up

May 2010. Extension to other countries, (Spanish Nuclear Group for Cooperation) mainly:
- India
- Latin America
- South Africa
SNGC ORGANIZATION

- Commercial alliance. Non profit
- Legal entity. Consortium.
- Contracts awarded to the companies. Not to SNGC.
- President: rotates from each company.
- Vice President: former President.
- Full time GM. Former ENSA VP for BD.
- Administrative, other support from the companies.
SNGC SCOPE

- General marketing efforts.
- Marketing coordination.
- Commercial promotion.
- Participation in exhibitions.
- Delegations coordination,
- Market news research and scope.
- SNGC newsletter publications and distribution.
- New opportunities. New alliances. etc.
- Finance. Export credits, etc.
- Government programs.
“SNGC companies play a leading role in the Spanish Nuclear Industry”

Institutional Framework On Nuclear Energy in Spain
SNGC MEMBERS: Main Facilities
**SNGC MEMBERS: COMBINED CAPABILITIES**

“We offer a wide range of products and services”

- Design engineering.
- NSSS components, spent fuel casks and racks.
- Licensing.
- Construction and start-up.
- Nuclear fuel cycle.
- Pre-Service and In-Service inspection and testing.
- Control room and simulator.
- NPP operation support.
- Outage services.
- NPP Maintenance.
- Valves components.
- Spare part management.
- Nuclear waste and decommissioning.
- New reactors.

<table>
<thead>
<tr>
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<th>ENSA</th>
<th>ENUSA</th>
<th>TECNATOM</th>
<th>RINGO</th>
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<tr>
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<td>Spare part</td>
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<td>Nuclear waste</td>
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<td>✓</td>
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</table>
Technology transfer & localization capabilities

TECNATOM
- Pre-service & In-service inspection and testing engineering
- Qualification and Dedication Engineering of Safety Class components
- Development and supply of control rooms and simulators
- Training Management of Licensed personnel & non licensed/plant staff
- Plant life Management and Plant life Extension programs

ENUSA
- Advanced fuel design and manufacturing
- Fuel manufacturing and inspection technology and equipment
- On-site fuel handling, inspection and repair

ENSA
- Steam Generators, Reactor Pressure Vessels and Internals manufacturing
- Spent Fuel Racks and Casks and Fresh Fuel Casks manufacturing
- NPP repair and maintenance services and procedures
- NPP waste management equipment supply and techniques and procedures
- Design, manufacturing, supply and installation of heat exchangers

RINGO VALVULAS
- Nuclear Safety related Valves manufacturing
- Spare parts and valves services
Combined Workforce

More than 2,000 nuclear professionals
Worldwide Experience @ NPPs diversity

- References in more than 35 countries
- Covering all current reactor technologies BWR, CANDU, PWR, VVER, etc
- Proven participation on design and construction of parts for new reactors ABWR, EPR, AP-1000, HTR, etc with high qualified staff according to several national standards
- Equipment & Component delivery and services provider
Worldwide presence of SNGC Members at New Nuclear Projects

USA & CENTRAL AMERICA
AP1000: 4 under construction + 6 under development
ESBW: 4 under development
ABWR: 2 under development
OTROS: 1 under construction and 1 under development

EUROPE
EPR: 2 under construction & 4 under development
VVER: 10 under construction
CANDU: 2 under development
ABWR: 6 under development
ITER & JHR: 2 under construction

CHINA & OTHER ASIAN COUNTRIES
CPR: 20 under construction + 14 under development
CNP600: 2 under construction
AP1000: 4 under construction
EPR: 2 under construction
ABWR: 2 under construction

MIDDLE EAST & SOUTH AFRICA
APWR: 2 under construction
APWR: 2 under development
VVER: 4 under development
CANDU: 2 under development
ATME: 1 under development
New reactors: 2 under project
OTHERS: 22 under development

NEW REACTORS (IN RED) WHERE SNGC MEMBERS ARE PARTICIPATING
Top arguments to choose SNGC

- Wide range of capabilities, products & services.
- Capabilities covering.
  - NSSS
  - Fuel.
  - Main Components.
- Independent from main original equipment manufacturers
- Innovated technologies and modern facilities
- Offer advanced own technologies for NPP and new reactors.
- Capable/oriented to technology transfer to local organization.
- Collaborative models based on international cooperation.
公司介绍
Tecnatom Facilities

Operation Support Centers at:
- Cofrentes NPP
- SM³. Garoña NPP

Subsidiaries and Agents:
- Argentina, Brazil, Bulgaria, China, Mexico, Russia, Taiwan, Ukraine.
Markets

NUCLEAR

Plants in Operation

New Projects

FOSSIL & RENEWABLE

Combined C. Fossil
Thermosolar
Wind Power

DIVERSIFIED

Aeroespace,
Railway,
Petrochemistry
Core Activities

- “Monitor and assess the structural integrity and operability of safety-related or critical components and systems”
  - Engineering services
  - Non-Destructive tests
  - Functional tests
  - Manufacturing of NDT & associated systems
  - R&D on above tasks

- “Provide technical support for the safe, reliable and efficient operation of complex industrial facilities”
  - Recruiting & Training
  - Simulators development and operation and maintenance services
  - Operation engineering
  - Support to operations
Technological Capabilities

- Inspection & Structural Integrity
- Testing: Systems & Components Operability
- Plant Operation Support
- Training Centres
- Developing, Manufacturing and Delivery of Equipment & Systems
- Safety Management
- New Nuclear Projects: (Advanced Reactors, Fusion)
Technological Capabilities

“New Nuclear Projects: (I)”

- Activity started in 1991
  - “SBWR and ABWR Reactors of General Electric”
  - “AP600 of Westinghouse”

- Since 1997
  - “Lungmen NPP” (Taiwan): “ABWR of Gen. Electric”

- Now
  - “ABWR & ESBWR of General Electric”
  - “AP1000 & ABWR of Westinghouse”
  - “Pebble Bed Modular Reactor” (PBMR PTY Ltd.)
  - “CPR1000” (Chinese PWR)

Activities

- Analysis of Human Factor Engineering
- Design and Implementation of Man-Machine Interface
- Verification and Validation
- Control Room design and full delivery
- Development of Simulators and Simulation Models
- Development of Procedures
- Training of Operation Personnel
- ISI Engineering and Services
ENUSA

ACTIVITIES

- PROCUREMENT OF ENRICHED URANIUM
- DESIGN OF NUCLEAR FUEL
- FABRICATION OF NUCLEAR FUEL
- FUEL ASSOCIATED SERVICES
- ENVIRONMENTAL PROJECTS
- DIVERSIFICATION

60.010.000 €
Diesel Engineering, Technology and Manufacturing Capabilities

ENUSA provides full scope service to its customers
Enusa Fuel Products Portfolio

- BWR
  - Garoña
  - Oskarshamn
  - Forsmark 2
  - Gundrem. B/C
  - Olkiluoto 1
  - Forsmark 3
  - Gundrem. C
  - Cofrentes

- PWR
  - Ascó 1&2
  - Vandellós
  - Almaraz 1&2
  - EDF
  - Doel 4
  - EDF (Several Plants)
  - Tihange 3

- GNF2

- 17x17 MAEF (12’’)

- 17x17 MAEF-XL/XLR (14’’)

- GE14

- VVER
  - Loviisa 2

- VVER 440

- COMPONENTS
JUZBADO PLANT LAY-OUT

- Transport container storage
- Powder reception
- Empty area
- Ceramic area
- Mechanical area
- Expedition docks
- Laboratories
- Gadolinium Line
- Line 1 Pellets (back-up Line)
- Powder storage
- Line 2/3 pellets
- Line 2/3/4 Fuel rods
- Fuel rods QC
- End plugs machining
- Line BWR final assembly
- Skeleton lines 3/4
- Components insp./storage
- Line PWR final assembly
- First weld Line 2/3/4

公司介绍
On Site Fuel Services

- Fresh fuel handling
- Irradiated fuel and core components handling
- Inspection of fuel leaks
- Fuel repair and reassembly
- Inspection and characterization of irradiated fuel
- SICOM equipment inspection family
- Other services
# ENUSA ´S Customers

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<tr>
<th>Country</th>
<th>Reactor Type</th>
<th>Sites</th>
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<tbody>
<tr>
<td><strong>SPAIN</strong></td>
<td>PWR 17x17 12”</td>
<td>Ascó I–II, Vandellós II, Almaraz 1-2</td>
</tr>
<tr>
<td></td>
<td>BWR</td>
<td>Cofrentes, Sta. Mª Garoña</td>
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<tr>
<td><strong>FRANCE</strong></td>
<td>PWR 17x17 12”</td>
<td>Blayais 1-2, Chinon 1-2-3-4, Tricastin 2-3-4, St. Laurent 1-2, Dampierre 3-4, Gravelines 1-2-4</td>
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<tr>
<td></td>
<td>PWR 17x17 14”</td>
<td>Belleville 1, Paluel 3, Penly 1</td>
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<tr>
<td><strong>SWEDEN</strong></td>
<td>PWR 15x15</td>
<td>Ringhals 2</td>
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<td>BWR</td>
<td>Ringhals 1, Forsmark 3, Oskarshamn 1-3</td>
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<tr>
<td><strong>BELGIUM</strong></td>
<td>PWR 17x17 14”</td>
<td>Doel 4, Tihange 3</td>
</tr>
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</table>

Map:
- **Spain**:
  - Ascó I–II
  - Vandellós II
  - Almaraz 1-2
  - Cofrentes
  - Sta. Mª Garoña

- **France**:
  - Blayais 1-2
  - Chinon 1-2-3-4
  - Tricastin 2-3-4
  - St. Laurent 1-2
  - Dampierre 3-4
  - Gravelines 1-2-4
  - Belleville 1
  - Paluel 3
  - Penly 1

- **Sweden**:
  - Ringhals 2
  - Ringhals 1
  - Forsmark 3
  - Oskarshamn 1-3

- **Belgium**:
  - Doel 4
  - Tihange 3

**Countries and Reactors**:
- France: Blayais, Chinon, Tricastin, Dampierre, Gravelines
- Spain: Ascó, Vandellós, Almaraz
- Sweden: Ringhals
- Belgium: Doel, Tihange
History

- Ringo Valvulas was established in 2000 by Walthon Weir Pacific management staff. Having more than 30 years experience in valves for nuclear application.

- Having manufactured more than 100,000 valves to 20 NPP in different countries.

- Thanks to our experience we have became to be the 1st supplier of valves for Spanish NPP in only 5 years with 95% of market share in Spain.

- Our supplies to NPPS also include references for other countries such as Mexico, China, Sweden, South Africa, Argentina & Switzerland.

- Since September 2006 we are installed in a new and modern plant.
New Facilities

The new plant started the activity at the beginning of September 2006. The surface of area is 7,000 square meters:
- 7,000 m² of workshop
- 1,500 m² of offices.
- Including 60tm crane

NEW FACILITIES

In 2009, a 1,500 m² new facility for big size valves (up to 60”) assembly and testing has been acquired.

In 2012, a 6,000 m² new facility for cryogenic and Subsea valves will be finished.

Ringo valves is expanding its facilities. 7,000 m² area. Completion date June 2012.
Ringo Key Factors

• WIDE RANGE OF VALVES MANUFACTURING / SUPPLY OF COMPLETE PACKAGES

• CUSTOMER ORIENTED COMPANY
  • Flexibility
  • Design and manufacturing to match customer requirement

• QUALITY

• EXPERIENCE
  • Personnel with over 30 years experience in Nuclear Valves

• SPARE PARTS SUPPLY / AFTER SALES SERVICE
Our Products & Services

Nuclear Products

- Valves to ASME code section III subsections NB, NC, ND & NN
- Valves in accordance with AD Merkblatter & KTA; class RC1, RC2, RC3, RC4, RC5 & basic safety class A1, A2, A3
- Valves to RCC-M code, class 1, 2, 3 & NN
- Valves to Russian standards OTT 87
- Including types such as: Gate, globe, check, butterfly, diaphragm, ball, bellow seal & control.
- Dedicated valves

Services

- Spare parts supply
- After sales services
- Spare Parts characterization
- Engineering support
- Supervision of valves assembly at Plant site
Our Main Customers in The Nuclear

Spain

Nuclear power plants:
- C.N. Trillo - PWR
- C.N. Almaraz I & II - PWR
- C.N. Vandellos II - PWR
- C.N. Zorita - PWR
- C.N. Garoña - BWR
- C.N. Cofrentes - BWR
- C.N. Asco I & II - PWR

Around the world

- CFE Laguna Verde (Mexico) - BWR
- Beznau Nuclear Power plant (Switzerland) - PWR
- Qinshan I & II Nuclear Power plant (China) - PWR
- Ringhals & OKG Nuclear Power plants (Sweden) - PWR
- DOEL NPP (Belgium) - PWR
- Koeberg (South-Africa) - PWR
- Forsmark Nuclear Power Plant (Sweden)
- Tihange Nuclear Power Plant (Belgium)
- Atucha II Nuclear Power Plant (Argentina)
- Embalse Nuclear Power Plant (Argentina)
- Kakrapar Nuclear Power Plant (India)
- Cernavoda Nuclear Power Plant (Romania)
- Bohunice Nuclear Power Plant (Eslovaquia)

More than 100,000 valves installed in NPP
From Cantabria, North Coast of Spain...

- Since 1973, permanent and continuous presence in civil nuclear equipment and services supply
- Owned by Sociedad Estatal de Participaciones Industriales (SEPI)
- Two subsidiary companies:
  - Enwesa (services)
  - WTS (engineering)
- State of art facility
- www.ensa.es

Map Coordinates:
Latitude 43° 25’ 3.61” N
Longitude 3° 44’ 55.96” W

...your Global Supplier
Products and Services

- Engineering
- Manufacturing
- Advanced Technology Centre
- Inspection Services
- Services at Plants
NSSS Manufacturing

- Reactor Vessels: 12
- Reactor Heads: 18
- Reactor Internals: 11
- Steam Generators: 125
- Pressurizers: 7
- Main Coolant Piping: 4

Total 177 NSSS Components
Non NSSS Manufacturing

- Reactor Supports
- Fuel Casks
- Fuel Racks
- Heat Exchangers
- Fuel Bundle Heads
- Non Nuclear

Total 188 Casks, and Racks in more than 20 NPPs
Services

- Racks installation
- Casks loading & fuel handling
- Heat exchangers
- Decommissioning
- Installation in NPPs
- Special projects
### NPP’S IN WHICH THERE ARE COMPONENTS SUPPLIED BY ENSA
(or pending of delivery)

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<thead>
<tr>
<th>ARGENTINA</th>
<th>FINLAND</th>
<th>(KOREA cont.)</th>
<th>SWEDEN</th>
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<tr>
<td>Atucha 2 R</td>
<td>Olkiluoto 1 RVI; R</td>
<td>Yonggwang 3 R</td>
<td>Forsmark 1 RVI</td>
<td>Sheeron Harris SG</td>
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<td>BELGIUM</td>
<td>Olkiluoto 2 RVI; R</td>
<td>Yonggwang 4 R</td>
<td>Forsmark 2 RVI</td>
<td>South Texas 1 SG</td>
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<td>Osksarnham 2 RVI</td>
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<td>Diablo Canyon 1 SG</td>
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<td>Farley 1 SG</td>
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<tr>
<td>Qinshan phase 2 - 4 SG</td>
<td></td>
<td></td>
<td>Farley 2 SG</td>
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<td>Samen 2 SG</td>
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<tr>
<td>Taishan 1 HX</td>
<td>Mutsu site C (note3)</td>
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<tr>
<td>Taishan 2 HX</td>
<td>Hamaoka C (note3)</td>
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<tr>
<td>CHINA (Taiwan)</td>
<td>KOREA</td>
<td></td>
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<tr>
<td>Kuosheng 1 R</td>
<td>Kori 2 SG</td>
<td></td>
<td>North Anna (esbwr)* RV</td>
<td></td>
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<tr>
<td>Kuosheng 2 R</td>
<td>Kori 3 R</td>
<td></td>
<td>Oconne C</td>
<td></td>
</tr>
<tr>
<td>Lungmen 1 R; T</td>
<td>Shin Ulchin 1 R</td>
<td></td>
<td>Peac Bottom C</td>
<td></td>
</tr>
<tr>
<td>Lungmen 2 R; T</td>
<td>Shin Ulchin 2 R</td>
<td></td>
<td>San Onofre C</td>
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</tr>
</tbody>
</table>

More than 85 NPP’s have or will have ENSA components
CONTRACTS AWARDED IN CHINA TO GROUP COMPANIES

• TECNATOM
  – Joint Venture CITEC: PSI/ISI CN Ling Ao
  – Control rooms for CN Fuqing, Fangjianshan and Hainan.
  – NPIC Electric penetrations for European NPPs

• ENSA
  – Steam Generators for Qinshan II NPP units 1-4
  – Spent fuel racks for Ling Ao 3&4.
  – Spent fuel transport cask for Daya Bay to Lanzhou.
  – Hainan NPPs Steam generators.
  – Taishan NPP (EPR) heat exchangers.
  – Sanmen Steam generators.

• RINGO
  – Qinshan 1&2 valves.
  – Spare parts for CNEIC

• ENUSA
  – Fuel rods ultrasonic inspection equipment
Ceremonies

ENSÁ’S President, F. Ballesteros and SNPEC’s general manager Sun Wenke signed the contract for the Sanmen steam generators supply (AP-1000) in the presence of Spanish Government President Mr. Rodríguez Zapatero and China State Council Vice President, Li Kequiang. (January 2011)

SNGC signs agreement with CNEA at Shenzhen in March 2011

Dinner offered by the SNGC to Chinese customers on March 2010 during the celebration of the International Nuclear Exhibition

Signing Ceremony of Cooperation Agreement between Tecnatom and NPIC. 2009
Qian Zhimin visits SNGC in Madrid (January 2011)

A delegation formed by the NEB (National Electric Bureau) and members of CGNPC (China Guangdong Nuclear Power Corporation) headed by Qian Zhimin, Vice Minister of Energy, Director of Energy Bureau of State Development & Reform Commission visited the SNGC at ENUSA and TECNATOM offices to reinforce the cooperation.

Qian Zhimin Vice Minister for NEB, Mr José L. Gonzalez ENUSA’S President, members of different CGNPC and ENUSA organizations and SNGC general manager
SNPEC visits SNGC in Madrid (January 2011)

A delegation headed by Sun Wen Ke, SNPEC General Manager which included other members of SNPEC, SMNPC, SEC and SENPEC attended presentation from SNGC companies at TECNATOM premises in Madrid. The meeting was in occasion of the signature of the Sanmen Steam Generators contract for Sanmen, with ENSA and the visit to Madrid of Li Keqiang. Vice primer minister of the State Council of the PRC and Qian Zhimin, Vice Minister of Energy. Director of Energy Bureau of State Development & Reform Commission i.e. SDRC.

SNPEC members during SNGC companies presentation at TECNATOM facilities.
The Spanish Nuclear Group/China (SNGC) take part in the Nuclear Exhibition at Shenzhen (Guangdong/China).

During April 6th to 8th the four companies of the SNGC: ENSA, ENUSA, RINGO VÁLVULAS and TECNATOM have participated in the International Nuclear Exhibition 2011 held at Shenzhen (Guangdong) in the Popular Republic of China. The group was supported by the “Foro de Industria Nuclear Española” and the Spanish State Agency ICEX. The four companies of the SNGC have shown in the booth their capacities and references for the supply of equipment and services for the nuclear power plants. The booth was visited by a great number of Chinese nuclear entities in search of further collaboration in the Chinese nuclear development.
Thank you for your attention!