Radioactive Waste Management National Policy in Spain

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Pablo Zuloaga
NUCLEAR IN SPAIN

- 57 TWh Nuclear origin produced in 2015 (21%)
- 10 Nuclear Reactors
- 7 reactors in operation at 5 sites
  - 7,400 MW
  - 21% of country’s electricity (2015)
- 2 NPP under decommissioning
- 1 NPP stopped (pending decision)

Electricity Balance 2015 (TWh)

<table>
<thead>
<tr>
<th>Source</th>
<th>TWh</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>57</td>
<td>21</td>
</tr>
<tr>
<td>Oil</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Natural Gas (CC)</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>Hydro</td>
<td>26</td>
<td>9</td>
</tr>
<tr>
<td>Nuclear</td>
<td>57</td>
<td>21</td>
</tr>
<tr>
<td>Renewables and CoGeneration</td>
<td>100</td>
<td>36</td>
</tr>
</tbody>
</table>

Total Generation 277 100%

Net Energy 268

Pumping -4

Demand 264
MAIN LEGAL TEXTS CONCERNING RW Mgt

- INTERNATIONAL LEGISLATION
  - Joint Convention on the Safety of SF and RWM
  - EURATOM

- DOMESTIC ACTS
  - Act 54/1997 on the Electricity Sector
  - Act 14/1999 on taxes and public prices of the Consejo de Seguridad Nuclear

- ROYAL DECREES
  - RD 102/2014, de 21 de febrero, for the responsible and safe management of nuclear spent fuel and radioactive waste

- MAIN PRINCIPLES
  - Prime responsibility rests on the waste producer
  - Waste management (including SF and decommissioning of NPPs) is an essential public service whose title is of the State
  - ENRESA is entrusted to provide this service
POLICY AND STRATEGY PLANNING

It falls to the Government to set policy on RWM and the dismantling and decommissioning of nuclear and radioactive facilities.

Approval by the Cabinet of Ministers

- Review: Every 4 years or when required by the MINETUR
- ENRESA draws up and submits to the MINETUR
- Information procedure:
  - CSN, CC.AA, organizations involved, social agents, …

Publication in web page

CONTENT
- Strategy
- Actions
- Technical solutions
- Economic and financial arrangements

HORIZON
- Short
- Medium
- Long Term
## ESTIMATED INVENTORIES (LILW, SNF, HLW, ILW-LL)

### LILW + VLLW

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Estimates $m^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>LILW</td>
<td>56,000 $m^3$</td>
</tr>
<tr>
<td>VLLW</td>
<td>120,000 $m^3$</td>
</tr>
<tr>
<td>TOTAL</td>
<td>176,000 $m^3$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Estimates FA (tU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNF ($UO_2$)</td>
<td></td>
</tr>
<tr>
<td>PWR</td>
<td>11395 (5136)</td>
</tr>
<tr>
<td>BWR</td>
<td>8389 (1504)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19784 (6640)</td>
</tr>
</tbody>
</table>

### HLW

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Amount (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLW</td>
<td>Canister CSD-V</td>
</tr>
<tr>
<td></td>
<td>68 (12)</td>
</tr>
</tbody>
</table>

### ILW-LL (Special Waste)

<table>
<thead>
<tr>
<th>Type</th>
<th>Total Amount (m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canister CSD-B</td>
<td>12 (2,14)</td>
</tr>
<tr>
<td>Canister CSD-C</td>
<td>12 (2,22)</td>
</tr>
<tr>
<td>Waste from reactor dismantling</td>
<td>530-600 m$^3$</td>
</tr>
</tbody>
</table>
- Estimated total cost ≈ 16,800 M€12 (1985-2080)
FINANCIAL ASPECTS

TOTAL REVENUES 2015
385 M€

RW + SF + DECOM of NPPs before 1st January 2010
Others

RW + SF + DECOM of NPPs after 1st January 2010

RW Juzbado
Decommissioning Juzbado
Institutional producers and others
Other revenues

TAX on electricity transport tolls
0.03%TR

TAX on NPPs Production
99.6% TR

TAX on Juzbado
0.12%TR

TAX on waste owners
0.010%TR

Financial flows
Audits and controls

NET FINANCIAL INCOME 2015
130 M€

FUND FOR FINANCING THE ACTIVITIES OF THE PGRR

INVESTMENT PORTFOLIO

As of 31st December 2015
4613 M€
ENRESA’s RESPONSIBILITIES

- Drafting and Proposal of National Strategy (PGRR)
- Treatment, conditioning, storage and disposal of SF and RW
- Site selection and the design, construction and operation of centers for the storage and disposal of RW
- Establishment of systems for the collection, transfer and transport
- Establishment and keeping of the National Inventory of SF and RW
- Operations arising from the decommissioning of nuclear installations
- Providing support to civil defense services in the event of nuclear emergencies
- Drafting and co-ordination of R+D Plans supporting RW Mgt
- Performance of the technical and economic–financial studies
- Management of the Nuclear Waste Management Fund
RWM SYSTEM IN SPAIN

VLLW + LILW POLICY

• Disposal of LILW
• Treatment and conditioning of LILW
• Characterisation and Verification tests
• Fabrication of Concrete containers
• Interim storage

• Auxiliary facilities
• Treatment of VLLW
• Disposal of VLLW

LILW Policy

♦ Large producers (NNPPs and Fuel fabrication):
  • Producers: Treatment and conditioning
  • ENRESA: Acceptance and Transport

♦ Institutional Producers
  • Producers: Sorting and preconditioning
  • ENRESA : Documentation, transport and conditioning
RWM SYSTEM IN SPAIN

6º PGRR. Gestión RBMA. Almacenamiento El Cabrillo

CELDA DE ALMACENAMIENTO

RED DE CONTROL DE INFILTRACIONES

SALA DE CONTROL

NAVE DE FABRICACIÓN DE CONTenedores

EDIFICIO ACONDICIONAMIENTO
**D+D ACTIVITIES**

**Vandellós I NPP**  
GGR 500 MWe (1973-1989)
- First D&D Phase completed (Level 2 IAEA)  
- Currently in latency period (25 years)

**José Cabrera NPP**  
PWR Westinghouse 160 MWe (1969-2006)
- D&D started in 2010  
- End of activities scheduled by the end of 2018

**PIMIC** (National Nuclear Research Lab)
- R&D reactor fully decommissioned  
- Nuclear Lab fully dismantled (CIEMAT)  
- Site remediation almost completed
POLICY AND STRATEGY FOR SF AND HLW

Open cycle – Direct Disposal of Spent Fuel

Reprocessing
Limited amounts of SF from José Cabrera and Santa María de Garoña NPP up to 1983

Total inventory of SF from Vandellós 1 NPP
All reactor SF pools where re-racked to compact racks in the 1990’s
Dry storage at Trillo NPP
- DPT dual purpose cask (21FA)
- Relicensed up to 49 GW/tU
- Capacity: 80 casks
- Commissioned in 2002
- 28 casks (588 FA)

Dry storage at José Cabrera NPP
- HI-STORM 100 / HI-STAR (canister-based system)
- Licensed for transport up to 45 GW/tU
- Capacity: 16 casks (4 for SW)
- Commissioned: 2009
- 12 casks with 377 FA

Dry storage at Ascó NPP
- HI-STORM 100 / HI-STAR (canister-based system)
- Licensed for transport up to 45 GW/tU
- Capacity: 32 casks
- Commissioned: 2013
- 5 casks with 160 FA
• ENSA’s ENUN52B dual purpose cask
  – Design approval for storage granted in November 2014.
  – Design approval for transport expected in this quarter.
  – Limited contents (low burnup fuel, high cooling times)

• ISFSI in licensing process by the Plant owner. Construction permit expected in this quarter.
  – 2 x 16 position pads at the open-air
  – First loading 2016. Uncertainties due to NPP situation on the restart of reactor operation.
ATC. THE CENTRALIZED SNF AND HLW STORAGE FACILITY PROJECT

• Defined as a priority in the 6th General radioactive Waste Plan

• Parliament supported:
  • In 2004, the Industry Commission of the Parliament unanimously asked the Government to develop an ATC facility
  • In 2006, the Parliament urged the Government to set up an Inter-Ministerial Commission to lead the site selection process

• Site selection Process
  • Launched in December 2009 with a decree establishing the criteria and procedure on a volunteer, public and participative process.
  • Technical report released in September 2010 pre-characterizing the eight (8) final candidates’ sites and providing proposal a candidate sites to the Cabinet
  • In December 2011 site selection is approved by Cabinet Minister (Villar de Cañas, Cuenca)
  • In October 2012 selection and purchase of the plot of land
ATC LICENSING. MAIN MILESTONES

• June 2013, Initiation of the Environmental Impact Assessment Procedure
• January 13th, 2014: Application for the
  • Previous or Site Authorization
  • Construction Authorization
• 2014: Public Enquiry and Consultation to stakeholders procedure for the EIA
• July 27, 2015: CSN favorable report to MINETUR to the Previous or Site Authorization.
• July 28, Decision of the Regional Government of Castille-La Mancha for the initiation of the extension of the nearby (11 km) Zone of Special Protection for Birds – ZEPA – of Laguna de el Hito
  • Extension approved by Regional Gvt October 2016
  • Decision appealed by the Government before the Superior Court of Justice
  • Study on affection of the project on the extended zone of special protection submitted October 2016
DEEP GEOLOGICAL DISPOSAL. PREVIOUS WORKS

- Site identification Program: 1986-1996
  - Stepwise Screening
  - To a phase where drilling boreholes became necessary

- Deep Geological Repository design and associated Performance assessment (1990-2004) in three steps:
  - Disposal concept and basic design
    - Carbon steel canisters placed horizontally in parallel galleries, with Calcium-Bentonite seal
  - Strengthening the bases of the concept
  - Optimization through requirements review

- Three rocks; 2 basic design + Performance Assessment performed (granite and clay)

- R&D projects, including experimental work in foreign underground laboratories
DGD General Lay-out

Conceptual Design in Clay Formations

- 3600 canisters
- 260 m deep

Drifts
- 2.4 m. diametre
- 500 m long
- 50 m distance
- 30 cm concrete support

Bentonite barrier
- 75 cm thick
- 2 m pitch max. temp
- 1.5 cm thick steel cover
- 1.6 tcm³ dry density
- 5 MPa swelling pressure
TENTATIVE SCHEDULE AND MILESTONES. SF AND HLW REPOSITORY

**Phase 1 (2013-2020):** Updating knowledge

**Phase 2 (2020-2023):** Assessment of information

**Phase 3 (2023-2027):** Elaboration of a procedure for Site Designation

**Phase 4 (2028-2035):** Assessment of candidate sites

**Phase 5 (2036-2050):** Site characterisation and validation

**Phase 6 (2051-2063):** Repository licensing and construction

**Phase 7 (2063-2068):** Testing and Start of Operations

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**ACTIVITIES**

- Start of operations
- Testing period

**2013**
- Report on options & site designation procedure
- Government assessment and recommendation

**2020**
- Site selection procedure
- Inventory of candidates sites

**2023**
- Site designation

**2027**
- Phase 3 (2023-2027): Elaboration of a procedure for Site Designation

**2028**
- Phase 4 (2028-2035): Assessment of candidate sites

**2035**
- Phase 5 (2036-2050): Site characterisation and validation

**2050**
- Phase 6 (2051-2063): Repository licensing and construction

**2063**
- Phase 7 (2063-2068): Testing and Start of Operations

**2068**
- License application
- Facility construction

**Repository design**
- URL
- Pilot plant
- ISAR & EIA
CURRENT CHALLENGES

• ATC:
  • Legal procedure and Environmental Impact Statement.
  • Need of additional storage capacity at most NPP sites.
• High Burnup Spent Fuel Transportation requirements
• Acceptance criteria, Characterization and Classification of SNF (damaged/undamaged)
• Joint Group with NPPs
CONCLUSIONS

• **ATC: a priority for the SF and HLW management**
  - Gives time before the final decision making that today depends on trends and technological and social advances
  - Based on Generic Design approved by CSN (2006)
  - Site seceded by the Government after a volunteer and participative process (2009-2011)
  - CSN favorable report to Previous or Site Authorization (2015)
  - Process conditions by Regional Gvt decision, now in Court

• **The increase of storage capacity on NPP sites is needed**

• **Research includes extended storage conditions. Research on geological disposal and on advanced recycling options will continue on a scale adapted to plan time frame.**
  - Need for maintaining momentum

• **Reports to the Government (2014) on**
  - Generic Design of Deep Geological Disposal
  - Management options and feasibility of advanced separation and transmutation
  - Decision making processes
THANK YOU!!