

Radioactive Waste Management National Policy in Spain

IGDTP Exchange Forum

Cordoba, Spain

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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)

	TWh	%
COAL	57	21%
OIL	7	3%
NATURAL GAS (CC)	30	11%
HYDRO	26	9%
NUCLEAR	57	21%
RENEWABLES AND COGENERATION	100	36%
TOTAL GENERATION	277	100%
NET ENERGY	268	
PUMPING	-4	
IMP/EXP	0	
DEMAND	264	

MAIN LEGAL TEXTS CONCERNING RW Mgt

■ INTERNATIONAL LEGISLATION

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

■ DOMESTIC ACTS

- Act 25/1964, de 29 de abril, on Nuclear Energy as amended by Act12/2011, Act 11/2009 and Act 2/2011
- Act 54/1997 on the Electricity Sector
- Act 15/1980, that establishes the Consejo de Seguridad Nuclear (Nuclear Safety Council) amended by 33/2007
- Act 14/1999 on taxes and public prices of the Consejo de Seguridad Nuclear

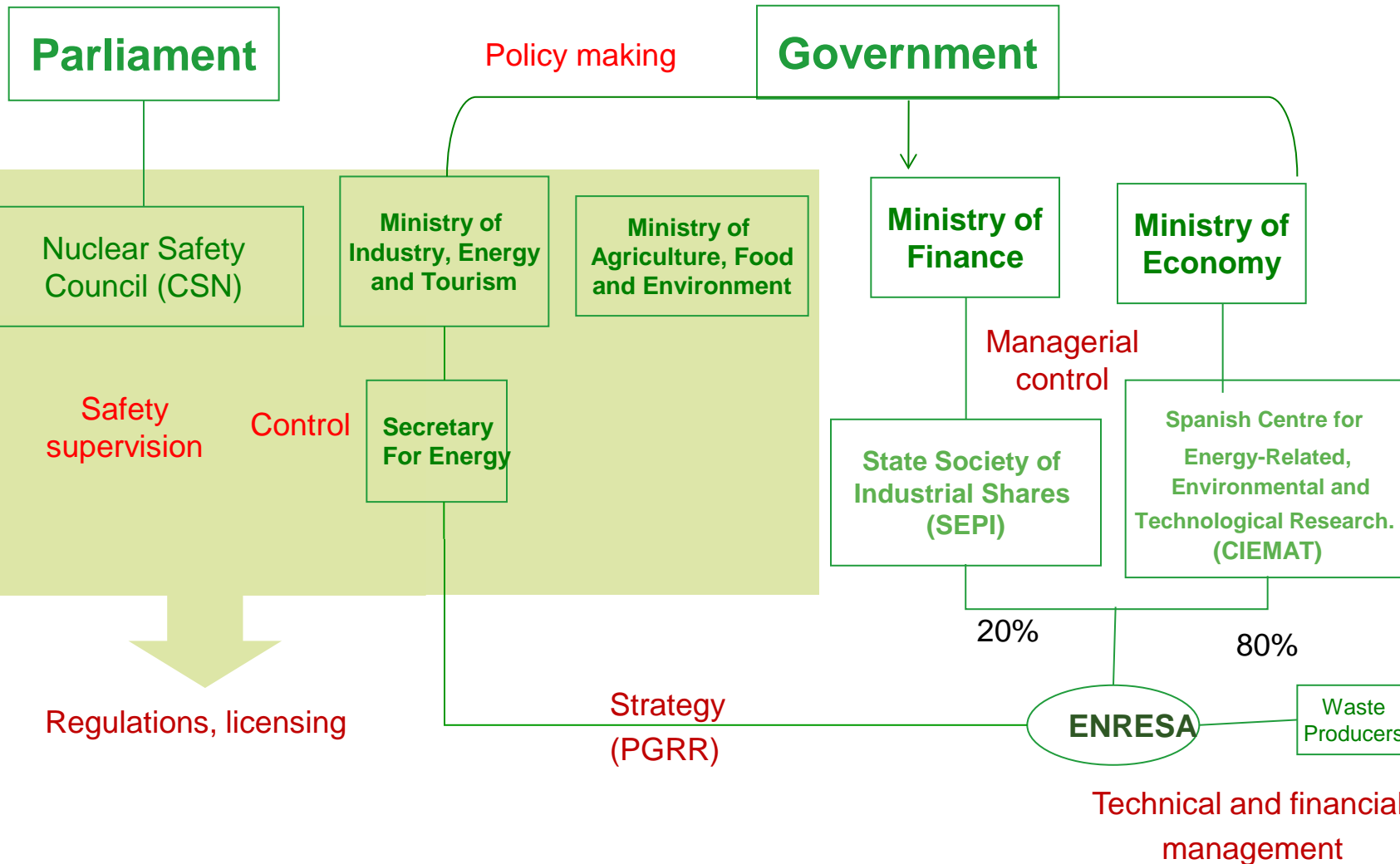
■ ROYAL DECREES

- RD 102/2014, de 21 de febrero, for the responsible and safe management of nuclear spent fuel and radioactive waste
- R.D. 1836/1999 Rules for nuclear and radioactive facilities as amended by R.D. 35/2008 and R.D. 1836/1999

■ 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

INSTITUTIONAL FRAMEWORK



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



Reporting to Parliament



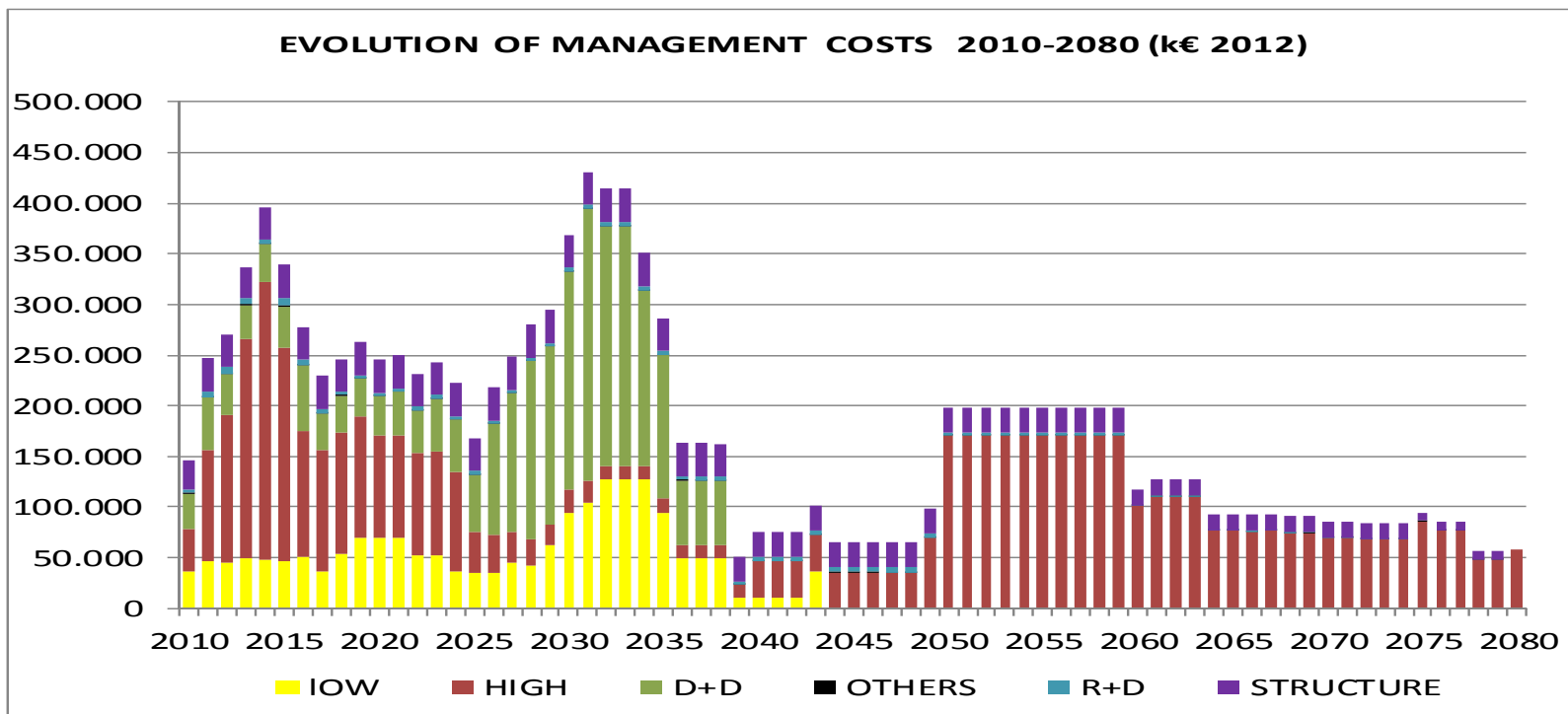
ESTIMATED INVENTORIES (LILW, SNF, HLW,ILW-LL)

	Type	Total Estimates m ³
LILW + VLLW	LILW	56,000 m ³
	VLLW	120,000 m ³
	TOTAL	176,000 m ³

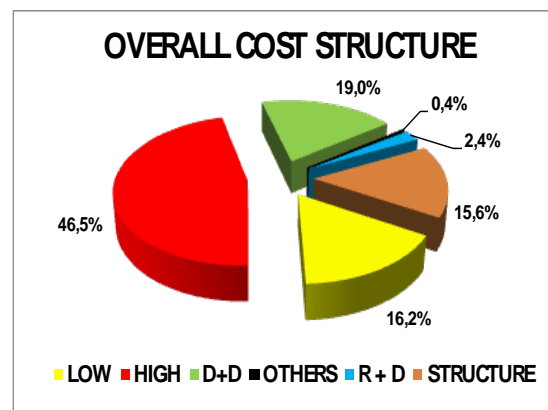
	Type	Total Estimates FA (tU)
SNF (UO ₂)	PWR	11395 (5136)
	BWR	8389 (1504)
	TOTAL	19784 (6640)

	Type	Total Amount (m ³)
HLW	Canister CSD-V	68 (12)
ILW-LL (Special Waste)	Canister CSD-B	12 (2,14)
	Canister CSD-C	12 (2,22)
	Waste from reactor dismantling	530-600 m ³

COSTS ASSESSMENT. OVERALL & PROFILE



- Estimated total cost \approx 16.800 M€12 (1985-2080)



FINANCIAL ASPECTS

THE FUND

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

NET FINANCIAL INCOME 2015
130 M€

FUND
FOR FINANCING THE
ACTIVITIES OF THE
PGRR
INVESTMENT PORTFOLIO

As of 31st December
2015

4613 M€

FOLLOW UP AND
CONTROL
COMMITTEE

MINETUR

COURT OF ACCOUNTS

STATE INTERVENTION

MINISTRY OF
THE TREASURY

EXTERNAL AUDITORS

ASSET
MANAGEMENT

FINANCIAL
REVENUES

FINANCIAL
MARKETS

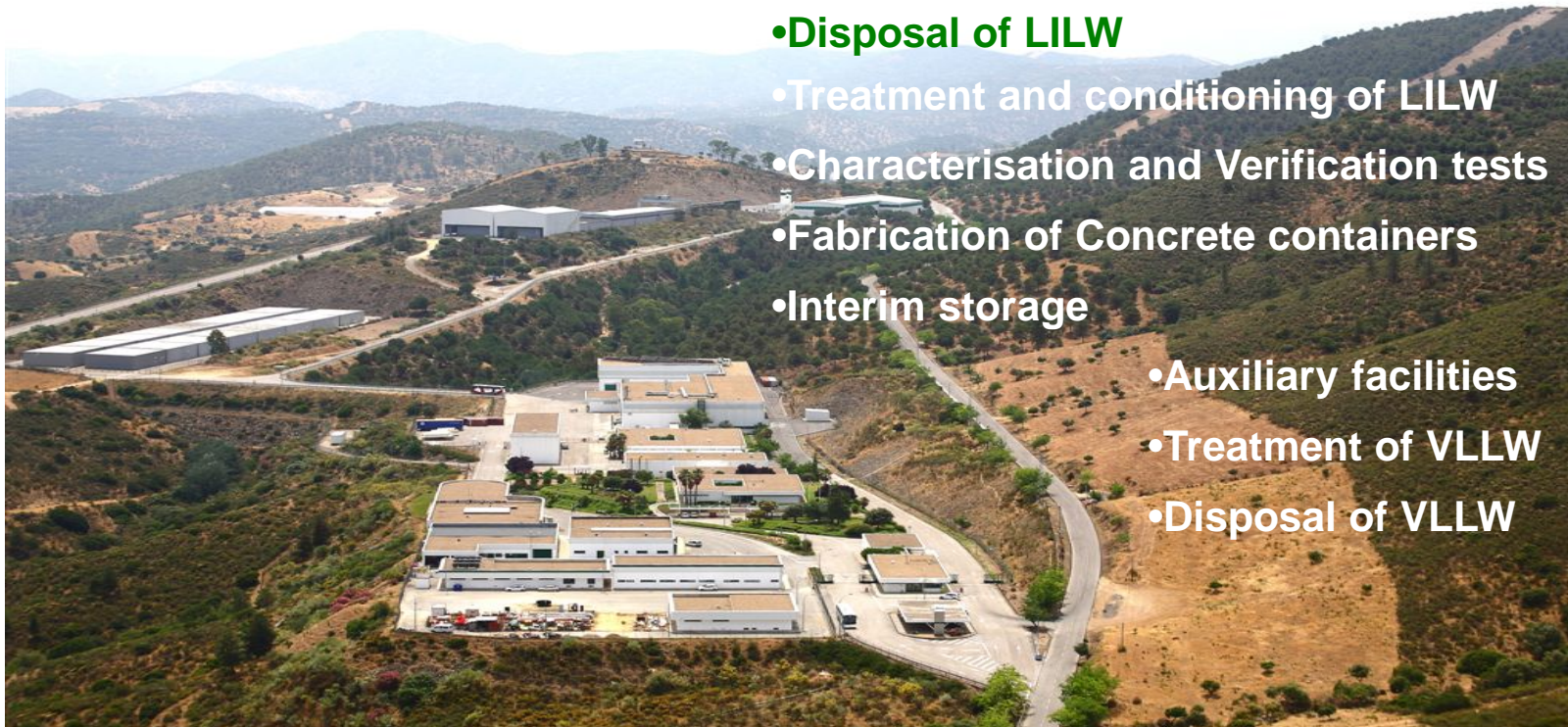
Financial flows

Audits and controls

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

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

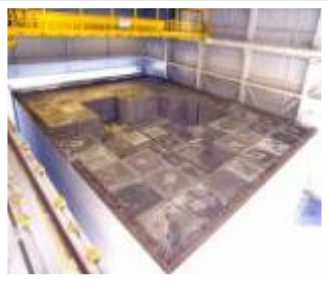
LILW Policy

◆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



CELDA DE ALMACENAMIENTO



NAVE DE FABRICACIÓN DE CONTENEDORES



RED DE CONTROL DE INFILTRACIONES



SALA DE CONTROL



EDIFICIO ACONDICIONAMIENTO

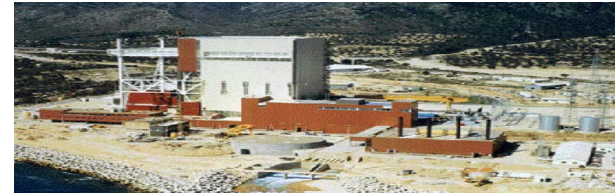
D+D ACTIVITIES

Vandellós I NPP

GGR 500 MWe (1973-1989)

- First D&D Phase completed (Level 2 IAEA)
- Currently in latency period (25 years)

BEFORE



AFTER



José Cabrera NPP

PWR Westinghouse 160 MWe (1969-2006)

- D&D started in 2010
- End of activities scheduled by the end of 2018

BEFORE



AFTER



PIMIC (National Nuclear Research Lab)

- R&D reactor fully decommissioned
- Nuclear Lab fully dismantled (CIEMAT)
- Site remediation almost completed



BEFORE



AFTER

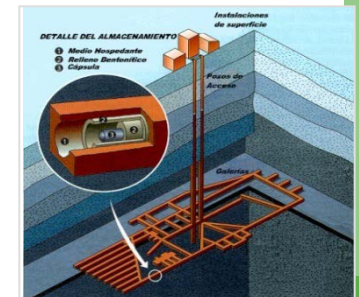
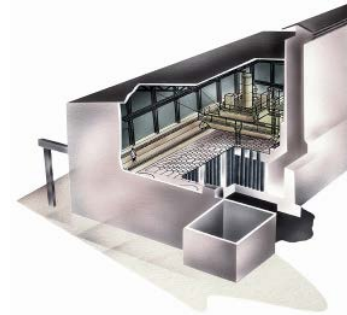
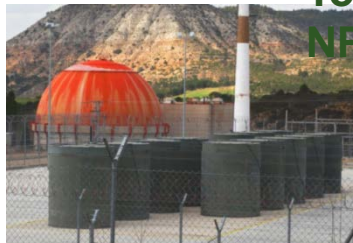
POLICY AND STRATEGY FOR SF AND HLW

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



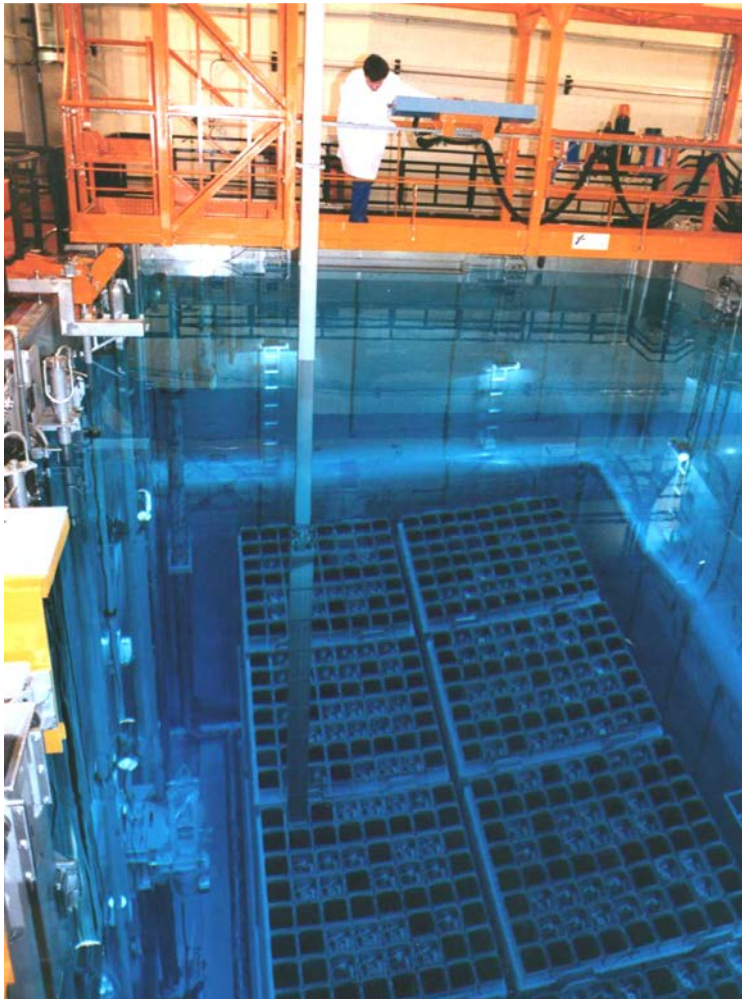
1.- Reracking
90's

2.- in situ
2000-2016

3.- ATC
2018-2077

4.- DGP
2068-

All reactor SF pools where re-racked to compact racks in the 1990's



DRY STORAGE AT REACTOR SITES (IN OPERATION)

TRILLO



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)

JOSÉ CABRERA



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

ASCÓ



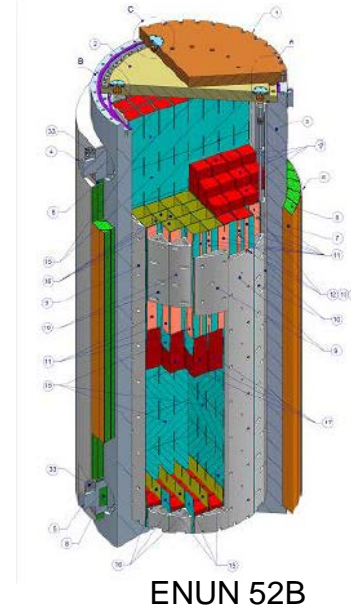
Dry storage at Ascó NPP

- 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

DRY STORAGE AT REACTOR SITES (IN CONSTRUCTION)

NEW DRY STORAGE FACILITY SANTA M^a DE GAROÑA NPP

- 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 – CENTRALIZED INTERIM STORAGE INSTALLATION



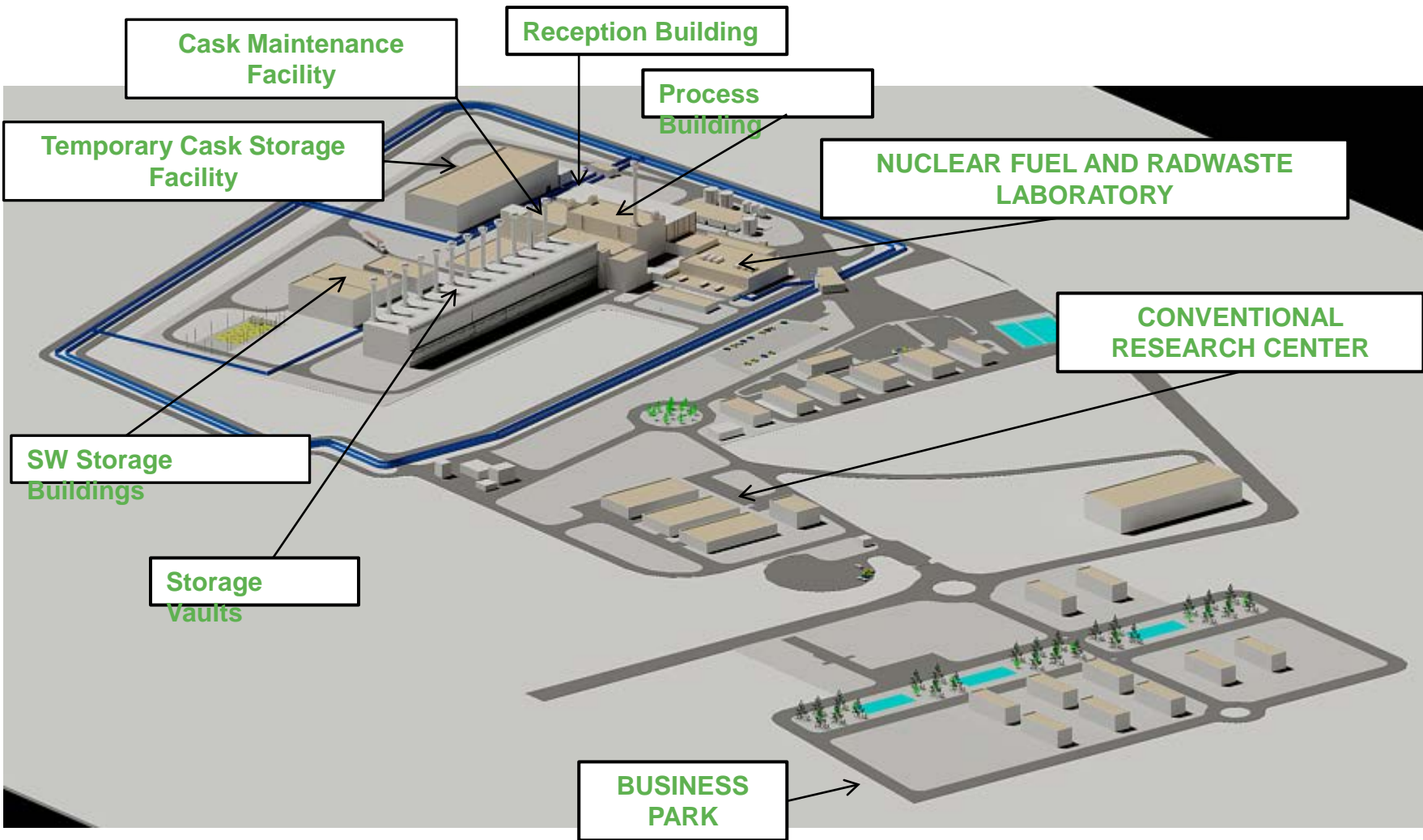
Centralized Interim Storage Installation (ATC)

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 LAYOUT



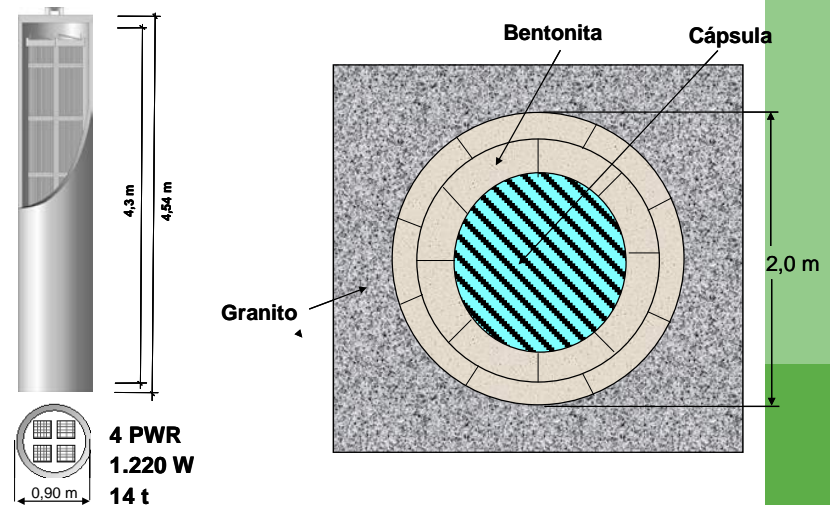
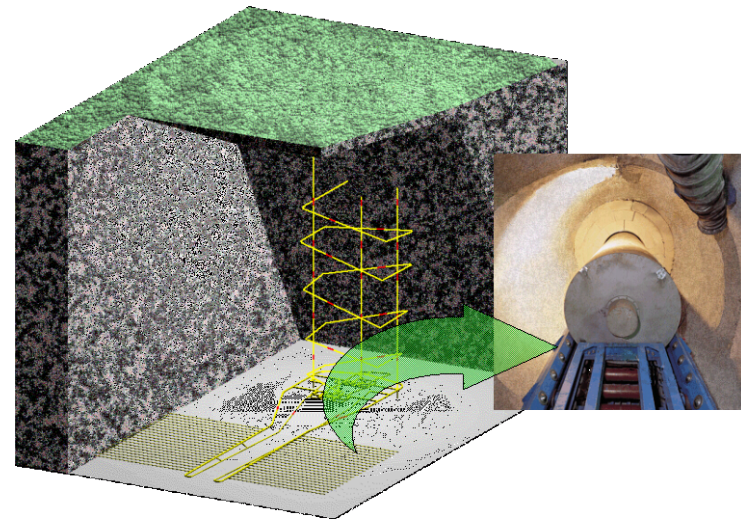
ATC LICENSING. MAIN MILESTONES

- 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

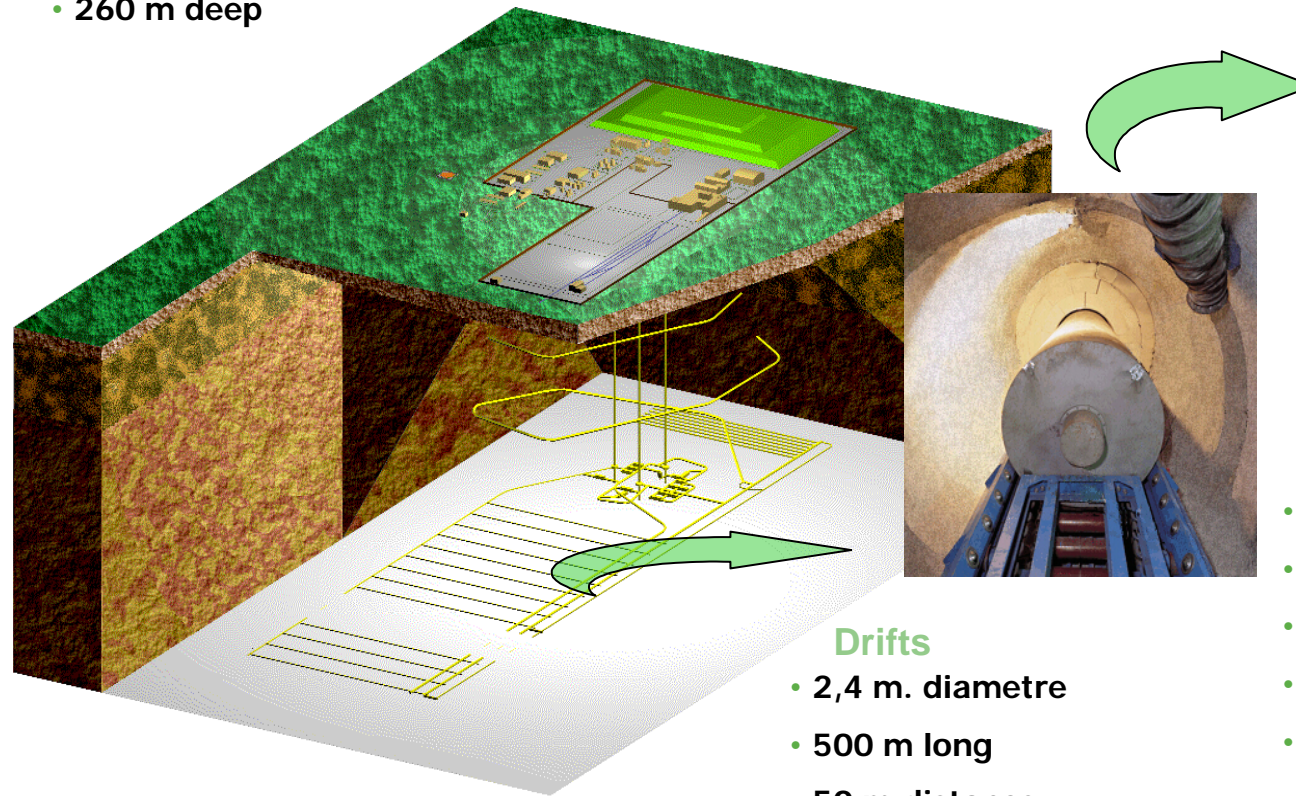
- Site identification Program: 1986-1996
 - Stepwise Screening
 - To a phase where drilling boreholes became necessary
- Deep Geological Repository design and associated Performance assessment (1990-2004) in three steps:
 - Disposal concept and basic design
 - Carbon steel canisters placed horizontally 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. diameter
- 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

MILESTONES

ACTIVITIES

Start of operations
Testing period

2068

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

License application
Facility construction

2063

Phase 6 (2051-2063) Repository licensing and construction

Repository design
URL
Pilot plant
ISAR &EIA

2050

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

Site designation

2035

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

Site selection procedure
Inventory of candidates sites

2027

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

Government assessment and
recommendation

2023

Phase 2 (2020-2023): Assessment of information

Report on options & site
designation procedure

2020

Phase 1 (2013-2020): Updating knowledge

2013



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

- **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

THANK YOU!!



GOBIERNO
DE ESPAÑA

MINISTERIO
DE INDUSTRIA, ENERGÍA
Y TURISMO

