

CIEMAT and CEIDEN (Nuclear R&D at Spain)

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CIEMAT: Basic data

Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

Personnel (2012): 1.370 (including Ph. D. students)

Operational Budget (2012): 101 M€

External Income (2012): 37 M€

Objectives: Promote and execute R&D activities, in the fields of energy, environment and technology, including specific fields of basic research.

Center of reference in the areas of its expertise, collaborate with other national R&D centers, universities and enterprise.

R&D activities in the framework of the EU and cooperate with intergovernmental bodies and R&D centers from other countries, with special attention to Latin America and the Mediterranean.

CIEMAT sites



Estudios Sociotécnicos (CISOT)

Energías R

Energías Renovables (CEDER)

Derecho Ambiental (CIEDA)

CIEMAT (Madrid)

Plataforma Solar de Almería (PSA)



CIEMAT and the Spanish nuclear sector





GOBIERNO DE ESPANA MINISTERIO DE ECONOMIA Y COMPETITIVIDAD MINISTERIO DE ECONOMIA Y COMPETITIVIDAD

- Provide Scientific and Technical Support to the Spanish Nuclear Waste agency (ENRESA), Nuclear Safety Council (CSN) and the nuclear industry as a whole.
- To promote and participate on National and International R&D projects for the development of and improvement of nuclear energy and the management of its environmental impact.





RMBA

Nuclear Fission Division: Laboratories

Fuel & HLW laboratory gloves boxes







LILW lab: Irradiated graphite treatment











Laboratory for test and development of Neutron detection system for Nuclear Data and Integral experiments

- ✓ The Structural Material Division is focused on the structural materials behaviour in energy production systems:
 - Nuclear power plant in operation (light water reactors)
 - Future nuclear power plant (Gen IV)
 - Renewable energies
 - o Concentrated thermal solar (CTS): Energy Storage
 - o Biomass

DE ECONOMÍA X COMPETITIVIDAD

- Coal fired power plant
 - o Advance materials

Energéticas, Medioambientales v Tecnológicas

Structural materials:

-Reactor Pressure Vessel Steels
-Ferritic/Martensitic Steels
-Austenitic Stainless Steel
-Ni-based Alloys
-Oxide Dispersion Strengthened
(ODS)



Structural Materials Division: Aim and scope



TEM FEGSEM-EBSD SEM-EDX-EBSD XPS AUGER Nanoindenter

Structural Materials Division: Nuclear Fission Framework

-MATISSE

EERA Joint of **Nuclear** International **Materiales Agreements NUGENIA** -Halden -IAEA CRPs 4FWP: - DISWEC **Spanish National R&D** Plan European Projects 5FWP: -LWR -Research projects -TECLA -Advanced reactors -High temperature -SPIRE materials -INTERWELD Structural -PRIS -CASTOC **Materials** -AMES Division Spanish 6FWP -EUROTRANS-DEMETRA Regulatory **EPRI Contracts for** -VELLA **Body Research projects** -HELIMET -Research projects -Ni-based alloys -PERFECT -Technical support -NULIFE Spanish Utilities 7FWP -UNESA -HELIMNET -Research projects -PERFORM60 -LONGLIFE -Failure analysis -GETMAT -MATTER

iemat

Centro de Investigaciones

Energéticas, Medioambientales y Tecnológicas

MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

GOBIERNO DE ESPAÑA

EDUCATION TRAINING & TUTORING

MODALITIES

<u>Face to Face</u>: Nuclear Technologies, Radiation Protection, R. Wastes Decontamination, Characterization,

E-learning & Virtual Centre

EDUCATION & POSTGRADUATE PROGRAMS on Nuclear Technology

Master program on en Nuclear Engineering and Applications

SPECIALIZED PROGRAMS

- Dismantling and Decommissioning
- Nuclear Safety and Security
- Materials
- Fusion

VIRTUAL CENTRE

- E-learning
- B- Learning
- Training support
- National & International Projects

SPECIALIZED PROGRAMS

- Radiation Measurement and Dosimetry
- Characterization and wastes management
- Safety Assessment Methodologies for Near Surface Radioactive Waste Disposal

OCUPATIONAL Training Programs

FP7 projects: P. DIANE, P. TIARA, P. ENETRAP, P. EUTERP IAEA: S. C. Strategy on E&T in Radiation Protection and Waste Safety



CEIDEN: The Nuclear Fission R&D Technological Platform



What is it? A Spanish entity for the coordination of the R&D needs and efforts in the field of the fission nuclear technology. It has no resources of its own, but it manages projects for about 13 M€, contributed specifically by the participants in these projects.

What does it do? It allows to set up collaborative projects and to have a single national position in relation to international proposals or compromises.

Who forms part of CEIDEN? CEIDEN includes all the sectors (Utilities, Industrial, Services, Regulator, Universities, Laboratories, etc.) related to the nuclear R&D in Spain. Its scope includes NPP currently in operation as well as new designs of reactors.

SOME HISTORY...



Year 1999

Comisión Estratégica de I+D Nuclear (CEIDEN)

•Promoted by the Ministry of Industry and Energy, in collaboration with the CSN, the Utilities and the main related agents.

• Its objective was to coordinate the different R&D national plans and programs, as well as the participation in international programs.

Year 2007 CEIDEN TECHNOLOGICAL PLATFORM

 With the aim to extend the participation to more entities with interests in the nuclear R&D, the TP of R&D about fission nuclear energy is created.

CEIDEN Members (Total 89+6)

SECTOR	Members	SECTOR	Members
Electric Utilities	4	Engineering & Construction	22
Fuel Cycle	2	Equipment supply	6
R&D centers	14	Services	20
Universities	14	Administration	3
Others	5	Colaborating members	6

International relations:

- UE: Sustainable Nuclear Energy Technological Platform (SNETP)
- Iberoamérica: Red Mexicana de Educación, Capacitación e Investigación Nuclear (REMECIN)



HOW DOES TP CEIDEN WORK?

General Assembly

Managing Board (15 Members)

- **Electric Utilities**: Endesa, Iberdrola and Gas Natural Fenosa.
- Fuel Cycle: ENUSA and ENRESA
- R&D Centers*: CIEMAT and TECNALIA
- Universities*: UPM
- Engineering & Construction*: Gas Natural Fenosa Engineering and Acciona
- Equipment supply*: ENSA
- Services*: TECNATOM
- Consejo Seguridad Nuclear
- Ministerio de Industria, Energía y Turismo
- Ministerio de Economía y Competitividad
- * Rotary representation renewed every 2 years.



Requirements to be a CEIDEN activity:

- Be of interest to a number of CEIDEN members (three or more).
- Be of notable technical or economical importance.
- Refer to aspects in which the Spanish Nuclear Sector can give added value to the activities that are being developed in the international programs.

The development of the programs or projects are managed by specific Working Groups, contributing each participating entity to the costs of the research as agreed in the W Group.

Chairman: Antonio Colino
Secretary: Pio Carmena (ENDESA)



STRATEGIC AGENDA



Horizontal topics: R&D infrastructures; Training, etc.



Material behavior



Studies of materials from Jose Cabrera NPP (dismantling after 40 years operation)



ZIRP Project:

◇Objective: Cut and extract part of the reactor internals to test the metallic materials and evaluate the aging and the degradation of its properties
◇Participants: CSN, ENRESA, Gas Natural Fenosa, UNESA/CCNN, CIEMAT, GNF Engineering, ENSA & TECNATOM EPRI, W, STUDVICK, NRC
◇Realization: 2007-2012 Budget: 700 K€

Concrete Project:

◇Objective: Cut and extract part of the reactor and spent fuel pool concrete structures, to experimentally evaluate the variation of the characteristics of this material
 ◇Participants: CSN, ENRESA, Gas Natural Fenosa, ENDESA, GNF Engineering & Instituto Torroja (CISDEM)
 ◇Realization: 2011-2016 Budget: 1.142 K€



Nuclear Fuel



Spent fuel storage and transport programs

- Objetive: Forum to promote and coordinate R&D projects related to spent fuel, that can add technical criteria for its management
 Participants: CSN, ENRESA, ENUSA, UNESA/CCNN, CIEMAT, GNF Engineering, ENSA, TECNATOM, ETSICM EPRI, W, DOE, ONL; IRSN y EDF; Vatenfall y NEA/OCDE



Almacenamiento temporal centralizado de residuos de alta actividad

preliminar



Projects:

- * Zirlo PWR cladding fluency with high burnup: Finished
- Sircaloy 2 BWR cladding fluency: In course
- High burnup PWR fuel isotopic composition: Finished
- BWR fuel isotopic composition: In course
- Cladding material fracture criteria: Finished
- Breakage by small speed impacts: In course
- Spanish participation in the "Extended Storage Collaboration Program (ESCP)" promoted by the USA Nuclear Sector
- Preparation of future ATC (centralized interim storage for 60 years) needs and technical criteria
- **Fukushima consequences**: Renewed interest for the spent fuel properties and behaviour

Radiation Protection and Radwaste management CEIDEN

In Vitro internal dosimetry development

- Objective: Increase the Spanish capacities to evaluate internal doses due to alpha & beta emitters through biological samples
 Participants: CIEMAT, UNESA, ENUSA, ENRESA, CSN, Tecnatom, Geocisa, Medidas Ambientales, Iberdrola Ingeniería y GNF Engineering
- Realization: 2007 FINISHED

Neutronic patrons calibration laboratory:

- Objective: Promote the specifications of industrial and R&D applications for these laboratories (CIEMAT and ETSIIM-UPM)
- Participants: CIEMAT, ETSIIM, UAB, CC.NN/UNESA, SEPR, CSN, ENRESA y ENUSA
- ✤ Realization: 2012-2015



New nuclear designs



JULES HOROWITZ REACTOR PROJECT

- Objective: Participate in the design, construction and operation of the French nuclear fission experimental reactor Jules Horowitz.
- Participants: Spanish Consortium: CIEMAT, CSN, ENUSA, TECNATOM, Empresarios Agrupados, ENSA y GNF Engineering
- Realization: 2006-2014 (construction)
- **& Budget:** 10 M€
- This Spanish contribution gives the Spanish Consortium 2% of the rights of use of this installation for future R&D projects that may need samples irradiation or manipulation of active material



SPANISH ESNII PROGRAM

- Objective: Participate in the SNETP European Sustainable Nuclear Industrial Initiative (ESNII)
- Participants: CIEMAT, Iberdrola, Tecnatom, Empresarios Agrupados, ENSA, GNF Engineering, UPM y UPV.
- Realization: 2011-2020
- Budget: Pending



Horizontal topics

Online Presentations on Safety Standards Training	Fuel Cycle Facility Safety	Standards
Quick-links to other Training Materials in the same area	ASR-S Studie: ALAS Stirty Regiments 102 Servery of PSMT minim Servery of PSMT minim PSM-12 Starty of Industry Parts: PSM-12 Starty of Parts: PSM-12 Starty	

CAPACIDADES ESPAÑOLAS PARA AFRONTAR UN NUEVO PROYECTO NUCLEAR

CEIDER

EDUCATION & TRAINING GROUP: "CEIDEN F+"

- Objective: Promote the national E&T programs coordination and the Spanish participation in international programs and networks (UE, EUROSAFE/ENSTTI, OIEA, Iberoamérica)
- Participants: CIEMAT, TECNATOM, CSN, MINETUR, UPM, UAB, EHU, UPV, ENUSA, Foro Nuclear, Thunder, INDRA, TITANIA y Endesa
- Realization: Permanent Group

SPANISH NUCLEAR CAPACITIES

* Objectives:

- Phase 1: Analize the present capacities of the Spanish nuclear industry to develop a new nuclear project
- Phase 2: Promote the neccesary calification of the Spanish suppliers to participate in new nuclear projects (Gen 3+) in Spain and abroad.
- Participant: Endesa, Iberdrola, Gas Natural Fenosa, Foro Nuclear, W, GE, AREVA
- Realization: 2007-2011; 2012-2013

Nuclear Safety & Security after Fukushima

Organization of the safety chain, Normative, How to handle with catastrophic combinations of very low probability events,

Emergency preparedness and response,

Best estimate (vs. conservative) safety codes, better basic data and associated uncertainties.

High & Intermed. level R.W. Complete, publicly acceptable, management strategy

Management of legacy wastes: E.g.: graphite, Implementing the Deep Geological Repository, R&D for Waste minimization, Closed cycle: Reprocessing, Partitioning and Transmutation.

Long term sustainability

Fast systems and closed cycle, ESNII: When and How to go to the demonstration phase.

Building the Spanish Centralized Interim HLW storage (ATC) and laboratories

Optimizing the design and developing the capabilities for ATC construction, and Building national capabilities for R&D on irradiated fuel.

Long term operation of present power plants

Materials performance and ageing: Basic ageing mechanism, modelling, monitoring, Prevention and mitigation of ageing, industrial obsolescence,...

Preparing and participating in the new build

Pre-normative R&D for Harmonization of Codes &Standards, Preparing common grounds and scientific basis for safety regulation and licensing. Building and maintaining human and technical capabilities and competitivity.





Extra Slides

Main actors of Nuclear Energy at Spain - 2013

- 8 NPP in operation (6 PWR and 2 BWR) aprox. 20% of the electricity in Spain (Utilities: Iberdrola, Endesa, Gas Natural/Fenosa, Nuclenor, HCEnergia)
- **CSN**: an Independent Nuclear Safety Council (Regulatory Body).
- **ENRESA:** a public enterprise responsible and with funds for Radioactive waste management. ENRESA operates EI Cabril LMRW storage, it is building an Interim Dry Centralized Storage (ATC) and dismantling 1 NPP.
- **ENUSA:** Juzbado Fuel manufacturing plant.
- **ENSA:** Heavy equipment (nuclear grade) supplier.
- **Engineering**: Several companies with a large nuclear portfolio: Tecnatom, Empresarios Agrupados, Sener, Initec, Iberinco, Idom, Gas Natural, Geocisa,...
- **CIEMAT** and other research organizations with significant nuclear programs
- Universities: Several Univ. with training and R&D on Nuclear Physics and Engineering
- **CEIDEN Technological Platform**: Coordination of R&D&I in Nuclear Energy
- Ministry of Economy and Competitivity & M. of Industry, Energy and Tourism

Main elements of the Nuclear R&D at Spain - 2013

- CSN: R&D on Radiological Protection, Evaluation and Reduction of Radiological impact and Wastes, Management of Nuclear & Radiological emergencies... Recently: R&D related to Fukushima, Stress tests, Security,...
- ENRESA:R&D on Geological Disposal and on Partitioning and Transmutation, waste
characterization, minimization and management.Recently:R&D in support to Interim Dry Centralized Storage and laboratories.Recently:
- **ENUSA**: R&D related to nuclear fuel.
- **UNESA**: R&D promoted by the Spanish Association of the Electrical Industry.
- Ministry of Economy and Competitivity: support to energy R&D by grants and loans. Recently: New State R&D plan prioritizing Sustainable Nuclear Fission.
- **CIEMAT**: R&D programs in different aspects of nuclear energy science and technology.
- **CEIDEN Technological Platform**: Coordination of R&D&I in Nuclear Energy.

+ EURATOM, EERA, SNETP (ESNII, NUGENIA), EPRI, NEA/OECD and IAEA.