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Accompanying the

**COMMUNICATION FROM THE COMMISSION
TO THE COUNCIL AND THE EUROPEAN PARLIAMENT**

Nuclear Illustrative Programme

**Presented under Article 40 of the Euratom Treaty for the opinion
of the European Economic and Social Committee**

**Annex 2
for the Draft Nuclear Illustrative Programme**

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COMMISSION STAFF WORKING DOCUMENT

Annex 2 for the Draft Nuclear Illustrative Programme Summary of nuclear fuel cycle activities carried out in individual EU Member States

DRAFT PRESENTED UNDER ART. 40, EURATOM TREATY FOR OPINION OF THE
EUROPEAN ECONOMIC AND SOCIAL COMMITTEE

Figure 1 - MS Share in the EU-Nuclear Production

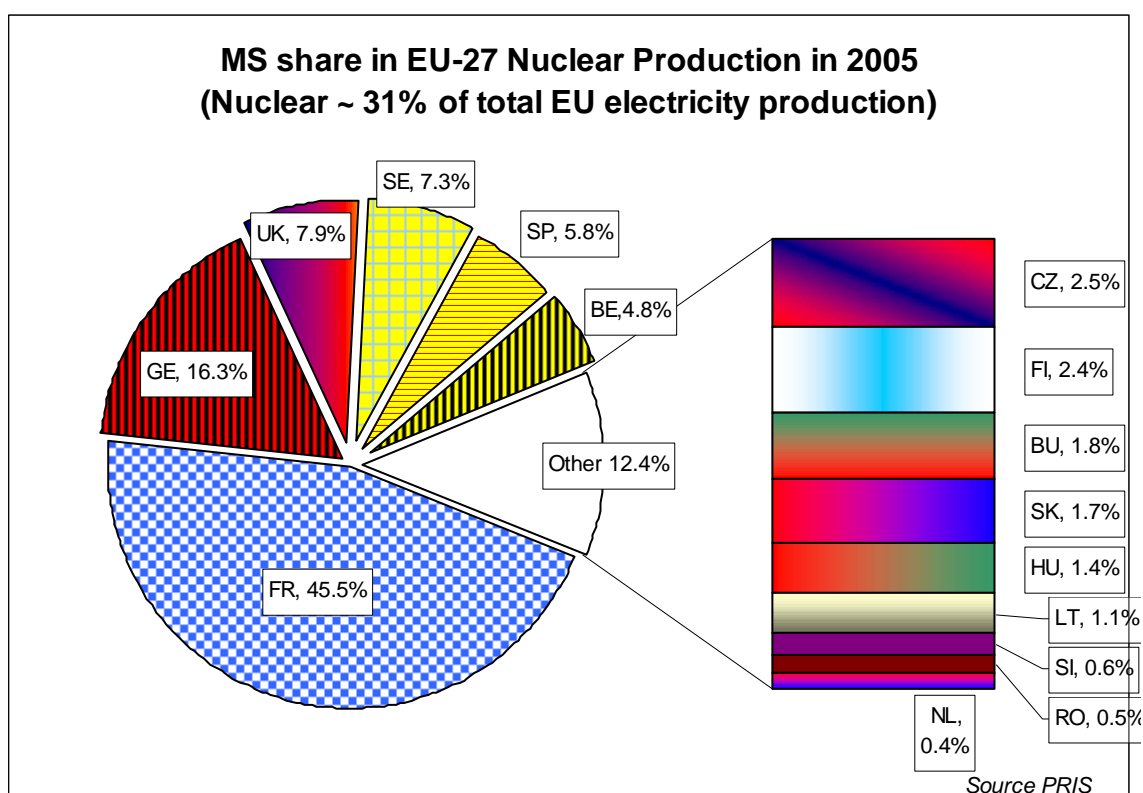


Table 1: Primary Energy used for Electricity Production in MS

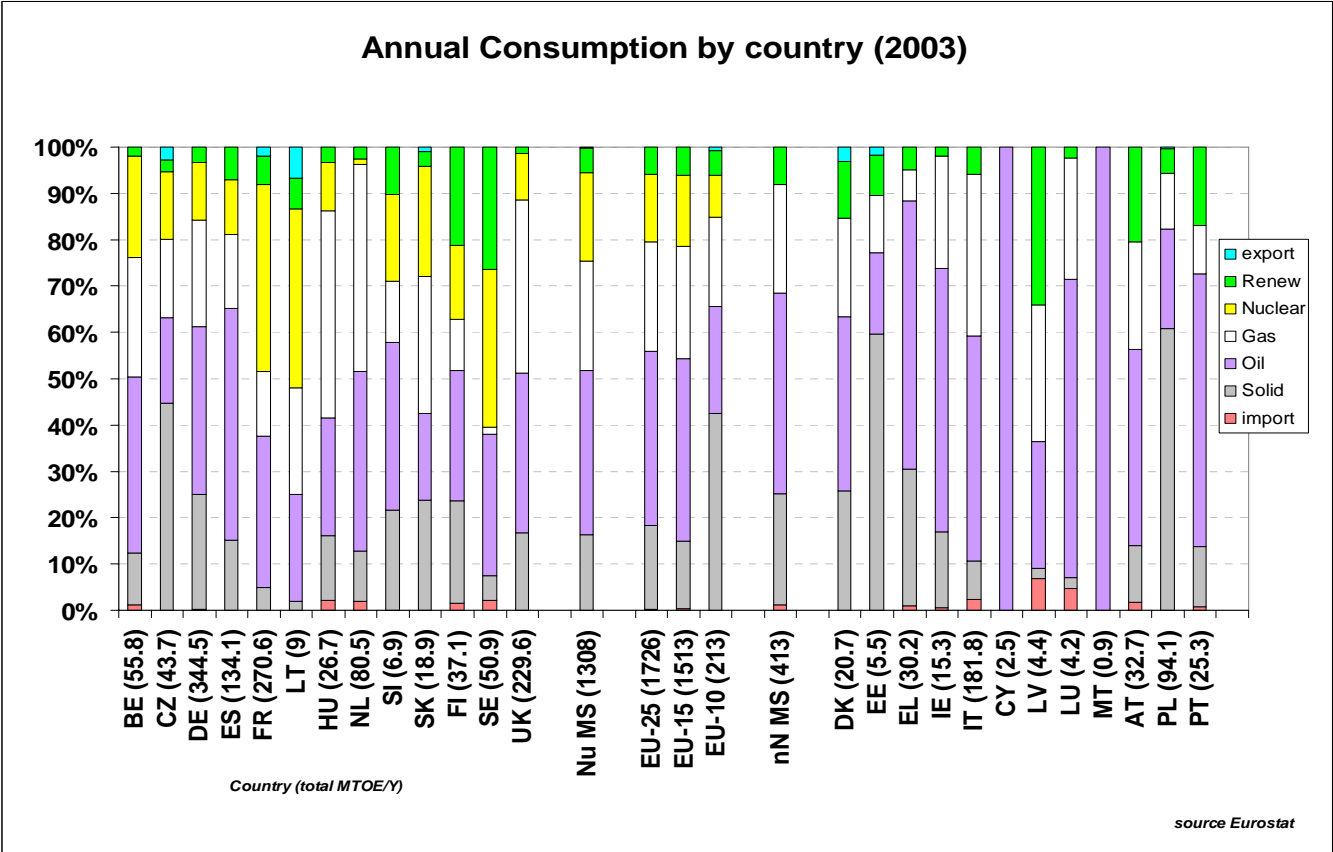


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1. BELGIUM

1.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 45.35 TW·h, about 55.6 % of total produced electricity.
- Average cumulated load factor for 2005 was 89.2%.
- Seven PWRs operated by Electrabel (now owned by Suez-EDF) on two different sites, Doel (4) and Tihange (3), with total installed capacity of ~5.7 GW(e).
- Related annual U requirement is approximately 1075 t U.
- One Nuclear Power Plant (NPP) is shutdown (BR3).
- Electrabel also has a share in both of the EDF French NNPs in Chooz.
- A phasing-out law after 40 years lifetime is still applicable except in case of "force majeure", which requires the closure of the first NPP in 2015, but there is a growing pressure to reconsider the role of nuclear in the energy Mix.
- A dedicated "Commission for Energy 2030" will report in April 2007 on the short and long-term energy strategies, focusing the analysis on scientific, economic, environmental and social aspects of the different energy sources, and the related needs of investments in, energy transmission as well as production and storage capacity.

1.2. Public Opinion (Eurobarometer 2005)

- 58.5% declares knowledge on radioactive waste (EU average 48.5%).
- 50% of the interviewees were in favour of nuclear energy.

1.3. Research Reactors

- There are 4 operational research facilities, for teaching, activation and isotopes production purposes.
- Two shutdown facilities, including the experimental and power reactor BR3 are being decommissioned.
- No significant related U requirements.

1.4. Mining and milling of uranium

- None

1.5. Conversion

- None

1.6. Enrichment

- None

1.7. Fabrication

- FRAMATOME ANP (AREVA NP) operates a 400 t U/y PWR and BWR fuel fabrication plant at Dessel (ex-FBFC) and also MOX fuels assemblies from the BELGONUCLEAIRE plant.
- BELGONUCLEAIRE operated a 35 t_{HM} /a MOX plant at Dessel, closed in July 2006 for market reasons.

1.8. Spent fuel and Radioactive Waste Management

- Spent fuels
 - About 4900t of spent fuel, 2175 t U is actually stored in BE.
 - Wet storage is in operation at the Tihange site and dry storage at the Doel site.
- Reprocessing
 - Reprocessing contract with COGÉMA LA HAGUE (FR) has not been renewed.
 - The return of vitrified waste after reprocessing in LAA HAGUE is about 75% completed.
 - The EUROCHEMIC Pilot reprocessing plant (Mol) with a capacity of 350 kg U/y was shut down in 1975. The vitrification of produced HLW was carried out at the end-of the 80s. EUROCHEMIC's decommissioning was recently completed.
- WASTE STORAGE operated on the EUROCHEMIC site by BELGOPROCESS, subsidiary of ONDRAF/NIRAS (www.nirond.be) :
 - HLW storage facility for EUROCHEMIC vitrified waste and reprocessed vitrified product returned from La Hague (AREVA).
 - LILW radioactive waste treatment, conditioning and storage facilities.
- A new nuclear waste management plan will be published at the end of 2008 by ONDRAF-NIRAS, which will focus on mid and long-term solutions.
- The Federal nuclear Research Centre CEN-SCK at Mol-Dessel is responsible for developing a realistic solution for the final disposal of high-level and long-lived radioactive wastes. Deep geological burial in clay is the primary option studied and an experimental geological disposal laboratory is under development at Mol-Dessel.

1.9. Waste Management, Radiation Protection, and Safety Authorities

- National Agency for Radioactive Wastes and Fissile Materials Management (ONDRAF/NIRAS) is dealing with the safe transportation, treatment, conditioning, storage

and disposal of all radioactive waste produced in the country and with decommissioning of old installations (www.nirond.be).

- Government Responsible body is the federal ministry of economics (<http://mineco.fgov.be>).
- The Federal Agency for nuclear Control (FANC) is a public agency responsible of public health and environmental protection against ionising radiations (www.fanc.fgov.be).
- The Association Vinçotte Nucléaire (AVN) is a private expertise and advisory company (www.avn.be).
- SYNATOM is a mixed company (State-Private) owning nuclear fuels from fabrication to transfer to ONDRAF-NIRAS as waste.

1.10. Decommissioning & related Funds

- Before the law of April 2003, the provisions were booked by the electricity producers (i.e. internal).
- After 11.04.2003: Funds in Nuclear Provision Company (in which the State has the right to veto).

2. BULGARIA

2.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 17.3 TW·h, about 44 % of the total electricity production.
- Average cumulated load factor in 2005 was 60.5 %.
- In Bulgaria, Kozloduy NPP PLC has four nuclear power reactors still operating at the Kozloduy site with a total installed capacity of ~2.7 GW(e).
- Two VVER-440/230 units (3 and 4) to be closed at the end of 2006 in application of Accession Treaty.
- Two VVER-1000 units (5 and 6) should operate until 2027 and 20312 respectively.
- Two older VVER-440/230 Kozloduy units 1 and 2 were closed in December 2002.
- Two additional units will now be completed (Russia contract) at the Belene site, where construction originally started in 1987 but later was suspended.
- Annual U requirements are approximately 253 t U.
- Decommissioning of Kozloduy 1 to 4 is foreseen with the financial participation of European Funds.

2.2. Public Opinion

- Bulgaria was not included in the 2005 Eurobarometer survey.

2.3. Research Reactors

- 1 shutdown facility.

2.4. Mining and milling of uranium (a)

- All production ended in 1994 following the Government's decision to close the uranium production industry.
- U Reasonably Assured Resources at 110 tU estimated at 6300 tonnes, about 20 years of actual needs.

2.5. Conversion

- None

2.6. Enrichment

- None

2.7. Fabrication

- There is no domestic fuel fabrication. VVER fuel is supplied by ex-Minatom, Russian Federation, now the Federal Agency for Atomic Energy (FAAE).

2.8. Spent fuel and Radioactive Waste Management

- **Spent Fuels:**
 - Spent fuel (Wet) storage facilities are installed for the Kozloduy nuclear power plant.
 - A building is under construction at the Kozloduy site for the interim dry storage of spent fuel after initial cooling.
- **Reprocessing:**
 - Until 1989, spent fuel from both VVER-440 and -1000 units was regularly sent to the Mayak facility in Russia for reprocessing.
 - The agreement between Russia and Bulgaria on reprocessing of Bulgarian spent fuel was re-initialised in 1998 with return of High level Waste.
- The actual strategy for spent fuel and radioactive waste management foresees two possible annual transfers of spent fuel to Russia, the construction of a dry storage facility together with financial provisions.

- State's Company Radioactive Waste (SE RW) established on January 2004 is responsible for the management of waste from NPP (storage at Kozloduy site) or other nuclear facilities (Novi Han storage), including treatment of LILW.
- A surface disposal facility is operated at Novi Han Site.
- No geological disposal project.
- Preferred option for spent fuel management is export, as storage or reprocessing of spent fuel/high level waste is not foreseen until 2050.

2.9. Waste Management, Radiation Protection, and Safety Authorities

- Responsible government body is the Ministry of Education and Science (www.minedu.government.bg).
- The Bulgarian Nuclear Regulatory Agency (NRA) (<http://www.bnsa.bas.bg>) was created in 2002 from the previous Directorate on nuclear safety within the committee on the use of atomic energy for peaceful purposes.
- The Committee of the Use of Atomic Energy for Peaceful Purposes (CUAEPP) is an Advisory Council for radiation protection and nuclear safety, created to contribute to the strengthening of nuclear safety in Bulgaria and assist the Bulgarian NRA for licensing decommissioning activities.

2.10. Decommissioning & related Funds

- Centralised (blocked) State Fund independent from plant operator.
- Significant international financial support, primarily from the Community.

3. CZECH REPUBLIC

3.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 23.3 TW·h, about 31% of its total supply.
- Four VVER-440/213 power reactors are in operation at the Dukovany site and two VVER-1000/320 reactors are operated at the Temelin site, all by the CEZ (the Czech power company), with a total installed capacity of ~3.5 GW(e).
- Average cumulated load factor in 2005 was 84 % for Dukovany and 70% for Temelin.
- Related annual U requirement is approximately 540 t U.
- No shutdown NPPs.
- Discussions are ongoing on the construction of two new nuclear reactors, which together would provide 1900 MWe.

3.2. Public Opinion (Eurobarometer 2005)

- 55.5% declares knowledge about radioactive waste (EU average 48.5%).
- 61% of the interviewees were in favour of nuclear energy.

3.3. Research Reactors

- There are 3 experimental and isotope producing research facilities in operation, Russian supplied.
- 2 other decommissioned facilities.
- No related U significant requirement.

3.4. Mining and milling (b)

- Current production is about 400 t U/y for the country's last active uranium mine at Rozná, which could produce output until 2008.
- Re-opening of the old mine Brzkov is under discussion.

3.5. Conversion

- None

3.6. Enrichment

- None

3.7. Fabrication

- Fresh fuels are imported from the Russian Federation for the four Dukovany NPPs and from Westinghouse (USA) for both Temelin plants.

3.8. Spent fuel and Radioactive Waste Management

- **Reprocessing:**
 - Until 1989 spent fuel was contracted to be sent for reprocessing to the Mayak Facility (RT-1) in the former Soviet Union and did not return to the former Czechoslovakia, but the contract was never implemented.
 - Between 1989 and 1992 the spent fuel assemblies from the Dukovany plant were transported (after a 3-year cooling period) to the interim storage (wet) facility at Jaskovske Bohunice in Slovakia. The transports were stopped after Czechoslovakia split into two separate countries.
 - At the Dukovany site, a dry storage facility for spent fuel is operational since 1997 with a capacity of 60 Castor casks (or 600 t_{HM}), a new facility with a capacity of 1340 t_{HM} will be put into operation in 2006. A dry store is designed for Temelin plant.
- **Spent Fuels:**

- In UJV-Rez, an interim storage facility for spent fuel from research reactors is operated since 1996, with sufficient capacity for their entire life.
- A shallow repository of radioactive waste is operational in the Dukovany NPP complex, for all future low and intermediate radioactive waste from both the Dukovany and Temelin NPPs.
- LILW are managed and stored in their NPP production sites, operated by CEZ-Temelin and CEZ-Dukovany and also at 3 repositories at Richard, Bratrství and Dukovany, operated by the Radioactive Waste Repository Authority – RAWRA. The Czech acronym is SURAO (www.rawra.cz).
- CZ plans storing spent fuel in a deep repository, to be operational by 2065, of which the siting procedure is currently stopped until 2009.

3.9. Waste Management, Radiation Protection, and Safety Authorities

- The Radioactive Waste Repository Authority (SURAO-RAWRA,) established in June 1997, is responsible for radiation protection and other activities related to disposal of radioactive wastes (www.rawra.cz).
- Government body responsible for waste management and radiation protection: the Ministry of Industry and Trade (www.mpo.cz).
- The State Office for Nuclear Safety (SÚJB) is the CZ's regulatory body responsible for the safety of nuclear installations, radiation protection, licensing (www.sujb.cz), under direct authority of the Prime Minister.
- Additional nuclear authority is the National Radiation Protection Institute (www.suro.cz), which is part of the State Office for Nuclear Safety (SUJB).

3.10. Decommissioning & related Funds

- Dedicated Nuclear Account (NA), established for radioactive waste management is managed by the Ministry of Finance.
- Verification of cost estimates and withdrawal of funds from the NA are monitored by the State organisation: RAWRA, which is independent from nuclear plant operators.

4. FINLAND

4.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 22.3 TW·h, equivalent to 26% of total electricity supply.
- Four nuclear power plants are operated with a total installed capacity of ~2.7 GW(e):
- FORTUM (Fortum Power and Heat Oy) operates two 510 MWe Russian designed reactors at Loviisa site.

- TVO (Teollisuuden Voima Oy) operates two 860 MWe BWR Swedish designed reactors at the Olkiluoto site.
- Average cumulated load factor in 2005 was 95.9%.
- Related annual U requirement is approximately 473 t U.
- No shutdown NPPs.
- Finland and France are the only two EU15 MS having officially started the construction of a nuclear power plant. The fifth Finnish plant, EPR 1600 MWe PWR reactor, is under construction since 2005 (FRAMATOME-ANP, now AREVA-NP design). Grid connection by Operator TVO is now expected by 2011.
- The use of nuclear power is considered as an option in the new energy and climate strategy adopted by the Parliament in 2006.

4.2. Public Opinion (Eurobarometer 2005)

- 60 % declares knowledge about radioactive waste (EU average 48.5%).
- 58% of interviewees in favour of the use of nuclear energy.

4.3. Research Reactors

- There is one TRIGA design 250 kW facility for medical and academic use.
- One older decommissioned facility.
- No related U significant requirement.

4.4. Mining and milling

- Finland produced 30 t U between 1958 and 1961. Currently no mines are in operation.
- Finnish reserves of U at an extraction cost of 110 €/kg U are estimated at 1125 t U.
- Various uranium prospecting companies (including AREVA, FR) showed interest in new mine exploration in Finland.

4.5. Conversion

- None

4.6. Enrichment

- None

4.7. Fabrication

- None

4.8. Spent fuel and Radioactive Waste Management

- Spent Fuel
 - The last return shipment of spent fuel from Loviisa to the Russian Federation took place at the end of 1996.
 - Both operating nuclear power plants have interim storages for spent fuel: 490 t_{HM} capacity wet storage at the Loviisa NPP and 1200 t_{HM} capacity at the Olkiluoto TVO-KPA facility.
- Low- and ILW temporary store facilities are also operated at both sites. The facility for final disposal of low and intermediate level radioactive waste was put into operation at Olkiluoto in 1992 and the facility for disposal of low-level waste at Loviisa, in 1998.
- A final disposal project for spent fuel was started in the early 80's:
 - In 2001 the Finnish parliament endorsed the Government's decision-in-principle on the construction of a final disposal facility for spent fuel and high-level waste at Olkiluoto.
 - The preparation of spent fuel disposal facility is highlighted by the construction of an underground rock characterization facility Onkalo started in 2004.
 - Construction of the final disposal facility is scheduled to start around 2010, licensing by 2016 and operation in 2020. Its foreseen capacity reaches 4000 tons, equalling the amount generated by the existing nuclear power plants during 60 years of operation.
 - The private Finnish Radwaste Management Company POSIVA (www.posiva.fi) will be in charge of these operations.
- No decommissioning projects of nuclear facilities are underway.

4.9. Waste Management, Radiation Protection, and Safety Authorities

- Responsible governmental bodies are:
 - The Finnish Council of State for licensing, and general safety regulations
 - The Ministry for Social Affairs & Health as supreme authority related to radiation protection (www.stm.fi) with the Ministries of the Environment (www.vyh.fi) and Interior (www.intermin.fi) for the population protection in emergency cases.
 - The Ministry for Trade and Industry, Energy Department (<http://www.ktm.fi/E&S>), supervising the Nuclear Energy Sector,
 - The Radiation and Nuclear Safety Authority, STUK (www.stuk.fi) under the Ministry for Social Affairs and Health.

- Nuclear waste management is guided by the Nuclear Energy Act and Decree and detailed regulations and regulatory guides are issued by the STUK, assisted by the Advisory Committee on Nuclear Safety (YTN).

4.10. Decommissioning & related Funds

- Finnish report to the 3rd review Meeting of the Joint Convention mentions that the provisions for licensing and the waste management obligation included in the current nuclear energy legislation are adequate for regulating a decommissioning project.
- Generators of nuclear waste are responsible for estimating annually future cost of managing the existing waste, including spent fuel disposal and decommissioning of NPPs, supplying a State Nuclear Waste Management Fund, managed independently from operator.

5. FRANCE

5.1. Nuclear Power Outlook

- Total nuclear production in 2005 reached 430.9 TW·h, about 79% of total electricity production.
- France started nuclear electricity generation in 1959 with GCR reactors, which are now shut down.
- The country currently has 59 PWR units all owned by ELECTRICITÉ DE FRANCE (EDF), with a total installed capacity of ~63.5 GW(e).
- 20 EDF reactors are licensed for MOX fuels
- Average cumulated load factor in 2005 was 83.4%
- The NPPs are licensed for a period of 40 years. EDF recently declared in favour of lifetime extension.
- Related annual U requirement is approximately 10150 t U.
- 11 shutdown NPPs (8 GCR, 1 HWGCR 1 PWR and 1 FBR)
- The construction of an additional PWR reactor has started at Flamanville for operation in 2012. The construction of a second EPR could be proposed soon. Those 1600 MWe EPR-type designed by the consortium AREVA-NP (ex-FRAMATOME-ANP) and the Finnish EPR at Olkiluoto are supposed to start a standardised, new family of Generation-III reactors, designed for 60 years operation.
- The annual connection to grid of 2 EPR from 2020 is announced by the French ministries
- EDF was partially privatised in 2005.
- The consortium constituting SUEZ-GdF owns the Belgian nuclear producer ELECTRABEL

- AREVA is the global leader in all the fuel cycle technologies (AREVA-NC) and plant engineering and fuel fabrication (AREVA-NP). It has a dominant position in Europe, particularly in France: mining and conversion with COGÉMA (AREVA-NC), enrichment with EURODIF (AREVA-NC), fabrication with (AREVA-NP) FRAMATOME-ANP (alliance with SIEMENS), AREVA-NP, COGÉMA (AREVA-NC) and MELOX (AREVA-NC), reprocessing with COGÉMA-LA HAGUE, plus also related engineering, metallurgical and logistics activities, etc.
- The French fuel cycle policy is based on a closed cycle with reprocessing of PWR spent fuel as required to supply plutonium for MOX fuel at La Hague (AREVA-NC) and the recycling of plutonium in MOX for PWRs.
- France is member of the Generation IV Forum (GIF) Program and is re-launching programs both on Sodium-cooled reactors (Phenix and Super Phenix) and Gas-cooled reactors (Very High Temperature Reactors-VHTR and Gas Fast Reactors-GFR). CEA is charged to develop a first Generation 4 pilot plant by 2020.
- The French site of Cadarache was chosen for the construction of the International Thermonuclear Experimental Reactor (ITER).

5.2. Public Opinion (Eurobarometer 2005)

- 53.5% declares knowledge about radioactive waste (EU average 48.5%).
- 52% of interviewees were in favour of the use of nuclear energy.

5.3. Research Reactors

- The new 100 MWth CEA research reactor JULES HOROWITZ is planned to go critical in 2014, construction starting in 2007.
- The PHENIX 563 MWth Fast Breeder is used for irradiation experiments, with CEA-COGEMA fuels.
- 12 additional material or irradiation testing, academic, training and isotopes producing facilities are still operated.
- 12 other are shutdown and 5 decommissioned.
- No related U significant requirements.

5.4. Mining and milling

- COGÉMA (now AREVA-NC) exhausted its mines in France. The French reserves of U at an extraction cost of 110 €/kg U are estimated at 11700 t of U, around one year of actual requirements.
- COGÉMA (now AREVA-NC) actually operates or has a share in mines in Niger, Canada Kazakhstan, Australia and the USA.

5.5. Conversion

- COGÉMA (AREVA-NC) operates two conversion COMURHEX facilities in Malvesi (UOC to UF₄) and Pierrelatte (UF₄ to UF₆), with a total capacity of 14.000 t U/y, and two other AREVA plants for de-fluorination of depleted uranium (to U₃O₈) and conversion of reprocessed uranium (REPU) to UF₆.

5.6. Enrichment

- AREVA and URENCO have a 50% partnership venture for the development of Centrifuge Enrichment Technology (CET).
- EURODIF (AREVA) performs enrichment at its GEORGES BESSE-I gaseous diffusion (GF) plant, located at Pierrelatte (capacity 10 800 t SWU/y¹). It is a very energy intensive facility, using GF technology and it will be progressively replaced, at the same Pierrelatte site, by a new installation GEORGES BESSE -II using centrifuge enrichment technology.

5.7. Fuel fabrication

- FRAMATOME-ANP (AREVA NP-SIEMENS) fabricates UO₂ fuel from enriched natural uranium at Romans (capacity 1400 t_{HM} /y). It also operates the FRAMAROME ANP plant in Belgium and the (ex) ANF-Lingen installation in Germany. Intermediate products (UO₂ powder) are exported.
- MTR fuel for research reactors is manufactured at CERCA (Romans) from HEU metal.
- MOX fuels are fabricated by MELOX (AREVA) at Marcoule, with a license to upgrade its production from 145 to 195 t/y. COGÉMA (AREVA-NC) MOX fabrication plant at Cadarache stopped its activities in 2004.
- AREVA-NC is also associated in the construction of a MOX Fabrication Plant in the USA.
- France has component manufacturing facilities operated by Cesus and Zircotube.

5.8. Spent fuel and Radioactive Waste Management

- **Reprocessing of Spent Fuels:**
 - All GCR fuel (18000 t) was reprocessed at the COGÉMA (AREVA-NC) UP1 plant located at Marcoule. This plant is now undergoing decommissioning.
 - At La Hague, two reprocessing facilities operated by COGEMA (AREVA-NC), with total capacity of 1600 t/y. COGÉMA UP2 (AREVA-NC) used to treat French EDF PWR fuels and COGÉMA (AREVA-NC) UP3 by contract for fuels supplies to other countries. French fuels are also treated in UP3 since expiry of several international contracts.
 - Total LWR spent fuel reprocessed is approximately 18.000 t Fuels.

¹ Separative work unit

- France would develop the Partitioning & Transmutation (P&T) option for the reduction and management of spent fuel and LLHAW.
- Recovered depleted uranium and plutonium are sent to other AREVA installations for storage or/and re-use in the fuel fabrication plants. HLW from reprocessing is vitrified and stored before return transfer to foreign customers, where the fuel originated or to the *AGENCE NATIONALE POUR LA GESTION DES DÉCHETS RADIOACTIFS* (ANDRA, www.andra.fr).
- LILW, LLW and Very-LLW are managed by ANDRA.
- A debate launched in 1991 on waste management (*Loi Bataille*) focused on P&T, disposal and long-term surface storage. The related 2006 law launches a research program on the same three axes with a calendar for their implementation. It also sets up the financing provisioning structure of waste management by the industry. The French strategy will include:
 - Reprocessing of Spent Fuel and recycling of U and Pu
 - Final treatment of non recoverable for intermediate surface storage
 - Reversible disposal in deep geological for after surface storage

5.9. Waste Management, Radiation Protection, and Safety Authorities

- The national Authorities are:
 - The 'Autorité de Sûreté Nucléaire' (ASN, www.asn.gov.fr) is responsible for all safety and health and safety aspects of nuclear fuel cycle, emergency situations and for related controls. ASN gathers the *Direction Générale de la Sûreté nucléaire et de la Radioprotection* (DGSNR) and decentralised services from the Ministries of Environment, Industry and Health
 - A new 'Haute Autorité de Sûreté Nucléaire' created in June 2006 is responsible for the Safety and Transparency legislations
 - The 'Institut pour la protection radiologique et la sûreté nucléaire', IRSN (www.irsn.org) provides expert analysis in radiological and safety matters under the joint authority of different ministries. IRSN replaces two previous organisations (IPSN & OPRI)
 - The issue of licences are made by the 'Service des Affaires Nucléaires du ministère des Finances et de l'Industrie' (www.industrie.gouv.fr)
- All level wastes when transferred by producers are managed and treated by the independent Agency ANDRA (www.andra.fr) on several sites in the country. Conditioned intermediate and high-level waste are stored at production sites, pending creation of a disposal site by ANDRA.
- One site for disposal of spent fuel and HAW is under investigation (research and feasibility) in the north of France (Bure).

5.10. Decommissioning & related Funds

- Internal non-segregated fund. Recent change in the law requires funds to be segregated by 2010.
- EDF is fully responsible for fund management.

6. GERMANY

6.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 154.6 TW·h, about 31% of the total produced electricity.
- 17 plants are operational, 11 PWRs and 6 BWRs, operated by 4 different private companies: E-ON (7), RWE (4), EnBW (4) and HEW (2), providing a total installed capacity of ~20.3 GW(e).
- Average cumulated load factor in 2005 was 80.6 %.
- Related annual U requirements are about 3458 t U.
- 19 shutdown NPPs (9 PWR, 5 BWR, 2 HGTR, 1 HWGCR, 1 PHWR, 1 FBR).
- A Phasing-Out Agreement (2001) between the nuclear power producers and the Federal Government is in place on the total electronuclear power to be produced equivalent to a period of 32 years. This allows producers to life extensions and TW·h transfers from an older nuclear plant to a newer one. Opposite transfer need the consensus agreement of three authorities².
- With the exception of repositories for final disposal and national interim storage facilities, all nuclear fuel cycle facilities are private enterprises.

6.2. Public Opinion (Eurobarometer 2005)

- 54% declares knowledge about radioactive waste (EU average 48.5%).
- 38% of interviewees were in favour of the use of nuclear energy.

6.3. Research Reactors

- There are 13 operational facilities dedicated to research, academic and isotopes production, 11 shutdown and 22 decommissioned.
- No significant U requirement.

² A joint consensus is needed between the Ministry of Environment (BMU), Ministry of Economy (BMWi) and the Chancellor's office. BMWi and Chancellor's Office would take a positive stance while BMU would be hostile.

6.4. Mining and milling

- No mining or milling has been undertaken in Germany since the closure in 1991 of the former German (DDR)-Soviet Company WISMUT, which was the third largest producer in the world. Remediation is ongoing.
- Recent estimates evaluate the inferred resources at 3000 t of U with an extraction cost of 110 €/kg U, less than 1 year of actual requirements.

6.5. Conversion

- None

6.6. Enrichment

- In URENCO's Gronau uranium enrichment plant, natural uranium or uranium recovered from reprocessing in the form of UF₆ is enriched by centrifuge separation. The plant started operation with a capacity of 400 t.
- It has since been expanded in 1985 to 1800 t SWU/y, and a second plant is under construction. The whole site is licensed for up to 4800 t SWU/y.

6.7. Fabrication

- FRAMATOME ANP (ex-ANF Lingén, now AREVA-NP) operates a fabrication plant (capacity 650 t U/a) for LWR fuel at Lingén.
- A MOX fabrication plant in Hanau (ALKEM) was constructed but not started subsequently closed permanently.

6.8. Spent fuel and Radioactive Waste Management

- Reprocessing:
 - All domestic reprocessing activities have ceased. After WAK reprocessing plant achieved its mandate, a new reprocessing plant with improved separation technology was build in Wackersdorf but never started due to political decision.
 - Contracts were signed for reprocessing of spent fuels in the 1990's in La Hague (Fr) and Sellafield (UK) but not renewed afterwards.
 - A law forbidding the shipment of spent fuel for reprocessing was adopted and the last shipment of spent fuel to France took place in spring 2005.
 - Vitrified waste returned from La Hague, Sellafield and those from WAK Karlsruhe are temporary stored at the BLG-Gorleben Facility.
- Spent Fuel:
 - Cooling Ponds at reactor buildings, dry interim storage at reactor sites, interim storage facilities at Greifswald.

- As of 31/12/2004, a total of about 3360 t_{HM} for a total capacity of about 6120 t_{HM} was stored at the nuclear power plants.
 - 12 licensed Interim spent fuel Storage Facilities.
 - All spent fuels are currently being stored at the nuclear power plant sites, in order to avoid transportation to the existing central interim storage facilities near Ahaus and Gorleben.
 - Three interim storage facilities are operated at ZAB Greifswald (560 t_{HM}), BZD-Ahaus (3960 t_{HM}) and BLG-Gorleben (3800 t_{HM}).
- LILW: Interim storage is organised from local to Federal levels (conditioning facilities, interim facilities by nuclear industry, research institutions, central interim storage facilities, state collecting and finally 4 Federal Repositories (licensed or projected).
 - Uranium and plutonium recovered in foreign reprocessing plants are recycled as uranium- and MOX fuels.
 - Amendments to the Atomic Act in Germany, which became law in 1994, opens the way for direct disposal of spent fuel.
 - The German Federal Government is planning a future facility for all types of radioactive waste to be available around 2030, although all activities at the Gorleben site remain suspended.
 - The contracted company for the construction of the future waste repositories is the 'Deutsche Gesellschaft zum Bau und Betrieb von Endlagern für Abfallstoffe mbH' DBE (www.dbe.de), with exclusive contracts by the Bundesamt für Strahlenschutz (BfS).

6.9. Waste Management, Radiation Protection, and Safety Authorities

- The Federal authority for the safety and radiation protection authorisations is the Bundesamt für Strahlenschutz (www.bfs.de) depending of the Federal Ministry of Environment (BMU, www.bmu.de) in charge of nuclear safety, with the expertise support of a Commission for Radiation Protection (www.ssk.de).
- Each Land has its own authority in charge of nuclear safety implementation, licensing and supervision.
- The Federal ministries involved in the phasing out are the BMU, the BMW Bundesministerium für Wirtschaft and the Chancellor's office (KanzlerAmt).

6.10. Decommissioning & related Funds

- Provision for decommissioning and spent fuel management (disposal) must be established separately during the plant's life.

7. HUNGARY

7.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 13 TW·h, accounted for 37% of the country's total electricity production.
- The four VVER-440/213 reactors with a total capacity 1866 MW(e) are operated by the Company PAKS NPP LDT (www.npp.hu), providing a total installed capacity of ~1.8 GW(e).
- Average cumulated load factor in 2005 was 85.5 %
- Related annual U requirement is approximately 250 t U.
- No shutdown NPPs
- A public hearing on NPP's lifetime extension from 30 to 50 years is actually ongoing in Hungary, extended to the Austrian authorities.

7.2. Research Reactors

- There are 2 operational facilities (training, research, total 10.1MWth), another is decommissioned.
- No related U significant requirements.

7.3. Mining and milling

- Prior to its closure, the MECSEKURAN LIC/CSERKUT mining and ore facility produced up to 500 t U/y, or half the requirements of the PAKS nuclear power plant.
- Production ceased in 1997 and production at the milling facility was phased out in 1999.
- Remediation programs of old mines is ongoing

7.4. Public Opinion (Eurobarometer 2005)

- 55% declares knowledge about radioactive waste (EU average 48.5%).
- 65% of the interviewees were in favour of the use of nuclear energy.

7.5. Conversion

- None

7.6. Enrichment

- None

7.7. Fabrication

- There is no domestic fuel fabrication. At present, nuclear fuel is supplied from the Russian Federation.

7.8. Spent fuel and Radioactive Waste Management

- Spent Fuels:
 - Between 1989 and 1998 around 2300 spent fuel assemblies were sent to the MAYAK facility (RT-1) in the Russian Federation without any obligation of recovering U, Pu and high-level waste from its reprocessing.
 - The total amount of spent fuel stored at the end of 2004 was 2488t in the Plant's ponds and 3767t at the interim spent fuel dry storage facility at the PAKS nuclear power plant.
 - A spent fuel storage facility is operated at research plants sites.
 - Although no final decision has been made for the back-end of the fuel cycle a repository is foreseen for around 2040.
- A repository for LILW is under construction at Bataapáti.

7.9. Waste Management, Radiation Protection, and Safety Authorities

- The Hungarian Atomic Energy Authority is the HAEA (www.haea.gov.hu) is responsible for all nuclear related matters.
- The Public Agency for Radioactive Waste Management (PURAM) was established to deal with all activities related to the treatment of radioactive waste and the decommissioning of nuclear facilities.
- An information and analysis centre is responsible for managing the emergency cases are (www.bik.hu).

7.10. Decommissioning & related Funds

- Central nuclear financial fund in a dedicated treasury account, managed by the Hungarian Atomic Energy Authority independently from operators.
- PURAM is responsible for the decommissioning and waste management activities.

8. LITHUANIA

8.1. Nuclear Power Outlook

- In application of the Accession Treaty the first power reactor IGNALINA-1 was definitively shutdown in December 2004, and the second IGNALINA-2 will close in 2009. Both are 1300 MW(e) Russian designed LWGR powered by IGNALINOS ATOMINÉ ELEKTRINÉ (www.iae.lt).

- The remaining plant has an installed capacity of ~1.2 GW(e).
- Average cumulated load factor in 2005 was 58 %.
- Related annual U requirement is approximately 134 t U.
- One shutdown NPP (LWGR Ignalina1).
- Decommissioning of (both reactors) is foreseen with financial participation of European Funds.
- Total nuclear production in 2005 was 10.3 TW·h accounting for 70 % of all generated electricity.
- Prime Ministers of the three Baltic States have agreed, in principle, on the construction of a new 1000 MW(e) NPP in Lithuania.

8.2. Public Opinion (Eurobarometer 2005)

- 45% declares knowledge about radioactive waste (EU average 48.5%).
- 60% of the interviewees were in favour of the use of nuclear energy.

8.3. Research Reactors

- There is no research reactor in Lithuania.

8.4. Mining and milling

- None

8.5. Conversion

- None

8.6. Enrichment

- None

8.7. Fabrication

- There is no domestic fuel fabrication. Fuel is flown in from the Russian Federation.

8.8. Spent fuel and Radioactive Waste Management

- Spent Fuels:
 - A Spent fuel dry storage was commissioned in 1999 after delivering of the required 20 castor flasks and 40 CONSTOR casks manufactured by GNB (GE).
 - Previously, all spent nuclear fuel had been stored in the pools situated next to the reactors.

- There are plans to build a new interim spent fuel storage facility on the Ignalina nuclear plant site, which will start operation in 2009.
- A siting process is underway for a Nuclear Storage Repository for LILW-SL. A VLLW disposal site is under construction for operation in 2007.
- There is actually no waste disposal facility foreseen in Lithuania.

8.9. Waste Management, Radiation Protection, and Safety Authorities

- The Radioactive Waste Management Agency (www.rata.lt) was established by the Government for management and final disposal of all radioactive waste, generated by the Ignalina plants during the operation and decommissioning, as well as to collect, process and finally dispose of radioactive waste.
- Radiation Protection matters are coordinated by the Radiation Protection Centre (www.rsc.lt), established in 1997, and Safety and Regulation matters by the State Nuclear Safety Incorporate (www.vatesi.lt).

8.10. Decommissioning & related Funds

- Centralised (blocked) State Fund independent from plant operator.
- Significant international financial support primarily from the Community.

9. THE NETHERLANDS

9.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 3.8 TW·h, about 3.9% of the generated electricity
- ELEKTRICITEIT PRODUCTIE MAATSCHAPPIJ ZUID NL N.V is operating the sole remaining power 449 MW(e) PWR at Borssele .
- Average cumulated load factor of its only reactor in 2005 was 83%.
- Related annual U requirement is approximately 112 t U.
- One shutdown NPP (Dodewaard, BWR), safe enclosure as of July 2005.
- After two successive governmental shutdown decisions on the Borssele Plant, the 2002 Government agreed to postpone its closure due to the Kyoto obligations. Extension was given until 2023.
- The Dutch government (Ministry of environment) recently set out conditions for new nuclear build, and initiated a decision process for HLW disposal strategy by 2016.

9.2. Public Opinion (Eurobarometer 2005)

- 55% declares knowledge about radioactive waste (EU average 48.5 %).
- 52% of interviewees were in favour of the use of nuclear energy.

9.3. Research Reactors

- There are 3 research reactors operated in the Netherlands, of which one 45 MW(th) is owned by the EC-JRC-IE.
- 2 decommissioned facilities.
- No related U significant requirements.

9.4. Mining and milling

- None

9.5. Conversion

- None

9.6. Enrichment

- URENCO has developed the advanced gas ultracentrifuge technology for the enrichment of uranium. This Company is 50% partner in ETC (see FR) with AREVA, for the development of enrichment technologies.
- Uranium enrichment is carried out by URENCO Nederland B.V., which is located in Almelo. URENCO Nederland is owned by the multinational company URENCO Ltd, which is located in Marlow (UK) and which has three equal shareholders : ULTRA CENTRIFUGE NEDERLAND (UCN) in the Netherlands, URANIT (Germany) and BNFL (UK). The Government of the Netherlands owns 99% in UCN.
- The current capacity of URENCO Nederland is 1850 t SWU/y. However, with a 1999 license to expand its capacity to 2500 t SWU/y, for which a fifth enrichment plant has been built at the Almelo site. In early 2003 a new nuclear licence was issued to increase capacity to 2800 t SWU/y.

9.7. Fabrication

- None

9.8. Spent fuel and Radioactive Waste Management

- Reprocessing
 - The contracts for reprocessing of spent fuel by BNFL (UK) and COGÉMA (AREVA-NC) La Hague in France were not renewed.
- Spent Fuel
 - There are temporary ponds for spent fuel in Borssele, Petten, Dodewaard and Delft.
 - The Central Organisation for Radioactive Waste (COVRA) (www.covra.nl) manages all spent fuel stored at Borssele, Dodewaard and Petten.

- The repacking and transfer of all spent fuel to COVRA facility in Borssele is scheduled over a period of 10 years.
 - HLW returned from reprocessing, spent fuel from research reactor HOR and from production plants will be stored at the surface HABOG (Vlissingen) facility managed by COVRA, with a storage time of around 100 years.
- Other Waste management :
- All radioactive wastes with a half-life less than 100 days are stored on site.
 - The radioactive Waste Storage Facility at Borssele and Petten are managed by COVRA.
 - COVRA is operating and managing other storage facilities at Vlissingen for all other waste.

9.9. Waste Management, Radiation Protection, and Safety Authorities

- COVRA is entrusted with the treatment and storage of all categories of radioactive waste.
- The regulatory responsibility is distributed between:
 - The Ministry for Housing, spatial Planning and Environment (www.vrom.nl) for environmental and nuclear safety matters, including inspections.
 - The Ministry of social affairs and employment for health-and-safety and radiation Protection aspects.
 - The Ministry of Economic Affairs (www.minez.nl) for energy production.
- The storage facility for HLW is under construction and is due for commissioning.

9.10. Decommissioning & related Funds

- Dodewaard (50 MWe BWR) currently in 'safestore' for 40 year prior to final decommissioning.
- Funds for waste management transferred under 2002 agreement to the State together with ownership of responsible company COVRA.
- Operators have to make financial provisions for decommissioning requirements.

10. ROMANIA

10.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 5.1 TW·h, about 8.6 % of Romania's total electricity production

- The 700 MW(e) CANDU-PHWR CERNAVODA-1 plant is operated by the CNE, *SOCIETATEA NATIONALA NUCLEARELECTRICA* (www.cne.ro)
- Average cumulated load factor of the only operating plant in 2005 was 86.6%
- Related annual U requirement is approximately 176 t U.
- No shutdown NPPs.
- The CERNAVODA-2 plant is under construction. It should be connected to the grid early 2007. Preparatory work for CERNAVODA-3 and -4 could start in 2007. The production of nuclear electricity should double by 2009 and triple by 2015³.
- Front end nuclear fuel cycle industrial facilities have been developed to supply nuclear fuel and heavy water for civil reactors.

10.2. Public Opinion (Eurobarometer 2005)

- Romania was not included in the 2005 Eurobarometer survey.

10.3. Research Reactors

- There are 2 TRIGA reactors with a total capacity of 14.5 MW(th) using fuel from the USA, operated at Pitesi by the Company SCN (www.scn.ro).
- 2 Russian type facilities, 1 zero-power decommissioned, 1 shutdown (WWF-INIF) at Marugele.
- No related U requirements.

10.4. Mining

- Uranium mining activities are lead by the (now autonomous) NATIONAL URANIUM COMPANY (CNU, www.cnu.ro) which operated 4 uranium mining branches at Feldioara, Bihor, Banat and lastly Suceava, which is the last remaining operational mine with a production capacity of 100 t U/y.
- The uranium production capacity is tailored to meet the requirements of the national nuclear power programme.
- Reasonably inferred resources are actually estimated at 3150 t U with an extraction price of 110 €/kg U.

10.5. Conversion

- At Feldioara, CNU is processing milling-concentration and refining-conversion in 2 distinct 300 t/y plants.
- Feldioara is the single U production plant in Europe for CANDU fuels.

³ www.minind.ro

10.6. Enrichment

- None

10.7. Fabrication

- The *NATIONAL NUCLEAR POWER COMPANY* (FCN) operates in Pitesti. The present capacity of FCN Pitesti (110 t U/y) will be increased in accordance with the requirements of the CERNAVODA nuclear plants. FCN Pitesti has been qualified by AECL as a CANDU fuel supplier.

10.8. Heavy water production

- The Romanian Nuclear Activities Authority operates the ROMAG heavy water plant (design capacity 360 t/y). Using the Girdler–sulphide process ROMAG is the largest producer of heavy water in Europe.

10.9. Spent fuel and Radioactive Waste Management

- Spent Fuels:
 - The wet storage for spent fuel near the Plant CERNAVODA has a limited capacity of 950 t corresponding to six years of cooling time.
 - Research reactors have their own spent fuel storage (SCN and shutdown IFIN).
 - The 2003 interim dry spent fuel storage facility with a capacity of 230 t is being extended and will accommodate the spent fuel for 2 reactors for at least fifty years.
 - Wet and dry storage are also operated at Pitesi for the research reactors.
- Other L&ILW management facilities are located at the same sites Cernavoda (CNE), Pitesi (SCN), Magurele (IFIN) and at the CNU Mining Company.
- There is presently no disposal project in Romania, and no decision on the storage of low and medium level waste.

10.10. Waste Management, Radiation Protection, and Safety Authorities

- The National Commission for the Control of nuclear activities is a state-secretary Commission with competences in all nuclear related matters (www.cncan.ro): safety, safeguards, transport and public health, including emergency measures.
- The national Nuclear Authority falls under the Ministry of Education and Science (www.mct.ro) while the national energetic strategy falls under the Ministry of Economics and Commerce (www.minind.ro).
- The National Agency for Radioactive Wastes (www.andrad.ro) is the competent authority for the coordination on national level, of the safe administration process of spent nuclear fuel and of radioactive wastes, including their disposal.

- There is a Romanian Energy Regulation Authority for energy matters (www.anre.ro).
- Two professional organisations provide information and support to the nuclear sector: the Romanian Nuclear Energy Association (www.aren.ro) and the Romanian Society for Radiological Protection (www.ispb.ro).

10.11. Decommissioning & related Funds

- Currently no decommissioning fund. These would be licensed by CNCAN.

11. SLOVAKIA

11.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 16.3 TW·h, about 56 % of produced electricity.
- Six 440 MWe power units are operated in Slovakia, four VVER (PWR) at Bohunice by *ELECTROSTATION BOHUNICE* and 2 at the Mochovce by *ELEKTROSTATION MOCHOVCE*, with total installed capacity of ~2.5 GW(e).
- Average cumulated load factor in 2005 was 75%.
- Related annual U requirement is approximately 356 t U.
- One shutdown NPP (HWCR Bohunice1).
- These plants are owned by the *SLOVENSKÉ ELEKTRÁRNE* (www.seas.ssk) which was taken over in 2005 at 66% by ENEL (www.enel.it).
- A plan to complete the construction of 2 - VVER reactors at the Mochovce nuclear power plant is currently under evaluation.

11.2. Public Opinion (Eurobarometer 2005)

- 48.5% declares knowledge about radioactive waste (equal EU average).
- 56% of them were in favour of the use of nuclear energy.

11.3. Research Reactors

- None

11.4. Mining and milling

- In the 1960s and 1970s small quantities of uranium were mined in eastern Slovakia.

11.5. Conversion

- None

11.6. Enrichment

- None

11.7. Fabrication

- None

11.8. Spent fuel and Radioactive Waste Management

- Spent Fuels and LILW Plants
 - Until 1987 some spent fuel was returned to the Russian Federation.
 - A temporary wet spent fuel storage facility of ~ 1700 t_{HM} capacity at shutdown of Bohunice Plant is operational since 1987.
 - Whole amount of other radioactive operational waste of Bohunice and Mochovce units is stored temporarily on the sites.
- An NSR Disposal for LILW-SL is operational at Mohovce with a possible expansion and/or construction of VLLW.
- Spent fuel /HLW disposal is planned for around 2075.

11.9. Waste Management, Radiation Protection, and Safety Authorities

- UJD is the national Nuclear Regulatory Authority, *URAD JADROVÉHO DOZORU SLOVENSKEJ REPUBLIKY* (www.ujd.gov.sk), responsible for regulations, licensing, safety, inspections, emergency, information and public health as well as waste management aspects, reporting to the Ministry of Environment (www.enviro.gov.sk).

11.10. Decommissioning & related Funds

- Centralised (blocked) State Fund independent from operator.
- International financial support primarily from the EU.

12. SLOVENIA

12.1. Nuclear Power Outlook

- The total Slovenian nuclear production in 2005 was 5.6 TW·h, 42 % of the country's total electricity production.
- The only NPP is a 700 MWe 1981 PWR located in Krsko, operated by *NUKLEARNA ELEKTRARNA KRSKO* (www.nek.si), 50 % owned by Croatia.
- Average cumulated load factor in 2005 was 80.4%.
- Related annual U requirement is approximately 144 t U.

- No shutdown NPPs.

12.2. Public Opinion (Eurobarometer 2005)

- 64.5% declares knowledge about radioactive waste (EU average 48.5 %).
- 44% of the interviewees were in favour of the use of nuclear energy.

12.3. Research Reactors

- There is one TRIGA teaching and experimental facility at Lubljana, 250 kW(th), US enriched U.

12.4. Mining and milling

- Between 1982 and 1990, 362 t of uranium were produced at the ZIROVSKI VRH mine and processing plant. This plant is now being decommissioned.
- Reasonably inferred resources with an extraction price of 110 €/kg U are estimated at 1200 t U.

12.5. Conversion

- None

12.6. Enrichment

- None

12.7. Fabrication

- None

12.8. Spent fuel and Radioactive Waste Management

- Spent Fuel:
 - A spent fuel wet storage pool (capacity 690 t_{HM}) is in operation at Krsko plant site, which has recently been re-racked to provide sufficient capacity for plant lifetime and even for possible lifetime extension.
 - There are no spent fuel off-site management facilities.
- Other Waste management:
 - A Central Interim Storage for Radioactive Waste in Brinje.
 - Interim Storage facilities at the Borst mill tailings site; the Jazbec mine and Zirovski Uranium Mine are the only radioactive waste management facilities.
- There is no disposal project in Slovenia.

12.9. Waste Management, Radiation Protection, and Safety Authorities

- In 2004 all energy matters passed under the departmental competence of the Ministry of Economy (www.mg.gov.si).
- The Ministry of Environment and Spatial Planning (www.gov.si/mop/en) is in charge of public health and leads the Nuclear Safety Administration, URSJV-SNSA.
- SNSA is the Slovenian Nuclear Safety Administration, URPAVA REPUBLIKE SLOVENIJE ZA JEDRSKO VARNOST (www.ursjv.gov.si), the regulatory, control and information national body, under the Ministry of Environment. URSJV powers in all national and international nuclear related competences, as nuclear - and radiological safety, trade, transport, accountancy, physical protection, as well as liability, early notification and emergency actions, environmental monitoring.
- ARAO is the governmental Agency established in 1991 for Radwaste Management (www.gov.si/arao/eindex.html) and is responsible for all types of waste including provision of safe conditions for final disposal.
- There is a Nuclear Training (and information) Centre in Ljubljana (www.icjt.org).

12.10. Decommissioning & related Funds

- External
- Managed by a specific agency.

13. SPAIN

13.1. Nuclear Power Outlook

- The total Spanish nuclear production in 2005 was 57.5 TW·h, equivalent to 19.5% of the country's total electricity production.
- After the shutdown of JOSE CABRERA Plant, eight nuclear power plants remain operational in Spain on six sites, totalising a capacity of 7.7 GW(e).
- Mean 2005 cumulated load factor was 83.4%.
- Related annual U requirements are about 1500 t U.
- 2 shutdown NPPs (Vandellós1, José Cabrera).
- ENDESA operates operating 7 plants, 5 in association with NUCLENOR for 3 of them and with IBERDROLA, and 1 of them in association too with UNIÓN FENOSA GENERACIÓN. for two other ones, IBERDROLA operates 2 plants, 1 in association with UNIÓN FENOSA GENERACIÓN and HIDROELÉCTRICA DEL CANTÁBRICO is operating the last one. There is a dispute on the OPA overtaking of ENDESA by the German E.ON or an hostile OPA launched by GAS NATURAL (SP, Catalogna).

13.2. Public Opinion (Eurobarometer 2005)

- 40.5% declares knowledge about radioactive waste (EU average 48.5 %).
- 16% of the interviewees were in favour of the use of nuclear energy.

13.3. Research Reactors

- One shutdown, 3 decommissioned.
- No related U requirements.

13.4. Mining and milling

- ENUSA INDUSTRIAS AVANZADAS, S.A. (www.enusa.es) operated an open-pit uranium mine and concentrates facility at Saelices el Chico (Salamanca), closed in 2000 for economic reasons. ENUSA is shared by at 40% CIEMAT (see below).
- The inferred U resources at an extraction price of 110 €/kg U were recently estimated at 6400 t U.

13.5. Conversion

- There is no more domestic conversion (up until 2002, 1325 t U managed by ENUSA).

13.6. Enrichment

- There is no domestic enrichment. (up until 2002, 799 t SWU managed and supplied in enrichment services by ENUSA).
- ENUSA shares 11% of the French, EURODIF.

13.7. Fabrication

- ENUSA is operating a fuel fabrication facility for BWR, PWR and VVER assemblies at Juzbado (Salamanca). The design capacity of this facility is 400 t U/y.

13.8. Spent fuel and Radioactive Waste Management

- Spent Fuels:
 - Wet storage of spent fuel in ponds innear each NPP totalling about5850 t_{HM}, and containing 2735 3,026 t U_{HM} on 31 December 20042005.
 - A temporary spent fuel wet storage facility is operational at the Trillo nuclear power plant since 2002 with a capacity of 1080 t U. It contained 344 tU on 31 December 2005.
- An old U prospecting site at El Cabril is operated for LILW-SL storage in vaults.
- The construction of a VLLW repository is under construction at El Cabril. This centralized temporary storage facility should start in 2010.

- The main strategy established in the VI General Plan for Radioactive Wastes, approved by the Government on 23 June 2006, is based on the availability of a centralised temporary storage facility by the year 2010.

13.9. Professional Nuclear organisations

- Two professional nuclear groups (lobby) are the FORO DE LA INDUSTRIA NUCLEAR ESPAGNOLA (www.foronuclear.org) and the SOCIEDAD NUCLEAR ESPAGNOLA (www.sne.es).

13.10. Waste Management, Radiation Protection, and Safety Authorities

- The Ministry of Industry, Tourism and Trade is the organisation responsible for the granting of the corresponding authorizations, with the previous binding report issued by the CSN.
- CSN is the National Council of Nuclear Safety, CONSEJO DE SEGURIDAD NUCLEAR (www.csn.es), responsible for nuclear safety, radioprotection, early notification and emergency actions, and related controls.
- CSIC is the National Institute for Science & Technology, CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (www.csic.es) is the national multidisciplinary advisory body.
- Two Governmental organisations are acting in the nuclear waste nuclear sector for the Ministry of Science and Technology, as CIEMAT (see above) and ENRESA, the EMPRESA NACIONAL DE RESIDUOS RADIOACTIVOS (www.endesa.es) in charge of El Cabril and committed to establish a General Radioactive waste Management Plan, including decommissioning in the larger framework of technologies applied to environmental protection.

13.11. Decommissioning & related Funds

- The state company ENRESA holds and manages funds independently from operators.

14. SWEDEN

14.1. Nuclear Power Outlook

- After the closure of Barsebäck 2 in 2005, the 10 operational nuclear reactors have a total installed capacity of ~9.0 GW(e).
- Total nuclear production in 2005 was 69.5 TW·h, equivalent to approximately 45% of the country's total production of electricity.
- There is one operator for each site with respect to two international utilities: The VATTENFALLS Group (www.vattenfalls.se) is running 4 plants at the Ringhals site operated by RINGHALS AB (www.ringals.su) and 3 at the Forsmark site operated by FORSMARK TRAFSGRUPP (www.forsmark.com), and the ALSTOM Power UK Group (www.alstom.com/us) owning OKG AKTIEBOLAG (www.okg.se/en), operating 3 plants at the Oskarshamn site.

- Average cumulated load factor in 2005 was 75%.
- Related annual U requirement is approximately 1435 t U.
- 3 shutdown NPPs (Agesta, Barsaback1+2).

14.2. Public Opinion (Eurobarometer 2005)

- 61.5% declares knowledge about radioactive waste (EU average 48.5%).
- 60% of the interviewees were in favour of the use of nuclear energy.

14.3. Research Reactors

- There are 3 shutdown research reactors at Studsvik (www.studsvik.se) and one critical assembly which now is decommissioned.
- No related U requirements.

14.4. Mining and milling

- About 10 old U mines are now all used up.
- Inferred resources with an extraction price of 110 €/kg U are actually estimated at 6000 t U.

14.5. Conversion

- None

14.6. Enrichment

- None

14.7. Fabrication

- The Westinghouse Atom fuel fabrication plant at Västerås produces PWR and BWR fuels and has a capacity of 600 t U/y.

14.8. Spent fuel and Radioactive Waste Management

- Spent Fuels:
 - Prior to the decision to phase out nuclear power in Sweden, approximately 140 t_{HM} were shipped to BNFL in the late 1970s.
 - Since then, Sweden has opted for the direct disposal of spent nuclear fuel. Currently, all spent fuel are transported to the CLAB facility (wet storage) by dedicated shipment to be temporarily storage pending final disposal.
 - Total pool capacity on 11 plants is ready for 30000 spent fuel assemblies, about 3400 spent fuel assemblies are stored as of 31 December 2004.

- Spent fuel from research reactors is stored in pools before export to the USA.
- Spent fuel will be stored in a CLAB Central Interim Storage Facility near Oskarshamn site for at least 30 years before encapsulation and disposal. The CLAB is operational since 1985 and more than 20000 spent fuel equivalent to 4185 t_{HM} are now stored (31-12-04). Its capacity was increased from 5000 to 8000 t_{HM}. It is operated by the SKB, the Swedish Nuclear Fuels and Waste Management Company SKB, *SVENSK KÄRNBRÄNSLEHANTERING AB* (www.skb.se).
- There are surface VLLW disposal sites in shallow land burials on 4 sites: Forsmark, Ringhals, Oskarshamn and Studsvik.
- All produced waste at the plants is managed on site before transport to the dedicated repository SFR.
- SFR is a cavern rock underground for the final repository for LILW and LILW-SL close to Forsmark site, also operated since 1988 by SKB. Its storage capacity is sufficient for all low and medium-level wastes. SFR will store most of the waste from decommissioning.
- SVAFO AB is an incineration facility of some LILW near the Studsvik research site shared by Studsvik (www.studsvik.se/en) and Vattenfalls (www.vattenfalls.se).
- Final Disposal: The Äspö Hard Rock Laboratory is acting on behalf of the nuclear utilities in conducting the extensive research with regard to the facility for final disposal of long-lived spent nuclear fuel and waste.

14.9. Professional Nuclear organisations

- ICRP, the International Commission for Radiological Protection (www.icrp.org) is located at Stockholm.
- A knowledge preservation initiative of the Swedish Young Generation (www.younggeneration.nu) connected with the European Nuclear Society (ENS) is acting to ensure the production of economic, environment-friendly, and safe nuclear power, with the transfer of expertise to the next generation. It brings together members from 22 countries and organises periodic events.
- NSFS is the Nordic Society for Radiation Protection created by R. Sievert (www.nsfs.org/en).

14.10. Waste Management, Radiation Protection, and Safety Authorities

- SKI, the Swedish Nuclear Power Inspectorate *STATENS KÄRNKRAFTINSPEKTION* (www.ski.se) is supervising all nuclear activities, and is co-operating with SSI (below) for radiation protection matters. SKI reports to the Ministry of Environment (www.regeringen.se).
- SSI is the Swedish radiation Protection Authority, *STATENS STRÄLSKIDDINSTITUT* (www.ski.se). SSI is also responsible for the co-ordination of emergencies.

- KASAM is the National Council for Nuclear Wastes *STÄTENS RÄT FOR KÄRLAVFALLSFRÄGOR* (www.sou.gov.se/kasam), an independent and governmental committee attached to the Ministry of Environment.

14.11. Decommissioning & related Funds

- Studsvik is the industrial group implied in decommissioning activities (www.studsvik.se/en).
- Nuclear Waste Fund (managed by the State) independent from operator.

15. UNITED KINGDOM

15.1. Nuclear Power Outlook

- Total nuclear production in 2005 was 75.2 TW·h, to approximately 20 % of the country's total production of electricity.
- 23 NPPs: Eight Magnox (GCR), fourteen AGR (GCR) plants and one PWR are in operation at 9 nuclear sites with a installed capacity of ~11.8 GW(e).
- BRITISH ENERGY (www.british-energy.co.uk) is operating 10 GCR and the only PWR, and also 4 GCR in association with SCOTTISH NUCLEAR LIMITED; British Nuclear Fuels (BNFL, www.bnfl.com) is operating the 8 remaining GCR.
- Average cumulated load factor in 2005 was 71.4%.
- Related annual U requirement is approximately 2160 t U.
- 22 NPPs shutdown (18 GCR, 2 FBR, 1 AGR, 1 SGHWR).
- UK is a member of the GIF Program.
- A complete fuel cycle exists in the UK, both for the home market as well as for export.
- The British government shows a renewed interest for a significant share of nuclear in the future energy mix.

15.2. Public Opinion (Eurobarometer 2005)

- 43% declares knowledge about radioactive waste (EU average 48.5%).
- 44% of the interviewees were in favour of the use of nuclear energy.

15.3. Research Reactors

- There is a large variety of research reactors and critical assemblies: 27 are actually decommissioned, 6 are shutdown and 3 (small) remain operational, with a total thermal power of 100kW.
- No related U requirements.

15.4. Mining and milling

- No mining or milling of uranium ore takes place in the UK.

15.5. Conversion

- WESTINGHOUSE (TOSHIBA) operates a conversion facility at its Springfields plant near Preston, where uranium ore concentrate is converted to UF_6 for customers, capacity of 6000 t U/y.
- The conversion facility should have closed in 2007, but CAMECO bought 5000 t/y capacity over 10 years.
- Uranium metal for Magnox fuel is produced from UF_4 , an intermediate product for UF_6 production. Magnox fuel production will cease in 2007.

15.6. Enrichment

- URENCO operates a commercial centrifuge enrichment plant at Capenhurst, with a capacity of 2300 t SWU/y. (www.urenco.com).
- URENCO is planning to build a new enrichment plant (NEF) in the USA.
- URENCO has a partnership venture with AREVA (FR) for the development of Centrifuge Enrichment Technology (CET).

15.7. Fabrication

- WESTINGHOUSE Springfields fabricates a number of different types of fuel. Current production capacities are Magnox (1300 t U/y), AGR (260 t U/y).
- The UKAEA fabrication plant for material test reactor fuel closed down in 2002, pending decommissioning.
- BNFL operates a small scale MOX fuel demonstration facility at Sellafield that has a capacity of 8 t HM /y. This facility will only be used for development purposes in the future. The commercial scale MOX plant started at the end of 2001. Its theoretical production capacity of 120 t HM /y is not expected to exceed 30-40 t/y.
- Quantities of UO_2 powder are exported to foreign fabricators.

15.8. Spent fuel and Radioactive Waste Management

- BNFL operates a Magnox fuel reprocessing plant at Sellafield, which has an operational capacity of 1500 t HM /y (this will close in 2012).
- The BNFL reprocessing plant is also operated at Sellafield with an operational capacity of 1200 t HM /y.
- BNFL operates spent fuel storage pools at Sellafield for both AGR and LWR fuels. The pools have a total capacity of 8000 t HM .

- A spent fuel dry storage facility (capacity 700 t_{HM}) is in operation at the WYLFA nuclear power plant, replacing wet stores in older reactors.
- A LLW surface disposal facility used by BNFL at Drigg.
- Several disposal facilities at Dounreay site for mainly own LLW.
- ILW (intermediate level waste) is stored, mainly at the centres of production, and will be disposed of in NIREX proposed facility, when issued proposals.
- HLW are currently stored, either raw or in vitrified form, mainly by BNFL at its Sellafield site. No decisions on final disposal have yet been taken by the Government.

15.9. Waste Management, Radiation Protection, and Safety Authorities

- Waste management and decommissioning are provided to the UK and international markets by BNG a subsidiary of BNFL.
- RWMAC is an independent Radioactive Waste Management Advisory Committee advising the Ministry of Environment and the Scottish and Wales Assemblies (www.defra.gov.uk/rwmac).
- The Committee on Radioactive Wastes Management (CoRWM) is in charge of recommendations for ILW and HLW (www.corwm.org.uk).
- NIREX is a government-owned non-profit company reporting to the same authorities working to develop safe and environmentally responsible solutions for the management of nuclear wastes (www.nirex.co.uk).
- Final disposal: CoRWM, presented its recommendations on LILW and HLW disposal but no plans exist at the moment.
- The NRPB is the national radiological protection Board part of the health Protection Agency, in charge of research, advisory and technical services on radioprotection (www.hpa.org.uk/radiation).
- The UK government's nuclear authority policy is run by its nuclear safety Directorate (www.hse.gov.uk/nuclear).
- AKEAE is the British Research institute **United Kingdom Atomic Energy Authority**, owning 5 research sites.

15.10. Decommissioning & related Funds

- There is not a single common regime for funding.
- There are three main nuclear operators: BE (private) and BNFL and UKAEA (public sector).
- BNFL: Internal not segregated fund but a Nuclear Liabilities Investment Portfolio earmarked for that purpose.

- BE: Internal independent Nuclear Generation Decommissioning Fund (NGDF).
- Under a recently implemented scheme the Nuclear Decommissioning Authority(NDA) is responsible for securing the discharge of all public sector liabilities on civil public sector sites (i.e. owned by BNFL and UKAEA).
- Under a BE's restructuring plan, the NGDF would be worked in under the new Nuclear Liabilities Fund (NLF).