



**AGENCE POUR L'ENERGIE NUCLEAIRE
NUCLEAR ENERGY AGENCY
COMITE CHARGE DES ETUDES TECHNIQUES ET ECONOMIQUES SUR LE DEVELOPPEMENT
DE L'ENERGIE NUCLEAIRE ET LE CYCLE DU COMBUSTIBLE
COMMITTEE FOR TECHNICAL AND ECONOMIC STUDIES ON NUCLEAR ENERGY
DEVELOPMENT AND FUEL CYCLE**

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COMITÉ CHARGÉ DES ÉTUDES TECHNIQUES ET ÉCONOMIQUES
SUR LE DÉVELOPPEMENT DE L'ÉNERGIE NUCLÉAIRE ET LE CYCLE DU COMBUSTIBLE [NDC]

46ÈME RÉUNION
24-25 JANVIER 2002

COMMITTEE FOR TECHNICAL AND ECONOMIC STUDIES
ON NUCLEAR ENERGY DEVELOPMENT AND THE FUEL CYCLE [NDC]

46TH SESSION
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<p>RAPPORT DES PAYS MEMBRES REPORTS BY MEMBER COUNTRIES</p>

➤ Australia.....	3
➤ Belgique	6
➤ Canada.....	10
➤ France.....	15
➤ Germany.....	20
➤ Hungary.....	22
➤ Italy	25
➤ Japan.....	26
➤ Republic of Korea	30
➤ The Netherlands	34
➤ Spain.....	36
➤ Sweden	38
➤ Turkey	39
➤ United Kingdom.....	46
➤ USA.....	48

AUSTRALIA

Uranium Production and Exports

► Production

Australian uranium production in 2000 increased 27 per cent to 8 937 tonnes (t) of U₃O₈. Production continued to be from the Ranger mine in the Northern Territory operated by Energy Resources of Australia Ltd (ERA) and Olympic Dam copper/uranium project in South Australia operated by WMC Ltd.

Production at Ranger increased 15 per cent to 4 437 t of U₃O₈. However, production has remained well below the mine's production capability of 5 800 tpa of U₃O₈ due to market conditions. In March 2001, ERA announced production had been reduced in line with sales forecasts, with production in 2001 likely to be slightly lower than in 2000.

Production at Olympic Dam increased by 41 per cent to 4 500 t of U₃O₈. The significant increase in output reflects a full year's contribution following the major expansion of the project completed in the first half of 1999 at a cost of A\$1.94 billion. The expansion increased nominal copper production capacity from 85 000 t per annum (tpa) to 200 000 tpa and uranium from 1 700 tpa to approximately 4 600 tpa of U₃O₈.

As a result of a major fire in the solvent extraction plant at Olympic Dam on 21 October 2001 (see below) and lower production from Ranger, Australian uranium production in 2001 is now unlikely to exceed the record level attained in 2000 despite new production from the Beverley mine.

► Exports

All Australian uranium production continues to be exported. Exports in 2000 increased 16 per cent to 8 757 t of U₃O₈. The principal destinations were the USA, Japan, ROK, UK and France.

Uranium Mine Developments – Existing Projects

► Ranger

In August 2000, Rio Tinto Ltd completed the acquisition of North Limited, including North's 68.4 per cent equity interest in ERA. The Ranger mine and proposed Jabiluka mine (see below) are thus now controlled by Rio Tinto which, following a strategic review of ERA operations, announced it had decided to retain its interest in the company.

► Olympic Dam

Olympic Dam is currently the world's second largest uranium production centre. In the July-September quarter of 2001, the annual rate of refined copper production exceeded 210 000 tpa. The uranium production rate in the same period was well in excess of 5 000 tpa of U₃O₈.

In August 2001, WMC announced that it had appointed an executive team to examine the expansion of the Olympic Dam project to produce 400 000 to 500 000 tpa of refined copper. WMC is also currently spending A\$83 million expand copper production capacity to 235 000 tpa. WMC has not indicated at this stage whether this first stage incremental expansion, scheduled to be completed in 2002, will have any significant impact on uranium production levels.

Existing Commonwealth and State environmental clearances allow copper production to increase to 350 000 tpa (in which case, uranium oxide output was expected to increase to around 7 730 tpa). These clearances are subject to no substantial change in the technology of mining practice that could cause significant impact on the environment, no change to tailings management systems and no change in water abstraction (from the Great Artesian Basin) beyond that already approved by South Australia (up to 42 megalitres/day).

Any further environmental assessment would be carried out in accordance with new Commonwealth environment legislation – the *Environment Protection and Biodiversity Conservation Act 1999* – which came into operation on 16 July 2000.

On 21 October 2001, WMC suffered its second fire within the past two years in the solvent extraction area of the Olympic Dam processing plant. WMC has indicated that the fire will only have a minimal impact on copper production over the next year, with the loss of production expected to be less than 10 000 t. However, uranium oxide production is expected to reduce by 1500 t over the same period.

WMC Ltd has also reported that drilling at Olympic Dam had intersected high grade mineralisation in an area adjacent to the main mine area. These intersections occur adjacent to the working areas in the northern ore zones and to the south, adjacent to resources not yet in the mine plan. The company reported that the zones intersected are of mineable widths and were encountered over an aggregate strike length in excess of one kilometre. They generally occur 50 to 100 metres (m) outside the active mining zone. The intersections range from 60 m averaging greater than 3% Cu to 12 m averaging greater than 6% Cu. The company stated that the ore zones intersected to date may be parts of a broader zone running parallel to the known mineralisation.

► **Beverley**

The Beverley in-situ leach (ISL) uranium mine in South Australia commenced operation in late 2000, but the first uranium production and exports did not place until early in 2001. Production has been ramping up towards an expected production level of approximately 1 000 tpa of U₃O₈.

Uranium Mine Developments – New Projects

Two new uranium mines are currently in prospect, Jabiluka in the Northern Territory and Honeymoon in South Australia.

► **Jabiluka**

As with Ranger, Jabiluka is surrounded by, but is not part of, Kakadu National Park (KNP).

In view of World Heritage concerns about the impact of Jabiluka's development on KNP, ERA has previously agreed that Jabiluka and the nearby Ranger operation would not be in full operation simultaneously. In line with this approach, ERA announced in April 2001 that the ERA Board would consider further development of ERA operations on a progressive basis in consultation with all key stakeholders, including Aboriginal interests. In the meantime, Jabiluka remains in a stand-by and environmental care and planning phase.

► **Honeymoon**

Southern Cross Resources Australia Pty Ltd (SCR) is proceeding with its proposal to develop the Honeymoon uranium project to produce up to 1 000 tpa of U₃O₈ using the ISL mining method.

On 1 February 2001 the Commonwealth Environment Minister announced that, before he could make a final decision on the project, further detailed information on the hydrogeology of the aquifers was required to confirm the lateral and vertical boundaries of the aquifer. This was designed to provide a more thorough basis for the design of the monitoring regime. SCR carried out the work required and submitted a report containing the relevant information for assessment by Geoscience Australia and the Bureau of Rural Sciences.

On 20 November 2001 the Commonwealth Environment Minister formally advised the Minister for Industry, Science and Resources that the proposed Honeymoon mine was environmentally acceptable. SCR was subsequently granted a 5-year conditional export permission. The State Government (South Australia) has also cleared the project's development by approving the offer of a mining lease subject to finalisation of mining agreements with native title claimants.

Radioactive Waste

► Proposed National Radioactive Waste Repository

On 24 January 2001, the Australian Government announced that a preferred site and two alternatives had been identified for a national radioactive waste repository for the near-surface disposal of Australia's low level and short-lived intermediate level radioactive waste. The sites are located in South Australia in stony desert country, in an area of deep, saline ground water. The preferred site, Evetts Field West, was selected as it performs best against the National Health and Medical Research Council's *Code of Practice for the Near-Surface Disposal of Radioactive Waste in Australia*.

In March 2001, the Commonwealth Environment Minister announced that an Environmental Impact Statement should be prepared for the repository project, in accordance with the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*. This is expected to take about a year, and will include a public consultation process.

The repository will be Commonwealth owned, and regulated by the Commonwealth regulator, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). The repository will not be constructed or commence operations until 2003 at the earliest, when environmental assessment and ARPANSA licensing processes have been successfully completed.

► National Store for Long-lived Intermediate Level Waste

Australia is also establishing a national above-ground storage facility for its long-lived intermediate level waste.

On 8 February 2001, the Commonwealth Government announced that it would establish a safe, purpose-built facility on Commonwealth land for the storage of national intermediate level waste produced by Commonwealth agencies. Co-location of the national intermediate level radioactive waste store with the planned national low-level repository in South Australia has been ruled out. The search for a site for the national store will be a comprehensive and transparent process, based on scientific and environmental criteria. A site will be selected following the advice of scientific experts, and an independent, expert advisory committee. The earliest a site could be identified would be late 2002.

A public discussion paper, *Safe Storage of Radioactive Waste, The National Store Project: Methods for Choosing the Right Site*, was released for comment in July 2001, and outlined the methodology and selection criteria which would be used to identify a suitable site. A paper responding to public comment will be released in the first quarter of 2002.

Administrative Changes

Following the Federal Election on 10 November 2001, uranium mining and export policy is now administered by the Department of Industry, Tourism and Resources (formerly the Department of Industry, Science and Resources). In view of the return of the Liberal/National Coalition Government, there have been no changes to government policy relating to uranium mining and exports.

Uranium Industry Section

BELGIQUE

MINISTÈRE DES AFFAIRES ÉCONOMIQUES, ADMINISTRATION DE L'ÉNERGIE

Division Applications nucléaires

Production et consommation d'électricité en 2000**► Production nette d'électricité**

Production totale nette 75 953 GWe (diminution de 5,2 % par rapport à l'année 2000).

Cette production totale nette est répartie comme suit :

SOURCE	PRODUCTION [GWh _e]	PART [%]
Combustible nucléaire	44 178	58,2
Combustibles solides	10 742	14,1
Combustibles liquides	1 039	1,4
Combustibles gazeux	16 925	22,3
Vapeur de récupération	1 413	1,8
Hydraulique	1 630	2,2
Éoliennes et autres renouvelables	26 000	-
<i>Total</i>	75 953	100,0

En 2001, la part de l'énergie nucléaire dans la production nette totale a légèrement augmenté de 1,4 % par rapport à l'année 2000, pour atteindre 58,2 %. L'énergie nucléaire est la seule forme d'énergie qui a pu augmenter sa quote-part dans la production nette totale belge.

► Consommation d'électricité

La consommation totale en énergie électrique en 2001 était égale à 83 367 GWh_e.

L'augmentation de la consommation a atteint une valeur de 0,6 % par rapport à l'année 2000.

La relation entre la production totale nette et la consommation peut être établie comme suit :

Production nette	75 953 GWh _e
Importations	15 543 GWh _e
Exportations	- 6 511 GWh _e
Énergie de pompage	- 1 618 GWh _e

Énergie appelée	83 367 GWh _e

Les importations ont de nouveau considérablement augmenté, tandis que les exportations continuent de diminuer.

Mesures politiques en matière de production d'électricité**► Libéralisation du marché de l'électricité**

La transposition de la directive 96/92/CE du 19 décembre 1996 s'est poursuivie durant l'année 2001. Étant donné que les compétences relatives à la politique de l'énergie sont réparties entre l'autorité fédérale et les Régions, la libéralisation du marché de l'électricité a nécessité l'intervention de ces divers législateurs.

Au niveau fédéral, l'organisation du marché de l'électricité relève de la loi du 29 avril 1999, laquelle requiert l'adoption de diverses mesures d'exécution. Plusieurs nouveaux arrêtés royaux ont ainsi été

adoptés en 2001. C'est ainsi notamment qu'un arrêté royal du 4 avril 2001 a déterminé la structure générale des tarifs de transport et qu'un arrêté royal du 27 juin 2001 a établi un règlement technique pour la gestion du réseau de transport et l'accès à celui-ci.

En outre, des négociations se sont poursuivies en vue de la désignation du gestionnaire du réseau de transport, lequel constituera un organisme indépendant ne pouvant exercer d'activités dans les domaines de la production et la vente d'électricité.

Au niveau régional, qui a trait plus particulièrement aux compétences exercées en matière de distribution, la mise en œuvre de la directive 96/92/CE a fait l'objet d'un décret du 17 juillet 2000 du Parlement flamand et d'un décret du 12 avril 2001 du Conseil régional wallon. Le Conseil de la Région de Bruxelles-Capitale a également adopté le 13 juillet 2001 une ordonnance transposant ladite directive. Ces législations nécessitent l'adoption de diverses mesures d'exécution qui sont actuellement en cours d'élaboration et de publication.

Lors de l'année 2001 ont eu accès au réseau de transport et de distribution les clients consommant plus de 20 gigawattheures par an (par site de consommation et autoproduction comprise).

En matière de régulation, de nouveaux organismes ont été mis en place : la Commission de Régulation de l'Électricité et du Gaz sur le plan fédéral (déjà depuis 2000), la Commission wallonne pour l'Énergie en Région wallonne et la « Vlaamse Reguleringsinstantie voor de Elektriciteits- en Gasmarkt » en Région flamande.

► **Avenir de la production d'électricité en Belgique**

La Commission de Régularisation de l'Électricité et du Gaz (CREG) est en train de préparer son programme indicatif des moyens de production d'électricité, tel qu'exigé par la loi du 29 avril 1999 relative à l'organisation du marché de l'électricité. Ce programme est attendu pour le premier trimestre de l'année 2002. Ensuite, il devra être approuvé par le Gouvernement.

► **Financement des charges à long terme**

Un double accord de principe est intervenu entre l'État belge et le secteur d'électricité couvrant les deux points suivants :

- Financement des passifs nucléaires sur le site de Mol-Dessel

Le financement des travaux d'assainissement des passifs historiques sur le site Mol-Dessel est régi par une convention qui date de 1990. Cette convention contient un schéma de financement chiffré, qui n'allait que jusqu'en 2000. Le financement ultérieur n'était réglé qu'en grandes lignes. Maintenant un accord de principe est intervenu en ce qui concerne les modalités d'application de ces grandes lignes. Cet accord revient à ce qui suit :

- ❖ L'État belge financera l'assainissement de l'ancienne usine de retraitement Eurochemic à Dessel pour un montant égal à 24.200 MBEF (599 902 M €).
- ❖ Le secteur d'électricité financera :
 - L'assainissement de l'ancien département du CEN•SCK pour un montant égal à 13 525 MBEF (335,276 M €).
 - 25 % du démantèlement de l'ancien réacteur BR3 pour un montant égal à 1 684,5 MBEF (41,758 M €).

Un projet d'avenant à la convention de 1990 a été établi. La discussion sur le texte de cet avenant est en cours de finalisation.

- La gestion des provisions pour le démantèlement des centrales nucléaires et la gestion du combustible irradié.

Les provisions pour le démantèlement des centrales nucléaires et pour la gestion du combustible irradié doivent être centralisées auprès de la S.A. Synatom. Cette firme est chargée de la gestion du cycle du combustible nucléaire en Belgique. Elle est la filiale de la S.A. Electrabel, l'opérateur des centrales nucléaires belges. L'État belge détient une action d'or de Synatom avec des droits spécifiques permettant de bloquer certaines décisions du Conseil d'administration de la firme. Sur les provisions, Synatom devra faire rapport à un comité de représentants gouvernementaux. Ce comité sera composé de représentants de la Banque nationale de Belgique, de la Trésorerie, de la Commission de Régulation de l'Électricité et du Gaz, de l'Office de Contrôle des Assurances et de l'Administration du Budget. Les directeurs généraux de l'AFCN et de l'ONDRAF peuvent assister au comité avec un vote consultatif. Ce comité est chargé de la surveillance des provisions et doit annuellement faire rapport au Gouvernement et au Parlement. Un projet de convention à ce sujet a également été établi. Le texte est toujours en discussion.

► Développement durable

Comme exigé par le plan fédéral 2000-2004 en matière de développement durable, le Gouvernement a publié un rapport justifiant la sortie du nucléaire et le moratoire sur le retraitement.

Organisation des autorités de sûreté nucléaire

La loi du 15 avril 1994 relative à la protection de la population et de l'environnement contre les dangers résultant des rayonnements ionisants et relative à l'Agence fédérale de Contrôle nucléaire, dont certains articles étaient déjà rendus applicables dans le passé, est entièrement entrée en vigueur le 30 août 2001.

A ce même jour, l'Agence fédérale de Contrôle nucléaire (AFCN) est devenue complètement opérationnelle. Cette agence regroupe en une seule entité tous les services qui étaient auparavant compétents pour la sûreté nucléaire et qui étaient répartis sur plusieurs ministères.

Le même jour est également entré en vigueur le nouveau règlement général de la protection de la population, des travailleurs et de l'environnement contre le danger des rayonnements ionisants. Ce nouveau règlement inclut la transposition d'une série de directives européennes, dont celle fixant les normes de base relatives à la protection sanitaire de la population et des travailleurs contre les dangers résultant des rayonnements ionisants.

Également le 30 août 2001 est entré en vigueur l'arrêté royal fixant le montant et le mode de paiement des redevances perçues en application de la réglementation relative aux rayonnements ionisants. Cet arrêté doit assurer le financement de l'Agence fédérale de Contrôle nucléaire pour son fonctionnement indépendant.

Cycle du combustible

Programmes d'études et de R&D en matière d'évacuation

En ce qui concerne les déchets de faible activité et de courte durée de vie, le programme établi dans le cadre de la décision gouvernementale d'opter pour une solution définitive ou à vocation définitive pour ce type de déchets a son cours normal. Les partenariats locaux et les comités d'accompagnement suivent de près les travaux de l'ONDRAF en matière de concepts d'évacuation et de leur faisabilité, d'implantation d'une installation d'évacuation, de sûreté, de santé et d'environnement.

L'ONDRAF est en train de préparer un rapport récapitulatif sur les travaux effectués les trois dernières années. Le but de ce rapport est de décrire le progrès réalisé. Le rapport sera présenté au Gouvernement dans le premier semestre de l'année 2002.

En ce qui concerne les déchets de moyenne et haute activité et de longue durée de vie, le programme d'études et de R&D continue sur son rythme normal. Dans le cadre du programme PRACLAY (visant à démontrer la faisabilité technique de l'évacuation géologique des déchets vitrifiés hautement calorifiques), le deuxième puits d'accès au laboratoire souterrain a déjà été construit il y a un certain temps. La construction de la galerie de liaison entre ce puits et le laboratoire existant est en cours et sera normalement

terminée dans le courant du premier semestre 2002. Perpendiculairement à cette galerie de liaison, on prévoit une galerie d'évacuation qui contiendra des déchets vitrifiés simulés (l'expérience Praclay elle-même). Avant de commencer la construction de cette dernière galerie, le concept d'évacuation des déchets hautement actifs sera revu complètement.

Le rapport de sûreté et de faisabilité intermédiaire, appelé SAFIR 2, est terminé. Il fait le point sur les résultats acquis au cours des dix dernières années en matière de R&D. Il définit, sur cette base, les travaux encore à réaliser. Le rapport sera bientôt soumis au Gouvernement. Les préparations sont en cours pour soumettre le rapport à un « peer review » international, organisé par l'AEN.

Recherche

L'étude d'avant-projet du projet Myrrha, une source neutronique à multiple usage pour les applications de R&D sur base d'un « accelerator driven system (ADS) » a été finalisée. Elle fait l'objet d'un examen externe. Ce dernier devrait être prêt pour mi-2003. Parallèlement à cette étude, une série de projets R&D sont en cours d'exécution, la plupart dans le cadre du programme-cadre européen.

Dans le courant de l'année 2001, trois transports de combustible irradié du réacteur BR2 ont eu lieu vers La Hague pour retraitement. Ces transports ont eu lieu dans le cadre d'un contrat conclu en 1997 entre le CEN•SCK et Cogéma.

CANADA

Nuclear Power Program

Nuclear Power Data as of 31 December 2000

	Canada	Ontario	New Brunswick	Québec
Electricity Demand Growth (% p.a.)	1.24	1.04	1.07	1.03
Nuclear Share (%) of Electric Utility Generation	13.5	42.6	19	2
Reactors in Service	14	12	1	1
Capacity In Service (Net MWe)	10 301	9 028	635	638

CANDU Performance Highlights

Canada's nuclear plants generate on average about 14% of Canada's electricity. Most of the nuclear electricity generated is in the province of Ontario. CANDU units are also in operation in Korea, Romania and Argentina. Most of the nuclear electricity generated was in the province of Ontario. Of the 20 reactor units in the province of Ontario, 8 are currently out of service, four of which are at the Pickering station and four at the Bruce "A" station. It is anticipated that all four units at the Pickering station and two of the units at the Bruce "A" station will be brought back to service in the next few years, subject to regulatory approvals. Construction of two CANDU 6 units in China is on track and in-service is planned for 2003-03.

The capability factor of the 14 operating units in Ontario, Quebec and New Brunswick was over 80% in 2001. The CANDU 6 units in Quebec, New Brunswick and abroad continue to show good performance with gross lifetime capacity factors of over 80%.

Status of the Program

Ontario

In May 2001, the 8 units at the Bruce site (A and B) were leased to Bruce Power Inc. which is a consortium led by British Energy. The lease covers the period to 2018, with an option to extend for up to another 25 years. Bruce Power is a joint venture of British Energy plc, Cameco Corporation, the Power Workers' Union and The Society of Energy Professionals. Bruce Power Inc. is now responsible for the laid-up units at the Bruce A site and is evaluating the possible restart of units 3 and 4 at the Bruce A facility. Work is underway on an environmental assessment – which has been released to the public for review – and on technical studies which will be used to support the EA report.

Ontario Power Generation (OPG) is continuing to implement its five-year 'Integrated Improvement Plan' (IIP) project. This program expenditure applies to the 8 operating nuclear units at Pickering B and Darlington. OPG has reported that progress has been made under the IIP and that the project is expected to be completed on schedule.

With respect to the Pickering A station, on 16 February 2001, the CNSC announced that it had determined that the restart of the Pickering A units would not cause significant adverse environmental effects. The ruling allows the CNSC to proceed to formal consideration of OPG's application to re-start the reactors.

New Brunswick

In February 2001, the New Brunswick government released its new energy policy. Over the next 10 years, the government intends to move ahead with the deregulation of its electricity market. The new policy does not, however, provide any clear indication of whether or not the government supports the life extension of Point Lepreau beyond 2008 for another 25 years. It simply indicates that in reviewing the future of any electric power generation facility the decisions will be driven by environmental and economic considerations.

NB Power has yet to make a decision on the refurbishment of Point Lepreau beyond 2008 and this decision is expected in 2002 following the completion of a refurbishment assessment by NB Power and Atomic Energy of Canada Limited (AECL) in spring 2002. NB Power and AECL signed an agreement on the refurbishment assessment program at the Point Lepreau Generating Station in January 2001. The refurbishment of Point Lepreau would require the replacement of fuel channels, calandria tubes and other components. Before a decision can be made, other factors over and above the engineering assessment, have to be considered including the energy market, generating capability of the utility, the cost of alternative sources of generation, the cost and economics of refurbishment and the socio-economic and environmental impact of closing the station. There is also the issue of whether Point Lepreau will be privatised along with NB Power's conventional generation facilities if the decision is made to privatize NB Power. No decision has been made, yet, by the government concerning the future of NB Power.

Quebec

Hydro Quebec's Board of Directors has agreed to initiate a detailed study aimed at assessing the life extension of Gentilly 2 station after 2008 for an additional 25 years. The study will be conducted by AECL and will include a comprehensive engineering evaluation of the rehabilitation work to be done as well as a detailed cost estimate. Based upon the findings, a proposal will be submitted to the Board of Directors for approval. Preliminary assessments indicate that the refurbishment of Gentilly 2 would be fully competitive when compared to other electricity generating options.

Status of the International Nuclear Program

The CANDU 6 unit in Romania is fully operational and is producing about 10% of the country's electricity. In May 2001, AECL and its partners concluded a contract with the Government of Romania for the completion of unit 2 at Cernavoda. Work on the unit will be initiated once the financing is in place (this is expected to occur within the next couple of months). Two CANDU 6 reactors are under construction at Qinshan, near Shanghai, China. The contract for these units was signed by AECL and the China National Nuclear Corporation (CNNC) in November 1996. The units are to go into commercial operation in 2003-04.

Uranium Industry Highlights

Canadian Uranium Industry Highlights

Despite low prices, Canadian uranium production capability continues to expand in the province of Saskatchewan. The McClean Lake mill, which entered into production in June 1999, reached its annual licensed production capacity of 2 300 tU in November 2000. The McArthur River mine, which entered into production in December 1999, continued to ramp up towards its annual licenced production capacity of over 6 000 tU, producing about 3 850 tU in 2000. Test mining and development continued at Cigar Lake in 2000, with the mine currently expected to begin production in 2005.

As of 1 January 2000, Canada's total "known" recoverable uranium resources were 417 000 tU, compared with 433 000 tU as of 1 January 1999. This downward adjustment of some 4% is the result of ongoing resource evaluation. Primary output from Canada's four uranium producing operations in northern Saskatchewan amounted to about 10 683 tU in 2000, up some 30 per cent from the 1999 total, mainly due to contributions from the new McClean Lake and McArthur River mines.

Recent Uranium Developments

In August 1998, COGEMA Resources Inc. (CRI) announced its intention to suspend operations indefinitely at the Cluff Lake uranium production center on 31 December 2000. However, with capacity remaining in the tailings management area, higher ore grades, lower production costs and improved productivity, CRI plans to continue operations through 2001. CRI is preparing a comprehensive study environmental assessment of its plan to suspend operations at Cluff Lake.

Table 2. Canadian Uranium Data

	2000	1999	1998	1997	1996
Known Uranium Resources Recoverable from Mineable Ore (1,000 tU as of January 1)*	417	433	419	430	490
Total Primary Production (tU)	10 683	8 214	10 922	12 031	11 706
By-product** Production (tU) [not included above]	0	0	0	0	48
Total Producer Shipments (tU)	9 921 ^p	10 157	9 984	11 127	11 396
Value of Shipments (\$C millions)	485 ^p	500	500	554	624
Average Price for Deliveries under Export Contracts (\$C/kgU) / (\$US/lb U3O8)	47.70/ 12.40	49.10/ 12.70	51.10/ 13.30	51.30/ 14.20	53.60/ 15.10
Exports of Uranium of Canadian Origin (tU)	10 966	7 146	8 274	10 255	11 223
Uranium Exploration Expenditures (\$C millions)	46	49	60	58	39

* Resources at prices of \$150/kgU or less

** Uranium from refinery/conversion facility by-products recovered at Elliot Lake. With the closure of Rio Algom's Stanleigh operation in mid-1996, byproducts from Cameco's refinery/conversion facilities in Ontario are no longer processed in Canada.

^p preliminary figures.

NA not available at this time.

On 12 October 2000, Cameco Corporation announced that it had signed an agreement with British Energy PLC (BE) to acquire a 15 per cent interest in the Bruce Power Partnership (Bruce Power), which has signed an agreement to lease and operate the Bruce A and B nuclear power plants and related facilities from OPG. Under the terms of the agreement Cameco will have the full responsibility to manage all of Bruce Power's fuel procurement needs.

In November 1998, Cameco announced production cutbacks that included the suspension of mining operations and reduced output at the Rabbit Lake mill. In August 2000, Cameco extended the temporary shutdown and, after the ore stockpile is depleted at the end of May 2001, the mill was placed on standby. Subject to favourable market conditions and regulatory approvals, Cameco is expected to renew mining and milling at Rabbit Lake in late 2002.

In January 2001 Cameco announced that, as a result of an extensive underground drilling program, McArthur River's total reserves had been increased by over 50%. The world's largest, highest grade uranium mine now has total reserves amounting to 152 000 tU, with an average grade of 18% U (from the previous total of 98 000 tU at an average grade of 15% U).

Radioactive Waste Management

Policy Framework for Radioactive Waste

In July 1996, the Government of Canada announced its Policy Framework for Radioactive Waste. The Framework sets the stage for the further development of institutional and financial arrangements to implement disposal of radioactive waste in a safe, environmentally sound, comprehensive, cost-effective and integrated manner. The Policy Framework specifies that the federal government has the responsibility to develop policy, to regulate, and to oversee radioactive waste producers and owners in order that they meet their operational and funding responsibilities in accordance with approved disposal plans. The Framework recognises that there will be variations in approach in arrangements for the different waste types in Canada, i.e., nuclear fuel waste, low-level radioactive waste and uranium mine and mill tailings.

Nuclear Fuel Waste

In 1988, the Minister of Energy, Mines and Resources (now Natural Resources Canada) referred the concept of deep geological disposal of nuclear fuel waste developed by AECL to the Minister of the Environment for a public review by an environmental assessment panel. In 1989, the Minister of the Environment appointed a Panel to undertake the public review. In October 1994, AECL submitted an Environmental Impact Statement to the Panel. Public hearings on the AECL disposal concept took place between March 1996 and March 1997.

On 13 March 1998, the Panel presented its recommendations on the safety and acceptability of the disposal concept and the next steps for the long-term management of nuclear fuel waste in Canada to the Minister of Natural Resources and the Minister of Environment. The Government of Canada's response to the recommendations was publicly announced on 3 December 1998. In its response, the government laid out its objectives and instructed the Minister of Natural Resources to return to Ministers with recommended options for federal oversight over a Waste Management Organization to be established as a separate legal entity by waste producers and owners.

Consultations with stakeholders, including waste producers, owners and the public, on options for federal oversight mechanisms were carried out. On 25 April 2001, the Government of Canada introduced legislation in the House of Commons which is presently undergoing the parliamentary review and approval process. The text of Bill C-27 entitled "*An act respecting the long-term management of nuclear fuel waste*" can be accessed on the internet at nuclear.nrcan.gc.ca.

Low-Level Radioactive Waste

The major nuclear utility in Canada, OPG, produces about 70% of the annual volume of low-level radioactive waste in Canada. To date there has been no pressing need in OPG for early disposal; volumes are small and the waste is being safely stored on an interim basis. However, in its 1992 plan for these wastes the utility fully recognised that, in the longer term, disposal is a necessary step in responsible waste management, so that future generations are not burdened with managing this waste. OPG has completed conceptual engineering studies and costed out options for a low-level radioactive waste disposal facility. The year 2015 is considered an achievable target date for bringing a disposal facility into service.

The other major ongoing producer of low-level radioactive waste, AECL, had discussions with the CNSC to license a prototype below-ground concrete vault known as IRUS (Intrusion-Resistant Underground Structure) for relatively short-lived waste. The future application of IRUS technology is currently being reassessed by AECL. Until this, or another disposal facility is available, AECL will continue to store its on-going LLW in-ground and above-ground structures.

Port Hope Area Wastes

The bulk of Canada's historic low-level radioactive waste is located in the southern Ontario communities of Port Hope, Hope Township, and Clarington. These wastes, amounting to roughly one million cubic metres, relate to the historic operations of a radium and uranium refinery in the town of Port Hope. In March 2001, the Government of Canada and the local municipalities where the wastes are located entered into an agreement for the long-term management of these wastes. The Project will involve the cleanup of the wastes and long-term management in newly constructed above-ground mounds in the local communities. The \$260 million project will take roughly ten years to complete. The first phase of the Project is an environmental assessment and regulatory review that is expected to last five years. Cleanup, waste facility constructing and waste emplacement would take place in the following five years.

Uranium Mine and Mill Tailings

In Canada, about 200 million tonnes of uranium mine and mill tailings have been generated since the mid-1950s. These comprise about two percent of all mines and mill tailings in the country. Most of the existing uranium tailings are located in the provinces of Ontario and Saskatchewan. There are a total of twenty-four tailings sites in Canada, twenty of which are no longer receiving waste material. Only the operations in Saskatchewan are now active.

Uranium tailings are decommissioned on-site. Uranium producers, in co-operation with provincial and federal governments, are involved in on-going research on the decommissioning of uranium tailings, specifically tackling the problem of acid mine drainage and increasing the stability of engineered barriers. Successful decommissioning has been achieved at sites in Saskatchewan and Ontario.

With regard to financial responsibility for decommissioning and long-term maintenance of the tailings, the CNSC requires that present-day operators provide financial assurances that decommissioning of uranium

facilities will take place in a responsible and orderly manner in the short and long term. Where a producer or owner cannot be identified, cannot be located, or is unable to pay, responsibility for decommissioning would rest with the Canadian federal and provincial governments. In January 1996, a Memorandum of Agreement (MOA) on cost-sharing for management of abandoned uranium mine tailings was signed between the federal and Ontario governments. The MOA recognises that present and past producers of uranium are responsible for all financial aspects of the decommissioning, and long-term maintenance of uranium mine sites, including the tailings. In the case of abandoned sites, the MOA outlines how governments will share the long-term management responsibilities and associated costs.

Decommissioning

The CNSC requires that all nuclear facilities be decommissioned in accordance with regulatory requirements. Nuclear facilities include CANDU power reactors, prototype/demonstration power reactors, research reactors, nuclear research establishments, and facilities involved in processing and fabricating uranium into fuel for power reactors or in conducting nuclear/uranium R&D activities. Planning for decommissioning activities should be initiated at the earliest stages in the design of facilities and refined during their operating life. Under the *Nuclear Safety and Control Act*, the CNSC can require financial assurances from facility operators to demonstrate that sufficient funds will be available for decommissioning activities.

FRANCE

Production et consommation d'électricité

Production nette et consommation intérieure d'électricité en 2001

La production totale nette d'électricité a été en 2001 de 527 TWh, en augmentation de 1,9 % par rapport à 2000. Cette production se répartit comme suit :

	Quantité (TWh)	Écart par rapport à 1999	Part en %
Production totale	526,7	1,9 %	100
Dont : Nucléaire	401,3	+1,5 %	76,2
Thermique non nucléaire	46,1	-7,6 %	8,7
Hydraulique	79,3	+10,8 %	15,1
Bilan Import-Export	- 68,4	-1,4 %	13,0
Pompage	5,8	-12,2%	1,1
Consommation intérieure	452,5	+2,7%	85,9

Le record historique de consommation d'électricité en puissance instantanée établi en janvier 2000 a été battu à plusieurs reprises en fin d'année 2001. Le nouveau record, enregistré le lundi 17 décembre, s'élève à 77 080 MWe, soit 4 700 MWe de plus que le record de 2000.

Par ailleurs les volumes d'énergie couverts par des contrats d'importation et d'exportation sont en hausse importante par rapport à l'année 2000. Cela traduit la mise en œuvre de nouvelles règles du marché de l'électricité, achats des clients éligibles à l'étranger, vente à l'étranger par des producteurs implantés en France, transits transfrontaliers, achats d'énergie à l'étranger pour la couverture d'une partie des pertes sur le réseau RTE, etc.

Installations nucléaires

REP

Parc

Le parc électronucléaire français comprend 34 réacteurs de 900 MWe, 20 réacteurs de 1 300 MWe, et 4 réacteurs N4 de 1 450 MWe. L'ensemble représente une puissance installée de 63 GWe. Le palier N4 a fait l'objet d'améliorations, notamment dans le domaine de la sûreté et du contrôle commande. Pour ce programme, une nouvelle turbine "Arabelle" a été développée, plus performante et plus légère.

Sur certaines tranches, les contrôles ont montré un taux de fuite gazeuse des enceintes en béton supérieur à la réglementation. Ce problème a été réglé par le dépôt d'une couche de résine sur la face intérieure des enceintes. Le taux de fuite a été ainsi ramené à une valeur trois fois inférieure au maximum réglementaire.

MOx

La France ayant choisi la voie du retraitement des combustibles irradiés, le plutonium séparé est brûlé sous forme de MOx. 20 réacteurs de 900 MWe sont actuellement autorisés à être chargés en MOx à hauteur de 30 % du cœur.

Sûreté

La sûreté en 2000 est restée bonne. Alors que les exigences d'exploitation fixées par l'autorité de sûreté se sont accrues, le nombre d'incidents est resté stable, avec une moyenne de 7,1 par tranche, sans aucun impact sur la population. Ces incidents se répartissent en 5,5 événements de niveau 0 et 1,6 de niveau 1. A noter deux événements de niveau 2 dans l'année, contre trois en 1999.

Le bilan de l'année 2001 n'est pas encore établi.

RNR

Creys-Malville

Les opérations de déchargement du combustible se poursuivent normalement. Depuis début avril 2001, 187 assemblages ont été déchargés, ce qui était déjà suffisant pour garantir la sous-criticité permanente du cœur.

En fin d'année, 418 assemblages combustibles ont été déchargés sur les 650 que contient le cœur. Les six pylônes électriques haute tension, hauts de 35 m, viennent d'être démontés.

Phenix

Les travaux de rénovation sont en cours, avec notamment le contrôle des structures internes ainsi que la remise à niveau sismique des bâtiments. A l'issue de ces travaux l'autorité de sûreté sera amenée à se prononcer quant à la remontée en puissance du réacteur sur les programmes de recherche de transmutation prévus dans le premier axe de la loi du 30/12/1991 concernant la gestion des actinides mineurs et les déchets à vie longue.

Exportation

En Chine, la France participe à la construction de l'îlot nucléaire de Ling Ao qui comporte deux unités de 930 MWe, identiques à celles de Daya Bay, et dont le démarrage est prévu en 2002 et 2003. Le chargement du combustible a commencé le 14 décembre 2001, la divergence étant prévue en février 2002 et la mise en service industrielle (MSI) en juillet de la même année.

Framatome contribue également à la construction des deux futurs réacteurs Qinshan 2 et 3. Qinshan II – 1 a divergé le 29 décembre 2001 ; la MSI est prévue pour juin 2002.

Évolution future

Parmi les activités qui concernent l'avenir du parc électronucléaire on peut citer la préparation du programme de démantèlement des centrales mises à l'arrêt. Celui-ci nécessitant l'amélioration des connaissances sur ce type de travaux, l'expérience sera acquise sur le réacteur de Brennilis dont les travaux de démantèlement au niveau 2 se sont poursuivis.

En 2000, EDF a décidé d'accélérer la déconstruction des centrales nucléaires de première génération (initialement prévue 40 ans après l'arrêt du réacteur) pour l'achever en 2025. Le montant de cette opération s'élève à 20 milliards de francs.

L'examen des grandes options de sûreté du projet franco-allemand EPR (European Pressurized Water Reactor) s'achève. L'autorité de sûreté nucléaire sera alors en mesure de rendre son avis au plan de la sûreté du réacteur.

Réacteurs de recherche

Le dossier de faisabilité du réacteur de recherche Jules Horowitz destiné à remplacer le réacteur Osiris se termine. Ce réacteur devrait être implanté sur le site de Cadarache, au centre d'une infrastructure de

recherche sur la technologie de fission. D'une puissance thermique de l'ordre de 100 MW, il doit, dans le cadre d'une coopération internationale, servir aux études sur les matériaux et les combustibles, tant pour les réacteurs existants que pour orienter les choix sur les systèmes futurs.

Cycle du combustible

Dans le domaine du cycle du combustible, la France dispose d'une industrie qui recouvre l'ensemble des différentes étapes qui vont de l'extraction du minerai d'uranium à la vitrification des déchets de haute activité à vie longue. La dernière mine d'uranium en activité sur le territoire national a cessé sa production en juillet 2001.

Le non renouvellement des contrats avec des clients étrangers a suscité une baisse notable de l'activité globale de l'usine de retraitement de La Hague.

Gestion des déchets

Suite à la parution du décret du 3 août 1999 relatif à la gestion des déchets de haute activité et à vie longue, l'ANDRA a engagé les travaux concernant le laboratoire de recherche souterrain de Meuse/Haute Marne sur la commune de Bure. Le creusement des puits se poursuit et a déjà permis d'atteindre la profondeur de 140 m pour le puits principal et 75 m pour le puits auxiliaire.

Le laboratoire doit permettre d'étudier, à 500 m de profondeur (qu'il est prévu d'atteindre fin 2002), si des roches stables depuis des millions d'années pourraient protéger les déchets et isoler de l'environnement la radioactivité qu'ils contiennent.

La recherche d'un deuxième site en roche granitique est pour l'instant suspendue.

Par ailleurs l'ANDRA a fait paraître l'édition 2000 de son rapport « Où sont les déchets radioactifs en France », actualisé et enrichi par rapport aux éditions précédentes.

Acceptation de l'énergie nucléaire par le public

Selon la dernière enquête annuelle d'opinion faite en avril 2001, 68 % des français ont globalement une bonne opinion des activités nucléaires, 88 % pensent que les risques liés à l'effet de serre doivent être pris en considération dans les choix énergétiques de la France et 50 % pensent que l'énergie nucléaire est une solution pour éviter ces risques.

Réforme de la sûreté

La loi du 10 mai 2001 a créé l'Institut de radioprotection et de sûreté nucléaire (IRSN) par fusion de l'actuel IPSN (institut de protection et de sûreté nucléaire) et de l'OPRI (office de protection contre les rayonnements ionisants). Les conditions précises de création du nouvel établissement, en particulier son périmètre exact et ses tutelles seront précisées par un décret en Conseil d'Etat en cours d'élaboration.

Étude économique prospective de la filière nucléaire

Le Premier Ministre avait commandé à Jean-Michel Charpin, Commissaire au plan, Benjamin Dessus, directeur du programme ECODEV au CNRS et René Pellat, Haut Commissaire à l'énergie atomique une étude économique prospective de la filière électrique nucléaire. Ce rapport lui a été remis en août 2000.

Ses principales conclusions sont que, dans tous les scénarios, l'allongement de la durée de vie des centrales améliore l'économie du système et retarde le calendrier des décisions à prendre pour le parc futur. Le retraitement-recyclage induit une économie d'uranium naturel de 5% et réduit la quantité de transuraniens

à stocker de 15 % (pour une durée de vie des centrales de 45 ans) comparé à un scénario sans retraitement, au prix d'un surcoût global inférieur à 1% et d'un accroissement de la quantité de Mox irradié à entreposer (pendant environ 150 ans contre 50 ans pour le combustible UO₂). Dans les 14 scénarios envisagés, le nucléaire est plus compétitif que le gaz sur la période 2000-2050. La tendance s'inverse dans deux de ces scénarios et sur la seule période 2020-2050 en cas de bas prix du gaz.

La prise en compte à la fois des externalités provenant de l'effet de serre et de la quantité d'actinides évitée renforce l'intérêt des scénarios à faible demande d'électricité et favorise les scénarios à fort contenu de nucléaire. Elle montre aussi l'intérêt potentiel de l'émergence de filières nucléaires nouvelles qui permettent de réduire le cumul des déchets à l'horizon 2050 (combustible APA, filière intégrant des réacteurs à haut rendement brûlant du plutonium de retraitement).

Nouvelle organisation du CEA

Le CEA a procédé à une profonde refonte de son organisation interne en créant en son sein trois pôles pour ses activités civiles : un pôle énergie nucléaire, un pôle recherche technologique et un pôle recherche fondamentale (comprenant les sciences de la matière et les sciences du vivant). Un contrat pluriannuel 2001-2004 a été signé avec le gouvernement prévoyant notamment une montée en puissance des recherches sur les nouvelles technologies de l'énergie.

Libéralisation du marché de l'électricité

La directive européenne sur l'ouverture du marché de l'électricité a été transposée en droit français par la loi du 10 février 2000 qui préserve, comme la directive le permet, les missions de service public et la définition d'une politique énergétique nationale (encouragement de certaines énergies renouvelables, droit à l'électricité, approvisionnement des territoires insulaires, etc.).

Cette loi s'est traduite par la création de la commission de régulation de l'électricité (CRE) dont l'essentiel des missions porte sur le contrôle de l'équité et la transparence de l'accès aux réseaux de transport et de distribution ainsi que sur la régulation du marché. Ses statuts lui garantissent les pouvoirs nécessaires à ces missions et garantissent son indépendance.

Les fonctions de gestionnaire du réseau de transport, le RTE, ont été isolées à l'intérieur d'EDF.

EDF a signé avec l'Etat un contrat de groupe portant sur les années 2001-2003. Ce contrat structure les relations avec l'Etat-actionnaire. Il s'inscrit dans le cadre de l'ouverture du marché et prévoit la poursuite de la stratégie de croissance du groupe, le renforcement du service public et l'adaptation des tarifs.

EDF a entamé la mise aux enchères de droits de tirage sur 6 000 MWe de capacité de production dans le cadre de ses engagements avec la Commission européenne.

Une bourse de l'électricité dénommée Powernext a été mise en place. Ses actionnaires principaux sont l'opérateur de marché Euronext (34 % du capital), la holding HGRT (17 %) qui regroupe les gestionnaires de réseau de transport français, belge et néerlandais, ainsi que des producteurs d'électricité et des établissements financiers. Les premières opérations de fixation de contrats horaires pour le lendemain se sont déroulées le 26 novembre 2001.

Réorganisation de l'industrie nucléaire française

Une réorganisation de la filière nucléaire visant à simplifier la structure de ses participations a été mise en œuvre. Elle s'est traduite par la création d'un groupe industriel dénommé AREVA, destiné à terme à s'ouvrir à la bourse. Le principal actionnaire en est le CEA, qui détient actuellement 78,96 % des parts du groupe.

A côté d'un pôle nucléaire composé de COGEMA et de Framatome ANP, la nouvelle entité coiffe un pôle nouvelles technologies composé de FCI (Framatome Connectors International) et de la participation de 11 % détenue par AREVA dans STMicroelectronics. La nouvelle organisation, qui optimise les structures industrielles, permettra de développer les partenariats nécessaires à chacun de ces métiers, d'en améliorer la compétitivité, de rationaliser et coordonner les stratégies de diversification.

En outre a été créé au niveau de la holding un fonds spécifiquement destiné à financer le démantèlement futur des installations nucléaires civiles du CEA. Ce fonds sera alimenté notamment par des remontées de dividendes du groupe industriel.

GERMANY

Nuclear phase-out

In December 2001, the German Bundestag (lower house of the Federal Parliament), decided to amend the Atomic Energy Law. This decision which remains to be passed by the German Bundesrat (upper house of the Federal Parliament) has been an important step towards nuclear phase-out. The amended Atomic Energy Law is aimed at discontinuing the promotion of nuclear power and at stopping it on an orderly basis. The operating licences for German nuclear power plants which have been unlimited in the past will be cut down to 32 years after commissioning. After that period of time the licence expires. Licences for setting up and operating new nuclear power plants will not be granted anymore. Obligatory regular safety checks have been introduced for the first time for the residual operating time of the existing nuclear power plants which is twelve years on the average today. Nuclear waste disposal will be limited to direct final waste disposal. From the middle of the year 2005, nuclear fuel reprocessing will not be permitted any more. To reduce transports and relieve existing repositories, intermediate storage on the sites of the power plants is obligatory.

Sustainable energy policy to meet the needs of the future

In November 2001, the Federal Ministry for Economics and Technology has published a report on “Sustainable Energy Policy to Meet the Needs of the Future”. Apart from a presentation of the main issues of energy policy since 1998, the report discusses the long-term prospects of energy policy in Germany. This discussion is based on a comparative evaluation and on the explanation of the consequences of two scenarios through the year 2020. The scenarios described consider both the targets of carbon dioxide reduction through 2020 and the consequences of the Federal government’s nuclear phase-out resolution. The report points out energy policy consequences and political-economic consequences while discussing conclusions as regards long-time options of energy policy action.

In Germany, the statements and consequences of the report have triggered off numerous discussions and agreement or disapproval, also in the government.

As compared with international energy policy, German energy policy has come off very well during the past few years.

- There has been a nearly continuous economic growth. And yet, energy consumption today is lower than at the beginning of the nineties.
- Germany keeps one of the top positions in international energy policy. Energy efficiency has been improved by 1.7% during the past few years in Germany while only 0.7% were reached during the same period of time throughout the OECD.
- From 1991 to 1999, carbon dioxide emissions were reduced by about 15%, what was not only due to the closing of companies in the eastern part of Germany. During the same period of time, there was an overall increase in carbon dioxide emissions of 4% in the remaining 14 EU member states. Due to consistent support and promotion by the Federal Government, the percentage of renewable energy sources in power generation has reached about 6% although there are no major resources of hydroelectric power available in Germany.
- Germany as the biggest end user market in Europe has opened its natural gas and electric power markets by 100%. Also in that respect, it holds one of the top positions in energy policy in Europe.

Further financial funds for securing the Chernobyl reactor

To secure the so-called sarcophagus in Chernobyl, the German government has agreed on supplying an additional amount of about 25 million US \$. Thus, Germany's payments into the fund have increased to about 50 million US \$. In addition, the government has initiated bilateral supporting projects to solve scientific and technical problems that have been arising from the Chernobyl reactor accident.

**Remediation of the Wismut uranium ore mining sites
in the former German Democratic Republic**

Since 1991, the Wismut Corporation has been eradicating the vast consequences of uranium ore mining in the former German Democratic Republic. There are facilities on the surface over an area of 37 km² and facilities underground over an area of 110 km². 48 waste dumps and 14 sedimentation pits are located on an overall area of about 10,000 km² in the south eastern part of Germany. Remediation of the mines and storage sites is supported by the Federal government. Up to now, more than 3.5 billion € have been provided. The overall costs are estimated at 8 billion €. At the moment, there is a staff of about 3 000 persons involved in remediation. The main remediation measures will probably be completed in 2010. Remediation is aimed at restoring the site and at turning the land into an ecologically intact region.

HUNGARY

Energy Policy

The parliamentary resolution, Hungarian Energy Policy (Resolution 21/1993), adopted in April 1993, is still the main document outlining the objectives and strategies of Hungarian energy policy which include:

- Diversified, reliable and safe energy supplies and eliminate one-supplier dependency.
- Liberalisation of the electricity market.
- Increase energy efficiency through modernisation of supply structures and better management of electricity consumption.
- Nuclear waste storage and disposal.
- Improve environmental protection and reduce pollution.
- Attract foreign capital investment in capital-intensive energy projects.

Since that time the Hungarian Energy sector underwent a process of thorough restructuring. In 1999 the reorganised Hungarian Power Companies Ltd (MVM Rt.) developed a new strategic plan for a five-year period. Based on that special business oriented model for the electric power sector was developed and accepted by the government in 1999, and a new act on electricity was adopted by the Hungarian Parliament [CX/2001, dec. 18]. The new act aims facilitating market liberalisation, i.e. introduction of competition in the electric energy industry.

From 1 January 2003 when the electricity market will have been partially opened (about 30%), the electric industry will operate according to a new model. One of the main features of this model is that new participants will appear in the market and the role of the participants who will have already been involved also will change. The functions of the transmission and distribution networks, system administration, trade and services will be separated. A certain – increasing by year – group of consumers will have been authorised to buy electricity from various sources (directly from the producers, by import, from the traders or on the stock exchange) while the others will continue purchasing within the system of public utilities.

Electricity Industry

According to the preliminary data the demand of the Hungarian electric energy network amounted to 28 684 GWh in the first 3 quarters of the year 2001, exceeding the value of 28 268 GWh for the same period in 2000 by 1.5% (416 GWh).

In the first 3 quarters of 2001, the import-export balance showed 2 759 GWh imported electric energy, amounting to 9.6% of the overall co-operative demand. For the same period of the previous year the imported electric energy was a bit higher, namely 2 902 GWh, amounting to 10.3% of the overall co-operative demand.

The thermal power plants produced more electricity by 3.9% (584 GWh), than in the same period of 2000. The electricity production of coal-fuelled plants decreased by 2%, that of the hydrocarbon based plants increased by 9%, and while the electric energy generation of the gas turbine plants increased by 76.1% comparing their data with the previous year.

The resource structure of the electric energy demand is shown in the following table:

Unit: GWh	First three quarters of 2000 (actual)	First three quarters of 2001 (preliminary)
Total demand [I]	28 268	28 684
– Import-export balance [II]	2 902	2 759
– Industry power plants [III]	390	325
Public utilities [I-II-III] [a+b+c]	24 976	25 600
▶ Nuclear power plant [a]	10 048	10 088
▶ Hydro power plant [b]	136	136
▶ Thermal power plant [c] [1+2]	14 792	15 376
Including: ✓ Coal-fired [1]	6 777	6 635
✓ Hydrocarbon based [2]	8 015	8 741
Including: Gas-turbine	2 303	4 056

Nuclear energy

The condition of the long-term operation of Paks NPP, which is also one of the most important elements of its future image, is to be committed to safety and to maintain the level of safety acceptable on the international level and follow the tendencies of development.

Safety improvement

During the accession process of Hungary to the EU higher importance is being attached to the safety issues and completion of the safety enhancement measures even constitutes one of the essential conditions for operating the nuclear power plant after becoming the member of EU. Paks NPP has planned to utilise HUF 60 billion investment resources for implementation of the safety enhancement measures during the period between 1996-2002. As a consequence of the safety enhancement measures the core damage frequency, which represents the level of the safety of the units, has decreased by more than one magnitude.

Maintaining the advantage in price

In order to operate Paks Nuclear Power Plant with a high capacity factor it is essential to maintain its cost advantage in the market, which is necessary for refunding the large capital lockup and the regular expenses exceeding the average.

Increase of capacity

One of the main objectives of the Paks NPP is to increase the capacity of the units in a measure ensured by the safety analyses and load capacity of the main equipment.

As a result of the refurbishment activities to be performed in the secondary circuit, the condenser reconstruction and turbine retrofit the electrical output of each unit achieves 470 MW. The example of Loviisa Nuclear Power Plant demonstrate that utilising the reserves and the advantages of VVER-440/V213 reactors enables the thermal and electrical output of the units to be increased by 7...9 %, thus 500-510 MW rated power can be achieved by each unit.

Life management

One of the most important long objectives of Paks NPP is to operate the units as long as possible in accordance with the technical, economical and safety requirements while implementing effective lifetime management. The objective of the Paks NPP is to extend the lifetime of the operating units in accordance with the international trends.

On the basis of a technical survey it can be stated that there is no technical restriction and safety limit against the feasibility of enhancing the operational lifetime of Paks NPP by 10 or 20 years.

Radioactive waste material and spent fuel management, decommissioning

The interim storage of spent fuel is ensured for 50 years in the storage modules located on the plant site and which will be gradually extended in the future.

The management of low and intermediate level liquid and solid radioactive wastes is performed by Paks NPP, including their collection, processing, packaging, qualification and interim storage on the site. In the future final storage of the wastes, including their transportation, is among the responsibilities of the Public Agency for Radioactive Waste Management (PURAM).

Commissioning of the final storage facility for low and intermediate level radioactive wastes is scheduled by 2006 in the medium-term and long-term plans for the activities financed by the Central Nuclear Funds (KNPA).

PURAM is responsible for preparing the plant for decommissioning and performing all activities in the plant shut down, including decommissioning, waste disposal and re-cultivation. In accordance with the associated regulations these activities should be financed by the resources of Central Nuclear Funds.

ITALY

In the following table, the electricity supply and demand for the first 9 months of the year 2002, is shown. As it can be seen, in spite of a huge increase of the hydroelectric production, the trend of increasing the broad electricity net import is confirmed.

Electricity supply and demand in september 2001 (GWh)

	September			January-September			October [Estimates]		
	2000	2001	$\Delta\%$ 01/00	2000	2001	$\Delta\%$ Jan-Sept01/ Jan-Sept.00	2000	2001	$\Delta\%$ 01/00
Gross production	23,293	22,591	- 3.0	205,500	207,764	+1.1	23,075	23,345	+1.2
of which: hydroelectric	3,399	3,626	+ 6.7	35,442	44,246	+ 24.8	4,788	3,950	-17.5
thermoelectric	19,502	18,611	- 4.6	166,582	160,117	-3.9	17,875	19,005	+6.3
geothermoelectric	392	354	-9.7	3,476	3,401	-2.2	412	390	-5.3
Auxiliary service consumption	-995	-962	-3.3	-9,208	-9,144	-0.7	-958	-1,120	+16.9
Net production	22,298	21,629	-3.0	196,292	198,620	+1,2	22,117	22,225	+0,5
Import/Export balance	3,517	3,932	+11.8	31,504	34,606	+9.8	4,208	4,575	+8.7
Pumping	-725	-638	-12.0	-6,594	-6,988	+6.0	-748	-800	+7.0
Production for consumption	25,090	24,923	-0.7	221,202	226,238	+2.3	25,577	26,000	+1.7

Source: Electricity grid operator

As far as nuclear research is concerned, activities included in several projects of the EU V framework programme were conducted by ENEA with success. A new EU project concerning comparison of ADS concepts is just started and is considered an important step towards an improved European co-ordination; in effects the number of technical aspects that will be touched and the many countries involved assure a full investigation of all open items.

JAPAN

Outline of the Japanese Nuclear Energy Policies

Japan has consistently developed and utilised nuclear energy including nuclear fuel cycle to achieve a stable energy supply for the future and to minimise environmental effects.

To confirm this position, the Cabinet issued a policy statement on “Policies to Promote the Nuclear Fuel Cycle” in February 1997. And the Japanese government has made efforts to promote construction of the Rokkasho reprocessing plant, plutonium utilisation in LWRs, spent fuel management, backend measures and research & development program of FBRs.

Since the first Long-Term Program for Research, Development and Utilisation of Nuclear Energy (Long-Term Program) was published in Japan in 1956, the Atomic Energy Commission (AEC) has issued eight Long-Term Programs, approximately every five years. In November 2000, the AEC issued a new Long-Term Program. This program plays a key role in the co-ordinated implementation of research, development and utilisation of nuclear energy in Japan. The Long-Term Program consists of two parts. Part I includes messages to the Japanese people and the international community, and Part II includes specific description of information on promoting nuclear research, development and utilisation, including research and development of innovative nuclear reactors with high economic efficiency and safety, suitable for diversified energy supply applications such as heat utilisation, and for other wider reactor uses as well.

Nuclear Power Generation

As of the end of 2001, 51 commercial nuclear power plants (26 BWRs, 2 ABWRs and 23 PWRs) were being operated in Japan. The total electric generation capacity of these plants was 44.917 MW. Nuclear power generation represented 34.0% of total electricity generated in 2000FY. Electricity generated by the nuclear power plants, which constitutes the core of base load, are estimated 319.7 TWh. Four plants (four BWRs) were under construction and six plants (three BWRs, one PWR and two ABWRs) were planned at this moment. Plans for expansion at Chugoku EPCo's Kaminoseki Unit No. 1 and No. 2 were also submitted in May 2001 to the Electric Power Development Committee.

The Federation of Electric Power Companies submitted the electricity supply plan to METI in March 2001. According to this plan, 13 nuclear power plants are to start operation in 10 years. It would add 16.94 million kW. Total electricity generation capacity would be 61.85 million kW in 2010.

The Japanese government has regularly made public a report called “Long Term Outlook of Japanese Energy and Supply”. In June 2001, Advisory Committee for Natural Resources and Energy submitted this report to METI. It is a comprehensive review of Japanese energy policy. This report recommends that Japan should raise the share of nuclear energy in primary energy supply from 13% in 1999 to 15% in 2010, and in electricity generation supply from 34.5% in 1999 to 42% in 2010.

Nuclear Fuel Cycle

Reprocessing

The reprocessing of spent fuel in Japan started in the Tokai Reprocessing Plant of the JNC in 1977. The Tokai Plant, which had reprocessed about 950tU as of the end of March 2001, resumed its operation in November 2000 after the shutdown period in the wake of the accident in Bituminization Facility in March 1997.

The Rokkasho Reprocessing Plant (designed for dealing with 800tU/y) of Japan Nuclear Fuel Ltd., (JNFL) is now under construction started and more than 80% of which was completed as of the end of 2001. The construction of a spent fuel storage facility, which is a part of the plant, was completed. It is planned to operate in July 2005. Spent fuel from Japanese utilities has been transferred to this storage since

December 2000. JNFL is planning to reprocess the spent fuel at the rate of 800 tU per year. Pre-operational test of the plant will start at the end of 2002FY.

Plutonium Utilisation

Japanese in nuclear policy priority is to establish a domestic nuclear fuel cycle system to make efficient use of nuclear materials. Plutonium can be utilised in a thermal reactor including an existing light water reactor and in a fast breeder reactor. Both approaches have been pursued in Japan from beginning of nuclear development in the mid 1950s.

Currently, electric power companies have a program to start practical loading of MOX fuel in sixteen to eighteen commercial LWRs by the year 2010, while fast breeder reactor is still in the development stage. Co-operated with the Government, Electric power companies have made efforts to get much more understanding of this program in order to realise the MOX utilisation.

JNFL has a plan to build MOX fuel fabrication facility with a production capacity of 130 tons-HM per year at Rokkasho. JNFL is consulting to build the facility with, Aomori prefecture and Rokkasho village, since August 2001.

Spent Fuel Storage and Management

“Policy to promote the Nuclear Fuel Cycle” was approved by Japanese Cabinet members in February 1997 including the management of spent fuel. For the appropriate storage and management of spent fuel, it is necessary to start interim storage outside of nuclear power stations by 2010 to accommodate with the increasing spent fuel. The Law for Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors was amended in June 1999, to rule a legal basis for private organisations to be licensed to construct and operate interim spent fuel storage facilities outside of nuclear power station. Tokyo EPCo. is investigating the potential site for interim spent fuel storage facilities in Mutsu, Aomori prefecture.

Waste Management

The number of vitrified bodies corresponding to the amount of spent fuel at the end of 2000, is estimated at almost 14,400. In June 2000, the Specified Radioactive Waste Final Disposal Act was passed at Diet and this act enables to institutionalise the final disposal system of high-level radioactive waste in Japan. This legislation includes a funding system for final disposal, site selection procedure, and the establishment of an entity to implement final disposal and the designation of an entity to manage the fund. Based on this act, Nuclear Waste Management Organisation of Japan (NUMO) was established in October 2000. NUMO is responsible for a selection of final disposal site of high-level radioactive waste, construction, operation and maintenance of the site, closure of the facility and institutional control after closure. In the case of depositing 40,000 vitrified packages, which corresponds to the nuclear power generation by 2020, the cost is estimated at almost 3 trillion yen. Concerning site selection, a three-step procedure will be adopted, and survey methods and selection criteria will be clarified through legal procedure. The final disposal site should start the operation around 2035.

As for LLW, the Advisory Committee on Nuclear Fuel Cycle Backend Policy of the AEC discussed the treatment and disposal of the low-level wastes arising from nuclear research and use of radioisotope, and issued the report entitled “Guidelines on Treatment and Disposal of Radioactive Waste from Radioisotope Use, Nuclear Research and other related Facilities” in May 1998. Following this reports, the NSC is discussing the basic concept on the regulation of disposal of these wastes since June 1998. In order to realise a suitable disposal of these wastes, Research Association for Nuclear Facilities Decommissioning (RANDEC) was reorganised in December 2000. The new RANDEC; Radioactive Waste Management and Nuclear Facilities Decommissioning Technology Centre, is expected to execute related investigation such as disposal site selection as well as to enhance public understanding of this issue, in co-operation with JAERI, JNC and Japan Radioisotope Association.

Public Acceptance

Japanese government has been keen on public information activities to gain the awareness for nuclear safety. Although, some local opposition such as the results of referendum in Kariwa-village in Niigata Prefecture last year proved that the ordinary approach is needed to review.

To co-operate and to take much closer communication among utilities in order to realise the MOX fuel utilisation, "Inter-Ministry Council on MOX fuel utilisation in thermal reactors" was set up and it released an interim report in August 2001. It points out the need to make clearer explanation of the importance of nuclear fuel cycle policy, and in order to get much more public understanding, it suggests some new key concepts for the public information activities, and agencies are to make the action plans based on these key concepts.

PROMOTION OF A VARIETY OF ADVANCED NUCLEAR TECHNOLOGY

Research and Development of Innovative Nuclear Reactors

The long-term Program points out the importance of innovative nuclear reactors with high economic efficiency and safety, which deserve in the next generation of light water reactors. As for innovative nuclear reactors, the government, industries and universities should be co-operative in examining research and development, giving consideration to utilisation of a variety of ideas regardless of scale or type of reactor. To follow up this statement, the discussion is to be commenced soon.

Japan signed Generation-IV International Forum (GIF) Charter in July 2001 and has been taking part in the GIF activities. Japanese technical experts are also contributing to several Technical Working Groups and Crosscut Groups in integrating the Generation-IV research and development roadmap.

With respect to plutonium utilisation by FBR, JNC has initiated the feasibility study to pursue the economic improvement, reducing environmental impacts and other advantages of FBR in collaboration with electric power companies and other related organisations since July 1999. In order to ensure its feasibility, this study is being carried out in two phases. The activities in Phase-I have been progressed as planned, and the highly feasible candidate concepts for FR Cycle System were screened out, and the development challenges for Phase-II (approximately five years) were identified. During Phase-II, a well-balanced consistency of the entire FR cycle will be pursued, based on engineering tests, and candidate concepts screened in Phase-I will be narrowed down. This study also will suggest development strategies that correspond flexibly to diverse future social needs in the 21st century.

Basic and Generic Research in Nuclear Science and Technology

The long-term program also points out the importance of basic and generic research in nuclear science and technology. It recommends for the government to promote such research projects, giving consideration to the originality of researchers in the competition for funds, and conduct proper evaluations of the projects.

OTHER NUCLEAR TOPICS

HTTR project

The high temperature gas-cooled reactor (HTGR) is one of the candidates as is currently discussed in the Generation-IV project. JAERI has promoted the HTGR development study as the high temperature engineering test reactor (HTTR) project to establish and upgrade the HTGR technologies. The HTTR, which is the first HTGR in Japan, reached first criticality in 1998 and accomplished a full power operation of 30MW and gas temperature of 850°C in December 2001. In the HTTR Project, a hydrogen production system is planned to be connected to the HTTR. This plan will be useful to apply nuclear energy not only to power generation but also to heat utilisation.

Research and Development plan for Nuclear Technological Infrastructure

METI's Nuclear Power Subcommittee reported in July 2001, to emphasis the Government's role in maintaining and enforcing technological base and infrastructure for nuclear power. It recommend research and development in several fields to be carried out by the government, technology transfer from the government research organisation (JNC) toward a private fuel cycle firm (JNFL) and securing human resources to implement technological activities. Another research and development activities are also recommended in the report, i.e. deep-geological research, disposal of high-level radioactive waste, research and development related to the innovative reactors and fuel cycle (e.g. MOX fuel fabrication, enrichment).

Decommissioning

Tokai Power Station (166 MWe) of the Japan Atomic Power Company is the first commercial nuclear power plant in Japan, which started operation in July 1966, using natural uranium and cooled by carbon dioxide gas. The commercial operation was terminated on 31 March 1998, for preparing the decommissioning, and taking out of all the spent fuel in reactor had been completed by June 2001. The nuclear reactor decommissioning plan was submitted to the METI on 4 October, last year, and decommissioning was started on 4 December after getting the approval by the regulator. All facilities including its nuclear reactor will be dismantled and removed by the end of March 2018. This is the first time to decommission a commercial reactor in Japan, excepting the research reactors.

The total amount of wastes by decommissioning of Tokai Power Station is estimated at about 177,000 t and about 10% of these are radioactive. Almost of all the radioactive waste by decommissioning is categorised in low-level. The radioactive waste can be dealt with safely and appropriately by conducting 3 level classification approach and adopting the proper processing and disposal method. About 90% remaining are not necessarily dealt with as radioactive waste, but as general industrial waste.

REPUBLIC OF KOREA

Nuclear Policy

In accordance with the Atomic Energy Act, Korean government updates the Comprehensive Nuclear Energy Promotion Plan (CNEPP) every five years in order to promote the peaceful uses of nuclear energy and secure nuclear safety. In consideration of domestic and foreign research environments, Korean government is focusing on the following areas in the 2nd phase CNEPP from 2002 to 2006:

- Balanced development of power and non-power areas.
- Establishment of systems for securing advanced nuclear safety in operational nuclear power plants.
- Expanding the scope of radioisotope utilisation in medicine, agriculture and industry.
- Active participation in collaborative research projects such as GEN-IV, I-NERI (International-Nuclear Energy Research Initiative) and others.

NUCLEAR POWER PROGRAM

The total number of nuclear power plants in operation in 2001 is 16, a capacity reaching 13 716 MWe sharing 27% of the total electricity generation capacity. Nuclear power plants supplied 112 133 GWh and their availability recorded 93.2% on the average in 2001. The share of nuclear power generation accounted for 40% of the total electricity generated in 2001. [Table 1]

Table 1. Status of Nuclear Power Reactors

Name	Type	Gross Capacity (MWe)	Commercial Operation	Production in 2001 (GWh)	Availability in 2001(%)
KORI-1	PWR	587	1978-4	4,887	95.0
KORI-2	PWR	650	1983-7	5,092	89.4
KORI-3	PWR	950	1985-9	7,885	94.8
KORI-4	PWR	950	1986-4	7,913	95.1
ULCHIN-1	PWR	950	1988-9	7,279	87.5
ULCHIN-2	PWR	950	1989-9	7,622	91.6
ULCHIN-3	PWR	1,000	1998-8	8,316	94.9
ULCHIN-4	PWR	1,000	1999-12	8,159	93.1
WOLSONG-1	PHWR	679	1983-4	4,939	83.1
WOLSONG-2	PHWR	700	1997-7	5,957	97.2
WOLSONG-3	PHWR	700	1998-7	5,272	86.0
WOLSONG-4	PHWR	700	1999-10	5,859	94.5
YONGGWANG-1	PWR	950	1986-8	8,685	100.0
YONGGWANG-2	PWR	950	1987-6	7,478	89.9
YONGGWANG-3	PWR	1,000	1995-3	9,076	100.0
YONGGWANG-4	PWR	1,000	1996-1	7,633	87.1
TOTAL		13,716		112,133	93.2

According to the 5th Long-term Electricity Expansion Plan revised in January 2000, in addition to the 4 units under construction, 8 more units will be added. [Table 2]

Table 2. Construction plan for nuclear power plant

Status	Plant name	No. of unit	Capacity(Mwe)	Construction completed
Under construction	Yonggwang-5, 6	2	1,000 x 2	2002. 4, 2002. 12
	Ulchin-5, 6	2	1,000 x 2	2004. 6, 2005. 6
Preparation	Sin-kori-1, 2, 3, 4	4	1,000 x 2 1400 x 2	2008. 9, 2009. 9 2010. 9, 2011. 9
	Sin-wolsong-1, 2	2	1,000 x 2	2009. 9, 2010. 9
Planned	-	2	1,400 x 2	- 2015
Total		12	13,600	

RESTRUCTURING OF THE ELECTRICITY INDUSTRY IN KOREA

A basic plan for the electricity restructuring was made in January 1999. According to this plan, KEPCO (Korea Electric Power Corp.) divided its power generation section into six subsidiaries in early April 2001. [Table 3] Five generation subsidiaries, excluding the Korea Hydro Nuclear Power (KHNP), will be privatised in near future. It is also planned that the power distribution section of KEPCO will be completely spun off by 2008. After 2009, the sales section will be privatised as the final step of the restructuring process. In spite of on-going restructuring process, KHNP will remain as a KEPCO's subsidiary.

Table 3. Status of power capacity by generation utility [unit: Mwe]

	South-east power	Mid-land power	Western power	Southern power	East-west power	KHNP
Nuclear	-	-	-	-	-	13,716
Bituminous	3,240	3,000	2,500	3,000	2,500	-
Anthracite	325	400	66	100	400	-
Oil	500	255	1,400	775	1,800	-
LNG	900	2,738	2,280	1,800	2,100	-
Hydro	600		600	400	700	535
Total	5,565	6,393	6,846	6,075	7,500	14,250

NUCLEAR R & D

SMART

Since July of 1997, KAERI (Korea Atomic Energy Research Institute) has been developing an advanced reactor called SMART (System integrated Modular Advanced Reactor). SMART is a 330MWt integral type pressurised water reactor that can be used for cogeneration, district heating and seawater desalination as well as electricity generation. The basic design of SMART is to be completed by March of 2002. Safety enhancement and economic improvement are the two most important considerations in the design of the SMART. The inherent safety features and passive engineered safety features are the major contributors to safety enhancement, whereas the system simplification, component modularization, on-shop fabrication and site installation contribute to reduce construction time and results in economic advantages. Substantial reduction in the liquid waste production is another important design goal.

After reviewing and evaluating the SMART on safety, economics, and reliability, the government has resolved to construct a pilot plant at 1/5 scale to assess the overall performance and safety. The project for the construction is to be launched in April of 2002, and it consists of two phases. The first phase will focus on the design optimisation and technology verification by way of tests and experiments, and the second phase will carry out detailed design and complete the construction by 2007.

DUPIC

Based on the feasibility study performed during 1991 and 1993, the experimental verification of DUPIC(Direct use of spent PWR fuel in CANDU reactors) fuel performance is currently under way at KAERI from 1994 to 2002 in co-operation with AECL in Canada, Los Alamos National Lab. and Department of State in USA with participation of IAEA.

KAERI has established the DFDF (DUPIC Fuel Development Facility) by utilising an existing hot cell and installing the remote DUPIC fuel fabrication equipment. The fabrication of DUPIC fuel pellets and elements for the irradiation test has been started from the beginning of 2000. The second irradiation test of DUPIC fuel pellets has been started at the Hanaro research reactor from June 2001, which will be completed in March 2002 with the target burnup of 7 000 MWd/MTHE.

The next phase of DUPIC co-operation research with Canada and USA in participation of IAEA is planned for the period of 2002 to 2007, in which various characteristics of DUPIC fuel pellets and elements will be fabricated and irradiated for the performance evaluation at the Hanaro research reactor in KAERI and NRU research reactor in AECL.

High-Power Proton Accelerator (HPPA) Program

A construction program will be approved for a HPPA of 100 MeV and 20 mA at KAERI. It is the second phase of the Korean HPPA Program, the KOMAC-Project, which aims ultimately to be 1.0 GeV and 20 mA. It will be used for supporting various experiments in the field of nuclear science and technology, as well as various new researches in the interdisciplinary fields with bio-technology, nano-technology, and space technology.

RADIATION AND RADIOISOTOPE UTILIZATION

The national radiation/radioisotope utilisation development plan (2002-2015) is established for enlarging the use of radiation/radioisotopes and for setting up the fundamental system of the radioisotope production in the wide range of the various industries such as medical, industrial, food and agricultural, environmental and biotechnological fields. From the result of successful implementation of this plan, the national competency as well as quality of life will be significantly improved. The basic directions of this plan are as follows:

- Firstly, raise a domestic production by settlement of stable production of radioisotopes and by establishment of the production, distribution and delivery system.
- Secondly, establish the national research institute (The Radiation Science and Technology Research Center) for the utilisation of radiation to applied industry by 2004 to increase the use of industrial, food and agricultural, environmental and biotechnological as well as medical fields.
- Finally, improve the system and development of encouraging methods throughout the fields including utilisation technology of the radiation/radioisotopes, activation of industry, safety management, international collaboration, training and education.

From the efforts of these systematic and fundamental trials, the ratio between electric power generation and utilisation of radiation/radioisotopes related industries will be moved up to 7:3 in the nuclear industry by 2010, on the basis of sale price.

KEDO (KOREAN PENINSULA ENERGY DEVELOPMENT ORGANISATION) PROJECT

The Korean Peninsula Energy Development Organisation (KEDO) is building two light-water reactors (LWRs) with a total generating capacity of approximately 2,000 MW(e) in the Democratic People's Republic of Korea (DPRK).

Thanks to the efforts of KEDO secretariat and its partners, construction work is underway for the LWR project. The DPRK issued a permit on September 2001 allowing KEDO to begin the excavation of the power block. With the completion of site arrangement and building infrastructure, KEDO is poised to proceed with main construction milestones of the LWR project.

INTERNATIONAL YOUTH NUCLEAR CONGRESS

Korea will host the second International Youth Nuclear Congress (IYNC) in April 2002 following the first one in Slovakia in 2000. The Congress will serve as a forum for the young generation to exchange views and to understand the importance of nuclear energy.

In connection with IYNC 2002, the Asian Young Generation Workshop was held in Korea, on October 24-26 2001. The theme of the workshop was 'the Present and the Future of Nuclear Energy in Asia'. Many young nuclear experts coming from several Asian countries including China, Japan, the Philippines, Thailand, and Korea presented the status and the future of nuclear programs in their nations and discussed on the topic of the international collaboration for the peaceful utilisation of nuclear energy.

We invite all Member States to participate in the Congress, through which young nuclear scientists and engineers could recognise the importance of nuclear energy and exchange their views under the theme of "Youth, Future and Nuclear."

THE NETHERLANDS

Nuclear electricity generation

The Netherlands only operation nuclear power plant at Borssele (1973, PWR, 449 net MWe) had an excellent year in 2001. One of the reasons still is the successful completion of the backfitting in 1997. Its safety level nearly increased by a factor of 10 as the core melt frequency decreased from $5.6 \cdot 10^{-5}$ to $4.5 \cdot 10^{-6}$. The power plants availability was 95.4% while its load factor was 95.3% over the year 2001. It generated 3 746 GWh. It was fourth year record in line.

A couple of years ago the Government took the decision that the plant has to close down at the end of the year 2003 and consequently a validity date until then was written into the license. The legal grounds of this action turned out to be insufficient and the Dutch State Council judged that Government took a wrong way to put its decision into effect. However Government decided to maintain its decision to close down at the end of 2003. Consequently a lawsuit is proceeding to force the operator EPZ to accomplish. Its judgement is expected in first half of 2002.

Percentage of nuclear	from total electricity production (centr. and decentr.):	4%
	from central electricity production:	6%

Uranium enrichment

Uranium enrichment is carried out by Urenco Nederland BV located at Almelo.

Urenco Nederland BV belongs to a multinational company, Urenco Ltd in Marlow (UK) which has three shareholders of equal share, Ultra Centrifuge Nederland (UCN) in the Netherlands, Uranit in Germany and INFL in the UK. The Netherlands Government owns the majority of the shares (99%) in UCN.

Uranium enrichment is the most important part of the fuel cycle for the Netherlands and it is very successful. Urenco Nederland BV has a licence for a capacity of 2 500 tSW/y. The total uranium enrichment market share of Urenco in the western world is about 15% and is still growing. Urenco has concluded contracts in 15 countries, incl. many EU-countries, Switzerland, Brazil, South Africa, the United States as well as in the Far East (Korea, Japan).

Urenco's success is based on its advanced gas ultra centrifuge technology. Improvements are still made in this technology as a result of an extensive R&D programme. Ultra-Centrifuge's availability was better than 99.9% in 2001. Construction of a new plant SP5 (fifth plant) was started in 1999; in its first hall the first ultra centrifuges ran smoothly in 2001. Construction of a second hall is nearly complete and a license for a third hall has been applied for. The construction of a new Urenco enrichment plant in the USA is being considered.

The decommissioning of the first UC-plant (SP1) was completed successfully and its site was transformed back to its original green field status. In addition Urenco Nederland uses this technology successfully in spin-off activities in the aerospace markets as well as in the enrichment of stable isotopes inter alia both for the nuclear sector and for medical purposes. A special plant for stable isotope production was completed, expanded in 1999 and ran smoothly in 2001.

RD&D and nuclear technology

The merge of nuclear departments of ECN (Energy Research Foundation) and KEMA (Dutch electric power reasearch institute) into the new entity NRG (Nuclear Reasearch and consultancy Group) turned out to be successful in 2001. NRG is performing most nuclear R&D in the Netherlands, is committed to

international projects in and outside European Union and performs a number of commercial activities. Its commercial services have been divided into six product groups, viz. Materials, Monitoring and Inspection; Fuels, Actinides and Isotopes; Risk Management and Decision Analysis; Radiation and Environment; Irradiation Services; Plant Performance and Technology. NRG is co-operating internationally in areas like:

- High Temperature Reactor development with Japan, Germany and South Africa.
- Actinide transmutation with European laboratories.
- Mixed Oxide fuel development with Japan.

Most important is that new R&D-goals have been set and that NRG developed and improved its R&D-tools and computer codes for the design and verification of innovative as well as inherently safe nuclear reactor concepts (both LWR-type and other ones e.g. GCR-type).

The computer codes involve the fields of nuclear reactor physics, thermal hydraulics, accidents and failures as well as structural mechanics. This means that NRG is prepared to play a role in an international co-operation leading to the design, approval and licensing of new innovative nuclear reactor concepts. However the public opinion is shifting although not yet supporting the idea of the construction of a First of a kind on the territory of the Netherlands.

A new organisation was set up for the HFR (High Flux Reactor, 45 MW thermal). In the old situation HFR which is owned by the European Union, was operated under contract by NRG. In the new situation there is only one organisation for the HFR, which is supervised by JRC Joint Research Centre of European Union). NRG will be responsible for the operation and the commercial exploitation of HFR. HFR's operation was again successful in 2001. Its load factor was 80 %, which is about the same figure as the average over the last eight years. HFR was especially successful in the irradiations for radio-isotope production which was about 10% up compared to the year 2000. HFR has a share of about 70% of the European market for medical applications. Nearly 10 million people in and outside Europe were treated with its radio-isotopes.

Another issue forms the conversion of HFR's fuel from HEU (High Enriched Uranium) to LEU (Low Enriched Uranium). After a thorough study the decision was taken to convert. Because of this decision the spent MTR-fuel has been transported back to United States. The conversion process is on schedule.

A co-operation between University of Delft and NRG was started in the area of neutron diffraction. The possibilities of this technology turn out to be very interesting e.g. in the areas materials stresses and soft condensed matter. The first scientific results were published.

Nuclear policy

National elections will take place in May 2002. A change in nuclear policy is not being expected. Also a debate in Parliament points into that direction.

SPAIN

ELECTRICAL GENERATION

In Spain there are 9 nuclear units in operation, in 7 sites, with an installed power of 7,816 MWe, which represents 14,2% of the whole installed power.

The total nuclear origin gross energy during 2001 has been 63,715 GWh, which represents 28,2% of the total electrical output of Spain.

During 2001, the average Load Factor of the Spanish nuclear park has been 93,1%.

The Unit 2 of Ascó and Vandellos II Nuclear Power Plants have increased their electrical power output in 12, 41 and 5,41 MWe respectively.

FRONT-END OF THE FUEL CYCLE

At the end of 2000, ENUSA Industrias Avanzadas, S.A, finalised Uranium mining activities in Saelices el Chico (Salamanca), because of economic reasons.

The Juzbado Fabrication Plant, that the same company has at Juzbado (Salamanca), has fabricated 703 nuclear fuel bundles with 207 tU. Out of them, 393 fuel bundles have been exported to Finland, Belgium, Germany and Sweden.

BACK-END OF THE FUEL-CYCLE

El Cabril Centre is, in accordance with the 5th General Radioactive Waste Plan, the fundamental basis for the management of low and intermediate level waste (L/ILW) in Spain. This facility provides an integrated management system that includes waste collection, transport, treatment and conditioning and accurate information on the waste inventory, radiological characterisation and quality assurance, all of which is compatible with the type of disposal applied.

A ministerial order from the Ministry of Economy issued the 5 October 2001 grants a new operation permit to ENRESA for exploitation of El Cabril disposal facility until the completion of the current available capacity, this means according to last estimates until the year 2020.

The El Cabril disposal facility is in operation since 1992. As of December 2000, some 17,500 m³ of conditioned waste had been disposed of, and some 4,200 m³ of conditioned waste were placed in the existing storage facilities at the installation.

The wastes arising as a result of the so-called Acerinox incident (the smelting of a radioactive source of Cs-137), along with the scrap produced during the industrial process that caused contamination of some plants, the equivalent volume of which amounted some 1100 m³ on arrival at the El Cabril facility, are now in temporary storage in the containers used for their transport, pending treatment and subsequent definitive disposal. Last year the Nuclear Safety Council approved the Action Plan for the treatment and disposal of these wastes.

Regarding the radioactive waste arising from the dismantling works at Vandellós I NPP, some 600 m³ have been transported to El Cabril in 220 litres drums and metallic containers of 1.32 m³ of capacity.

The approach adopted in the 5th Plan with regard to the spent fuel and HLW, makes a distinction between the temporary and definitive technological solutions, and considers a period of analysis prior to establish in detail the required strategies and actions.

Concerning a temporary solution, the strategy is:

- On the one hand, to have available by the year 2002 a temporary dry storage facility for the Trillo NPP spent fuel due to lack of capacity in its pool. The project of which, now underway by means of dual purpose metal casks, is completed at 95%. Dual purpose casks have been designed and homologated for the SF from this plant.
- On the other hand, to have available a centralised temporary storage facility by the year 2010, in order to solve the problem of storage of the Spent Fuel from the other power Plants, of the wastes coming from Vandellós 1 fuel reprocessing and of others types of wastes.

DECOMMISSIONING AND DISMANTLING OF NUCLEAR INSTALLATIONS

The dismantling works of the conventional components and active parts at Vandellós I NPP are in progress and will continue until the end of 2002 when the level 2 decommissioning is expected to be reached. Last July, the CSN approved the methodology to clear material with very low radioactive content, including the monitoring procedures, and currently, discussions are being held regarding large surfaces, as walls, floors, etc. Concerning the progress of dismantling work, it is worth mentioning that the reactor cage isolation was reached last year and nowadays a new reactor box is being installed in order to reduce the visual impact.

ENUSA Industrias Avanzadas, S.A. began in 2001 restoration and closure works in the mining facility in Saelices el Chico (Salamanca), along the year were moved in the site mining tails.

At the beginning of 2001 was granted the dismantling authorisation of Planta Elefante, Uranium concentrates production, located in the mine site. The dismantling works were finalised in the middle of the year.

SWEDEN

Nuclear power

In Government Bill 1996/97:84 the Government considered that the localisation of the two nuclear reactors at Barsebäck is inappropriate and that they should be taken out of service and following negotiations with the owner the first reactor was taken out of service on 30 November 1999. In the bill it was stated that then electricity loss is to be compensated by more efficient energy use, electricity conservation, conversion from electricity and supplies of electricity from other energy sources. One condition for the closure of the second reactor is that the electricity production loss can be compensated through the addition of new electricity production as well as through a decreased use of electricity. New electricity generating capacity and decreased electricity consumption are a precondition for phasing out additional reactors. A precise year in which the last nuclear reactor should be taken out of operation should not be specified.

In 2000 an evaluation concluded that the conditions for the closure of the second reactor, including considerations related to environmental effects, effects on security of supply and the price of electricity was not fulfilled. A new evaluation during 2001 came to the same conclusion. A new evaluation whether the conditions are fulfilled is expected during 2003.

Management of waste

It is more than 20 years since a co-ordinated nuclear waste management programme was set up in Sweden. A key element of the programme is siting of a deep geological repository for spent nuclear fuel, which started in a focussed manner almost ten years ago. Facilities for intermediate storage of the spent fuel (CLAB), final disposal of low and medium level waste (SFR) and underground research (Äspö Hard Rock Laboratory) were sited during the 1980:ies.

The programme has had substantial progress in the siting-process of the deep repository in 2001. In November 2000 SKB presented a comprehensive plan for the continuation of the siting programme, based on technical and safety relate criteria as well as voluntary participation by municipalities. Three sites – in Oskarshamn, Östhammar and Tierp – were selected for site-investigations. The report was reviewed by the Swedish Nuclear Power Inspectorate (SKI), the municipalities in the siting regions and many others. In November 2001 the Government found that SKB has fulfilled the requirements expressed to continue the process. The government, like SKI, considered that SKB should use the KBS-3 method as a planning prerequisite for the site investigations and development of alternative methods should also in the future be followed within the frame of the RD&D-programme. Further, the Government had no objection against SKB starting site investigation at three sites indicated by SKB (Forsmark in Östhammar, Simpevarp in Oskarshamn and Tierp north in Tierp municipalities).

In December 2001 the municipality council of Östhammar said yes to site investigation in the Forsmark area. A written agreement will be established between SKB and the municipality. This means that site investigations, aimed at determining the suitability of the site to host a deep repository for spent nuclear fuel, can start in the beginning of 2002.

The municipalities of Oskarshamn and Tierp are expecting to make their decisions regarding site investigations during spring 2002.

The final decision on the siting of a deep repository for spent nuclear fuel in Sweden is expected around year 2007.

TURKEY: NATIONAL ENERGY OUTLOOK AND EXPECTATIONS FROM NUCLEAR TECHNOLOGY

Energy Situation

Energy has been a priority government investment sector for some time and in 1986 received the second largest allocation of foreign financing among public-sector investments. Although limited, Turkey has some energy sources; coal, uranium, lignite, some oil and gas deposits, and considerable potential for hydroelectricity. In the year 2000, as could be seen in Fig. 1, 43.8% of primary energy consumption was met by petroleum, 26.3% by coal, and 17.7% by natural gas. During the period of 1996-2000 the primary energy consumption rate has increased by 4.5 % per year and reached to 78.8 Mtoe by the year 2000. The electricity demand was increased about 8.2 % per year, during the same period, and reached about 128 TWh at the end of this period. The installed capacity for electricity generation was about 27 GW by the year 2000. The primary energy consumption per capita was about 1.2 toe and electricity consumption per capita was about 1,966 kWh by the year 2000. The projections show that electricity consumption per capita will increase to about 3867 kWh by the year 2010 (Fig. 2). Turkey is not rich in energy resources and import dependency was about 62% by the year 2000 (Fig. 3) and will increase in time as the energy consumption increases. It is expected that the annual electricity demand rate will increase about 8%-10% till 2010. Although the electricity demand rate was about 8.2% between the period of 1996-2000, the economical crisis in 2001 led to negative economical growth and hence electricity demand decreased. The projection for electricity consumption reveals that about 290 TWh will be consumed by the year of 2010 and the required installed capacity will be around 46 GW. The share of fuels for installed electricity generation capacity is given for the year 2000 as 41% (hydro+geothermal+wind), 26% (coal), 26% (gas), 7% (oil). The CO₂ emission was about 210 Mton in 2000 and is expected to increase to 390 Mton in 2010 (Fig. 4). The CO₂ emission per capita is 2.9 tons/capita in Turkey that is much less than those of world and OECD averages, i.e., 3.87 tons/capita and 11 tons/capita, respectively.

Figure 1. Primary Energy Consumption by Fuel Types (2000)

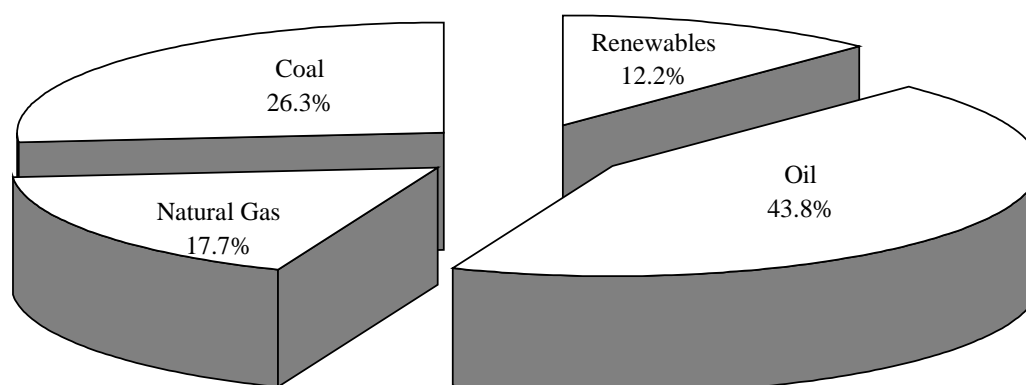


Figure 2. **Projection of Electricity Consumption per Capita**

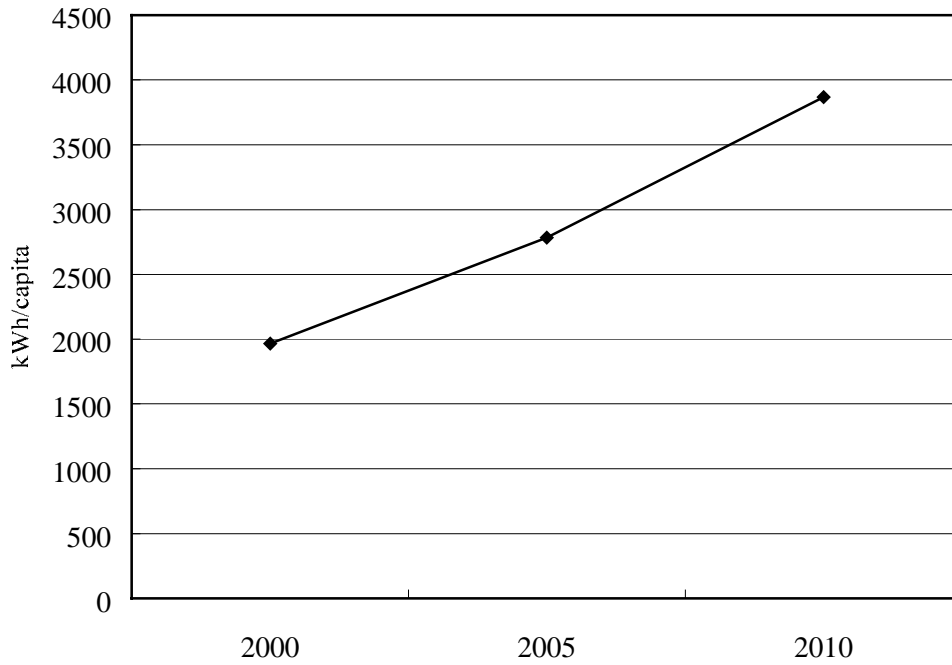


Figure 3. **General Energy Production and Consumption (Mtoe) (2000)**

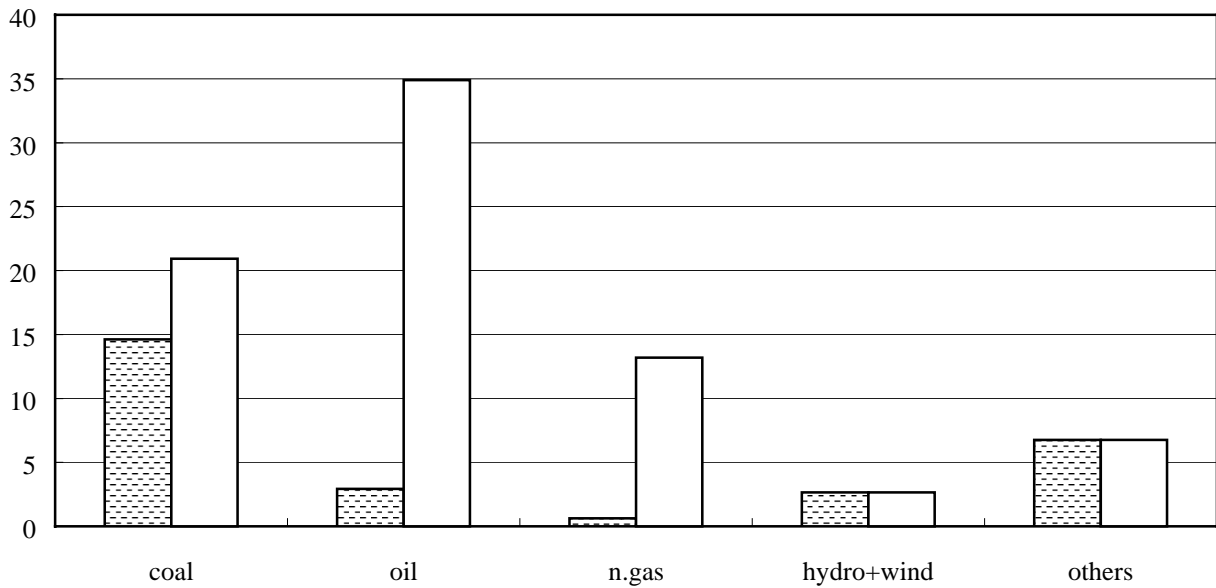
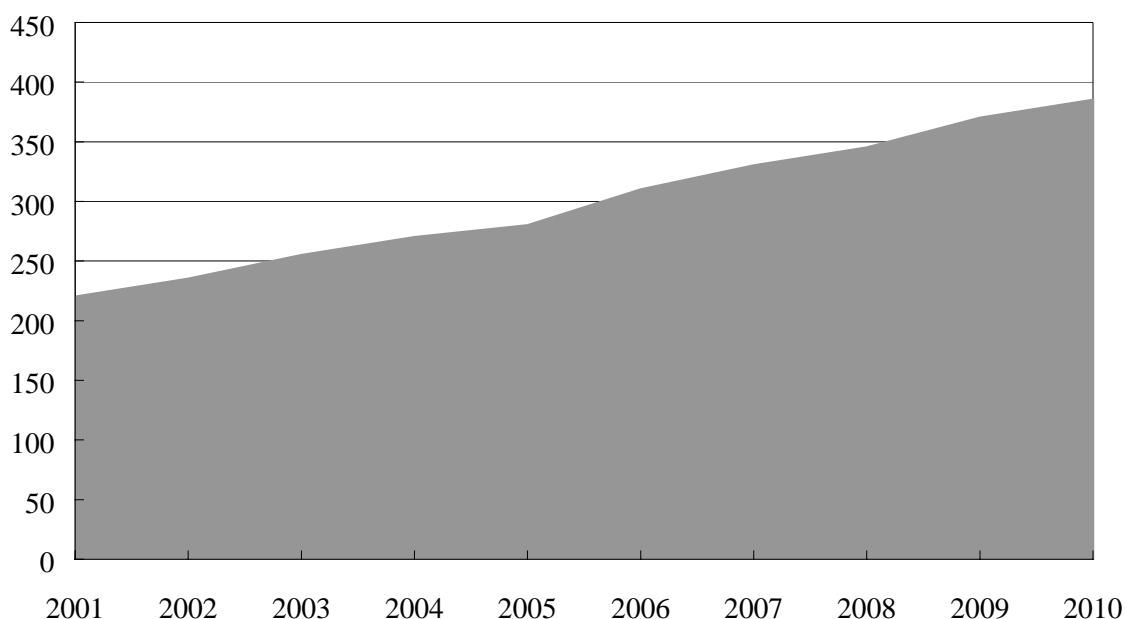


Figure 4. Projections of CO₂ Emissions (Mton)

In spite of the fact that nuclear energy contribution was planned to be 2,000 MW_e by the year 2015 (2.3% share to total generation) and there was a strong intension of the Government to install the first NPP in Akkuyu, the Government has decided to postpone the Akkuyu NPP project, following the meeting of the Cabinet held on 25 July 2000. The Government's statement on this decision made it clear that the reasons were not related to safety issues. Since Turkey needed to concentrate on a programme of economic stability aiming to reduce inflation rates to reasonable figures, under supervision of the IMF, the Government could not afford the estimated three to four billion US dollars needed for construction of the country's first nuclear power plant. It is also declared by the Government that the postponement of the Akkuyu NPP project does not mean that Turkey will avoid usage of nuclear energy in the future. The Cabinet's announcement also includes the need of contributing to the technological improvements of new generation nuclear power plants. The announcement also addresses the need of waiting for new generation nuclear reactors with reduced capital cost. In short the reasons of postponement of the Akkuyu NPP project can be summarised as:

1. Financial burden of external credits was unbearable by Turkey's current economic situation.
2. It would be better to wait for new generation nuclear reactor technology with decreased capital costs.

The Turkish Atomic Energy Authority took three actions upon postponement of the Akkuyu NPP project:

- Review of the National Nuclear Energy Policy.
- Participation to the International Project of the IAEA on Innovative Nuclear Reactors and Fuel Cycles (INPRO).
- Application to the IAEA for participation to the Technical Working Group on Gas Cooled Reactors (TWG-GCR).

Energy Policy

The Turkish energy policy is mainly concentrated on assurance of reliable, sufficient, economic and clean energy supply in time, and in a way to support and orientate the target growth and social developments. Although almost all conventional resources exist in Turkey, these resources are not sufficient to meet the energy demand, except lignite and hydro. More than half of the energy demand is met through imports in Turkey. The energy planning studies shows that energy demand of the country will increase parallel with

its development and industrialisation. In order to meet the demand reliably, significant increase is expected both in energy production and in supply in coming years. Turkish environmental policy considers that energy policy should take into account environmental problems and that a balance should be found between increases in energy demand, which is required for economic development and environmental concerns. Some of the main criterions which were stated in the Seventh Five-Year Development Plan, are given below:

- A dynamic and feasible master plan, which accomplishes the optimum planning of resources in an economical and reliable way and which minimises the environmental problems taking place during the production and consumption of energy, has been prepared.
- For Turkey, it is necessary to meet energy demand with national resources as much as possible and to use new technologies, which eliminate the adverse effects of energy production on the environment.
- According to the development plans, “energy conservation” is one of the basic principles.

Although a member of OECD, Turkey is not a party to the United Nations Framework Convention on Climate Change (UNFCCC). Turkey’s current position in this regard is that, if the agreement is to be signed, Turkey would be classified as a developed country and included in Annex 1. The convention places commitments for the developed countries in Annex 1 according to the principle of “common, but differentiated responsibilities” and considering that the commitments should reflect the relative development levels of the countries. In this regard Turkey is still in the process of rapid industrialisation. Thus, the burden of the commitments imposed on Annex 1 countries is not in conformity with the social and economic circumstances and level of development of the country.

Energy Sector

“Electricity Market Law” no: 4628 published in the Official Gazette dated March 3, 2001 is enacted to unbundle electricity market activities, enable progress into a liberalised electricity market and provide for fair and transparent market regulation.

In summary, the new Law includes the following key elements:

- An autonomous Energy Market Regulatory Authority, governed by a Board,
- A new licensing framework for market participants,
- An energy market, to be comprised bilateral contracts between market participants,
- Eligible consumer concept; eligible consumers to be free to choose their suppliers,
- A transition mechanism to be implemented over a two-year program for electricity.

In addition, all over the world energy sector investments are gradually being undertaken by the private sector and Turkey is following this global trend as well. It is important to ensure that this transition will be smooth and effective. The purpose of this Law is to ensure the formation of an electricity market which is financially strong, transparent and operates in accordance with provisions of private law in a competitive environment, to achieve a stable supply of adequate, low-cost, and environmentally-friendly electricity of good quality, and to ensure autonomous regulation and supervision of this market. The main objective of this law is to create a competitive electricity market with the great majority of the participants in this market being private firms and most of the assets used to supply electricity being privately owned. The role of the State will be greatly reduced.

Expectations from Nuclear Reactor Technology in Future

Since future nuclear power program of Turkey is to be dependent on nuclear policy, the Turkish Atomic Energy Authority (TAEA) has recently initiated a project to revise the nuclear policy of the country. This project includes various application sectors of nuclear energy, including nuclear power, and programs

associated to each sector. One of the sectors that should be considered is the “*Research and Development*” which also includes innovative designs and small and medium sized reactors (SMRs). Co-operation with international/national groups on theoretical and experimental projects concerning SMRs and innovative technologies would lead to an increase of staff capabilities and experience on nuclear technology in Turkey. To achieve this goal, the TAEA decided to participate in the “International Project on Innovative Nuclear Reactor Technologies and Fuel Cycles”, which is co-ordinated by the IAEA, by sending a cost-free expert to the IAEA Headquarters. The TAEA will continue technical contributions to the INPRO Project in 2001. As mentioned in Sect. 1, the TAEA applied to the IAEA for participation to the Technical Working Group on Gas Cooled Reactors (TWG-GCR) and in short term, two areas of contribution seem feasible for the TAEA concerning TWG-GCR:

1. Co-operation with other licensing authorities in the area of licensing of GCR type of NPPs. The TAEA is a governmental organisation and has the duties and responsibilities of licensing, inspection, regulation, policy making in nuclear energy and technology, research and development, and training. Since the TAEA has experience mainly on licensing of light and heavy water type of NPPs, any kind of co-operation could increase in-house expertise on licensing and/or safety review of GCR type of reactors.
2. Contribution to the safety research activities including code validation/assessment. The TAEA has some expertise on code validation/assessment on light and heavy water reactor technologies. Thus the TAEA has the objective of developing expertise on GCR technology for code validation/assessment and plans to develop a code infrastructure in collaboration with universities. International standard problem exercises could be performed under the co-ordination of IAEA and/or OECD/NEA based on real plant or test facility data and this might serve for sharing of current expertise and knowledge on utilising computer codes for GCR reactors. The primary concern of the Turkish Atomic Energy Authority for the nuclear reactor technology comprises the following subject areas. It is to be noted that similar opinions and views of the TAEA concerning following subject areas were also conveyed officially to the Steering Committee meetings of the INPRO Project.

► Resources, Demand and Economics

As mentioned in Sect. 1, Turkey has some energy sources like coal, uranium, lignite, some oil and gas deposits, and considerable potential for hydroelectricity. The known uranium reserves in Turkey were reported as 9129 tons, however this amount of reserve needs further investigation with respect to grade and feasibility. The same holds true for thorium reserves, as fertile material, which was reported as 380,000 tons. It is to be noted that Turkey should have a long-term policy for using own natural resources for generating nuclear energy. However, today the cost of uranium favours the utilisation of import uranium fuel for short and medium-term nuclear fuel supply. The cost of uranium is about USD 23 per kg and there is a world reserve of about 1.2 million tons, which is recoverable at less than USD 40 per kg of uranium. The total reserves that is recoverable at less than USD 80 per kg of uranium is about 3.4 million tons. Assuming world wide annual consumption of uranium between 60,000 and 80,000 tons, supply requirements over 40 years can be met by primary production from reserves recoverable at less than USD 80 per kg uranium. Moreover, given the relatively low impact of the cost of uranium on energy generating cost of nuclear power plants, it can be considered that the total reserves –whatever the cost of production– is enough for a period of more than 100 years. It is well known that even if nuclear fuel cost doubles the cost of today, the electricity generation cost increases by 10% that is much less than those of other types of power plants. For example, in gas fired plants the dependency of generation cost is very sensitive on fuel cost variation and doubling the fuel cost could increase the generation cost about 100%.

The energy situation of Turkey is summarised in Sect. 1. The projections of the Ministry of Energy and Natural Resources reveals the fact that our installed capacity and generated energy will increase fast in coming 20 years. The installed capacity is estimated to be 46 GW with 290 TWh energy productions in the year 2010 and these figures will increase to 88 GW and 547 TWh by the year 2020. The additional

installed capacity breakdown for the next 20 years reveals that gas power stations will dominate to the other type of technologies like coal, hydro and nuclear. Gas used for electricity generation and heating is imported from various countries. Although the most important potential risks for gas import for generating electricity are stability of gas cost and political conflicts, lower electricity generation cost and shorter construction period favours the utilisation of this fuel for electricity generation, like other OECD countries. The capital cost of gas fired plants is about 400-600 \$/kW, however the cost is about 2000-3500 \$/kW for current nuclear power plants. It is clear that two factors are to be considered for nuclear reactor designs to be able to compete with combined cycle gas stations:

- Capital and generation costs.
- Construction period.

If the capital cost would be around 1000 \$/kW or less then the financial burden could be much less than current nuclear technologies which could ease launching nuclear power programs in especially developing countries. As explained in Sect 1, the main reason for postponing Akkuyu NPP project was the financial burden due to external credit needed for the project. The innovative nuclear reactor technologies should focus on decreasing capital cost, without compromising safety. In Turkey, after the Electricity Market Law, the private sector will lead to new investments along with privatisation of electricity generation plants. The range of capital cost per kW will play an important role for selection technology in future and reduction of capital cost of nuclear stations can favour the use of nuclear energy stations by private investors. Another option for private investors in Turkey can be the use of small sized nuclear generation stations. At this point distributed power concept can be considered. The construction period, on the other hand, is important in developing countries including Turkey since energy demand increases at higher rates (8-10% per year) and delays in construction periods sometimes can lead to undesired over capacity. In developing countries however planning of new capacities is very dynamic and can change in short-terms. The electricity generation cost of a nuclear power plant should be less than 4 cents/kWh to be able compete with combined cycle gas power plants.

► Safety

The improvement of safety of nuclear reactors is always in progress inline with technological improvements and lessons learned from various applications. Indeed, the accidents at the Three Mile Island and Chernobyl nuclear power plants have led to a momentum for improving safety technology and even the safety philosophy. We learned from both accidents that the *defence in depth* concept is important for safety and risk perception could be changed easily even after one serious disaster at a commercial reactor per 438 reactors in operation with more than 9000 reactor-years operating experience. Following items summarise the factors to be considered for innovative reactor technologies:

- (a) Inherent safety philosophy should be applied to the design of innovative reactor technologies along with the requirement that each sequence of events leading to an accident condition should be well evaluated.
- (b) In case core melt is not avoidable the core melt frequency should be 10^{-6} or less.
- (c) The reactor should have a self-protection system against insertion of maximum possible reactivity.
- (d) The licensibility of nuclear power plants could be important for developing countries due to lack of enough experience. In that case, a licensed reference plant could be a solution for innovative designs.
- (e) The NPP developers should take care of two main points: 1) to develop safe and economic design and 2) to provide conditions in which the public would accept this design as safe and economic.
- (f) The use of passive mechanisms for heat transport system and/or safety systems might be a better solution for simplifying designs that also decreases the cost however performance of these systems should be well demonstrated against accident conditions. The use of passive systems could also improve availability of those systems upon demand.
- (g) The innovations on nuclear reactor technology should shorten the licensing period.

► Environment

The position of TAEA is such that *environment* as a subject area plays an important role for the concept of *sustainable development*. The share of fossil fuel for energy generation in the world is about 77% and this figure reaches to 90% in some countries. The situation is not different in Turkey and the share of fossil fuels is as high as 90% in primary energy consumption. The fossil fuels dominate in electricity generation as well, i.e. about 60%. From the greenhouse gas emissions point of view, Turkey is not that critical since the CO₂ emission per capita is as low as 3/4 of world average, as stated in Sect. 1. However, in the year 2020, the current installed capacity will be tripled and greenhouse gas emissions will be increased accordingly. Hence clean technologies like nuclear and renewable sources will be unavoidable in developing countries like Turkey if greenhouse gas emissions should be stabilised at certain levels, as international agreements and protocols (like Kyoto Protocol) dictate. However, high level radioactive waste seems to be the most important drawback of nuclear technology as far as public acceptance is considered since no demonstration could be made yet for commercial reactor waste disposal. The position of the TAEA is that the technology for such geological disposal is available but it is to be demonstrated for public's acceptance. There may be two approaching points for this problem: 1) innovative nuclear reactor designs can be such that their high level wastes could be less than current technologies and 2) accelerator driven reactor systems could be used for transmutation of long lived wastes to short lived isotopes.

UNITED KINGDOM

Government Policy on Nuclear Energy Production and Waste Management

In June 2001, the Government launched a review of the longer term, strategic issues surrounding energy policy for the UK, within the context of meeting the challenge of global warming, while ensuring reliable and competitive energy supplies. The aim of the review is to set out the objectives of energy policy for the UK to 2050 and develop a strategy that ensures current policy commitments are consistent with longer-term goals. The review is considering the role of coal, gas, oil and renewables for the future energy balance for the UK and what role, if any, the nuclear industry should play in meeting environmental and security of supply objectives. It is expected that the review will be completed shortly.

In September, the Government published a consultation document on the options for the management of radioactive waste over the coming centuries. The document sets out proposals from the Government and the Devolved Administrations on how best to initiate a UK-wide debate on future radioactive waste management policy. The Government believes that it is necessary to involve as many people as possible in the debate in order to reach a decision that can achieve the widest public acceptance.

The proposals include setting up an independent advisory body on what information there is, what more is needed and when enough has been gathered to enable the debate to start. By opening a wide range of communication channels, the Government hopes as many as possible of the UK's population will give their views. The paper sets out a five-staged programme, culminating in legislation, if needed, in 2007. Further details and a copy of the consultation paper can be found on www.defra.gov.uk/environment/index.htm.

Industry Structure: Recent Developments

The Government wants to ensure that the public sector civil nuclear legacy, currently the responsibility of BNFL and UKAEA, is managed safely, securely and cost effectively and in a manner that ensures the protection of the environment. The Government believed there was a need for a stronger strategic control and direction for the management of this legacy. As a result, following a review commissioned early in 2000, the Government announced in November 2001 the creation of the Liabilities Management Authority (LMA). The LMA will be responsible for all public sector civil nuclear liabilities.

The LMA will work in partnership with site operators and nuclear regulators reflecting the common interest in achieving the safe discharge of the liabilities. It is expected that the relationship will be defined in statute in implementing legislation which will be put before the UK Parliament as soon as possible. The creation of an LMA will alter the make up and responsibilities of BNFL. As a result, it is expected that any Public-Private Partnership (PPP) will not now take place before 2004. The introduction of any PPP remains subject to the company's overall progress towards achieving a range of targets on safety, health, environment and business performance.

In June 2001, AEA Technology (AEAT) announced that it had sold its nuclear engineering business to Nukem Nuclear Ltd for £23.7m. The engineering business specialises in decommissioning, waste management, engineering design and radiation safety services. In July, AEAT announced that it was selling its nuclear consulting business to SERCO for around £75m. Sale of a third business, nuclear science, is not anticipated at present because it is being restructured to concentrate on its highly specialised facility at Windscale.

Industry Activities: Recent Developments

In October 2001, the Government announced the approval of the operation of BNFL's Sellafield MOX Plant (SMP). The Plant will manufacture mixed oxide (MOX) fuel from uranium and plutonium separated from spent fuel, which is reprocessed mainly at BNFL's Thermal Oxide Reprocessing Plant (THORP), also located at Sellafield. The decision to approve the operation of SMP was taken after a number of public

consultations and after the Government considered it justified in accordance with the requirements of European Community Law. The Irish Government and a number of NGOs have pursued legal challenges through the courts but in each court case the UK Government's decision has been upheld. In December 2001, BNFL started the first stage of plutonium commissioning of the Sellafield MOX plant (SMP), following the granting of licence consent by the UK Health and Safety Executive.

Early in the year, BNFL announced that it would shut down its Springfields UF₆ plant at the end of March 2006 and cease all further marketing of conversion services. It is projected that the shutdown of the BNFL plant in 2006 will result in the need for an expansion of the remaining primary production capacity early in the second half of this decade. In the meantime, it will operate in support of its own nuclear power reactors and existing customer commitments.

BNFL announced in July that it had decided to apply an early safestore strategy to all its Magnox stations which, after defuelling, entails replacing exterior cladding with high integrity materials and in-filling unneeded openings to create a low maintenance structure. BNFL developed its early safestore strategy for Trawsfynydd in the mid 1990s as a result of public requests to transform the reactor buildings into more visually attractive complex almost immediately.

In November 2001, British Energy (BE) signed an agreement with Atomic Energy of Canada Ltd (AECL) relating to a 12-month assessment of the feasibility of using Canadian reactor technology in the UK. Both companies had decided that should the CANDU-NG (new generation) prove the most likely option for any new construction, they would pursue joint licensing of the design by the Canadian Nuclear Safety Commission (CNSC) and the UK's Nuclear Installations Inspectorate (NII). The implementation of a replicate design in both countries, covered by an identical safety case, would provide the opportunity for other countries considering purchasing the CANDU NG to do likewise on the regulatory front.

Following a deal earlier this year to lease Ontario Power Generation's 8 CANDU reactors at the Bruce Nuclear generating Station, Bruce Power has taken another step towards re-starting Bruce 3 & 4. CNSC has requested that Bruce Power, which is almost 85% owned by BE, prepare studies on the environmental impact of restarting the two units. The draft environmental assessment report will be available by the end of the 1st quarter of 2002. Bruce Power expects to spend \$340m to restart the reactors, which will generate an additional 1 500MW, and hopes to be able to do so by the summer 2003. The environmental assessment is an integral part of the license amendment required to start the two units at Bruce A.

At the end of July, NII gave UKAEA permission to re-start three key plants in its Fuel Cycle Area (FCA) at Dounreay, which has not operated since May 1998. NII's consent means UKAEA can start gearing up to its £4bn program to decommission the site within 50-60 years. The three key FCA plants that received NII consent are all facilities that sort and package a variety of solid intermediate-level wastes (ILW) for storage in engineered vaults. Their return to service is an essential step toward UKAEA being able to decommission more of the site's redundant research and development facilities. In June 2001, the Government announced that the fast reactor reprocessing facilities at Dounreay would not be refurbished and asked UKAEA to take whatever action was needed to put the fuels in a condition where they could be safely managed for the long term.

Following the NEA/NDC publication *Nuclear Education and Training: Cause for Concern?*, the Department of Trade and Industry (DTI) decided that a Nuclear Education and Training Forum should be held. The Forum, jointly sponsored by HSE and DTI, was held in February 2001 and attracted more than 100 senior delegates from industry, academia and government. It concluded that there was "cause for concern". The result was the establishment of a Nuclear Skills Group, whose objective is to produce recommendations for government, industry, academia and education on how to ensure there is a sufficient number of appropriately skilled and educated staff for UK employers involved with nuclear technologies. The Group plans to address the broader scope of "the provision of sufficient suitably educated and trained people to satisfy the nuclear industry's needs" as opposed to the narrower scope of "revitalising nuclear education". This work has been termed the "Nuclear Skills Project" and aims to forecast the skills needs of the nuclear technology and radiologically involved industries beyond a time horizon of 10-15 years.

USA



Department of Energy Notifies Nevada of Intent to Recommend Yucca Mountain as National Nuclear Waste Repository

Sound Science & Compelling National Interests Lead to Secretary's Recommendation of Yucca Mountain

Washington, D.C. – As required by the Nuclear Waste Policy Act, Secretary of Energy Spencer Abraham today notified Nevada Governor Kenny Guinn and the Nevada Legislature that he intends to recommend to President Bush that the Yucca Mountain site is scientifically sound and suitable for development as the nation's long-term geological repository for nuclear waste, which will help ensure America's national security and secure disposal of nuclear waste, provide for a cleaner environment, and support energy security.

The Secretary of Energy phoned Governor Guinn at 2:10 p.m. to inform the Governor of his decision. The Secretary's letter of notification was transmitted to Governor Guinn and the Nevada Legislature immediately following the call. Following is the text of the notification letter:

Thursday, January 10, 2002

Dear Governor Guinn:

This letter is to notify you, in accordance with section 114(a)(1) of the Nuclear Waste Policy Act, of my intention to recommend to the President approval of the Yucca Mountain site for the development of a nuclear waste repository. In accordance with the requirements of the Act, I will be submitting my recommendation to the President no sooner than 30 days from this date. At that time, as the Act also requires, I will be submitting to the President a comprehensive statement of the basis for that recommendation. First, and most important, that recommendation will include the basis for and documentation supporting my belief that the science behind this project is sound and that the site is technically suitable for this purpose. Second, there are compelling national interests that require us to complete the siting process and move forward with the development of a repository, as Congress mandated almost 20 years ago. In brief, the reasons are these:

- A repository is important to our national security. We must advance our non-proliferation goals by providing a secure place to dispose of any spent fuel and other waste products that result from decommissioning unneeded nuclear weapons, and ensure the effective operations of our nuclear Navy by providing a secure place to dispose of its spent nuclear fuel.
- A repository is important to the secure disposal of nuclear waste. Spent nuclear fuel, high level radioactive waste, and excess plutonium for which there is no complete disposal pathway without a repository are currently stored at over 131 sites in 39 States. We should consolidate the nuclear wastes to enhance protection against terrorists' attacks by moving them to one underground location that is far from population centres.
- A repository is important to our energy security. We must ensure that nuclear power, which provides 20% of the nation's electric power, remains an important part of our domestic energy production.
- And a repository is important to our efforts to protect the environment. We must clean up our defence waste sites permanently and safely dispose of other high level nuclear waste.

As I indicated earlier, pursuant to section 114(a) of the NWPA, I will be submitting my recommendation to the President no earlier than 30 days from today, together with the other documentation the statute requires. I will provide you with a copy of those materials at that time.

Sincerely

signed

Spencer Abraham

Secretary of Energy

In addition to the notification letter, the Department also released today a document entitled Yucca Mountain "Commonly Raised Topics" which includes a map of nuclear-waste sites. This document is reflective of the most commonly raised topics and includes a description of the step-by-step decision process as required by law.

In addition, as required by law, the Secretary of Energy's basis for recommendation and supporting materials will be available to the public once the formal recommendation is delivered to the President.

For an online copy of the "Commonly Raised Topics", a map* of the nuclear waste-related sites, and the Secretary's letter to Governor Guinn, visit the Department of Energy's website: www.energy.gov.

* The map is public domain and permission is granted to news organisations to reproduce, without content changes, for use in broadcast and print mediums.

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Release Date: January 10, 2002



NEWS MEDIA CONTACT:

FOR IMMEDIATE RELEASE

Joe Davis, 202/586-4940

Wednesday, December 19, 2001

Department of Energy To Permanently

Deactivate Fast Flux Test Facility Research Reactor

WASHINGTON, DC – After an exhaustive, eight-month review of possible missions and future commercial uses for the Fast Flux Test Facility (FFTF) research reactor ordered by Energy Secretary Spencer Abraham and conducted by Under Secretary Robert Card, the U.S. Department of Energy announced today that restart of the FFTF is impracticable and that the department will proceed with the deactivation of the facility.

The department's decision comes after Secretary Abraham ordered, on April 25, a thorough and comprehensive review of the FFTF, which included an initial 90-day review of all information that might be relevant to a decision on the future of the FFTF, as well as a review of expressions of interests by public and private groups to commercially operate the facility.

"I want to thank the FFTF review teams who committed countless hours to this process," Secretary Abraham said. "And in particular, I want to thank Congressman Doc Hastings, who worked longer and harder than anyone else to identify options for the potential restart of the FFTF. This review was conducted in an objective, exhaustive and thorough manner. The department's final determination is based on sound

science, an extensive analysis of the costs and benefits of disposition options and an in-depth consideration of the feasibility of commercial use options.”

During the review process, the department asked for submissions of proposals outlining potential commercial uses for the FFTF. Only one commercial proposal, submitted by the Advance Nuclear and Medical Systems (ANMS) proposing to use the FFTF for medical and research isotope production, provided new information that the department deemed worthy of further review. Subsequently, Secretary Abraham ordered an analysis of that proposal.

A working group of department personnel, directed by Under Secretary Robert Card, ultimately concluded that the ANMS proposal introduced significant drawbacks and presented potentially new legal and financial liabilities to the Department of Energy. Separate consideration was given to a related DOE-funded research mission proposed by Argonne National Laboratory to use the facility as a demonstration project related to nuclear fuel issues. Both proposals, collectively, were deemed to introduce significant liability and funding requirements for the DOE that could exceed \$2 billion dollars.

Specifically, the review team determined that the ANMS proposal presented significant operational and legal obstacles likely to result in project delays and increased costs to taxpayers; including:

- Worker-related financing of operations.
- The lack of any identified commercial purchasers of medical or research isotopes.
- DOE’s assumption of costs associated by fuel disposal, as well as, DOE’s assumption of costs associated with ultimate decontamination and decommission of the site if the commercial operations of the FFTF by ANMS proved unsuccessful.
- Operational and safety oversight and approval of the FFTF by the Nuclear Regulatory Commission are questionable, given that the reactor was not originally built to NRC specifications.