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In this issue

High-definition digital pictures, ultra slow-motion replays and extreme close-ups have brought the fascination of the natural world to our living rooms. It's impossible to be indifferent to the relentless cyclical power of nature, its awe-inspiring capacity to regenerate itself. It is genetically pre-programmed to recover from any situation. As Aristotle said, "Nature does nothing without purpose or uselessly." Well, the annual miracle of spring reminds us that nature is the comeback king. But this time it's not the only one.

Twelve months ago, our sector was showing the first signs of emerging from a cold anti-nuclear winter into the bright spring sunshine of a nuclear renaissance. Everyone wondered whether the revival would prove to be a short-lived phenomenon, a permanent or seasonal one. Initial optimism from the nuclear sector was, understandably, tempered with caution. False dawns can have a sobering effect.

Well, so far the revival has not faded away. On the contrary, it has actually gathered momentum. The green shoots of recovery have grown into a healthy plant that is not about to wither simply to fulfill some seasonal destiny. This plant is fed by a nutritious diet of political pragmatism, economic necessity, growing environmental awareness and the gradual acceptance of a new reality.

The devastating effects of climate change and growing concerns about security of energy supply have put nuclear energy back in the spotlight. Decision-makers, environmentalists and even some NGOs are increasingly coming to the conclusion that nuclear energy is here to stay. Public opinion continues to shift subtly in favour of retaining - and in some cases even expanding - the use of nuclear energy. It is no longer an isolated issue on the margins of the global energy agenda. Now it occupies the centre ground.

The return of nuclear is slowly redrawing the political energy map in Europe. A new spirit of realism has forced governments to acknowledge that nuclear energy offers us the best chance of combating climate change and ensuring the secure supply of electricity that the world craves. The facts speak for themselves and, as the saying goes, "only a fool never changes his mind." Although some countries, like Austria and Ireland, remain unconditionally anti-nuclear, others are openly reviewing their policies, reassessing their energy options. Last spring the revival began, this spring we are seeing the fruits of that revival.

In the UK, for example, the Blair government has recently stressed that nuclear energy should be part of the country's energy equation. This might include re-launching its hibernating nuclear industry. It is currently carrying out a root and

branch review to ensure that it makes the right energy choices for the future, while respecting its international CO_2 reduction commitments.

The Netherlands is reviewing its nuclear phase-out policy. Its only nuclear power plant, at Borssele, was recently granted a 20 year lifetime extension. The government is openly considering the possibility of building a second nuclear power plant.

Other countries, like Belgium, Spain and Italy, also appear prepared to allow nuclear energy back on their political radar.

The Baltic States of Lithuania, Latvia and Estonia recently announced that they wanted to build a new nuclear power plant, in Lithuania, that would be "shared by all three states." Romania is building two new reactors. Other countries, like Poland, are considering the possibility of a bright new nuclear future.

So, the signs look good, but a note of caution is required. The events at Chernobyl that occurred twenty years ago this month are a timely reminder that no renaissance is guaranteed permanent. There is still a long way to go before nuclear energy establishes itself as the number one energy option worldwide. If the nuclear industry does not use its increased acceptability to hammer home key messages about its economic, social and environmental advantages, and about its scientific excellence and impressive safety record, then the revival may yet prove to be a false dawn.

So, like a constant gardener, we must nurture the nuclear plant carefully to ensure that the come back is a lasting one. As the PIME 2006 conference in Vienna recently showed us, one of the major weapons at our disposal is communications. With public perceptions of nuclear improving and economic circumstances playing in our favour, the time is ripe to go on the offensive and to use targeted communications to press home our advantage. We need to improve our communications skills, intensify our communications strategy and send out our messages loud and clear to a broader range of target audiences. At a time when more and more people are inclined to listen, we must do all we can to make sure that we are heard. We cannot afford to miss the bus - there might not be another one around for several springs to come.

The **ENS NEWS** section of Issue N° 12 kicks off with a word from ENS President, Frank Deconinck. Frank gives a blow-by blow account of the events that led up to the Chernobyl accident that happened 20 years ago, analyses its social, economic environmental and health consequences and focuses on the regulatory and political fall-out of what was a watershed event for the nuclear industry.

In his article entitled ***Critical Thinking***, Andrew Teller reflects upon how the reasoning that underpins the points of view expressed by the press and anti-nuclear lobbyists – for example in relation to the Chernobyl accident - is often fundamentally flawed due to faulty reasoning methodology, factual errors, imbalanced reporting and illogical arguments. By exploring, among other things, the concepts of motivated reasoning, Andrew highlights the importance of critical thinking and reasoning in forming valid arguments that can withstand close scrutiny.

In the ***Events*** section, the spotlight falls on PIME 2006, which that took place in February, at the IAEA's Vienna International Centre (VIC) facilities in the Austrian capital. First up, you can read the opening speech delivered by Frank Deconinck, who chaired this international conference for communicators working in the nuclear industry. This is followed by a detailed summary of the conference that underscores the programme highlights and provides links to all the speakers' presentations

(including a speech from American physicist and Nobel Prize Winner, Professor Burton Richter, of Stanford University, California).

Another major ENS event in the nuclear calendar that **ENS NEWS** reports on is the TOPNUX conference that was organised in collaboration with the British Nuclear Energy Society (BNES) and took place in London, in March. Other ENS events in the pipeline are also featured, including RRFM (Sofia, Bulgaria, from 30 April – 4 May 2006), TOPSEAL (Olkiluoto, Finland, from 17 – 20 September, 2006) and TopFuel (Salamanca, Spain, 22 – 26 October, 2006). **ENS NEWS** will provide reports on all important events that ENS organises or co-organises.

The ***Member Societies*** section has a decidedly strong new Member States flavour to it, with two in-depth features: one is by the Lithuanian Nuclear Energy Association and deals with the Baltic States' recent decision to collaborate with the expansion of their nuclear activities; the other, written by our friends from the Nuclear Society of Slovenia, gives an update of the present situation and an appraisal of the future direction of the nuclear industry in Slovenia.

The ***Young Generation (YGN)*** section focuses first on the PIME 2006 workshop that YGN organised on the subject of communicating with young people about radioactive waste. It then gives details about the forthcoming International Youth Nuclear Congress (IYNC), which will take place in Stockholm and Olkiluoto, from 18 – 23 June 2006.

No prizes for guessing the main news item in the ***European Institutions*** section of Issue N° 12! The recent EU Energy Green Paper has, understandably, grabbed all the political headlines and continues to preoccupy industry leaders, stakeholder groups and the press alike. **ENS NEWS** features the measured response that was given by FORATOM, on behalf of the nuclear industry, to the Green Paper and invites those interested to fill in the European Commission's questionnaire on the Green Paper and make their views known on the subject.

Also in this section is a FORATOM reaction to WENRA's Harmonisation Reports on safety standards at nuclear installations.

The ***ENS World News*** section features the complete DVD-recorded message that Nobel Prize winner and eminent physicist, Professor Burton Richter, delivered to delegates at PIME 2006 from Stanford University in California.

Finally, the ***NucNet News*** section focuses on a new book on climate change, entitled The Weather Makers that highlights the competitive benefits of nuclear energy.

Enjoy reading Issue N° 12 of **ENS NEWS** and don't hesitate to give us your feedback.

Peter Haug
Secretary General

Mark O'Donovan
Editor-in-Chief

http://www.euronuclear.org/e-news/e-news-12/presidents-contribution.htm

ENS NEWS

Word from the President

Chernobyl, the accident scenario and its global impact

As the world recalls the Chernobyl accident twenty years ago, this report aims to provide a brief description of the facts surrounding the Chernobyl accident (known and assumed), to examine its possible causes and to provide answers to commonly asked questions on issues like health, social and socio-political impacts, environmental considerations etc. It also draws some conclusions on the current state of affairs twenty years after an event that troubled man's collective conscience.

The accident: what happened ?

Chernobyl's N°4 reactor was a graphite moderated light water reactor (RBMK) with an output of 1000 MWe. It was a pressure tubes boiling water reactor with direct steam feed to the turbines.

A standard maintenance stop for reactor N°4 was planned on April 25. To run the RBMK type plant requires the generation of electrical power, mainly for cooling. In the event of a power failure, emergency generators start up a few seconds later. Due to problems with the new emergency generators, it was decided to carry out a test on the cooling pumps, which required the bypassing of safety systems. The aim of the test was to check if the inertia of the turbines provided enough power to keep the cooling pumps operational during the time required to start the emergency generators.

Here is chronological run-down of the chain of events that took place in the days and hours that led up to the accident:

Friday April 25 1986:

- 01.00 a.m.: the operators decrease the power of the reactor
- 02.00 p.m.: the reactor runs at half power
- 11.00 p.m.: decision to start the test. Due to an error in the regulation, the power is much lower than normal. Rather than stopping the reactor (and the test), the operators try to increase the power again by lifting many more control bars than allowed (6-8 rather than 30). The problem is that at low power, the reactor has a positive void coefficient

Saturday April 26 1986:

- 01.22 a.m.: the test begins while the reactor continues operating under non-authorised conditions. The operators switch off the safety mechanism that should stop the reactor in case of loss of steam supply to the turbine.

- 01.23.04 a.m.: the turbines shut down and the cooling pumps stop. This increases the steam content in the tubes and the reactor power increases rather than decreases due to the positive void coefficient.

- 01.23.40 a.m.: an attempt is made to manually stop the reactor by releasing the control bars (211). The control bars take about 20 seconds to reach the core, and their design is such that reactivity increases during the initial seconds. Fuel elements start breaking up. A few seconds later, shocks are felt and explosions are heard. Steam explosions destroy the reactor core and blow the roof off the reactor building. Fires start all over the place. The worst civil nuclear accident in history has just occurred.

- 01.28 a.m.: the first fire-fighters arrive on the scene

- 02.30 a.m.: the largest fires are under control

- 05.00 a.m.: the graphite fire starts

Today, the causes and the consequences of the accident have been thoroughly studied and many lessons have been learnt.

The main causes of the accident, as identified by Western experts are:

- **Unsafe and unstable reactor design**: In addition to generating electricity, the RBMK reactors at Chernobyl were also designed and adapted for the production of plutonium for military purposes, as fuel can be loaded and unloaded during operation. This double function restricted the reactor's built-in safety mechanisms. Consequently, the accident cannot be disassociated from the politico-military context of the former Soviet Union at that time, even if there are no indications that at any time plutonium was produced there for military purposes

- **The operators' lack of theoretical training and knowledge:** During the cold war, safety was clearly not a priority. There was a critical lack of safety culture at Chernobyl, which was amplified by an global lack of understanding and training

- **The culture of strict confidentiality** that reigned in the former Soviet Union due to the strong interdependency of civil and military nuclear applications: Within the context of the 1980's, operators were not supposed to think critically or take initiatives in case of emergency situations, which were never even officially considered.

Health

The question of exactly how many casualties resulted from the Chernobyl catastrophe remains on everyone's mind today, twenty years later - even though quantifying human suffering in terms of fatalities is much too restrictive. The

following data mainly come from a report published by the Chernobyl Forum (*Chernobyl's Legacy: Health, Environmental and Socio-Economic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine*[1]) and another one written by SCK-CEN report entitled C*hernobyl, 20 years later*[2]. Distinction has to be made between the different categories of casualties, as follows:

- Fatalities that occurred among people who received high radiation doses during the 4 months that followed the explosions (in total, 134 people suffered from radiation sickness). It is highly probable that fatalities also occurred, a few years after the accident, among people who had initially suffering from radiation sickness but had seemed to have recovered from it
- Fatalities estimated among rescue workers and the so called 'liquidators' who did not suffer from radiation sickness
- Fatalities estimated among the general population

Two **employees** died from injuries caused by the explosions that were not connected to radiation.
One other employee probably died from an acute cardiac arrest brought on by the explosions.
28 employees or rescuers died within 4 months and there is no doubt that their death is as a result of the accident. A further 19 workers died between 1987 and 2004. As they were among those suffering from radiation sickness, it seems more than probable that the majority of them died from the consequences of the accident, although some certainly died from other causes. Some authors limit radiation-related deaths to 11.

Remark: Out of 134 people, 28 died from extremely high radiation doses. That leaves 106 people. Of those 106, between 11 and 19 died over a period of more than 15 years. Those are "normal death rates?" Radiation-related models indicate much higher rates. Why the discrepancy?

Among the **rescue workers** and the **liquidators** (initially about 350.000, later up to 600.000), about 1000 received radiation doses ranging from 2 – 20 Gy. The average effective dose among all 600.000 liquidators is estimated to be around 100 mSv. Therefore, the doses range between 25 and 250 times the natural radiation dose. 21 cases of leukaemia have been detected among workers who received more that 150 mSv. That is about twice the normal rate of occurrence (in other population groups, no increase has been seen). An increase in solid or thyroid cancers has also been noted, but this is certainly due to vastly improved screening methods. A radiation-induced increase in incidence of these cancers cannot, however, be excluded. But

statistically this is not significant due to the very low numbers involved.

Models, mainly based on observations made with regard to survivors of Hiroshima and Nagasaki, led to about 2000 radiation-induced cancers being made attributable to rescue workers or liquidators, during their lifetime. Furthermore, the extrapolated numbers depend upon the life expectancy model used. The current life expectancy in the Ukraine or Belarus is now as low as 55 - 65 years for adult males. Many solid cancers may not have the time to develop by this age group.

All numbers derived from such models are subject to great uncertainty, but the ongoing discussion about the linear threshold model, or a simple threshold, or even hormesis, is irrelevant here because the doses are much too high for those potential effects to have played a role.

Among the **general population**, there is very little doubt that the increase of thyroid cancer in children (about 5000 detected cases) is due to contamination, probably by iodine and caesium isotopes trapped by an iodine deficient thyroid. Unfortunately, about 15 children have died. It has been suggested that screening explains the increase in observed cases of thyroid cancer. The observed correlation with soil contamination points to radiation effects. It should be realised, however, that in Western countries one half of all elderly people have thyroid cancer that goes totally unnoticed (autopsy data). No other increase in cancer incidence has been observed. However, it may yet ocur, or it may be too small to be detected.

Based probably on a linear non-threshold model, the report by the Chernobyl Forum (September 2005 version) predicts some 2000 extra cancer deaths among the general population, taking into account average radiation doses above background levels. It is stated that this is an increase of 3% on normal cancer incidence levels. This means that since the normal incidence of cancer death is about 25%, a total exposed population of about 250.000 people was considered. Obviously, nobody will be able to prove or disprove 2000 extra cases among what is a normal rate of occurrence - unless the cancers are of a very specific nature.

The linear non-threshold model assumes that there is no threshold level below which no detrimental radiation effect is observed. A model with even a small threshold level would greatly decrease the number of 2000 cancer cases. Also, it does not seem reasonable to speak about “extra cancer deaths” as if those people would not have died without radiation. Would it not be better to speak about “early cancer deaths?” Furthermore, an increase in cancer deaths does not necessarily mean decreased life expectancy in general. It may be that survivors live longer (the “healthy survivor” effect) and, therefore, that cancer may not be the only indicator for radiation effects to be taken into account.

It is probably fair to conclude that, apart from thyroid cancer among children, no statistically significant increase in cancer incidence has been observed today, and if it were to occur, it will not have a major impact on the average health status of the population in the Chernobyl area. Indeed, even though statistically significant, and certainly dramatic from a personal point of view, 10 or even 100 extra deaths due to a particular or rare cancer have no impact on public health in areas where chronic factors such as alcohol abuse, malnutrition, smoking etc. have a compound effect on health.

As far as incidence of malformations is concerned, about which numerous false information has been communicated and misleading photographs published, no

relevant radiation-induced increase has been identified. The only probable non-cancer health effect is an increase in the incidence of cataracts among liquidators and children.

Social consequences

On April 27 at 11.00 a.m., the population of the town of Pripyat was told that it was going to be evacuated. Two and a half hours later, all inhabitants had left their homes forever, along with friends, people living in the neighbourhood, cats and dogs. The evacuation was progressively extended to include people living within a 30 km radius of the stricken reactor. This brought the total number of evacuees to about 116.000. In the years following the accident, the number of people that were relocated grew to more than 330.000. It is not hard to imagine the psychological damage cause by this forced evacuation and relocation - not only among the resettled people, but also among the residents of the areas of resettlement who feared and disapproved of the mass arrival of busloads of 'contaminated foreigners'.

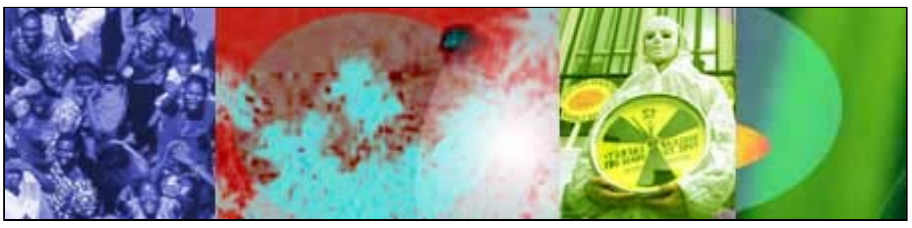
This forced relocation gave rise to mental health problems, alcohol and tobacco abuse etc..., in what the Chernobyl forum reports as "the largest public health problem unleashed by the accident today".

The permanent relocation of such a large number of people, irrespective of age and social background, can certainly be questioned. Many public health arguments used to justify the relocation policy were either irrelevant or temporary by nature. Some formerly evacuated areas have now been resettled. This is a positive development, but probably happened much too late.

If one accepts that the first evacuations had to be decided upon in an emergency situation, it is not clear what other reasons could have led to the evacuation of an extra 200,000 residents months or years after the accident.

Some 100.000 people are considered as permanently disabled as a result of the accident and 7 million people receive compensation because of it. Today, between 5 and 7% of government spending in Ukraine and Belarus is allocated to various Chernobyl-related compensation packages.

How many people are objectively entitled to specific support and how many have obtained support from “less acceptable channels” - simply in order to escape unbearable poverty - remains an open question.



Environment

The effects on the environment are well-documented and less subject to fuzzy interpretations as they are often measurable. However, the economical or political decisions taken on the basis of the measured data, such as the restrictions on the sale of milk products and vegetables have taken account of many other factors than public health alone. These were taken not only the accident region, but also worldwide. The

decision-making process also showed how difficult it is for experts to communicate their findings to the authorities, and for the authorities to know which experts to listen to.

About 4300 km^2 are in the no-go zone. Another area of about 7000 km^2 is considerably contaminated by ^{137}Cs. In Belarus, Ukraine and Russia, a further 130.000 km^2 were less severely contaminated. Similar levels also occurred in 60.000 km^2 in other parts of Europe.

In the inhabited but contaminated areas, the radiation burden due to remaining radioactivity in soil and food is now down to less than 1 mSv/y/person. This is due, among other reasons, to natural decay, but also to countermeasures affecting soil contamination levels and farming methods.

In Europe, different countermeasures were taken. Not all of them were justifiable. The fact that some radioactivity could be measured, certainly when expressed in Bq, was interpreted by some that danger was inevitable.

It seems that among wildlife in the most contaminated regions, malformations occurred in the first generation of offspring, but no obvious hereditary effects have been observed. What has been observed, however, is flourishing biodiversity. This is to be expected when the main predator - man - is no longer present.

One remaining problem that has potential consequences that go far beyond strongly-contaminated areas is contamination of groundwater and downstream water-ecosystems by ^{137}Cs and ^{90}Sr. It adds to existing problems due to industrial pollution.

Regulations

The regulatory impact of the accident has been profound, both at national and international levels. The major international actors involved since the beginning are the IAEA, EURATOM, ICRP, NEA, WHO, WANO and others.

The Chernobyl accident gave rise to a fundamental worldwide change in approach when it comes to safety. The world certainly is much safer now that it was before, not only with respect to safety of nuclear power, but also with regard to other industrial areas - where the pioneering role of regulation in the nuclear industry gave rise to similar initiatives in other industries.

One perverse effect of stricter regulations is to induce increased fear among the population. The general view is that if something requires strong regulations it has to be very dangerous to begin with. It is certainly correct top say that nuclear power, air travel, even driving a car are all very dangerous if regulations are not respected. This is what regulations are for.

Nuclear power

In 1972, the Club of Rome predicted that, in the US alone, nuclear energy would supply 900.000 MW by year 2000. The Three Mile Island and Chernobyl accidents drastically changed all previous projections. Whereas in Western Europe and the US the installation of new power plants came to a full stop, this was not the case in the East.

The accidents occurred at a time of increasing environmental awareness and changing views worldwide. The green political movement demonised nuclear power as an evil technology. This situation has slowly changed, due mainly to the more objective analysis of pro's and con's, strong economic arguments put forward by the power industry, awareness of the potentially harmful effects of CO_2 emissions and the problem of security of supply.

Politics

In 1985, President Gorbachov decided to impose a certain degree of transparency to Russian politics. This was called 'Glasnost' and was part of his 'perestroika' policy. Then the Chernobyl accident occurred and the old culture of secrecy once again took the upper hand. Under heavy pressure from the West to provide open information on the accident, Gorbachov imposed full glasnost, thereby annihilating one of the strongest pillars of the Soviet regime. That regime fell apart soon after. Chernobyl was a major catalyst in triggering the chain reaction of events that would soon lead to the disintegration of the Soviet Union.

Conclusions

Twenty years have passed since Chernobyl. Twenty years without a significant nuclear accident in a power plant. Twenty years later, the public seems to have gradually changed it's perception of nuclear energy, against the backdrop of what is often referred to as 'the nuclear renaissance'. This could be seen as evidence of the maturity of nuclear technology, of the adequacy of the safety culture, of effective regulations etc... . But it may also be proof of loss of memory.

We know that coal mining alone kills thousands of people every year. We know that car accidents kill more people during a single weekend than Chernobyl ever will. Let’s not forget that public perception is not about cold figures, but instead about feelings. One single major accident in a power plant could - in a matter of minutes - ruin twenty years of considerable effort.

References

1) The Report by the Chernobyl Forum 2003-2005, second revised version, Chernobyl's Legacy: Health, Environmental and Socio-Economoic Impacts and Recommendations to the Governments of Belarus, the Russian Federation and Ukraine, IAEA/PI/A.87 Rev.2/06-09181, April 2006.
URL: www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf

The Chernobyl Forum is composed of the IAEA, WHO, UNDP, FAO, UNEP, UN-OCHA, UNSCEAR, the World Bank Group, Belarus, the Russian Federation and Ukraine.

2) Chernobyl, 20 years later, a report published b ySCK•CEN (available in April 2006):
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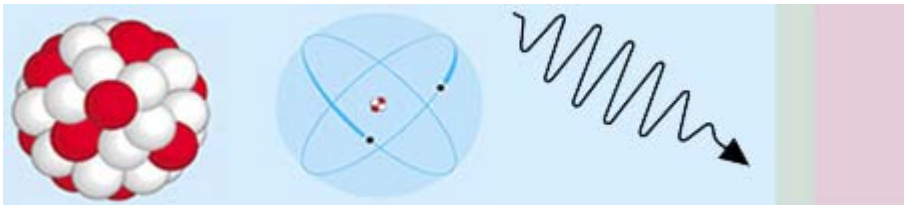
http://www.euronuclear.org/e-news/e-news-12/critical-thinking.htm

ENS NEWS



Critical thinking

by Andrew Teller

The press keeps providing a steady flow of dubious claims concerning this or that element of the nuclear debate. The forthcoming anniversary of the Chernobyl accident won't do anything to improve this situation. Critics of nuclear energy continue to pile up arguments, old and new (mostly old), justifying their position. This is all well and fine: it is only normal to speak up for what one believes is right. I want to be allowed to enjoy this freedom, so I cannot possibly deny it to anybody else, were it to someone I disagree with. What worries me is the methodology used by so many of the protagonists for and against nuclear energy (mostly against). The reason for my concern is of course that a conclusion can only be as good as the reasoning that produced it. The numerous flaws that can impair reasoning are well known:

- selective (i.e. biased) use of arguments,
- factual mistakes that are nevertheless indispensable to the conclusion submitted,
- failure to take account of the relevant orders of magnitude when dealing with quantifiable matters,
- failing to address obvious objections,
- preaching sound reasoning methodology but not applying it to one's own demonstration,
- taking for granted what should actually be demonstrated,
- failing to heed the rules of logic, etc.

We are all liable to fall prey to such pitfalls, but it appears that all are not equally liable to do so. Research in the area of cognitive science enables to shed useful light on the mechanisms presiding the generation of arguments in support of one's opinion. One very important finding is that emotion is an essential ingredient of efficient reasoning. People deprived from emotions (e.g. due to brain damage) do not reason well. They would keep pondering the elements of the issue without ever feeling a need to reach a conclusion. The other side of the coin is that emotions will

affect the decision process well beyond the legitimate urge to make up one's mind. We all know by experience that we recognise instantaneously the impact of any piece of news on the opinion we currently hold. Our desire to maintain our opinion will push us to treat this piece of news accordingly. If it confirms our position, it can be accepted without the minimum amount of scrutiny required. If it goes against it, we will have to make heroic efforts not to dismiss it on spurious grounds. This is what makes all of us, not dispassionate discoverers of truths, but "motivated reasoners". Motivated reasoning can be further described through taking account of the strength of its two main components. Combining the strength of the directional goals and with that of the accuracy goals lead to a double entry table. We so obtain four categories represented in the table below[1]

	Weak Accuracy Goals	Strong Accuracy Goals
Strong Directional Goals	**Partisan Reasoner** • seeks to justify a preferred conclusion • confirmation or disconfirmation biases in information processing • disconfirming evidence may polarise attitudes	**Intuitive Scientist** • seeks an accurate conclusion • optimising, within subjective limits • even-handed with evidence • actively adjusts for bias • updates beliefs through a Bayesian-like process
Weak Directional Goals	**Low Motivation** • apathetic • heuristic • possibly no processing	**Classical Rationality** (normative ideal) • Enlightenment man • reasoning as dispassionate calculation

It must be added that, by natural inclination or by training, different people fall into different categories. Given what this e-Bulletin stands for, the reader might expect me to assert now that the anti-nuclear are Partisan Reasoners and that the pro-nuclear are close to the ideal of classical rationality. Wrong: I am quite prepared to admit that the latter are Intuitive Scientists, which is still better than being a Partisan Reasoner. Given the topic of this article, the reader might also expect me to explain why it is not the other way round: the anti-nuclear as Intuitive Scientists and the pro-nuclear as Partisan Reasoners. I could engage in a full-fledged, and therefore lengthy, demonstration of my assertion, but there is a simpler way of meeting the reader's expectation. It consists in not attempting to do so at all. My advice to those who would question my appraisal is: see for yourself. Read the newspapers, read articles written by opponents of nuclear energy, scour the Internet for arguments in favour of it. Then try to identify instances of the failings listed above. Try also to see where in the above table the authors of the material read fit best. But above all, get acquainted with critical thinking. Type these words in the input box of your favourite search engine if you are not familiar with the concept yet. You will find a wealth of information on how to reason without falling in any of the pitfalls mentioned earlier. It will also teach you how to identify the traps motivated reasoners of all shapes and sizes are laying for you. If I had to emphasise one single characteristic of critical thinking, I would point out that it advocates *self-regulation*. Critical thinkers define self-regulation as monitoring one's own cognitive activities, the elements used in those activities and the results deduced from them. This implies practicing self-examination and self-correction[2]. Critical thinking is therefore about being alert to

one's own potential failings in order to better avoid them. This is a demanding exercise. The stronger the directional goal of the reasoner will be, the weaker will be the incentive to practice a discipline that is likely to stand in the way of the reasoner's objectives.

It has become fashionable nowadays to underline the environmental dangers threatening us. The fashion has not yet been extended to calling for the compulsory use on all sides of the cognitive tools needed to rise to the challenge. The practice is actually quite the reverse: those who by trade or by natural inclination are more likely to apply sound rules of reasoning are being dismissed as a lobby motivated by vested interests. Critical thinking, not to speak of plain common sense, indicates that an argument should be accepted or dismissed on the basis of its strength or weakness, not according to the affiliation of its author

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1 Three Steps toward a Theory of Motivated Political Reasoning, Milton Lodge and Charles Taber, in Elements of Reason, Cognition, Choice and the Bounds of Rationality, Edited by Arthur Lupia, Mathew D. McCubbins and Samuel L. Popkin, Cambridge University Press, 2000.

2 See "Critical Thinking: What it is and Why it Counts" by Peter A. Falcione (can be downloaded from the Internet).

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http://www.euronuclear.org/e-news/e-news-12/pime.htm

ENS EVENTS

PIME 2006: Chairman's speech for Frank Deconinck

Monday 13 February 2006: Opening speech

Ladies and Gentlemen,

Welcome to PIME 2006 and to the beautiful, romantic city of Vienna. More about Vienna later, but first I would like, on behalf of ENS and the co-organisers of this year's conference – FORATOM and the NEA/OECD – to thank the IAEA for hosting this year's PIME. We are also very grateful to the IAEA for the use of the Vienna International Centre. Our hosts have left no stone unturned in an effort to make us feel welcome and to provide the perfect environment for a constructive and interactive debate on the main issues facing communicators in our industry today. The contribution that they have made to the agenda is considerable too.

And so, to Vienna: Austria's iconic capital city is synonymous with music, culture and refinement. Its famous monuments, palaces and museums reflect its glorious past when, for seven hundred years, it was capital of the Habsburg Empire. Today, with its countless theatres, art galleries, coffee houses and contemporary urban architecture, Vienna maintains that tradition of style, flair and individualism.

Unless you have spent the last few weeks on Mars, it won't have escaped your notice that Vienna is also the focal point for celebrations to mark the 250th anniversary of the birth of one of Austria's most famous sons – the legendary Wolfgang Amadeus Mozart. Mozart's music communicates so many messages to so many people. It challenges. It provokes. It asks questions. It provides answers. It seduces. Of course, taste in music is very subjective, but it's hard to remain indifferent to talent. There is a lesson to be learnt here for all nuclear communicators: as we strive to ensure that our communications reach the right targets and send the right messages, we would do well to consider the example of Mozart; our communications must be creative, imaginative and high impact. People must not be indifferent to them. They too, like Mozart, must challenge, provoke, ask questions, provide answers and seduce. As the nuclear renaissance continues to gather momentum and governments, environmentalists and citizens increasingly realise that nuclear energy provides the best option for combating climate change and ensuring security of energy supply, there are even greater rewards to be reaped from successful communications.

Our industry is not in the defensive mindset that it was in before. On the contrary, we must now make the most of the nuclear revival and go on the offensive.

We must reach out, with renewed confidence and conviction, to new audiences.

We must reiterate new as well as familiar messages. We must win over the skeptics and hesitators.

The PIME agenda is designed to provoke debate on the issues that really count. We will discuss how to communicate effectively the economic, social and environmental advantages that nuclear offers. The targets we will focus on are varied: local communities, politicians and all levels of civil society. The communications tools at our disposal are varied too, with the Internet and blogging engaging more and more people in debate every day. And we have expert communicators to stimulate debate, share experiences with us and highlight best practices.

I urge all delegates to play the most active role possible in the debates and hope that they will return home with food for thought, inspired to push their communications to the next level. Nuclear is back and our communications should make that fact known - loud and clear.

I hope that you all enjoy a constructive and interesting conference and officially declare PIME 2006 open.

Thank you.

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http://www.euronuclear.org/e-news/e-news-12/pime2006-summary.htm

ENS EVENTS

ENS PIME 2006

PIME 2006

Nuclear communicators converge on Vienna for PIME 2006

From 12 – 16 February, nuclear communicators from across Europe and beyond congregated at the IAEA's (International Atomic Energy Agency) Vienna headquarters to take part in **PIME 2006**. This annual European Nuclear Society (ENS) conference for nuclear communicators was organized in co-operation with the IAEA, FORATOM and NEA/OECD. The conference was chaired by Frank Deconinck, President of ENS and Chairman of the Board of Governors of SCK-CEN, the Belgian Nuclear Research Centre, in Mol (see the profile of Frank Deconinck in the January 2006 edition of FLASH). PIME is a unique annual conference that has established itself as a not-to-be-missed fixture for nuclear communicators.

Europe's nuclear societies and national nuclear fora, environmentalists, industry leaders, IAEA staff members and journalists took part in **PIME 2006**.

On the agenda at the Vienna International Centre (VIC) were three days of dialogue, analysis and exchange of information and experiences on a broad range of nuclear hot topics, as well as technical tours to Austria and the Czech Republic. The conference pogramme centered on a series of presentations and questions followed by answers from the floor during the morning Plenary Sessions and on afternoon Plenary Workshops and Workshops.

Among the key speakers at **PIME 2006** were Tomihiro Taniguchi, the Deputy Director General of the IAEA; Fatih Birol, Chief Economist of the International Energy Agency (IEA); Mikhail Balonov, the Scientific Secretary of the IAEA's Chernobyl Forum and Conference, Bruno Comby, the well-known pro-nuclear

environmentalist and Ute Blohm-Hieber, Head of the Nuclear Energy, Waste Management and Transport Unit of the European Commission's DG TREN.

Whereas **PIME 2005** took place against a backdrop of rising hope for the nuclear industry, this year's conference occurred at a time when the global nuclear revival is well under way and has continued to gather pace, thanks partly to the increasingly accepted advantages that nuclear energy has with regard to security of supply and climate change issues. The current favourable climate for the industry has created an improved environment for communicating and greater opportunities for communicators to get their impact messages across to a wider audience. At the same time, the premium for effective, impact communications is also greater and delegates were keen to exchange experiences and learn new methods and tools that will help communicate more effectively and press home the advantage that the current nuclear renaissance has given them.

Among the presentations made during **PIME 2006** were those on the future global energy outlook and the role of nuclear in that future, Chernobyl and the true state of the accident, a King's College London study about public perceptions of nuclear and risk, the advantages of nuclear energy from an environmentalist's viewpoint, the power of positive branding and how the IAEA gets in messages out.

True to PIME tradition, a communications professional from another industry was invited to talk to Pimers about how his/her industry meets its communications challenges. Christine Gould, Policy Communications and Research Manager at Croplife International (the global federation that represents the plant sciences industry) explained how the biotechnology industry meets the communications challenges that it faces from, among others, NGOs, opposed decision-makers and sceptical members of the public.

Two new types of sessions were introduced alongside the more familiar PIME format: firstly, the IAEA organised and moderated a panel session entitled Meet the Media: What journalists think about nuclear communications. This highly interactive panel discussion was a kind of role-reversal session, with delegates able to put their questions to a panel of senior journalists from Agence France Presse, the BBC and Associated Press. Secondly, the 1976 Nobel Laureate for physics, Professor Burton Richter gave a special pre-recorded DVD-link presentation to PIME from his headquarters at the University of Stanford, in California. His presentation focused on the promises and problems of nuclear and gave a generally upbeat assessment of the current and future potential for nuclear energy.

The afternoon Workshops, a mixture of Plenary and break-out sessions, gave delegates the opportunity to take part in lively, interactive discussions, rather like focus groups, on issues including: how to communicate on Chernobyl, crisis communications, stakeholder communications, communicating waste for the next generation, best practices, exploiting the Internet and cross-border communicating with non-nuclear neighbours.

Throughout **PIME 2006** there was a poster exhibition in the lobby in front of the main conference room that featured exhibits from Russia, Japan, Slovenia and Hungary.

The PIME Award for Communications excellence this year was one by the Czech nuclear operating company, CEZ, for its campaign entitled the Temelin Olympic Games. The winning campaign involved excellent local community relations, stakeholder participation, celebrity advocacy from famous Czech sportsmen and Olympic gold medalists and a range of communications tools to help convey key messages about nuclear energy.

PIME 2006 also included a programme of technical visits for delegates, which took place after the conference. This year, the choice was between either a half-day visit of the Austrian nuclear research laboratories at Seibersdorf and a day trip to the nuclear power plant (NPP) at Temelin, in the neighbouring Czech Republic. At the Seibersdorf laboratories, an hour from Vienna, research is carried out by a team of experienced scientists and fellowship trainees from around the world into how radiological techniques and analyses can help identify the presence of radioactive substances (especially at decommissioned sites or when an incident has occurred), improve crop yields and plant selection through biotechnology and develop new healthcare diagnostic and prophylactic techniques. Research is also carried out to promote environmental protection – especially with regard to enhancing the quality of soil and water.

At the Temelin NPP there are two VVER 1000MW reactors, which were built by Westinghouse and are run by the operating company CEZ. Together with the 4 units at the Dukovany NPP - the Czech Republic's other operating plant - Temelin NPP accounts for 31% of the Czech Republic's domestic electricity production. The country's two NPPs also export electricity to Germany, Austria and Slovakia, thereby contributing to the Czech Republic's economy.

For full details about **PIME 2006** and copies of the speakers' presentations, visit the following links on the ENS website:

PIME website Programme
Presentations

Next PIME 2007 will take place in Italy, from 11 – 14 February.

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http://www.euronuclear.org/e-news/e-news-12/topnux2006.htm

ENS EVENTS

TOPNUX 2006

From 20-23 March, the **TOPNUX** conference took place in London. This international conference, entitled Securing the Future – the Role of Nuclear Energy, was organized by the European Nuclear Society (ENS) in collaboration with the British Nuclear Energy Society. Around 200 delegates attended from across Europe, China, the US, Canada South Africa etc. This included several ministers and senior politicians, industry experts, scientists (among them was the famous environmentalist and Gaia theory proponent, James Lovelock) and members of BNES and ENS. Among the key speakers were: Malcolm Wicks, UK Energy Minister; Paavo Lipponen, the former Finnish Prime Minister and current Speaker of the Finnish Parliament; Pierre Gadonneix, CEO of EDF and Bill Coley, CEO of British Energy.

Among the main issues under discussion at **TOPNUX** were: international partnerships to fuel the supply chain, waste management, security and safeguards, public perceptions, new engineering and R & D initiatives with regard to design and construction, attracting and recruiting talented young engineers into the into the nuclear industry and research sector and proactive risk communication strategies. There were also a number of technical sessions that focused on products that will secure the future of the nuclear industry, including advanced gas-cooled reactors, “smart technologies,” hot labs, innovative spent fuel initiatives, encapsulating waste in hard rock or in underground wet storage sites and the Generation IV reactors of tomorrow.

Another important issues discussed by **TOPNUX** delegates was the nuclear industry’s need for promoting greater national awareness of the advantages of nuclear energy with legislators, regulators and the general public.

The current nuclear renaissance, with the increasing importance attached to plant lifetime extensions and new-build, was a commonly recurring theme throughout the conference.

For more information about the **TOPNUX** conference, including details about the programme and the speakers’ presentations, visit the ENS website at: www.topnux2006.org.

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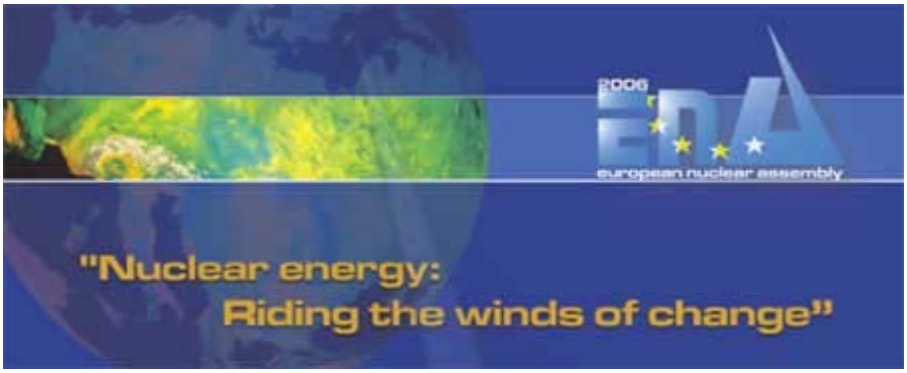
http://www.euronuclear.org/e-news/e-news-12/ena.htm

ENS EVENTS

ENA 2006: Riding the winds of change



When the inaugural **European Nuclear Assembly (ENA)** took place in November 2004, the first green shoots of the nuclear recovery were just beginning to appear after a long anti-nuclear winter. Twelve months down the road and the revival has gathered momentum. This was clear for all to see at **ENA 2006**, which took place in Brussels, on 28 & 29 March, under the chairmanship of Mike parker, CEO of BNFL in the UK.

The upbeat mood at the conference reflected the sense of renewed optimism and confidence felt by the European nuclear industry as global energy is now firmly established at the top of the political agenda. The publication of the EU's Energy Green Paper, the importance given to energy at the recent European Spring Council (Summit), and the fact that security of energy supply and climate change considerations are driving the energy debate in several European countries, combined to make the timing of **ENA 2006** especially appropriate.

Among the 220 delegates from 25 countries who attended the conference to discuss the burning nuclear issues of the day, were the EU Energy Commissioner, Andris Piebalgs; ministry officials from France, Bulgaria, Romania and Poland; MEPs, industry leaders, environmentalists and academics.

Another significant factor at this year's **ENA** was the presence of so many representatives of the European institutions. Around 25% of all the delegates who attended were from the European Commission and the European Parliament. There were also speakers from the European Bank for Reconstruction and Development and Roland Schenkel, Director General of the European Commission's the Joint Research Centre JRC). This shows how FORATOM's extensive lobbying of Europe's decision-makers is bearing fruit and underlines a subtle change of attitude among administrators and politicians towards the issue of nuclear energy. The European nuclear industry has engaged in an active debate with the European institutions and, fuelled by the need to address the security of supply and climate change problems that preoccupy so many European citizens, Europe's decision-makers are now more prepared to take onboard what the industry is saying.

But there were also experts from beyond Europe, including: Admiral (retired) Frank L. “Skip” Bowman, President and CEO of the Nuclear Energy Institute in the US; Richard Garwin, an eminent physicist from the Thomas J. Watson Research Centre in the US who and Elizabeth Dowdeswell, President of the Nuclear Waste Management Organisation of Canada.

The agenda revolved around plenary sessions, a Ministerial Roundtable discussion featuring government officials from Bulgaria, Romania, and Poland and four panel debates devoted to key issues facing governments and industry alike.

Among those issues highlighted during the conference was nuclear new-build in Europe and worldwide, nuclear energy’s contribution to meeting the goals of the EU’s Lisbon Strategy, investing in nuclear and public perceptions as a catalyst for political action.

The press conference on 28 March, which was attended by 19 journalists, featured keynote statements from industry leaders on the subject of nuclear new-build in Europe. In all, 27 media representatives covered the press conference and/or conference – including 3 TV stations. At least twenty interviews were arranged between journalists and **ENA 2006** speakers and delegates. This illustrated how the media is more and more plugging into the nuclear debate, reflected the heightened interest of their readers in energy matters. More informed and objective reporting based on the facts can only help to positively influence public acceptance of nuclear energy and make more and more people embrace it as the energy option of choice for the future.

The number of delegates in attendance and the range of expert speakers, senior politicians and highly-qualified scientific experts present to take part in the lively debates underlined that **ENA 2006** was an undoubted success. The conference has quickly established itself as the main event on the European nuclear industry’s calendar.

All the speeches and presentations from **ENA 2006** are now online on the ENA website (www.ena2006.org), together with audio streaming, photos and press clippings.

Make a note in your diary now – ENA 2008 will take place, in Brussels, on 8 & 9 April 2008!

http://www.euronuclear.org/e-news/e-news-12/rrfm2006.htm

ENS EVENTS

RRFM 2006

It is not yet too late to register for RRFM 2006!

Preliminary Programme and registration form on www.rrfm2006.org

The 10th conference on Research Reactor Fuel Management will take place from 30 April to 4 May 2006 in Sofia, Bulgaria.

Don't miss out on:

- A key event for the research reactor community bringing together 170 international professionals
- A quality programme offering the latest news on current developments in the field
- Unrivalled networking opportunities for the exchange of experiences and expertise
- Attractive social events, highlighting the best of Sofia

Technical programme highlights include:

- Progress in the new very-high density fuels (U-Mo) development, both monolithic and dispersed. Various methods and attempts to explain the observed swelling of the dispersed fuel and how to avoid it
- International initiatives to address proliferation concerns: Update on GTRI and the new US GAP materials programme
- Overview of global TRIGA activities
- Fuel management for research reactors
- Innovative methods in research reactor analysis
- Progress on reconstruction of the IRT research reactor in Sofia

Research Reactor Fuel Management (RRFM) - The key event for the international research reactor community

http://www.euronuclear.org/e-news/e-news-12/TOPSEAL2006.htm

ENS EVENTS

TOPSEAL 2006

Mark your diary!

Mark your diary for **TopSeal**, the international meeting place for waste management professionals, organised by the European Nuclear Society in **Olkiluoto** from 17 **to 20 September 2006.** Olkiluoto, with both an EPR and an underground rock characterization facility under construction, is a hotspot for the nuclear industry – not to be missed.

Who should attend?

- Nuclear engineering designers
- Plant operators
- Safety assessment experts
- Rock construction experts
- Experts in geo-sciences
- Regulators

Call for Papers

Share your expertise and success with your waste management colleagues by presenting a paper on one of the following topics:

- **Experiences with existing LLW/ILW storage and disposal facilities** Design, construction, licensing, operation and upgrading
- **Planned activities for geological and near-surface repositories** Design, construction and licensing of facilities for all waste types
- **Research, development and demonstration for radwaste storage and disposal**

Repository systems: Technologies and operation/long-term safety demonstration

- Stakeholder involvement, regulatory aspects and related issues

Please submit your abstract by **15 May 2006.**

Call for Papers, abstract form and all further information on www.topseal2006.org.

Join us in Olkiluoto in September!

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http://www.euronuclear.org/e-news/e-news-12/TopFuel2006.htm

ENS EVENTS

TopFuel 2006

It is not yet too late for you to submit a paper to the 2006 International Meeting on LWR Fuel Performance (TopFuel)!

This key event for the nuclear fuel community will be held from 22 to 26 October 2006 in Salamanca (Spain), a UNESCO World Heritage Site.

Call for Papers, abstract form and further details on www.topfuel2006.org.

Papers on:

- Advances in fuel design and fabrication
- Fuel cycle strategies and core management
- Security of supply
- Fuel performance and operational experience
- Fuel analysis methods and models
- Fuel behaviour under off-normal conditions

- Logistics, containers and transportation
- Spent fuel management (including storage)
- Licensing and safety requirements
- Advanced fuel cycles

The abstract submission deadline is 15 March 2006.

Who should attend TopFuel?

- Nuclear fuel marketing managers
- Fuel engineering designers
- Fuel operations managers
- Advanced fuel experts
- R&D experts
- Nuclear fuel materials scientists
- Nuclear fuel physicists and modellers
- Fuel fabricators

Sponsors:

Organised by the European Nuclear Society, TopFuel 2006 is sponsored by:

- American Nuclear Society
- Atomic Energy Society of Japan
- Spanish Nuclear Society
- International Atomic Energy Agency
- OECD Nuclear Energy Agency

TopFuel – A reference for the nuclear fuel community

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http://www.euronuclear.org/e-news/e-news-12/baltic-states.htm

MEMBER SOCIETIES

THREE BALTIC STATES SAY "YES" TO NUCLEAR ENERGY

The following report by Jonas Gylys, President of the Lithuanian Nuclear Energy Association and Stanislovas Ziedelis, Secretary General of Lithuanian Nuclear Energy Association summarises the recent energy history of the Baltic States, highlights the ongoing EU energy policy debate and focuses on the future as expressed collectively by the leaders of Lithaunia, Latvia and Estonia.

Striving to fulfil the EU's accession requirements, the Parliament of Lithuania decided to close the Ignalina NPP, with its two RBMK-1500 type reactors. Fulfilment of the decision started in December 31, 2004, when the first reactor at Ignalina NPP was shut down. Then second reactor should be shut down at the end of 2009. This closure will negatively affect the energy sector of all the Baltic States.

In recent years, discussions at different levels about the future energy options of Lithuania, Latvia and Estonia have continued to intensify. Several studies and research projects concerning the analysis and forecasting of possible future changes in power balance of Lithuania and entire Baltic region have been carried out. The results can be summarised as follows:

1. Power reserves are decreasing, and the energy balance has become negative in the most countries – those neighbouring on Lithuania.

2. The power balance in the Lithuanian energy system will become negative sometime between 2010 and 2020 and new bigger power generating capacity is needed if the balance is to remain positive. New nuclear power plants or combined-cycle gas turbine power plants could achieve this purpose.

3. Lithuania's energy supply system once the Ignalina NPP is finally shut down will not comply with the main security requirements and will be extremely vulnerable due to lack of diversification of primary energy sources and energy supply routes. Security of energy supply could be substantially improved if new modern nuclear power plant were built.

These well-known arguments were further reinforced by the important changes in the gas market that occurred in January 2006. A sudden jump in gas prices from GASPROM (about 40%, on average, for Lithuania) and interruptions of the gas supply from Russia to Ukraine and Georgia demonstrated that problem of security of energy supply have becomes much more important than other considerations.

In order to coordinate future activities for ensuring security of energy supply, a meeting between the Prime Ministers of Estonia, Latvia and Lithuania was organized, in Trakai (Lithuania), on February 27, 2006. Two official documents of great importance to the Baltic States' energy sector were signed during the meeting – the "Declaration" and the "Communiqué."

In the Declaration it is stated the following:

- referring to the forthcoming European Commission Green Paper on *Secure, Competitive and Sustainable Energy for Europe* and to the European Council in March 2006, and welcoming the initiative of the Austrian Presidency regarding the need to develop a new energy policy for Europe;

- seeking to achieve the EU's energy objectives, especially with regard to its primary goal of creating a safe, competitive and secure internal energy market;

- taking into account the sensitive issue of security of energy supply in the Baltic States and the fact that the Baltic States do not have any gas and electricity interconnections with other EU Member States, and therefore do not have possibilities to participate in the internal energy market;

- considering the necessity to reduce the dependency of the Baltic States on dominant outside suppliers of energy and

- bearing in mind that the closure of the Ignalina NPP will have serious effects on the energy security of the Baltic States;

Andrus Ansip, the Prime Minister of the Republic of Estonia; Aigars Kalvitis, the Prime Minister of the Republic of Latvia and Algirdas Brazauskas, Prime Minister of the Republic of Lithuania:

1. Express their support to the development of a common European energy policy as a guarantee to the security of supply at the Community level;

2. State that the energy security problem that affects the Baltic States should be addressed at EU level and, therefore, request that the European Commission, by the end of 2006, assesses the energy vulnerability of individual Member States and EU regions in order to propose specific actions - at the EU level - for reducing this vulnerability. In order to integrate the Baltic States into the EU energy market, it is necessary to define appropriate measures that would diminish the existing fragmentation of the EU energy market.

3. Consider that there is a need to integrate the EU's energy, external relations and security policies. A harmonized EU external energy policy should be established vis-à-vis third countries and organisations, notably with Russia and the OPEC countries. The European Union should speak to suppliers of energy in one strong voice. For example, the Community and international instruments, such as G-8, WTO, Energy Charter Treaty, should be effectively employed to ensure the transparency of energy supply and the liberalisation of energy markets.

4. Call for the development of an EU mechanism that prepares for and ensures solidarity and assistance to a country facing difficulties following damage to its essential infrastructure or disruptions in energy supply. This includes enhancing Europe's gas stocks, *inter alia* utilising the vast potential storage capacity of the Baltic States to ensure against short-term supply disruptions to the European Union.

5. State that while being in favour of a common EU energy policy, the necessity to maintain national sovereignty over the choice of primary energy sources and structure of energy mix is paramount.

6. Call the European Commission and the Member States to develop an action plan of immediate measures aimed at enhancing EU energy security. Such an action plan should be approved by the Council on the basis of the above mentioned assessment of the European Commission.

After the meeting a Communiqué was signed. In the Communiqué, the prime ministers of the three Baltic States declared their collective action plan for launching concrete short-term activities to promote energy security in the region. The Communiqué outlines the aims of the action plan as follows:

- to work out a common energy strategy for the Baltic States up until the end of 2006

- to attempt to broaden the Baltic energy market until 2009 and to harmonize standards in the Baltic electricity market consistent with those applied in the Nordic countries' electricity market (Nordpool)

- to support the construction of electricity grid interconnections between Baltic states and the rest of European Union, on the basis of full cooperation

- to promote an initiative to build a new NPP in Lithuania

- to invite state-owned energy companies in the three Baltic States to invest in the design and construction of a new NPP in Lithuania on the basis of agreed terms and conditions applicable to each party involved

- to follow the principle of consensus for all involved parties when inviting other companies to participate in the project

- to examine possibilities to erect terminals for liquid gas and to develop gas storage capacities;

- to examine the general conditions governing the importing of electricity to the Baltic States from states not included in the European economic space and the possibility of parties involved in the new NPP construction project to sign long-term contracts for the buying-selling of electricity

On the basis of the above-mentioned documents, which were agreed by the Prime Ministers of Lithuania, Latvia and Estonia respectively, the heads of the three Baltic national energy providing companies - Lietuvos Energija AB, Eesti Energia and Latvenergo - met in Ignalina, on March 8, 2006. Following that meeting, they signed a Memorandum of Understanding on the Preparation for Construction of a New Nuclear Reactor in Lithuania.

Mr. Karlis Mikelsons, chairman of the Board Latvenergo, Mr. Sandor Liive, CEO of Eesti Energia, and Mr. Rymantas Juozaitis, General Director of Lietuvos Energija AB (from left to right) signing a Memorandum of understanding on Preparation for Construction of a New Nuclear Reactor in Lithuania

The Memorandum of Understanding states, that the signatories will participate, in accordance with terms and conditions applicable to all parties, in the project and will contribute to its development. They will establish a Management Committee that will be responsible for managing and supervising the project and will delegate CEOs of all three energy companies to join the committee. The parties will share equally all expenses related to the common interests of the project. All signatories of the Memorandum of Understanding agree that in order to reduce dependence upon a single primary energy source, it is extremely important to have diversified power generation portfolio. The main issue to be solved is that of existing competition between gas-fired power plants and other energy generating sources that use other types of fuel. The parties of Memorandum of Understanding have pointed out that certain know-how has already been acquired with regards to the infrastructure required for building and operating of an NPP in Lithuania. At the same time, power companies have already developed skills needed to ensure successful cooperation.

With the signing this Memorandum of Understanding, the three countries involved launched the first preparatory phase, namely a feasibility study aimed at evaluating technological, environmental, legal and economic aspects of the project. This study will help all three countries to reach the most appropriate mutual solution and ensure the promotion of adequate electricity supplies throughout the region and the development of diversified electricity generation sources for the future. The feasibility study should be completed by November 1, 2006.

The parties will set up various working groups to prepare the feasibility study, each one preparing a study of its own. They will cover aspects such as technologies and environment, project financing, legal issues and electricity transmission that will.

The study prepared by the Working Group for Technologies and Environmental Issues will tackle essential issues relating to technology selection for the NPP and all related environmental aspects, available technologies, equipment suppliers, possible deadlines of the construction, fuel supply options and other factors important for evaluation of power plant technologies. It will also examine possible options for the disposal of radioactive waste and their approximate costs, as well as evaluate a possible location for the construction of the NPP.

The study prepared by the Working Group for Project Financing will address certain project financing options and calculate the primary economic and financial conditions that will need to be fulfilled for the construction of a new NPP in

Lithuania.

The study prepared by the Working Group for Legal Issues will identify all the legal and regulatory preconditions that will have to be met for the construction and operation of the new NPP.

The study prepared by the Working Group for Electricity Transmission will evaluate the existing capacity among Baltic States for the transmission of electricity generated at the NPP and, if necessary, the need for additional transmission capacity. It will also evaluate options for reserves at the new NPP.

Once the project implementation feasibility study has been completed, the parties will launch the development phase of the project, unless the study results in critical obstacles that are beyond the reasonable control of the parties or unless conclusions are drawn that imply that the project is not economically justifiable.

According to Mr. Rymantas Juozaitis, General Director of Lietuvos Energija AB, “None of the parties alone would be capable of providing sufficient investments in generation sources that would allow the present market situation to be sustained.”
Mr. Karlis Mikelsons, chairman of the Board Latvenergo said: “This should be considered as a future joint project involving Baltic energy experts, as we have demonstrated successful cooperation before with the Estlink energy transmission project. We have so far only talked about replacing power capacity after the closure of the Unit 2 of the Ignalina NPP, and yet this project concerns the future development of energy for the Baltic Region. I would like to point out that our energy supply should not only be economically reasonable and perfect from a technical perspective. It should also offer maximum safety. I am confident of finding up- to-date, social, environmentally friendly and safe solutions”.

Mr. Sandor Liive, the CEO of Eesti Energia has shown an interest before in participating in NPP development projects. Speaking about how he felt that the agreement signed by the three Baltic energy companies constituted a real opportunity, he added: "The study we conducted in 2002 with Ministry of Economic Affairs showed that for the purposes of diversifying generation resources an NPP is one of the most seriously perceived options. Based on the aforementioned study, it was clear that it is reasonable to explore in depth the possibility of collaborative ventures with Lithuania. As one of our closest neighbours and partners Lithuania has the relevant infrastructure and experience."

The importance of ensuring energy supply independence was underlined once more during meeting between the Presidents of Lithuania and Poland on March 13, 2006. Valdas Adamkus, President of Lithuania, invited Poland to join the three Baltic States in preparing a project for the construction of a new NPP in Lithuania.

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http://www.euronuclear.org/e-news/e-news-12/nuclear-fields-in-slovenia.htm

MEMBER SOCIETIES

SLOVENIA: THE POSITIVE PRESENT AND FUTURE OF NUCLEAR

Letter from Milena Cernilogar Radež, ENS Board Members and Member of the Nuclear Society of Slovenia - NSS

In recent years, the Nuclear Society of Slovenia (NSS) has carried out several activities aimed at raising its profile by conveying messages about the advantages of nuclear energy to the general public and politicians. We believe that such frequently articulated messages can gradually help to reduce the extent of anti-nuclear feeling expressed by the public and young students. The board of NSS has reviewed recent trends in Slovenian nuclear energy policy and has promoted further action by inviting all the members of the society, especially the younger generation of members to take part in the activities of NSS. NSS increasingly organizes conferences, workshops, exhibitions, and communication campaigns aimed at the public, which present positive reports on the future role of nuclear energy. Finally, Slovenian policy-makers have already started creating the favourable conditions that Slovenia needs to meet its economic, energy and environmental objectives – by keeping nuclear as one of the central options in their energy policy and by encouraging increased education about nuclear energy.

In September 1996, the Slovenian Government adopted its *Strategy for Long-Term Spent Fuel Management*, with ongoing revision of the strategy carried out by the national Agency for Radwaste. Furthermore, activities related to choice of site and conceptual design of the low and intermediate level waste disposal have been given top priority by the government. IN the last two years, substantial progress has been made towards the selection of a location for the final disposal of low and intermediate radioactive waste. The government, with the full support of members of parliament, recently adopted a national programme for the management with radioactive waste and spent fuel for the period from 2006 to 2015.

Slovenia has one operating nuclear power plant that contributes about 40% of the country's electricity production, a research reactor, an interim central radioactive waste storage unit for low and intermediate level solid radioactive waste from non-power users of nuclear energy. Slovenia also has one uranium mine and mill that is currently being decommissioned.

The government's energy policy is outlined in the National Energy Programme, which also addresses nuclear power. The main principles that underpin this programme are sustainability, ecological acceptability and security of energy supply.

The resolution on the National Energy programme was adopted by the Slovenian Parliament in 2004. In this document the following main policy decision was made: the Krško NPP will remain in operation until at least 2023. In order to ensure its continued safe and reliable operation, adequate steps will be taken and the decision on the life extension of the Krško NPP will be made in 2012. This decision will be based on an evaluation programme that will start in 2008.

The Krško Nuclear Power Plant, which is situated in the south eastern part of Slovenia, is a Westinghouse two-loop pressurized water reactor with originally installed capacity of 632 MWe. After the steam generator was replaced the power was up-rated to 676 MWe. In 2006, the low pressure turbine will be replaced and the power will be up-rated again providing an additional 23 MWe. The construction of the Krško NPP started in 1974. On the basis of a special permit, the first fuel loading took place in May 1981 and the plant was connected to the grid in October of the same year. After an authorised trial operation, full power was reached in August 1982, and the first full year of commercial operation was 1983.

Solid radioactive waste and spent nuclear fuel are stored at the plant. A major project that took place in 2003 was the expansion of the capacity of the spent fuel pit, which has now enough capacity to store spent fuel until 2023 (with the possibility of further expansion of capacity in the future). Solid radioactive waste is treated and then packed into steel drums, which are then stored in the Solid Waste Storage unit at the plant. The safety features of the Krško NPP's design are based on the requirements of the US Atomic Energy Commission of 1973. Westinghouse, as the main contractor, was responsible for the implementation of these requirements during the design phase, construction and testing.

The Krško NPP has been the subject of IAEA supervision since the very beginning of the project. The commitment made by the plant operator and the regulatory body (the Slovenian Nuclear Safety Administration), advised by a number of technical support organisations, was to learn from international experiences and expertise in the field of nuclear safety and to fulfil strict western safety standards.

The research reactor TRIGA Mark II, at the Jožef Stefan Institute, is situated in the vicinity of Ljubljana and has a 250 kWth General Atomic pool reactor. TRIGA was initially licensed in 1966 as an IAEA project and was re-licensed for steady state and pulse operation after refurbishment and reconstruction, in 1992.

The Žirovski Vrh Uranium Mine and Mill was in operation from 1985 to 1990. Its lifetime production was 607,700 tons of ore, which corresponded to 452.5 tons (U308 equivalent) of yellow cake. Both the mine and the mill are undergoing decommissioning and the remediation of surface disposal of 1,548,000 tons of mine waste and red mud, and 593,000 tons of mill tailings is also ongoing.

The Central Radioactive Waste Storage unit adjacent to the Jožef Stefan Institute research reactor in Brinje is used to store low and Intermediate -evel solid radioactive waste from the reactor centre and from small waste producers such as medical, research and industrial units that use ionizing radiation.

Permanent publicly funded research programmes on nuclear technology are carried out by the Universities of Ljubljana and Maribor and by the Jožef Stefan Institiute. Projects and interdisciplinary research on nuclear technology are performed hand in hand with research on radiation protection and research on public opinion with regard to nuclear, radioactivity and radiation-related issues.

Scientists and university teachers from several Slovenian institutions, who are also active NSS's members, are involved in various international research projects related to both nuclear fusion and fission. These international research activities are - to a large extent - performed by the Jožef Stefan Institute. University courses are taught within the European Nuclear Education Network (ENEN), of which the Jožef Stefan Institute is one of the founding members and the University of Ljubljana of the academic members.

In 2005, Slovenian institutions, together with Polish institutions, reached agreements with EURATOM, the European Atomic Energy Community that secured long-term R&D co-operation across the European Union in the field of fusion. Scientists and research organisations in both countries now have greater access to Europe’s integrated fusion research programmes and facilities. Slovenia is convinced that fusion is one of the few sustainable energy options that will benefit the long-term future of mankind. Research in this field has seen enormous progress made in recent decades. The results obtained in a variety of tokomaks and other experimental machines have enabled the foundations of future research to be laid. Slovenian institutions are participating in the work of the experimental tokomak facility (ITER), which demonstrates the scientific and technological feasibility of harnessing energy from fusion for peaceful purposes.

http://www.euronuclear.org/e-news/e-news-12/INYC-2006.htm

International Youth Nuclear Congress 2006

18-23 June 2006 Stockholm – Olkiluoto

The **International Youth Nuclear Congress (IYNC**) was formed in 1997 by an international group of young nuclear professionals united in the belief that young generation organisations around the world could be more effective in promoting nuclear technology in individual countries if their efforts were integrated globally.
It includes a network of elected National Representatives that cover over 60 countries worldwide. This allows it to have personal (and local) contacts with people who are visible to thousands of people in many countries. There is also the IYNC website that is available to all.

The first IYNC Congress was held in Bratislava, Slovakia (2000), the second in Daejeon, South Korea (2002) and the third in Toronto, Canada (2004). Around 300 young professionals from 35 countries attended the 2004 Congress. **IYNC 2006** will take place from 18 - 23 June in Stockholm, Sweden and includes a technical tour to Olkiluoto, Finland, to see the first EPR under construction and the investigation site of spent fuel repository plus related underground rock characterisation facility under construction.

The technical programme consists of four parallel sessions: Nuclear Science and Technology, Nuclear Waste and Decommissioning, Non-power Applications of Nuclear and Nuclear Politics and Economics. Apart from these four sessions there will also be a session focusing on Young Generation and IYNC Activities worldwide. Over 160 abstracts have been submitted, most of which will be presented (either as papers or posters) at **IYNC 2006** this June.

The organisers of IYNC are delighted to announce that almost 283 registrations have so far been received for **IYNC 2006**. The deadline for early registration is 30 April 2006 (50€ reduction). The deadline for all registrations is 14 May. We are limited to 400 spaces on the Technical Tour, so it is worth booking soon to guarantee your place!

ENS NEWS will keep its readers informed about the International Youth Nuclear Congress 2006, so watch this space!

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http://www.euronuclear.org/e-news/e-news-12/YG-report-pime2006.htm

MEMBER SOCIETIES

PIME 2006: ENS/Young Generation Nuclear (YGN) Report

During **PIME 2006**, which took place in Vienna, from 12-16 February, the ENS YGN group organised and moderated a workshop conference dedicated to the subject of how to communicate effectively to the next generation on the sensitive issue of waste management. The workshop theme was chosen because the issue of radioactive waste generated by nuclear power plants remains a major obstacle to furthering the cause of nuclear new build in Europe. Five speakers gave interesting presentations on the subject. The themes discussed included an analysis of how local partnerships can help encourage the active participation of key stakeholders, initiatives aimed at involving schools to promote increased knowledge of the subject among young people of various ages, a review of how young people can contribute to a national debate on waste management, country-specific perspectives and a consideration of what the industry should do to promote its actions and record when it comes to waste management. Here is a YGN network summary of what happened at the workshop:

The workshop started with Fanny Bazille, Head of Communications at the CEA's) Nuclear Energy Division. In her presentation, which was titled 'Why don't young people mind energy?' Fanny gave an overview of how young people have participated actively in the recent national debate on nuclear waste management in France. She reported that young people were very reluctant to participate in debates on a topic that was both scientific and political as these are areas which the younger generation do not like to engage in that much.

The national debate in France has highlighted a key issue – which is that the young generation is unlikely to participate in a debate where they feel that its viewpoint has no impact on the final decision and where participants act more like consumers or stakeholders than citizens. Fanny stated that personal responsibility and greatercitizenship is required if there is to be greater participation in important public debates.

Sini Gahmberg, Press Officer at TVO's Olkiluoto plant, then gave a presentation on TVO's collaborative work with local schools. She described the progressive educational programme that has been put in pace to offer to local school children

aged between 13 – 16 years old the opportunity to learn more about nuclear energy. The programme has a strong practical element to support the theoretical teaching content, which enables students to play an active role in the learning process. Excursions were advocated as an essential part f the programme, with TVO members setting students homework assignments on their visits to nuclear facilities.

This collaboration, which involves schools located within a 50 km radius of the Olkiluoto site, has further developed, with TVO now also organising science and technology camps for students. These camps have been strongly supported by the parents. Overall, Sini's presentation provided a very positive example for industrial companies to consider adopting and implementing.

Miranda Kirschel, Corporate Affairs Officer at Nuclear Industry Association in the UK then spoke to delegates about specific communications problems with regard to radioactive waste that the UK has experienced and their impact upon the British public's perception of the new-build option. In her presentation, which was entitled "No time to waste," Miranda underlined that the UK public considers the nuclear waste issue to be the greatest "disadvantage" of nuclear energy (57% of those questioned quoted radioactive waste as the most negative thing about nuclear energy). Various lessons have been learnt from previous public consultation processes and Miranda advocated informed and responsive behaviour and emphasis on the industry's pride in its competence record constructive as ways of supporting communications on waste management. It was also emphasised how YGN is an important part of the waste communication matrix, with members networking with young politicians, coaching experts in effective communications and actively participating in nuclear debates.

Kajsa Engholm, of SKB, began her presentation by focussing on how the nuclear industry should communicate more with children and teenagers, as they represent the future. Like Sini Gahmberg, Kajsa too advocated strong collaboration between industry and local schools as the key to communicating more effectively with the younger generation and securing a better understanding of nuclear energy in the future. Among the initiatives that she suggested were creating an interactive website with a simple navigation format where young people can find information in a simple, easily-accessible and entertaining way. An interactive approach is essential to inform the next generation on nuclear waste and to encourage active learning on the subject.

Kajsa went on to outline SKB's activities in this area. All costs associated with school children's visits are met by SKB, which helps with school budgets and organises site visits. Prior to the visit a resource pack is issued to teachers to enable them to inform their classes about the forthcoming visit. Following the visit, a "teachers' newsletter" is published and sent to teachers four times a year. This type of follow-up activity is extremely important as it keeps interest in SKB - and therefore the industry - alive and provides an update of how SKB's activities are progressing.

The final presentation of the workshop was entitled “Local partnerships: A way to achieve a sustainable solution for LILW.” It was given by Laurent Wouters, and E. Hooft, of ONDRAF/NIRAS (Belgium’s national organisation responsible for managing radioactive waste and fissile materials). ONDRAS/NIRAF took the brave decision to involve stakeholders from the very beginning in a decision-making process that aimed to identify a solution for final LILW waste disposal. An open and transparent process based on close co-operation was developed to enable stakeholders to decide together on options for the long-term management of radioactive waste. Three municipalities with nuclear facilities on their territory created local partnerships, each supported by an annual budget, which enabled stakeholders to work independently to identify possible solutions. Ground-level communication was the key to successful cooperation, with concept designers liaising directly with local stakeholders and reworking the initial concept or proposal based on their discussions.

Laurent stressed that the main strength of such a collaborative and inclusive approach was that it encouraged a mutual decision-making process between stakeholders and the waste management organisations. It also enabled concept designers to gain a greater understanding of what local inhabitants expect a waste disposal project to bring to the local community. In essence, this approach places a project for the location of a waste repository within the social and cultural context of a specific area, which can only help the right long-term waste management decisions to be taken.

In conclusion, delegates who attended the YGN workshop on waste management were able to clearly recognise that waste management issues will continue to fundamentally affect the public’s perception of nuclear energy as a whole, and both conventional and innovative communication strategies will need to be adopted if greater awareness and understanding of the issue is to be achieved.

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http://www.euronuclear.org/e-news/e-news-12/green-paper.htm

EUROPEAN INSTITUTIONS

Nuclear Idustry's respose to EU Energy Green Paper

Following the recent publication by the European Commission of its much-awaited Energy Green Paper, Secure, Competitive and Sustainable Energy for Europe, and acting in response to requests from the press, FORATOM released the following position paper on the eve of **ENA 2006**:

FORATOM welcomes the emphasis that the EU’s recently-published Energy Green Paper, Secure, Competitive and Sustainable Energy for Europe, puts on a “transparent, objective and non-ideological debate” that assesses the merits of all energy sources. FORATOM also supports the view of EU Energy Commissioner, Andris Piebalgs, that political consensus must be reached if the strategy is to work. The Green Paper’s acknowledgement that all energy sources can contribute to ensuring sufficient generation capacity to meet demand is a welcome development. FORATOM also notes with satisfaction the Green Paper’s statement that nuclear energy ‘represents at present the EU’s largest source of largely carbon-free energy in Europe. ‘

However, although the general strategic direction of the Green Paper, and its emphasis on including all power sources in the energy debate, are encouraging, FORATOM is disappointed that the document failed to sufficiently highlight the crucial contribution that nuclear energy - as a source of secure, affordable and environmentally friendly energy - makes towards meeting the EU's energy goals.

Furthermore, since one of the major objectives outlined in the Green Paper is for the Community to achieve "50% of its energy production from secure, low-carbon energy sources within 20 years," FORATOM believes that the fact that nuclear energy was not mentioned within this context is very short-sighted. Clearly, nuclear energy is the only major energy source that can help achieve this objective and this fact should have been recognised.

As far as security of supply, competitiveness and environmental protection are concerned, which underpin the EU's new energy policy direction, nuclear energy is the energy option of choice. But the Green Paper failed to mention this fact. It is time to set the record straight:

Firstly, Europe has never before produced so much nuclear-generated electricity. With most nuclear plants operating continuously with a capacity factor of 90%, the nuclear sector provides an excellent source of reliable and secure base-load power.

Secondly, the industry's high capacity factor - coupled with the fact that prices for nuclear generated electricity are generally very stable and predictable compared to other generating sources - makes nuclear power very competitive.

Finally, as a non-$C0_2$ emitting source of power, nuclear energy also helps to combat climate change.

Public opinion continues to shift subtly in favour of retaining - and in some cases even expanding - the use of nuclear energy. For the first time, a significant number of European citizens are now making the connection between nuclear energy, security of supply and climate change.

There appears to be an illogical discrepancy between the Green Paper's reluctance to recognise the important contribution that nuclear energy makes and the fact that a growing number of European countries are pressing ahead with the nuclear option. For example, some countries like the Netherlands and Belgium are already openly questioning the validity of their nuclear phase-out policies. Others, like Bulgaria, Finland, France and Romania are expanding their nuclear sectors. The Baltic States of Lithuania, Latvia and Estonia recently agreed on a project to build a nuclear power plant in Lithuania that will provide electricity for all three countries by 2015.

In conclusion, the Energy Green Paper constitutes an encouraging start, but there is a long way to go. FORATOM will continue to lobby the European Commission to ensure that the nuclear industry's voice is heard loud and clear, that the facts about nuclear energy are presented and recognised, and that it is given a higher profile throughout the policy debate and in the resulting energy White Paper.

FORATOM's press release on the Energy Green Paper is available in the "Press Room" (Press Releases) section of the FORATOM website at: www.foratom.org. In this section you can also read FORATOM position papers on a range of issues, including safety, security of supply and climate change.

The European Commission has launched an online questionnaire asking people to give their opinions on the Green Paper. If you want to make your views on it known, visit the European Commission's website at the following address: europa.eu.int/comm/energy/green-paper-energy/index_en.htm and fill in the questionnaire.

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http://www.euronuclear.org/e-news/e-news-12/wenra.htm

EUROPEAN INSTITUTIONS

Safety at nuclear plants: WENRA presents its Harmonisation Reports

On 9 February, the Western European Nuclear Regulators' Association (WENRA), which groups together the heads of nuclear regulatory bodies from 17 countries, organised a seminar in Brussels to present the 3 Harmonisation Reports that it published last month on its web site (www.wenra.org). These reports deal with the harmonisation of European safety standards for existing nuclear plants, as well as for spent fuel handling, waste storage and decommissioning activities.

Around 200 people attended the seminar, including all the top regulators in Europe, representatives from the European nuclear industry, European Commission officials, representatives from the IAEA and other institutions and NGOs. The seminar revolved around a number of key sessions. The first of two main sessions was devoted to presentations of the three harmonisation reports and of reports from France and Hungary on national results with regard to compliance with WENRA Reference Levels for Reactor Safety.

The other main session provided the different stakeholders present, including representatives of the ENISS (European Nuclear Installations Safety Standards) initiative, the opportunity to give their comments. As FLASH readers will recall, ENISS was created in May 2005, under the aegis of FORATOM, to better articulate the views of operators running nuclear installations and to work closely with WENRA and other stakeholders to ensure that greater harmonisation is achieved.

Commenting on the WENRA recommendations, ENISS Steering Committee Chairman, Mr. Karl-Fredrik Ingemarsson told the seminar that ENISS welcomes WENRA's work on harmonising safety standards in nuclear industry. He pointed out that the main mission of ENISS is to help identify and agree upon the scope and substance of harmonised safety standards. Operators must, therefore, support regulators to help ensure that once defined the new regulations are properly implemented in a harmonised way. He also noted during the seminar that, according to WENRA, 88% of the required reference levels are already being implemented at existing plants. This assessment clearly reflects the fact that license holders have always acted on their own initiative and have accepted responsibility for

continuously improving safety.

Mr. Ingemarsson also pointed out that ENISS found the waste and decommissioning reports imbalanced compared with the Reactor Safety Harmonization Report, which makes the possibility of receiving the call for comments by 1 June rather impracticable.

Mr. Fourest, Chairman of the ENISS Administration Group, made some additional technical remarks on WENRA's reactor safety recommendations.

In the final session, Mrs. Melin, WENRA's Chairperson, reiterated the association's intention to have the harmonised reference levels implemented by 2010 in the respective regulatory system. As several regulators acknowledged during the seminar, this goal is quite ambitious. It is, therefore, clear that the objective is to implement all the recommendations in legal terms, but not at all nuclear power plants. Mrs. Melin invited stakeholders to provide WENRA with their comments by June 1. A review process of WENRA's recommendations will take place and the final reference levels for reactor safety should be agreed upon by the end of 2006. WENRA members have also committed themselves to develop, in 2006, a national action plan to implement the recommendations that result from the in-depth comparative analysis.

Contact: For further information on the work of ENISS contact Dr. Werner Zaiss at Werner.zaiss@foratom.org or Muriel Glibert at muriel.glibert@foratom.org

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http://www.euronuclear.org/e-news/e-news-12/burton-richter.htm

ENS WORLD NEWS

A Look at the Promise and Problems of Nuclear Energy

Professor Burton Richter - Stanford University

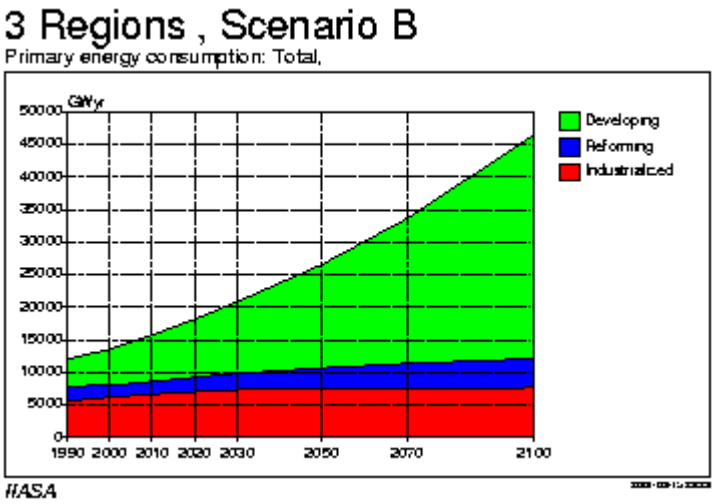
PIME 2006 Conference, Vienna, 15 February 2006

I. Introduction

Nuclear energy is undergoing a renaissance, driven by two very loosely-coupled needs; first, to supply more energy to support global economic growth, and second, to mitigate global warming driven by the emission of greenhouse gases from fossil fuel. With the current mix of fuels, growing the economy increases emissions and increased emissions lead to climate change that will eventually harm the economy. Nuclear energy offers one way out of this cycle.

Many forecasts of energy demand in the 21st century have been made and all give roughly the same answer. The International Institute of Applied Systems Analysis, for example, shows in its mid-growth scenario (figure 1) primary energy demand increasing by a factor of two by mid-century and by nearly another factor of two by the end of this century. By the year 2030 the developing countries are projected to pass the industrialized ones in primary energy use, and China will pass the United States as the largest energy consumer. It is worth noting that economic growth in China and India is already higher than assumed in the mid-growth scenario.

Fig. 1. IIASA Projection of Future Energy Demand



Today, about 80% of primary energy is derived from fossil fuels. Supply constraints on two out of the three fossil fuels are already evident. Oil prices have surged and now are about $60 per barrel. Demand is rising at an average rate of about 1.5 million barrels per day per year, requiring the output of another Saudi Arabia every eight years to keep up with increased demand.

While there is a lot of natural gas, there are transport constraints. Natural gas prices also have risen and now are at the unprecedented level of $9-$10 per million BTU.

The only fossil fuel in abundant supply is coal. However, it has serious pollution problems and expensive technological fixes are required to control environmental problems that have large-scale economic consequences.

Concern about global warming is increasing and even the United States government has finally said that there is a problem. The Intergovernmental Panel on Climate Change (IPCC) forecasts, in the business-as-usual case, an increase in atmospheric carbon dioxide to 750 parts per million by the end of the century with a consequent global temperature rise of 2? to 5? C, less at the equator and more at the poles. We can surely adapt to this increase if it is small and occurs smoothly. If, however, it is large, and accompanied by instabilities in climate, economic and societal disruptions will be very severe.

It is too late to prevent some global warming, but limiting the effect requires a move away from carbon-based fuels. The global-warming issue has caused some prominent environmentalists to rethink their opposition to nuclear power. The question to be confronted is which devil would they rather live with, global warming or nuclear energy? James Lovelock, among others, has come down on the side of nuclear

energy.

There are many who believe that solar or wind energy would be a better choice than nuclear. However, these are not now ready for deployment on a large scale. They are costly, but the real problem is that the sun does not shine nor does the wind blow all the time. Until the energy storage problem is solved, solar or wind energy will not make a major contribution to base-load energy.

When economic interests and environmental interests point in the same direction; things can begin to move in that direction, in this case toward the deployment of large-scale carbon-free energy. Nuclear energy is one such source. While it cannot be the entire solution to the energy supply or climate change problems, it can be an important part if the public can be assured that it is safe, that nuclear waste can be disposed of safely, and that the risk of weapons proliferation is not significantly increased by a major expansion.

II. Nuclear Power Growth Potential

At present there are about 440 reactors worldwide supplying 16% of world electricity (NEA Annual Report 2004). About 350 of these are in the OECD nations supplying 24% of their electricity. The country with the largest share of nuclear electricity is France at 78%. To an environmentalist, France should be looked at as a model for the world. Its carbon-dioxide intensity (CO2 per unit GDP) is the lowest in the world (figure 2). If the entire world CO2 intensity were as low as France's, CO2 emissions would be reduced by a factor of two and global warming would be a much easier problem to solve.

Fig. 2. CO_2 Intensity

Area	GDP (ppp) (Billions of U.S. Dollars)	CO_2/GDP Kg/$(ppp)
World	42,400	0.56
France	1,390	0.28

Projections for growth in nuclear power are uncertain because of uncertain costs along with the three potential problems mentioned earlier, safety, waste disposal, and proliferation risk. The International Atomic Energy Agency (IAEA) projection (figure 3) of July 2004 for the year 2030 ranges from a high of 592 GWe to a low of 423 GWe. This represents a net growth of between 16% and 60% over the next 25 years. A recent MIT study (The Future of Nuclear Power – an Interdisciplinary Study, July 2003) projected as much as 1000 GWe by 2050 (an extrapolation of the IAEA high projection for another 20 years), and an Electricite de France projection is for about 1300 GWe (private communication). The more aggressive growth numbers imply completions of about two 1-GWe power plants per month for the next 45 years.

Fig. 3. Nuclear Power Projection to 2030

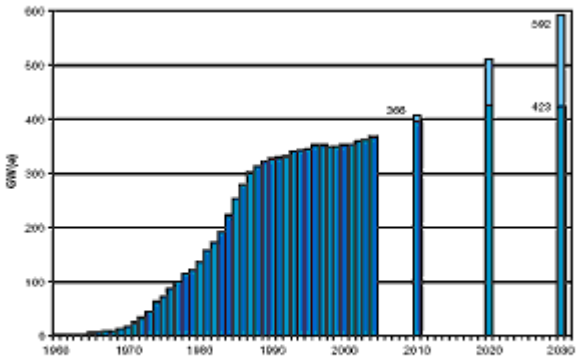


FIG.1. Historical growth in worldwide installed nuclear power capacity, 1960–2004, and the Agency's latest low and high projections through 2030 (low projections: dark blue bars; high projections: light blue bars). (Source: Energy, Electricity and Nuclear Power Estimates for the Period up to 2030, July 2004, Reference Data Series No. 1, IAEA, Vienna (2004)).

The cost of the new reactor being built in Finland is about Euro 1800 per KWe. Costs will come down with series production and locations more benign than northern Finland. Reactor manufacturers claim that the cost of electricity from a new nuclear plant would be comparable to that from a coal plant after first of a kind engineering cost has been recovered and after coming down the learning curve with five or so new plants. Even so, projections like those above will represent the expenditure of 1-2 trillion dollars on nuclear plants in the next 50 years. It is not clear that we will have the trained personnel for the construction, operation, or regulatory needs of a system that large, so education and infrastructure are issues that need addressing too.

III. Safety

There's little new to say on safety. Power reactors of the Chernobyl type have never been used outside the old Soviet bloc because of the potential for catastrophic accidents. Even for reactors of that type, the accident would not have happened had not the operators, for reasons we will never know, systematically disabled all of the reactor's safety systems.

The new generation of light-water reactors has been designed to be simpler to operate and maintain than the old generation, and with more passive safety systems.

With a strong regulation and inspection system, the safety of nuclear systems can be assured. Without one, the risks grow. No industry can be trusted to regulate itself when the consequences of a failure extend beyond the bounds of damage to that industry alone.

IV. Spent Fuel Treatment

In discussing the safe disposition of spent fuel, I will set aside weapons proliferation concerns for now, and return to them later. Looking separately at the three main elements of spent fuel (figure 4), there is little problem with most of it. The uranium which makes up the bulk of the spent fuel is not radioactive enough to be of concern. It contains more U-235 than does natural ore and so could be input for enrichment, or could even be put back in the mines from which it came.

There is no scientific or engineering difficulty with fission fragments, the next most abundant component. The vast majority of them have to be stored for only a few hundred years. Robust containment that would last the requisite time is simple to

build.

Fig. 4. Components of Spent Reactor Fuel

Component	Fission Fragments	Uranium	Long-Lived Component
Per Cent Of Total	4	95	1
Radioactivity	Intense	Negligible	Medium
Untreated required isolation time (years)	200	0	300,000

The problem comes mainly from the last 1% of the spent fuel which is composed of plutonium and the minor actinides, neptunium, americium and curium (collectively, the actinides). For some of the components of this mix, the toxicities are high and the lifetimes are long. There are two general ways to protect the public from this material: isolation from the biosphere for hundreds of thousands of years, or destruction by neutron bombardment.

Long term isolation is the principle behind the “once through” system as advocated up to now by the United States for weapons-proliferation-prevention reasons. In a world with a greatly expanded nuclear power program I do not believe the once-through system is workable. There are technical limitations that would require a very large number of repositories, and there is public doubt that the required extremely long isolation times can be achieved.

The first technical problem comes from the heat generated in the first 1500 or so years of storage which limits the density of material that can be placed in a repository. Limitations on the allowed temperature rise of the rock of a repository from this source determine its capacity. The early heat generated from fission fragments is not difficult to deal with. The decay of plutonium-241 to americium-241 which then decays to neptunium-237 is the main source of heat during the first 1000 or so years.

The second technical problem is the very long-term radiation. Here the same plutonium to americium to neptunium decay chain generates the long-lived component that requires isolation from the biosphere for hundreds of thousands of years.

For example, if nuclear energy in the United States were to remain at the present 20% fraction of electricity supply through the end of this century, the spent fuel in a once through scenario would need nine repositories of the capacity of the one proposed at Yucca Mountain. If the number of reactors in the U.S. increases by mid-century to the 300 GWe projected in the MIT study, a new Yucca Mountain would have to open every six or seven years. This would be quite a challenge since we have not been able to open the first one. In the world of expanded use of nuclear power, the once-through cycle does not seem workable.

The alternative to once-through is a reprocessing system that separates the major components, treating each appropriately and doing something specific to treat the

component that produces the long-term problem. The most developed reprocessing system is that of France and I will use it as a model. The French make mixed oxide fuel, MOX, by separating out plutonium from spent fuel and mixing it with an appropriate amount of uranium from the same spent fuel. (The extra uranium from the spent fuel not used for MOX goes to an enrichment facility.) The fission fragments and minor actinides are embedded in glass (vitrification) for eventual emplacement in a repository. The glass used appears to have a lifetime of many hundreds of thousands of years in the clay of the proposed French repository. The French Parliament has held a series of hearings early this year and is expected to soon issue its report on the acceptability of this system.

MOX fuel plus vitrification solves part of the problem but not all of it. The next question is what to do with the spent MOX fuel. The plan is to keep it unreprocessed until fast-spectrum reactors are deployed commercially. These fast-spectrum reactors burn a mix of plutonium and uranium-238 and can, in principle, burn all of the minor actinides as well which is not possible in the present generation of reactors. It is possible to create a kind of continuous recycling program where the plutonium from the spent MOX fuel is used to start the fast-spectrum system, the spent fuel from the fast-spectrum system is reprocessed; all the plutonium and minor actinides go back into new fuel, and so forth. In principle, nothing but fission fragments goes to a repository and these only need to be stored for a few hundred years. The U.S. has just announced an aggressive R&D program called Global Nuclear Energy Partnership (GNEP) aimed at destroying the actinides in fast-spectrum burners (http://gnep.gov).

This sounds good in principle, but there's much work to do before putting it into standard, commercial practice. Clearly a coherent international R&D program is the best way to move ahead rapidly.

What we have now are two visions for the long-term solution to the waste problem that are really not that difference (figure 5). In the cycle of figure 5(a), MOX is burned in LWRs and the residue is held for later treatment in a FR. In the cycle of figure 5(b), all of the actinides in LWR spend fuel are separated and treated in the FR.

Fig. 5(a). Transmutation Schematics with LWR Recycle

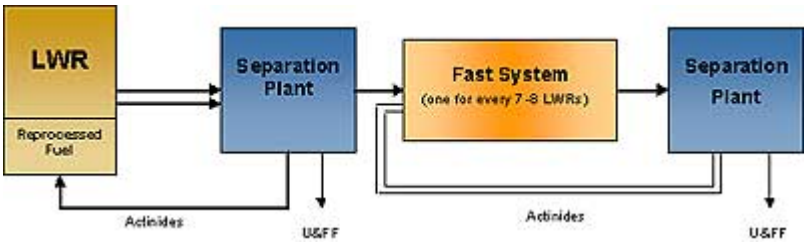
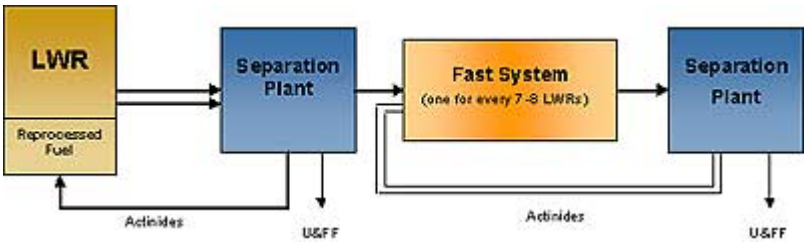


Fig. 5(b). Without LWR Recycle



In the long term, the two visions will merge and become one. The current MOX fuel

cycle can stabilize the world's Pu inventory until the fast systems come along to reduce it, and to burn the minor actinides. The model of figure 5(a) will evolve into that of figure 5(b) where the only materials that get to a repository are fission fragments and the long-lived components that leak into the fission fragment waste stream from inefficiencies in the separation process. If that leakage can be kept to below one percent, the required isolation time is of the order of 1000 years. This is less than the lifetime of the Egyptian pyramids and we should be able to build at least as well.

V. Proliferation Prevention

Preventing the proliferation of nuclear weapons is an important goal of the international community. Achieving this goal becomes more complex in a world with a much expanded nuclear-energy program involving more countries. Opportunities for diversion of weapons-usable material exists at both the front end of the nuclear fuel cycle, the U-235 enrichment stage, and the back end of the nuclear fuel cycle, the reprocessing and treatment of spent fuel stage. The more places this work is done, the harder it is to monitor.

Clandestine weapons development programs have come from both ends of the fuel cycle. Clandestine enrichment programs can lead to U235 weapons. Chemical separation techniques can produce from spent fuel the material needed for plutonium weapons. For example, concern about Iran's program relate to the enrichment phase, while concern about North Korea's relate to reprocessing spent fuel.

The level of technical sophistication of the countries that have developed nuclear weapons outside of the NPT range from very low to very high, yet all managed to succeed. The science behind nuclear weapons is well known and the technology seems to be not that hard to master through internal development or illicit acquisition. It should be clear to all that the only way to limit proliferation by nation states it through binding international agreements that include effective inspection as a deterrent, and effective sanctions when the deterrent fails.

We in the science and technology (S&T) community can give the diplomats improved tools that may make the monitoring that goes with agreements simpler and less overtly intrusive. These technical safeguards are the heart of the systems used to identify proliferation efforts at the earliest possible stage. They must search out theft and diversion of weapons-usable material as well as identifying clandestine facilities that could be used to make weapons-usable materials.

The development of advanced technical safeguards has not received much funding recently. An internationally coordinated program for their development needs to be implemented, and proliferation resistance and monitoring technology should be an essential part of the design of all new reactors, enrichment plants, reprocessing facility, and fuel fabrication sites.

Some have asserted that reprocessing of spent fuel leads to less proliferation resistance that the "once through" fuel cycle. Recent analysis, however, seems to show that the "once through" fuel cycle is not significantly more proliferation resistant than reprocessing systems like that used in France (see, for example, "An Evaluation of Proliferation Resistant Characteristics of Light Water Reactor Fuels," November 2004, available on the DOE's website (www.nuclear.gov) under "Advisory Committee Reports"). This is an important conclusion since one of the objections to the reprocessing schemes needed to mitigate the spent fuel problem was

that it might increase proliferation risk.

Recently the IAEA Director General, Dr. ElBaradei, and United States President, George Bush, have proposed that internationalization of the nuclear fuel cycle be seriously studied. In an internationalization scenario there are countries where enrichment and reprocessing occur. These are the supplier countries. The rest are user countries. Supplier countries make the nuclear fuel and take back spent fuel for reprocessing, separating the components into those that are to be disposed of and those that go back into new fuel.

If such a scheme were to be satisfactorily implemented there would be enormous benefits to the user countries, particularly the smaller ones. They would not have to build enrichment facilities nor would they have to treat or dispose of spent fuel. Neither is economic on small scales and repository sites with the proper geology may not be available in small countries. In return for these benefits, user countries would give up potential access to weapons-usable material from both the front end and the back ends of the fuel cycle.

If this is to work, an international regime has to be created that will give the user nations guaranteed access to the fuel that they require. This is not going to be easy and needs a geographically and politically diverse set of supplier countries to give confidence to user countries that they will not be cut off from the fuel required for an essential part of their energy supply.

Reducing the proliferation risk from the back end of the fuel cycle will be even more complex. It is essential to do so because we have seen from the example of North Korea how quickly a country can “break out” from an international agreement and develop weapons if the material is available. North Korea withdrew from the Non-Proliferation Treaty at short notice, expelled the IAEA inspectors, and reprocessed the spent fuel from their Yongbyon reactor, thus acquiring in a very short time the plutonium needed for bomb fabrication.

However, the supplier countries that should take back the spent fuel for treatment are not likely to do so without a solution to the waste-disposal problem. In a world with a greatly expanded nuclear power program there will be a huge amount of spent fuel generated worldwide. The projections mentioned earlier predict, by mid-century, the deployment of more than a terawatt (electric) of nuclear capacity producing more than 20,000 tons of spent fuel per year. This spent fuel contains about 200 tons of plutonium and minor actinides and 800 tons of fission fragments. The once-through fuel cycle cannot handle it without requiring a new Yucca Mountain scale repository opening somewhere in the world every two or three years.

The U.S. government has recognized this and is changing its R&D direction to focus on reprocessing spent fuel and burning the actinides in fast reactors with continuous recycle. This program, the Global Nuclear Energy Initiative (GNEI) aims to develop the technology to allow the implementation of an internationalized fuel cycle as well as to handle its own nuclear waste. The U.S. long-range program is now aligned with those of France, Russia, China, Japan, Korea, and India. The possibility exists for an effective, international control regime.

In this model the supplier-user scenario might develop as follows. First, every one uses LWRs. Then the supplier countries begin to install fast-spectrum systems. These would be used to supply their electricity needs as well as to burn down the actinides. Eventually, when uranium supplies begin to run short, the user countries would go

over to fast-burner systems, while the supplier countries would have a combination of breeders and burners as required.

VI. Conclusion

In summary, nuclear energy is an important component of a strategy to give the world the energy resources it needs for economic development while reducing consumption of fossil fuels with their greenhouse-gas emissions. If this is to happen on a large scale, advances in both physical S&T and political S&T will be required.

We on the physical S&T side can produce better and safer reactors, better ways to dispose of spent fuel, and better safeguards technology. This can best be done in an international context to spread the cost and to create an international technical consensus on what should be done. Countries will be more comfortable with what comes out of such developments if they are part of them.

While the physical S&T development can best be done in an international context, the political S&T can only be done internationally. The IAEA seems to be the best place to start and the first baby steps have already been taken. I look forward to larger steps of both kinds in the future. However, it will be difficult for an organization as large as the IAEA to create a framework for a new international nuclear enterprise if too many voices are involved at the start. Discussions might start off better if a broadly based, but compact, subgroup does the initial work. If I were setting up such a group, the minimum membership would include Canada, China, France, India, Japan, Russia, South Korea, United States, and representatives of the larger potential user states, Brazil and Indonesia, for example. I do not think it will be difficult to create mechanisms for the front end of the fuel cycle. The back end will be the problem and the most intractable issue is likely to be the final waste disposal system.

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New Climate Change Book Acknowledges 'Competitive Benefits of Nuclear'

Another prominent international scientist and conservationist has highlighted the economic - and environmental - benefits of nuclear energy, especially when it comes to meeting countries' base-load electricity needs and helping to reduce CO_2

emissions. Australian-born Professor Tim Flannery* discusses the impact of mankind's activities on the global climate in his latest book *The Weather Makers*.

Professor Flannery's book also refers to comments on nuclear, made in the past and still reiterated today, by the leading international environmentalist Professor James Lovelock who, according to Flannery, "had a point when he delivered a heartfelt plea for a massive expansion in the world's nuclear energy programmes". Flannery also supports Lovelock's view that because climate change is advancing so rapidly nuclear power is the only option to stop it. "Lovelock is right here," adds Flannery, "because all power grids need reliable base-load generation and there remains a big question mark over the capacity of renewable technologies to provide it."

Focusing on the economic benefits of nuclear energy, Professor Flannery also underlines how nuclear energy also provides competitive benefits: "As is the case with coal-fired plants, nuclear power stations are very large and, with a starting price of around $2 billion apiece, they are expensive to build. The power they generate, however, is at present competitive compared with that generated from wind."

Although Professor Flannery analyses the problems associated with public perceptions about nuclear safety and the management of radioactive waste, he essentially believes in the future of nuclear energy when he says: "It is often said that the sun is nuclear energy at a safe distance. In this era of climate crisis, however, the role of earth-based nuclear power is being reassessed, and what was until recently a dying technology may yet create its own 'day in the sun'. "

The book is clear about the non CO_2-producing advantages of nuclear energy and equally unequivocal about the urgent need to redress the current situation as quickly as possible: "The best evidence indicates that we need to reduce our CO_2 emissions by 70% by 2050. If you own a four-wheel-drive car and replace it with a hybrid fuel car, you can achieve a cut of that magnitude in a day rather than half a century. And if you vote for a politician who has a deep commitment to reducing CO_2 emissions, you might change the world. The transition to a carbon-free economy is eminently achievable because we have all the technology we need to do it. It is only a lack of understanding and the pessimism and confusion generated by special interest groups that is stopping us from going forward."

UK Prime Minister Tony Blair is among those who have praised Professor Flannery's book. Blair said recently: "Climate change is perhaps the most challenging collective action problem the world has faced. Almost uniquely, *The Weather Makers* provides insights not only into the history, the science and politics of climate change, but also the actions people can take now that will make a difference."

The Weather Makers is published by Grove/Atlantic and can be ordered from bookstores over the Internet (ISBN N° 0-87113-935-9).

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**Dr Flannery is a member of the National Committee for the Environment at the Australian Academy of Science, a member of the National Environmental Education Council and he is also director of the South Australian Museum.*

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Editorial Staff:

Mark O'Donovan, Editor-in-Chief

Contributors to this Issue:

Milena Cernilogar Radež (NSS)
Frank Deconinck (ENS)
Rebecca Ferris (YGN UK)
Jonas Gylys, Lithuanian Nuclear Energy Association
Hans Korteweg (ENS)
Burton Richter - Stanford University
Andrew Teller (Areva)
Stanislovas Ziedelis, Lithuanian Nuclear Energy Association

And

Graphic Designer:

Marion Brünglinghaus

Rue de la Loi 57, BE-1040 Brussels
Phone +32 2 505 30 50 - Fax: +32 2 502 39 02
E-mail: ens@euronuclear.org - http://www.euronuclear.org

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