September - October

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In This Issue

In this second issue, ENS News – the ENS e-Bulletin – has assumed its intended generic structure. The first section, devoted to the ENS, features two articles and news about upcoming ENS events. Our President-Elect, Bertrand Barré, wrote the first article, *'Generation IV: A Hint Of Déja Vu'*. In it, he explains why the innovative reactors selected by the Generation IV initiative had already been considered in the 1960s. Whatever the younger generation may be tempted to believe, this does not betray a lack of imagination!

The second article, *'Listening To Others'*, is a personal view by the e-Bulletin's Editor-in-Chief. Through specific examples, he expresses his view that, by listening carefully to our opponents or to uncommitted experts, we might identify more effective arguments to support the peaceful uses of nuclear technologies. He does not purport to provide the final word on the topics raised – so, if you have different ideas, do not hesitate to send them to us.

Idleness is most certainly not the reason for the lack of a contribution from the ENS President, Andrej Stritar! His monthly letter, focusing on the Yearly Review of Energy Consumption, is in the members' pages of the ENS website.

Among the announcements we are singling out here is the one relating to the next Board Meeting and the next General Assembly because there has been a change in location for these. Please refer to page 6 for the details.

In section two, Member Societies, there is only a single item – announcing the Belgian Nuclear Society's November symposium. We need to keep the quality of the content but gain in quantity, which is why we are renewing the call made in our inaugural issue. Our newsletter can only flourish through input from you. Please send us details about your work and events you are organising. We will be delighted to publish them for the benefit of all ENS Members.

Whereas our third section provides you with news on what is going on in Brussels, the fourth one is limited this time to one book announcement. Our final section lists all of our Corporate Members and their website or email addresses. We hope that this will be of service to both the Corporate Members and the individual members who would like to contact them.

Dr. Peter Haug
Secretary-General

Andrew Teller
Editor-in-Chief

Generation IV: A Hint Of Déjà Vu? *by Bertrand Barré, ENS President-Elect*

Back To The Future

Since 1999, a dynamic multinational[1] effort has been launched to delineate the features of the proposed 'Generation IV' reactors, to be put in operation after 2030, and to identify the R&D to conduct in order to make them possible. The Generation IV International Forum, GIF, has focused on six concepts, considered to be the most promising among the 100+ initially considered. This endeavour has attracted a great deal of interest throughout the world, but some critics point out that these concepts are not really 'new', and that they are more revisited than invented. Are we going 'back to the future?'

To answer this question, let us look at the 'natural history' of the nuclear reactor, considered as 'a living species', and starting not from Oklo[2] (a bit too far away), but from the first man-made sustained chain reaction on 2 December 1942.

Natural History Of The Nuclear Reactor

The fifties and sixties, following on from the famous 'Atoms for Peace' speech whose jubilee we celebrate this year, heralded – mostly in the United States – an era of unbridled creativity, of vital luxuriance we can hardly imagine today. All possible reactors, and again some more, were dreamt of, designed and often built, and most of them were actually operated! Just about all conceivable combinations of fissile and fertile materials and moderators and coolants were tried, in facilities of which the scale was, admittedly, moderate and the safety not up to modern standards. Let us say that respect for the environment was relative.

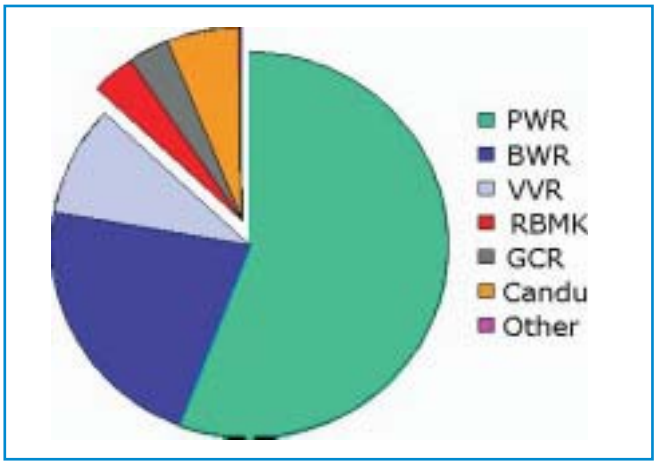
But all these 'devices' did operate, albeit for a few days, and without major accident - with the exception of SL1. Uranium, thorium, plutonium, metals, oxides, carbides or more exotic compounds, air and various gases, light and heavy water, graphite, beryllium, rods, pins, needles, particles, suspensions, fluidised beds, liquid metals and molten salts - *everything was* tried at least once between 1945 and 1965. And this does include all the Generation IV concepts, at least on paper. As an illustration of this luxuriance, at the Idaho Falls Center alone, more than 50 reactors were built between 1949 and 1974 and none of them was identical! If you add to this the prototypes of Brookhaven, Oak Ridge, Hanford, Savannah River and Los Alamos, you can almost double the figure.

And then, as in the natural history of species, this creative fervour was followed by a selection, which led to the survival of a small number of reactor systems, as illustrated in Figure 1.

Many branches of the evolutionary phylum did terminate abruptly, sometimes for diriment technical reasons, such as the swelling of graphite by sodium impregnation which killed Hallam, or the bulk of shielding which would have prevented the nuclear powered aircraft from taking off. Safety played its role: the Windscale fire led graphite reactors to forego air cooling, and nobody will order a new RBMK after the Chernobyl accident.

Some models were simply too complex, and, though quite viable, were overtaken by the competitors, like the French Brennilis EL4. For a couple of years, the competition between Molten Salt and Liquid Metal was very heated, and the latter may have won mostly because of the sheer willpower of its proponents. Some designs were simply unlucky, introduced with bad timing: the first series of 8 High Temperature Reactors ordered in the USA

Figure 1: World Nuclear Power Plants, 31/12/2001 (Total: 356 GWe)



Various mechanisms led to such a drastic selection and these were helped by the very specific conditions of this 'pioneer' (some would say: 'cowboy') era, during which the delays were so short from first concept to first concrete that the succession of generations was very fast-paced indeed.

disappeared along with a hundred LWRs during the rash of cancellations which affected the whole utility industry after the 1974 oil crisis.[3] Sometimes, economic factors were involved, but seen in retrospect, the comparisons of the time appear laughable.

There were also positive forces which boosted some of the designs. First, the technological evolution: without enrichment, there would not be any LWR, and no breeder without reprocessing. Not having to depend on the US monopoly on enrichment was a key factor of success for natural uranium-fuelled reactors, as long as this monopoly lasted. The success of the nuclear-powered US submarines (and the personality of Admiral Rickhover) gave a strong, initial competitive advantage to the PWR versus its BWR cousin, and the overwhelming power of the American industry in the sixties did a lot to spread the LWR technology around the world outside the Soviet Union.

The results are tangible: with 87% of the installed power, the various LWRs occupy the 'biotope', leaving a small niche to HWRs, while GCRs and RBMKs, once dominant, are slowly decaying.

Is There Life After The LWR?

When a species completely dominates its biotope, it leaves potential competitors with little chance of coming to the fore. When dinosaurs ruled the earth, mammals had no option but to stay put, until changes in the environment gave them the opportunity to move in. When the automobile was developed at the end of the 19th century, it experienced the same vital luxuriance we have witnessed in nuclear reactors, and the internal combustion engine did not immediately establish its present primacy. The first car to break the 100-km/h barrier, in 1899, was the '*Jamais Contente*', an electric car, and in 1906, the record speed of 196-km/h was held by a car powered by a steam engine.

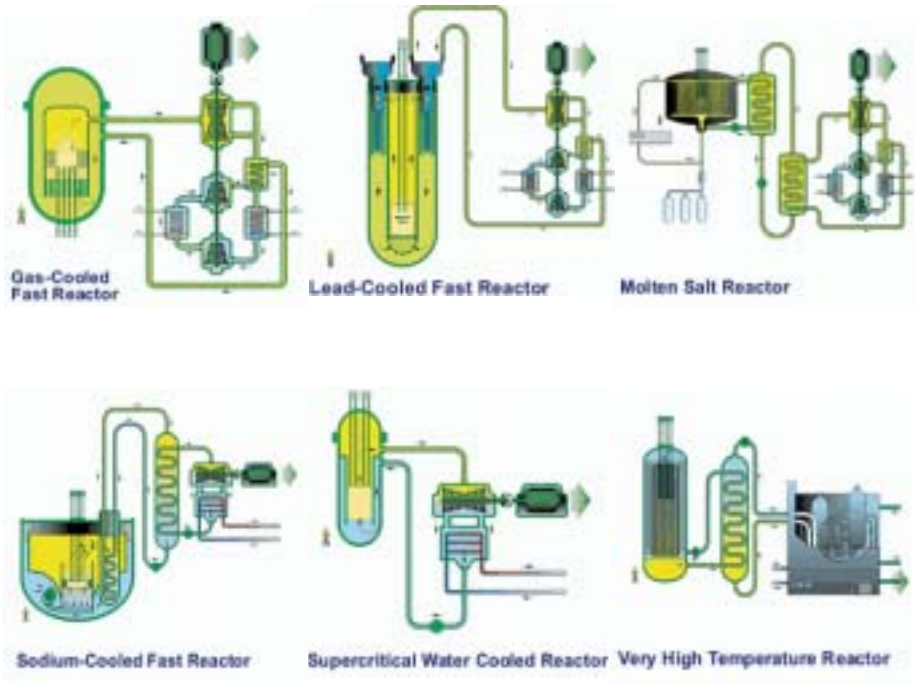
Nowadays, steam-powered cars have been forgotten, and electric cars occupy a very small niche. It is even funny to consider that internal combustion engines share their market supremacy between two cousin technologies, explosion and diesel, as do the LWRs between the pressurised and the boiling varieties.

But evolving environmental conditions are now challenging the all-potent internal engine: concerns about urban pollution today and greenhouse gases tomorrow will probably give the electric car a new chance, possibly as a combined hydrogen-electric device. Similarly, some nuclear designs which did not pass the selection, because their specific qualities were not critical according to the criteria of the '70s and '80s, may find a second chance in today's environment. Let us take two examples from the GIF concepts, shown in Figures 2-7.

LWRs are sturdy, reliable, economically competitive in many country, and they can operate much more flexibly than was originally thought. EPR, SWR, AP1000 and ABWR are ready to assume overwhelming dominance of the Generation III about to start. Even the latest Candu is now partly LWR! But they have some weaknesses, which did not hamper their success: their thermal efficiency is mediocre, they make rather poor use of fertile materials, their excellent safety relies on sophisticated systems – and sophisticated operators. Up to now, their only use has been ship propulsion and electric power generation.

If nuclear energy is to supply a share of the world's primary energy which is significantly larger than the

Figures 2-7: The 6 GenIV Families



Source: Generation IV International Forum

present 6 or 7%, uranium availability and price will become a concern, and all four breeder systems will attract renewed interest.[4] If nuclear energy is to help to significantly reduce greenhouse gases emissions, then generating hydrogen in addition to electricity might prove very valuable and could make the VHTR quite attractive.

Conclusion

Nuclear technology is young. Hardly 50 years have elapsed since Queen Elisabeth II inaugurated Calder Hall and the Nautilus completed its undersea cruise around the earth. Its future is very open, and could follow many routes. Yes, there is a hint of déjà vu in the designs selected by the GIF, but they appear promising and well worth revisiting.

Notes

[1]The 10 partners are the USA, which initiated the project, Argentina, Brazil, Canada, France, Japan, Korea, South Africa, Switzerland and the UK, with the Nuclear Energy Agency acting as secretariat for the GIF.

[2]Slightly less than two billion years ago, the natural enrichment of ^{235}U was above 3%. In one location in Gabon, where uranium was highly concentrated deep underground in the presence of water, several genuine natural nuclear reactors went critical and 'operated' for many thousands of years. This fascinating 'Oklo phenomenon' was discovered in 1972.

[3]Contrary to popular belief, it is the first oil crisis which maimed the US nuclear industry, but the 1979 TMI-2 accident did nothing to help the recovery.

[4]In 1976, when SUPERPHENIX was ordered, it was expected – or feared – that the total installed nuclear capacity would reach 1800 GWe by the year 2000. If such had been the case, most reactors on order today would be breeders!

Listening To Others: A Personal View *by Andrew Teller, ENS Society Manager*

Risk Compendia

Ljubljana, June 2003. The ENS general assembly was taking place on the top floor of a hotel near the centre of the city. On a table just outside the conference room, nicely displayed leaflets were waiting to be picked up by the participants. These leaflets presented a number of basic facts on radioactivity and the risks associated with it. Among the arguments was what is known in technical parlance as a risk compendium.

Risk compendia come in the form of tables comparing the risks entailed by various human activities such as cigarette smoking, alcohol drinking, using different transport means, living near a nuclear power plant, etc. The corresponding risks are usually expressed in days of estimated loss of life expectancy or in fatalities per person and hour of exposure. Whatever the yardstick used, such compilations invariably show that the risks resulting from the use of nuclear power generation are much lower than those of most other purposeful activities. By way of illustration, at one end of the spectrum, smoking would cost a human being six years on average. At the other end, living close to an NPP could result in a loss of 15 to 51 days, depending on the radiation dose assumed.

Furthermore, other investigations have revealed that the public tends to grossly overestimate the actual risk of nuclear while it underestimates the risk attached to more familiar activities. It is therefore not surprising that all the advocates of nuclear power invoke risk compendia - along with cost-benefit analyses and the "de minimis"[1] principle – to support their position. This three-pillared approach embodies an attitude which is steadfastly no-nonsense and fact-driven.

On the other side of the nuclear divide, however, the opponents of nuclear power generation conscientiously ignore risk comparisons. To them, the use of cost-benefit analyses and of the "de minimis" principle is only evidence of hard-nosed insensitivity. The difference in the choice of demonstration tools is so clear-cut that one can predict with 100% reliability the conclusion of a report on nuclear by just looking at which ones have been used.

As far as we supporters of nuclear power generation are concerned, invoking risk compendia elicits two reactions. Firstly, it makes us feel totally justified in advocating the use of nuclear technologies. Secondly, it leads us to consider those who remain unmoved by the cogency of our point as stubborn and impervious to the facts. This is certainly how I personally felt until I started reading the analyses of uncommitted risk specialists. It sometimes pays to listen to others, especially those who know what they are talking about and say it in terms less antagonising than the anti-nuclear. I found the following observation in one of the books I read:

"If an approach produces a clear, persistent, and unwanted signal, the offended parties may choose to discredit the whole approach rather than just contest one particular conclusion."[2]

It then dawned on me that our opponents refuse our demonstration not as a result of simple obstinacy but because of a deep dislike of the conclusion it leads to. Seen in this light, risk compendia appear as a battlefield of our own choosing. No wonder that the opponents of nuclear power generation refuse to meet us there: they know that this is not where they are going to win a battle, let alone the war.

There is something more important, however. Whatever the real reasons for rejecting risk compendia, this rejection can nevertheless be supported by objections deserving to be addressed. The first one is that risk compendia restrict the picture to the consideration of two parameters only: the probability and the extent of the damage. It does not take an environmentalist to admit that there are more facets to risk than this. O. Renn and A. Klinke[3] have identified no less than six additional factors deserving to be considered. You might try to guess what they are before looking up the answer provided in the endnote below.[4]

A second objection is that risk compendia rest on the implicit assumption that the current casualty rate is a given that does not call for any further reduction. The assumption is all the more questionable because, in the case of people living close to an NPP, the rather low loss of life expectancy mentioned earlier would hide a wide disparity: hardly any loss for most and quite a lot for some.

Once these objections have been expressed, we cannot afford the luxury of ignoring them. Reiterating the old argument could still provide comfort to the faithful but would not help us vis-à-vis the rest of the world. Worse, it would give those who are neutral and knowledgeable the impression that we are much better at pursuing a monologue than at engaging in a real dialogue.

Bearing the afore-mentioned quotation in mind, the observant reader might object that, if it does indeed apply, then trying other approaches is useless. Insofar as they lead to the same outcome, they would be likewise discounted by our opponents. I beg to differ. There are at least three good reasons for being aware of and addressing reasonable objections. First, it would provide evidence of our willingness to establish a dialogue with our critics, a claim that we regularly make. Second, we would bring the discussion onto their own battlefield, a move that is much more difficult to ignore. And last but not least, we would provide relevant answers to those individuals who have not yet fashioned their own opinion but are weighing up the pros and cons of the issue.

This having been said, what can we do in the present case? I submit that the best strategy consists in showing that the number of lives saved by the use of nuclear technologies far exceeds the losses it might entail. Of course, this approach will cut no ice with those fundamentalists who assert that nuclear technologies (including military ones) have so far claimed no less than 65 million lives. But for those belonging to the middle ground, who are still trying to shape their own opinion, this alternative approach would highlight the need to examine the issue in a broader perspective. All balance sheets have two sides. The anti-nuclear rhetoric systematically contrasts the actual liabilities of nuclear energy with the virtual assets of ABN (Anything But Nuclear).

We should waste no occasion to remind the middle ground that the assets of nuclear and the liabilities of ABN are also part of the problem.

Notes

[1]The "de minimis" principle excludes cases that are highly unlikely or have very small consequences relative to their factors.

[2]B. Fischhoff et al, *Acceptable Risk* (Cambridge University Press, 1981).

[3]O. Renn and A. Klinke, Risk Evaluation and Risk Management for Institutional and Regulatory Policy, in '*On Science and Precaution in the Management of Technological Risk, Volume II*' (Report EUR 19056/EN/2, European Commission, Joint Research Centre).

[4]Certainty of assessment (for both probability of occurrence and extent of damage), ubiquity, persistency, reversibility, delay effect, potential of (political) mobilisation.

December Board and General Assembly

Brussels has been chosen as the host city for the end-of-year Board Meeting and General Assembly. The first will take place on Thursday, 11 December and the second on Friday, 12 December in Brussels.

Details of the venue and logistical arrangements for the Board Meeting and G.A. will be sent to our members in due time.

Sofia – formerly considered (see the minutes of the last General Assembly in June) – has not been forgotten, however. In agreement with the Bulgarian Nuclear Society, the Secretariat will be possibly organising a Board Meeting there in March 2004.

PIME 2004

PIME 2004 - 31 October Deadline For Contributions

Do you have a fresh perspective on nuclear communications? What new challenges did you face this year and how did you tackle them? If you've got a good story to tell, then ENS PIME 2004 is the place to tell it.

This is your chance to play a constructive role in raising the quality of nuclear communications work by sharing your experiences and new ideas with your counterparts from around the world.

But don't delay too long; the deadline for contributions is on Friday 31 October to be exact.

At this stage, you don't need to submit a detailed account of your proposed presentation - just a broad outline will do. For details, go to the special conference website, www.pime2004.org, and click on the link marked 'Contributions'.

PIME is one of the highlights of the nuclear communications calendar, and the next conference will take place in Barcelona on **8-12 February 2004.**

Meanwhile, another PIME deadline is looming - even if you want to participate without giving a presentation.

Conference registrations received on or before **19 December** will qualify for an **'early bird' discount**. Details are in the registration form, which can also be downloaded from the PIME website. (www.pime2004.org)

Remember to check the site for the latest updates to the programme. The usual varied line-up of speakers this year includes three energy specialists from the European Institutions:

- MEP Alejo Vidal-Quadras Roca, Vice President of the **European Parliament**, who will focus on 'The nuclear debate as a political issue';
- Mr. Michel Poireau, of the **European Commission**'s Directorate General for Research, addressing EU public opinion in the energy field; and
- Dolores Carrillo, of the **Euratom Supply Agency**, who will speak about the Euratom Treaty.

PIME will once again offer a successful mix of informative presentations, stimulating discussions in a round-table and workshop setting and ample opportunities for networking. The conference part of PIME 2004 will be followed by a **technical tour** to the Vandellós nuclear power plant on Thursday **12 February**.

Book your place now - or contact us by email: pime2004@euronuclear.org or telephone: +32 2 505 32 23, if you have any questions about ENS PIME 2004.

Vandellós nuclear power plant

Research Reactor Fuel Management 2004

Registrations Open in November

This year's topical meeting on Research Reactor Fuel Management (RRFM) was a great success, with participation eclipsing any of the event's previous years. It's now high time to look ahead. RRFM 2004 is taking place from 21 to 24 March 2004 at the Forum Hotel in Munich, Germany. Registration will be open from mid November, when you will be able to download the form from www.euronuclear.org. In the meantime, please block off your diary and spread the word.

For RRFM 2004, our philosophy is: why tamper with a winning formula? The two-day conference – like its predecessor - will be an open forum for researchers and decision-makers to exchange information on all significant aspects of the fuel cycle.

Specific focus will be given to innovations in the use of research reactors as well as international initiatives such as Generation-IV, INPRO and the 6th European Framework Research Programme. Issues and changes in international policies affecting the RR fuel cycle will also fall under the spotlight – as these will be the topics of a select number of invited presentations.

Munich, as the host city for RRFM 2004 has been chosen with care – not only for its aesthetic appeal – but also because it is where FRM II is being commissioned. Our conference is set to end on a high note. This innovative research reactor – epitomising the leading edge in neutron-based research – will be the destination of our traditional post-conference technical visit on 24 March. It is a special privilege to have been granted permission for this visit.

An exhibition is being organised alongside the conference, which will provide a perfect platform for companies to reinforce their position as an industry leader.

Further details on RRFM 2004 can be found at:
http://www.euronuclear.org

November Symposium on Civil Nuclear Energy

On 26 November 2003, the Belgian Nuclear Society (BNS) is hosting in Brussels a one-day symposium tipped to draw interest from major leaders in peace movements and the nuclear world – and to spark vivid debate.

For the event's theme, the BNS - a scientific society dedicated to civil nuclear science and engineering – is focusing on 'Civil nuclear energy as a tool for development and security'. This underscores the society's convictions that inherently safe power plants and proliferation free fuel cycles can be developed – and would be suitable for use as cheap and environmentally friendly electricity sources, as water desalination plants and for the future production of hydrogen as a clean energy reservoir.

Organisations and people dedicating their efforts to sustainable peace may not necessarily agree with the society's views. For this reason, the BNS is gathering all parties interested in these issues to explore and discuss civil nuclear energy's contribution to the unarguably global issues of not only energy, but water, non-proliferation and disarmament.

The BNS also organises monthly evening lectures on a broad spectrum of subjects ranging from reactor design to radiotherapy and climate change.

Download the November symposium's full programme and registration form, from:

http://www.bns-org.be/symposium26Nov/programme.pdf
or through the ENS web site
http://www.euronuclear.org

Commission

GIF Welcomes EURATOM

EURATOM was officially welcomed as a member of the Generation IV International Forum (GIF), at its meeting in Toronto, Canada on 26 September 2003. At the meeting, the Joint Research Centre (JRC), which has prepared a number of technical proposals for joint projects, participated in the negotiations on the terms for model agreements on such projects.

Commissioner Highlights Research in Nuclear Safety Field

EU Research Commissioner Philippe Busquin has stressed the importance of research in the field of nuclear safety and plant life management. The Commission says that, as Europe's nuclear power reactors grow older, maintaining high safety levels is a key issue for industry and policymakers.

The Commission issued a press statement coinciding with a seminar, 'Networking for Effective Research and Development', held at the JRC Institute for Energy at Petten on 22-23 September. The meeting examined future networking activities for nuclear plant life management.

In the statement, Mr. Busquin said: "Players in the nuclear sector have to talk to each other especially when nuclear safety is at stake. Sharing vital information to enhance the reliability of nuclear plants is a necessity rather than a choice. EU-wide networks in the nuclear field play a key role in processing and disseminating data, in bridging information gaps and achieving a critical mass in knowledge. This allows for a fast response in the event of problems and actually prevents problems from arising.

"The Commission fosters this information flow and contributes to it. Lessons learned during the past 10 years will now be used to step up co-operation, in the spirit of the European Research Area."

The Commission co-ordinates major networks on the ageing of materials in nuclear power plants (AMES), on inspection and qualification (ENIQ), for evaluating the structural integrity of components (NESC) and on application of neutron diffraction techniques (NET), as well as on safety of Eastern European type nuclear facilities (SENUF). These are part of the JRC's SAFELIFE project on the safety of ageing nuclear power plants. These initiatives address issues such as enhancing the safety of Soviet-design reactors in Eastern Europe, checking on the capacity of ageing nuclear facilities to withstand accidents and preventing cracks and leaks.

Council of the European Union

ITER Decision Due Soon

A decision on whether France or Spain should be put forward as the EU candidate state to host the International Thermonuclear Experimental Reactor (ITER) project is expected in November.

The EU's Competitiveness Council decided on 22 September that discussions would continue with a view to a decision being taken at the council's session on 27 November.

A recent report compiled for the Council by the ITER site analysis group found that whichever site is eventually selected as the single EU candidate to host ITER - Vandellós in Spain or Cadarache in France - "either would be likely to win the international site selection".

The other potential host countries are Canada (Clarington) and Japan (Rokkasho).

IEA To Launch World Energy Investment Outlook 2003

4 November is the launch date for *World Energy Investment Outlook* – an International Energy Agency (IEA) report which is a ground-breaking attempt to assess in detail the global energy investment challenge over the next 30 years. This publication will be a follow-up to the highly acclaimed *World Energy Outlook 2002.*

In assessing each fuel and world region's energy supply chain investment requirements up to 2030, the report provides comprehensive projections and an in-depth analysis on funding needs. It also identifies the obstacles to be overcome in order to mobilise this investment in a timely manner, meet anticipated demand growth and ensure long-term energy security.

The price of World Energy Investment Outlook is €150. For further information and details on how to order it, please go to http://www.iea.org/books or address an inquiry to books@iea.org. A 10% discount is available for orders placed prior to publication, and non-profit organisations as well as students are entitled to a 30% discount.

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NRG Petten
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