The 31st JAIF ANNUAL CONFERENCE

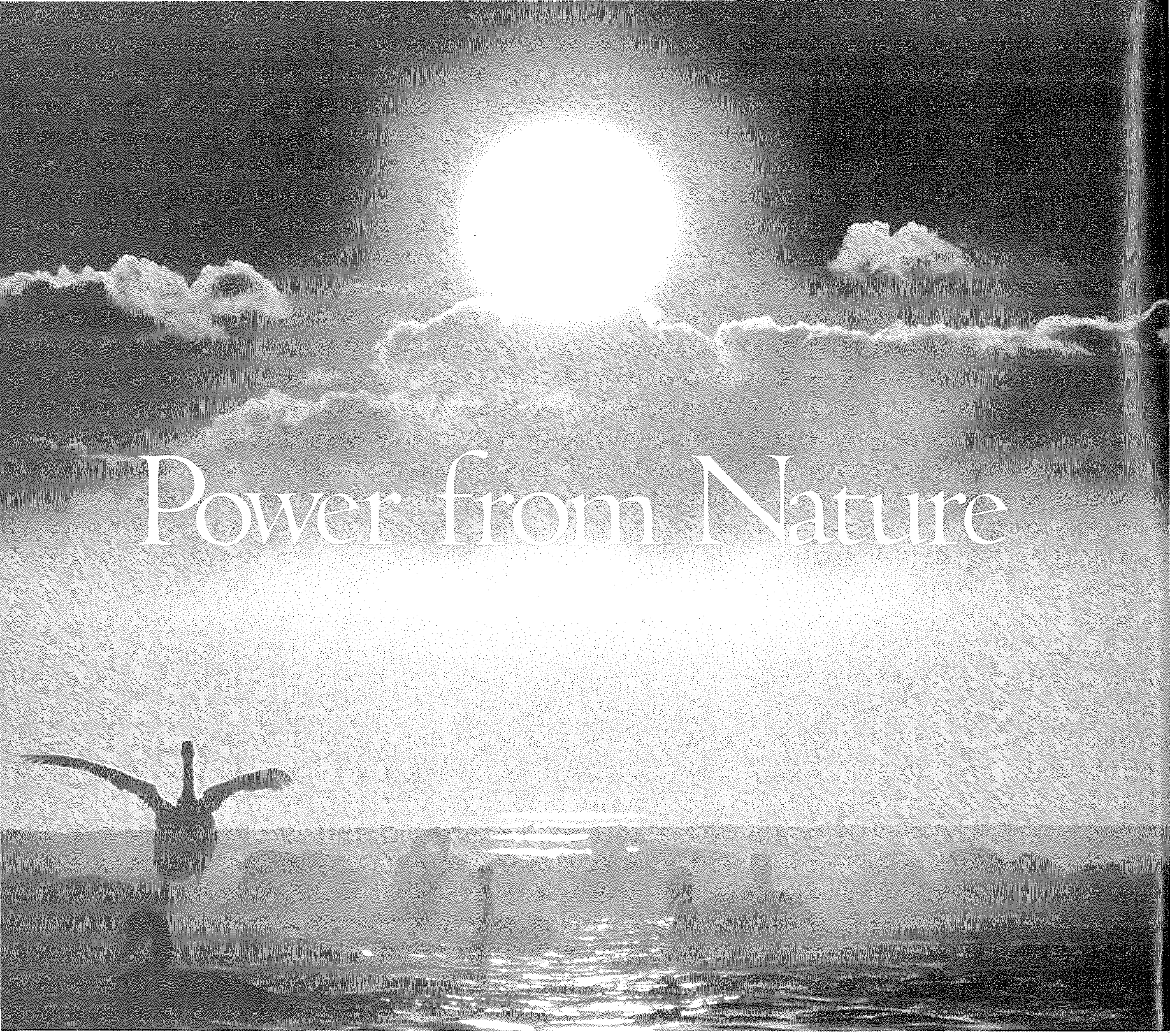
ABSTRACTS

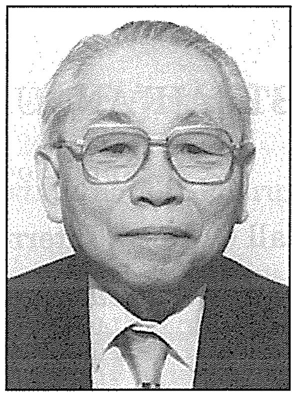
April 20-22, 1998

Tokyo International Forum

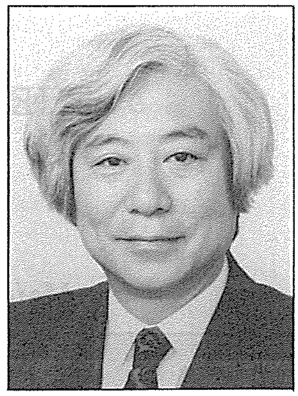
Tokyo, Japan

JAPAN ATOMIC INDUSTRIAL FORUM, INC.


Power from Nature



Takashi Mukaibo
JAIF Chairman



Hiroyuki Yoshikawa
Chairman of the
Program Committee

The 31st JAIF Annual Conference

Main Theme: Nuclear Energy—New Challenges

Nuclear power development has been facing numerous challenges at both domestic and international level. As a global feature, growing energy consumption poses serious problem of climate change, to which the significance of nuclear power generation ought to be evaluated in view of its limited emission of greenhouse gas. As highlighted in France and else, national politics surrounding nuclear power developments has been hampering their initial performances, unduly denying the merits induced by sustaining those development options. Rising concerns for environmental protection and expectations for highly established safety practices have become momentum for the technological advancement of nuclear plants, while the public education of nuclear energy and information disclosure gaining further importance. Potentials of civilian nuclear reactors await to be explored in various aspects as well demonstrated in disposition of nuclear warhead materials.

The 31st JAIF Annual Conference provides a platform where nuclear specialists and non-specialists can exchange views on issues of contemporary significance related to nuclear power developments in light of global energy security.

THE 31ST JAIF ANNUAL CONFERENCE

April 20－22,1998

Hall C, Tokyo International Forum

Main Theme : Nuclear Energy—New Challenges

	Monday, April 20	Tuesday, April 21	Wednesday, April 22
AM	OPENING SESSION (9:00～12:30) [Opening Remarks] [Lectures]	SESSION 2 (9:00～12:00) Japan's Social Transformation and Its Impact on Nuclear Energy Development [Panel Discussion]	SESSION 3 (9:00～12:00) Nuclear Fuel Cycle: Review in the Long-term [Panel Discussion]
	Lunch Break (12:30～14:00)	LUNCHEON (12:15～14:15) at Hall B FILMS (13:00～14:00)	Lunch Break (12:00～13:30)
PM	SESSION 1 (14:00～17:30) Global Warming and Energy Solution [Panel Discussion]	PUBLIC TALKS (14:30～17:00) Energy and Nuclear Power —What are Problems? at Reception Hall	SESSION 4 (13:30～17:10) Advanced Technology and Nuclear Energy: Progress and Prospects [Lectures and Visual Presentations]
	JAIF CHAIRMAN'S RECEPTION (18:00～19:30) at Hall B	YOUNG GENERATION'S FORUM (17:30～19:30) What Needs to be Done Now for Nuclear Energy's Future at Reception Hall	

Program of the 31st JAIF Annual Conference

April 20－22, 1998

Hall C, Tokyo International Forum

[MONDAY, APRIL 20]

OPENING SESSION 9:00－12:30

Chairman:

Soichi Iijima
Vice Chairman
Japan Atomic Industrial Forum

JAIF Chairman's Address

Takashi Mukaibo
Chairman
Japan Atomic Industrial Forum

Remarks by Chairman of the Atomic Energy Commission of Japan

Sadakazu Tanigaki
Chairman of the Atomic Energy Commission of Japan
Minister of State for Science and Technology

Remarks by Chairman of the Conference Program Committee

Hiroyuki Yoshikawa
Professor Emeritus, University of Tokyo, Japan

Chairman:

Sho Nasu
Chairman
Tokyo Electric Power Co., Japan

Lectures:

"Security and Energy Security in East Asia"

Robert Gallucci
Dean, Edmund Walsh School of Foreign Services
Georgetown University, U. S. A.

"Status and Prospect of China's Nuclear Power Program"

Jiang Xinxiong
Standing Commissioner, National People's Congress;
President, China National Nuclear Corporation,

"The Future of Nuclear Power in France"

Yannick d'Escatha
Administrator General
Atomic Energy Commission, France

"Nuclear Energy for Sustainable Development: the Role of IAEA"

Sueo Machi
Deputy Director General
International Atomic Energy Agency

SESSION 1 14:00－17:30
"Global Warming And Energy Solution"

Chairman:

Jiro Kondo
Chairman
Science and Technology Foundation of Japan

Keynote Address:

"Global Warming and Global Energy after Kyoto"

Michael Jefferson
Deputy Secretary General
World Energy Council

Panelists:

Luis Echávarri
Director General
OECD Nuclear Energy Agency

Qu Shiyuan
Professor and Deputy Director
Energy Research Institute
State Planning Committee, China

Yoshihiko Sumi
Chairman
Committee for Nuclear Power Development
Federation of Electric Power Companies, Japan

Tsutomu Toichi
Director
Institute of Energy Economics, Japan

Discussion with the Floor

JAIF CHAIRMAN'S RECEPTION 18:00－19:30

Hall B, Tokyo International Forum

[TUESDAY, APRIL 21]

SESSION 2 9:00−12:00
"Japan's Social Transformation and Its Impacts on Nuclear Energy Development"

Chairman:

Mitsuko Shimomura
Journalist, Japan

Keynote address:
"Japanese Society at the Turning Point"

Soichiro Tahara
Journalist, Japan

Panelists:

Soichiro Tahara
Same as above

Yumi Akimoto
President
Mitsubishi Materials Corporation, Japan

Gregory Clark
President
Tama University, Japan

Masazumi Saikawa
Mayor
Kashiwazaki City, Japan

Masao Takuma
Director; Deputy Executive General Manager
Nuclear Power Program Operation
Tokyo Electric Power Co., Japan

Yoshinori Yamaoka
Managing Director
Japan NPO Center, Japan

Discussion with the Floor

LUNCHEON 12:15−14:15
Hall B, Tokyo International Forum

Remarks by State Secretary for International Trade and Industry

Kensei Mizote
State Secretary for International Trade and Industry, Japan

Special lecture:
"Harmony for Civilization with Nature"

Françoise Moréchand
Visiting Professor
Kyoritsu Women's University, Japan

FILMS ON NUCLEAR ENERGY 13:00−14:00

Hall C, Tokyo International Forum

PUBLIC TALKS 14:30−17:00

"Energy and Nuclear Power—What Are Problems?"

Reception Hall, Tokyo International Forum

Moderator:

Kazuko Tamura
Senior Writer and Editorial Writer
Kyodo News Agency, Japan

Coordinator:

Kazuhisa Mori
Vice Chairman
Japan Atomic Industrial Forum

Commentators:

Soichiro Tahara
Journalist

Tokunosuke Nakajima
Former Professor, Chuo University, Japan
Member of the Conference Program Committee

YOUNG GENERATION'S FORUM 17:30−19:30

"What Needs to Be Done Now for Nuclear Energy's Future"

Reception Hall, Tokyo International Forum

Coordinator:

Tatsujiro Suzuki
Visiting Associate Professor
University of Tokyo, Japan

Special presenter:

Maria del Mar Dominguez Blanco
Chairperson, Spanish Young Generation Program;
Member, European Young Generation Network

[WEDNESDAY, APRIL 22]

SESSION 3 9:00−12:00
"Nuclear Fuel Cycle: Review in the Long-term"

Chairman:

Atsuyuki Suzuki
Professor
University of Tokyo, Japan

Keynote address:
"The Back-end of the Nuclear Cycle: A Summary of the Situation in France"

Claude Mandil
Director General for Energy and Raw Materials
Ministry of Economy, Finance and Industry, France

Panelists:

Claude Mandil
Same as above

In-Soon Chang
President
KEPCO Nuclear Environment Technology Institute, Korea

Helmut Engelbrecht
Head of Purchasing and Logistics Department
Preussen Electric Co., Germany

Toshiaki Enomoto
Director; Deputy Executive General Manager
Nuclear Power Program Operation
Tokyo Electric Power Co., Japan

William Wilkinson
President
British Nuclear Industry Forum, U.K.

Discussion with the Floor

SESSION 4 13:30-17:10
"Advanced Technology and Nuclear Energy: Progress and Prospect"

Chairman:

Mamoru Akiyama
President
Institute of Applied Energy, Japan

Lecture:

"The Dynamics of Science and Technology Development toward the 21st Century"

Fumio Kodama
Professor of Science, Technology and Policy
Research Center for Advanced Science and Technology
University of Tokyo, Japan

Visual Presentations:

"Computers in Relation to Atomic Energy"
Shojiro Matsuura
Vice President
Japan Atomic Energy Research Institute, Japan

"Nuclear Technology towards the 21st Century—Advancement of Nuclear Technology"
Hiroshi Machiba
General Manager, Nuclear Energy Systems
Toshiba Corporation, Japan

"The Status Quo of Medical Technology Using Radiation"
Yukio Tateno
Senior Research Counselor
National Institute of Radiological Sciences, Japan

"Unique Russian Technologies Related to Nuclear Energy"
Sergey Zykov
Principal Deputy Executive Director
International Science and Technology Center, Russia

Lecture:

"The Role of Radiation in the Origin and Evolution of Life"

Mitsuhiko Akaboshi
Professor
Research Reactor Institute of Kyoto University, Japan

Discussion with the Floor

MONDAY, APRIL 20

OPENING SESSION (9:00－12:30)

Opening Remarks
Lectures

Security and Energy Security in East Asia

Robert L. Gallucci
Dean, Georgetown University School of Foreign Service
Keynote Address Abstract

As we all think about how we will meet our energy needs in the future, we do so standing at the precipice, looking over it into the uncertainty of the next millennia. It is fitting that we take stock of where we are, where we may be going, of the risks and the opportunities that present themselves to the international community.

It appears that this may be a critical moment for governments deciding on how they will meet their energy needs over the coming decades, how dependent their countries will be on fossil fuels, how much energy they will consume, and the extent to which they will cooperate with other governments to control the effects of global warming. In light of the threat posed by international terrorism and the concern over the proliferation of nuclear weapons, it is certainly a critical time for governments to cooperate in the effort to assure that the enormous stockpiles of excess fissile material available in the states of the former Soviet Union and elsewhere are subject to safe control and rapid disposal.

If nuclear energy is to figure in the future of many advanced countries, it is also a critical time to replace the images of Chernobyl and other nuclear accidents with a technology that will be broadly perceived as safe and sound for generations to come. Given the political uncertainties that exists in Asia -- from the future direction of Chinese foreign and domestic policy to the unification of the Korean peninsula -- this may be critical moment for governments that will decide upon nuclear technologies that will be more or less provocative to neighbors.

All these issues are obviously related. Just as obviously , Japan is in a unique position to influence the decisions taken in Asia and around the world .When Japan speaks about matters of nuclear energy and international security, the international community listens. For the people of Japan, it is another opportunity of our time.

Status and Prospect of China's Nuclear Power Program

Jiang Xinxiong
President
China National Nuclear Corporation

China needs nuclear power.

China has uneven distribution of unrenewable energy resource in terms of the national geography. China enjoys rich coal resource, main part of which is located in the north. The hydro resource is located in the west and southwest. The densely populated and economically developed eastern coastal provinces short of energy resource. have increasingly large demand for power supply. Coastal East China needs nuclear power. If the provinces in that area continue to count on their fossil-fueled plants, the stress on transportation and environment will be growing.

In mainland China, 2 NPPs (3 units) are in operation. The total installed capacity is 2100MW, accounting for 1% of the national total.Under construction are 4 NPPs (8 units) with capacity of 6800MW.

China's energy policy is to optimize structure of fossil-fueled plants, to develop hydro power with main efforts and to develop nuclear power commensurately.

Policy for China's nuclear power program:
1)to capitalize on the existing nuclear power technical basis;

2)to pursue the nuclear power localization and standardization;

3)to adopt advanced proven nuclear power technology;

4)to stick to the principle of " self-reliance as the major goal plus Sino-foreign cooperation".

The Future of Nuclear Power in France

Yannick d'Escatha
Administrator General, French Atomic Energy Commission

• After a period of intensive construction which culminates today with the commissioning of level N4, the French nuclear system has reached maturity, with a nuclear power park that will be operational as is until at least 2020. At that time, to meet France's energy requirement while complying with the commitments of the KYOTO Conference (problems related to greenhouse effect gases) and the directives given by the Government concerning the energy policy, the park will probably have to be renewed, at least to cover the base electricity production requirements.

• The time is therefore particularly favorable to develop research in view of preparing the future and orienting prospective choices. This research is essentially aimed at providing answers to legitimate questions from political authorities, industry and the public, not only on the competitiveness of nuclear electricity but also on the safety of reactors and the management of wastes. The Government has clearly reasserted the mission of CEA which has a major role in the preparation of the decisions to be made in 2006 for the back end of the fuel cycle and around 2010 for the renewal of the park. It must actively and objectively explore the different possible solutions and, in due time, propose a whole range of diversified alternatives.

• In this context, CEA's responsibility is committed to at least seven determinant objectives for the renewal of the nuclear power park : a new generation of reactors that meet the safety requirements worked out jointly with Germany, while maintaining margins of competitiveness with respect to other forms of energy, new solutions for isotope separation and high performance fuels enabling the largest part possible of the energy content of uranium to be burned directly or after reprocessing-recycling, a range of technical options validated for waste management, the demonstration that dismantling is mastered, research on safety, radiobiology and, at the longer term, controlled fusion.

• These objectives and their stakes open ambitious program prospects for CEA, commensurate with the challenge to be taken. For all these research topics, CEA has to muster its expertise and its test facilities, and thus draw maximum profit from the possible synergies among its various sectors of activity. For a number of its research topics, CEA must also, through collaboration, strengthen its ties with the whole of the scientific and technical community, both national and international. This involves, in particular, partnerships with our nuclear counterparts in Japan. Indeed, success shall result from the mobilization of all participants in the nuclear field in domains of research representing widely shared technical and political stakes such as safety and long-lived radioactive waste management.

Nuclear Energy for Sustainable Development: the IAEA's Role

Sueo Machi
Deputy Director General
International Atomic Energy Agency

1. Nuclear power is needed to meet the rapid increase of energy demand due to rising living standard in developing countries. The current nuclear capacity of 345 GWe may increase to 1132 GWe in 2050 with the nuclear energy scenario of medium increase (IIASA/WEC Report).

2. Enhancement of nuclear power is the only practical measure to reduce greenhouse gas (GHG) (carbon-dioxide) emission to meet the new Kyoto protocol which requests 5.2% reduction from 1990 levels between 2008-2012 in industrialised countries. At present nuclear energy is avoiding 8% of global CO_2 emission.

3. Renewable energy such as solar, wind and biomass are not economically feasible for the coming two or more decades. Nuclear power is an environmentally friendly energy resource in comparison with, for example, coal which emitts noxious gases, sulphur dioxides and nitrogen oxides, and produces ashes containing toxic heavy metals.

4. There are two conditions to be met for enhanced utilization of nuclear energy and for public acceptance, namely

- operational safety of NPP and final disposal of high level radioactive wastes
- clear demonstration of comparative benefits of nuclear power vis-a-vis other renewable energy sources.

The Agency is actively carrying out a comparative study of nuclear energy with other energy resources.

5. Improved public acceptance of nuclear power is one of the crucial issues for further introduction of nuclear energy. The Agency has been organising workshops in Member States to provide necessary information for public and mass media to have better perception of nuclear energy.

6. The nuclear safety convention has entered into force in 1996, and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was adopted at the Diplomatic Conference in September 1997 and 26 States have signed. A global nuclear safety culture is evolving around binding international agreements, codes of practice, standards, international peer reviews and advisory services.

7. The Agency will strengthen nuclear safety assurance by working for comprehensive participation and a global assessment of strengths and weaknesses. National safety profiles covering radiation protection, waste safety and the safety of nuclear installations are being developed to provide a clear picture of needs and to guide priorities for IAEA assistance

8. The final disposal of high level radioactivity waste is technically feasible but still needs to be demonstrated convincingly to the public. At present high level wastes are being stored above or below ground, awaiting policy decisions on their long-term disposal.

9. Continued research and development in the fields of advanced reactors including fast breeder reactor and fuel cycle technology should be conducted to ensure that nuclear power could contribute to sustainable development in the long term. Important technical tasks of FBR development are economic competitiveness and improved safety.

10. Pu use as MOX fuel in thermal reactors has proven to be technically and economically feasible. Since fast reactors have not been built on the scale originally planned, Pu from reprocessing plants is used as MOX fuel for coming decades.

11. In order to ensure that nuclear energy is used exclusively for peaceful purposes more than 80 states have accepted to subject their nuclear activities to IAEA safeguards. The IAEA safeguards system has been strengthened to cover both declared and undeclared nuclear activities.

12. Nuclear techniques using isotopes and radiation is proven to have a large potential to contribute to sustainable development in the fields of food/agriculture, industry, water resource management and environmental protection. The IAEA is actively engaged in development and technology transfer of these techniques to developing countries.

SESSION 1 (14:30－17:00)

"Global Warming and Energy Solution"

The Third Conference of The Parties of The UN Framework Convention on Climate Change (COP3) has set the target for greenhouse gas emission level after 2000. For achieving the target, various measures have been proposed, including "joint implementation". Now industrialized member states are required to develop the national strategy to meet the target without hindering their business activities while considering the world sustainable development. This session will make a comprehensive review of the outcomes of COP3 and explore solutions effectively made by the commitments by the electricity/energy sector. Discussions will be focused on electricity generation of environmental efficiency in view of a growing worldwide demand of electricity, and feasible measures for this.

Panel discussion

Discussion with the floor

GLOBAL WARMING AND GLOBAL ENERGY AFTER KYOTO

Michael Jefferson
Deputy Secretary General
World Energy Council (WEC)

According to the IPCC's Second Assessment Report, the balance of statistical evidence now points towards a discernible human influence on global climate. The UN Climate Convention of 1992 stated that cost-effective precautionary measures should be taken, regardless of lack of full scientific certainty, so as to ensure global benefits at the lowest possible cost. Industrialised countries were to take the lead in combating climate change and aim at returning their greenhouse gas emissions to 1990 levels by the year 2000.

By the time of the Kyoto conference in December, 1997 the industrialised countries had done little to meet these commitments, but then entered into new ones for six gases for the period 2008-2012.

The results of the COP-3 deliberations in Kyoto are considered in relation both to scenarios of energy use at 2008-2012,and to possibilities out to 2100. Kyoto, at best, is seen as merely a small first step. Alternative scenarios which could meet some of the IPCC and other explicit or implied desirable emissions and concentration targets by 2100 are examined, each of which emphasise the necessity of much greater efforts to provide and use energy more efficiently; the desirability of accelerating the development and use of new renewable energy resources; and especially in higher economic growth and energy consumption scenarios , the difficulty in producing a credible outcome without greatly increased reliance upon nuclear power.

The talk concludes that despite deep-rooted public concerns about the operational safety, waste disposal and potential proliferation risks of nuclear power there are some hard choices lying ahead. How seriously are we to take global climate change and what are the realistic mitigation measures required?

Mr. Luis E. Echavarri
Director-General
OECD Nuclear Energy Agency
Paris, France

Nuclear power is, today, a commercially available source of electricity that already contributes to reducing anthropogenic greenhouse gas emissions. Some 17% of the electricity consumed worldwide is generated by nuclear power plants and in OECD countries, nuclear power supplies 25% of electricity consumption. Worldwide, if nuclear power plants were replaced by a mix of state-of-the-art, fossil-fuelled power plants, greenhouse gas emissions from the energy sector would increase by some eight per cent.

The nuclear fuel chain is essentially free from other atmospheric emissions, such as sulphur dioxide, nitrogen oxides and particulates. The small quantities of radioactive materials released by nuclear reactors and fuel cycle facilities in routine operation are monitored, and are limited to levels believed to cause insignificant environmental and health damage on the basis of the recommendations of the International Commission on Radiological Protection, as interpreted by national regulations.

Natural resources and technologies existing, or under development, could support broad nuclear development in the 21st century. With current technologies, known uranium resources would not be sufficient to support a significant development of nuclear power beyond the first half of the next century. However, additional uranium resources could be discovered and economically exploited in the long term. Furthermore, improved fuel design and management, and advanced reactors, offer ways to significantly reduce the amount of natural uranium required per unit of electricity generated. In the long term, thorium fuelled reactors, and fusion, could enlarge even further the nuclear resource base.

Substantially increasing the share of nuclear power in the energy supply is feasible and would help to address concerns about global climate change and to meet the target GHG reductions agreed upon within the UN Framework Convention on Climate Change. Keeping the nuclear option open implies ongoing efforts to ensure that existing nuclear power plants continue to be operated safely and economically, and the development of new reactors that will find more widespread uses worldwide.

Intergovernmental organisations such as the NEA and the IAEA, which play a major role in nuclear co-operation through information exchange and experience sharing, can help to preserve certain elements of infrastructure more cost effectively, notably research and experimental facilities, necessary to keep the nuclear option open.

Energy Consumption and Carbondioxide Emission in China (outline)

Qu Shiyuan
Energy Research Institute
State Planning commission
Beijing, China

Content

EFFORTS TO COUNTER GLOBAL WARMING PROBLEMS BY THE JAPANESE ELECTRIC POWER INDUSTRY

Yoshihiko Sumi
Chairman of The Executive Committee for Nuclear Power Development
The Federation of Electric Power Companies

1. Energy Consumption and CO_2 Emissions in Japan

・ Between 1990 and 1995, Japan's final energy consumption rose by 11%, and CO_2 emissions by 8%. Unless special measures are taken, final energy consumption in the year 2010 will increase 31% over 1990, with a 21% increase in CO_2 emissions, chiefly based on increase in the residential/commercial and transport sectors.

2. Actions Taken by Japanese Electric Utilities

・ Japanese electric utilities have been making strong drives for CO_2 reduction on both the supply and demand sides. On the supply side, we have aimed at an optimum combination of power sources, focusing mainly on nuclear power. On the demand side, we have been developing and disseminating equipment and systems of high energy efficiency.

・ As a result of these efforts, CO_2 emissions per kWh of electric power generated (unit CO_2 emissions) have declined more than 37% between 1970 and 1995. This is mainly because non-fossil energy sources have been introduced for power generation. Especially, the introduction of nuclear power, which has a much lower CO_2 emission rate than other power sources, has strongly contributed to the reduction in CO_2 emissions.

3. Environmental Action Plan of Electric Utilities

・ In November 1996, Japanese electric utilities adopted the "Environmental Action Plan by the Japanese Electric Power Industry" and announced efforts to achieve 20% reduction of unit CO_2 emissions by 2010 from the 1990 level, which was 0.104 kg-C/kWh.

・ Based on this Action Plan, we intend to take various actions on both the power supply and demand sides. Among these actions, the promotion of nuclear power will be the key to achieving the target because of its high contribution to CO_2 reduction, while efforts will be undertaken to ensure the safety of nuclear power. For example, to reduce CO_2 emissions to the 1990 level by 2010, 70.5 million kW of nuclear power will be needed. This means the construction of 20 more plants, totaling 25 million kW in capacity.

4. Problems in Development and Use of Nuclear Power

・ To introduce 20 more nuclear power plants, PA activities must be enhanced, since public understanding and trust is a prior condition to public acceptance of nuclear power. We will seek, in cooperation with the government, to expand measures to vitalize local areas where nuclear power stations are located, since such vitality in areas where nuclear power already exists is an incentive to success in new locations.

Global Warming Issue and Energy (Gist)

Tsutomu TOICHI, Director
The Institute of Energy Economics, Japan

At the international conference held in Kyoto in December 1997, referred to as COP3, legally binding targets for reducing greenhouse gas emissions were established by parties centering on industrially developed countries, which are believed to have a great impact on the world's energy supply and demand structure to be built up in the 21st century. This is because what has sustained the modern industrial civilization of mankind to date, developed with the Industrial Revolution which began at the end of the 18th century as a momentum, has been fossil fuels such as coal, oil and natural gas, and even today, approximately 90% of the world's total energy supply is accounted for by these fossil fuels. Moreover, in many developing countries which are continuing rapid population growth and marked economic development, energy consumption is thought certain to show a sharp increase further in the future. In order that the world continues sustainable economic development in the future, while endeavoring to stabilize CO_2 emissions, therefore, it is becoming increasingly necessary for industrially developed countries, including Japan, to lead other countries in their efforts to address the issue to reform existing energy supply and demand systems from global and long-term perspectives. In this connection, the role to be played by technological innovation is crucial in utilizing fossil fuels as clean energy sources to the greatest feasible extent, in improving electric power generating efficiency, in expediting the utilization of non-fossil energy sources such as nuclear power and renewable energy sources, and in advancing highly efficient utilization of energy sources. Concurrently, it is believed indispensable to revolutionize national consciousness as well as economic and social systems to have a variety of new technologies take root widely in society.

Meanwhile, with the rapid progress in globalization of many fields of human activities in recent years, the energy market also has witnessed growing quest for worldwide deregulation and liberalization measures. In Japan, it has become the most important energy policy measure how to achieve three objectives simultaneously which Japan has advocated so far, i.e., security of stable energy supply, revitalization of the economy through deregulation measures, and reduction in CO_2 emissions, which contradict with one another in some cases. Judging from the current conditions facing Japan's energy supply and demand, however, it would be difficult to achieve the targeted reduction in CO_2 emissions to the 1990 level by 2010, in such a short period of time from the standard of long lead times normally required in energy-related projects, without sacrificing other policy measures to a considerable extent. Taking into account the far-reaching impact of the global warming issue in terms of time and space, therefore, Japan is urged to make utmost efforts to address the issue domestically, while discharging its international responsibilities positively, so that international schemes such as emissions trading, joint implementation and clean development mechanism, agreed to in the Kyoto Protocol function properly. Japan's addressing itself to these schemes is expected to contribute eventually to advancing transfers of various technologies aimed at reducing CO_2 emissions from industrially developed countries to developing countries.

[MEMO]

LUNCHEON (12:15－14:15)
at Hall B, Tokyo International Forum

Special lecture

Harmony for Civilization with Nature

Françoise Moréchand
Visiting Professor, Kyoritsu Womens' University

[MEMO]

TUESDAY, APRIL 21

SESSION 2 (9:00－12:00)
"Japan's Social Transformation and Its Impact on Nuclear Energy Development"

Japan's social system, which has undergirded the country's development for so many years, is now experiencing strains in a wide range of areas. Japanese society is about to embark on an era of wrenching transformation. A fundamental rectification of the situation is widely regarded as necessary, especially social reforms that will bring the country into the new era. Nuclear energy is also facing similar calls to reorganize its framework of development at the earliest opportunity, taking the initiative in carrying out reforms that will hew a path to the new era. Viewing those changes from multiple perspectives; e.g., national and regional policy, public communities, industry, and the international community; basic problems held in common will be identified, with prescriptions for reform explored. Also to be discussed are the decision process and system to promote comprehensive energy policy in Japan, including the development of nuclear energy.

Panel discussion
Discussion with the floor

Japanese Society at the Turning Point

Soichiro Tahara
Journalist

JAPAN'S SOCIAL REFORMS AND NUCLEAR ENERGY

Dr. Yumi Akimoto
President and CEO
Mitsubishi Materials Corporation

In the wake of the 1973 Oil Crisis, Japan embarked on a program of energy conservation and diversification that, to a certain extent, has succeeded. Nuclear energy is now a leading alternative source of energy, accounting for about one-sixth of all primary energy sources and generating more than one-third of all electric power. Despite these long-term efforts, however, Japan's energy supply system remains insufficient. As of 1994, Japan still relied on fossil fuel for 57.4% of its energy needs and continued to import more than 80% of its energy from abroad. By comparison, France (a nation which, like Japan, has few natural resources of its own) was importing less than 50%. The supply of petroleum has stabilized in recent years. Asia's ongoing economic troubles have resulted in declining demands and lower prices, but another energy crisis is only a matter of time. As it enters the 21st century, Japan needs to reassess its energy security from a much broader perspective, in terms of both time and space.

There are two viewpoints concerning time, we can take here: the short-term and the long-term. In the short-term view, economic, political, social and environmental restrictions play a much bigger role than resource limitations. New energy sources like solar power are clearly not going to meet our major energy demands, at least not in the short-term. Indeed, expanded use of nuclear energy seems to be the only way we can obtain the energy we need while protecting the environment.

In the long-term, we are faced with a major resource limitation: the drying up of our fossil fuel reserves. We have to introduce new energy sources positively. In the field of nuclear energy, the once-through cycle of uranium is far from being a solution to our resource limitations. We are going to have to start recycling plutonium in fast reactors. Developing such reactors and a suitable fuel cycle is going to take considerable lead time. We must begin today; after the energy crisis occurs, it will be too late.

Concerning the viewpoint about space, we need to have both a global and a local perspectives. The economies of various nations are strongly connected with each other as never before, making it impossible to consider the energy supply of any one nation alone. Asia's economic expansion, for example, has led to a corresponding rise in this region's demand for energy. What's more, those countries are even more dependent on the Middle East than Japan is; their energy structures are as fragile as - if not more fragile than - our own. If we fail to consider the needs of Asia as a whole, the energy crisis of a single nation may very well put the entire region at risk.

The environmental side-effects of fossil fuel consumption (global warming, acid rain, etc.) are likewise global in nature and therefore demand a global perspective. Along with building more nuclear power plants in Japan, it is important for us to extend financial and technological assistance (for matters like operational safety and management of nuclear materials) to other Asian nations that are planning to develop nuclear energy programs. Providing this support would do more than serve the interests of our Asian neighbors. It would also contribute to Japan's own energy security and the world's environment.

We must also think about specific energy needs at the local level. Wind power, solar power, geothermal power and other forms of renewable energy rely on local climatic or geological characteristics. We need to choose local energy supply fitting to the regional characteristics between these renewable energies and other localized forms of energies, such as IPPs (which make full use of local industries) and RDFs (which participate in local recycling efforts). Of course, none of these localized forms of energy is likely to become a major source of power, but they play an important role in helping to decentralize energy generation and promote recycling.

ABSTRACT

Gregory Clark
President, Tama University, Japan

The problem facing Japanese society today is not hard to explain. To date it has been quite successful in using the values of an earlier, immediately post-feudal era with which to progress to where it is today. In this sense its progress resembles that of the north European societies - England and Germany especially. But inevitably these values begin to conflict with those needed for the running of a large modern industrial society. England and Germany have had over one hundred years gradually to make that transition. Japan is trying to do the same in little more than a decade.

Worse, it is trying to do this in the middle of a severe recession. In the process, it is making the same mistakes as the north European societies also once made. For when a recession occurs the natural instinct is for people to stop spending and for governments to try to economise. But as an economist called Keynes pointed out some time ago, in a recession it is important to do the exact opposite. People should be encouraged to spend and governments should do everything possible to stimulate the economy.

One reason for Japan's mistake could be the example of England and the US in the 1980's . It is true that these countries implemented major reforms in this period - enterprise restructuring, liberalisation, privatisation, smaller government etc. But the immediate effect of these reforms was severe recession. These economies were rescued from that recession by severe currency devaluation. Japan too should eventually undertake the same reforms. But that should only be done when Japan's economy shows some signs of recovery.

A key aspect of any recovery is encouragement for new industries, new technologies and new forms of investment. One such industry, surely, is expanding nuclear power. Many in Japan and the rest of the world worry about possible dangers. But people traditionally have worried about new technologies. Many once feared that railways, air or car transport were dangerous or would destroy the environment. Some even once opposed electric power. And so on. The history of mankind is the overcoming of these fears, and the continual opening of new technological frontiers.

This is not to say there are no dangers with nuclear power. But as with all new technologies, experience rapidly reduces those dangers. And people need to think of alternatives. Would we all be safer today if all transport was by horse or sailing ship? Nuclear power accidents may cause harm to some. But coal and oil supplied energy also have their disadvantages. They create air pollution. Resources are limited. Every year thousands are certain to die around the world in coal mining accidents. Are the lives of these men, and the tragedy caused to their generally young families, supposed to be less than the possible harm from nuclear power generation? Those opposed to nuclear power need to answer such questions. In particular they need to tell us how global warming can be reduced in a world that continues to rely on thermal electricity.

Love-Hate and Nuclear Power Stations

Masazumi Saikawa
Mayor, Kashiwazaki City, Japan

1. Did the 20th century make people happy?

2. Where will humanity -- and Japan -- be in the 21st century?

3. Society and nuclear power stations are troublingly inseparable.

4. Yet we work to realize a mutual love, and appeal to others to understand our efforts.

Revolution of Society and Nuclear Power Development in Japan

Masao Takuma
Tokyo Electric Power Company

I want to focus on following three viewpoints:

1. We can reasonably deduce that since the Meiji Restoration until quite recently "producer logic" has governed the conditions of the whole of economic society in Japan in order to overcome our disadvantage of having virtually no resources. For improving production efficiency, a centralized operation of industries, by concentrating authority on selected elite groups, must have been the most effective means. The system of the business world being divided into industries and protected and controlled by bureaucracy (the so-called "convoy system") is a typical arrangement designed with such intention, and the development of nuclear energy was not an exception. The problems existing between electricity consuming and producing districts have probably resulted from this system in the background.

   The origin of the word "technology" is said to be the ancient Greek word *"atireia"*, which means "to reveal what is concealed". "Technology" has something in common with philosophy and art in that they reveal what is concealed in nature and bring it to blossom. However, "technology" is also a creative process through challenging nature to force it to reveal what is concealed, and "technology", in that process, begins to assume autonomous movements, inflicting serious impacts on the global environment and human spirit, it is said.

   Once the elite group in control of some kind of technology begins to act as an autonomous force in a society operating under producer logic, such technology could eventually turn out to be unacceptable to society, however useful the technology. Maybe we need to ask ourselves if nuclear energy has not developed into a type of such technology.

   Furthermore, we are living today in an age where "consumer logic" prevails which requires priority be given to costs and services and the satisfaction of customers and in a globalized liberal economy where market principles rule. In such an environment, what is required of "technology" is the social acceptability of the technology rather than its usefulness.

   In this context, "the social performance" of nuclear technology and the elite group managing the technology is now being seriously questioned.

2. The world under the workings of producer logic is in a way a society of masculine or paternal logic, whereas the world of consumer logic may be contrasted as a society of feminine or maternal logic. Qualities such as symbiosis to allow diversity, trust between people, valuation of nature as environment, mutual understanding between producing and consuming societies are regarded as highly valuable today, but they cannot be fostered without a maternal toleration capacity.

   In this situation, the only way to successfully win the understanding and support of people for nuclear power, which may be a typical masculine and hard technology, is to moderate the manner of appealing for the introduction of a hard technology to society, because it is not easily practicable to replace a hard technology with some soft technology, like that for a renewable energy, in terms of its usefulness. New approaches different from those used in the past have recently been introduced. They include thoroughgoing information disclosure, creating informed consent and the participation of the general public in the determination process for policies and plans.

What is important is that the minds of the people in the elite group be directed sympathetically toward society and nature.

3. The present condition of our country which requires us to rely on imports for most of our natural resources should not change in future; however, society undergoes change with time. Furthermore, new restrictions being imposed on a global scale, such as those addressing global environmental problems could possibly further narrow down the range of options available for our domestic energy supply.

When utility companies were making strenuous efforts in support of the industrial rehabilitation and assurance of required energy supply for the survival of the 100 millions of our people after the last world war, an opportunity for the peaceful use of nuclear energy and nuclear power generation emerged in 1953. Our country promptly joined with England and others in accepting nuclear energy as a quasi-domestic energy resource and undertook to develop a system of "thermal neutron reactor — reprocessing and recycling of uranium resources — fast breeder reactor". This background has not changed as of today. Also, we should not fail to notice the fact that we hold, as a globally valuable infrastructure, technology, human resources, and facilities and systems capable of instilling superior safety culture and high quality into products, which we have fostered in the process of our development and industrial application of nuclear energy. I believe the importance of this infrastructure of ours for developing countries is very significant when we consider the need for the resolution of the problems of environment and energy compatibility as we enter the 21st century. However, in this changing world we must always keep in their mind the proverb; "Substance does not change with the passing of time".

Industrial Policy during the Transition from a Crony Society to a Civil Society

Yoshinori Yamaoka
Managing Director of Japan NPO Center

Japan, in a period of transition, is moving from "a crony society" to "a civil society "— or, more specifically, from a Japanese-type crony society to a global-type civil society.

The change was triggered by the Plaza Accords in 1985 and the resulting sharp appreciation of the yen, which caused Japanese manufacturing industries, including auto and electric-appliance makers, to increase their investments in the United States and other countries. Industries that had been protected by the Japanese crony-society structure were then faced squarely for the first time with the rigorous demands of a civil society. And, by and large, they acquired the Civil-Society-type management experience needed to survive.

During the same period, however, industries that were focused on the domestic market remained protected by the crony system, and saw their strengths further sapped in the so-called bubble economy. A series of bankruptcies beginning last year and continuing, and the coming to light of numerous cases of collusion between public officials and the private sector, demonstrate clearly the need to complete the conversion to a civil-society-type management structure. Not merely industry, but the whole of society, is obliged to fully make the change.

This is symbolized by the NPO Act—the Nonprofit Organizations Act—which became law on March 19. Originally called the Act to Promote Citizens' Activities, it was proposed by members of the House with a "people power" background, with the aim of simplifying the procedural mechanism by which citizens' organizations can become juridical persons. Its direct effect will be little more than that; its potential significance is greater, in that it breaks through —however slightly—the juridical-person wall in the Civil Code, which itself came into effect exactly 100 years ago. The law also contains the requirement that such organizations becoming juridical persons release information on their activities. This will contribute to general transparency and help nonprofit organizations avoid various bureaucratic pitfalls -- an essential condition in the shift from a crony to a civil society.

Although I am a layman in the nuclear field, I believe the nuclear industry, too, is finding itself newly challenged in the circumstances of the societal shift now in progress. I hope to discuss this matter with the other panelists.

[MEMO]

[MEMO]

PUBLIC TALKS (14:30－17:00)

"Energy and Nuclear Power－What Are Problems?"
at Reception Hall, Tokyo International Forum

Some 92% of Japan's CO2 emissions stem from energy use, and COP3 has committed the country to make a 6% cut in its greenhouse-gas emission levels by the year 2010 compared with 1990 levels. It is a pressing issue for resource-poor Japan to maintain a stable supply of energy while trying to meet its commitments. This forum will focus on the problem of energy supply and demand from the public's perspective, offering a venue for the exchange of opinions on the nuclear power's role, and the ways to promote it. As several measures have already been instituted to enhance information disclosure and the transparency of the decision-making process since the sodium leakage at "Monju", participants will be asked to give their evaluation of them so as to effect better consensus-making in the future.

[MEMO]

[MEMO]

YOUNG GENERATION'S FORUM (17:30－19:30)

"What Needs To Be Done Now for Nuclear Energy's Future"
at Reception Hall, Tokyo International Forum

The development of nuclear power in Japan is suffering from a situation of public mistrust, owing to a series of mishaps in its execution. Nevertheless, nuclear power still retains the strong potential of being an energy source that can contribute to human society well into the 21st century, because of its relatively few resource restrictions and the light burden that its generation places on the environment. To ensure that nuclear energy continues to offer such potential in the coming years, new perspectives and outlooks must be adopted over a wide sphere of development-related areas. This forum will take up concrete and constructive proposals submitted by young people, as they will be the leaders of society in the first part of the next century. A free exchange of opinions will be welcomed among forum participants, encouraging a consideration of the future shape of nuclear energy, including various problems facing R&D today.

Presentations and discussion

[M E M O]

[MEMO]

WEDNESDAY, APRIL 22

SESSION 3 (9:00－12:00)
"Nuclear Fuel Cycle: Review in the Long-term"

The plans by industrialized nations for the nuclear fuel cycle call for the completion of the whole program by the early part of the next century, when final storage will begin of spent fuel and high-level radioactive wastes (HLW). To that end, a variety of R&D efforts are vigorously being carried out. While reflecting on recent changes in the situation, this session will examine the results of specific R&D efforts to date, as it has come time to discuss the ways each should be advanced in the future from a long-term perspective. The activities of a number of countries will be reviewed, as participants explore the various options open to the nuclear fuel-cycle plan. A reexamination will also be made of the ways R&D programs are being advanced to devise flexible back-end measures.

Panel discussion
Discussion with the floor

The back-end of the nuclear cycle : a summary of the situation in France

Claude MANDIL
General Director for Energy and Raw Material
Ministry of Economy, Finance and Industry - FRANCE

France's policy regarding the back-end of the nuclear cycle has now reached a particular level. Large industrial investments have been made and are now operational, while research programmes are being implemented in preparation of the future, and in particular for the decisions due to be made in 2006 concerning management of long-life radioactive waste.

<u>1/ A highly-performing and consistent industrial tool</u>

France's network of nuclear power plants includes 57 operating reactors. France opted for the reprocessing-recycling approach and is equipped with the corresponding industrial capacity :

- the reprocessing plant in La Hague ; this site also works to meet the requirements of Japanese, German, Belgian, Dutch and Swiss electricity supply companies ;

- the MELOX plant for the production of mixed-oxide fuels (MOX) ; this site supplies both domestic and export markets. New investments will enable the plant to produce fuels for boiling water reactors ;

- the number of MOX reactors in France is increasing and could reach 28 in years to come.

<u>2/ Research programmes in preparation for the future</u>

In line with the December 30, 1991 Law which defined a democratic and transparent process, France has conducted intensive research on management of high-level radioactive waste in three key areas :

- separation-transmutation ;

- study of underground disposal in deep geological layers, particularly by the setting up of underground laboratories ;

- surface conditioning and storage.

The aim of this research is to allow Parliament to make decisions in 2006 regarding the future of this waste.

The Government recently reaffirmed its commitment to continuing the research on these three key areas (press conference given by the Minister of Economy, Finance and Industry on February 2, 1998).
As far as the first area of interest is concerned, research into transmutation will be continued, despite the decision to shut down SUPERPHENIX permanently, notably because of the relaunch of PHENIX and thanks to international cooperation.

As for study of underground storage, three potential sites have been identified for the building of underground laboratories. The Government is expected to decide on which sites are to be chosen (at least two) in the next few weeks.

Lastly, research in the third area will be stepped up : the funding allocated to the programme will increase by 15% in 1998 and again by 20% in 1999.

Overall with these research programmes, France could usefully pursue its programmes for international cooperation, particularly with Japan.

3/ A flexible strategy

The Government wished to ensure that the decisions already taken concerning the back-end of the cycle were sufficiently consistent, and asked M. MANDIL and M. VESSERON, director in the French Ministry of Environment, to make sure that the strategies implemented by the various nuclear operators would not result in a stalemate.

Some ten scenarios likely to be implemented up to 2050 were studied, from direct storage to the most sophisticated reprocessing and incineration. It was felt that no irreversible decision -this is a decision ruling out a particular scenario- had to be made until 2006. M. MANDIL and M. VESSERON advised to carry on with implementing the current flexible strategy until 2006, namely to continue research in the three key areas defined in the 1991 Law, and, in industrial terms, carry on the reprocessing and recycling of most of the spent fuel.

The interim report is currently being studied by the Parliamentary Office for the Assessment of Scientific and Technical Choices.

Summary of Presentation

In-Soon Chang, Ph.D.
President
Nuclear Environment Technology Institute
Korea Electric Power Corporation

Nuclear power is the major source of electricity in Korea and handles the base load generating more than one third of the country's electricity. The planned expansion of this nation's nuclear generating capacity is an attempt to curb the increasing dependence on fossil fuel imports. However, proper treatment and disposal of radioactive waste have been a national concern. Various state-of-the-art volume reduction technologies have been adopted to reduce low- and intermediate-level radioactive wastes(LILW) from power reactors. Based on experience and technology accumulated through the construction and operation of domestic nuclear power plants for the past several decades including the introduction of the Korean Standard Nuclear Power Plant (KSNP), the Korea Electric Power Corporation (KEPCO) is implementing the national radioactive waste management project. A disposal facility for LILW will be in operation in about 10 years from now.

The national acceptability of a particular back-end strategy depends on Government demonstrating a long-term commitment to nuclear power and providing a clear environment of a chosen strategy. In the context of the nation's primary objective to improve energy security and sustain economic development, the two priorities are energy conservation and protection of the environment. The national policy on the long-term management of spent nuclear fuel is to wait and see for the time being. As regards direct disposal, it is observed that despite the comparative novelty of the technology involved and potential problems with regard to its public acceptability, this route currently commands substantial international support. To date, however, there has been no commercial scale operation of direct disposal facility of spent fuel or high-level radioactive waste(HLW). In the mean time, to provide flexibility in spent fuel management, MOX fuel utilization through international cooperation might be considered. Spent fuel will be stored until a decision of direct disposal or recycle will be made.

The major issues to be addressed in relation to direct disposal of spent fuel concern the means by which man and the environment can be adequately protected from the harmful effects of waste in a way to minimizes transfer of responsibility to future generations. These problems should be resolved by R&D. R&D on deep geologic disposal has been conducted by relevant research organizations in accordance with a long-term plan established by the Korea Atomic Energy Commission. Basic research program on the following four areas have been continued: performance assessment and disposal system development, geoenvironmental study, engineered barrier development, and radionuclide migration study. A joint research program for the development of DUPIC (Direct use of spent PWR fuel in CANDU reactors) fuel cycle technology is also being conducted in partnership with Canada, USA and the IAEA.

Nuclear Fuel Cycle Back-end Policy in Germany

Helmut Engelbrecht, Preussen Electric Co., Germany

From the very beginning of nuclear industry in Germany up to today the nuclear fuel cycle back-end was always in the focus of public and political interest. Due to the changing attitude towards nuclear issues, strategic long-term approaches to provide closed fuel cycle services failed and alternative solution had to be developed. With the increasing competitive pressure on electricity generation, in future, only commercially attractive technics and services will have a chance to be implemented. The challenge to German nuclear industry is to look for new or at least economically improved fuel cycle procedures without endangering the established industry routine.

International co-operation on fuel cycle issues, we trust, will help to give nuclear generation a successful future.

"Nuclear Fuel Cycle: a Long-Term Point of View from Japan"

Toshiaki Enomoto
Director and Deputy Executive General Manager
Nuclear Power Division
& Engineering R&D Division
Tokyo Electric Power Company

1. Recent Nuclear Power Generation in Japan

Nuclear power generation in Japan now amounts to a total of 52 plants with an aggregate capacity of 45,083 MW, generating about 35% of the total electricity demand in the fiscal year 1996. Its technology is reaching the stage of maturity.

2. The Significant Role of Nuclear Power Generation To Date--Benefit of the Light Water Reactors

Through developing and maintaining light water power plants on a significant scale until now, Japan has enjoyed benefits from acquiring bargaining power on imports of fossil fuels, and as a result, it has restrained the escalation in the cost of fossil fuels.

As a consequence of the dissolution of the cold war and the economic globalization, the strategic significance of energy resources is less tangible even though temporarily while the competition between different energy resources is intensifying.

3. The Significant Role of Nuclear Energy in Future — Benefit of Technical Innovation

We can define the benefit of having developed and maintained the light water reactor up to date as the merit gained from "the first stage of nuclear energy development". The nuclear power, however, will have much greater potential capability, if technical innovation is made in feature exploiting its characteristic nature of high energy density. If we think of our future, the importance of this potential capability of nuclear energy will not diminish even after light water technology has matured. In order to fully exploit this great potential of nuclear energy, our long term effort towards "the second stage of nuclear energy development" is required.

4. Toward Future Nuclear Energy Development

The important points in the second stage development effort are the further enhancement of its economies and the broadening of the range of nuclear energy development programs.

When we consider the global conditions surrounding nuclear energy today, it seems longer time can be affordable for such developments. Accordingly, it seems important in the second stage of nuclear energy development to establish flexible strategies not bound by the course of development so far pursued, as well as careful analysis and observation of future energy market tendencies.

While Japan has set technology development as one of its mainline national policy, if we extrapolate the current trend of globalization of economy, it is important to promote technical development through international cooperation, and, with those, to develop technologies that can be applied in many places around the world. Also it can be pointed out that it is important to survey solutions to other internationally common issues under international cooperation.

Such technical development programs need to be advanced steadily and solidly from a long-term point of view. This, on the other hand, means that such development process is not subject to the scrutiny of the market mechanism. Therefore, it should be essential for the sound advancement of technical development programs to have continuous scrutiny with uncompromising eyes, including by third parties to assure that the program is being performed rationally and efficiently. In order to stand at the frontier of technical development, it is necessary to institute a framework that could reorganize technology development, if it should be needed through continuous technical evaluation.

The public sector, including the government, is looked to actively participate in promoting a symbiotic measures with society, as urgently demanded by local society around nuclear installations, as part of an important energy policy, in addition to the important role it plays as the core to advance development of big science.

Spent Fuel Management

by
Dr William L Wilkinson
President, British Nuclear Industry Forum

ABSTRACT

The two options for managing spent nuclear fuel, namely, **reprocessing** with recycle of plutonium and uranium and **direct disposal** are discussed based on experience in the UK.

The reprocessing option is well proven. It is available now and operating well under international safeguards. Direct disposal may prove to be technically feasible in the future. The economic differences between the two are likely to be small and likewise the environmental impact. So far as public acceptability is concerned the main issue is the geological disposal of radioactive waste and this is common to both options. Long term sustainability is a key issue and only recycling can achieve this.

The choice between the two will depend on many factors and utilities may come to different conclusions depending on the individual circumstances at the time. Both options are likely to be pursued in parallel over the coming years. It us unlikely that new developments will have a significant impact on spent fuel management policy, at least in the medium term.

[MEMO]

[MEMO]

SESSION 4 (13:30－17:10)

"Advanced Technology and Nuclear Energy: Progress and Prospect"

In the past half century, nuclear technology has advanced dramatically at the same time it has mutually interacted with the development of advanced technologies in other fields. The progress of nuclear technology will not only lead to the expansion of the use of nuclear energy, but is expected also to contribute greatly to the advance of other scientific fields and industries, besides improving our living standards. It is thus particularly important for Japan which has pinned its future on the creation of science and technology always to maintain a stance of actively engaging in the development advanced fields, with nuclear technology serving as a locomotive of growth for science and technology in general. This session will review the process by which nuclear energy has developed in concert with its interaction with other advanced technologies, looking at specific examples that highlight the special characteristics of nuclear technology, and will also look at the present and future possibilities. Short film/video clips will be presented, along with explanations. Also, the role of radiation long interrelated with human being will reviewed in this session.

Panel discussion
Discussion with the floor

The Dynamics of Science and Technology Development

Toward the 21st Century

by

Fumio Kodama

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Abstract

The cumulative nature of technological advance has been described by R.Nelson and S.Winter as following a natural trajectory: today's research produces successful new technology and the natural beginning place for tomorrow's searches. They discuss a "neighborhood" concept of a quite natural variety: once a system proves to be a success, it is possible only to make minor changes.

However, a set of technological possibilities sometimes consists of a number of different classes of technology. Within any of these classes, technological advance may follow a particular trajectory. At any given time, all R&D may be focused on one class of technologies with no attention paid to other classes of technologies. These path dependencies, which are often involved in technology development, indicate the possibility that the system will *lock* into paths that are not globally optimal. This might be an effective theory for discussing how to get out the stalemate that seems to be occurring

in the Japanese nuclear development, especially in the FBR(Fast Breeder Reactor) program.

The conventional policy discussion has been framed around what is called a pipeline (or linear) model of innovation: it follows a process of research, development, capital investment, production, and distribution. Our review of the history of high-tech development will reveal that the leading innovators at each stage came from different industrial sectors while collaborating in joint research across industry boundaries. Furthermore, each time a change in leaders occurred, dramatic improvements in technological development were made. Therefore, the innovation process should be thought of as multilayered. In this multilayered structure, changes in leaders could be taken to mean that leaders move from an innovation process in one industry to a new innovation process in a different industry, solving technological problems as they go. The innovation process, then, becomes a *spiral* innovation model with three-dimensional cycles.

The essential feature of this innovation model is the *one-to-one* correspondence between technological approach and industrial sector. Each industry tries to solve a problem using specific technological competencies accumulated in its industrial sector. Therefore, the high-tech R&D process is *interindustry* competition, instead of interfirm competition within a given industry. Indeed, J. Utterback collected and complied the combined sample consisted of 46 discontinuous innovations, of which 26 are product discontinuities and 20 are process discontinuities. He finds that nearly one-quarter of the 46 innovations come from inside the industry (12 out of the 46 cases), while the remainder -- a larger majority (27 out of the 46 cases) -- come from *outside* the industry. All of these imply that the interindustry competition might be effective in *unlocking* the trajectories that are not globally optimal.

However, the interindustry competition is a necessary condition for this unlocking, but is not a *sufficient* condition for bringing us to restart following a new trajectory. In this regard, we can draw some lessons from the experiences in the high-tech development. Recent innovations in *mechatronics* and *optoelectronics* make it more appropriate to view innovation as the *fusion* of different types of technology rather than as a series of technical breakthroughs. Fusion means more than a combination of different technologies; it invokes an arithmetic in which one plus one makes three. In the future, we will see an enhancement of fusion beyond the manufacturing. The idea of ITS (Intelligent Transport System), for example, will not be realized without fusion in a societal system involving both the transport infrastructure and individual transport commodities developed by private companies. Moreover, the nuclear technology development is not just a big science project, but entails a large and complex system development. In addition, it is destined to construct a self-sustained, autonomous, and closed system involving a careful management from fuel supply, power generation, through reprocessing of the spent fuel. Considering this insurmountable tasks waiting us ahead, we need not just construction of a societal system, but what I call "policy fusion" is an absolute necessity.

In conclusion, the enhanced fusion in several areas will become a major source for innovations in the coming 21st century. Since fusion implies cooperation, it is diametrically opposed to the interindustry competition. An intrinsic process of navigating us to a new trajectory, however, involves a dynamic interaction between the two concepts. This creation dynamics should be a key concept in the next century toward realizing a synergy between nuclear development and high-tech development.

Computers, in relation to Atomic Energy

Shojiro MATSUURA
Japan Atomic Energy Research Institute

Atomic energy based on nuclear science and technology, by definition, falls within the category of quite a comprehensive nature ranging multiple diciplines. Accordingly, development in the atomic energy R&D takes so-to-say a spiral course that once progress occurs in certain individual fields of science and technology other than the atomic energy, it evokes and prompts another development in the atomic energy, and vice versa.

One good example of this interactive process between the atomic energy and other fields is that with the computer technology. Both computers and the atomic energy, born nearly at the same point of the human history, have, from the very beginning, worked as the driving force to one another.

In this review the speaker presents the history of the interactions between computers and the atomic energy with their spiral evolution by three periods of time, i.e.;

(1) the first period, from 1960's through 1980's, in which nuclear R&D organizations played an aggressive role for the development of computers, and the progress in the solid state electronics brought the explosive computational capabilities available to mankind,

(2) the second period, the decade of 1990's, in which nuclear R&D organizations became to adopt, as their powerful means, real-time and/or large-scale computations owing the advent of high performance computers, and

(3) the third period, through present, in which nuclear R&D organizations are proceeding into the new era of advanced computational science and engineering based on the abundant capability of massively parallel computers.

Using the research results made by the Japan Atomic Energy Research Institute, Power Reactor and Nuclear Fuel Development Corporation, Central Research Institute of Electric Power Companies and others, the speaker intends to illustrate the spiral evolution of computers and the atomic energy technologies.

Nuclear Technology towards the 21st Century
— Advancement of Nuclear Technology —

Hiroshi Machiba
General Manager, Nuclear Energy Systems, Toshiba Corp.

1. Preface

Commence of commercial operation of ABWR brought a new epoch in nuclear technical development and hereafter ABWR plants will be constructed as a standard of BWR. So, firstly the developed technology in ABWR and the technical development of ABWR Ⅱ towards future will be explained as an example of advancement of nuclear technology. Secondly advancement of nuclear engineering will be explained, which aims at the cost reduction of plant. Finally developed technology of preventive maintenance using automatic equipments will be shown as a sample of advancement of technology in the operating plant.

2. Completion of first and second ABWR plant and its Developed Technology

Tokyo Electric Power Company's Kashiwazaki-Kariwa nuclear power plant unit 6, which is the first commercial ABWR plant in the world, and unit 7, which is the second one, started the commercial operation respectively on November 1996 and on July 1997. ABWR's goal of development are improvement of safety & reliability, improvement of operability & load following capability, reduction of costs and reduction of occupational radiation exposure. Now the operating ABWR shows the more excellent performance than expected. Moreover further technical development for the future ABWR Ⅱ plant are now under study.

3. Advancement of Nuclear Engineering

Advancement of Nuclear Engineering aims at ① Preparation of standard data base of ABWR as latest BWR standard and ② Electric information exchange between plant maker, vender and utility. The former aims at increase of efficiency of plant construction by standardization of information and its purpose is preparation of standard data base based on construction experience, management of information structure and standardization and computerization of work process. The latter aims at increase of efficiency of plant construction by the timely and accurate information exchange in electric form. In future it will be developed to electric information exchange with the administrative agency to perform the efficient permission of plant construction.

4. Technical Development considering the extended term of light water reactor

Extension of life of operational nuclear plant is important , because of the extended term of light water reactor and the difficulty of having a new nuclear site. Recently, stress corrosion crack of reactor shroud was discovered in aged BWR plant in Japan and the other countries. So, it was expected to develop method of work to exchange the reactor shroud for one with higher corrosion-resistance materials. Therefore, the reactor shroud exchange method which key technologies are remotely controlled was developed and applied it to nuclear plant.

The Status Quo of Medical Technology Using Radiation

Yukio Tateno
Senior Research Counselor
National Institute of Radiological Sciences, Japan

Unique Russian Technologies Related to Nuclear Energy

(Sergey Zykov, Deputy Executive Director of International Science and Technology Center, Moscow)

Influence of Nuclear Industry on the Other Branches of Russian Economy.

Due to the historical peculiarities of our country development, the creation of nuclear industry was first of all linked to the development of nuclear weapons. Under the extremely hard economic conditions immediately after the end of the second world war the large scale activities were started aimed on the emerging of completely new industry branch starting practically from zero level.

The priority of such political incentives as willing to obtain new type of weapons may, perhaps, be unattractive from the panhuman point of view, but now I want to step apart from initial motivations and to analyze the situation just from the economical point of view.

The science, formerly always suffering from the lack of funds and supported mainly by the rich sponsors and minor government support of universities, suddenly found itself in the unique situation where at its disposal appeared significant material resources and the almost unlimited support was granted from the upper political level.

Unfortunately, the recognition of the science's ability to be a real source of economical prosperity by itself, came to main business organizations much later than unique power of science was recognized by politicians. Thus, first real significant investments into science were made mainly under the strong political motivations.

The results appeared to be remarkable. Besides solving the "major task", it became necessary to solve "on the way" a great number of supplementary problems not directly related to nuclear science and technology. This "side-tasks" by themselves proved to have enormous internal potential capable of self-sustaining development and extremely useful for other, non-nuclear applications.

The most impressive examples of such developments may be the emerging of computer technologies initially oriented just on solving weapon design problems. Now it is impossible even to imaging the everyday life of any ordinary citizen without computers or at least calculators. The other example was the necessity of creating industry capable of producing adequate measurement and control instrumentation. This led to the development of vacuum and semiconductor technologies that formed the basis for the further commercial applications resulted in the modern boom in industrial and home television, electronics, etc. The need for new chemical processes involving unusual aggressive and exotic media gave a rise to the material science. Even such branches as medicine and geology, mining and construction were greatly influenced by the "forced" progress in nuclear industry.

Even the electricity power production on nuclear plants itself was essentially the "byproduct" of plutonium production both in Russia and US. In this area we even have a sort of a paradox because in case if nuclear reactors would be designed initially for the purpose of power production the final concepts might be with high probability very different from the standard contemporary designs. In particular, the uranium–thorium fuel cycle have in many cases serious advantages in comparison with present uranium-plutonium standard inherited from the weapon era.

After the impressive demonstration of efficiency of serious investments in science its power became evident already for wide business circles and for politicians already without any connection to the initial defense tasks. Thus, the nuclear industry became the "birth point" for many scientific technological and industrial applications that are now stand firmly on their own feet and their nuclear origin not so obvious.

The Examples of Nuclear Related Technologies Implemented in RF.

In Russia all nuclear related technologies were initially developed in frame of Minatom structure (the previous name of the Agency was Ministry of "middle machine building"). All activities in this branch of industry were completely funded by the state budget. The majority of supporting infrastructure was also incorporated into the Ministry.

The number of different technologies developed in frame of Minatom activities is too large even for simple listing of them. I would like just to describe few of them. Some of the technologies will be illustrated by video materials prepared at the marketing office of Minatom, the others will be just mentioned.

Russian Federation was the pioneering state in the development of nuclear powered fleet. The geographical layout of Russia made it extremely important to have the possibility of using Arctic Ocean as a route for supplying Siberian and Far East regions. The role of nuclear icebreaker fleet for providing such a possibility can not be underestimated. The natural continuation of the nuclear fleet development was the emerging of the concept of floating nuclear power units for energy supply at the remote locations where the construction infrastructure is absent and long power supply lines are not economically beneficial.

The other example that may seem to be rather far from nuclear origin is the development of superconductivity technologies. The way of superconductivity utilization from pure laboratory applications to large scale industrial implementation was defined at initial steps by the necessity of production of high power magnets for particle accelerators. The majority of technological developments in this area in Russia are now concentrated in the Institute of Inorganic Materials named after academician Bochvar. This is the leading Minatom Institute dealing also with fission material technologies and waste disposal schemes.

One of the important civilian outputs from the military branch of nuclear energy research became the development of precise explosive technologies. Now the specialists from Russian military research centers (Sarov and Snezhinsk) are capable of providing services in such unique areas as explosive destruction of outdated buildings, reinforced concrete basements; precise cutting of large metal constructions (ships, submarines) by the so-called "cord-explosive" technology; effective borehole drilling with explosive perforators, etc.

Development of complicated chemical processing plants besides other innovations required application of different filtration procedures, sometimes in a very unusual conditions. One of the results of such motivated research was the creation as a separate task production of a variety of filter materials and devices. This materials include the range from the fabric filters for personnel protection against dust and aerosols up to ceramic filters for aggressive media and nano-filters based on particle induced micro-holes in different thin films.

The self-sustaining production brunch is now the manufacturing of radioactive sources for the large range of scientific, technical and medicine applications.

ISTC and new technologies.

Global changes in the former Soviet Union led to the qualitatively new situation in the funding conditions in scientific organizations. The governmental programs of scientific development were dramatically reduced and a large number of scientists, first of all in defense oriented research establishments experienced sharp reduction of governmental funding. At the same time the development of private business in CIS had not reached the point when corporations are able to develop long term scientific programs driven by potential commercial interest.

The potential risk of "brain drain" of the scientific and technical specialists from the defense related areas was the major motivation for establishing in Moscow of International Science and Technology Center (ISTC). The Center was established in 1992 by signing the intergovernmental Agreement by initial Parties: European Atomic Energy Community and European Economic Community; Japan, Russian Federation and United States.

The main goal of the ISTC as defined in Agreement is to develop, approve, finance, and monitor science and technology projects for peaceful purposes, which are to be carried out primarily at institutions and facilities located in the Russian Federation and, if interested, in other states of the CIS and Georgia.

The objectives of the Center shall be:

- To give weapons scientists and engineers, particularly those who possess knowledge and skills related to weapons of mass destruction or missile delivery systems, in the Russian Federation and, if interested, in other states of the CIS and Georgia, opportunities to redirect their talents to peaceful activities;
- To contribute thereby through its projects and activities: to the solution of national or international technical problems; and to the wider goals of reinforcing the transition to market-based economies responsive to civil needs, of supporting basic and applied research and technology development, inter alia, in the fields of environmental protection, energy production, and nuclear safety, and of promoting the further integration of scientists of the states of the CIS and Georgia into the international scientific community.

Now, on the sixth year of its existence and after almost five years of actual operations, ISTC is a mature international organization with unique experience in managing R&D projects in CIS countries. The Center supported projects enjoy tax-free status within CIS and have exemption from customs fees. More than 280 CIS institutions and about 17000 specialists participate now in ISTC projects at different levels. The overall funding has reached $160M and the number of supported projects exceeds 540.

Among unique features of ISTC projects are direct payments to individual project participants, full transparency of any project activities even at the closed sites within Minatom. During past years ISTC involved as funding Parties Sweden, Finland (now acting within European union), Norway, and Republic of Korea (now finishing accession procedures). CIS countries participating in ISTC projects now include besides Russia also Kazakhstan, Belorussia, Kyrgyzstan, Armenia and Georgia.

Initially ISTC was completely relying on funding from governmental sources, but now the Center is actively developing Partner program aimed on the attraction of private and other funds from entities interested in establishing business relations with CIS countries. In case of projects consistency with ISTC goals and objectives the Center may provide Partners with its unique infrastructure adjusted to the specific local conditions of CIS and that have proved its efficiency during more than four years of active operations.

The completed ISTC projects (now it is about 40 of them) give an examples of successful development of new technologies in the areas of environmental monitoring and remediation, safety of nuclear reactors, production of stable isotopes and others. At present stage ISTC may be considered as almost ideally adjusted infrastructure in CIS for the promotion of international R&D works at the pre-commercialization stage.

The Role of Radiation in the Origin and Evolution of Life

Mitsuhiko AKABOSHI (Research Reactor Institute, Kyoto University)

Kyoto University International Conference on "The role of radiation in the origin and evolution of life" was held on 1~5 March, 1998 at Hotel Sanroute Kanku.
The intent of the conference is described below. In the present report, the substance of the conference will be outlined together with the histrical review of the research activities associated with origin and evolution of life

After the pioneering work by Miller and Urey in 1953, a great number of studies on the chemical evolution and origin of life have been carried out using a variety of energy sources, such as electric, heat, ionizing, shock wave, ultrasonic, ultraviolet, etc. These energy sources are widely distributed through out the universe and on the Earth. Energetic UV-rays induced chemical changes in the upper atmosphere while those less energetic are able to reach the surface layers of the primitive ocean. Close to the earth 's surface, electric discharges in the atmosphere synthesized a variety of compounds which could be protected from further degradation in the atmosphere by rainout processes. Heat from volcanos has been useful both for chemical reactions in the atmosphere as well as on peripheral lava surfaces. Of primary importance for efficient chemical synthesis is the specific action of a given type of energy, not its abundance.

Ionizing radiation was probably widely distributed on the early Earth and might induce synthesis of the organic molecules needed for the chemical evolution and origin of life. Once life appeared on the Earth, ionizing radiation may have produced mutations leading to a more rapid diversification of life forms in the Precambrianera.

The number of studies has been limited directly testing the possible role of ionizing radiation on the chemical evolution and origin of life, mainly because of experimental difficulties. In recent years, however, there is growing evidence of the importance of ionizing radiation in the origin and evolution of life. The main objective of this conference is to stimulate activity in this field and to gather specialties of all disciplines to critically evaluate the possible role of ionizing radiation on the origin and evolution of life on the Earth and beyond.

The organizing committee is expecting an exciting exchange of ideas among the participating scientists. Those interested in obtaining further information concerning this meeting should contact
Professor Mitsuhiko Akaboshi (Research Reactor Institute, Kyoto University)

[MEMO]

[MEMO]

Short Biography of Chairmen, Speakers, and Panelists

Members of the Program Committee for the 31st JAIF Annual Conference

Chairman:	Hiroyuki Yoshikawa	Professor Emeritus, University of Tokyo
Members:	Ryukichi Imai	Professor, Kyorin University
	Hitoshi Kume	Professor, Chuo University
	Shojiro Matsuura	Vice President Japan Atomic Energy Research Institute
	Toshiki Miyamoto	Chairman Nuclear Energy Steering Committee Japan Electric Manufacturers' Association
	Tokunosuke Nakajima	Former Professor, Chuo University
	Tomio Sudo	Former Mayor of Tokai Village
	Yoshihiko Sumi	Chairman Committee for Nuclear Power Development Federation of Electric Power Companies
	Atsuyuki Suzuki	Professor, University of Tokyo
	Kazuko Tamura	Senior Writer and Editorial Writer Kyodo News Agency
	Katsuya Tomono	Executive Vice President Tokyo Electric Power Co.
Observers:	Tsutomu Imamura	Deputy Director General Atomic Energy Bureau Science and Technology Agency
	Tomihiro Taniguchi	Deputy Director General Agency of Natural Resources and Energy Ministry of International Trade and Industry

OPENING SESSION

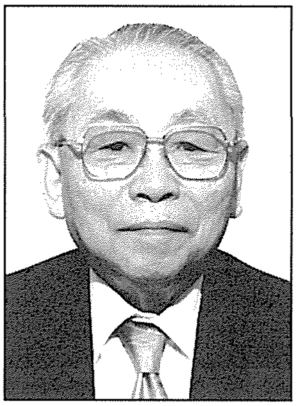
Soichi Iijima

Date of Birth : November 28, 1922
Academic & Professional Career:

1946 Graduated in Medicine at Nagoya Imperial University
1947-52 Studied pathology at postgraduate course of Nagoya University
1961 Professor of Pathology at Hiroshima University
1969-77 President of Hiroshima University
1978 Professor of Pathology at Nagoya University
1980 Dean of Medical School of Nagoya University
1981-87 President of Nagoya University
1988-91 Senior Consultant of the Department for General Affairs of Aichi Prefecture
1975-87 Member of Council on University Foundation, Ministry of Education
1977-83 Member of Central Council on Education, Ministry of Education
1984-87 Member of National Council on Educational Reform, Government of Japan; Chairman of Higher Education Division etc.

At Present:

President of Aichi Arts Center
Honorary Professor of Nagoya University
Honorary Professor of Hiroshima University etc.



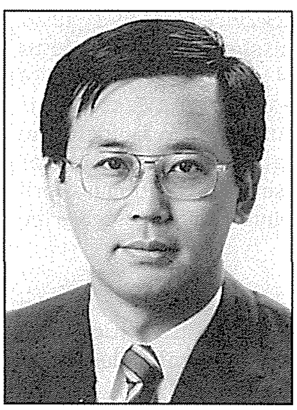
Takashi Mukaibo

Date of Birth : March 24, 1917

1939 B. S. in Engineering, the University of Tokyo
1947-54, 1958-59 Associate Professor of the University of Tokyo
1954 Ph. D. in electrochemistry, at the University of Tokyo
1954-58 Science Attachê, Embassy of Japan in USA
1959-77 Professor of the University of Tokyo
1968-69 Dean, the Faculty of Engineering, the University of Tokyo
1977-81 President, the University of Tokyo
1981-91 Acting Chairman, Japan Atomic Energy Commission
1992- Chairman, Japan Atomic Industrial Forum, Inc.

1983- President, Japan Association of Engineering Education
1985- President, Japan Society for Science Policy and Research Management
1989- President, Engineering Academy of Japan

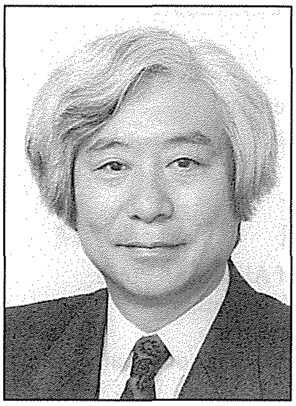
Awards:Order of Gorkha Dakshin Bahu, First Class, His Majesty a Government of Nepal (1977); Commondatore Al Merito Bella Republic Italiana (1980); Ordem Nacional do Cruzeiro do Sul, Brasil (1982); the Henry de Wolf Smyth Nuclear Statesman Award, American Nuclear Society and American Atomic Industrial Forum (1984); Ordem de rio Branco (Grande Official), Brasil (1988); the First Class Order of the Sacred Treasure (1989), etc.



Sadakazu Tanigaki

Born on March 7, 1945

1972 Graduated from Faculty of Law, University of Tokyo
1983 First elected Member of the House of Representatives from Kyoto (Elected as LDP member of H.R. six times until now.)
1988 Parliamentary Vice-Minister of Posts and Telecommunications
1990 Parliamentary Vice-Minister for Defense
1991 Chairman, Committee on Communications, H.R.
1993 Member, Deliberative Council on Political Ethics, H.R.
1995 Chairman, Committee on Rules and Administration
1996- Director-General, Election Bureau, Liberal Democratic Party (LDP)
1997- Minister of State for Science and Technology; Chairman of Atomic Energy Commission of Japan

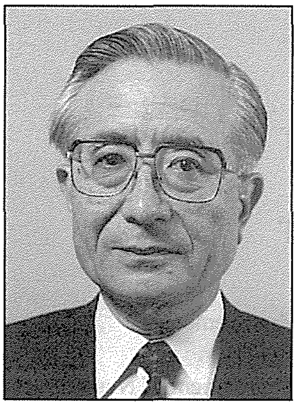


Hiroyuki Yoshikawa

Born on August 5, 1933

1956 Bachelor of Engineering(Precision Engineering), University of Tokyo
1956 Research Member, Institute of Physical & Chemical Research, Tokyo
1963 Doctor of Engineering, University of Tokyo
1966 Associate Professor of Engineering, University of Tokyo
1967 Senior Visiting Fellow, University of Birmingham, U.K.
1977 Visiting Professor, Technical University of Norway
1978 Professor of Engineering, University of Tokyo
1989 Dean, Faculty of Engineering, University of Tokyo
1990 Vice President, University of Tokyo
1993 President, University of Tokyo
1997 Science Advisor to the Minister of Education, Science, Sports and Culture
Apr. 1998- President, University of the Air

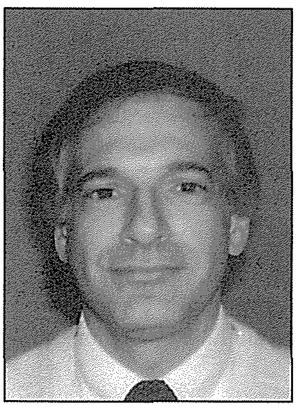
His current professional affiliations include : Chairman of Committee of Intelligent Manufacturing System Promotion, MITI ; Councillor of STA ; President of Japan Society of Precision Engineering ; Member of Council of Industrial Technology, MITI ; President of Science Council of Japan ; President of Japan Society of the Promotion of Science. He received Education Award from Society of Manufacturing Engineers (1995), Japan Prize (1997), etc. His publications are "Robots and Human Being""Reliability Engineering""Computer Graphics."



Sho Nasu

Born on September 19, 1924 in Sendai

1948 Graduated from Political Sciences Courses, Law Department, University of Tokyo
Entered Kanto Haiden Co.
1951 Entered Tokyo Electric Power Co., Inc. (TEPCO) (through the reorganization of the electric power industry)
1977 Became Director in charge of General Affairs Department, TEPCO
1984 Became President, TEPCO
1993 Became Chairman, TEPCO
1985 Chairman, The Federation of Electric Power Companies, Japan (-1993)
1991 President, World Association of Nuclear Operators (WANO)(-1993)
1991- Member of National Public Safety Commission
1994- Vice Chairman, KEIDANREN
1994- Chairman, Telecommunications Council, Ministry of Posts and Telecommunications

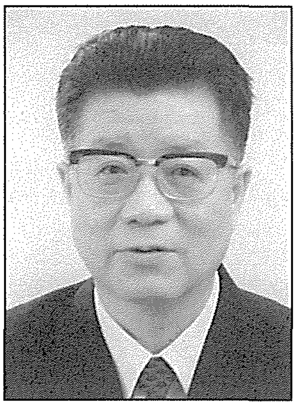


Robert Gallucci

Robert L. Gallucci began as Dean of Georgetown's School of Foreign Service on May 1, 1996. He had just completed twenty-one years of government service that started with the Arms Control and Disarmament Agency in 1974, serving since August 1994 with the Department of State as Ambassador at large. From July 1992 until August 1994 he was the Assistant Secretary of State for Political-Military Affairs. Dr. Gallucci had returned to Washington in February 1992 to be the Senior Coordinator responsible for non-proliferation and nuclear safety initiatives in the former Soviet Union. Prior to his return, and since its creation in April 1991, he was the Deputy Executive Chairman of the UN Special Commission overseeing the disarmament of Iraq.

Dr. Gallucci was born in Brooklyn on February 11, 1946. He earned a bachelor's degree from the State University of New York followed by a master's and doctorate in Politics from Brandeis University. Before joining the State Department, he taught at several colleges and universities.

He has authored a number of publications on political-military issues. He received the Department of the Army's Outstanding Civilian Service Award in 1991.

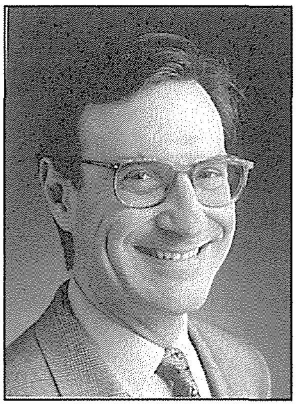


Jiang Xinxiong

Born on July 6, 1931 in Zhejiang Province, China

Graduated from Nan Kai University in Tianjin in 1952

1952 Deputy Chief of Section, Engineer, Jixi Mining Machinery Factory, Ministry of Coal Industry
1958 Chief Engineer, Director of Operating Department, Lanzhou Uranium Enrichment Plant, The Second Ministry of Machinery Industry
1975 Deputy Director, Lanzhou Uranium Enrichment Plant
1979 Director, Lanzhou Uranium Enrichment Plant
1982 Vice Minister, Ministry of Nuclear Industry
1983 Minister, Ministry of Nuclear Industry
1988- President, China National Nuclear Corporation (CNNC)
Deputy Chief, Nuclear Power Steering Group of State Council
Chairman, China Atomic Energy Authority (1994)



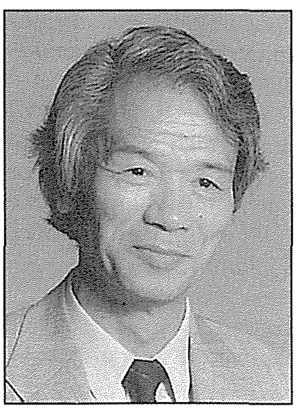
Yannick d'Escatha

Mr. Yannick d'Escatha was born on March 18, 1948 in Paris. He is a graduate from the Ecole Polytechnique (1966) and Ingenieur au Corps des Mines. In 1972 he was appointed Professor at the Ecole Polytechnique and Ecole des Mines and ENSTA (1971-77). His works and research at the Mechanics Laboratory of Ecole Polytechnique made him a leading specialist in fracture mechanics.

Mr. d'Escatha's publications gave him an Academy of Sciences Award in 1982.

He joined the nuclear industry when appointed Head of the Control Office for Nuclear Construction where he was in charge of state technical control (1978-81). In 1982 he joined TECHNICATOME, a subsidiary of CEA, specialized in nuclear propulsion and became Director of the Cadarache and Aix-en-Provence plants. In 1987, he was appointed Deputy Director General of TECHNICATOME. From March 1990 to September 1992, he was Director of Advanced Technologies, a newly created Department within CEA. From September 1992 to June 1995 he served as Deputy Administrator General (Deputy Chairman) of the Commissariat a l'Energie Atomique (CEA).

Mr. d'Escatha was appointed Administrator General (Chairman) of CEA on July 1, 1995.



Sueo Machi

Born on January 15, 1934

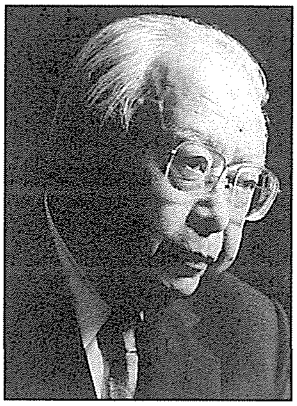
Dr. Machi has been Deputy Director General and Head of the Department of Research and Isotope, International Atomic Energy Agency (IAEA) since 1991. Prior to this assignment, he was Director General, Takasaki Radiation Chemistry Research Establishment, Japan Atomic Energy Research Institute, JAERI, from 1988 to 1991. During 1980-83, he held the position of Head, Section of Industrial Application and Chemistry, IAEA.

Dr. Machi's research activities for 25 years focus on application of radiation technology for new polymer products and environmental protection, and on radiation effects on materials used in nuclear facilities in JAERI.

His major achievements include: invention and development of battery separator using radiation technology which is used for commercial production; invention and development of technology to clean flue gases from coal and oil burning power plants using electron beams. Industrial scale plants using this technology are under construction.

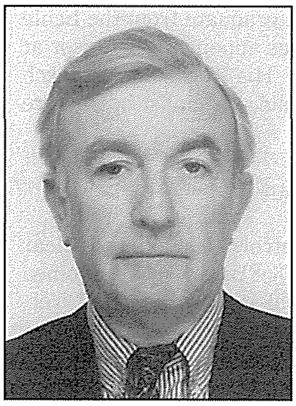
Dr. Machi earned his doctorate of engineering from Kyoto University in 1967.

The Awards he received are: Award of Japan Chemical Society 1968; Iwatani Memorial Award 1989; Award of Minister of Science and Technology 1989; Doctor Honoris Causa, Polytechnic University of Bucharest 1995; Life-time Achievement Award of International Meeting on Radiation Processing 1997.



Jiro Kondo

Birth of Date: January 23, 1917
Education:
1940 graduated Faculty of Science, the University of Kyoto
1945 graduated Faculty of Engineering, the University of Tokyo
Career:
1958 Professor, the University of Tokyo
1975 Dean, Faculty of Engineering, the University of Tokyo
1977 Director, National Institute for Environmental Studies
1985 Member and Chairman, Science Council of Japan (the 13th)
1988 Member and Chairman, Science Council of Japan (the 14th)
Commissioner, National Land Council 1990
Chairman, Central Council for Environmental Pollution Control
Commissioner, Science Council
1994- Vice Chairman, Japan Atomic Industrial Forum, Inc.
1998- President, Science and Technology Foundation of Japan



Michael Jefferson

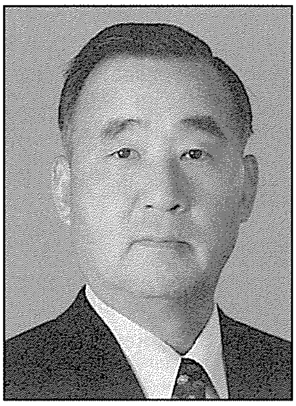
Mr. Michael Jefferson has been Deputy Secretary General of the World Energy Council (WEC) since 1990, following 20 years in The Royal Dutch/Shell Group where he held posts as diverse as Group Chief Economist, a Director of Oil Supply and a member of the Group Planning scenario team.

The WEC is a multi-energy organization, and Mr. Jefferson brings that balanced approach to considering global energy prospects in the light of fears about human-induced climate change. His interest in climate goes back over 40 years and he has been an IPCC Lead Author. He continues to be involved in IPCC Special Reports.

Mr. Jefferson directs the WEC's Climate Change Program, has authored all its reports to date, and also wrote the WEC Commission report "Energy for Tomorrow's World," 1993.

Luis Echâvarri

Birth : April 17, 1949, Bilbao(Spain) Nationality : Spanish
Academic distinction :
1971 Fellow of the College of Industrial Engineers of Madrid, Master in Industrial Engineering from the Superior Technical School of Industrial Engineering of Bilbao Univ.
1974 Postgraduated in Management from the Industrial Organization School of Madrid
1978 Master in Information Sciences from the Faculty of Information Sciences of the Complutensis Univ. of Madrid
Major professional career :
Feb. 1975-Feb. 1985 Westinghouse Electric in the Madrid Nuclear Office, Project Manager Manager of Lemoniz, Sayago and Almaraz Nuclear Power Plants.
Feb. 1985-Oct. 1987 Technical Director (E.D.O) of the Spanish Nuclear Regulatory Commission
Oct. 1987-Nov. 1994 Commissioner of the Spanish Nuclear Regulatory Commission
Sep. 1995-Jun. 1997 Director General of the Spanish Nuclear Industry Forum
Jul. 1997-present Director General of the OECD Nuclear Energy Agency
Other activities :
- Representative of Spain for Nuclear Safety and Radiation Protection in many meetings and conferences of NEA, IAEA and the European Union
- Numerous papers, public speeches and conferences on matters of Nuclear Safety and Radiation Protection



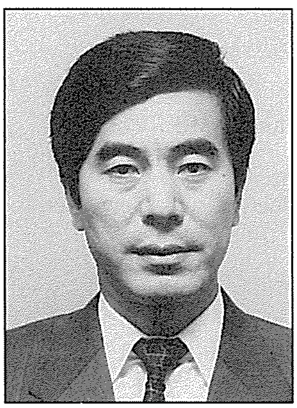
Yoshihiko Sumi

Date of Birth: November 15, 1930
Academic Career:
1953 Graduated from Electrical Engineering, Kyoto University
Professional Career:
1953 Joined the Kansai Electric Power Co., Inc.
1971 Director of Kujyo Sales office
1972 Resident Engineer in Indonesia as a member of Newjec Inc.
1974 Assistant General Manager, System Engineering Department
1977 General Manager, System Engineering Department
1979 General Manager, Central Office of High Voltage Transmission Projects Construction
1981 General Manager, Hokuriku District Office
1983 General Manager, Fukui Nuclear Power District Office
1985 Elected to the Member of the Board of Directors
General Manager, Fukui Nuclear Power District Office
1986 Board Director, Nuclear Operations
1987 Board Director, Nuclear Operations and Nuclear Projects
1988 Managing Director
1991 Senior Managing Director
1993- Director and Executive Vice-President
1997- Chairman, Committee for Nuclear Power Development, Federation of Electric Power Companies

Qu Shiyuan

Dr. Qu Shiyuan, born on July 5, 1940, is now Professor and Deputy Director at Energy Research Institute of State Planning Commission, Beijing, China.

Aug. 1960-Jul. 1965 Studied in China Science and Technology University.
Jul. 1965-Mar. 1975 Researched in chemistry at the Chinese Academy of Science.
Mar. 1975-Mar. 1978 Worked in China's Environment Protection Agency.
Mar. 1978-Nov. 1981 Researched in the field of environment-chemistry at the Chinese Academy of Science.
Nov. 1981-present Working in Energy Research Institute of State Planning Commission, researching on energy and environment issues.



Tsutomu Toichi

Born on December 26, 1945

1968 Graduated from Department of Science, University of Tokyo.
1973 Received a doctorate of science in geophysics, Department of Science, University of Tokyo.
1973-83 Joined The Institute of Energy Economics, Japan (IEE)
Chief Economist, responsible for coordination and supervision of study projects related to energy supply/demand analysis, IEE
1983-85 Research Fellow, Energy Laboratory, Massachusetts Institute of Technology, dispatched by IEE to research
1985-91 Chief Economist, responsible for coordination and supervision of study projects related to the international oil market, IEE
1991-94 General Manager of Research Development, IEE
1994-present Director, IEE

SESSION 2

Mitsuko Shimomura

Ms. Shimomura, one of Japan's most distinguished journalists, has made a career of interpreting Japan to the world and the world to Japan. Until 1994, she was a senior staff writer for the Asahi Shimbun, Japan's leading newspaper, and her three decades with that newspaper is a record of many professional "firsts," e.g. first female foreign correspondent (Asahi Shimbun, New York 1980), first woman journalist to achieve Senior Staff Writer status, and the first woman Editor-in-Chief of a major national-circulation weekly magazine (Asahi Journal, 1990-92). Having left the Asahi at the end of 1994, she now is continuing her extremely active career as an independent writer and journalist. She was the first woman to receive the Vaughn-Ueda International Journalist prize for outstanding international reporting (1982).

She became President & CEO, Tokyo Kenbikyo-in Medical and Public Health Center. She has also been a member of the Prime Minister's economic advisory committee since March in 1996.

Ms. Shimomura's specialty has been clarifying dialogues with the "movers and shakers" in the politics, business, and the cultural elites of America, Europe and Japan.

Graduating from Keio University in economics, she took a master's degree in the same subject at New York University's Graduate School of Arts and Sciences.

Books that she wrote include: "Made in Japan,""The Truth behind Japan Bashing,""Front Page, Back Page,""The Eye of a Reporter--The Eye of a Woman," etc. Her latest book is "The Age of Cool Guys."

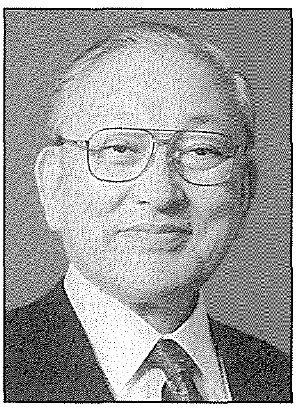
Soichiro Tahara

Born in 1934

After graduating from Waseda University, he joined Iwanami Movies Co. and then TV-Tokyo Broadcasting Co.

Mr. Tahara has been very energetic in extending critique of a broad range of issues such as politics, economy, industries, advanced technologies in mass media since he became a free-lance journalist in 1976.

He wrote many publications including "Nuclear Wars," "Japanese Bureaucracy," "Media Wars." His latest publication is "A Whale without Head--A Fact of a Political Drama."



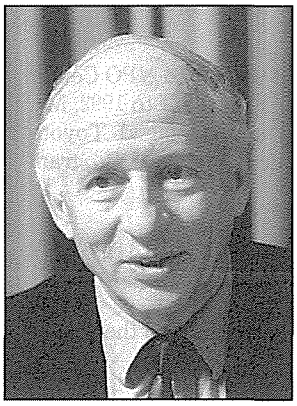
Yumi Akimoto

Born on March 14, 1929

1951	BS, Chemistry, Tokyo Bunrika University (Tsukuba University)
1957	Ph.D.,Tokyo Bunrika Univ.
1954	Joined Mitsubishi Materials Corp. (MMC)
1954-57	Metallurgical refining process development, Hosokura Smelter, MMC
1957-58	R&D on uranium refining, MMC
1958-60	Research on actinide chemistry, Lawrence Berkeley Laboratory
1960-67	R&D on Nuclear Fuel Cycles, Electronic Materials Production and New Metal Refining, MMC
1974-76	General Manager, Nuclear Fuel Cycle Dept., MMC
1976-81	General Manager, Nuclear Energy Dept., MMC
1981-86	Managing Director, MMC
1986-92	Senior Managing Director, MMC
1992-94	EVP, MMC
1994-present	President and CEO, MMC

Professional membership : Atomic Energy Society of Japan ; Special Committee for the Atomic Energy Commission of Japan ; Engineering Academy of Japan

Awards and other achievements: Award for Distinguished Research Achievement, Power Metallurgical Society of Japan (1968), Medal with Blue Ribbon from the Japanese Government (1997), etc.



Gregory Clark

Born on May 19, 1936 in Cambridge, U.K.

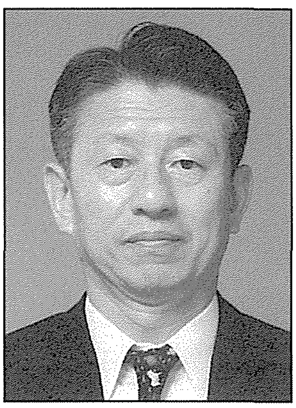
1953-56	Oxford University, MA
1956-65	Australian Department of External Affairs, Canberra
1959-62	Second Secretary, Australian Commission, Hong Kong
1963-65	First Secretary, Australian Embassy, Moscow
1965-69	Department of Economics, Research School of Pacific Studies, Australian National Univ. (PhD research on Japanese private direct investment overseas)
1969-74	Head of Tokyo Bureau of "The Australian" (Naitonal Newspaper)
1974-76	Consultant, Policy Coordination Unit, Department of the Prime Minister and Cabinet, Canberra
1976-78	Visiting Professor, Sophia University, Tokyo
1979-95	Professor, Faculty of Comparative Culture, Sophia University
1990-	Chancellor, Institute of Developing Economies Advanced School, Tokyo
1995-	President, Tama University, Tokyo

Dr. Clark served as members of a variety of public committees such as Australian Cabinet Subcommittee on Resource Policy ; MOF Committee on International Trade Policy ; Bank of Japan Expert Consultative Group ; KEIDANREN Committee to Discuss Education for Creative Personnel ; MITI Research Committee for Personnel Education in the 21st Century (Chairman); STA International Experimental Fusion Reactor Plan Promotion Committee, etc. He was awarded Officer de l'Ordre de LeopoldII(Belgium) and Tokyo Metropolis Culture Award.

Masazumi Saikawa

Born on March 17, 1943

In 1967 Mr. Saikawa graduated from Dept. of Economy, Keio University and joined Nippon Yusen Kaisha (NYK Line). After leaving NYK Line, he joined Hakuyo Machinery Co. in his native region. In 1983 Mr. Saikawa was first elected a member of Kashiwazaki City Assembly in Niigata Prefecture, Japan. He served as the City Assembly member in a total of three terms until 1992 when he was Speaker of the City Assembly. He became Mayor of Kashiwazaki City in 1992 and is in his second term of office.

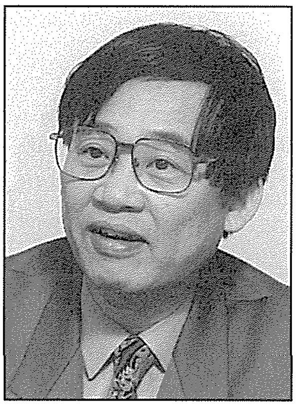


Masao Takuma

Born on September 22, 1937

Graduated from Engineering Department, University of Tokyo.

Jul. 1979	Manager, Nuclear Power Plant Construction Section, Nuclear Power Plant Construction Dept., Tokyo Electric Power Co.
Jul. 1981	Deputy General Manager (Corporate Communications), Corporate Planning Dept.
Jul. 1983	Deputy General Manager (Planning), Nuclear Power Administration Dept.
May. 1984	General Manager, Nuclear Fuel Cycle Promotion Dept., The Federation of Electric Power Companies
Jul. 1985	Deputy Superintendent, Kashiwazaki-Kariwa Nuclear Power Plant Construction Office
Feb. 1988	General Manager (Planning), Nuclear Power Administration Dept.
Jun. 1991	Superintendent, Kashiwazaki-Kariwa Nuclear Power Plant
Jun. 1995	Director and Deputy Executive General Manager, Nuclear Power Division and Engineering Research & Development Division
Jun. 1997-	Director and Deputy Executive General Manager, Nuclear Power Division



Yoshinori Yamaoka

Born in April 1941

Mr. Yamaoka assumed the post of Secretary and Managing Director of the Japan NPO Center in November 1996. Prior to this, he was an urban planning consultant. From 1977 to 1992, Mr. Yamaoka worked for the Toyota Foundation where he developed and managed Toyota grantmaking, and conducted research on public not-for-profit activities, first as a Program Officer, and then as a Program Director.

Mr. Yamaoka is a graduate of the University of Tokyo School of Architechture with a specialty in urban planning.

He has published articles on Japanese Foundations, public non-profit activities and the role of philanthropy in society.

LUNCHEON

Françoise Moréchand

Born in Montparnasse, Paris. She studied the Japanese language at the Oriental Language College of the Sorbonne and came to Japan for the first time in 1957. She served as the first French lecturer in the NHK Language Seminar. After leaving Japan in 1964, she obtained a license as a beauty consultant in New York, then worked for Revlon and Dior in Paris. She returned to Japan in 1974 as the chief beauty coordinator for Chanel. Her book "Shippai-shinai Oshare (Fashion Without Failure)" became a best seller. She remains prominent in the media as a fashion authority.

Her book "Ohashi Mochimasho (Let's Bring Our Own Chopsticks)" pioneered awareness of environmental issues in Japanese society immediately prior to the start of the Bubble Economy.

Ms. Morechand is active in a diversified array of fields based on her philosophy that the basis of culture, whatever the medium — fashion, dance, music, film, literature — is building on a personal lifestyle with an impartial, global spirit. In 1981, in recognition of her contributions to both French and Japanese culture, she was awarded the Ordre National de Merite by the French government. In 1991, she published in France the book "La Gaijin (The Foreigner)", which became a best seller.

In 1995, she started a lifestyle seminar, called the "Morechand-Juku (Morechand Class)" at d'Institut Franco-Japonais de Tokyo, that looks creatively at questions of food, clothing and shelter.

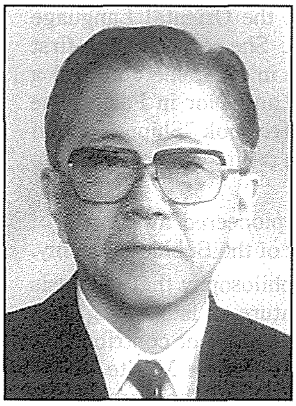
PUBLIC TALKS

Kazuko Tamura

Date of birth : February 26, 1940
Place of birth : Tokyo
Education :
1962 Graduated from Ochanomizu Women's University (Bachelor of Education)

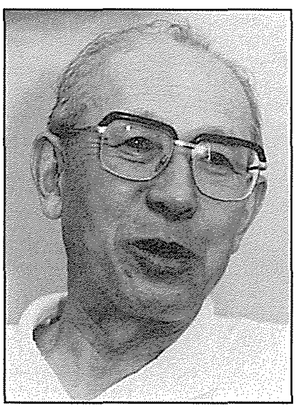
Career :
1962 Joined the Kyodo News Agency
Staff writer of City, Cultural and Science News
1989 Chief Editor, Science News Section and Editorial Writer(science, environment, life science)
1992 Senior Writer and Editorial Writer
1997 Deputy Chief Senior Writer and Editorial Writer

Other posts :
1993 Member, Council for Consulting Engineer
1995 Member, Panel on General Planning Council for Science and Technology



Kazuhisa Mori

Born on January 17, 1926 in Hiroshima Prefecture
Education : Graduated from the Kyoto Univ. Faculty of Science, Dept. of Physics in 1948
Occupational Record :
1948-56 Publisher Chuokoron-sha Inc.
1956-65 The Electric Power Development Co., Ltd.
1956- Japan Atomic Industrial Forum, Inc.
1963-65 Manger Programming Division, Tokyo Channel 12 TV Ltd.
1965- Director, Nuclear Safety Research Association
1978-96 Executive Managing Director, JAIF
1996- Vice Chairman, JAIF
Other Positions :
1975- Director, Marine Ecology Research Institute
1975- Director, Nuclear Materials Control Center
1976- Vice President, Japan Atomic Energy Relations Organization
1984- Counselor, Power Reactor and Nuclear Fuel Development Corporation
1994- Councilor, University Alumni Association
Official Positions :
Special Member, Advisory Committee for Energy, Ministry of International Trade and Industry ; Special Committee Member, Atomic Energy Commission ; Special Committee Member, Nuclear Safety Commission, etc.

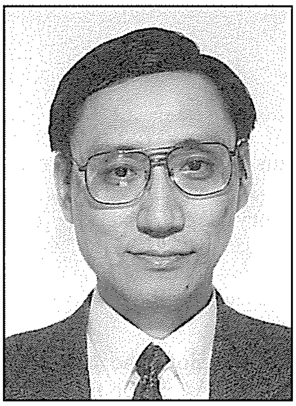


Tokunosuke Nakajima

Born in 1925 in Shanghai, China

Education :
1949 Graduated from Faculty of Science, University of Tokyo

Career :
1949-56 Governmental Industrial Research Institute, Tokyo, Ministry of International Trade and Industry
-83 Deputy Senior Researcher, Division of Reactor Chemistry, Tokai Research Establishment, Japan Atomic Energy Research Institute(JAERI)
1972-85 Member, the 4th Group, Science Research Council of Japan ; Member, Speicial Committee for Atomic Issues
Former Professor, Faculty of Commercial Sciences, Chuo University(Natural Sciences)



Tatsujiro Suzuki

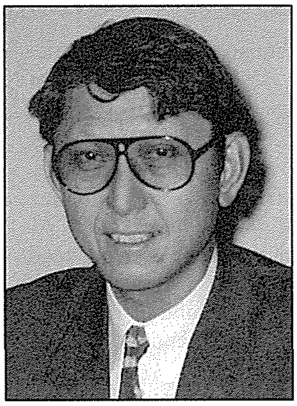
Born on April 9, 1951

Dr. Suzuki is Research Fellow of Socio-economic Research Center at Central Research Institute of Electric Power Industry (CRIEPI), Japan. He is also Visiting Associate Professor of "Sociotechnics of Nuclear Energy" (sponsored by JAPC) of Department of Quantum Engineering and Systems, University of Tokyo, from October 1997.

He joined the Boston Consulting Group, Inc. Tokyo in 1978 and moved to International Energy Forum, Tokyo, as a Senior Researcher. He was a Visiting Scientist from 1986 at Center for Energy and Environmental Policy Research, Massachusetts Institute of Technology (MIT). At the Center, he also served as Associate Director for the International Program on Enhanced Nuclear Power Plant Safety from 1988 to 1992. He joined the Center for International Studies at MIT as a Research Associate in 1993 until he came back to Japan and joined CRIEPI in October 1996. His major research interests are: nuclear energy policy, science and technology policy, energy and environment policy.

Dr. Suzuki received his bachelor's degree in nuclear engineering in 1976 from University of Tokyo, and MS degree in Technology and Policy in 1979 from MIT. He earned his Doctorate in Engineering from University of Tokyo in 1988. He is a member of Japan Atomic Energy Society, Research Planning and Management, and served as consultants to both government and private institutions in energy and environmental policy fields.

SESSION 3



Atsuyuki Suzuki

Born in Tokyo on October 31, 1942.

Career:

1985- Professor, Dept. of Nuclear Engineering, University of Tokyo

1977 Associate Professor, Ditto,

1975 Research Associate Ditto,

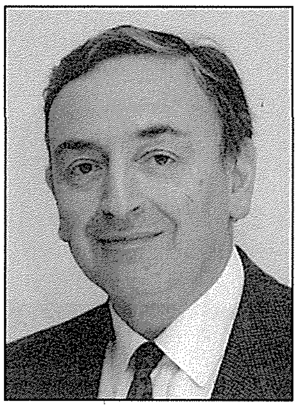
1974 Research Staff, The International Institute for Applied Systems Analysis, Laxenburg, Austria

1971 Research Associate, Nuclear Engineering Research Laboratory, the University of Tokyo, Ibaraki.

Educational Background:

Ph.D in Nuclear Engineering (1971); MS in Nuclear Engineering (1968); BS in Nuclear Engineering (1966). All from the University of Tokyo.

He is also Members of the Special Committee, Atomic Energy Commission, the Special Committee, Nuclear Safety Commission, and the Special Committee, Advisory Council on Energy, Agency of Natural Resources and Energy, MITI.



Claude Mandil

Born on January 9, 1942 in Lyon

He was a student of "Polytechnique" School and is Senior Mining Engineer.

1967-74 Mining Engineer (in Metz and in Rennes)

1974-77 Official Representative to the Delegation for Country Management and Regional Action (DATAR)

1978-81 Interdepartmental Director of Industry and Research, and Regional Representative to the National Agency for Valorization of Research (ANVAR)(Pays-de-Loire)

1981-82 Technical Adviser to the Cabinet of the Prime Minister (industry, energy and research sectors)

1983-84 Chief Executive Officer, Institute for Industrial Development (IDI)(a venture capital company)

1984-88 Chairman and Chief Executive Officer, IDI

1988-90 General Director, Bureau of Mines and Geology (BRGM)

1990- Director General for Energy and Raw Materials in the Ministry of Industry and Foreign Trade

1991- French Representative at the Nuclear Safety Working Group of the G7

1996 Chairman of this Working Group

Oct. 1997- Chairman of International Energy Agency Governing Board parallel to Director General for Energy and Raw Materials

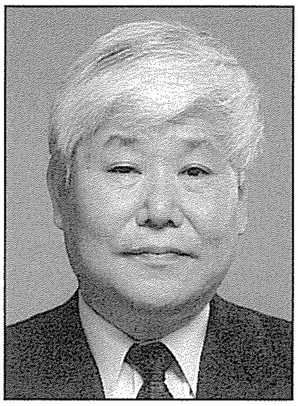
William Wilkinson

Dr. Wilkinson read mechanical sciences and chemical engineering at Cambridge and then carried out research there as a Salter's Scholar.

He joined the nuclear industry in 1959 and left in 1967 to become the Professor of Chemical Engineering at the University of Bradford where he established a flourishing research school.

In 1978 he joined British Nuclear Fuels as Assistant Director of Research & Development. He was appointed Engineering Director in 1982 and joined the Main Board as Technical Director in 1984. From 1986 until 1992, he was the Deputy Chief Executive with responsibilities for engineering and technical matters.

He is President of the British Nuclear Industry Forum, Past President of the European Nuclear Forum. He was a member of the government's Advisory Council on Science and Technology, the Radioactive Waste Management Advisory Committee and the Science and Engineering Research Council. He is currently the Chairman of DTI's Carrier Technology Programme Committee. He is a Visiting Professor at Imperial College, London, a Past President of the Institution of Chemical Engineers, a Member of the Royal Academy of Engineering and a Fellow of the Royal Society.



Toshiaki Enomoto

Born on July 7, 1939

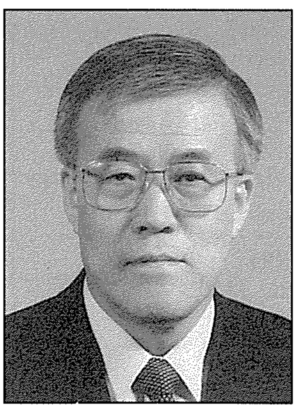
He received his B. Eng. from University of Tokyo in 1965. He joined Tokyo Electric Power Co. (TEPCO) in 1965, and he has extensive experiences in various fields in nuclear power engineering from the TEPCO's first nuclear plant in Fukushima Daiichi Nuclear Power Station to the latest ABWR in Kashiwazaki-Kariwa NPS. He has also been involved in developing utilities' program in fuel cycle activities. He had been Superintendent, Kashiwazaki-Kariwa Nuclear Power Station since 1995 till he was appointed Director last June.

Dr. Enomoto has been Director, Deputy Executive General Manager of Nuclear Power Administration of TEPCO since June 1997.

Helmut Engelbrecht

Dr. Engelbrecht is currently Head of Purchasing and Logistics Division of PreussenElektra, a German electric power company.

After graduating in mechanical engineering, he joined the Nuclear Research Center of Jülich focussing on reactor physics. In 1981, on his first business job he worked on the nuclear core design of three PWRs. With PreussenElektra he was granted responsibility for the nuclear fuel cycle. This is still one of his major tasks today, being responsible for the overall purchasing and logistics requirements of PreussenElektra.



In-Soon Chang

Born on March 29, 1940

Education :
Ph.D. (Inorganic Chemistry), Univ.of Western Ontario, Canada, 1976
M.Sc. (Inorganic Chemistry), Korea Univ., Seoul, Korea, 1966
B.Sc. (Chemistry) Korea Univ., Seoul, Korea, 1964
Major experience:

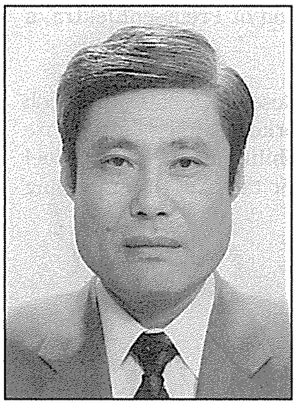
Sep. 1974-Aug. 1975	Principal Researcher, University of Western Ontario
Jan. 1977-Jan. 1979	Post Doctoral Fellow, University of Iowa
May. 1979-Jan. 1994	Director, Chemical Engineering and Materials Research Div., Korea Atomic Energy Research Institute
Nov. 1988-Dec. 1992	Vice President, Nuclear Fuel Project, Korea Nuclear Fuel Co., Ltd.
Nov. 1992-Oct. 1994	Technical Advisor, Korea Nuclear Fuel Co., Ltd.
Jun. 1993-Jan. 1994	Vice President, Nuclear Policy and Planning, Korea Atomic Energy Research Institute
Jan. 1994-Apr. 1995	Senior Vice President, Korea Atomic Energy Research Institute
Apr. 1995-Dec. 1996	President, Nuclear Environment Management Center
Jan. 1997-present	President, Nuclear Environment Technology Institute
1992-present	Advisory Editorial Board, The Journal of Nuclear Materials

SESSION 4

Mamoru Akiyama

Born on August 23, 1935

Mr. Mamoru Akiyama is the President of the Institute of Applied Energy and a Professor Emeritus of University of Tokyo. He graduated from University of Tokyo in 1958, and joined the Japan Atomic Energy Research Institute. He became Instructor of Department of Nuclear Engineering, University of Tokyo in 1963, Associate Professor in 1964, and Professor in 1974. He has been involved in research, development and safety analysis on nuclear power systems, as well as in studies on broad spectra of energy science and technology. He is a member of the Atomic Nuclear Society, Japan Society of Mechanical Engineers, American Society of Mechanical Engineers etc. He was a former Vice-President of the Atomic Energy Society of Japan and is a member of the Science Council of Japan.



Fumio Kodama

Born on July 11, 1941

Fumio Kodama is Professor of Science, Technology and Policy at Graduate School of Engineering in University of Tokyo. He is also Director of Socio-Technological Research Department at Research Center for Advanced Science and Technology. Previously, he taught at Department of Industrial Engineering and Management in Tokyo Institute of Technology and at Graduate School of Policy Science in Saitama University.

He was Visiting Professor of Kennedy School of Government at Harvard University in 1991-92, for teaching at Program Science, Technology, and Public Policy. In 1992-93, he was Visiting Professor of Mechanical Engineering at Stanford University for teaching at VTSS Program. In addition to teaching, he has worked as Director-in-Research of National Institute of Science and Technology Policy, 1988-91.

He is a graduate of University of Tokyo, where he got B.S., M.S. in mechanical engineering in 1964 and 1967 respectively and earned Ph.D. in Engineering in 1974.

He is the author of many articles on science and technology policy. One of his works is "Analyzing Japanese High Technology : The Techno-paradigm Shift, the Japanese version of which received the 1991 Sakuzo Yoshino Prize. He is also a recipient of the 1991 Science and Technology Minister's Award for Research Excellence. His most recent book "Emerging Patterns of Innovation: Sources of Japan's Technological Edge" was published in April 1995.

Shojiro Matsuura

Born on November 20, 1935

Education : B.S. Applied Physics, Faculty of Engineering, Kyoto University (1958)
M.S. Kyoto University

Professional Career :

1960-61	Assistant, Dept. of Nuclear Physics, Kyoto University
1961-63	Dept. of Power Demonstration Reactor Construction, Japan Atomic Energy Research Institute(JAERI)
1963-69	Dept. of Power Demonstration Reactor, JAERI
1969-79	Office of Power Demonstration Reactor Development, JAERI
1977	Head, Office of Power Demonstration Reactor Development, JAERI
1979-81	Senior Staff, Office of Planning, JAERI
1981-85	Deputy Director, Dept. of Reactor Engineering, JAERI
1985-86	Director, Dept. of Rector Engineering, JAERI
1986-89	Director, Office of Planning, JAERI
1989-93	Deputy Director General, Tokai Research Establishment and Director of Nuclear Safety Research Center, JAERI
1993-95	Executive Director and Director General, Tokai Research Establishment, JAERI
1995-present	Vice President, JAERI

Hiroshi Machiba

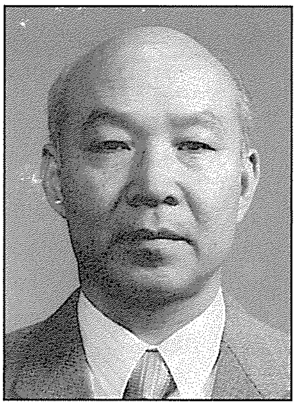
Born on June 28, 1942

Education :

Mar. 1966	Graduated from Mechanical Engineering Department, Faculty of Engineering Science, Osaka University

Career :

Apr. 1966	Joined Toshiba Corporation
Apr. 1988	Senior Manager, Nuclear Plant Design & Engineering Department, Toshiba
Apr. 1994	Senior Manager, Nuclear Engineering Information Systems Department, Toshiba
Oct. 1995	Nuclear Plant & System Planning Department, Toshiba
Jun. 1997-	General Manager, Nuclear Energy Systems, Toshiba



Yukio Tateno

Born on March 30, 1934

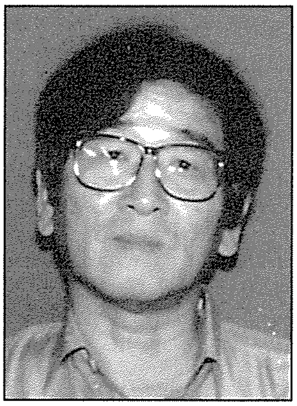
Mar. 1959	M.D. from Chiba University School of Medicine
Mar. 1964	Ph.D. from Chiba University
Apr. 1964	Assistant of Chiba University School of Medicine (Radiology)
Nov. 1971	Lecturer of Chiba University School of Medicine (Radiology & Nuclear Medicine)
Jan. 1974	Associate Professor of Chiba University School of Medicine (Radiology)
Jun. 1974	Director, Department of Radiology, Chiba University Hospital
Dec. 1975	Chief, Division of Clinical Research, National Institute of Radiological Sciences
Jun. 1983	Director, Division of Clinical Research, National Institute of Radiological Sciences
Apr. 1993	Director, Division of Radiation Health and Clinical Research, National Institute of Radiological Sciences
Apr. 1994	Guest Scientist, National Institute of Radiological Sciences
Apr. 1996	Senior Research Counselor, National Institute of Radiological Sciences

Major publications :
"History of Radiology" 1973 (in Japanese), "Positron Emission Computed Tomography" 1983 (in Japanese), "Computed Radiography" 1987

Sergey Zykov

Born on March 1, 1956 in Moscow

Finished high school (1973) in the city of Sarov (former Arzamas-16) and then entered Moscow Institute of Physics and Technology. After graduating from the Institute (1979) with specialization in experimental nuclear physics started work in the Russian Federal Nuclear Center (RFNC-VNIIEF), Sarov. Main activities were connected with radiation measurements as applied to nuclear weapons control, technical means of verification for international treaties, nuclear safety. Since 1991 participated in international programs for nuclear material protection, control and accounting in frame of US-RF "Lab-to-Lab" program. Ph.D. in experimental nuclear physics in 1989. In 1986-87 participated in the response team recovering Chernobyl catastrophe within the radiation safety group. Last position in RFNC-VNIIEF was deputy director of Nuclear & Radiation Research Center. In September 1997 was nominated as Deputy Executive Director of International Science and Technology Center in Moscow.



Mitsuhiko Akaboshi

Born on November 28, 1936

1955 Bachelor of Science Degree, Ehime University
1957 Master of Philosophy, Osaka University
1972 Doctor of Philosophy, Osaka University

1964-88 Research Fellow, Research Reactor Institute, Kyoto University
1988-96 Associate Professor, Research Reactor Institute, Kyoto University
1996-present Professor, Research Reactor Institute, Kyoto University

Research activities include: application of nuclear decay and nuclear radiation to the origin of life and chemical evolution; utilization of radio-isotope in the study of antitumor effect of various compounds; effect of thermal neutrons on cells and biomolecules.

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Tel : 81-45-682-1111 Fax : 81-45-682-1112
Overseas Offices : Shanghai / Beijing / Metro Manila / Jakarta / Singapore / Kuala Lumpur / Bangkok / Abu Dhabi / Tehran / Kuwait / Al-khobar / Riyadh / Jeddah / Dordrecht (The Netherlands)/ The Hague / Lagos / Algiers / Arzew (Algeria)/ Paris / London / Washington, D.C. / Houston

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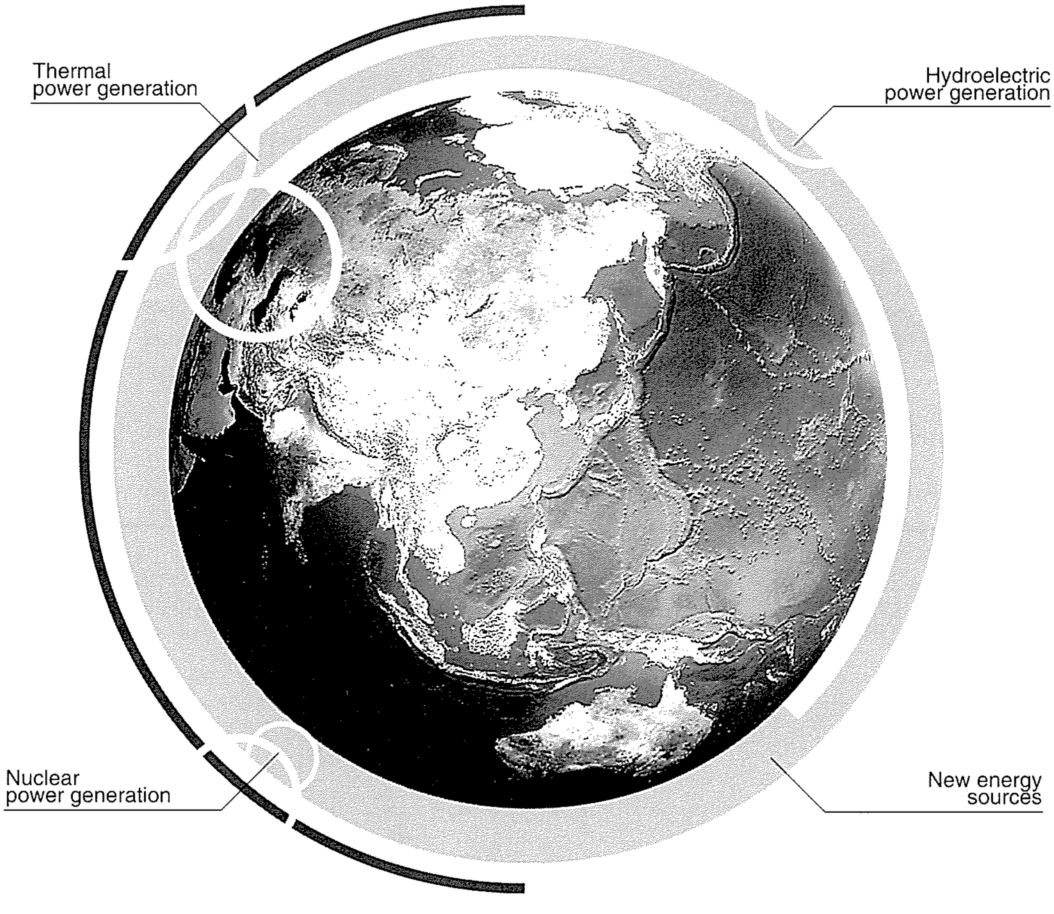

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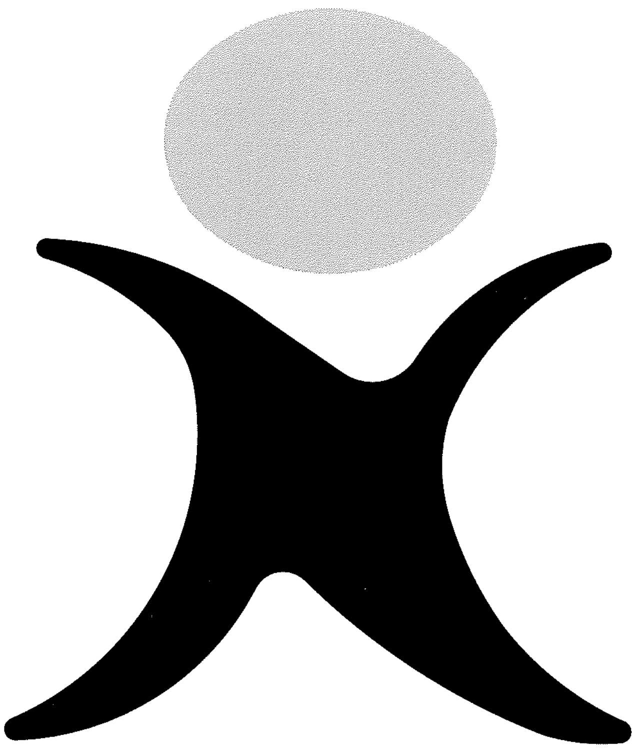

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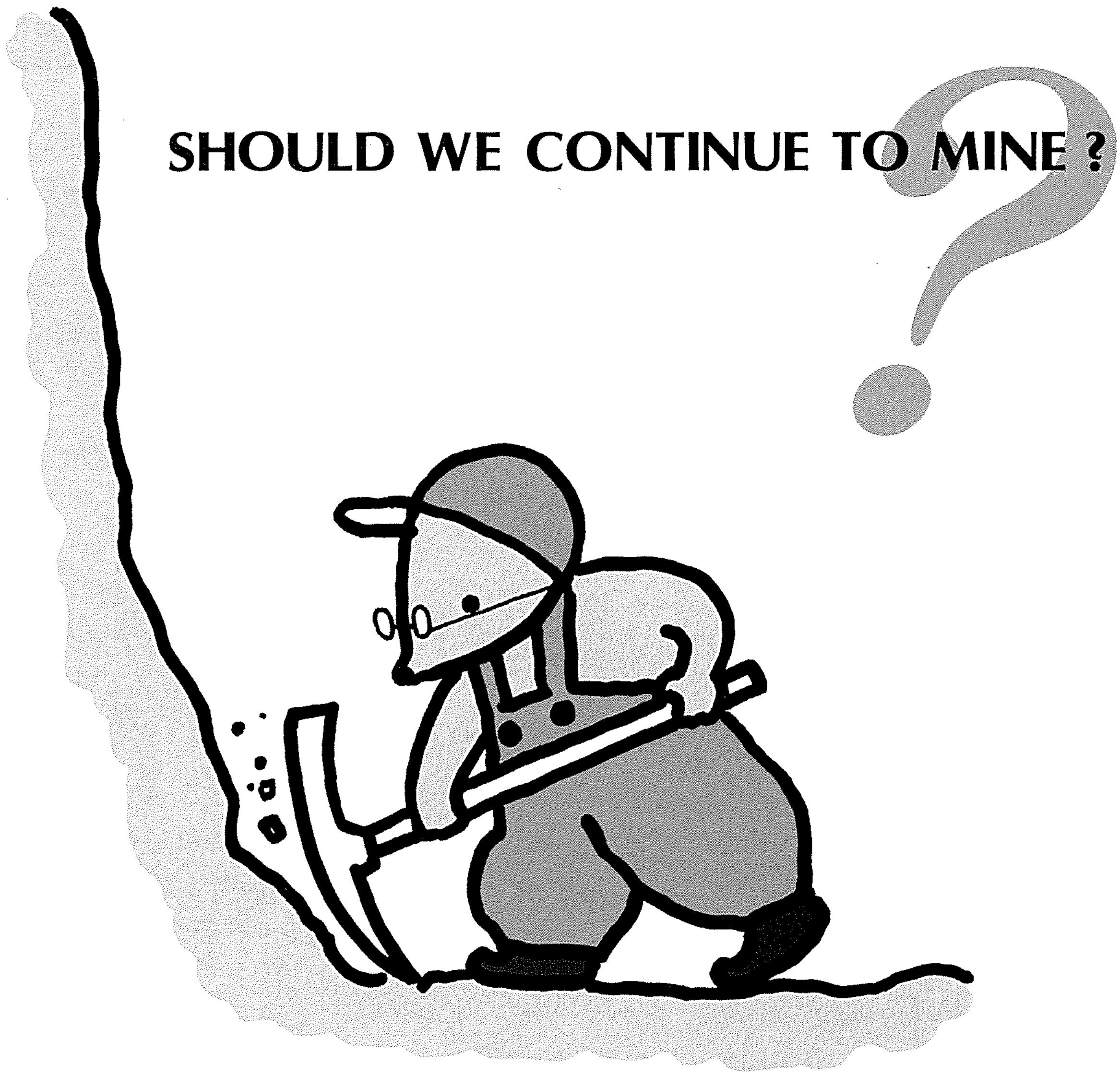
SHOULD WE CONTINUE TO MINE ?



All energy resources are limited.
If we continue mining at this pace, they will be exhausted before long.
Remaining deposits of oil and natural gas are about 50 or 60 years,
uranium is about 70 years, and coal, which is relatively abundant, is about 200 years.
But uranium, as a fuel for nuclear power plants, can be recycled to 96% of its original amount.
When we reuse uranium, it becomes more efficient in producing power.
Up to now we have used a large quantity of fossil fuel at the expense of our environment.
For the development and posterity of our nation and the earth,
it is time to switch to more efficient, clean and long lasting nuclear energy.

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