

NUCLEAR KNOWLEDGE:

Managing for Preservation and Growth

by

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IAEA and Nuclear Knowledge Management

- IAEA established, in 2002, Knowledge Management as an “Agency-wide Cross-cutting activity” “through all Major Programmes.... To address preservation and promotion of knowledge and maintaining competence....” Director-General also expressed concern in GC 2001 about the aging nuclear workforce, about fewer young people studying nuclear-related fields, about fundamental research receiving less support, about the accompanying loss of institutional memory, etc.
- We commend the Director-General for addressing these serious concerns through the June 2002 meeting of Senior officials and now this Scientific Forum.

The Need

- Human Development correlates strongly with per Capita Electricity Consumption.
- Trend in those developed countries where nuclear power growth had stalled in the recent past seems to be reversing. Global climate change concerns and the recognition of nuclear energy as a clean environment – friendly energy source are important factors in this context.
- Nuclear Energy growth in the near-term future will be in countries with large economies and high GDP growth rates.
- But Nuclear Energy is an inevitable option to satisfy the long-term future energy needs of *all* developing countries.

Sustainable Development

Sustainable development requires nuclear energy and sustainable development of nuclear energy requires closing the nuclear fuel cycle. A short-term perspective on nuclear energy, I believe, has inhibited some countries from going ahead with reprocessing of spent fuel and development of fast breeder reactors; it must be ensured that this does not hurt knowledge management in these important technologies.

Evolution and Innovation

There are nuclear reactor and fuel cycle technologies which have been around for some time but they still need innovative and evolutionary development, in terms of improved performance and increased safety. And there are emerging advanced reactor designs and fuel cycle strategies, which require new technology generation and transfer to industry. Non-power nuclear applications – in medicine, agriculture and industry – are also growing.

All these require continuous inputs from R&D laboratories. The Velocity of this R&D is unfortunately vulnerable to prejudices.

Nuclear R&D

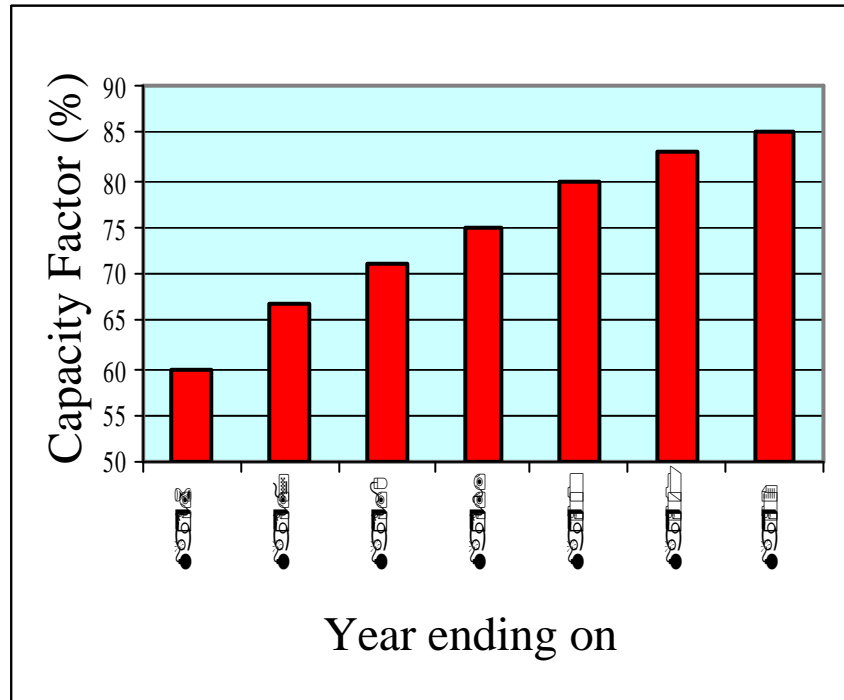
Government funding of R&D is driven by a perception of longer term benefit/cost ratio, while private investment tends to shy away from speculative R&D with possible long-range pay-offs.

If nuclear industry in a country stagnates – fortunately it is not happening in Asia – attraction to youth in a research career in a nuclear technology - related area in that country dissipates and so does, consequently, the base of nuclear knowledge in that country.

Because, Knowledge is also People!

Indian Nuclear Power Programme

- **Operating Reactors**
(2x 160MWe BWRs and 12 PHWRs) **2720 MWe**
- **Reactors Under Construction**
(2 x 540MWe, 4 x 220MWe PHWRs
2 x 1000MWe LWRs) **3960 MWe**
- **Target for the year 2020** **20000 MWe**



Growth of Trained Scientific and Engineering Human Resource for Indian Nuclear Programme

BARC Training School

Disciplines	Number of Trainees	
	Current Batch	Since Inception (1957)
Mechanical	29	1334
Chemical	13	560
Civil	2	56
Metallurgy	7	279
Electrical	7	577
Electronics	11	596
Computer	14	85
Instrumentation	4	209
Physics	9	1176
Chemistry	13	926
Bio-science	6	104
Environmental science	5	11
TOTAL	120	5913
In-plant training in Nuclear Reactors & Plants (BE/BTech)	Nil	760
Post-graduate engineers	23	154
GRAND TOTAL	143	6827

Additional training centers have been started at following locations.

- **CAT**
(Centre for Advanced Technology)
- **NFC-HWB**
(Nuclear Fuel Complex- Heavy Water Board)
- **NPCIL**
(Nuclear Power Corporation of India Ltd.)

Total number of trainees at DAE

Year-2001	Year-2002
305	392

Nuclear Skills

Nuclear skills, individual and collective – expertise acquired by an individual or a group, through education, training and experience – also have to be preserved.

Skills degrade in the absence of usage. Conservation of nuclear skills is needed for continued safe operation, maintenance and decommissioning of existing nuclear plants.

International Cooperation

Sustainable development of nuclear energy requires international synergy – synergy of complementary strengths, and synergy of needs and capabilities. The latter will fulfill the energy needs of developing countries and the commercial interests of nuclear-developed countries.

Here IAEA has an important role. Safeguards - related activities are necessary but are relatively simple from a scientific point of view. Development - related activities are scientifically more complex, but must be strengthened if the Member States of IAEA are interested in Managing Nuclear Knowledge for Preservation and Growth.

Facts, Concerns and Misconceptions

- International cooperation in nuclear technology is circumscribed by proliferation concerns, but I feel that the latter are adequately addressed through the present IAEA safeguards system – safeguards for each country consistent with its international obligations.
 - Coercive international instruments, which go beyond the present IAEA safeguards system, are harmful for nuclear technology development.
 - Concerns about clandestine acquisition of weapon-related equipment/materials and about nuclear terrorism must, of course, be addressed.
 - Nuclear power–related technologies are irrelevant for nuclear weapon sophistication
- I would like to advise:

“Encourage and facilitate international nuclear cooperation, and address only *genuine* proliferation concerns”, if you are interested in managing nuclear knowledge for preservation and growth.

Knowledge Management and the Mission of IAEA

Technology Foresight attempts to select Critical Technologies needed for a country's development. Many countries consider Nuclear Technology as a Critical Technology. The Mission of IAEA should be to help establish what I call 'Coherent Synergy' among the nuclear-related activities of institutions, governments and industry.

Information becomes knowledge when the transfer of information is complete and when it is consistent with the receiver's pattern of learning. International exchange of information is valuable in this context and IAEA's role *inter alia* is to facilitate this. Technology Control Regimes tend to distort meaningful transfer of information

Knowledge Management for IAEA is not an end in itself but a means to realise the objectives defined in Article II of the Statute, viz:

“The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.”