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Renaissance of Nuclear Energy. What it Means for Global Economics, Security and Non-proliferation

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Mr. Chairman,

Distinguished members of the panel,

Ladies and Gentlemen.

It is a privilege to participate in a Seminar on an issue of such high international importance and to be part of such a distinguished panel of speakers. I wish to take this opportunity to thank the organizers of the Seminar-the Geneva Centre for Security Policy, the Monetary Non-Proliferation Strategy Group, the PIR Center and the Federal Department of Foreign Affairs of Switzerland for inviting me and for extending such splendid hospitality.

The current phenomenon of renewed and widespread interest in the global nuclear industry has been termed as **nuclear renaissance**, a rebirth of the belief in the original vision and promise of abundant energy derived from nuclear sources that began with the dawn of the nuclear age in the middle of the last century. This renewed interest in nuclear energy today is not confined merely to those countries that acquired substantial nuclear production assets between the 1960s and 1980s but also regions which are turning to nuclear energy for the first time.

Today, there are 439 nuclear power plants in operation world wide. Of these, more than 90 percent are in OECD countries or countries in transition. Of the total energy produced from nuclear sources-380 GWe or 16%of global electricity produced, 95% is in these countries. However, the picture changes dramatically if we look at the figures with regard to construction of new nuclear power plants. There are today 30 nuclear power plants under construction. Of these, more than 65 percent are in developing countries and a **majority of them in Asia**. India with a total of six nuclear power plants under construction occupies the second place after Russia which has seven. India has fallen to the second place since

last year as it has commissioned Tarapur III and IV as well as Kaiga III in the last two years!

Countries such as India, China, France, Japan, RoK and Finland maintained a continuous interest in nuclear energy. In Russia there was a brief hiatus in construction of nuclear power plants domestically during the last decade, but this trend has now been reversed. Even during the lean period, Russia continued its international cooperation in particular with India, in the construction of the 2000 MW Kudankulam nuclear power project in Southern India. Countries such as India, China, France, UK, Russia and Japan have also maintained a continuous interest in reprocessing. Countries such as India, Russia and Japan, and possibly now France have maintained an active interest in fast breeder technologies.

In the United States, which has not added a new nuclear plant in the last three decades, a renewed interest in nuclear energy has come about during the Bush Administration. This has led to new policy initiatives as well as legislation to help revive and rejuvenate the U.S. domestic nuclear industry. It is significant that more than 90 percent of the 104 nuclear power plants in the United States have applied for extension or renewal of licenses to operate existing nuclear power plants. Proposals for establishing a couple of new power plants are also under active consideration.

The U.S. administration has also shown willingness to take another look at a long standing US policy, established by the Carter Administration, of not encouraging reprocessing for civilian purposes. The U.S. is also actively promoting or is involved with new initiatives such as GNEP, Generation IV initiative and is an active participant in the search for new multilateral approaches to the nuclear fuel cycle. There is no doubt that **changing US policy** is a major factor for the nuclear renaissance, though not the only one.

There is renewed interest in nuclear energy in countries as diverse as South Africa, Brazil, Argentina, Bulgaria and Ukraine. Countries of the Gulf and North Africa have also expressed interest in augmenting their energy resources by gaining access to nuclear energy. It appears that there may be some change in thinking in countries such as Germany which are considering extending the phase out period for designated nuclear power plants.

It is significant that interest in nuclear energy has never been so widespread across continents. Major nuclear companies have established trans-national commercial linkages of a global character. For instance, U.S. companies have had tied up with companies in Japan; French

companies have made investments in the U.S. nuclear power industry; Russian companies are actively involved in China, India, Iran and in Eastern Europe. Major uranium suppliers such as Canada and Australia are expanding production capacities and exploring new markets.

The nuclear industry today has not been left untouched by the winds of **globalisation,** though it's full ramifications are yet to unfold. There has been a steady and incremental technological improvement in the nuclear industry over the last two decades-in terms of production efficiency, reduced construction and operating costs, better safety and security features and newer possibilities in terms of spent fuel management and disposal.

The reasons for the nuclear renaissance can be traced to the larger global context. There is widespread recognition of the importance of nuclear energy to **sustainable development, protection of the environment and in ensuring energy security.** Access to secure and affordable energy resources is integral to the developmental objectives of a vast majority of developing countries. Global electricity consumption is expected to double from about 3700 GWs now to over 7300 GWs by the year 2030, as more than 1.6 billion additional people are expected to gain or demand access to electricity. Nuclear energy is indispensable as a means of filling at least a part of the energy demand in the coming decades.

Nuclear energy is also indispensable in addressing the challenges of **global warming**. The complete nuclear power chain emits only one to six grams of carbon equivalent per kilo watt as compared to the carbon footprint of fossil fuels which is six to eight times higher. It is no coincidence that France, with depends on nuclear energy for 75% of its energy needs, has the cleanest air in Europe and the cheapest electricity. The existing nuclear power plants in the world save the planet from 600 million tonnes of carbon emissions per year. India hopes to achieve a target of 20,000 MW of nuclear energy by 2020. If this was substituted by electricity produced from domestically mined coal reserves, which have high ash content, India would produce 145 million tonnes of carbon emissions per year. Multiply that with the average age of nuclear plants, say 40 years, the overall magnitude becomes apparent.

The **economics of nuclear energy** must be assessed by factors which are intrinsic to the nuclear industry, but also take into account other comparative factors. Two decades of excess electricity capacity in OECD has come to an end. Asia's demand for power is increasing. There is now a global dimension for long term investment in the nuclear industry. There has been a considerable improvement in the performance of the nuclear industry, though comparative strengthens of countries

vary. Construction and operating costs have progressively fallen. A recent World Nuclear Association Report noted that new nuclear power plants offered the most economical way to generate base load electricity even without taking into consideration other geopolitical and environmental advantages. In India, an average construction period for a new nuclear power plant has fallen below five years. India has standardized the 220/540 MWe PHWR designs and has the domestic industrial capacity for constructing nuclear power plants at a rate of adding additional capacity of 1,000 MW per year. Construction costs have also fallen. India is able to construct new 1000 MW light water nuclear power plants, in international cooperation with Russia, at US dollars 1,222 per kilo watt which compares well with international standards. The per kilo watt cost of its domestic PHWR nuclear power plants is even lower. The cost per unit of power produced in Tarapur I and II is about 95 paise, which is less than one thirtieth of the cost of a can of coke!

India has registered economic growth rates of over 9%. The electricity-GDP elasticity is about 1.2, even though the energy intensity of its economic growth compares favourably with OECD levels. India depends for more than 72 percent of its energy needs on coal. Our proven reserves of coal, oil and gas are insufficient for India's developmental needs and we do not have the luxury of an either-or choice. India's requires energy from all known and likely sources of energy which should be affordable not only in terms of financial costs but also in terms of the cost to our environment. As Prime Minister Dr Manmohan Singh said in a speech at Tarapur on August 31 2007, "**nuclear energy will be the energy co-efficient of the future."**

Nuclear energy is also vital for **energy security** as it compensates for insecure national energy supply and allows for diversification of energy supplies, especially external supplies from volatile regions. It is also clear that nuclear generating costs are less sensitive to rise in fuel prices-2 percent of the total cost of nuclear energy as compared to 60-70 percent with regard to fossil fired electricity. Uranium fuel is also available from geographically more diverse sources than fossil fuels and a deregulation of the nuclear fuel market, and removal of extraneous restrictions, would make nuclear energy even more attractive for large consumers such as India.

During the last fifty years, there was inadequate appreciation in some countries of the **limitations of nuclear fuel resources**. Thus, current reactors burn up less than 2 percent of the energy contained in the uranium fuel. At this rate, the world's total estimated Uranium reserves of about 4.7 million tonnes (at commercially extractable rate of US$ 130 per kg) will be exhausted in 75 to 80 years. The utilisation of

the energy potential in uranium fuel increases by over 60 times through fast breeder technology. Global uranium reserves utilised fully through such technology would be able meet global energy requirements for next five to six thousand years. At present only one third of the world's spent fuel is recycled in some form to extract energy.

There is growing recognition that nuclear energy must be used in a sustainable manner. A renaissance in nuclear energy must be accompanied by a '**reformation'** in global thinking on the importance of nuclear energy as a sustainable energy source. This will require a new global consensus on the benefits of closing the nuclear fuel cycle in a manner that is economically productive, technologically safe and efficient and proliferation resistant. Nuclear renaissance may not be able to serve global energy needs if it is not reinforced by a nuclear reformation described above.

India's nuclear programme has been premised on the need for exploiting fully the limited uranium resources in our country through a three-stage nuclear power programme. This involves setting up of an adequate number of PHWRs from whose spent fuel plutonium would be extracted to feed fast breeder reactors which along with depleted uranium extracted from the spent fuel of the first stage will be used as a blanket to breed more plutonium to fuel more fast breeder reactors. At the third stage, thorium would be used as a blanket material to produce uranium 233 for use as fuel. The energy potential of India' uranium resources, enhanced 60 times through fast breeder reactors, can be enhanced 600 times through the use of India's vast thorium resources. A 500 MW prototype fast breeder reactor will be commissioned in 2011 making India only the second country to operate a commercial power unit on fast breeder technology. India intends to introduce metallic fuel to shorten doubling time. Four more fast breeder reactors are to be constructed by 2020. India is also constructing a 300 MW Advanced Heavy Water Reactor as a technology demonstrator and forerunner to the future third stage reactor systems for energy from thorium resources.

How does nuclear renaissance square with the need for strengthening global **non-proliferation objectives**, which India fully shares? The global spread of nuclear technology per se is not a source of proliferation. Therefore, it is important to recognise that nuclear power is not a principal source of proliferation risk. The emphasis should rather be on proliferation sensitive elements of the nuclear fuel cycle, which could pose problems if countries, in contravention of their obligations under-take diversion activities, clandestine or otherwise, for non-peaceful purposes.

India believes that reprocessing and recycling under effective institutional control is key to sustainability of resources, environment and security. India was the first country in Asia to establish full fledged reprocessing facilities and is amongst a select band of countries which have mastered all elements of the complete nuclear fuel cycle. India has always been an advocate of a closed fuel cycle, conscious of the fact that the energy potential of nuclear sources must be fully exploited. It therefore refrained from joining international initiatives which considered spent fuel as nuclear waste. However, India has joined cutting edge technology initiatives such as the ITER project and has expressed interest in joining the Generation IV Initiative. India has made considerable strides in desalination of sea water through heat generated by nuclear power stations and is engaging in cutting edge research on use of hydrogen as an energy carrier generated by nuclear energy.

Reprocessing is critical to India's three-stage programme and we have mastered all its technological processes. At the same time, India has not engaged in any international transfers of sensitive technology relating to reprocessing or enrichment. India is open to constructive and practical solutions to any eventual multilateral arrangement that may emerge, from the numerous proposals now under discussion, for assured fuel supplies to countries that request them and India has the capabilities for being a supplier state. We feel that such an arrangement, which balances the imperatives of non-proliferation and the values of assured supplies, should be evolved through dialogue and consultation, implemented on a voluntary basis and the alternatives proposed should be attractive to the countries concerned, politically and commercially. The coming together of all **States with advanced nuclear technology** on a common platform will reinforce their rights and responsibilities to act as a vanguard in carrying the momentum of the nuclear renaissance forward.

In July 2005, **India and the United States** reached an understanding whereby the United States would work with its friends and allies and change its domestic legislation to resume full civil nuclear cooperation with India. In March 2006, agreement was reached between India and the United States on the reciprocal steps that both sides would take in implementing the July understandings, including a separation plan which would be implemented by India in a phased manner in placing a select number of its nuclear facilities under IAEA safeguards. In August this year, India and the United States finalized a bilateral nuclear cooperation agreement, called the '123 Agreement'. An India-specific safeguards agreement is to be negotiated between India and the IAEA. The NSG is to take a decision on an India-specific exemption to facilitate nuclear trade with India.

The initiative on nuclear cooperation between India and the United States, and with the international community at large, is one of the most significant elements of the evolving global nuclear order. The initiative is in recognition of India's long standing non-proliferation credentials, its energy requirements and the positive impact on the global environment. It will lead to India joining the global nuclear mainstream. This would have beneficial effects not only for India's nuclear industry but the global nuclear industry as well as it would gain from India's market, industrial and technological capabilities and its massive trained scientific manpower, which can open possibilities for co-production for the growing Indian and global markets. When this process is completed it can provide a considerable fillip to the global nuclear renaissance.

In **conclusion**, we are today witness to a nuclear renaissance that is more global in its reach than before and moving forward through a technologically modernized and commercially competitive nuclear industry. There is need for a parallel process of reformation in terms of global thinking on nuclear energy as a sustainable energy source. The international community must adopt a forward looking approach to shape the ongoing process in an inclusive manner so that the benefits of nuclear energy are available more widely, leading to energy security, environmental protection and sustainable development. This can be done in a manner that strengthens non-proliferation, as we believe that the nuclear renaissance and a new non-proliferation consensus must go hand in hand. India, a State with advanced nuclear technology, has a vital stake in the future of this process and is prepared to make a significant contribution for its success.

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