

## Dr. Abdul Kalam address at the Canada India Energy Forum Toronto, Canada

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### Energy Research challenges for Sustainable Development Discoveries need great deeds

I am delighted to participate and deliver the key note address in the Canada India Energy Forum organized by Canada India. My greetings to the organizers, participants, Scientists, Technologists, Energy experts, public policy Planners and other distinguished guests.

I am happy that the Conference focuses particularly on energy sector and provides a platform for knowledge sharing and business cooperation between India and Canada. I would like to focus on the topic "Energy Research Challenges for Sustainable Development".

### Leading to Energy Independence

When we analyze the critical problems facing the planet earth today, three important issues come to our minds. First one is the continuous depletion of fossil-material-derived oil, gas and coal reserves as predicted by World Energy Forum. The second one is the continuous degradation of environment primarily due to extensive use of fossil materials for generating energy. Third is the continuous rise and major fluctuations in the cost of crude. I have been studying the price pattern of standard crude oil over the last six years. From under \$25 per barrel in September 2003, the oil price went up to \$147 per barrel in 2008 and it has now come down to \$50. These fluctuations bring in lot of uncertainty for the industrial sector and also to the people. We have to find an alternative method to contain the problem. The solution to these problems is achieving energy independence. That is to work for Fossil fuel free energy mix.

Energy Independence - A Perspective: Based on the developmental profile and its progress visualized in India for the next two decades, the power generating capacity has to increase to 400,000 MW by the year 2030 from the current 150,000 MW in India. This takes into consideration of energy economies planned and the design and production of energy efficient equipments and systems. Energy independence has got to be achieved through three different sources namely renewable energy (solar, wind apart from hydro power), electrical power from nuclear energy and bio-fuel for the transportation sector.

The hydel capacity generated through normal water sources and inter-linking of rivers is expected to contribute an additional 50,000 MW. Large scale solar energy farms of hundreds of megawatts capacity in certain number could contribute around 55,000 MW. The nuclear power plants should have a target of 50,000 MW of power. Atleast 64,000 MW of electrical power should come from wind energy. The balance 51,000 MW has to be generated through the conventional thermal plants through coal and gas and other renewable sources of energy such as Biomass, Power through municipal waste and solar thermal power.

The most significant aspect, however would be that the power generated through renewable energy technologies has to be increased to 28% against the present 5%. Let me discuss about the profile of renewable energy systems. Firstly I would like to talk to you on Solar Energy.

### Solar Energy

We need to embark on a programme in solar energy systems and technologies, for both large, centralized applications as well as small, decentralized requirements concurrently, for applications in both rural and urban areas. The key to success of this programme is the development of high efficiency photo voltaic cell using carbon nano tubes. Recent research has shown that the alignment of the CNT with the polymer composites substrate is the key issue and this aligned CNT based PV cells would give very high efficiency in photovoltaic conversion. The polymer composites increase contact area for better charge transfer and energy conversion. In this process, the researchers could achieve the efficiency of about 50% at the laboratory scale. Multiple nations can take up this challenge and come up with the development of a CNT based PV cell with an efficiency of at least 50% within the next three years so that it can go into the commercial production within five years. In addition, they can also take up the development of organic solar cells, dye-sensitized solar cells and third generation solar cells and Solar thermal powerplants. Participants of this Conference could facilitate such an international research in this key area. Now let me discuss about the wind energy.

## Wind Energy

The experts have estimated that the potential of wind energy in India is around 45,000 MW. Studies must be launched to explore other potential sources such as off-shore wind farms, especially, since India has over 7000 km long coastlines. India is working out the application of advanced techniques in wind velocity measurement and relating it to available electrical out put. We are also standardizing the wind turbine power plants to realise the cost reduction due to economies in the scale. Research and development for reducing the investment per MW through improved designs and application of newer technologies is in progress. In islands and remote areas autonomous wind generating units are planned to be established if the site has the wind potential. Feasibility studies are being conducted to determine economic sizes of wind energy plants which can be used for lifting water from 30 meter level and serve the needs of farmers having small holdings in a region with an average wind speed of 8 to 10 km per hour.

Integrated actions on all these areas will enable realization of 64,000 MW of electric power from wind energy sources from the present generating capacity of 8000 MW. Let me now discuss with you on the power generation through nuclear energy.

## Nuclear Energy

The present nuclear power capacity which is around 4120 MW is expected to go to 7160 MW by 2012 with the completion of nine reactors which are now in progress. Eventually as per present plan of BARC and Nuclear Power Corporation the capacity by 2020 is expected to be increased to 24,000 MW. There is a need to plan right from now to increase this capacity to 50,000 MW by 2030 through uranium and thorium route.

Nuclear power generation has been given a thrust by the use of uranium-based fuel. However to meet the increased needs of nuclear power generation, it is essential to pursue the development of nuclear power using Thorium, reserves of which are higher in the country. Technology development has to be accelerated for Thorium based reactors. Thorium is a non-fissile material. For conversion of Thorium and maximizing its utilization development of Fast Breeder Reactor has been rightly taken up. Building the thorium based reactors require participation of multiple research institutions. Researchers assembled here can work with department of Atomic Energy and draw a detailed road map for research which can accelerate the process of establishing thorium based power plants. This is an area where nations can work for accelerating the establishment of additional energy capacities. As the transportation sector in India consumes about 90% of the total available oil (Imported and indigenous), I would like to discuss the possible energy option and actions in the sector.

## Energy in Transportation Sector

The Transportation sector in India is the fastest growing energy consumer. Our indigenous oil production meets only 30% of our total requirement. Hence, there is an urgent need to find alternative fuels and energy sources. One of the

promising areas for the country is production of bio-fuels. In biofuel, we are planning to embark on the following mission mode actions in India.

- (i) Realizing the production of 60 million tonnes of bio-diesel per annum by 2030 (this would be 20% of anticipated oil consumption in 2030).
- (ii) As a first step towards reaching this target, a coordinated plan for achieving 6 million tonnes production by 2010 which would be 5% of the present import of oil.
- (iii) To improve through research, the productivity of seed and extraction techniques and expand the area under bio-diesel crops including Algae towards achieving 30 million tonnes oil by 2020 and 60 million tonnes by 2030.

## Ethanol

India has already got a policy of blending 5% ethanol with petrol. Also, in the next phase, the plan is to blend 10% ethanol. The country has capacity for producing nearly 10 MMT of ethanol. A large part of this capacity is being utilized for producing alcohol for supply to liquor industry. The main issue is pricing of ethanol which is not attractive enough. With the fluctuating cost of crude oil, there is a need to review the entire situation and embark on realistic pricing so that the sugar companies and growers will have adequate incentive to produce ethanol. Here, I would like to point out the recent government decision to enhance the procurement price of wheat that has resulted in increasing the wheat output considerably by our farmers. We should draw certain lessons from such experiences and implement changes for overall economic upliftment of country. This singular action of facilitating availability of 10% ethanol for blending will result in reducing the crude requirement by 3 MMT assuming that 25% of the crude is used for petrol purposes.

For realizing the above, we need to embark on a research and development in various components of energy sector with the multilateral cooperation and also establishment of production facilities, so that the results of R&D can be quickly converted into commercial availability.

## Conclusion:

The energy scene in the 21st century is going to see a major shift. Very soon, oil and gas will see its finiteness. It is high time that we realize this factor and work towards the fuel of the future. I suggest that the energy researchers in India and Canada should re-align their research and development contribution for generating commercially viable technologies for Solar energy, Wind energy and Nuclear energy power plants and production of Bio-fuels both ethanol and bio-diesel sufficient to substitute at least 20% of the fossil fuel in the initial phase. Work is also required for developing emulsified fuels which could enable further saving of 25% to 40% fossil fuel. I would suggest Canada India energy forum to submit comprehensive recommendations for leading the nations to become energy independent within next 2 decades. We have to collectively ask ourselves, is it possible to have a fossil fuel free energy system for planet earth. I consider that it is possible. We have to carry out focused research in this direction.

My best wishes to all the participants of Canada India Energy Forum for success in their mission of promoting sustainable development and growth of the societies in planet earth through the Energy Research missions.

May God Bless you.

APJ AbdulKalam,

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