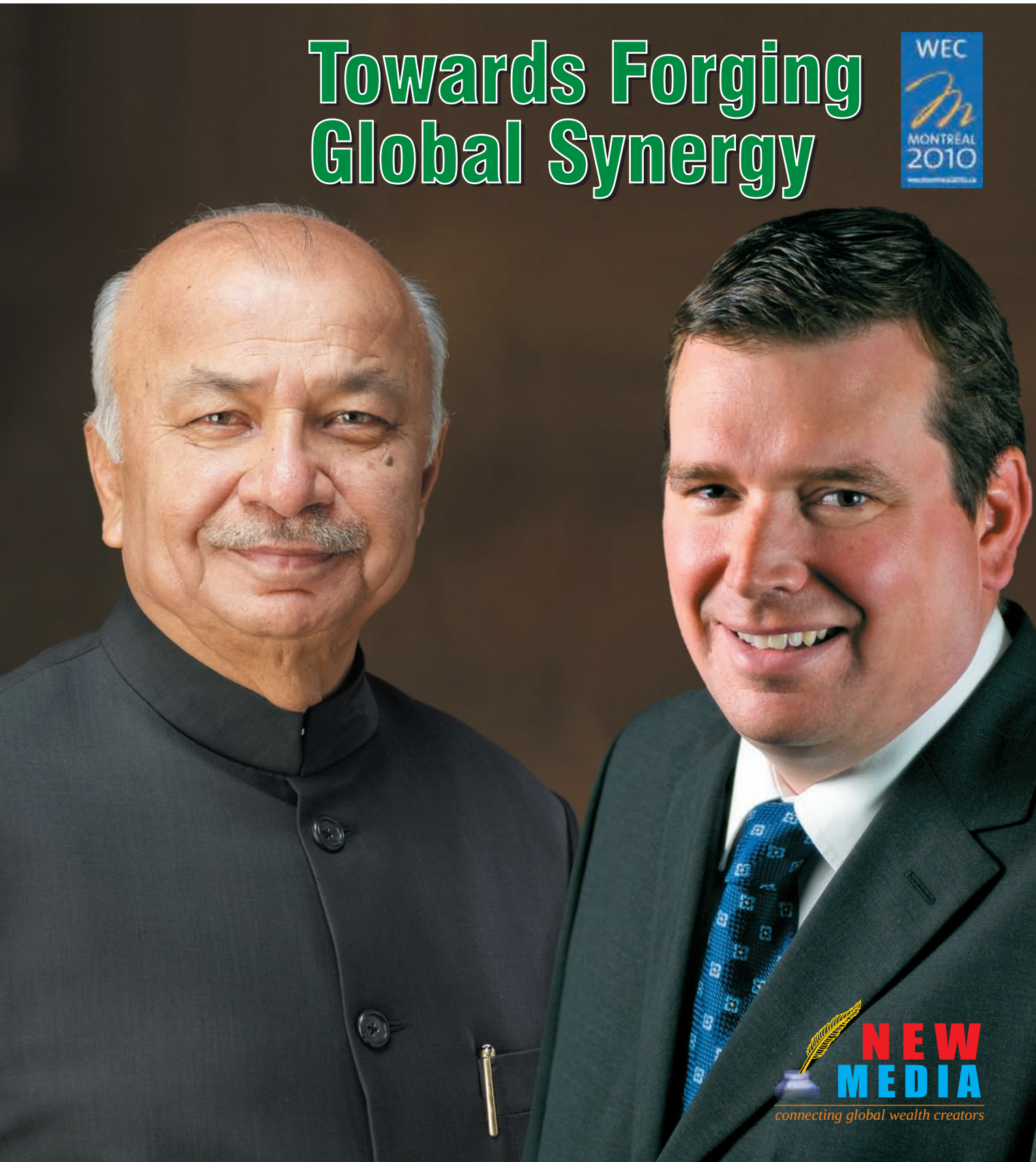
www.indocanadianbusiness.com

INDO CANADIAN BUSINESS

Energy Special 2010

Towards Forging Global Synergy

WEC MONTREAL 2010



NEW MEDIA

connecting global wealth creators

A2Z Group.

A powerhouse of 360 degree solutions and success.

A leader in diverse business verticals, the A2Z Group has evinced unprecedented growth. A2Z is much sought after Engineering, Procurement and Construction (EPC) company among the public and private sector clients. It has gained an enviable reputation of executing complex project within extremely challenging time frames to the satisfactions of exacting and highly demanding clients. A2Z consistently delivers 360 degree solutions to all its clients with international parameters.

Founded in 2002, it has grown today into an admirable and versatile business group with Approx 1200 crores (FY 10 E) turnover. A2Z has established sound leadership in an exciting portfolio of opportunities viz. Power Transmission and Distribution EPC, Solid Waste Management, Biomass Power Generation, Facilities Management & IT Application-Power Sector etc. The company received accolade in form of E&Y conferring Start-up of the Year Award to Mr Amit Mittal (Founder-MD)

Mr Amit Mittal (Founder-MD)

A2Z Maintainence & Engineering Services

- ISO 9001-2000 certified by MOODY
- Leader in Building Primary and Secondary Power Distribution Network on EPC basis.
- Concept to commissioning of Power Transmission line Project upto 765 kV and substation of upto 400 kV.
- One-stop-shop for complete Engineering Maintenance/ Asset Management & Utility Infrastructure Services the Power Generator Transmission & Distribution Enterprises Electrical.

A2Z Infrastructure

- JCB-CII Award for Excellence in Waste Management Year 2010
- Early entrant in IRRF mode MSW Management Company.
- Operating a large 1500 TPD MSW Project in India at Kanpur on an integrated mode
- Portfolio of approx 5000 TPD across various municipalities/urban local bodies
- Strong experience in PPP model
- Deploying unique technologies for operational efficiency
- Integrated waste management entails collection of waste, transportation of waste, processing of waste, disposal of waste & converting waste into energy.

A2Z Infra-Services

- Unique approach as Integrated Facilities Management Organization.
- Professionally managed with almost 800 technical people on roll out of the total approx12000 employees.
- Pan India Presence.
- Focus on energy savings and green solutions.

Corporate Office: Plot No. 44, Sector - 32, Institutional Area, Gurgaon - 122001, Haryana. Tel : 91-124-4517600, 4776100 Fax: 91-124-4380014. Email: info@a2zemail.com

In This Issue

Founder Chairman
Late Shri R.K. Prasad

Distributed by:
New Media Communication Pvt. Ltd.

Managing Editor: Satya Swaroop
Directors: B.K. Sinha
Cdr. P.S. Amar
Group Editor: Dev Varam
Consulting Editors: Prabhuu Sinha,
Md. Sabir Nishat, Tripat Oberoi
Editors: Uday Tarra Nayar & Nicholas
Deputy Editor: Tripti Chakravorty
Assistant Editors: Prajwala Poojary &
Subhajit Bhattacharya

Head-Business Development: Veerendra Bhargava
Strategic Advisor: Vinaya Shetty
Head - Admin & Finance: Sunil Kumar
Liaison Officer: Vrunda Gurav
Special Projects: Manjeet Bhawsar
Executive Database: Madhavi Singh
Circulation: Jawaharlal, Santosh Gangurde &
Vijay Wangade

Art Director: Santosh Nawar
Associate Art Director: Sagar Banawalikar
Visualizer: Maya Vichare
Web Designer: Balwinder
Photographer: Bilal Ahmed Khan & Kishan Singh

BRANCHES:
Kolkata:
Anurag Sinha, Regional Head,
Mob: 098300 43339
Email:anurag@newmediacomm.biz

Pune:
Jagdish Khaladkar, Regional Director,
Mobile: 098230 38315
Email: pune@newmediacomm.biz

Australia Office:
Bandhana Kumari Prasad, 129 Camboon Road,
Noranda, Perth, W.A. 6062 Tel: 0061 892757447
Email: bandhana@newmediacomm.biz

New Media Communication Pvt. Ltd.,
New Media House, 1 Akbar Villa,
Near Old State Bank, Moral-Maroshi Road,
Andheri (E), Mumbai - 400 059
Tel: +91-22-2925 0690. Telefax: +91-22-2925 5279
E-mail: enquiry@newmediacomm.biz
www.newmediacomm.com

Printed & Published by
Satya Swaroop and printed at: Jayant Printery 352/54,
Girgaum Road, Thakurdwar, Mumbai 400002 and
published from New Media House, 1 Akbar Villa,
Near Old State Bank, Marol-Maroshi Road,
Andheri (East), Mumbai 400 059. India
Tel: +91-22-2925 0690 Telefax: +91-22-2925 5279

Dear Reader,

Greetings and welcome to the special issue of the Indo Canadian Business, the focus of which is on energy. The 2010 World Energy Congress is being held in Montreal. The Congress, the premier international multi-energy forum held once every three years, brings together about 3500 top world leaders in the field of energy, coming from industry, governments, and international organizations, as well as the media, universities and energy industry associations. The current issue of Indo Canadian Business, therefore, is devoted to the coverage of the World Energy Congress, with particular reference to the energy sectors in India and Canada. We have exclusive interviews with Indian Minister of Power Sushil Kumar Shinde and Canadian Minister of Natural Resources Christian Paradis. While Minister Shinde talks about India's plans of adding 60,000 mw in the 11th Five-Year Plan, which is three times the capacity added in the 10th Plan, Minister Paradis dwells on Canada's unique energy resource endowment that puts it in a position to be a leader in clean energy and green job creation. On the World Energy Congress front, Madan Lal writes that the forum is to lay down a strategy for growth with low GHG emissions. The Indian Member Committee of the World Energy Council has become a tremendous synergizing force in the Indian energy sector. J.K. Mehta, its General Manager, recounts the major works of WEC IMC in the recent past. Further, we carry summaries of some of the major papers to be presented at the Congress. The case of reforms in transmission and distribution, the need for public funding of solar photo voltaic projects, are just some of the interesting Indian papers we feature. The historic Nuclear Cooperation Agreement that was signed between India and Canada in June, 2010 will take bilateral ties between the nations to a new level altogether, argues Neil Alexander of the Organization of Candu Industries. Rupa Devi Singh holds forth on the need to double energy output within a decade for India to sustain its high GDP growth. Solar Energy will be the main thrust of India's National Action Plan on Climate Change and towards this end, the government has set up the Jawaharlal Nehru National Solar Mission. Robin Mazumdar writes about this ambitious project. There are also a series of articles on Canada's impressively diverse energy campaign.

Wish you happy reading

Satya Swaroop
Managing Editor
satya@newmediacomm.biz

Huge Opportunities Await Canada & India on Energy Front

By Saroj Mishra, Ph.D.
Trade Advisor, Canadian High Commission New Delhi
e-mail: india.commerce@international.gc.ca

With its economy liberalizing and growing at a healthy pace, India is emerging as one of the top growth stories in the world. Canada, with its diverse and innovative economy, is very well-placed to be a partner in this development. In fact, Canada already regards India as an emerging market for Canadian goods and services and as a growing source of foreign direct investment in Canada, with bi-lateral trade currently standing at C$4.1 million.

However, Canada and India's trade relationship has yet to reach its full potential. Energy, infrastructure and other prime sectors can contribute greatly to the volume of trade, and Canada is expected to significantly raise its trade and investment with India through partnerships in areas like power, telecom, railways, ports, oil and gas, and environmental management. Among advanced technologies, the nuclear cooperation agreement signed in Canada by Prime Minister Stephen Harper and Prime Minister Manmohan Singh on 27 June, 2010 is also expected to boost export growth.

In the case of energy infrastructure, Canada has had a special and historic involvement in the development of India's power. SNC Lavalin, AECON, Atomic Energy of Canada and other Canadian companies are continuing to help build key projects in India. This partnership is especially timely, for India's needs are rapidly rising as the result of the rapid expansion of its economy, with power generation capacity slated to reach 800,000 megawatts by 2032. Consequently, India's power sector offers the private sector huge business opportunities in the interconnected areas of power generation, transmission and distribution.

There are many emerging opportunities that are of particular interest to Canadian companies. These include areas such as hydro power generation; the modernization of existing generation units; building and updating power transmission and distribution networks; and providing a variety of specialized tools and solutions pertaining to energy audit, energy conservation, demand side management, communication and GIS. And for other energy sources such as renewable energy projects and cleaner fossil fuel energy, India also offers enormous potential.

An opportunity to enhance the strategic energy relationship between Canada and India arose directly from the bilateral MOU on Energy Cooperation and the Canada-India Energy Forum launched on 26 May 2010. Co-chaired by senior officials from both nations, the Forum is designed to include the participation of industry and sub-national governments. The inaugural meeting identified several highly promising areas for bilateral cooperation, including clean and renewable energy, energy efficiency, power generation, oil and gas, and research and development.

To build upon the latest developments in the energy sector, the Canadian High Commission and the World Energy Council Indian Member Committee are jointly organizing a high-level Indian energy delegation to Canada to attend the World Energy Congress 2010 to be held in Montreal from 12 to 16 September. The overall objective is to advance and strengthen Canada-India bilateral cooperation in energy through industry and academia interaction. The delegation also plans to meet with Canadian industry and government organizations in Toronto and Vancouver to discuss collaborative opportunities, all to foster a new era for the Canada-India bilateral relationship.

There is no question that enormous opportunities await both Canadian and Indian entrepreneurs in the Indian marketplace. And whether a Canada-based company is looking to do business in India or an India-based enterprise is interested in establishing a presence in Canada, the Trade Commissioner Service of the Department of Foreign Affairs and International Trade Canada provides a vital service in facilitating stronger trade relationships. Located in various offices throughout Canada and India, Trade Commissioners are currently helping establish linkages to foster trade and investment.

For these and so many other reasons, the India-Canada business relationship has been a longstanding and dynamic partnership, one that is continuously evolving and strengthening itself with new bilateral agreements in the energy and environmental sectors. With our ongoing efforts to build upon our close trade and investment ties, both sides can look forward to our continued partnership in success. ■

India to add 60,000 MW by 2012 to Sustain 8 pc GDP Growth

- Minister for Power Sushil Kumar Shinde

As the Indian economy hurtles forward, availability of power will be key to sustaining this high-growth trajectory. In the last few years, the government has tried to put in place plans and policies to meet this massive increase in power demand and consumption. In this exclusive interview with Satya Swaroop, Managing Editor, Indo-Canadian Business, India's Minister of Power Sushil Kumar Shinde speaks at length about what has been done so far and the difficult road ahead.

India needs significantly high capacity additions in power. Can you tell us how the government is looking to achieve this?

India is aiming to grow at the rate of 8.0 to 10% in the coming years. To sustain this growth, infrastructure, including the power sector, will have to grow at a faster pace. This calls for huge capacity augmentation in power, apart from commensurate augmentation and strengthening of transmission and distribution sectors.

In the 11th Five-Year Plan (2007-2012) we propose to add over 60,000 MW of fresh capacity which is nearly three times the capacity added in the entire 10th Plan. In the 12th Plan, we propose to add about 100,000 MW at the rate of 20,000 MW per year. Presently, a capacity aggregating to over 60,000 MW is under execution for likely benefits during the 12th Plan (2012-17).

Such a gigantic task can be successful only when the efforts of Government are strongly supported and complemented by the private sector. Recognizing the need for an overall and comprehensive legal architecture and a policy framework conducive to larger and more sustained investment in the power

The Union Power Minister, Sushil Kumar Shinde addressing at the foundation stone laying ceremony of the NTPC-BHEL Power Projects Private Limited's manufacturing plant, at Mannavaram village in Chittoor, Andhra Pradesh

sector, the Government of India has taken numerous steps to reform the sector. The Electricity Act 2003 allows the sector to align itself with market dynamics and clears the roadblocks especially in the way of greater participation by the private sector. Generation projects no longer require licenses and have reasonable assured returns on investments over the long term. An independent regulatory framework now provides business confidence to power companies and a fairly lucrative rate of return on equity of 15.5 per cent per annum.

Policy documents like the National Electricity Policy, 2005 and the Tariff Policy, 2006 have paved the way for renewed interest amongst both developers and investors. Bidding documents have been standardized and the competitive bidding route is slowly becoming the norm. Hundred Per cent Foreign Direct Investment is allowed in all segments of the power sector including power trading. Investor confidence has returned to the sector which is amply borne out by the fact that all our projects of the 11th Five Year Plan have achieved financial closure and they are likely to add around 20,000 MW in this Plan. The success of our Ultra Mega Power Projects [each project is of 4000 MW and involves investment to the tune of US$4 billion] has renewed the faith of the private investors in our power sector. We have already completed bidding for 4 projects. The fifth is under process and the sixth is ready for bidding. Eight more projects are being planned.

Rising global concern for climate change puts pressure on use of conventional fossil fuels. India's main fossil reserves are coal. What are the action plans to use this resource in a more environment friendly manner? Is India prepared for executing CCS demonstration plants?

For a developing country like India where per capita electricity consumption is only about 700 units per annum, the first priority is to provide "Electricity to All." To pursue that goal we will exploit all resources available to us. This necessarily implies that we will use coal for generation in an instrumental manner over the near and mid term. We would however definitely take steps to reduce our dependence on coal. In this connection we are working on a low carbon growth strategy for generation capacity addition during 12th Plan and future plans. Accordingly, the Plan takes into account the development of projects based on renewable energy sources as well as other measures and technologies promoting sustainable development of the country.

Major Steps of this Sustainable Integrated approach are as follows:

i. Capacity Addition from Conventional fuel based plants complemented by Renewable Energy based plants to the maximum extent possible;
ii. Development of National Electricity Plan based on Conventional Energy Sources with highest priority to setting up of Hydro and Nuclear

India to add 60,000 MW by 2012 to Sustain 8 pc GDP Growth

- Minister for Power Sushil Kumar Shinde

As the Indian economy hurtles forward, availability of power will be key to sustaining this high-growth trajectory. In the last few years, the government has tried to put in place plans and policies to meet this massive increase in power demand and consumption. In this exclusive interview with Satya Swaroop, Managing Editor, Indo-Canadian Business, India's Minister of Power Sushil Kumar Shinde speaks at length about what has been done so far and the difficult road ahead.

India needs significantly high capacity additions in power. Can you tell us how the government is looking to achieve this?

India is aiming to grow at the rate of 8.0 to 10% in the coming years. To sustain this growth, infrastructure, including the power sector, will have to grow at a faster pace. This calls for huge capacity augmentation in power, apart from commensurate augmentation and strengthening of transmission and distribution sectors.

In the 11th Five-Year Plan (2007-2012) we propose to add over 60,000 MW of fresh capacity which is nearly three times the capacity added in the entire 10th Plan. In the 12th Plan, we propose to add about 100,000 MW at the rate of 20,000 MW per year. Presently, a capacity aggregating to over 60,000 MW is under execution for likely benefits during the 12th Plan (2012-17).

Such a gigantic task can be successful only when the efforts of Government are strongly supported and complemented by the private sector. Recognizing the need for an overall and comprehensive legal architecture and a policy framework conducive to larger and more sustained investment in the power

The Union Power Minister, Sushil Kumar Shinde addressing at the foundation stone laying ceremony of the NTPC-BHEL Power Projects Private Limited's manufacturing plant, at Mannavaram village in Chittoor, Andhra Pradesh

sector, the Government of India has taken numerous steps to reform the sector. The Electricity Act 2003 allows the sector to align itself with market dynamics and clears the roadblocks especially in the way of greater participation by the private sector. Generation projects no longer require licenses and have reasonable assured returns on investments over the long term. An independent regulatory framework now provides business confidence to power companies and a fairly lucrative rate of return on equity of 15.5 per cent per annum.

Policy documents like the National Electricity Policy, 2005 and the Tariff Policy, 2006 have paved the way for renewed interest amongst both developers and investors. Bidding documents have been standardized and the competitive bidding route is slowly becoming the norm. Hundred Per cent Foreign Direct Investment is allowed in all segments of the power sector including power trading. Investor confidence has returned to the sector which is amply borne out by the fact that all our projects of the 11th Five Year Plan have achieved financial closure and they are likely to add around 20,000 MW in this Plan. The success of our Ultra Mega Power Projects [each project is of 4000 MW and involves investment to the tune of US$4 billion] has renewed the faith of the private investors in our power sector. We have already completed bidding for 4 projects. The fifth is under process and the sixth is ready for bidding. Eight more projects are being planned.

Rising global concern for climate change puts pressure on use of conventional fossil fuels. India's main fossil reserves are coal. What are the action plans to use this resource in a more environment friendly manner? Is India prepared for executing CCS demonstration plants?

For a developing country like India where per capita electricity consumption is only about 700 units per annum, the first priority is to provide "Electricity to All." To pursue that goal we will exploit all resources available to us. This necessarily implies that we will use coal for generation in an instrumental manner over the near and mid term. We would however definitely take steps to reduce our dependence on coal. In this connection we are working on a low carbon growth strategy for generation capacity addition during 12th Plan and future plans. Accordingly, the Plan takes into account the development of projects based on renewable energy sources as well as other measures and technologies promoting sustainable development of the country.

Major Steps of this Sustainable Integrated approach are as follows:

i. Capacity Addition from Conventional fuel based plants complemented by Renewable Energy based plants to the maximum extent possible;
ii. Development of National Electricity Plan based on Conventional Energy Sources with highest priority to setting up of Hydro and Nuclear

power plants. Gas based plants to be accorded higher priority as compared to coal /lignite plants, to the extent feasible;

iii. Efficiency Improvement of existing stations, R&M of Old thermal power projects, and retirement of less efficient plants/old and small size generating units;

iv. Energy Conservation in generation and demand side management.

v. Other measures to reduce pollution, i.e. Reduction in T&D losses, Coal quality improvement, i.e. coal beneficiation;

vi. Strategies/Initiatives being taken for low carbon growth, i.e. technology improvement of new capacity including Introduction of Clean Coal Technologies (Supercritical Technology, Ultra supercritical technology, IGCC, etc);

vii. Formation of a Strong National Grid;

viii. Early notification of CEA regulation on construction of power plants indicating mandatory minimum efficiency levels;

ix. Implementation of the National Mission on Enhanced Energy Efficiency (NMEEE);

x. Utilization of Coal Bed Methane (CBM) and other clean coal technologies including washeries and beneficiation of coal.

As far as CCS is concerned, India has already shown its commitment to the international community by agreeing to participate in CSLF (Carbon Sequestration & Leadership Forum). However, we have also expressed concerns about the safety and security aspects of the nascent technology as well as implications in increase of cost of power, storage and stabilization of technology. We have also indicated our resolve to take part in any R&D effort that is taking place in this area and our willingness to be associated with demonstration plants being taken up in the developed countries.

Energy drives economic growth and India's dependence on coal in the foreseeable future is unquestionable. Under such circumstances, how does India plan to overcome the conflict of growth and climate change?

It is true that coal will remain the mainstay of future power generation in India, given its abundant reserves available with us. Further, power generation using domestic reserves increases energy security. However, the Indian Government is treading a low carbon path for its economic growth. We are fully committed to improve the efficiency of coal based power generation, so as to reduce the carbon emissions per kWh of electricity generated. We have already adopted super critical technology for power generation and migration to state of-the-art Ultra super critical technology is envisaged. Supply of cleaner coal, deployment of IGCC, etc. will address emission related issues directly linked to the quality of fuel.

While coal based power generation will be dominant, the share of renewable and hydro based power generation will increase significantly. This will further address emission related issues. To give you an illustration, the Government has given very high priority to Solar power generation and recently, the Jawaharlal Nehru National Solar Mission has been announced. Steps have also been taken to address various regulatory issues for ensuring a mix of conventional and relatively more expensive renewable power in the overall power supply in India.

India has desired a better adherence to Capacity addition plans, which has not been possible in past years. How does India see the future of a capacity addition programme and what is being done to remove the identified bottlenecks?

In the 11th Plan, we propose to add over 60,000 MW of fresh capacity which is nearly three times the capacity added in the Tenth Plan. We have already added over 26,000 MW of capacity in the Eleventh Plan which is 123% of the capacity added in the entire Tenth Plan. In the last three years, we have been adding capacity, on an average, of over 7,000 MW per year, which is roughly double that of the average yearly capacity addition in the previous Plans.

In spite of increase in the pace of capacity addition, the demand for power has always exceeded its supply, leading to peak and energy shortages in the country. Presently, peak and energy shortages are around 12.7% and 10.1%, respectively.

A higher growth rate of 9 to 10% in the 12th Plan would call for a quantum jump in capacity addition. We are, therefore, proposing a capacity addition target of 100,000 MW for the 12th Plan at the rate of 20,000 MW per year.

Primarily, constraints on capacity addition can be traced to 4 broad areas, i.e. manufacturing capacity of BHEL to supply power equipment, limited vendors to supply balance of plants, shortage of skilled manpower and project management. A number of steps have been taken to mitigate these constraints.

The capacity of BHEL has been increased to 15,000 MW which is likely to go up to 20,000 MW by 2012. Moreover, five joint venture companies, viz. Bharat Forge with Alstom, L&T with MHI Japan, JSW with Toshiba, GB Engineering with Ansaldo and Thermax with Babcock & Wilcox have been formed for not only augmenting the power equipment manufacturing capacity but also to introduce supercritical technology for achieving higher coal efficiency. All stakeholders have been sensitized towards enlarging the vendor base so as to meet the Balance of Plants (BoP) requirements.

To overcome the shortage of skilled manpower, the 'Adopt an ITI' initiative has been initiated. So far, CPSUs have adopted 57 ITIs.

Lack of project management capability and skills in the Central and State utilities have always been an area of serious concern. Therefore, Web Miles, a web-based milestone monitoring system, has been introduced in NTPC to bridge this gap. It has yielded encouraging results and some of the recent generation projects of NTPC, such as the Dadri Thermal Power Project (2x490 MW), have been commissioned well in time. It has been decided to implement this monitoring system in all our thermal and hydel CPSUs.

The power sector is set to play a critical role in driving India towards becoming a global economic power. What is your vision for power in India in the next decade?

Electricity is a vital input for economic and social development in our society. Besides its importance in the growth of the country's economy, it plays a major role in the life of a common man and has a direct impact on the quality of life. In spite of capacity addition during the last sixty years, the demand for power has always exceeded the available supply, leading to peak and energy shortages in the country. Our endeavor and commitment, therefore, is to provide reliable, adequate, affordable and quality power to all users.

The National Electricity Policy aims to provide access to electricity for all households and power demand to be fully met by 2012. The Policy also stipulates that the per capita consumption of electricity is to be increased to over 1000 units by 2012. To realize these objectives, we are fairly confident to add about 60,000 MW of fresh capacity in the Eleventh Plan, and in the 12th Plan, we propose to add about 1,00,000 MW at the rate of 20,000 MW per year.

Coal will continue to be the mainstay of power generation in the country. However, we have taken policy decisions to adopt efficient coal technologies for power generation. We are encouraging setting up of super-critical and ultra-critical power stations. We would increasingly move towards cleaner and greener sources of energy. Share of renewable energy, hydro-electricity and nuclear energy in our energy basket will grow substantially in the next 5 to 10 years. ■

Emerging Global Leader Creates Clean Energy Jobs

The Greening of Canada

Greening the Canadian economy is the foremost task of the Natural Resources Ministry. With the right energy policies and improvements in the use of energy in all sectors of the economy, Canada is all set not just to be self-sufficient but move into energy conservation. Minister for Natural Resources Christian Paradis speaks in detail to Tripti Chakravorty of the Indo-Canadian Business on how Canada has made a systematic move into clean energy sources making it a leader in the sector.

Rising prices have compelled governments, businesses and consumers to take renewed interests in cleaner sources of energy. What is the kind of energy plan that Canada has in place and how has it been able to accommodate the most important component of conservation while addressing the issue of increasing energy needs of your country?

Our energy resource endowment provides Canada with an unparalleled economic advantage that we must leverage to secure our place as a leader in clean energy and in green job creation.

Canada's energy policies are guided by a set of core principles: supporting open and competitive markets; taking concrete actions that are in the public interest; and striking a clear balance between economic competitiveness and environmental leadership. The aims of these principles are to ensure energy security for Canadians and to promote the continued contribution of the energy sector to the growth of our economy.

Canada's energy policies have supported a vibrant energy sector, provided reliable and affordable energy to citizens, contributed to economic prosperity and created jobs. Market forces alone cannot deliver on broader policy objectives and this is where governments have a key role to play.

Based on the present energy consumption patterns, what has been the net impact on the Canadian consumers?

Energy accounts for a large segment of spending by households, business, and industries. In 2007 Canadians spent about $166 billion on energy to heat and cool their homes and offices, and to operate their appliances, cars, and industrial processes. This amount is equivalent to almost 12% of GDP. The Energy Efficiency Act of 1992, and recent amendments in 2009, provides for the making of and enforcement of regulations, concerning minimum energy performance levels for energy using products, the labelling of energy using products and the collection of data on energy use. Between 1990 and 2007, overall energy efficiency has improved 16% and those improvements have saved Canadians approximately $22.8 billion.

In your view which is the best renewable energy source that India should adopt?

What are the "best" renewable energy sources generally depends on specific situations including local climatic and other conditions. In fact, my department has developed a software package called "RETScreen" that is used around the world to assess the feasibility and economics of applying renewable energy technologies in specific situations. The software uses data input on climate and other factors at a particular location to determine this.

A couple of examples of renewable energy sources that I understand can be adopted by India are hydro power,

including small hydropower (mostly in the northern and eastern hilly regions) and solar energy. Some benefits of hydropower include saving scarce fuel reserves and generally lower costs of generation, operation and maintenance than the other sources of energy. Canada has a lot of expertise in developing both large and small hydropower. I also understand that solar water heaters have proven very popular and solar photovoltaic for decentralized power supply is fast becoming adopted all across the rural and remote areas of India. Also like Canada, wind energy in India is growing. Compared to 2006, India has more than doubled their wind capacity from about 5000 MW to 11,800 MW.

What are the criteria for a product to get the Energy Star labeling? How does it differ from EnerGuide label?

ENERGY STAR qualified products must first of all meet and exceed minimum Canadian energy performance standards according to Canada's Energy Efficiency Regulations. Products that fall under Canada's Energy Efficiency Regulations include refrigerators, washing machines, dishwashers, water heaters, room air-conditioners, dehumidifiers and heat pumps among others. The ENERGY STAR criteria specify energy efficiency levels that are more stringent than the regulated levels. ENERGY STAR criteria are established in collaboration with the U.S. ENERGY STAR program to ensure close harmonization within the North American market. For the purposes of Canada's Energy Efficiency Regulations, third-party certification of a product's energy performance by an organization accredited to the Standards Council of Canada must be provided. Products qualified as ENERGY STAR must be verified by organizations acceptable to the US Environmental Protection Agency. Most products, but not all, that qualify in the U.S. automatically qualify in Canada.

The EnerGuide label provides comparative information on the energy performance of products, allowing the buyer to compare energy performance ratings for different models. ENERGY STAR identifies the most energy-efficient models that meet or exceed premium levels of energy. For some products (refrigerators, clothes washers, dishwashers and room air conditioners), the ENERGY STAR mark may appear on the EnerGuide label.

The Canadian energy person of the year award for 2010 has been conferred to G. Stephen of Trans Alta Corporation. What goes into deciding the recipient? What are some of his achievements?

The Canadian Energy Person of the Year Award was established by the Energy Council of Canada, supported by the sectoral energy associations of Canada, to recognize and pay tribute to leaders in Canada who have made a significant impact at both the national and international level with respect to energy.

The Canadian Energy Person of the Year serves as an ambassador of our nation's energy sector, demonstrating a clear vision and commitment to fostering the sustainable use and development of energy for the benefit of all.

The Canadian Energy Person of the Year is nominated for this prestigious annual award based on their remarkable accomplishments in the energy and business or government sectors, as well as the community at large. One of their foremost characteristics is their strong sense of social responsibility and belief in giving back to the community by focusing on environmental and social issues, and economic development. Through their forward thinking and innovative spirit, these leaders promote the Canadian energy sector and Canada's role as a major player in the world energy market.

Stephen G. Snyder, President and Chief Executive Officer, TransAlta Corporation will be honored as 2010 Canadian Energy Person of the Year on October 27th, 2010 at the Telus Convention Center, Calgary Alberta. For more on Stephen Snyder, see page 4 of the following Energy Council of Canada brochure: http://www.energy.ca/users/getdownload.asp?DownloadID=495

Biomass, ethanol, geothermal and marine energy are some of the renewable energy sources that Canada has been promoting. What are some of the initiatives that have been undertaken in each case?

Investing in clean energy stimulates growth, creates jobs and helps to preserve our environment. Through our ecoENERGY initiatives and the Clean Energy Fund we are investing in renewable energy technologies such as wind, solar, hydro, biomass, tidal, smart grid systems and integrated communities. Nineteen projects have been selected in response to a call for proposals under the Renewable and Clean Energy portion of the Clean Energy Fund. Up to $146 million will be invested over five years in these projects to support clean, renewable energy, including biomass, geothermal and marine energy technologies. As an example, two geothermal projects will demonstrate how northern communities can use geothermal resources to generate electricity and to heat buildings to reduce the entire community's fossil fuel demand and reduce energy costs. Similarly, two marine energy projects will be funded, one to validate the performance and resilience of tidal current turbines in the Minas Passage in the Bay of Fundy (Nova Scotia), and the other to validate the performance of an offshore wave energy device in ocean conditions in British Columbia's open coast.

Projects under the Pulp and Paper Green Transformation Program are increasing the production of green energy from forest biomass, and helping to secure jobs at mills across Canada. By supporting projects that reduce energy consumption and increase renewable energy production, the Green Transformation Program complements the new $100 million, four-year Investments in Forest Industry Transformation program that will support the development, commercialization and implementation of advanced technologies in the forest sector helping create a world-class industry able to compete in the clean energy economy of tomorrow.

The ecoENERGY for Renewable Power is a four-year, $1.48-billion program to encourage renewable power in the form of wind, biomass, hydro, geothermal, solar and ocean energy. The program has been an overwhelming success, registering over 200 renewable power projects and it will bring more than 4,000 megawatts of new, clean electricity to the grid enough to power a million Canadian homes.

The ecoENERGY for Biofuels program was launched in April 2008 and is investing up to $1.5 billion over nine years to boost Canada's production of renewable fuels including ethanol and biodiesel.

The Government of Canada has also provided an additional $500 million to Sustainable Development Technology Canada to invest with the private sector to ensure Canada continues to be the leader in the next generation of biofuels technologies.

In the absence of national policies and/or binding international agreements that would limit or reduce greenhouse gas emissions, world coal consumption is projected to increase. How is Canada dealing with the situation and gradually weaning itself off coal-fired generations?

In December 2009, the 15th Conference of the Parties culminated in the Copenhagen Accord, a significant

breakthrough in the effort to address climate change. Canada has inscribed in the Copenhagen Accord a 2020 economy-wide target of a 17 per cent reduction from 2005 levels, which is completely aligned with the U.S. target. The Government of Canada is taking action to meet this target through developing and implementing a range of principles, policies, regulations and standards harmonized with those of the U.S.

While Canada already boasts of one of the cleanest electricity systems in the world with approximately 77 percent of electricity generated from non-emitting sources, the Government of Canada is working to build on that strength as we position Canada as the world's foremost clean energy superpower.

That's why the Government of Canada is taking action in the electricity sector to reduce greenhouse gas emissions and to improve air quality by regulating coal-fired electricity generation. Our approach would require new coal-fired electricity generation units, and those reaching the end of their economic life to either close down, or meet a stringent standard of environmental performance. The ultimate objective is the transition towards lower- or non-emitting types of generation.

This could include using renewable forms of energy, implementing high-efficiency natural gas, or incorporating thermal power with carbon capture and storage. I've been clear that we will not lose sight of the potential for developing cleaner coal technologies. Our country is a leader in carbon capture and storage, and we will maintain that focus.

In fact, providing this technology on a commercial scale is key to reducing Canada's greenhouse gas emissions and, in these regulations, new coal-fired plants that incorporate carbon capture and storage technology as an alternative will be exempt from the standard until 2025. These regulations, which will be developed over the course of the next year, are expected to come into effect by July 1, 2015. Working to regulate coal-fired electricity generation will help reduce greenhouse gas emissions, and help to improve air quality for all Canadians from coast to coast to coast.

The gradual phase-out of old and dirty coal-units is expected to have a significant impact on reducing emissions from the electricity generation sector.

This policy, coupled with the commitments of the provinces, and companies who have committed to coal closures, will amount to emissions reductions of about 15 Megatonnes by 2020.

This builds on our action to reduce greenhouse gas emissions on a sector by sector basis. In the transportation sector, we have already published draft regulations for renewable content in gasoline, and draft regulations to reduce GHGs from vehicles, in harmonization with the U.S. We are now working to establish a regulatory framework to reduce GHG emissions from the electricity sector.

In a scenario where the world's natural gas has not been fully assessed, why is Canada looking to become a net importer of natural gas under these circumstances?

Canada has abundant domestic natural gas supply and globally is the third-largest producer and the second-biggest exporter of natural gas. Recent resource estimates by industry suggest Canada may have over 100 years of natural gas supply available.

Advances in drilling and production techniques continue to help unlock vast unconventional natural gas resources, such as shale gas. Given optimism about Canadian natural gas production, some industry proposals contemplate expansion of Canada's natural gas export capacity. Of the forecasters we have surveyed, including the National Energy Board, none are anticipating that Canada would become a net importer of natural gas by 2030.

Technological advances in the field of renewable energy sources are making their availability less costly and more reliable; however there still remain certain obstacles. How can these obstacles be overcome? How can Canada help India gain access to them?

There can be several different types of obstacles to greater use of renewable energy sources in different situations, including technical and economic obstacles and policy and institutional obstacles. Overcoming these obstacles is the subject of a lot of discussion and work both within countries and internationally through organizations such as the International Energy Agency, and we welcome India's growing participation in these discussions. There is extensive and growing expertise in both India and Canada in the development of renewable energy sources, and I am very optimistic and enthusiastic about the potential to apply this expertise to the benefit of both of our countries, particularly through growing commercial and investment contacts. In addition, as you may know my department and the Indian Ministry of Power on behalf of the Indian government recently entered into a Memorandum of

Understanding (MOU) on Energy Cooperation. We are currently exploring the ways that this MOU can be used most effectively to advance collaboration in renewable energy and other areas.

India faces rampant energy cuts, what is Canada's remedy in dealing with the existing situation?

Canada would not presume to advise India on its energy policies, and appreciates the energy challenges that India faces, particularly with its high rate of economic growth. In Canada, electricity is generally in the jurisdiction of the provinces. They have generally been able to ensure adequate supply and reliability, although there are occasional local outages, generally due to equipment failure which is often weather-related. There are also interjurisdictional organizations, standards and other arrangements to help ensure the reliability of the North American electricity grid.

Canada has gained a lot of experience over many years in planning and developing electricity systems. At the same time, there is also now growing recognition of the need and opportunities to manage electricity demand more effectively and incorporate more renewable energy sources, including through so-called "smart grid" technologies. Canada is also developing expertise in these areas, which might also be of interest to India.

Boreal forests play an important role in reducing carbon from the atmosphere comprising almost 30% of Canada's land mass. What are some of the measures that are being taken to protect them?

More than 2.5 million Canadians, including 650 Aboriginal communities, live and work in the boreal region and depend on the forest for their well-being. The Government of Canada works in partnership with the provinces through the Canadian Council of Forest Ministers and with all stakeholders to ensure the sustainability of all of Canada's forest types.

Each province and territory has a strong regulatory framework governing forest practices within its boundaries, and these rules are continually being strengthened.

Activities such as harvesting, tree planting, and efforts to fight forest fires and insects all have an impact on the forest carbon balance. Under Provincial law in Canada, all harvested areas must be promptly regenerated, either through planting or through natural regeneration. Our sustainable management practices ensure that harvested areas are regenerated with healthy young forests that store carbon as they grow. Suppression of fires and protection against insects in the boreal can lead to a reduction in the area affected and help maintain the carbon stored.

Canada has a proven record of sustainable forest management, with more land certified under independent forest certification programs than any other country. Forestry practices in Canada are based on science and the Government of Canada continues to invest in the development of science-based tools to help ensure the long-term sustainability of our forests, including the boreal.

Anything else you would like to add to this interview.

To reach our goal of becoming a clean energy leader, Canada has made significant improvements in its energy use in all sectors of the economy and we continue to look for new ways to advance our efforts for a green energy economy.

To ensure progress in this area the Government of Canada is continuing to create high-quality jobs through investments in people and ideas that support the development of clean energy technologies. And, we are continuing to invest in more green energy, from both a production and consumption perspective.

Our Government has developed a broad suite of policies and programs to contribute to reducing greenhouse gas emissions by 17 percent below 2005 levels by 2020 - a target that reflects the importance of aligning with the U.S.

Moving forward aggressively with investments in clean energy technologies will help us reach this target and balance our need for energy with our need to protect the environment. Since 2006, the Government of Canada has invested more than $10 billion to reduce greenhouse gas emissions and build a more sustainable environment through investments in green infrastructure, energy efficiency, clean energy technologies and the production of cleaner energy and cleaner fuels. ■

Canada, a Key Contributor to World Energy Security

Christian Paradis, Minister of Natural Resources, writes about the emergence of Canada as a global leader in energy. The variety and abundance of Canada's energy resources has set it apart from almost any other nation, he argues.

Canada ranks fifth in the world in total energy production. In terms of gas and oil production, Canada is ranked globally third and seventh respectively. Although shale gas production is still an emerging sector in Canada, there are enough shale gas resources to provide about 35 years of total Canadian production. Canada also has the world's second largest hydro capacity and holds the world's largest reserves of high-grade, low-cost uranium.

Canada is a leader in the generation of clean energy, including the production of hydroelectricity. Currently, about 75 percent of the country's electricity comes from non-emitting sources, giving it one of the cleanest electricity portfolios in the world. A significant amount of Canada's renewable energy potential is untapped. Onshore wind and large hydro will likely make the largest contribution in the future, but Canada still holds immense potential for run-of-river hydro, solar, geothermal and ocean energy. Through its forests and agricultural land, the country is home to a significant portion of the world's bio-energy potential.

Effective policies have contributed to both Canada's energy security and its economic prosperity…

Canada's energy policies are guided by a set of core principles; supporting open and competitive markets; taking concrete actions that are in the public interest; and striking a clear balance between economic competitiveness and environmental leadership. The aims of these principles are to ensure energy security for Canadians and to promote the continued contribution of the energy sector to the growth of our economy.

Canada's energy policies have supported a vibrant energy sector, provided reliable and affordable energy to citizens, contributed to economic prosperity and created jobs. Market forces alone cannot deliver on broader policy objectives and this is where governments have a key role to play.

Government must ensure the orderly and responsible exploration, development, delivery and use of energy supplies. The Canadian government conducts environmental assessments, establishes regulations and makes major investments in clean energy. It also participates in the negotiation of international agreements such as the North American Free Trade Agreement and the Copenhagen Accord agreements which have had or will have a large influence in shaping domestic energy policy-making.

The oil sands provide Canada with the second largest oil reserves in the world …

Canada's oil sands are a strategic energy resource of global importance, given that oil is expected to remain a dominant fuel in meeting global energy demand for decades to come. The oil sands contain more than two thirds of world oil reserves that are neither state-owned nor controlled by national oil companies.

There are unique challenges associated with oil sands development and Canadian governments have responded to these with concrete actions. We have improved regulatory frameworks and are investing in the research and development of technologies that will enhance the environmental integrity of the oil sands sector.

Current oil sands development is already subject to some of the strictest environmental standards in the world. The Government of Canada believes that through proper management, the oil sands can continue to be a secure, stable, and environmentally responsible source of energy for many years.

Canada's objective is to focus on how it produces and uses energy, in addition to what it produces….

The pre-eminent challenge is to make the transition to a clean energy future and strengthen Canada's position as a clean energy superpower. Technology will play a major role in shifting Canada towards a clean energy economy while strengthening the country's competitiveness and increasing its productivity.

This poses a significant investment challenge and requires a delicate balance between making the improvements necessary today while investing enough to prepare for the future. Huge infrastructure investments will be required in the next 20 years in the oil and gas sector (pipelines, refinery capacity) and in electricity generation and transmission.

Canada has made, and continues to make, strategic investments in clean and renewable energy. We are also taking steps to strengthen our energy efficiency standards and investing in energy efficient buildings and transportation. Since 2006, the Government of Canada has invested close to $10 billion to reduce greenhouse gas emissions and build a more sustainable environment through investments in green infrastructure, energy efficiency, clean energy technologies and the production of cleaner energy and cleaner fuels.

Canada is a world leader in carbon capture and storage (CCS), a key technology for balancing energy security and environmental goals. Over $3 billion has been allocated by both federal and provincial Governments to support up to six CCS demonstration projects in Canada which will accelerate the development of technology, drive down costs and ensure that CCS is commercially viable by 2020.

These strategic investments will also help us achieve the G8's objective to launch 20 such projects globally by 2010. Canada is already leading the way with the International Energy Agency's Greenhouse Gas Weyburn Midale C02 Monitoring and Storage Project in the southern part of the province of Saskatchewan.

The country's stable regulatory and political regimes also have a role in providing an environment that increases the market penetration rates of new technologies, reduces investment risks, promotes energy efficient decisions and processes and removes information barriers.

Canada has made realistic yet ambitious GHG commitments….

The Copenhagen Accord represents a significant step forward in international climate change discussions and provides a solid basis from which Canada can continue to work with international partners to address the global challenge of climate change. In line with our commitment under the Accord, Canada has submitted an economy-wide emissions reduction target for 2020 of 17% below 2005 levels. This target is aligned with the target and base year of the U.S. under the Copenhagen Accord.

The North American market is one of the most integrated in the world. Canada will continue to harmonize its climate policies with relevant polices in the U.S. in light of the integration of the two economies and their geographic proximity.

Canada is also working collaboratively with the U.S. and Mexico, its hemispheric partners, to achieve progress on climate change and clean energy. With a deeply integrated automotive industry, Canada has established common North American standards for regulating greenhouse gas emissions from vehicles. The proposed regulations, which would affect new vehicles manufactured or imported for the 2011 model

year and onwards, promise to generate substantial benefits for the environment, consumers and industry alike.

Canada is collaborating on clean energy with the U.S. through the Clean Energy Dialogue and with Mexico through the Canada-Mexico Partnership. At our most recent Summit in 2009, North American leaders also agreed to a comprehensive energy program including initiatives to reduce gas flaring and to cooperate internationally to reduce emissions from aviation and marine transport.

Canada is uniquely positioned to contribute to energy security ....

Canada will continue to develop its significant energy resources and continue to invest in clean energy and energy efficiency. It will also keep working to reduce emissions from its electricity, fossil fuels and transportation sectors.

The development of new technologies, effective government regulation and an accessible open investment market will continue to ensure that Canada can meet its environmental objectives and contribute to the world's energy security for years to come. ■

WEC Indian Member Committee: Creating Synergy in Energy Sector

By J. K. Mehta, General Manager, NTPC

The World Energy Council Indian Member Committee is one of the leading organizations in the country for policy research, advocacy and action in the energy sector. It has been playing a proactive role in creating synergy in the energy sector through its various initiatives.

The WEC-IMC had conceived the India Energy Congress as an apex level meet of energy professionals from across the sector. The first Congress on 'Economic, Efficient, and Environment Friendly Energy' took place in January 2007. The India Energy Congress 2010 was organized on the theme "Energy Challenges for a sustainable Future" and addressed the issues of Availability, Accessibility, Acceptability and Accountability in the energy sector.

The Energy Synergy Dialogue is another initiative of the WEC-IMC, where experts from the Energy Sector are invited to lecture. So far the Energy Synergy Dialogue has been on:

- The Road map for Indian Coal Sector (by Sh. T L Sankar)
- CDM & Climate Change (by Sh. R.K. Seth)
- Energy Conservation Building Code (by Dr. Ajay Mathur)
- Challenges in coping with Global Warming - Thermal Power Generation (Dr. Malti Goel)
- Delivering Energy Security for Rural India (by Dr. S.K Chopra).

A recent initiative of the Committee, in partnership with the All India Women's Conference (AIWC) and with the support of the Ministry of New and Renewable Energy (MNRE), has been organizing the Solar Energy Fair. The Fair helps create greater awareness about the use of solar appliances, such as water heaters and cookers, in daily life. Five such fairs have been organized in New Delhi. WEC-IMC has plans to replicate this initiative and hold a number of road show Energy Fairs at various locations across India.

IMC has also initiated studies on current issues aligned with the national energy goals of the country.

WEC IMC also brings out a number of publications, foremost among them being the India Energy Book. It serves as a single source of comprehensive statistics on India's energy sector. The Indian Energy Book 2010 was released at the India Energy Congress by the Hon'ble Minister of Power, Sri Sushilkumar Shinde.

(The author heads the Secretariat of the World Energy Council in India and is the Regional Manager of WEC for South Asia. He is also Advisor to the WEC Global Studies Programme, leading a global initiative on "Sustainable Energy Poverty Alleviation for Asia.") ■

Indo-Canadian N-Pact Will Further Bolster Bilateral Ties

By Neil Alexander, President, Organization of Candu Industries

On the evening of Sunday 27 June this year, the day the G20 closed in Toronto, the Prime Minister of Canada, the Right Honorable Stephen Harper, held a dinner in honor of His Excellency Dr. Manmohan Singh, Prime Minister of the Republic of India. This dinner, attended by about 700 guests, celebrated the close ties between the two countries and provided an opportunity for the two Prime Ministers to announce the signing of the bilateral Nuclear Cooperation Agreement. This much-anticipated announcement drew a standing ovation from the guests, an action that clearly demonstrated the importance of this agreement to the business community and government representatives at the dinner.

India had already signed such agreements with a number of other countries but the Indo Canadian agreement is special because of the shared technological heritage and Canada's expertise in uranium mining and uranium supply. It is likely that the early trading will be focused on fuel issues with this agreement allowing India to continue its economic development without a parallel increase in green house gas production while Canada benefits from the sale of a high added value natural resource. Two way trade will however arise from the shared technology.

The shared heritage started in the 1960s with India's purchase of a Canadian designed Pressurized Heavy Water Reactor (PHWR). Based on the Douglas Point design, Rajastan Atomic Power Plant 1 (RAPP1) was completed in 1973 when RAPP 2, a refinement of this design, was already under construction. Since then PHWRs have gone on to form the backbone of the civilian nuclear industries in both countries with Canada building 32 commercial "CANDU" units leading up to the 900MW Darlington CANDU 9 and the successful export of the standardized CANDU 6 to Romania, Argentina, Korea and China. Meanwhile India completed RAPP 2 on its own and evolved the design to build 16 PHWRs of various sizes to reflect regional needs. One more is approaching completion and the largest units at 640 MW are presently in planning. Although India has so far not exported its civilian nuclear power designs it sees the opportunity in the region as part of the nuclear renaissance and the demand for power in the developing states.

Both countries have research facilities primarily focused on the PHWR concept that have separately been innovating to enhance safety, efficiency, operability, constructability and longevity. Similarly supply chains in both countries have been developing in order to supply the goods and services needed to build, operate and maintain PHWR reactors. Noting that in Canada alone, there are over 165 companies that are part of the Organization of CANDU Industries which supply virtually every aspect of the CANDU Units. There can be no doubt looking at the combination of both countries Supply Chains as well as the best scientists and engineers applying themselves to these Nuclear Plants that some of the innovations will be the same. At the same time some of the developments quite possibly may have gone in different directions. There will be components of different design, different materials will have been utilized, and monitoring and control equipment will be different. Even where the design has remained common, manufacturing techniques will have changed.

In some cases, Canada may have identified the better approach while in others India will have made a breakthrough that Canada may not have considered. The electircity producers in both countries can immediately benefit by adopting optimum solutions for the ongoing operation of their plants while companies that have developed those optimum technologies will double their potential markets. Two way trade will start swiftly for those companies that recognize the

opportunity and act upon it. Yes this can be done through simply exporting/importing between the two countries but with conservative buying patterns and the need to satisfy local regulations and regulators the real benefit will likely go to those companies that set up joint working relationships with partners in the other country, optimizing design and production to become the most competitive suppliers to the much expanded market. As well as direct commodity trade the Nuclear Cooperation Agreement will bring about financial transactions and inward and outward investments that will improve commerce for both nations.

Operation of the existing plants is though only a small part of the opportunity. Even greater benefits will be seen in the development of both the Canadian and Indian PHWR new build programs. India is calling for 20,000MWe of nuclear power by 2020 increasing to 63,000MWe by 2032 thereby creating a $25-$50 billion market for new build and opportunities for PHWR suppliers in engineering services, design and construction of plants and subsystems, balance of plant, safety assessments and licensing.

While uranium supply and two way trade in operational support will likely be immediate and the indigenous markets for new build will be large, the real opportunity that the signing of the NCA creates is more competitive Indo Canadian PHWRs that can be sold into third party markets in direct competition to existing light water designs and more rapid progress on innovative PHWR applications that will arise through coordinated research and will lead to reactors that can utilize Thorium and other Natural Uranium Equivalents (NUE) as fuels. These unique capabilities of the PHWR design are not in mass market demand at the moment but are becoming increasingly valuable in niche markets to customers that have limited uranium resources or wish to minimize used fuel volumes. Both India and Canada have already recognized these opportunities and have well developed research programs. Combining these programs will produce more satisfactory results quicker.

The Canadian owner of the CANDU design, Atomic Energy of Canada Ltd (AECL) through its owner the Federal Government is presently seeking partners that will bring the investment, business experience and international presence needed to make CANDU a success in the burgeoning nuclear new build market. It is almost certain that the commercial opportunity created by the bringing together of the CANDU and INDU markets will be high on the agenda for this new partner.

Nothing though is guaranteed. Bringing together markets like this requires vision and it requires effort. At the Canadian end we understand the opportunity and our resources are rallying to commit the effort. Support can be found through nuclear industry associations such as the Organisation of CANDU Industries, international trade organisations such as the Canada India Business Council and both the Canadian Federal Government and the Ontario Provincial Government.

Both Prime Minister Harper and Prime Minister Singh, in making their announcement on June 27, created an opportunity for a highly competitive nuclear business that could see Indo Canadian PHWRS sold to third party countries while the increased trade in such a strategic area will strengthen the already strong ties between the two countries. The standing ovation was well deserved and I am proud to have been a contributor to it. ■

India's National Solar Mission Sets 10-Yr, 20,000 MW Target

Solar Power to be Thrust of Renewable Energy Agenda

By **Robin Mazumdar,** AGM (NVVN), NTPC Limited

Prime Minister Manmohan Singh, while launching India's National Action Plan on Climate Change (NAPCC) on 30 June 2008 emphasised that "the Sun occupies centre-stage, as it should, being literally the original source of all energy". India is located in the equatorial sun belt of the earth, thereby receiving abundant radiant energy from the Sun. About 5000 trillion kWh of energy is incident over India's land area with most parts receiving 4-7 kWh per sq. m per day. The NAPCC had identified National Solar Mission as one of the original eight Missions (a ninth mission, "National Mission on Clean Coal Technology," was subsequently added) emphasising the shift from non-renewable sources to renewable sources of energy. JNNSM (Jawaharlal Nehru National Solar Mission), launched on 11 January 2010 by the Prime Minister aims at developing and deploying solar energy technologies in the country to achieve parity with grid tariff by 2022. NTPC Vidyut Vyapar Nigam Limited (NVVN) is identified as the nodal agency to implement the first phase of JNNSM.

The NAPCC has identified nine Missions that are part of an effort to make a graduated shift from economic activity based on fossil fuels to one based on non-fossil fuels and from reliance on non-renewable and depleting sources of energy to renewable sources of energy. Of these nine missions, as stated by the Prime Minister, the National Solar Mission is the Centrepiece.

Figure 1 shows the map of India with solar radiation levels in different parts of the country. It can be observed that although the highest annual global radiation is received in Rajasthan, northern Gujarat and parts of Ladakh region, parts of Andhra Pradesh, Maharashtra and Madhya Pradesh also receive fairly large amount of radiation as compared to many parts of the world especially Japan, Europe and the US where development and deployment of solar technologies is maximum.

Both technology routes for conversion of solar

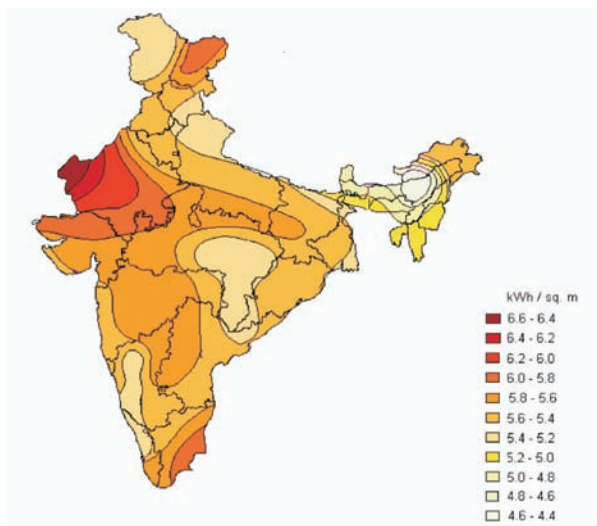


Figure 1 : Solar radiation on India (Source: TERI)

radiation into heat and electricity, namely, solar thermal and photovoltaic, can effectively be harnessed providing huge scalability for solar in India. Therefore, tapping of solar energy assumes a prominent position among the options for transitioning to low carbon or carbon free sources. This vast potential has several benefits - for example by displacing fossil fuels it promotes energy security and brings down emission levels and can be adopted for various scales starting from a few KWs to MW scale in the modular and standardized design. Further, the solar energy can be used for almost all applications - domestic, industrial processes, agricultural, commercial etc. - in an integrated or standalone basis.

The Mission

The Jawaharlal Nehru National Solar Mission is a major initiative of the Government of India to promote ecologically sustainable growth while addressing India's energy security challenge. The objective of the Jawaharlal Nehru National Solar Mission (JNNSM) under the brand 'Solar India' is to establish India as a global leader in solar energy, by creating the policy

conditions for its diffusion across the country as quickly as possible. The Mission has set a target of 20,000 MW and stipulates implementation and achievement of the target in phases (first phase up to 2012-13, second phase from 2013 to 2017 and the third phase from 2017 to 2022) for various components, including grid connected solar power.

The Roadmap

The proposed roadmap of the Mission is to ensure large-scale deployment of solar generated power for grid connected as well as distributed and decentralized off-grid provision of commercial energy services. The deployment across the application segment is envisaged as below:

No.	Application segment	Target for phase-1 -1 (2010-13)	Target for phase-2 (2013-17)	Target for phase -3 (2017-22)
1.	Solar collectors	7 million sq. meters	15 million sq. meters	20 million sq. meters
2.	Off grid solar applications	200 MW	1000 MW	2000 MW
3.	Utility grid power, including roof top	1000-2000 MW	4000-10000 MW	20000 MW

Implementing JNNSM

The Mission provides for NTPC Vidyut Vyapar Nigam Ltd or NVVN to be the designated Nodal Agency for implementing the mission. NTPC Vidyut Vyapar Nigam Limited (NVVN) is a wholly owned subsidiary of NTPC Limited. NVVN is engaged primarily in the business of power trading. It is the only government owned power trading company and is the second largest power trading company in terms of market share. Government of India, through a Presidential Directive has designated NVVN as the Nodal Agency for the first phase of the National Solar Mission for 2009-13 with the following mandate:

• NVVN shall enter into Power Purchase Agreements (PPAs) with Solar Power Developers to purchase power from the solar power projects connected at 33 kV and above grid at tariff regulated by CERC and enter into back to back Power Sale Agreements (PSAs) with Distribution Utilities for sale of such power bundled with the power sourced from NTPC coal power stations.

• The Ministry of Power shall allocate equivalent megawatt (MW) capacity from the unallocated quota of NTPC power stations at the disposal of the Government of India to NVVN for bundling together with solar power to be procured by NVVN.

• Solar power and unallocated power of NTPC stations bundled together shall be sold by NVVN to the Distribution Utilities.

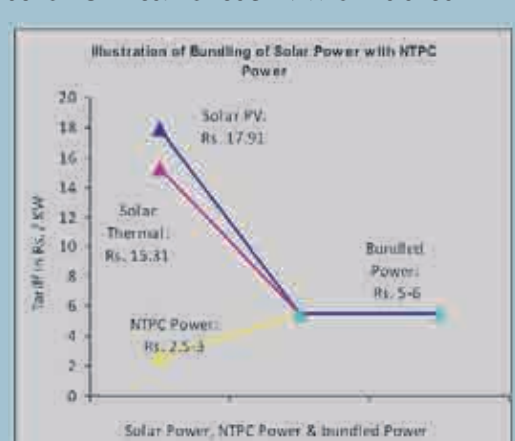
• The above arrangement shall be limited to cumulative solar power capacity of 1000 MW in operation up to 31st March, 2013.

Guidelines for Selection of Solar Project Developers

To facilitate quick start up of the JNNSM, the Ministry of

Bundling of Solar Power with NTPC Power

In order to facilitate grid connected solar power generation in the first phase, a mechanism of "bundling" relatively expensive solar power with power from the unallocated quota of the Government of India (Ministry of Power) generated at NTPC coal based stations, which is relatively cheaper, has been proposed by the Mission. This "bundled power" would be sold to the Distribution Utilities. For each MW of installed capacity of solar power for which a PPA is signed by NVVN, the Ministry of Power (MoP) shall allocate to NVVN an equivalent amount of MW capacity from the unallocated quota of NTPC coal based stations and NVVN will supply this "bundled" power to the Distribution Utilities.



New and Renewable Energy (MNRE) has finalized the guidelines for "Migration of existing under development grid connected Solar Power Projects from existing arrangements to the Jawaharlal Nehru National Solar Mission" and launched the same in its website on 9th February,2010. The cut-off date for submission of Applications along with necessary documents by the Solar Power Developers to NVVN was 26th February,2010. Under the migration scheme, eligible Solar Power Developers have been shortlisted for 84 MW solar capacity (Solar PV 54 MW, Solar Thermal-30 MW) and MOUs have been signed with them on 24th July, 2010. The details are given in the table.

S.No.	State	Eligible Solar Power Developer	Plant Capacity (MW)	Whether Solar PV or Solar Thermal
1	Maharashtra	3	11	Solar PV
2	Punjab	2	7	Solar PV
3	Rajasthan	8	36	Solar PV
		3	30	Solar Thermal
Total		16	84	

The Guidelines for selection of new projects under Phase 1 of JNNSM have been released by MNRE on 25th July, 2010. NVVN shall subsequently issue the notice for inviting the Request for Selection of the Solar Power Developers. The key points of the guidelines for new projects are as given below.

i. Portfolio of Technology: The Mission provides for deployment of both Solar PV Technology Projects and Solar Thermal Technology Projects in a ratio of 50:50, in MW terms. This provision will be reviewed after one year from the date of issue of these guidelines. However, the selection of projects would be technology agnostic.

ii. Phasing Allocation of Capacity: In case of Solar PV, to prevent bunching of large capacities and the difficulty in achieving financial closure and to promote domestic manufacturing, the allocation of capacities would be done in two batches and over two financial years of Phase 1 i.e., 2010-11 and 2011-12. The total capacity of Solar PV projects shall be limited to 150 MW in FY 2010-11, and for remaining capacity for Solar PV projects (500 MW less 150 MW and migrated capacities), in FY 2011-12. Due to longer gestation period for Solar Thermal projects, entire capacity less migrated capacity shall be done in 2010-11.

iii. Capacity: In case of Solar PV, the capacity shall be 5 MW ± 5% with no further variation in the capacity permitted. In case of Solar Thermal, the minimum capacity shall be 5 MW and the maximum capacity shall be 100 MW.

iv. Net Worth: In case of Solar PV, the Net worth of the company should be equal to or greater than the value calculated @ Rs.3 crore/MW of the project capacity. In case of Solar thermal, the Net worth of the company should be equal to or greater than the value calculated @ Rs.3 crore/MW of the project capacity up to 20 MW. For every MW additional capacity beyond 20 MW, additional net worth of Rs.2 crore would be required.

v. Technical Criteria: In case of Solar PV, it is proposed to promote only commercially established and operational technologies to minimise the technology risk and to achieve the Commissioning of the Projects. In case of Solar Thermal, it is proposed to promote technologies, that have plants, which have been in operation for a period of one year or a technology for which financial closure of a commercial plant has already been obtained.

vi. Domestic content proposed: For solar PV, in first batch during FY 2010-11, it will be mandatory for projects based on crystalline silicon technology to use modules manufactured in India. In second batch during FY 2011-12, it will be mandatory for all the Projects to use cells and modules manufactured in India. For solar Thermal, it would be mandatory for Project developers to ensure 30% of local content in all plants/installations under thermal technology.

vii. Connectivity with the grid: Letter from STU confirming technical feasibility of the connectivity of the plant to the grid substation is to be submitted. The Solar Power developer would have to enter into transmission evacuation agreement with the STU.

viii. Commissioning of the Project: For solar PV, 12 months from the date of signing of PPA and for solar thermal, 28 months from the date of signing of PPA.

Tariff of Solar power

Central Electricity Regulatory Commission through a Notification dated 16th September, 2009 has determined the generic tariff of both solar PV power and solar thermal power for the year 2009-10 and for subsequent year through a Notification dated 25th February, 2010 based on the following parameters:

S.No.	Parameters	Unit	Solar PV		Solar Thermal	
			2009-10	2010-11	2009-10	2010-11
1	Capacity Utilization Factor	%	19	19	23	23
2	Aux Consumption Factor				10.00	10.00
3	Useful Life	Years	25	25	25	25
4	Capital Cost	Rs.Cr./MW	17.00	16.90	13.00	15.30
5	Debt : Equity ratio		70 : 30	70 : 30	70 : 30	70 : 30
6	ROE for first 10 years	% p.a.	19	19	19	19
7	ROE 11th year onwards	% p.a.	24	24	24	24
8	Interest rate	%	14.29	13.39	14.29	13.39
9	Discount Rate	%	16.60	15.97	16.60	15.97
10	Depreciation Rate for first 10 years	%	7	7	7	7
11	Depreciation Rate 11th year onwards	%	1.33	1.33	1.33	1.33
12	O&M Expenses					
	Power Plant	Rs.Lakh/MW	9	9.51	13	13.74%
	Total O&M Expenses escalation	%	5.72%	5.72%	5.72%	5.72%
13	Working Capital					
	i) O&M Charges	Months	1	1	1	1
	ii) Maintenance Spares as % of	%	15	15	15	15
	O&M Expenses	Months				
	iii) Receivables on Debtors		2	2	2	2
14	Levellised tariff	Rs./kWh	18.44	17.91	13.45	15.31

As per the CERC Notification dated 25th February,2010, the generic tariff determined for Solar PV projects for the year 2010-11 shall also apply for such projects during the year 2011-12. Similarly, for Solar Thermal projects for the year 2010-11 shall also apply for such projects during the year 2011-12 and 2012-13. The CERC also made a proviso to this Notification that (i) the Power Purchase Agreements (PPAs) in respect of the Solar PV projects and Solar Thermal projects are signed on or before 31st March, 2011 and (ii) the entire capacity covered by the PPAs is commissioned on or before 31st March, 2012 in respect of Solar PV projects and on or before 31st March, 2013 in respect of thermal projects.

The Electricity Act mandates the State Commission to specify a percentage of the total consumption of electricity in the area of a distribution licensee, for purchase of electricity from renewable sources. As per the Policy framework of the National Solar Mission, the solar power purchase obligation for States may start with 0.25% in the phase I and to go up to 3% by 2022, which could be complimented to allow utilities and solar power generation companies to buy and sell certificates to meet their solar power purchase obligations.

Scaling up for phase II and III

The ambitious target of 20,000 MW by 2022 will be dependent on the learnings of phase-I and II as major capacity addition is likely to come in phase-III. ■

PetroFed Promotes Energy Conservation & Safe Environment

The Petroleum Federation of India, or PetroFed, is a non-profit, consortium of Indian and International Companies/Association in the hydrocarbon sector proactively promoting member interests in line with public/national policies through a self-regulatory environment with consumer interest in sight.

It acts as an oil industry interface with government, regulatory authorities, and public and representative bodies of traders. It helps in resolution of issues and facilitates evolution of hydrocarbons related policies and regulations. It represents the industry on government bodies, committees and task forces.

PetroFed promotes energy conservation, health, safety & environment and helps to optimize resource utilization of members. It organizes seminars, conferences, workshops, training programmes, lectures and brings out technical publications. It produces a quarterly journal.

Efficient and reliable energy supplies are a prerequisite for accelerating the growth of the Indian economy. While the energy needs of the country are going to increase at a rapid rate in the coming decades, the energy resources that are indigenously available are limited. In these circumstances the unified, focused and pragmatic approach of PetroFed is providing sustainable energy solutions to the policy and decision makers.

PetroFed...Governance and Management

The Management and Operations of PetroFed are guided and overseen by a Governing Council. The Governing Council presently has 12 Members with Shri S. Behuria as Chairman and Shri P. Raghavendran, President (Refinery Business), Reliance Industries Limited as Vice Chairman. PetroFed has a full time Director General, and currently three Directors, two Joint Directors and two Assistant Directors.

It functions through committees from member organizations and other experts, covering all aspects of the oil and gas industry which submit recommendations on an ongoing basis.

PetroFed Initiatives

PetroFed has submitted several study reports which have been hotly debated for implementation. The first projection for India's consumption of petroleum products till 2030 was undertaken by PetroFed when it produced two publications - "Fuelling India's Growth: Past Trends and Scenarios 2011-12" and "Fuelling India's Growth: Vision 2030".

A publication titled "Sustainable Imperative" focused on economic, environment and social development goals of Corporates in the form of Triple Bottom Line Reports.

The publication "Green Imperative Future of Natural Gas in India-2030" sensitizes stakeholders in initiating actions for India's gas market development for economic growth.

Reports have been developed on Petrochemical market assessment, opportunities for earning CERs through Clean Development Mechanism as well as on the Regulatory Issues on Oil & Natural Gas.

A Workforce Sustainability and Talent Management study delves into the human resource requirements and availability in the next decade in the upstream sector.

PetroFed has instituted annual PetroFed Oil & Gas Industry Awards to recognise individuals and organisations who have made significant contribution in implementing innovative, cost-effective and environment friendly energy usage.

PetroFed is all set to offer... energy solutions, for sustainability!

GFDR
GLOBAL FORUM FOR
DISASTER REDUCTION
Global Vision, Local Action

GLOBAL FORUM FOR DISASTER REDUCTION

Since 2005

A NEW MEDIA Initiative
connecting global wealth creators
www.newmediacomm.com

GFDR Secretariat: 1-Akbar Villa, Near Old State Bank, Marol Maroshi Road, Andheri (E),
Mumbai-400 059, India Phone: +91 22 2925 3086, Fax: +91 22 2925 5279.
Email: connect@gfdr.org www.gfdr.org.

towards resilient risk reduction...

C-WET Gears to Tap India's Wind Energy Potential

By S.Gomathinayagam, Executive Director, Centre for Wind Energy Technology

Wind Energy Projects were initiated by Government of India in the 80's through demonstration projects in a few states in Gujarat, Tamil Nadu and Maharashtra. These demonstrated the capability of wind generated electricity as pollution-free power that can be grid-connected and distributed. With accelerated depreciation, custom duty exemption and several other fiscal incentives offered by the Government ever since the establishment of an exclusive Ministry known as the then Ministry of Non-Conventional Energy Sources (MNES) has resulted in significant developments pushing India to the forefront of wind power exploitation and threw open a huge market in Global wind power scenario. Today installed capacity of wind energy projects (Wind Electric Generators: WEG), is placing India in the fifth position in the World Wind Power. Centre for Wind Energy Technology (C-WET) as an Autonomous R & D Institution under the MNRE has been since its inception (in 1998) an enabling body for orderly development of wind energy projects in India.

However, the present installed capacity of about 12 GW spread over eight states essentially in India is only about 25% of the predicted potential of 48 GW. Tamil Nadu leads the installed capacity having a stake of about 41% in India. Maharashtra, Karnataka and Gujarat follow it with 18%, 14% and 13.5% respectively. Rajasthan with 7.4% and Andhra Pradesh with 4.2% just have started developing wind farms recently in the last few years. (Table I)

With the Ministry's new initiatives like GBI (Generation Based Incentive), RPO (Renewable Purchase Obligation), REC (Renewable Energy Certificate) etc and 11th Plan (2007-12) targets of reaching about 5000 MW annual capacity addition by 2015, the wind power development in India is likely to get a significant boost in the years to come. Maharashtra, Karnataka, Andhra Pradesh and Gujarat have extensive land availability in which developments would be faster around the passes of western ghats and in Gujarat. Developments in Madhya Pradesh where plenty of land to the tune of 44.3 million hectare is available, may require a revised policy to allow wind farms in the areas which are marginally deficient in WPD of 200 watts/sqm. A policy framework for repowering, intercropping and offshore wind power would certainly speed up wind power deployment in India. It is more than evident that the wind power is environmentally benign. It allows any kind of agricultural and other rural developments right at the foot of the wind mill towers without any problems. However, the main challenges would be the requirements of wind forecasting, the development of roads and logistic needs, interstate evacuation grid network and transmission grid capacity enhancements and declaration of forest areas for wind power development apart from the need for indigenous technology through innovation and R&D for cost reduction. (website : cwet.res.in)

Table-1 . Wind Energy Projects India : Achievements and Opportunities

Windy State	Net ar ea of state (million hectares)	Gross Potential based on requirement of 12 ha/MW With WPD 200 watts/m ^{2}@50m Hub-height, Land Availability (LA) Wind Measurements level (WM)		Installed Capacity in MW	% use of regional states potential	% share of installed wind power in India
		1% LA, WM 20-25m (Ending 2004)	2% LA, WM 20-50m (Ending 2009)*			
Andra Pradesh	27.7	8968	5394	512.08	5.7	4.2
Gujarat	19.6	10645	10609	1626.01	15.3	13.5
Jammu and Kashmir	22.2	0	5311	0	0.0	0.0
Karnataka	19.2	11531	8591	1706.94	14.8	14.1
Kerala	3.9	1171	790	27	2.3	0.2
Madhya Pradesh	44.3	1019	920	216.16	21.2	1.8
Maharastra	30.8	4584	5439	2204.25	48.1	18.3
Orissa	15.6	255	910	0	0.0	0.0
Rajasthan	34.2	4858	5005	896	18.4	7.4
Tamil Nadu	13.0	5530	5374	4889	88.4	40.5

** As per the Indian Wind Atlas 2010 of C-WET*

Initiating Reforms to Curb Power Thefts & Distribution Losses

By Mrinal Madhav & Shivika Mehta

Following is the summary of a paper written by the authors entitled "Case of Reforms in the Indian Power Distribution Sector: A Move Towards Eradicating Energy Poverty" to be published and circulated at the World Energy Congress 2010, Montreal.

Mrinal Madhav
(MBA - Oil & Gas)

Shivika Mehta
(MBA - Oil & Gas)

Hindustan Petroleum Corporation Limited

India's transmission and distribution losses are among the highest in the world. When non-technical losses such as energy theft are included in the total, losses go as high as 65% in some states and average about 35-40%. The financial loss has been estimated at 1.5% of the national GDP. These act as a major deterrent to the private as well as global investments in the sector. To address the issue of Aggregate Transmission and Commercial (AT&C) losses, the Accelerated Power Development Reforms Programme (APDRP) was introduced. Its key objectives were to reduce AT&C losses, improve customer satisfaction as well as financial viability of the State Distribution Companies (SDCs), adopt a systems approach and introduce greater transparency. It was in this backdrop that the Restructured APDRP (R-APDRP) was conceived in September 2008 for the 11th Five Year Plan (2007-12).

The Indian Context

With a population of over one billion people (that is, 15 percent of the world's population) living in 28 states, India is the second most populous country in the world. India's GDP, based on purchasing power parity, is estimated at US$ 3.528 trillion for 2008 currently the fourth highest in the world .With a median age of 25 years and GDP growth rate ranging 8-9% there is going to be an enormous need for energy in the country for a long time to come.

The projected elasticity of electricity with respect to GDP is 0.95. With this, the growth rate in electricity consumption is expected to be 7.6 percent. At an 8 percent GDP growth, the per capita consumption of India in 2032 is estimated to be 2,643 kWh, which is just comparable to the present day world average. It is clear that demands on the electricity sector will increase at a dramatic rate.

The electricity sector in India is predominantly controlled by the Government of India's public sector undertakings (PSUs). The Ministry of Power is the apex body responsible for the development of electrical

State-wise AT&C Losses in India

Less than 20%	Between 20-30%	Between 30-40%	Above 40%
Goa	Andhra Pradesh	Karnataka	Delhi
Tamil Nadu	Gujarat	Kerala	Uttar Pradesh
	West Bengal	Assam	Bihar
	Himachal Pradesh	Haryana	Jharkhand
	Maharashtra	Rajasthan	Madhya Pradesh
	Tripura	Meghalaya	Arunachal Pradesh
	Punjab	Mizoram	Manipur
	Uttaranchal	Chhattisgarh	Nagaland

energy in the country.

About 75% of the electricity consumed in India is generated by thermal power plants, 21% by hydroelectric power plants and 4% by nuclear power plants. More than 50% of India's commercial energy demand is met through the country's vast coal reserves.

Electricity losses in India during transmission and distribution are extremely high and vary between 30 to 45%. **Theft of electricity, common in most parts of urban India, amounts to 1.5% of India's GDP**

Distribution Sector Reforms

Power sector reforms were first initiated in India in 1992 by the Ministry of Power (MoP) to invite private investments in power generation to bridge the demand-supply gap. However, private investments failed to yield much benefit due to serious deficiencies and losses in electricity distribution in most of the State Electricity Boards (SEBs).

In the reform process distribution segment was identified as the key area for reform for putting the sector on the right track. Distribution Reforms involve System upgradation, Loss reduction, Theft control, Consumer orientation, Commercialization and adoption of IT.

Finally, there is a thrust on privatization.

The idea is that private energy utilities will be better managed, more motivated to raise revenue - and less susceptible to political pressure than government-run enterprises. In Delhi, the private power firms are making progress. India's two largest private power companies - Tata Power and Reliance Energy - have been awarded management control of supplying electricity to Delhi, working in partnership with state-run organisations.

Tata Power has cut transmission losses in its patch from over 50% of the power supplied to little more than 30%.The company has launched several thousand civil legal cases against people it suspects of abusing the system in Delhi. Tata is also undertaking an education campaign to convince consumers of the merits of paying for power. And it is also offering an incentive: a scheme that gives slum-dwellers power enough for lights and a fan for a monthly fixed price. The company rewards the people informing the company about power theft in their neighbourhood. Besides, the company backed by police conducts raids in areas where electricity theft is supposed to be on a large scale.

In case of large industrial customers, the company had to introduce an automated meter-reading system making use of wireless technology, in a bid to prevent these high-value customers from bribing the meter readers to get their electricity bills reduced to the minimum. To train its employees in anti-theft techniques, the North Delhi Power Ltd. runs a training centre in Northwest Delhi, where the employees are taught how meters can be manipulated; powerful magnets can deactivate meter's mechanism etc. and, above all, what can be done to check such illegal and immoral practices. In order to keep power thieves from tapping power directly from overhead lines, the employees are taught to replace wires with insulated cables.

Restoration of the financial health of SEBs and improvement in their operating performance continues to be a critical issue in the power sector. The Electricity Act of 2003 contains provision for securitisation of accumulated SEB dues.

One per cent reduction in T&D loss can save additional capacity of 800 MW. Reduction of technical losses by 6,0007,000 MW is expected to obviate the need of fresh capacity addition to an extent of 9,000 to 11,000 MW avoiding investments to the tune of Rs.40,000 crore to Rs.60,000 crore. As the Prime Minister Manmohan Singh pointed out in his address at the Conference of Chief Ministers on the Power Sector on May 28, 2007 at New Delhi, "Theft is the cancer of the power sector". To combat the power crisis being faced by the country adequate measures must be taken to minimize theft at the earliest. ■

Indian Power Output Needs to Be Doubled to Sustain GDP Growth

By Rupa Devi Singh, B.Sc., L.L.M., University of Delhi

India's growth story of the last decade has brought the focus on infrastructure in general and energy security in particular. It is an accepted fact that in order to achieve double digit growth rates, the power sector needs to grow about two fold from its current size to an installed capacity of about 315-335 GW by 2017.The anticipated surge in demand caused by high projected growth rates poses challenges related not only to the quantum of supply but also the related infrastructure, both physical as well as market related.

India has been fortunate that its legislators and policy makers have provided the country with a path breaking legislation in the form of Electricity Act 2003 which has been followed through by an accompanying framework of policies which ensures sufficient clarity to all participants. In addition, the sector also benefits from a strong regulatory framework which ensures that the vision of the legislature is not diluted on the ground and the sector can continue to move towards its envisioned targets. Empowered by such unique enablers, Government of India has been focusing on the entire value chain from supply to technology to delivery. Focus on indigenous development of projects on imported fuel, facilitation of captive mining, development of infrastructure for natural gas and facilitating availability of finance through multiple sources are some of the recent initiatives. On the technology side existing manufacturing capabilities are being augmented and new ones are being set up such as L&T-Mitsubishi, Bharat-forge etc. to support the rate of capacity augmentation.

As the sector moves towards being more market oriented, "Competition" is being introduced at all levels. The development of Ultra Mega Power Projects on competitive bidding was the first step to introduce competition for bulk purchase by utilities. The initiative has demonstrated the benefits of competition where UMPPs were awarded at price of electricity being as low as Rs.1.19/ unit for domestic coal and Rs.2.24/ unit for imported coal.

The second stage of competition came in through establishing power exchanges to develop an efficient, transparent and national market place for electricity. Power Exchanges within a short period of their operations have demonstrated the benefits of neutral, fair, transparent and efficient price discovery followed by information dissemination. Power exchanges have provided access to the large section of industrial and open access customers. As the ultimate objective of competition the choice would be available to the retail customers to usher in the benefits of competition across the value chain and passing of those benefits to the end user. Exchanges have already enabled corporate and industrial users with established demand as low as 1MW to procure electricity via the exchanges. Another unique feature is the contract structure which allows a minimum bid of 0.1 MW with an incremental tick as low as 0.01 MW, a feat never before achieved in any wholesale electricity market around the world.

Power Exchanges have also provided a national market place to mitigate the geographic dispersion of renewable energy sources through Renewable Energy Certificates as a market based instrument, in view of the fact that the current as well as planned capacity addition is heavily biased towards conventional fuels. Energy Efficiency Certificates would be another mandated market based instrument for prudent demand side management for large industrial consumers. These mandated instruments are not only a recognition of the efficient, transparent, neutral, fair price discovery and risk management adopted by Power exchanges but also of the ease of access and of nationwide market which has achieved a measure of maturity to realize prices which have come out to be significantly lower than last year and also over the bilateral OTC market.

With the maturity of the physical spot market, exchanges would be in a position to offer long tenure products and also products for financial settlement reaching out to integrate the electricity markets with the financial markets. ■

Tax Sops Accompany $100bn Avenues

British Columbia Beckons Investors in Renewable Energy

A centre of excellence in hydrogen and fuel cells, British Columbia whose green economy contributes over $15 billion to provincial GDP annually-is also at the forefront of several other cleantech sub sectors, including renewables, power technologies, low-energy transportation, and green buildings. Along with world-leading technology and NAFTA benefits, British Columbia (B.C.) offers immense potential in renewables, with $100 billion in investment opportunities, $15 billion in investment-ready projects, and 37 GW of renewable power ready to be tapped. In addition to attractive incentives, such as the Innovative Clean Energy Fund and tax credits for-and 100% immediate deduction of-eligible R&D expenditures, qualifying firms can enjoy an effective total (federal & provincial) tax rate of just 16.5% (15% by 2012), compared to 39.8% in California, along with attractive personal income tax refunds for qualifying employees.

B.C. which is one of the ten provinces of Canada has developed cutting-edge IP and world leading technology in renewable energy, power conversion, power measurement, low-energy transportation systems, green buildings and the whole range of energy efficiency and environmental technologies. In view of the fact that buildings account for approx 40% of energy consumption in industrialized countries, B.C. has developed world-leading expertise in Green & Smart Buildings. Leaders include the British Columbia Institute of Technology's Centre for Architectural Ecology which conducts research on green roof and living wall systems, the Light House Sustainable Building Centre, a green building knowledge centre, Corinex, which specializes in high speed IP communications systems that run over power/coaxial/phone lines allowing for 200 Mbps Triple Play Access Network and In-Building networks and In-Home networks.

B.C. is home to more than 50 highly entrepreneurial research centres of excellence, of which 15 are developing Sustainable Technology, including 5 world-class research institutes focused on Advanced Energy Technology. For example, the University of British Columbia, considered one of the world's great public universities, ranks in the top 10 universities in North America in commercializing research, forming, between 1996 and 2006, more spin-off companies per research dollar than MIT and Stanford.

B.C. in particular, and Canada in general, in stark contrast with many other industrialized nations, have a long-established tradition of welcoming and valuing immigrants, in addition to longstanding economic, cultural, and immigration ties with India. You will enjoy a warm welcome, a mild climate, a spectacular quality of Life, and all the benefits that have won Vancouver "The Most Livable City in the World" ranking several times from the Economist Intelligence Unit.* With a GDP of $200 billion, AAA credit ratings (S&P and Moody's), and one of the best business environments in Canada-which is ranked among the world's top business destinations by both the Economist Intelligence Unit and the World Bank Group, B.C. is powered for business.

The British Columbia Trade & Investment Representative Office offers market intelligence, strategic advice, networking & business matchmaking services, all at no charge, in order to bring together B.C. and Indian companies through JVs, R&D partnerships, investments, and knowledge exchange. You can profit by collaborating with world-class companies and research institutions to obtain not only world-leading technology, but also unfettered access to the NAFTA (North American) markets. Our multi-disciplinary team has rich private-sector experience, vision, and the drive to help you find the most appropriate partners, opportunities and resources you need to succeed.

1. Join our World Energy Congress Delegation To Canada (Vancouver, British Columbia; Montreal & Toronto - Sep 12th-17th) and our delegation to the Canadian Bioenergy Association's CANBIO Annual Conference, Trade Show and Technology Tours in Vancouver (Sep 30-Oct 1)

2. Meet our innovative cleantech companies at the Delhi International Renewable Energy Congress (Oct 27th-29th) ■

India's only bilateral trade magazine publishing house

- Outsourced Publishing
- Community Magazine
- K.P.O.
- International Business Advisory
- Online Publishing
- Events

NEW MEDIA

www.newmediacomm.com

To know more about our services: connect@newmediacomm.com

New Media House, 1 Akbar Villa, Near Old State Bank,
Marol-Maroshi Road, Andheri (E), Mumbai 400059. India.
Tel: +91-22-2925 0690, Fax: +91-22-2925 5279

Montreal's WEC to Focus on Green Energy for Growth

By Madan Lal, President, Institution of Engineers (India)

The World Energy Congress is being organised at a crucial stage when the global leaders are working for a mutually acceptable solution for overcoming climate change effects. The Climate Summit at Copenhagen, in December 2009, has focused on moving towards production and consumption patterns that will lead to low GHG emissions so that the global temperatures are maintained within manageable limits. This expectation has been projected with total understanding that the world will continue to rely on fossil fuels for the supply of its energy for decades to come. So, finding ways to reduce the carbon emissions that come from burning these fuels is a major challenge that must be addressed. This solution can be found only at the forthcoming WEC Congress at Montreal.

The Integrated Energy Policy Expert Committee, in 2006, carefully studied the formidable challenge India faces in meeting its energy needs and in providing adequate energy of required quality in various forms in sustainable manner and at competitive prices. India needs to sustain its economic growth rate at 8% to 10%, over the next 20 years, to overcome poverty and meet its human development goals. To meet its target in 2031-32, India needs to increase its primary energy supply by about four times, and its electricity generation capacity/supply by five to six times, over the base of 2003-04 levels. India's commercial energy supply would need to grow from 5.2 to 6.1% per annum while its primary energy supply would grow from 4.3% to 5.1% annually. In numbers the electricity generation capacity will grow to 800,000 MW; coal supply to 2 billion tonnes and crude oil supply to over 550 million tonnes. I am especially mentioning of these facts because the Institution has been actively involved in formulation of this report, and therefore we stand committed to provide engineering solutions to India's energy sector and provide the humanity at large with appropriate solutions.

As Founder Member of the World Energy Council we are confident that the intellectual discussion at the Montreal Congress will evolve a low carbon energy path way to serve the humanity in the best possible manner. This will discuss options of making nuclear energy and renewable energy supply options at competitive prices and identifying low cost options to lower the GHG emissions from energy supply and demand applications. Indo-Canada cooperation in nuclear energy for peaceful uses has a long successful history and should continue to strengthen in future.

The Congress will also provide global leaders with the options to negotiate at the next Climate Change Summit at Cancun later in the year. Positive actions from the Congress will be crucial in making a successful Cancun Conference, thereby charting out a path of sustainable development for the common man on this globe. We will involve the global engineering fraternity in providing engineering solutions for sustainability. ■

CEPG: Developing Technologies for Canada's Clean Energy

The Clean Electric Power Generation (CEPG) Program is Canada's centre of excellence for the development of efficient stationary combustion processes and pollution abatement technologies to support industrial development both nationally and internationally.

In Canada, combustion of hydrocarbons provides approximately 80% of the energy used in stationary power generation equipment. Because fossil fuels will continue to play a vital role in our world's economy for years to come, CEPG is actively developing and deploying processes and tools that:

- increase our knowledge of combustion;
- substantially reduce the release of greenhouse gases; and
- improve the efficiency of combustion based power generation.

The Group's research focuses on optimizing the performance of stationary equipment and evaluating and developing new products, fuels and retrofit technologies. Processes under study use conventional fuels: oil, coal and natural gas, as well as biomass and specialty fuels.

Clean Electric Power Generation (CEPG) research areas include:

- pressurized gasification;
- fluidized bed combustion;
- 02/C02 combustion
- computational fluid dynamics
- advanced measurement techniques
- simulation;
- mercury capture;
- fine particulates research;
- advanced control systems;
- flaring;
- fuels and byproduct characterization;
- biomass combustion; and
- isokinetic sampling.

CEPG's researchers undertake both lab-scale and pilot-scale research from within its well equipped facilities. The facilities also include laboratories for equipment testing, laser diagnostics and fuel characterization as well as emissions monitoring capabilities and a strong computer modeling team. Field demonstrations, to promote the implementation of new technologies, are often undertaken in cooperation with private sector companies, universities and special interest groups.

Research facilities in Bells Corners, ON

Availability of Services

CEPG's services are available to public and private groups with an interest in combustion for process heat, steam and power generation, including pollution abatement. Collaborative projects are usually task or cost-shared with clients. Staff specialists can assist clients in developing state-of-the-art control technologies such as expert systems and artificial intelligence. Using their advanced computational modeling skills, scientists can assist clients to increase process production and energy efficiencies. Residential and commercial oil and gas-fired heating systems, woodstoves, fireplaces and boilers can be tested and redesigned in cooperation with manufacturers, with the goal of increasing efficiency and reducing environmental emissions.

Some of CEPG's clients have used its research capabilities for:

- performance evaluation of burners
- studies on integrated emissions monitoring and control
- performance studies of low-grade fuels
- application of neural networks and other artificial intelligence systems to process control
- studies on combustion processes for power generation
- analysis of fuels and their emissions
- computational fluid dynamic modeling and simulation of industrial processes
- studies on integrated systems for residential and commercial use.

CEPG's staff serves clients from the following sectors: electrical utilities and other operators of stationary combustion facilities; oil, coal and natural gas producers; pulp and paper industry; combustion equipment manufacturers; software developers; industry associations; federal and provincial government departments; as well as standards writing organizations.

As a group CEPG works in partnership with provincial departments and agencies, national and international agencies, Environment Canada, DOE/EPA USA and the International Energy Agency, Standards Organizations (i.e. CGSB, ASTM, ASHRAE, ISO) as well as universities and other research institutes in Canada and overseas.

CEPG's Energy Technology Applications Group (ETAG) can assess, design and help implement the ideal energy solutions for an organization. ETAG's mandate is to develop energy efficiency projects and apply, when appropriate, the leading-edge technologies that are being developed within the Clean Electric Power Generation group and CETC Ottawa.

ETAG can assist with technologies ranging from current boiler and combustion technologies to renewable energy systems and fuel cells.

Other programs within the Clean Electric Energy Group include:

- Fossils Fuels and Climate Change;
- Flaring;
- FBC-Gasification;
- Advanced Controls, Simulation and Emissions;
- Fuels Assessment and Emissions;
- Combustion Measurements and Kinetics;
- Modeling;
- Instrument Controls and Analytical Lab; and
- Biomass and Renewables.

Many concerns have been mitigated as a result of CEPG's successes:

- finding reliable methods for burner evaluation;
- determining combustion performance and emission characteristics of coal, oil, biomass,
- natural gas and specialty fuels ;and
- finding the means for the increased use of alternative and renewable fuels from agricultural and wood wastes.

Pace-setting Research

CEPG's combustion engineers and scientists focus on achieving, by new or improved technological means, optimal performance from combustion processes and equipment. Optimal performance is the key to more efficient use of resources and reduced environmental emissions.

Analytical Capabilities

CETC-Ottawa's Analytical Services group tests the quality of fuels and combustion products and by-products according to industrial standard test methods accepted worldwide.

They also deal with characterization problems regarding all aspects of fuel production and utilization.

To do so, this group operates such equipment as:

CEPG's PRESSURIZED GASIFIER

- X-ray photoelectron spectroscopy (XPS);
- scanning auger microscopy (SAM);
- nuclear magnetic resonance (NMR);
- infrared spectroscopy (IR) thermogravimetric (TG) and TG/IR analysis;
- gas (GC), liquid (LC), ionic (IC) and supercritical fluid (SFC) chromatography;
- high-resolution mass spectrometry (MS) and gas chromatography/mass spectroscopy (GC/MS);
- X-ray diffraction (powder XRD) and X-ray fluorescence spectrometry (XRF);
- inductively coupled plasma (ICP), atomic absorption (AA) and graphite furnace AA (GFAA) spectrometries;
- environmental sampling and handling of particulates, trace elements and organics and inorganic/organic leachability capabilities; and
- non-intrusive laser measurements (Coherent Anti-Stokes Raman Spectroscopy).

Facilities supporting this research:

- 3.6 GJ/h (1 MW thermal) flame research tunnel furnace that can be fired by coal, oil, natural gas, or other specialty fuels and burners;
- non-intrusive laser measurements (CARS, see Figure 6);
- intrusive measurements of temperature, gaseous speciation, heat transfer and radiation profiles;
- 3.6 GJ/h (1 MW thermal) circulating fluidized-bed combustor;
- 3.6 GJ/h (1 MW thermal) gas fired rotary kiln for waste conditioning and remediation;
- mini-pilot-scale circulating fluidized bed reactor for sorbent studies;
- laboratory-scale equipment for microanalysis;
- 3.6 GJj/h (1 MW thermal) pilot scale research gasifer;
- 1.3 GJ/h (350 kW thermal) pilot-scale pressured entrained flow reactor;
- 3.6 GJ/h (1 MW thermal) bubbling fluidized bed combustor;
- two fully-instrumented appliance testing cells for residential system development, allowing efficiency and emission determinations; and
- 4 GJ/h (1.1 MW thermal) pilot-scale-grate boiler.

Centre of Excellence for Stationary Combustion

CEPG's people and facilities combined with its research network make this group the Canadian Centre of Excellence for stationary combustion.

CEPG welcomes joint projects with industrial parties and other organizations that wish to make use of its combustion research facilities and expertise.

- environmental sampling and handling of particulates, trace elements and organics and inorganic/organic leachability capabilities; and
- non-intrusive laser measurements (Coherent Anti-Stokes Raman Spectroscopy).

Lab Facilities:

The Clean Electric Power Generation (CEPG) Group partners with industry to improve combustion processes for energy efficiency and emissions. Facilities for the Group include:

- A well equipped analytical laboratory
- Biomass fluidized bed reactor (from Queen's University)
- Bubbling fluidized bed combustor (3.7 Gj/h)
- Burner cold test facility
- CARS laser
- Calorimetric tunnel furnace
- Circulating fluidized bed combustor (3.7 Gj/h)
- Circulating fluidized bed combustor, benchscale
- Circulating fluidized bed combustor, pilotscale
- Computer modeling laboratory
- Entrained flow combustion reactor, pilotscale
- Flame research tunnel furnace
- Flame research tunnel furnace (3.7 Gj/h)
- Flare test facility
- High efficiency residential laboratory
- Mobile emissions testing facility
- Oil laboratory for emissions testing
- Research boiler (3.7 Gj/h), pilot-scale
- Rotary kiln (1MW), pilot-scale
- Stoker fired industrial grate boiler, pilotscale
- Vertical combustor (1.1 Gj/h)

Website: cetc.nrcan.gc.ca

CEPG staff performing temperature measurements on the vertical combustor

Harnessing Canadian Coastal Wave & Tidal Energy

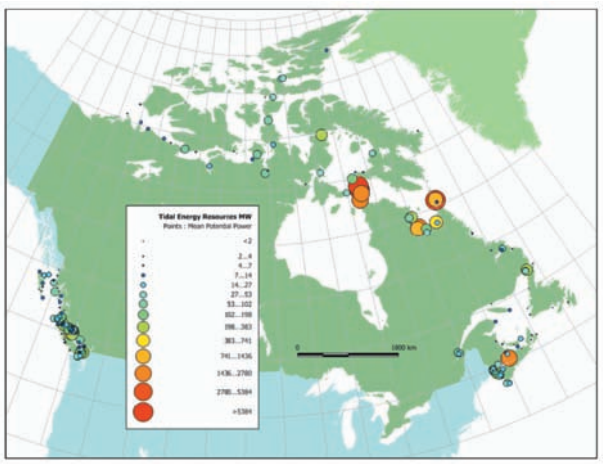
The waters off Canada's coast offer significant potential for wave and tidal energy. Preliminary studies estimate a total gross resource potential of 225 gigawatts (GW), with tidal current power estimates in excess of 40 GW, the bulk of it in the Bay of Fundy and 160-180 GW of wave power along the Atlantic and Pacific coastlines. Canada's total installed capacity for tidal power is 20 megawatts, installed in 1984 using a barrage/dam concept in Annapolis Royal, Nova Scotia. An additional 65 kW installed capacity is located at Race Rocks, B.C. in a technology demonstration project using a Canadian designed tidal current turbine.

The Technologies

Tidal energy is produced from the predictable rise and fall of tides under the gravitational influence of the sun and the moon. The majority of tidal energy R&D is focused on tidal current technologies which extract energy using undersea tidal turbines. The tidal-current turbine approach can consist of multiple turbines, similar to a conventional wind farm. The predictability of tidal currents is an important positive factor for the commercialization of this technology.

Wave energy is produced from ocean surface water movement derived from wind, a concentrated form of solar energy. Energy can be produced using nearshore devices that are mounted at the sea bottom or shore, and offshore devices which incorporate one or more-semi buoyant or floating devices.

First 5kW prototype VAHT water current turbine installation at Bonnybrook Wastewater Treatment Plant in Calgary
(Inset): Fully assembled VAHT generating system



Leading tidal current power sites in Canada[4]

Technology Development

Tapping ocean power and getting it to the shore requires significant engineering and technology development. In recent years, considerable advances have been made in the development of technologies to generate energy from waves and tides. However, the majority of these technologies are in concept and prototype development stages, with only a select few nearing commercial development.

Canada has the third highest number of ocean energy technology development projects internationally. In addition, Canada has world-class testing facilities, extensive capacity to undertake feasibility studies, transferable experience from the offshore oil and gas industry, and extensive capacity in marine engineering, design, systems integration, installation and construction.

It has been recognized within the federal government that ocean energy represents a potential opportunity to provide clean energy to meet growing energy demands and replace increasingly expensive and polluting fossil

fuels. Ocean energy research and development will be centred around four research streams: technology development, resource assessment, environmental impacts and mitigation. The CANMET Energy Technology Centre-Ottawa leads R&D projects aimed at supporting activities undertaken at the provincial level and to foster the growth of the ocean energy industry in Canada.

Internationally, CETC-Ottawa represents Canada on the Executive Committee of the International Energy Agency Ocean Energy Systems Implementing Agreement and is involved in activities that are being conducted concerning grid integration and the provision of guidelines for testing and evaluating ocean energy systems. NRCan is also representing Canada as chair of the newly formed International Electrotechnical Committee for Marine Energy which will allow Canada to be at the forefront of the development of codes and standards for ocean energy systems.

CETC-O has over 30 years of experience in working with emerging renewable energy technologies from the research and development stage, through to demonstration and deployment and finally market adoption. CETC-O has also developed significant expertise and experience with hydropower and water current technologies. CETC-O's water current technology R&D presently includes the commercialization of the 5 kW and 25 kW Vertical Axis Hydro Turbine (VAHT). This work is expected to result in a standard design for the VAHT that can be scaled up for marine (tidal) current application. ■

Website: www.sbc.nrcan.gc.ca
www.canren.gc.ca

Tapping Canada's Huge Potential for Small Hydro Projects

Canada has tremendous potential for the development of small hydro projects with more than 5,500 identified sites (11,000 MW), the majority of which are located in British Colombia, Newfoundland, Québec, Ontario, Northwest Territories and Yukon. There is also significant untapped low-head hydro potential with heads less than 15 metres, estimated at about 20,000 MW. Refurbishment of old, existing or decommissioned small hydro plants presents an opportunity to increase capacity as well. The current small hydro capacity in Canada is approximately 3300 MW (Statistics Canada, 2004) and new capacity is growing at a rate of 150 MW/y.

Improved Camelback Francis Turbine in the No. II Powerhouse, Energy Ottawa

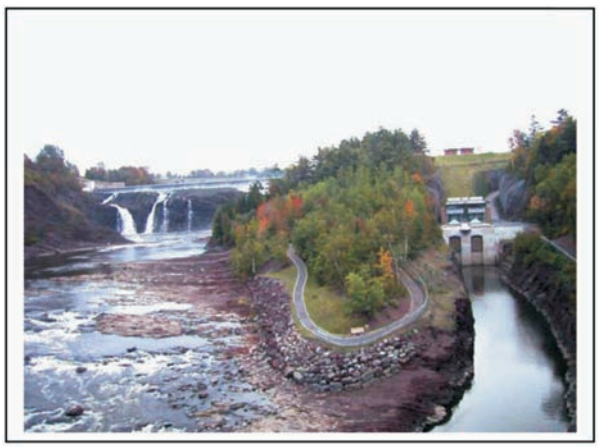
Hydropower is the most predictable of the renewable energy sources, with highly efficient systems and extremely low maintenance costs. Small hydro is clean and renewable, with zero GHG emissions during operation. It uses little or no storage in reservoirs, often termed "run-of-river," and can bring about environmental and socio-economic benefits through integrated design, multipurpose planning and community involvement. In Canada, it is generally accepted that there are three categories under small

hydro: micro hydro (less than 100kW), mini hydro (100 kW 1MW), and small hydro (1MW 50MW).

Hydraulic energy experts at the CANMET Energy Technology Centre - Ottawa (CETC-Ottawa) are actively involved with provinces, utilities, private industry, academic institutions and other organizations on key projects to reduce equipment and construction costs, to increase turbine and site efficiencies, and to support technology demonstrations nationally and internationally. This facilitates the realization of the small hydro capacity available within Canada while at the same time helps the industry strengthen its expertise in both products and services within Canada and abroad.

A key component of CETC-Ottawa's activities is the Laval University Hydraulic Machinery Laboratory (LAMH) in Québec City. LAMH is the only independent hydro turbine testing laboratory in Canada and one of the top five labs worldwide at measuring the accuracy of turbine efficiencies. LAMH was developed through the support of CETC-Ottawa and Laval University. The lab validates new hydro turbine designs with improved efficiency and provides educational facilities to train future engineers and researchers. The importance of LAMH is also recognized by major turbine manufacturers who carry out R&D projects with the lab through the Canadian consortium on hydraulic machines. This allows the test facility to be fully certified, essential to maintaining and developing Canadian expertise in turbine design and testing.

CETC-Ottawa's research and development in emerging technologies where there is market potential in Canada and internationally creates economic opportunities for the Canadian small hydro industry. One example is very low-head turbines. Research is underway to increase efficiencies and reduce capital costs that will significantly reduce civil work and encourage development of very low head sites with high flow that would otherwise not be economically viable. These turbines could also be used to retrofit existing structures and are fish friendly because of the low velocity of the water through the turbine.



Hydroelectric generation station at the Parc des Chutes-de-la-Chaudière (24 MW), Lévis, Québec

CETC-Ottawa's hydraulic energy experts also support demonstration projects that showcase innovative Canadian technologies. Refurbishment at the historic No. 2 and 4 Power Houses at Chaudière Falls, owned by Energy Ottawa Inc., increased site capacity from 5 MW to 8 MW. Automation and control systems allowed remote control of the power plant and Computational Fluid Dynamics (CFD) based optimization of the turbine design improved output by 20%.

Internationally, CETC-Ottawa was instrumental in carrying out the CIDA-China project to transfer Canadian small hydro technologies to China. The project involved design enhancement of the Francis turbine using Canadian technology geared for the Chinese small hydro market, as well as plant automation, river basin optimization technologies and micro hydro systems, demonstrating Canadian expertise to one of the largest international markets for small hydropower. ■

Website: www.sbc.nrcan.gc.ca
www.cetc.nrcan.gc.ca

Managing Your Energy Challenges

Solutions:
- Energy Infrastructure and Management
- Engineering Solutions
- Business Continuity Management
- IT and Datacenter Infrastructure
- Disaster Management
- Re-engineering and Upgrade of Antiquated Infrastructure of Enterprises

J. E. Bapasola & Associates

Infrastructure Technology solutions

F-11 Ramesh Niwas, 51/C B.D. Road, Mumbai 400 026,
India. Mobile: + 91-9821113725. Email: jamshedbapasola@gmail.com

JADAX INFRASTRUCTURE TECHNOLOGY SOLUTIONS PTE. LTD.

J. E. BAPASOLA & ASSOCIATES PTE. LTD.

7500A Beach Road # 08 313, The Plaza, Singapore 199591
Phone: + 91-9821113725. Email: jamshedbapasola@gmail.com

ONE-STOP SHOP FOR ENERGY CONSERVATION SOLUTIONS

Canada: A Powerhouse of Clean & Renewable Energy

Canada occupies a unique position on the world energy stage. As a world leader in the development and deployment of cost-effective and environmentally responsible renewable energy technologies, Canada is actively engaged in diversifying and balancing its energy portfolio, including large and small hydro; wind, solar and ocean energies; bioenergy. Canada is working to bring innovative renewable energy technologies from the idea stage into the marketplace. We have a balanced set of initiatives that are delivering tangible benefits, increasing our competitiveness, creating green jobs and improving our air quality and the environment.

Bioenergy

Canada has more biomass resource per capita than any other nation. The renewable energy sources, produced from Canadian abundant biomass resources, currently accounts for approximately 5% of Canada total energy supply. Canada's bioenergy production includes combustion, co-combustion, pyrolysis, gasification, anaerobic digestion, landfill biogas utilization, fermentation and catalytic hydrotreating of biomass oils.

Canadian firms can provide the following:

- expertise in the design, construction and operation of large-scale ethanol production plants
- biomass gasification technology
- technology for large-scale production of high quality biodiesel fuels, derived from vegetable and animal fats at a cost that competes with petroleum diesel
- high efficiency wood burning appliances and automated commercial systems
- expertise in landfill gas electricity generation projects design, construction and operation
- low cost turnkey anaerobic digester and power generation systems for livestock farms
- biomass mapping and evaluation tools
- biomass handling
- biorefinery conceptual designs for agriculture and forestry biomass

Hydropower

With 475 hydropower plants, this sector is the oldest and best established green industry in Canada. Hydro power accounts for 97% of Canada's renewable electricity generation and nearly 13% of the global production of hydropower. Canada is a world leader in hydropower production, with an installed capacity of over 70,858 MW and an annual average production of 350 terawatt hour (TWh). Our energy sector continues to be prosperous and innovative, and we continue to explore new methods and technologies to produce cleaner energy, as well as use it more efficiently.

Canada can provide:

- consulting services for numerous hydrological and hydropower feasibility studies around the world
- design, manufacturing, installation and testing of automated control and safety systems used in hydropower plants
- design, manufacturing, installation and testing of all type of turbines used in hydroelectric facilities
- design of hydropower plants
- refurbishment, rebuilding and updating of hydropower facilities of all sizes

Small Hydro

Small-scale hydropower is a vital part of the Canadian hydropower industry. In fact, over the last decade, hydroelectric facilities, generating 30MW or less, contributed about $150 million per year to the Canadian economy in manufacturing and services. The Canadian hydropower industry includes more than

20 equipment manufacturers and about 70 engineering firms focused on small scale hydropower projects development.

The Canadian hydropower industry has developed a variety of cutting edge technologies for small-scale hydropower projects including:

- a low-cost, modular approach to powerhouse automation
- water turbines with high efficiency and reliability
- turbine upgrade and retrofitting expertise
- world leading control systems for off-grid application
- advanced computer modeling for flow-through turbines

Ocean Energy

Bordered by three oceans, Canada is exceptionally rich in tidal current and wave energy resources. Investing in clean energy technologies, such as ocean energy and electricity storage, is a win-win situation as it stimulates growth in the domestic energy industry, creates high-quality green jobs and contributes to reducing greenhouse gas emissions.

Canada became active in the ocean energy fields when it constructed the 20 MW tidal energy plant at Annapolis Royal on the Bay of Fundy in Nova Scotia. The plant has been in operation since 1984 and is the only one of its kind in North America.

Canada is fast becoming a recognized expert in areas including: marine fabrication and marine operations; horizontal and vertical axis turbine for harnessing currents and tides; operation of tidal generation stations; manned and unmanned specialized remote tooling systems for subsea work; and, wave technology test and simulation facilities at the Institute for Ocean Technology and the Canadian Hydraulics Centre.

Solar Energy

Canadian firms offer a variety of innovative technologies, products and services in the two key segments of solar thermal and photovoltaics (PV).

Canada can provide products and technologies for both solar thermal and PV applications:

- solar collectors for domestic and commercial water or air heating
- photovoltaic manufacturing equipment and automation expertise
- high efficiency solar-LED lighting systems

- expertise in the design of solar electric systems for off-grid and remote locations
- design of solar electric systems for large-scale grid-tied applications
- concentrated solar power collectors designed to combine solar heat and power generation in one unit
- cold climate expertise for PV and solar thermal applications

Wind Energy

The Canadian wind energy industry is maturing and is the fastest growing renewable energy source in Canada. In 2008, Canada became the 11th country in the world to surpass the 2,000 MW mark for installed wind energy capacity and by the end of 2009, it reached 3,426 MW. Approximately, 430 companies are active in Canada in the wind energy sector, with a combined workforce of 4000 people. Wind power development which includes project development, project operation and independent power generation is the largest segment of Canada's wind energy industry. More than 40 percent of wind energy companies are active in this industry segment. Manufacturing is the focus of 16 percent of Canadian wind energy firms. The main products manufactured in Canada are wind-related components such as rotor, blades, control systems, turbines, inverters, nacelles, towers and meteorological towers.

Canadian firms can offer:

- wind resources assessment and mapping expertise
- wind farm planning, financing and development expertise
- expertise in large scale wind turbine tower, base frame and rotor blade manufacturing
- nacelle assembly expertise
- leading edge technology in electric inverter, power conditioning equipment and large scale battery storage
- expertise in cold and harsh climate wind turbine research and application
- design, installation and integration of wind generation systems for isolated, and off-grid hybrid system applications

Research and Development (R&D)

The Canadian R&D community is actively involved in the research and development of renewable energy technologies, working not only to meet energy demands but also to reduce the technical and financial risks associated with each technology. This work is performed alongside industry to establish standards and to openly share new knowledge and information about renewable energy technologies. Working with partners, including industry, communities and other governments, Canadian public investments in research, development and deployment are providing important support for increasing the efficiency and reducing the cost of clean energy technologies.

It is by making these important investments from the early research and development phase, through the development and demonstration phases that Canada has become a world leader in a number of key energy technologies, from carbon capture and storage to the use of forest and agricultural by-products to generate clean energy.

Current focus in R&D:

- fundamental resource assessment and understanding of renewable energy impacts on the environment
- codes and standards development
- development of small-scale hydro and wind technologies
- solar resources assessment and forecasting
- combine solar heat and power technologies to reduce cost and increase performance
- second-generation transport biofuels from agricultural, marine and forest residues
- biomass for heat and electricity including co-firing

The Canadian Trade Commissioner Service (TCS)

The Canadian Trade Commissioner Service is a key resource for anyone interested in doing business internationally. Our global network of trade offices and dedicated officers are there to provide assistance and resources to maximize engagement with companies and government. For more information on Canadian expertise, we encourage you to contact one of Canada's local Trade Commissioners. You can access their knowledge and networks at: www.tradecommissioner.gc.ca ■

Micro Technologies

Secure your Vehicle by SMS

MICRO VBB

VEHICLE SECURITY SYSTEM

Features :

- Lock, Unlock, Stop your vehicle
- **SMS*** Alerts in case of entry in your vehicle/Tampering with stereo set
- Get exact location of vehicle (Navigator Model only)

Email : info@microshoppe.biz
www.microshoppe.biz

*Conditions apply

YOUR SECURITY IS OUR CONCERN

Call Toll Free
1800 209 2000

SMS*
MICRO VBB to 56363
*Rates as applicable

Available at your nearest
Micro SHOPPE
Your Security Zone

For Dealership, Distributorship, DSA Enquiries Call 022-40743000

Enriching Lives

- Pursuing a structured CSR policy around our coal mining areas based on immediate and long term social and community development programmes
- Earmarked 5% of subsidiary profit of the previous fiscal subject to a minimum of Rs. 5 per ton of raw coal production in the previous fiscal year for its CSR activities
- Providing medical services to employees, their families and local population by supporting 85 hospitals and 1,565 doctors as of March 31, 2010
- Providing water facilities to people living near our areas of operation by installing hand-pumps, tube-well, rain water, harvesting schemes, digging & renovating wells
- Establishing educational institutions that offer courses in engineering, nursing, management studies, medicines and other technical courses
- Providing skills development and capacity building programmes, such as vocational training, programmes supporting technical and vocational educational institutions, provide assistance to primary, middle and higher secondary schools, provide parental counselling, run awarness programmes and others

Empowering India • Nurturing Nature • Enabling Life • Coal India

Coal India Limited

A Navratna Company

www.coalindia.in

"Coal India Limited is proposing to make a public issue of securities and has filed a Draft Red Herring Prospectus (**"DRHP"**) with the Securities and Exchange Board of India (**"SEBI"**). The DRHP is available on the SEBI website at www.sebi.gov.in as well as on the websites of the book running lead managers at http://www.online.citibank.co.in/rhtm/citigroupglobalscreen1.htm, www.db.com/India, www.dspml.com, www.enam.com, www.kmcc.co.in and www.morganstanley.com/indiaofferdocuments. Investors should note that investment in equity shares involves a high degree of risk and for details relating to the same, see the section titled "Risk Factors" of the DRHP." "The announcement is not an offer for sale or solicitation of an offer to buy securities in any jurisdiction, including the United States. This announcement has been prepared for publication in India and may not be released in the United States, Australia, Canada or Japan. The securities of Coal India Limited have not been registered under the U.S. Securities Act of 1933, as amended ("Securities Act") and may not be offered or sold in the United States absent registration under the Securities Act or an exemption from registration under the Securities Act. There will be no public offering of securities in the United States." "The Company has not been, and will not be, registered under the U.S. Investment Company Act of 1940, as amended, and investors will not be entitled to the benefits of that Act."