ENERGY EFFICIENCY IN BUILDINGS
LAYING NEW FOUNDATIONS
Contents

cover story
04 Joint Centre for Building Energy Research and Development
Energy Savings ...INBUILT

features
09 Resonance | An MIT-Harvard-IIT initiative
Resonant Neuroscience

reports
13 Global Methane Initiative
To Cap it All!
16 Excerpts from the Joint Statement
Obama-Singh Summit
18 Student-Speak
Giving Wings to Talent
24 Bharat Ratna
Prof. CNR Rao
26 Startup Accelerator Workshop
Gathering Speed

news and events
29 Events Diary
A synergy across two nations

In the domain of higher education in science and technology, India and the United States have two pressing needs.

India has several outstanding institutions for higher education that provide world-class training in numerous disciplines. However, many of the more recent domains of research are not adequately represented in their programs. This limits their students’ opportunities for pursuing higher studies in these areas and, more broadly, India’s ability to have an impact on cutting-edge research.

The United States has several outstanding young researchers, typically at the post-doctoral level, who have excellent training in specialized research fields, but have not had opportunities for teaching and mentoring students. This greatly limits their training as well-rounded scientists with good teaching and communication skills.

Clearly, the two needs are complementary and provide perfect answers for each other. We have recently launched an initiative that formalizes this mutually beneficial confluence. It is structured as short, intensive instructional programs conducted by exceptional young US scientists for talented students selected from institutions across India.

A great start in 2013

MIT Professor Pawan Sinha was the catalyst for Resonance through the MIT-India program and his outreach to partner institutions. Through his conversations with IIT-Delhi and Harvard’s South Asia Institute, a team gathered to plan a series of courses. For the pilot course, we identified neuroscience as a key topic that would benefit from a Resonance program, and organized a summer school in neuroscience in June 2013 in New Delhi. Three major institutions committed themselves to
supporting Resonance: MIT, Harvard, and IIT Delhi (which served as the host). The Indo-US Science and Technology Forum saw the bilateral benefits that Resonance could yield and provided critical funding support.

Why did we choose neuroscience as the inaugural theme for Resonance? Understanding how the brain works is considered to be one of the greatest frontiers in modern science. Research in this area is driven not only by curiosity, but also the possibility of making a profound impact on the real world. By advancing our knowledge about the brain, we can help the many millions of people who suffer from neurological disorders, and also realize the promise of artificial intelligence. Dr. Pawan Sinha, Professor of Vision & Computational Neuroscience, and Dr. Venkatesh Murthy, Professor of Molecular & Cellular Biology, Harvard University led the neuroscience program with teaching assistance by Garga Chatterjee, MIT, Tapan Gandhi, MIT, Amy Kalia, MIT, Laura Magnotti, Harvard, Tim Marzullo, Backyard Brains, and Jitendra Sharma, Martinos Center, Harvard. The IIT host faculty and administration was organized by Dean Ambuj Sagar, Vipula and Mahesh Chaturvedi, Professor of Policy Studies, IIT-Delhi and Dr. Sanjiva Prasad, Department of Computer Science and Engineering, IIT-Delhi. Resonance is organized through the MIT-India office and Harvard’s South Asia Institute.

Our goal for Resonance 2013 was to provide an intensive introduction to neuroscience to students who might not yet have had an exposure to this field; among other things it would
prepare them for undertaking higher studies or corporate R&D in this area. This program was designed so that a select group of students had the chance to spend two weeks with several scientists from MIT and Harvard, immersed in a rich set of experiences that include lectures that covered background material and also offered a glimpse of the cutting edge in neuroscience research, along with exercises that promoted hands-on learning. The student selection process was highly competitive and the class size was limited to 25 students.

The key components of the summer school were daily lectures on key neuroscience topics in the mornings and afternoons. Evenings were reserved for demonstrations and hands-on work. Lectures covered a wide range of key neuroscience topics and gave the students a sense of the interdisciplinary nature of neuroscience (encompassing molecular biology, genetics, physiology, engineering, physics and computer science). The evening demonstrations allowed students to get exposed to methods and tools of research in neuroscience. A vital part of the course was the discussions that continued through dinner and beyond, facilitated by housing faculty and students in the same location. These informal discussions were vital because it helped impart the culture of interactive exchange that is taken for granted in the US, but is not prevalent in India. These informal periods allowed fertile meandering of discussions, imparting a sense of excitement and wonder about the subject matter that may not become apparent in didactic lectures.

The program also linked up with industry in India through a Corporate Day, during which scientists and executives from the private sector discussed neuroscience opportunities. This link to industry was much appreciated by students and the teaching faculty, and has led to ongoing connections. GE India, IBM, Infosys, and government officials offered insight and awareness of research possibilities in top corporate laboratories and government as future career destinations. The speakers included Dr. MK Bhan, Former Secretary to Government of India, MD Pediatrics; Dr. Rakesh Mullick, Chief Scientist, Diagnostics and Biomedical Technologies at GE Research; Dr. Lokendra Shastri, AVP & GM - Research, Infosys Labs; Dr. Raghav Singh, IBM Cognitive Computing.

A spectacular finale capped the program, where students presented posters of neuroscience topics of their choice to the public (a crowd favorite was titled “How do I know you are not a zombie?”).

The program was an unqualified success. Feedback from students was glowing, and the
teaching faculty found the Resonance experience uniquely powerful. As word has spread, several other academic institutions and companies have expressed keen interest in participating in future editions of the program.

**The Road Ahead**

Our experience during the first offering of Resonance has convinced us that this program fulfills an important need in the Indian as well as American educational landscape. It simultaneously achieves the objectives of introducing Indian students to exciting areas of scientific inquiry, while also allowing young American scientists the opportunity to gain valuable teaching experience. Building on this success, we feel excited about, and indeed obligated to, making Resonance a recurring feature in the years ahead. Among our objectives for future offerings are to further develop neuroscience as a flagship Resonance course, expanding the summer school to include a faculty-training module, increasing the involvement of corporate entities, and increasing the scope of Resonance to include other cutting-edge topics such as genomics, climate change, nanotechnology and renewable energy.

We are convinced that Resonance will prove true to its name by bringing together the best and the brightest young scientists from India and the US to enhance their careers and, more broadly, the landscape of frontier science.

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To Cap It All!

The latest assessment from the Intergovernmental Panel on Climate Change (IPCC) concluded that it is extremely likely that human influence, through the emission of greenhouse gases (GHGs), has been the dominant cause of global warming since the mid-20th century. Carbon dioxide (CO₂) is the most abundant GHG in the atmosphere and receives most of the headlines when discussing GHG abatement, but there is another potent GHG which is already being successfully abated in projects around the globe - METHANE.

Methane is the second most important GHG after carbon dioxide. Although it is emitted into the atmosphere in smaller quantities than CO₂, its global warming potential (ability to trap heat in the atmosphere) is 25 times greater than CO₂, resulting in methane’s stronger influence on warming during its 12-year atmospheric lifetime. Reducing methane emissions, therefore, can significantly slow near-term climate change. Additionally, methane is the primary component of natural gas, so its capture and utilization as a clean-burning energy source can promote sustainable development and energy security.

Anthropogenic (man-made) sources of methane include oil and natural gas production, coal mining, municipal solid waste (e.g., landfills), municipal wastewater, and agriculture (including livestock manure). These sources of methane have increased over time, causing the atmospheric concentration of methane to grow 150 percent since 1750. Without more aggressive mitigation measures, methane emissions are expected to increase nearly 20 percent by 2030, continuing an upward trend far above the natural level of methane.
The Global Methane Initiative

The only world effort specifically targeting methane abatement, recovery and use by focusing on the five main methane emission sources is the Global Methane Initiative (GMI). Launched in 2004, with 14 Partner Countries, GMI is now an international public-private initiative that comprises 41 Partner Countries and the European Commission, as well as more than 1,100 diverse organizations from six continents. GMI Partner Countries work with these public and private sector organizations providing project development and implementation support, training and capacity building, technology demonstration and deployment, and market development.

India and the GMI

India was one of GMI’s founding Partner Countries and now has over 88 potential sites and 48 activities linked to methane abatement, recovery and use, with almost 150 Project Network members from the governmental, research and private sectors. Working in close partnership with several U.S. Government Agencies, India has developed several methane reduction projects which produce environmental and economic benefits for the country.

In the Agriculture and Wastewater sectors GMI is facilitating the deployment of anaerobic digesters (AD) and biogas plants. In recent years, India AD projects have grown to include a 1.2-MW manure-based project, two 4-MW co-digester projects including agricultural wastes and residues, a 1.6-MW project using sugar industry solid waste, and five additional projects that upgrade biogas to natural-gas-quality fuel. In addition, there are approximately 100 digesters that generate biogas from wastewater along with nearly 10 projects generating a total estimated capacity of 10 MW of power.

Municipal solid waste management studies have noted India’s transition from open dumps to more managed landfills, and GMI has developed case studies on landfill gas management when designing new landfills, particularly in the Mumbai area. Local municipalities are now more aware of the potential of capturing and using methane generated by landfills.

GMI has launched an extremely successful partnership with India’s Oil and Natural Gas Corporation (ONGC). In 2008, the ONGC Chairman directed his personnel to pursue implementation of cost-effective technologies and practices that could reduce ONGC’s methane emissions by an estimated 10 million
cubic meters per year, potentially saving the loss of natural gas with a value of $740,000. GMI provided support for onsite methane emission measurement studies to identify and measure major methane emission sources. An ONGC measurement team pursued the leak evaluation strategies, resulting in a 7.9 million cubic meters reduction in emissions from 2008 to 2010. GMI is now working with the Gas Authority of India Limited (GAIL) at its Vijaipur facility.

Methane gas released from coal mining activities, known as coal mine methane (CMM), can be captured and used as a clean energy source, not only reducing GHG emissions, but also enhancing mine safety. Since the inception of GMI, the USEPA’s Coalbed Methane Outreach Program (CMOP) has worked with key Indian organizations to provide essential information on coal mines, common mining practices and project opportunities. The culmination of this successful collaboration was the establishment in 2007 of the CMM Clearinghouse in Ranchi, Jharkhand. Managed by India’s Ministry of Coal and hosted by Coal India’s Central Mine Planning and Design Institute (CMPDI), the Clearinghouse promotes the development of CMM projects and makes CMM resources publically available.

GMI’s work in India has resulted in numerous CMM technical workshops, pre-feasibility studies, grant awards and study tours to the US to observe CMM operations. In March 2010, GMI and the Government of India hosted the 2nd International Methane Partnership Expo in New Delhi. The event attracted more than 500 participants from 36 countries, and brought together investment, project development and government professionals to network and collaborate on advancing new methane capture and use projects. In October 2011, EPA co-hosted the first Indo-U.S. workshop on CMM with the Central Institute of Mining and Fuel Research (CIMFR) in Dhanbad. The goal of the workshop was to share information on coal seam gas and drainage and utilization technologies with local mining officials. Presentation topics included financial feasibility of CMM projects, mine degasification systems, directional drilling, well logging, and sustainability. In November 2013, the CMM Clearinghouse was the site of a workshop held to showcase opportunities for the development of coal-based non-conventional energy resources in India. This was a sequel to the successful 1st International Workshop on Coal Mine Methane held in Ranchi in 2008.

With the second greatest anthropogenic methane emissions globally, India has much potential for methane abatement and use. Through the GMI and the work of Indian partners, good progress has already been made in methane emissions reductions from the agriculture, coal, oil and gas, and landfill and wastewater sectors. Continuing this progress will be of great benefit to the people of India and the global environment.
The Indo-US Science and Technology Forum (IUSSTF), established under an agreement between the Governments of India and the United States of America, is an autonomous, not for profit society in India, co-funded and co-governed by both the governments. IUSSTF promotes and catalyzes Indo-US collaborations in science, technology, engineering, biomedical research and innovation through substantive interaction among government, academia and industry.

Foster excellence by capitalizing on the scientific and technological synergy
Disseminate information and create awareness through scientific exchanges
Build linkages through networking between academia and industry
Explore new frontiers by nurturing contact between young and mid-career scientists
Pave way to sustainable interactions and establish long term relationships
Encourage public-private partnership to inculcate elements of innovation and entrepreneurship

Exciting and innovative collaborative programs cutting across disciplines and institutions

Academia-Industry Connect Programs
Advance Schools & Training Programs
Bilateral Workshops & Symposia
Flagship Events
Knowledge R&D Networked Joint Centers

Programs on Innovation and Entrepreneurship
Public-Private Networked R&D Joint Centres
Research Fellowships for Faculty
Special Initiatives for Strategic Partnerships
Student Internships & Visiting Professorships

Proposals which are peer reviewed both in India and USA for awards

Bilateral Indo-US Workshop/Symposia & Indo-US Training/Advanced Schools
Submission Deadlines
15 February
15 August
Award Announcements
30 June
31 December

Indo-US Public-Private Networked Centres & Indo-US Knowledge R&D Networked Centres
Submission Deadline
15 August
Award Announcement
31 December

For program details visit:
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