Architectural Curriculum Enhancement and Building Energy Simulation Capacity Building Program

An Educational Initiative by USAID, ECO-III Project

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ECO-III Educational Curriculum Enhancement Program: Preparing the Next Generation of Architects and Engineers to Design and Construct Sustainable Buildings

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Background

Building Energy Efficiency is a priority area for the Government of India considering the growth that is taking place in the Indian Services sector. From an existing commercial building floor space of 500-600 million m^2, the floor space is expected to rise to approx. 1,500-2,000 million m^2. Focusing on this sector will not only help in government's climate change mitigation efforts but will also aid in reducing the widening gap between supply and demand of power. The Bureau of Energy Efficiency has already launched the Energy Conservation Building Code (ECBC) in May 2007 and it has been working with a variety of stakeholders to help develop the capacity of the building industry and start implementation of ECBC all over India. USAID's Energy Conservation and Commercialization (ECO) program has a long history of association with BEE on Energy Conservation Building Code starting with development of ECBC and continuing with its implementation under the third phase of the ECO program.

Bureau of Energy Efficiency (BEE) and USAID ECO-III project have initiated a unique program to develop capacity of architects, engineers, and building energy efficiency professionals, as well as architecture and engineering students to help with implementation of Energy Conservation Building Code (ECBC) and equip them with the knowledge and technical skills to design sustainable buildings and habitats. This effort hopes **to empower the architecture and engineering students by providing them access to quality technical reference material and equipping them with fundamental principles of building energy efficiency, and giving access to state of the art energy simulation tools** so that they are well prepared to take on the sustainability challenges that India is already facing in the building design and construction sector. The objective of this initiative is **to make India a global and intellectual leader in the field of building physics and energy simulation by 2015.**

At the beginning of the project, the ECO-III team conducted an Architectural Curriculum Survey focusing on the Environmental Design course work (e.g. building physics, climatology, lighting design, building energy simulation, etc.). The feedback received helped the ECO-III team in identifying the academic institutes that are ECO-III project partners under this initiative. Subsequently, a paper titled '*Preparing the Next Generation of Architects and Engineers to Design and Construct Sustainable Buildings – An Educational Initiative'* was prepared and circulated to project partners to solicit ideas on the next round of activities under the ongoing program.

DesignBuilder and EnergyPlus Software and E-Source Technology Atlas Distribution (February and December 2008)

With the support of BEE and USAID, ECO-III Project procured and distributed the "*E Source Technology Atlas Series*" Books (on **Lighting, Cooling, Heating, Appliances, and Drive Power**) and "*Window Systems for High Performance Buildings*" to 20 academic institutions and 12 Not-for-Profit

organizations at a function held in New Delhi in February 2008. The Technology Atlas Series is a comprehensive up-to-date reference work on energy efficiency in buildings containing technical information and practical case studies, prepared by highly reputed E-Source group from Colorado, USA. These high-quality references are now available for students across India to explore and enhance their learning on building energy efficiency.

With an objective of encouraging the use of building energy simulation tools in the designing of buildings, the ECO-III Project has negotiated with DesignBuilder software of the United Kingdom, to provide educational site licenses to all architectural/engineering colleges associated with the project. DesignBuilder uses Energy Plus (developed by the US Department of Energy) as the simulation engine and complements it with an easy-to-use user interface for helping users learn a state of the art building energy modelling tool that can be used to design ECBC-compliant, LEED or GRIHA certified commercial buildings. The software was gifted to 18 partner institutes in December 2008. Thereafter, a series of workshops was conducted for DesignBuilder installation and training at these centers. The Project continues to monitor and evaluate the extent of use of these tools and its impact on the academic curriculum and exercises. Based on this survey, the Project has provided site licenses for the updated DesignBuilder version to selected institutes. Simultaneously, it is encouraging other institutes to use the tool for building energy analysis and provides any technical assistance they may require. To the best of ECO-III team's knowledge, it is the first time that a national-level capacity building educational program of this magnitude covering Building Physics and Energy Simulation with a long-term vision of preparing the next generation of building designers has been undertaken anywhere.

Energy Simulation Awareness Workshops (June 2008 till present)

In collaboration with Asia Pacific Partnership (APP), the Project has also organized a series of Energy Simulation Awareness workshops (in Devi Ahilya University, Indore, Jadavpur University, Kolkata, and UP Technical University, Lucknow) and Energy Simulation Training workshops (in Delhi, Chennai, Mumbai and Pune) for students, practicing architects and building consultants in partnership with CEPT, IIIT, MNIT, and ISHRAE, to directly address a professional capacity crunch in the area of energy simulation of buildings.

ECO-III project has also conducted half-day energy simulation software installation and awareness workshops where students and faculty members have been made aware of the benefits of using energy simulation tools to capture the dynamic nature of the physical processes that is needed in designing energy-efficient buildings. These workshops were conducted at Sir JJ School of Architecture, Rachana Sansad's Institute of Environmental Architecture, IIT Roorkee, Devi Ahilya University, NIT Hamirmpur, Chandigargh College of Architecture, D.C. Patel School of Architecture, Arvindbhai Patel Institute of Environmental Design, Vidhyanagar, School of Architecture, Vadodara Design Academy and National Institute of Construction Management and Research, Pune. It helped the institutes in gaining a better understanding of the subject and in seeking direct assistance from the ECO-III team members in installing the software on computers.

Train the Trainers Workshop (January, 2009, Pune)

USAID ECO-III project in collaboration with Asia Pacific Partnership (APP) on Clean Development and Climate and National Institute of Advanced Studies in Architecture (NIASA) at Pune organized a "Train the Trainer" Workshop in January 2009 where 19 faculty members from India's leading architectural and engineering colleges participated. The objective was to provide

detailed guidance on the topic of Building Physics and Energy Simulation and how an awareness of the fundamental concepts taught in these two courses can help in both understanding ECBC and designing ECBC-compliant buildings. The expectation is that the trained faculty members can start incorporating these topics at their respective institutes – a critical development considering that all the academic institutes are interested in hiring and/or providing continuing education opportunities to their faculty members who can teach these courses.. The main objective of these "Train the Trainer" workshops is to update the technical expertise of educators and/or academic professionals in various institutions across India, which, in-turn, would lead to curriculum enhancement at other academic institutes, essentially creating a ripple effect. A combination of international and Indian faculty members and trainers provide their expertise towards the "Train the Trainer" sessions. They are:

- **Dr. Ardeshir Mahdavi,** Director and University Professor, Department of Building Physics and Building Ecology, Vienna University of Technology, Austria
- **Dr. Satish Kumar**, Chief of Party, USAID ECO-III project
- **Mr. P. C. Thomas,** Director, Team Catalyst, Sydney, Australia
- **Prof. Rajan Rawal,** Center for Environmental Planning and Technology (CEPT), Ahmedabad
- **Dr. Vishal Garg,** International Institute of Information Technology (IIIT), Hyderabad
- **Dr. Jyotirmay Mathur,** Malviya National Institute Technology (MNIT), Jaipur

Building Physics and Energy Simulation Regional Workshop (January 2010, Roorkee)

As a follow up to the Train the Trainer workshop, a four-day regional workshop was organized on Building Physics and Energy Simulation at IIT Roorkee. Seventy-five students from nine architecture colleges from Northern India and 10 faculty members as well as students and faculty members from Architecture, Civil, Mechanical, and Electrical department and scientist from the Central Building Research Institute participated in the workshop. During the workshop, many colleges and schools of architecture approached the ECO-III team and requested them to expand the program so that their institutes can also become partners of BEE and USAID. A combination of international and Indian faculty members and trainers provided their expertise towards the "Train the Trainer" sessions. They are:

- **Dr. Ardeshir Mahdavi,** Director and University Professor, Department of Building Physics and Building Ecology, Vienna University of Technology, Austria
- **Dr. Satish Kumar**, Chief of Party, USAID ECO-III project
- **Dr. Kristina Orehounig,** Department of Building Physics and Building Ecology, Vienna University of Technology, Austria
- **Ms. Sanyogita Manu**, Energy Efficiency Research Associate, USAID ECO-III Project

Based on the excellent feedback received from the participants of the "Train the Trainer" Workshop and from the Heads of Departments of participating organizations, ECO-III project is chalking up plans on the next set of activities it will undertake to take advantage of the partnerships and relationships that have already been developed. Some activities that are currently being contemplated are listed below:

a. In partnership with the BEE, help design an award for best architectural thesis incorporating energy analysis through energy simulation, continued dissemination of

DesignBuilder/EnergyPlus software and E-Source Technology Atlas to other architectural and engineering institutes;

b. Help develop two new educational courses on Building Science for undergraduate programs and Energy Modelling for post-graduate programs;
c. Help develop an Environmental Design Studio Problem that can be pilot tested to integrate the theoretical concepts into the design process;
d. Develop web-based teaching curriculum, text books, etc. that can be used as standard teaching material by academic institutions, in partnership with internationally renowned universities (Technical University of Vienna, Arizona State University, for example), and help develop diagnostic capabilities of the institutes (may require additional funding from other sources, e.g. BEE, REEEP, etc).
e. Depending on additional resources, consider the possibility of expanding the program to those institutes who have made good progress without being our formal partners.

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List of Partner Academic Institutions

1. School of Planning and Architecture, New Delhi
2. Center for Environment Planning and Technology (CEPT) University, Ahmedabad
3. Malviya National Institute of Technology (MNIT), Jaipur
4. International Institute. of Information Technology (IIIT), Hyderabad
5. Indian Institute of Technology, Kharagpur
6. National Institute of Technology (NIT), Hamirpur
7. Devi Ahilya University, Indore
8. D.C. Patel School of Architecture, Arvindbhai Patel Institute of Environmental Design, Vidhyanagar, Gujarat
9. School of Architecture, Vallabhai Patel Institute of Technology, Anand, Gujarat
10. School of Architecture, Vadodara Design Academy, Vadodara
11. J.J. School of Architecture, Mumbai
12. Rachana Sansad's Institute of Environmental Architecture, Mumbai
13. Dr. Bhanuben Nanavati College of Architecture, Pune
14. Chandigarh College of Architecture, Chandigarh
15. Faculty of Architecture of UP Technical University, Lucknow
16. Indian Institute of Technology, Roorkee
17. National Institute of Construction Management and Research, Pune
18. Jadavpur University, Kolkata

For more information, please contact:
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