EXECUTIVE EDUCATION

CMU-BCA Executive Development Program 2016

LEADERSHIP IN ENVIRONMENTAL SUSTAINABILITY

Carnegie Mellon.

BCA ACADEMY

PROGRAM OVERVIEW

A collaboration between Carnegie Mellon University (CMU) and the Building and Construction Authority (BCA) since 2009, the CMU-BCA Executive Development Program aims to accelerate the development of executives in leadership roles that will shape Singapore's built environment towards higher level of environmental sustainability.

The program offers a global overview of the sustainability movement, advocating a holistic approach to address resource management, promoting increasing use of renewable energy sources while minimizing energy consumption and maximizing health and comfort through innovative design and application of advanced building technologies.

Focuses for this year's program are on biophilic design and big data analytics.

BIOPHILIA describes the natural affiliation of human beings toward nature and living organisms and its emphasis on the innate connection between humans and other living systems such as plants, animals and the weather. **BIOPHILIC DESIGN** refers to the process of creating good habitat for people as a biological organism in the built environment.

BIG DATA ANALYTICS in the context of the built environment can be defined as sensing, collection, processing and conveyance of building performance information that is understandable and actionable for data-drive decision making for processes of design, construction and operation of buildings and groups of buildings from campus to urban scales.

LEARNING OUTCOMES

Program participants will be exposed to the energy-saving technologies, design and management support tools and best practices for project and business decisions, so that they are able to

- present and manage the difficult trade-offs between business goals and environmental goals;
- find the appropriate integrated solutions for higher energy efficient building design, construction and management, thus saving resources, reduce waste and enhance company profitability;
- be familiarized with the concepts of biophilia and biophilic design that incorporates natural elements and qualities into buildings and urban spaces for the purpose of designing healthy and productive environments for humans; and
- appreciate how big data analytics can be utilized for data-driven decision making throughout the life cycle of building projects for improved energy efficiency and occupant comfort.

KEY LECTURES

- **BIOPHILIA AND BIOPHILIC DESIGN: NATURE'S ROLE IN HUMAN HEALTH AND WELLBEING**
  Biophilia asserts that humans biologically evolved an inclination to affiliate with nature that is instrumental in people's physical and mental health, productivity and wellbeing. As modern people spend roughly 90% of the time in buildings and constructions – the "natural habitat" of contemporary society – satisfying people's need for contact with nature require a new paradigm of building design and development – what has been called "biophilic design." The framework of biophilic design will be elucidated, including principles and practices associated with its effective application at varying scales from individual constructions to the urban scale. Examples and a case study will illustrate the application of biophilic design.

- **BIG DATA ANALYTICS**
  The built environment is becoming more agile and responsive to meet the needs of occupants' comfort, health and tasks at hand while ensuring minimal energy and resource use. Internet of Things (IoT) devices and the associated data are changing the way buildings are controlled, managed and occupied. A Gartner study estimates that smart cities will use 1.6 billion connected things in 2016. This lecture will discuss the latest developments and applications in Big Data and how the power of an integrated building data analytics platform can create environments that are efficient, healthy, productive and environmentally sustainable.

- **IMPUTATIONS OF MISSING VALUE IN BUILDING SENSOR DATA AND BUILDING ENERGY MODEL CALIBRATION**
  A comparative study was done on five methods for the estimation of missing values in building sensor data. Using data collected from an actual office building, the methods were evaluated using varying parameter settings. Correlation based feature selection was used to evaluate how using different subsets of attributes may affect each method's performance. Besides, methods for modeling uncertainties in building energy models were also studied. This lecture will cover the research findings, practical implementations in industry as well as the advantages and disadvantages of various methods.

- **DYNAMIC LIFE-CYCLE BUILDING INFORMATION MODELING FOR SUSTAINABLE DEVELOPMENT**
  Dynamic Life-cycle BIM infrastructure is developed to meet the industry challenges which require integration of inputs from multi-disciplinary professional teams involved in the various building phases and processes. This infrastructure will support the creation of a detailed BIM model during the design phase; modification of the design model during the construction and validated during the commissioning phases to become the as-built model; and eventual continuous deployment during the operation phase as an integrated component of the building management system for conducting advanced predictive building control and optimization to reduce energy consumption and improve occupant comfort.

- **TRIPLE BOTTOM LINE INVESTMENTS FOR PROFIT, PLANET AND PEOPLE: CMU'S BUILDING INVESTMENT DECISION SUPPORT (BIDS)**
  Life cycle economic arguments for sustainable, high performance building systems are through triple bottom line decision-making. A case-based cost-benefit analysis method entitled 'BIDS' has been developed at CMU to support investments in advanced and innovative building systems that improve environmental quality, health and productivity in buildings. An added emphasis on the power of biophilic design for energy, human health and productivity will unify this workshop with the program emphasis.

KEY SPEAKERS

PROF STEPHEN KELLERT *Tweedy Ordway Professor Emeritus of Social Ecology and Senior Research Scholar, School of Forestry and Environmental Studies, Yale University*

Prof Kellert's research focus is on understanding the connection between nature and humanity, with a particular interest in environmental conservation and sustainable design and development. He serves as a member of the Board of Directors of Bio-Logical Capital, and was the founding partner of Environmental Capital Partners. Prof Kellert has served on committees of the National Academy of Sciences and has won distinguished achievement awards from the Society of Conservation Biology, the National Wildlife Federation, National Park Service and the Connecticut Outdoor and Environmental Educators Association. Prof Kellert has authored more than 150 publications and Nine books, including Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life, which was given the 2008 American Publishers Professional and Scholarly Best Book of the Year Award in Architecture and Urban Planning. He has also produced a 60-min documentary video "Biophilic Design: the Architecture of Life" with Bill Finnegan in 2011, which has been shown in several Film Festivals around the World.

PROF VOLKER HARTKOPF - *Director of Center for Building Performance & Diagnostics (CBPD) & Professor, School of Architecture, Carnegie Mellon University*

Prof Hartkopf formed and now directs the Advanced Building Systems Integration Consortium (ABSIC) that supports the work of the Center for Building Performance & Diagnostics. Under his leadership, the CBPD team has received numerous prestigious national awards for research. The research and demonstration effort of ABSIC focuses on the impact of advanced technology on the physical, environmental, and social settings in office buildings, towards creating high performance work environments. Prof Hartkopf is the Chair of the United Nations Environment Programme (UNEP) Sustainable Building Construction Initiative (SBCI) that works with governments and companies worldwide to adopt sustainable building practices. He also provides consultancy to organizations such as DaimlerChrysler, US Department of State and US Department of Energy.

PROF VIVIAN LOFTNESS - *Professor, School of Architecture, Carnegie Mellon University*

Prof Loftness is an internationally renowned researcher, author and educator with over 30 years of focus on environmental design and sustainability, advanced building systems integration, climate and regionalism in architecture, as well as design for performance in the workplace of the future. She is a key contributor to the development of the Intelligent Workplace – a living laboratory of commercial building innovations for performance. Her work has influenced both national policy and international building projects. Prof Loftness serves on the Governance Board of the US Green Building Council among other professional bodies, and the editorial boards of Building and Environment Journal, JCRE, and High Performance Buildings.

PROF LAM KHEE POH - *Professor, School of Architecture, Carnegie Mellon University*

Professor Lam is an educator, researcher, architect and consultant who specialized in life -cycle building information modeling and computational design support systems for total building performance analysis and building diagnostics. He was Carnegie Mellon's Project Director in the US DOE's Energy Efficient Buildings Hub which received $129 million from the Federal Government's Energy Regional Innovation Cluster (E-RIC) Initiative. He is also a board member of the Energy Foundation, USA, a partnership of philanthropic donors promoting clean energy technologies to solve the world's energy problems with a focus on United States and China, the largest and fastest-growing energy markets in the world. He is a building performance consultant for several major award winning projects in the private and public sectors in Singapore and USA, and remains actively engaged in on-going green design projects in China and Taiwan. He is currently a Visiting Professor of Tsinghua University and the Chinese University of Hong Kong.

LEARNING JOURNEYS

Participants will have an opportunity to visit exemplary projects in Pittsburg and San Francisco and hear directly from the building owners, design teams and facilities managers.

PITTSBURGH

- **Phipps Conservatory** – LEED Silver Certification
- **Center for Sustainable Landscape (CSL)** – *Net-Zero Energy Building & Living Building Challenge*
  The Welcome Center at Phipps is the first LEED certified visitor center in a public garden in USA and the first green conservatory in the world. In late 2010, Phipps started the construction of CSL, which is a restored brownfield-turned-productive place that takes what it needs from what is available to it. In 2015, CSL has been certified as a Living Building, exceeding LEED Platinum certification.
- **David L Lawrence Convention Center** – *LEED NC Gold & LEED EB Silver Certification*
  This is the first and largest LEED Gold certified green convention center in the world. The 1,500,000 sqft center makes use of natural ventilation and lighting, flexible space and energy efficient technology for its exhibition halls and meeting rooms.
- **Robert L Preger Intelligent Workplace** – *Living Laboratory at Carnegie Mellon University*
  The 7,000 sqft Intelligent Workplace is constructed on the roof of an existing building. It is a test bed for plug and play technologies and will be used to demonstrate the capability of next generation commercial buildings.

SAN FRANCISCO

- **The San Francisco City Planning Department** – *Biophilic Cities Initiative*
  The Biophilic Cities Project aims to make San Francisco sustainable. The Department of Environment's initiatives have included public and private sector Green building ordinances, renewable and efficient energy programs, zero waste ordinance, and urban agriculture. Together with the planning department's initiatives, these programs set a strong foundation to test biophilic planning ideas
- **California Academy of Sciences Building**– *Double LEED Platinum and Largest LEED Platinum Public Building in the World*
  The building has many sustainability strategies like 34% saving of energy through the use of natural ventilation, heat recovery, displacement ventilation, external shading, reduced power lighting densities and daylighting controls, solar canopy around the perimeter of the roof which supply at least 5% of the Academy's energy needs, water efficient landscaping which provides 50% savings through the use of captured / recycled site water from the green roof and use of recycled building materials from the demolition waste from the old Academy.
- **OSIsoft, San Leadro**
  Through sharing by OSIsoft's executives, participants will gain new insights and perspectives to address and solve business challenges in a more efficient manner. Discussions will address how megatrends in Big Data, Internet of Things (IoT) and Cloud can empower project teams to drive transformational changes across organizations, and how businesses have leveraged on big data technologies to transform their operations. Participants could learn how to work with the latest advances in big data technology to address new business challenges and contribute to game-changing innovation.
- **The Nature Conservancy Headquarters**
  Participants will visit and hear from The Nature Conservancy (TNC) on their involvement in the biophilic cities movement. Their San Francisco office is a remarkable example of occupant centric planning with deep involvement of the client in the process and resulted in savings of USD270k in annual operational expenses. In addition, the TNC has reported a rise in daily occupancy due to a carefully considered work environment that embodies the spirit of the organization. The new space allows for seamless interpersonal interaction enabled by the new dedicated collaboration areas.

PROGRAMME OUTLINE

DATE	SCHEDULE	SPEAKERS
FRIDAY **6 May 2016** *Travel from Singapore to Pittsburgh via New York*	Group Departure Schedule: - Depart Singapore at 11:55pm [Tentative] - Flight duration: 21 hours 15 min	
SATURDAY **7 May 2016** *Travel from New York to Pittsburgh*	Group Departure and Arrival Schedule: - Arrive New York John Kennedy International Airport (JFK) at 11:10am (Local Time) [Tentative] - Depart for Pittsburgh from JFK at 3:40pm (Local Time) [Tentative] - Flight duration: 1 hour 45 min	
SUNDAY **8 May 2016**	- Leisure Tour to Fallingwater House and Kentuck Knob House (at own expenses) - BBQ Party	K P Lam
PITTSBURGH		
DAY 1 MONDAY **9 May 2016**	Welcome and Introduction to the Program	K P Lam, S Lee, J Cohon / Provost / Dean
	CBPD and the Industry & University Cooperative Research Program (I/UCRC) of the National Science Foundation – 25 years of pioneering exemplary research contribution to technology innovation and its positive impact on technology, industry and the society as a whole.	V Hartkopf
	Triple Bottom Line Investments for Profit, Planet and People: CMU's Building Investment Decision Support (BIDS)	V Loftness
	Dynamic Life-cycle Building Information Modelling for Sustainable Development	K P Lam
	Big Data Analytics	A Aziz, B Lasternas
	Day 1 Wrap Up	K P Lam
	Welcome Dinner at The Monterey Bay Fish Giotto, Pittsburgh	
DAY 2 TUESDAY **10 May 2016**	**Biophilia and Biophilic Design: Nature's Role in Human Health and Wellbeing**	S Kellert
	Working Session, Q&A	S Kellert
	Phipps Conservatory and the Center for Sustainable Landscape	K P Lam, R Kernic
	David L Lawrence Convention Center	E Pittinger

BCA Academy reserves the right to amend the program without prior notice.

PROGRAMME OUTLINE

DATE	SCHEDULE	SPEAKERS
DAY 3 WEDNESDAY **11 May 2016** *Travel from Pittsburgh to San Francisco*	**Imputations of Missing Value in Building Sensor Data and Building Energy Model Calibration** **School of Computer Science, CMU – Data Analytics Case Study and Visit to Bill Gates Building** Group Departure Schedule: - Depart from Pittsburgh at 4:19pm (Local Time) [Tentative] - Flight duration: 6 hours 30 min	A Chong, W Xu V Loftness, B Lasternas, A Aziz
SAN FRANCISCO		
DAY 4 THURSDAY **12 May 2016**	**OSIsoft, San Leandro** **California Academy of Sciences**	K P Lam, P Kennedy Simon
DAY 5 FRIDAY **13 May 2016**	**The Nature Conservancy Field Office** **The San Francisco City Planning Department – Biophilic Cities Initiative** Farewell Cocktail – Concluding Remarks, Q&A, and Feedback Session	D O'Leahy S Edmondson, K P Lam
DAY 6 SATURDAY **14 May 2016**	Group Departure Schedule: - Depart for Singapore from San Francisco International Airport at 1:15am (Local Time) [Tentative] - Flight duration: 18 hours 10 min	K P Lam
SUNDAY **15 May 2016**	Group arrive Singapore at 11:50am (Singapore Time)	

Photo Credit: Cesar Rubio

Photo Credit: California Academy of Sciences
www.calacademy.org

> The business case for green buildings paints a very detailed picture of cost replication when developing green buildings. The intelligent workplace and how it is integrated with the usage provides validation for sustainable design when applied out of the classroom.
> - Alumni

WHO SHOULD ATTEND

- Architects
- Engineers
- Consultants
- Developers
- Project & Facilities Managers
- Academics
- Builders

CPD POINTS

PEB: Pending
BOA-SIA: Pending

FOR ENQUIRIES ON ADMINISTRATION AND LOGISTIC MATTERS

Please contact Ms Celes Cheng, Tel: 6248 9947.
Alternatively, you can email her at celes_cheng@bca.gov.sg

FOR ENQUIRIES ON COURSE DETAILS

Please contact Ms Tai Yoke Ying at 6248 9980.
Alternatively, you can email her at tai_yoke_ying@bca.gov.sg

SKILLSFUTURE STUDY AWARD FOR BUILT ENVIRONMENT SECTOR

Singapore Citizens who are working in the built environment industry are eligible to apply for SkillsFuture Study Award. An amount of up to S$5,000 will be awarded to successful applicant.

To apply for the Award, please submit your application online via **www.skillsfuture.sg/studyawards/built-environment**

Concurrently, the applicant has to send in the completed registration form on Page 9 to Ms Celes Cheng.

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APPLICATION FORM

LEADERSHIP IN ENVIRONMENTAL SUSTAINABILITY

Executive Development Program 2016

Name (Dr/Mr/Ms)*	
NRIC	
Date of Birth	
Designation	
Organisation	
Address	
Email	
Nationality	
Office No.	
Mobile No.	
Fax	
Cheque No.	

BCA Academy Alumni Membership No.:

Are you applying for SkillsFuture Award? ❑ **Yes** ❑ **No**

** Please delete accordingly*

AIRFARE AND ACCOMMODATION RESERVATIONS

Participants are encouraged to book their accommodation and air tickets through BCA Academy.

PLEASE RESERVE A HOTEL ROOM AT PITTSBURGH & SAN FRANCISCO

☐ 4-Star Hotel or equivalent
(The estimated room rates are about USD 280 per day)
Hotel room rates quoted are exclusives of taxes and subjected to confirmation.

PLEASE BOOK AN AIR TICKET (Please tick accordingly)

☐ SIA Economy class + Domestic Flights

☐ SIA Business class + Domestic Flights

☐ Domestic Flights Only

Booking of air tickets is subject to availability.
Visa requirements to USA also applies.

OPTIONAL TOUR

☐ I would like to attend the optional tour to Fallingwater & Kentuck Knob

The estimated cost for admission & transport is about USD 250.

REGISTRATION CLOSES ON
22 APRIL 2016

COURSE DURATION: 9-13 May 2016

PROGRAM FEE *(GST is not applicable)*

❑ **SGD5,500** ❑ **SGD5,150***

* Discounted fee is only applicable for:
- 'Early Bird' who register by 4 Apr 2016
- Group of 3 or more delegates
- BCA Academy Alumni Card Holder

Fee includes course materials, refreshments, Welcome dinner, as well as local ground transportation to and from the airport, between hotel and training venues and for all project visits in Pittsburgh and San Francisco. The program fee does not include airfare, accommodation and meals.

A Certificate of Participation will be issued at the end of the program.

PAYMENT

Cheques should be crossed 'A/C' payee only' and made payable to '**Building and Construction Authority**'.
Please indicate 'CMU-BCA Executive Development Program 2016' at the back of the cheque.

Please mail the cheque, application form and a copy of your passport to:
Ms Celes Cheng
School of Graduate and Management
BCA Academy
200 Braddell Road Singapore 579700

CONDITIONS ON REPLACEMENT AND WITHDRAWAL REQUEST

- Replacement request in writing must reach BCA Academy on or before 29 Apr 2016
- Withdrawal request in writing that reaches BCA Academy before 8 Apr 2016: 90% refund of the program fee
- Withdrawal request in writing that reaches BCA Academy after 8 Apr 2016: No refund of program fee

BCA Academy reserves the right to amend the course or program details, content and applicable fees without prior notice. It also reserves the right to cancel or postpone the course or program due to unforeseen circumstances.

CARNEGIE MELLON UNIVERSITY

Carnegie Mellon University has established a global reputation as a leading institution in the area of environmental sustainability. Recognized for its world-class engineering and technology programs, collaborations across disciplines and innovative leadership in education, CMU is consistently ranked among the top universities in the world. The Center for Building Performance and Diagnostics (CPBD) of the School of Architecture at CMU conducts research, demonstrations and teaching in relation to the performance of advanced building systems and technology. In 2008, the DesignIntelligence Magazine ranked CMU 7th in its undergraduate programs and first in Sustainable Design Practices & Principles.

> Sustainable design is a collective process whereby the built environment achieves new levels of ecological balance through new and retrofit construction, towards the long term viability and humanization of architecture.
> - SoArch, CMU

BCA ACADEMY

The BCA Academy is the education and research arm of the Building and Construction Authority, Singapore. Founded in 1984, the Academy offers a wide range of training and education programmes tailored to the needs of the building and construction industry. These programmes include programmes for professionals, management and executive personnel, and technical specialists.

In support of the national effort to transform Singapore into a green and sustainable global city, the Academy has initiated several training programmes to nurture and develop managerial and technical capability in such niche areas as green building design and technology, renewable energy, and sustainable facility and environment management. To enable our industry leaders and practitioners to learn from the experience and knowledge of leading experts, the Academy collaborates with established tertiary institutions (such as Carnegie Mellon University, Singapore Management University, UniSIM, University of Newcastle and Stanford University) to conduct degree and post-graduate degree programmes, and executive programmes.

PAST PARTICIPANTS

ADDP Architects LLP
Building & Construction Authority
CPG Consultants Pte Ltd
Davis Langdon & Seah Singapore Pte Ltd
Defence Science & Technology Agency
DP Architects Pte Ltd
GIC Real Estate Pte Ltd
Green Dot Consulting Pte Ltd Consultant
Hexacon Construction Pte Ltd
Housing & Development Board
Ibase Technology Pte Ltd
JTC Corporation
Keppel Land International Ltd
Ministry of Community Development
Ministry of Education
Ministry of Manpower
MKPL Architects Pte Ltd
National Parks Board
Ong & Ong Pte Ltd
RSP Architects Planners & Engineers (Pte) Ltd
Singapore Health Services Pte Ltd
Squire Mech Pte Ltd
Temasek Polytechnic
Tiong Seng Contractors Pte Ltd

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