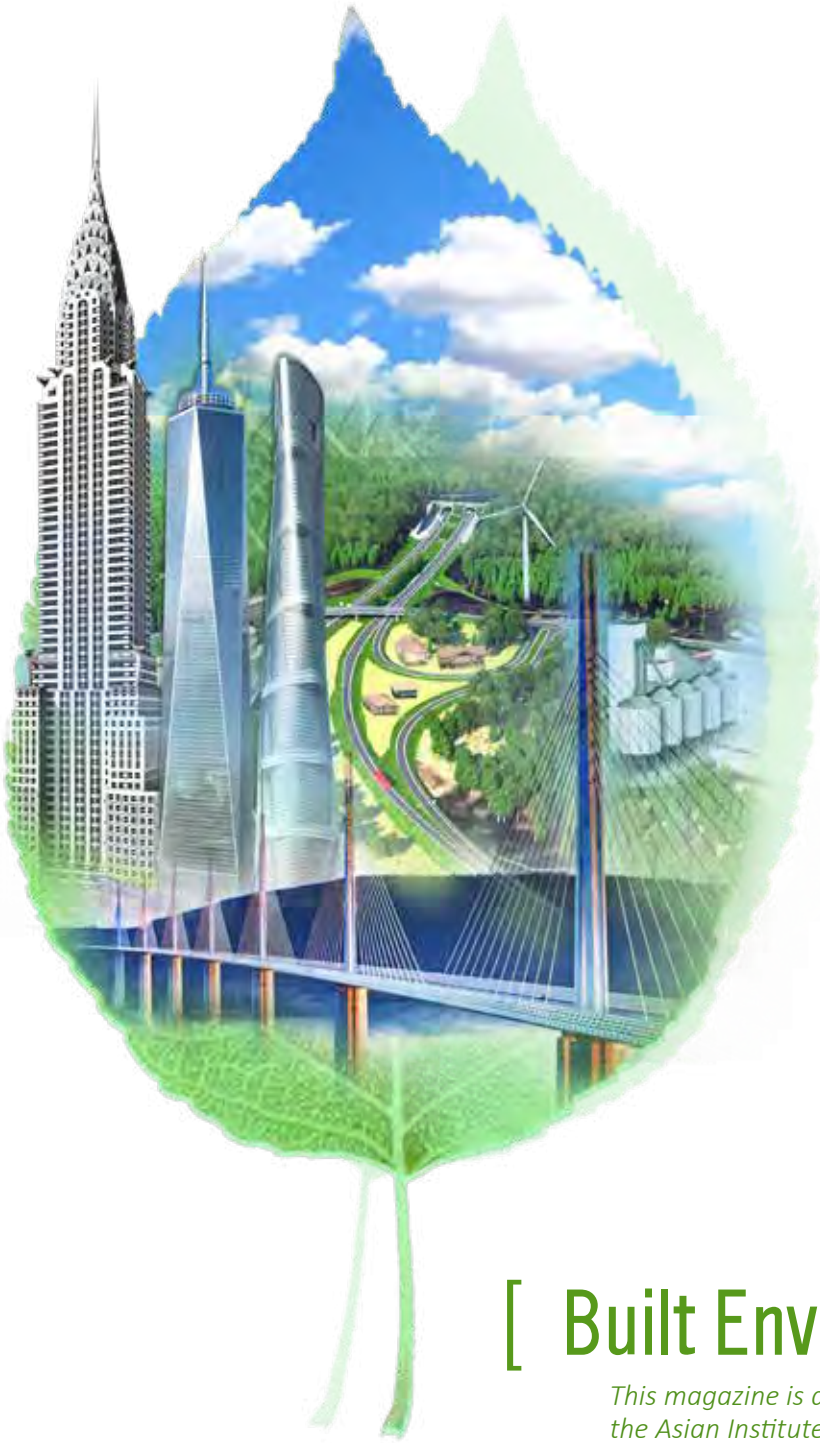


TECHNOLOGY

Asian Outlook on Engineering and Technology



Zero Waste: Beyond the Concept

Green Spaces in Bangkok

Biogas Plants 4.0 – IoT Based Anaerobic Digestion

Climate Change in the Built Environment

What and How the Future Engineers will Continue to Learn?

How to Travel More Sustainably

[Built Environment]

This magazine is a publication of the Asian Institute of Technology



AIT
Asian Institute of Technology



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November 2018

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Editorial



Editor in Chief

Naveed Anwar

Associate Editor

Jennifer Pangilinan

Layout and Design

Khattiyanee Khancharee

Pitruedee Angkhananuchat

Contributors

C. Visvanathan

L. Mohanakrishnan

Shayan Naveed

Subina Shrestha

Javaria Waqar

Admin Support

Jiraporn Kudeerak

Digital Circulation

Shreya Pradhan



AIT Solutions

solutions@ait.asia

www.solutions.ait.ac.th



ACECOMS

acecoms@ait.asia

www.acecoms.ait.ac.th



Habitech Center

sthapit@ait.asia

www.habitech.ait.ac.th



Innovation Lab

ilab.solutions@ait.asia

www.solutions.ait.ac.th/ilab

km. 42 Paholyothin Highway
Khlong Luang, Pathumthani
12120, Thailand

Tel : +(662) 524 6388

: +(662) 524 5533

Fax : +(662) 524 6655

Editor's Note

Our built environment says a lot about the city we live in. These man-made structures have the ability to inspire and impact the lives of the inhabitants. As these structures are created to be used for human activities, we need to ensure that our built environment is resilient and sustainable.

How we build and maintain our cities and infrastructure in the future will have a huge impact on climate change. Studies show that building infrastructure in developing countries could release 226 gigatons of carbon dioxide by 2050, more than four times the amount used to build the existing developed-world infrastructure.

In this issue of Technology magazine with the theme Built Environment, we focused on three main attributes of a sustainable and resilient built environment: safety of the infrastructure and people, carbon footprint impact on the environment, and waste management and solutions. The article about climate change and the built environment provides an overview of what can be done to help reduce the impact to our environment. The concept of zero waste is presented to show how through small initiatives a lot can be done by us individuals to support the circular economy. This issue also shares some of the initiatives being done in AIT to support resilient and sustainable built environment, from biogas plant that addresses food waste to the role of structural engineering in developing resilient urban infrastructure.

AIT Solutions (AITS) has valuable experience in developing solutions and organizing informative events related to multiple dimensions of built environment from structural performance design of the building to structural health assessment and post-earthquake response of buildings. AITS remains passionate to contribute towards the development of modern built environment and zero waste communities to ensure that our cities are livable, sustainable, and safe.

I am thankful to all our experts and authors who gave their valuable contribution, as well as our editorial team for making this issue both informative and creative. We intend to develop this magazine into a valuable knowledge product and a professional communication platform for experts and a gateway to its readers towards upcoming technologies, events, and development.

We are happy to receive your feedback anytime, please email us at solutions@ait.ac.th



Naveed Anwar, Ph.D.

Executive Director, AIT Solutions
nanwar@ait.ac.th



Zero Waste: Beyond the Concept

By Jennifer Pangilinan, Javaria Waqar

Zero waste is a big concept but in simple words it refers to the goal of sending no trash to landfills or incinerators. It is the principle that encourages to redefine and redesign the resource life cycle so that all products are reused, similar to the way resources are reused in nature.

Zero Waste: Beyond the Concept

Zero waste is a big concept but in simple words it refers to the goal of sending no trash to landfills or incinerators. It is the principle that encourages to redefine and redesign the resource life cycle so that all products are reused, similar to the way resources are reused in nature. It works through 3R approach where we reduce what we need, reuse as much as we can, send little to be recycled, and compost what we cannot.

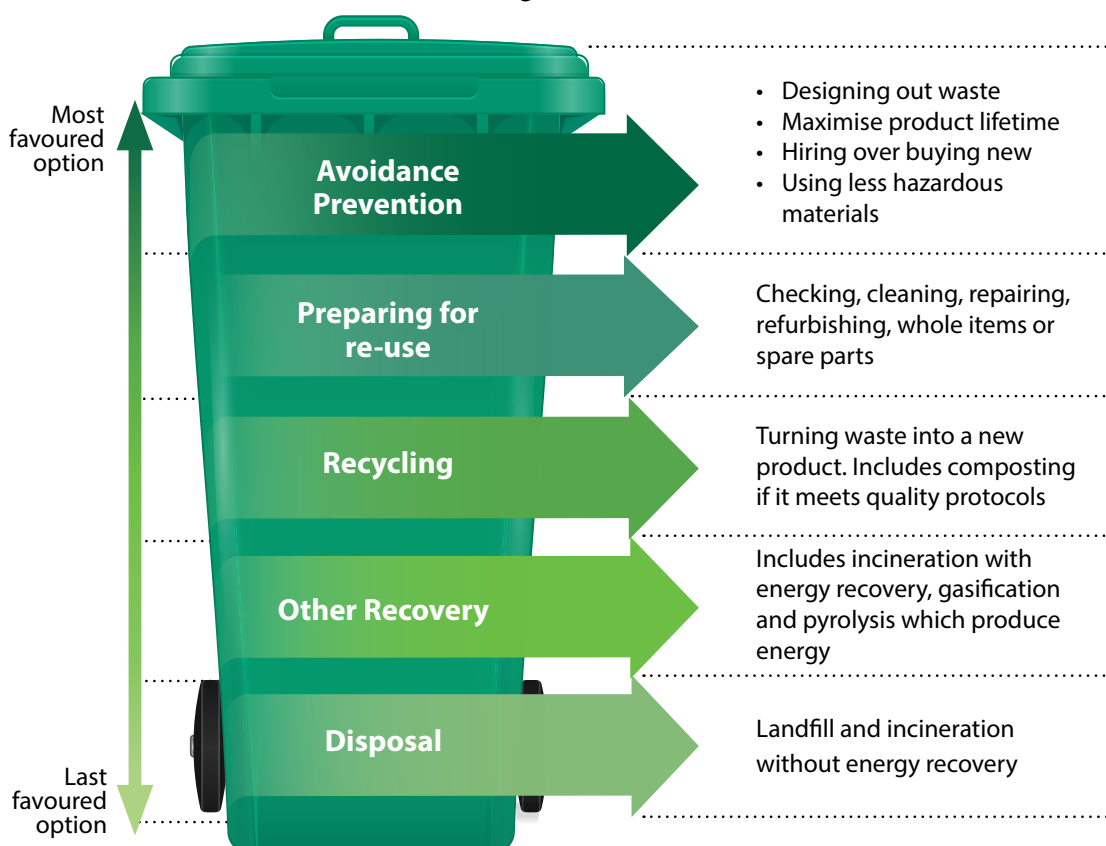
Presently, we live in a linear economy where we take resources from our planet (produce), utilize (use) them, and then dump (throw) them in the ground. The goal of zero waste is to move

towards a circular economy (cradle to cradle) where the trash is completely eliminated through new product designs with the aim to retain as much value as possible of products, parts and materials. The circular economy replicates the natural ecosystem in the way that there is no trash in nature. Contrary to the end-of-pipe waste management concept, the zero waste focuses on waste management and planning approaches which emphasize waste prevention. It is a systematic approach that aims for an enormous shift in the way materials flow through society, resulting in no waste and resumption of all resources fully back into the system.

Although there are many definitions for the term “Zero Waste”, the definition adopted by the Zero Waste International Alliance (ZWIA) is:

Zero Waste is a goal that is ethical, economical, efficient, and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.

Waste Management Hierarchy



Source: Global Waste Management Outlook, UNEP, 2015

Authors:



Jennifer Pangilinan
Innovation Lab Team Lead,
AIT Solutions



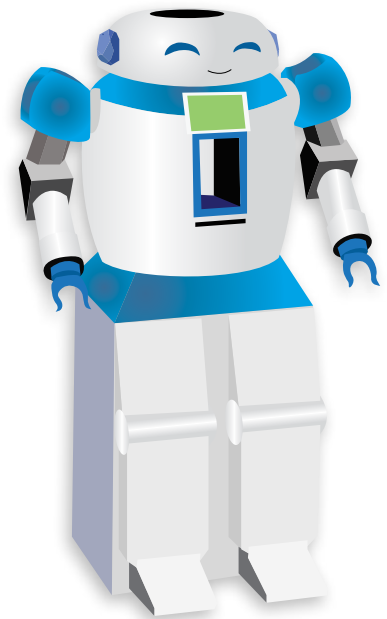
Javaria Waqar
Researcher

Here in Asia, one company that is in the forefront of circular economy is Gone Adventurin, a recycling waste management consulting company that conducts research, plans strategy and implements project to deal with three types of waste: plastic packaging waste; food waste; and electronic wastes. Its Founder and CEO, Mr. Ashwin Subramaniam, visited the Innovation Lab [ilab] at AIT Solutions when he learned through Mr. Amorpol Huvanandana, one of ilab's mentors that AIT is working on several waste solutions initiatives.

Mr. Subramaniam shared some of the key research findings they learned about the critical waste management challenges in Asia. They found out that there is very little to no space to dump waste anymore as landfills are getting full; lots of plastic packaging waste are going to our ocean which eventually enter human food chain; there is an increasing consumption in electronics particularly in Southeast Asia, but much of the e-wastes is currently not being recycled in environment-friendly ways; and a lot is wasted all throughout the food chain from farm level to transportation and consumer level. We need to do our part to raise awareness so the public will be well-informed and these waste problems can be minimized.

When asked what steps AIT can undertake to help, Ashwin said that AIT should just continue what the Institute is collectively doing as it is already leading the way in supporting zero waste or circular economy, particularly in Thailand. He was referring to the several waste solutions in AIT, one of which is the anaerobic digester technology perfected by AIT's Prof. C Visvanathan of Environmental Engineering Management and his researchers and students.

AIT's [ilab] itself has redirected its focus on waste solutions. [ilab] team is currently working on Innovative Waste Solutions, championing Circular Economy and how recycling can be a consumer engagement opportunity. Under development is a smart machine that can pre-process post-consumer waste such as aluminum soda cans and plastic drink bottles to make them ready for recycling. This machine can be used to raise awareness on the importance of waste segregation and recycling.



Demo prototype of smart robot that can pre-process post consumer wastes and gives reward points

Dr. Somthai Wongcharoen, President of Wongpanit Group, the biggest recycling company in Thailand expressed a positive feedback when [ilab] presented this idea of pre-processing packaging wastes before sending to recycling plants. Wongpanit's vision is in line with the circular economy model by converting waste to

"What we have successfully demonstrated is producing 100 cubic metres of biogas from the daily food waste generated in AIT, which is an equivalent of 60 liters of kerosene, or 167 kg of firewood, or 73 kg of charcoal," Professor Visvanathan says. "Power generation from our plant will be 187 kWh, which can power about 1000 15W LED light bulbs for 12 hours."

Source: AIT website

The pilot project seeks to convert "waste to energy" thereby ensuring localized energy availability, that can substitute for fossil fuels. At the same time, it ensures sustainable management of organic and on-site waste segregation, while decreasing the carbon footprint and reducing waste management expenses.

(For more information about this project, go to page 16)



valuable so nothing goes to landfill or incinerator. Wongpanit also provides trainings and opens its facility for a study trip or a job training course for poor, homeless, beggars, and disadvantaged people so that they can make a living by selling wastes.

Another waste solution initiative that itlab is supporting is a startup company called MoreLoop founded by Mr. Amorpol Huvanandana. MoreLoop curates the best leftover fabrics from quality garment factories and creates a market to allow SMEs to access quality fabrics at reasonable prices. Their vision is to make circular economy in textile industry a reality by helping fabric and garment suppliers share their leftover information on their leftover fabrics and make them available for remanufacturing in a scalable and profitable way.

Zero Waste Movement

Zero waste has now become a worldwide movement thanks to Bea Johnson and her family who pioneered the concept and living a zero waste home.

Ms. Johnson follows the 5R rule in living a zero waste home. *"Refuse, Reduce, Reuse, Recycle, Rot (and only in that order) is my family's secret to reducing its annual trash to a jar since 2008."*

Her book with the same title *"Zero Waste Home"* is an international bestseller and has been widely quoted in articles as well as Youtube videos of zero waste and minimalist advocates.

She debunked one of the most common misperceptions about zero waste that it costs more than normal living saying that *"We found that the zero waste lifestyle actually saves us 40 percent on our overall budget,"* she shared in one of the Tedx Talks. *"We consume way less than before, and when we buy something it's only to replace,"* she added.

Another zero waste influencer is Lauren Singer, an environmentalist, entrepreneur and blogger. Her blog *"Trash is for Tossers,"* has now become a tiny empire of sustainable ecommerce. She is also the founder and CEO of a package free shop, which sells household and personal care products free from harmful chemical and wasteful packaging.

Although zero waste lifestyle may vary depending on the person's situation, one of the most basic and fundamental factors to start a zero waste lifestyle is to give up the use of single-use plastics.



Zero waste pioneer Bea Johnson
Photo credit: Zero Waste Home



Say No to Single-use Plastics

UN Environment recently published a report titled **Single-USE Plastics, A Roadmap for Sustainability**. The report revealed that although the benefits of plastic are undeniable, plastics waste causes a plethora of problems, especially when it leaks into our environment. In particular, single-use plastics, often referred to as disposable plastics commonly used in packaging, accounts for nearly half of all plastic waste globally.



Since the 1950s, the production of plastic has outpaced that of almost every other material. Much of the plastic we produce is designed to be thrown away after being used only once. As a result, plastic packaging accounts for about half of the plastic waste in the world. Most of this waste is generated in Asia, while America, Japan and the European Union are the world's largest producers of plastic packaging waste per capita.

Source: UNEP (2018). *SINGLE-USE PLASTICS: A Roadmap for Sustainability*



Plastics in the environment pose significant hazards to wildlife both on land and in the ocean.



Photo Credit: <https://www.indiatvnews.com/>

Plastic bags and Styrofoam containers can take up to

1,000
years
to decompose.



Photo Credit: <https://www.posttoday.com/>



Styrofoam items contain toxic chemicals such as styrene and benzene. Both are considered carcinogenic and can lead to several health complications, including adverse effects on the nervous, respiratory and reproductive systems, and possibly on the kidneys and liver.

Source: Agency for Toxic Substances and Disease Registry

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How to Start a Zero Waste Lifestyle?

Embarking on a zero waste journey is not a walk in a park but we can certainly take some easy-to-follow steps right away without thinking too much. Once we develop it as a habit, we can then slowly transition it into a lifestyle.



NEWS IN BRIEF

July-September 2018

SEPTEMBER



AIT Signs Multi-party Agreement for Smart City Initiative in Khon Kaen

The Asian Institute of Technology (AIT) signed a multi-party agreement on 21 September 2018 with five municipalities, and the College of Local Administration of Khon Kaen University for furthering the smart city initiative of Khon Kaen city. The multi-stakeholder agreement includes the municipalities of Khon Kaen and Sila Town; and sub-district municipalities of Muang Kao, Samran, and Tha Phra. The agreement seeks to bring together researchers and practitioners from several institutions to collaborate on smart cities to help establish Khon Kaen as a smart city leader in Thailand and the region.

Source: AIT Office of Media and Communications



New AIT President Dr Eden Y Woon Shares His Vision for AIT

AIT community officially met its new President Dr. Eden Y Woon on 5 September 2018 at the AIT Conference Center auditorium in an Open Forum where the new head of the Institute shared his vision.

His vision for AIT to be relevant, respected, global and well-known technological and entrepreneurial institute serving Asia and the world was backed up by his strategic formula I2E2S2 which stands for Innovation, International, Enterprises, Entrepreneurship, Stakeholders, and Support. President Woon envisions the Institute to embrace innovation, be international, work with enterprises, nurture entrepreneurship, care for the stakeholders, and broaden support system.

AUGUST



Prof. Worsak Kanok-Nukulchai Delivers Last Lecture as AIT President

An Appreciation Day was organized on 27 August 2018 for Prof. Worsak Kanok-Nukulchai and his team at AIT Conference Center auditorium. Prof. Worsak delivered his last lecture titled "AIT as I know and the disruptive world," where he shared the history of AIT from its founding days and mentioned the institutional transformations. AIT has experienced significant transitions from the SEATO Graduate School of Engineering to AIT, and from being a regional platform for development to becoming a neutral platform for international cooperation. Dr. Subin Pinkayan, Chairperson of the Board of Trustees, inaugurated the event while Chairperson of the AIT Executive Committee, Dr. Sahas Bunditkul delivered an address titled "Prof. Worsak as I knew in the last 51 years."



Professional Master Degree in Structural Design of Tall Buildings, AIT's First Online Degree Program through AIT Share

Practicing structural engineers often come across challenges where they feel the need to equip themselves with the right skill sets, but that very need brings them to a crossroad where they have to make a choice whether to continue working or leave their job and enroll for skill enhancing graduate degree program. Now, AIT is offering a Professional Master Degree in Structural Design of Tall Buildings (PM-TB) through its Civil and Infrastructure Engineering Department under School of Engineering and Technology. PM-TB will be available under AIT Share, an interactive platform that provides access to the knowledge generated at AIT through online lecture videos and courses. AIT Share is being managed by AIT Solutions under its Knowledge Lab.



Bangkok Conference on Science, Technology, and Innovation for Addressing Wildlife and Forest Crimes and Attaining SDGs

The Conference on Science, Technology and Innovation for Addressing Wildlife and Forest Crimes and Attaining SDGs was organized on 28-29 August 2018 by AIT through WEMS Secretariat at AIT Solutions and the Department of National Parks, Wildlife and Plant Conservation, Thailand in collaboration with ASEAN Centre for Biodiversity; European Union; Lusaka Agreement Task Force; National Institute for Environmental Studies, Japan; Remote Sensing Technology Center of Japan; South Asia Wildlife Enforcement Network; United Nations Development Program; and United Nations Office for Outer Space Affairs. This conference tackled three key issues governments are facing in their efforts to stem wildlife and forest crimes: 1) Science, Technology, and Innovations in Addressing Wildlife and Forest Crimes; 2) Information Management in Addressing Wildlife and Forest Crimes; 3) Governance and Capacity Development Initiative for Addressing Wildlife and Forest Crimes.



COLA KKU and AIT meet Mayor of Khon Kaen Fostering Collaboration in Khon Kaen Smart City Project

College of Local Administration, Khon Kaen University (KKU) and the Asian Institute of Technology (AIT) through AIT Solutions attended a meeting with Khon Kaen Mayor Mr. Teerasak Teecayuphan to discuss about the on-going project, Khon Kaen Smart City, initiated by Khon Kaen Think Tank (KKTT) Group. Khon Kaen Smart City masterplan is a colossal project that features a collaboration among three major sectors: local business, government and educational institutes.

JULY



Meeting with Dr. Somthai Wongcharoen, President of Wongpanit Group to explore further collaborations

Dr. Naveed Anwar and his team visited Wongpanit Recycle Plant headquarters at Phitsanulok in July to meet Dr. Somthai Wongcharoen, President of Wongpanit Group to explore potential collaborations in waste solutions initiatives including smart robot machine that pre-recycle post-consumer waste, buy and sell online market, waste segregation robot, and conversion of waste into energy. Since 1974, Wongpanit has been operating as a full-loop recycling company. The company, currently with 1,681 branches, targets to have more than 1,700 branches by the end of this year.



Tenth International Conference on Construction in the 21st Century (CITC-10) in Colombo, Sri Lanka

The tenth International Conference on Construction in the 21st Century (CITC-10) was held at Hilton Hotel, Colombo, Sri Lanka from 2-4 July 2018. The CITC-10 was hosted by the Department of Construction Management at East Carolina University in collaboration with other known universities. This three-day event aimed to facilitate communication between multi-disciplinary teams, especially related to engineering, management, architecture and technology. Dr. Naveed Anwar, Executive Director, AITS, attended the conference and presented the study "Construction Monitoring and Reporting using Drones and Unmanned Aerial Vehicles (UAVs)" jointly carried out with Mr. Muhammad Amir Izhar, Senior Software Developer, AIT Solutions, Asian Institute of Technology (AIT), and Dr. Fawad Ahmed Najam, Assistant Professor, National University of Sciences and Technology (NUST).



Premier Innovation Camp in the Region

The third AIT-Tiger Leong International Innovation and Leadership Camp delivered yet another successful 10-day interactive program held from 16-26 July 2018 at the AIT campus, Thailand. A total of thirty-one bright and talented students from 14 countries were selected out of the almost 100 applications. (See page 50 for more details)



Green Spaces in Bangkok

By Shayan Naveed

Bangkok is one of the most visited cities in the world. In fact, it was named world's top tourism destination in 2016 and 2017. People from around the world come to Bangkok to enjoy its culture, food, nightlife and shopping. It's also a beautiful city in its own right – one that never seems to sleep.



Green Spaces in Bangkok

Bangkok is one of the most visited cities in the world. In fact, it was named world's top tourism destination in 2016 and 2017. People from around the world come to Bangkok to enjoy its culture, food, nightlife and shopping. It's also a beautiful city in its own right – one that never seems to sleep.

Amidst all the tall buildings and the chaos of a megacity, Bangkok has a few charming places as well. Throughout the city, one can find green spaces sprawled about in the forms of parks and pseudo forest areas.

Local Parks

It is hard to believe, but there over 30 parks of all sizes around Bangkok. Most notable ones are the Wachirabenchatrat (Rot Fai) park, Chatuchak park, Lumpini park, Benjakitti park and Rama IX park. These are massive green areas where people go to jog, bike or engage in other physical activities. Rama IX park is the biggest of them all measuring at almost 200 acres. Smaller, community-based parks can also be found throughout and around Bangkok areas.

Bangkrachao

Known as the green lung of Bangkok, this is the largest green space undeterred by modern development. Just across the Chao Phraya river, is this peaceful place where tourists and Bangkok residents love to visit for fresh air and to experience the slow life. Here you will find lush green trees, calm lakes, and fresh food markets that aren't lined against busy streets.

PTT Forest in the City

What used to be a dumping ground has recently been converted into a sustainable eco-park on Sukaphiban 2 Road near Suvarnabhumi airport. This green space consists of mangrove forest and wetlands that co-exist with sustainable and natural construction materials. You'll find elevated walkways, observation towers and exhibition rooms.

The PTT forest in the city is a perfect example of a green and sustainable built environment.



Lumpini Park is a 57.6-hectare of open public space with trees, playground, and an artificial lake, popular for morning and evening joggers.

Chulalongkorn University Centenary Park

Conceptualized and designed under the urban forest concept, Chulalongkorn University recently introduced a community park. It was created to not only provide a green space for the city but but also to serve as a multi-purpose oasis for Bangkokians and tourists to spend some quality time in a fresh atmosphere.

The park is a good mix of urban lifestyle living, technology and nature. This 4.48-hectare land consists of trees, safe roads, biking lanes, rain garden and small bodies of water. Visitors can also enjoy an interactive virtual museum where they can learn about the project and the concept of green spaces.



Chulalongkorn University Centenary Park

Author:



Shayan Naveed
Lifestyle Writer

Sky Lane

Dubbed as a 'Happy and Healthy Bike Lane', Sky Lane is a 23.5 km cycle track that loops around the Suvarnabhumi Airport, grasslands and a massive lake.



Sky Lane is a 23.5 km cycle track that loops around the Suvarnabhumi Airport.

But is it enough?

RISC is a knowledge-sharing environment that aims to generate and develop ideas and innovations through local and international collaboration to improve quality of life for all beings.

We reached out to Dr. Singh Intrachotoo, Head of the Building Innovation and Technology Program at Kasetsart University Architecture and the Chief Adviser, Research and Innovation for Sustainability Centre (RISC) on his views.

Q: Do you think these green spaces are enough to offset the environmental degradation caused by urban development?

Dr. Singh: No way. It's not even close to the need of the people. If you go to these parks, the trees are not healthy. Lumpini is one of the first parks in the city and yet nothing seemed healthy. It's really sad for me to see big trees that look clunky. I always feel envious with Singapore when I see their trees, we have the same climate but our trees are not as healthy - we don't even know how to prune our own trees. I think people don't put

so much value in the public spaces here. I think it's not in our culture to care (about our public spaces).

Q: Is Bangkok on the pathway to become a sustainable city?

Dr. Singh: I don't think Bangkok is on the way to become a sustainable city but it's dramatically different than when I first started 15 years ago. Even my students back then asked me why they needed to learn about sustainability. They didn't care about this topic but now everybody talks about sustainability. We have recognized the problems now but the question is, do we take action.

Q: What do you think can be done?

Dr. Singh: Part of the reason why I set up this research center (RISC) was because I want everyone to have access to this facility to learn from us how to create better quality spaces. We are wellbeing focused both in private space and public space and hopefully (through our lab) we can create some changes or some impacts on few people every day.

To learn more about Dr. Singh and his ongoing initiatives and projects, go to the next page.

Over the years Bangkok's infrastructure has developed significantly at an alarming rate. Highrise condominiums, corporate offices, shopping malls and commercial complexes engulf the city without any sustainable city planning. There are simply too many high-rise buildings and shopping malls and more seem to pop up without any impact assessment.

For Bangkok to be sustainable and green, we need more initiatives like *PTT forest park* and *Forestia*, the world's first property development to introduce a living environment integrated into a natural ecosystem to provide sustainable happiness under the concept 'Imagine Happiness.' The developer of this forest settlement concept project is Magnolia Quality Development Corporation Limited (MQDC), which funds Dr. Singh's research center.



Innovative Self-financing Approach to Affordable Housing, a concept that through the integration of cost saving technologies and revenue producing components, there is potential for a housing product that both reduces the cost of living and generates a net increase in value for both the residents and the developer.

How One Man is Redefining Sustainability

By Jennifer Pangilinan

His name could well be synonymous to the word sustainability with all the initiatives and projects he has been doing - from working with scraps for upcycling to promoting sustainable living for well-being of all, but Dr. Singh Intrachooto would prefer not to put any label. And here's why.

"I grew up in Seattle Washington, it's an evergreen State so it's not like we need to talk about the environment. I took it for granted. I thought everywhere is like that. When I came back to Thailand, I realized no it's not the same. Then I went to pursue my PhD and talk about eco-friendly building, sustainable building, and that's when I became more conscious about terminologies. Before it was just a part of life but after education, you learn the lingo. But I think that's the part that creates the problem because we try to label all these things that are supposed to be just basic needs, basic rights. Suddenly the academia, including me, start labeling all these terms that people don't understand," Dr. Singh explained.



He further added, *"So when I communicate now, I don't talk about sustainability or life cycle assessment or carbon footprint – those whole bunch of academic terms kind of destroy the natural movement of the mass to move them forward. I think when we communicate to the public we need to be very careful of saying things. And this is what I tell my research team, that we should talk to people in the language they understand."*


According to Dr. Singh, sustainability should not be human-focused, but it should be for the well-being of all living things. It does not mean only physical [conservation] or energy saving but also mental and financial care.

To show how we can achieve this, Dr. Singh mentioned *Forestia*, the first urban development of its kind in Thailand because their focus is not only on humans but the well-being of all including animals, insects, and trees by integrating forest into urban development.

Dr. Singh hopes that through this development, we are able to educate the people of importance of forest settlement (being one with nature). He believes that forest is better than parks as it has greater impact not just the physical but mental well-being of all.

But is it affordable for all to live in cities where these kind of developments are available?

"I believe we can achieve that. One of the reasons why we are working with AIT (through AIT Solutions) on Innovative Self-financing Approach to Affordable Housing because we have not been able to do sustainable project for low-income but we believe we can. And we are on the way and hopefully next year we can see something," Dr. Singh added. 🌱



Biogas Plants 4.0 – Performance Investigation of IoT based Anaerobic Digestion

By C. Visvanathan, L. Mohanakrishnan

Each and every segment in waste management from collection, conveyance, recycling, treatment to disposal is undergoing revolution with the advent of Industry 4.0 technologies. Smart waste collection bins, automated robotic recycling, monitoring process parameters in real time basis in waste treatment units; and site selection, mining, monitoring of gas emissions in landfills are few of the many revolutions in waste management sector.

Biogas Plants 4.0 – Performance Investigation of IoT based Anaerobic Digestion



With almost two-thirds of the world's population projected to live in cities in 2030, development of smart and sustainable solutions to improve quality of urban living is of utmost importance. Meanwhile, there is a rapid spread of digital technology applications and automation processes that are currently happening in the industry, such as big data, internet of things, augmented reality, cloud computing, artificial intelligence, etc., referred as Fourth Industrial Revolution or 'Industry 4.0'. The industrial revolutions happened during different era is illustrated in Figure 1.

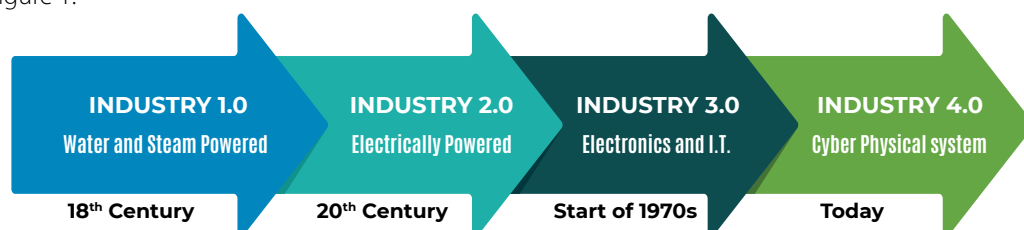


Figure 1: Journey towards the Fourth Industrial Revolution

Each and every segment in waste management from collection, conveyance, recycling, treatment to disposal is undergoing revolution with the advent of Industry 4.0 technologies. Smart waste collection bins (RFID tags, self-compacting bins, fullness level sensing bins, automated waste segregation); pneumatic conveyance system, vehicle tracking system, optimal routing using GSM/GPS/GIS in waste collection and transportation; automated robotic recycling, monitoring process parameters in real time basis in waste treatment units; and site selection, mining, monitoring of gas emissions in landfills are few of the many revolutions in waste management sector by Industry 4.0.

Waste treatment will be completely reshaped by the evolution of Artificial Intelligence, advanced sensors and robotics (Mavropoulos, 2017). To be specific, automation of waste sorting systems and smart waste logistics platforms are two broad manifestations of Waste 4.0 (a portmanteau of 'Waste Management' and 'Industry 4.0'). With Waste 4.0, manual sorting will be progressively wiped out, more fractions will be separated with much less impurities, and separation process will become faster and cost effective, with easy adaptations to changes of the input waste.

There are two proposed primary transition pathways to Waste 4.0 viz.,– transforming with technology by retrofitting of existing systems in developed countries and leapfrogging with

mobile apps in developing countries. Waste 4.0 offers several benefits to waste management sector. It improves waste management towards smartness and efficiency, leads to 3R and Circular Economy, helps to achieve Sustainable Development Goals, transforms waste management to organized sector relatively, ensures occupational health and safety, wins the trust of regulatory bodies and local governments, conducts transparent business transactions, enables centralized monitoring for decentralized waste management systems, increases public private partnerships, and incentivizes customer towards waste management etc. Waste 4.0 is inevitable for smart cities that will be built in the future as depicted in Figure 2.

IoT based Decentralised Community Scale Wet Mesophilic Anaerobic Digestion

Asian Institute of Technology (AIT) in Thailand has developed Internet-of-Things based decentralized community scale anaerobic digestion for waste treatment and resource recovery as shown in Figure 4. This research project was financially supported by the Department of Business Innovation and Skills UK, National Science and Technology Policy Office, Thailand and British Council Newton Fund. The work was conducted by research group from AIT and Loughborough University in UK.

Authors:



Prof. C. Visvanathan
Professor, Environmental Engineering and Management, School of Environment, Resources and Development, Asian Institute of Technology, Thailand.



L. Mohanakrishnan
Research Associate, Environmental Engineering and Management, School of Environment, Resources and Development, Asian Institute of Technology, Thailand.



Figure 2: Waste 4.0 in a Smart City

Disposal of organic waste such as food waste along with municipal solid waste decreases recycling rate and increases landfilling rate. Hence, source segregation and treatment are the way forward for sustainable waste management of these organic wastes. Renewable energy targets set by several countries are encouraging installation of community scale anaerobic digesters with subsidies and incentives. Anaerobic Digestion degrades organic wastes and converts them to 'Biogas' – a renewable energy source that can meet higher applications (like cooking gas, vehicle fuel, power generation etc.) and 'Digestate' that can serve as bio-fertilizer. The evolution of Waste-To-Energy is presented in Figure 3.

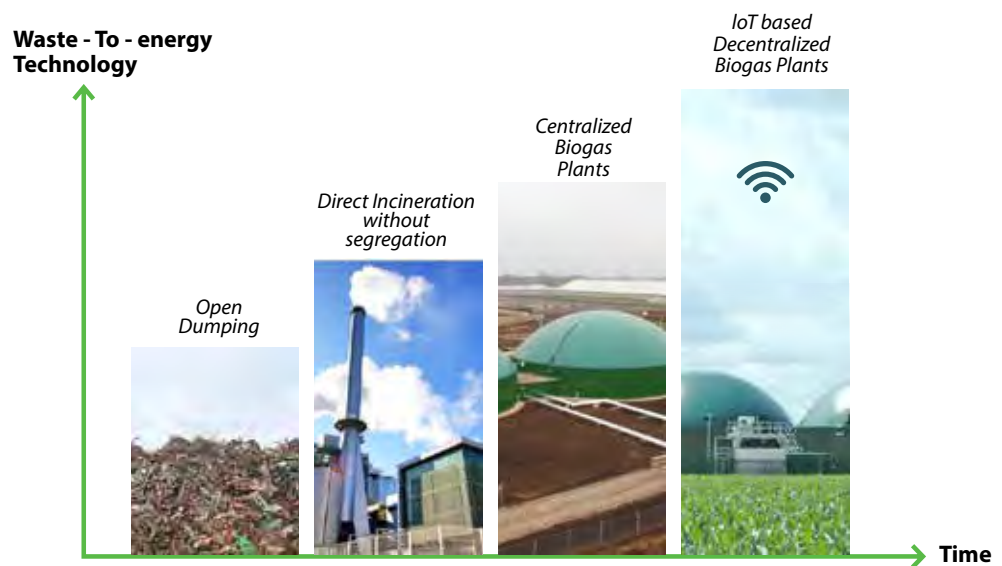


Figure 3: Waste-To-Energy in different era

Presently, biogas plants are operated at centralized level, which has serious drawbacks owing to their frequent process failures together with huge expenses. Hence, decentralized biogas plants are recommended for efficient operation and maintenance. Increasing advocacy for this shift can be perceived as further improvement in waste management, following awareness and

encouragement for source segregation practices at community level. Meanwhile, with the advent of IoT, remote monitoring of waste treatment plants is a reality, which could allow for centrally monitoring community scale biogas plants. Clearly, the study demonstrates futuristic biogas plants i.e., centrally monitored community scale anaerobic digestion systems.



Figure 4: IoT based Decentralized Anaerobic Digestion

Design and System Setup

A pilot scale Continuously Stirred Tank Reactor (CSTR) made of stainless steel with a total volume of 1 cu.m., and working volume of 675.4 L was designed and installed at AIT research station. The digester was located outdoors at an ambient temperature of 20–37°C (mesophilic condition) representing its application in the Asian context. The CSTR was cylindrical in shape with diameter of 1 m and the total height of 1.2 m including 0.86 m of working height. Conical feeding inlet, glass window for observation of the digester, mounted motor for stirrer, inlet for recirculation pipe, and biogas outlet were provided in the cover plate in the top of the reactor. The outlet for digestate and recirculation were provided in the bottom of the reactor. Two sampling points and substrate level measuring scale were provided in the sides of reactor.

The pH, temperature and Oxidation-Reduction Potential (OPR) probes were embedded into the digester, which were monitored online on real-time basis by employing a Programmable Logic Controller (PLC). Acquired information was recorded in, and transmitted via, a central server that can be accessed in other devices. By using Team Viewer application, a software for remote monitoring, the user could track the performance of the system and make decisions. The CCTV monitored Anaerobic Digester also had other sensors including photo sensors. The composition of biogas (CH₄, CO₂, O₂ etc.,) was continuously monitored by employing an in-situ online biogas analyzer unit, that was powered by

solar PV (with battery back-up) and was equipped with custom-programmed microcontrollers to manage data logging and remote transmission (GSM communications). Data sampling was user adjustable but in this case was set up to obtain four readings per day. Moisture and other impurities (like particulates) present in the biogas were removed before entering the online biogas analysis system, and a one-way valve was installed to prevent back-flow of water from gas counter box. A gas flowmeter was used to measure the volume of biogas produced from the digester. The digestate dewatering system consisted of a stainless-steel tank and a sieve with pore size less than 1 mm for solid-liquid separation.

Operational Conditions

The pilot scale CSTR system was operated at pH 6.5 – 8.2, feedstock of 10% TS, mixing speed of 16 rpm and variable Organic Loading Rates (OLR) of 0.5 to 3 kg VS/m³.d in mesophilic condition. The start-up phase contains feeding of inoculum with molasses, molasses with food waste and finally feeding the CSTR with food waste. 50% of working volume of reactor was filled with inoculum collected from Malee industry. Purging nitrogen gas ensured strict anaerobic conditions. Later, the digester was fed with 10 g/L of molasses which was gradually increased to 30 g/L. Molasses were selected as they are easily degradable during the acclimatization period of microorganisms in the reactor environment and to simultaneously achieve the working volume of the reactor.

Acquired information was recorded in, and transmitted via, a central server that can be accessed in other devices. By using Team Viewer application, a software for remote monitoring, the user could track the performance of the system and make decisions.

In the continuous phase, food waste collected from AIT Cafeteria, prepared after separation of bones, plastics etc., and size reduction to less than 0.6 cm, was used as feedstock and was manually fed to the reactor. The performance of the anaerobic digestion system was investigated for three organic loading rates viz., OLR of 1 kg VS/ m³.d (30 days), 2 kg VS/ m³.d (150 days) and 3 kg VS/m³.d. (45 days). Feeding was done based on FOS/TAC (VFA/Alkalinity) ratio. Food waste and anaerobic digestate were characterized by analyzing pH, TS, VS, TOC, COD, TKN, Total lipid, Oil and Grease, and Alkalinity. In addition to the continuous monitoring of the quantity and quality of biogas produced, digestate characteristics and stability of the system was evaluated.

Results and Discussions

The pH value was found to be stable around 7.5 during the start-up phase. By the end of the start-up phase, when the digester was fed with mixture of 1 kg VS/m³.d of food waste and 30 g/L of molasses, the average biogas yield, methane yield and VS reduction were 0.568 m³/kg VS, 0.42 m³ CH₄/kg VS and 79.84 % respectively. The characteristics of food waste used as feedstock is presented in Table 1.

Table 1: Characteristics of food waste

Parameter	Unit	Amount
pH	-	3.8 – 4.9
Moisture Content (MC)	%	81 – 83
VS/TS	-	91 – 97
C/N	-	12 – 15
NH ₄ -N	mg/100g	8.7 – 9.5
sCOD	mg/L	26100 – 59700

From Table 1, it can be observed that food waste contains moisture content of 81 – 83%. This high moisture content makes food waste an easily biodegradable organic substrate. The C/N ratio of food waste used was between 12-15, similar values have been reported by Zhang et al. in 2007. Noteworthy, optimum C/N ratio of 20-30 was reported for Anaerobic Digestion by Li et al. in 2011. The performance of Anaerobic Digestion was evaluated essentially in terms of biogas quality and quantity. Figure 5 shows the daily and cumulative biogas production in different Organic Loading Rates.

The average biogas production was 508 L/d, 825 L/d and 1068 L/d for OLR of 1, 2 and 3 kg VS/ m³.d respectively. The biogas yield reduced with increase in organic loading rates. The biogas yield was 754 L/kg VS, 612 L/kg VS and 528 L/kg VS for OLR of 1, 2 and 3 kg VS/m³.d respectively. The experiment results also showed that the average concentration of methane decreased from 57%, 54% to 51% for OLR of 1, 2 and 3 kg VS/m³.d respectively.

During the study, the highest temperature value was 32.9 °C and the lowest temperature recorded was 22.5 °C during the month of December in Bangkok. The performance of anaerobic digestion increases at higher temperature in mesophilic condition (El-Mashad et al, 2004). It was observed that at Day 86, the temperature reached less than 25 °C, consequently the biogas yield also reduced on the following days. When the temperature increased to more than 30 °C, the biogas production also increased. The same trend was observed in Days 129, 152, 176 and 208. The ORP value was found to be around -510 mV throughout the experimental period. The optimum value for ORP was reported as < -200mV (Appels et al, 2008).

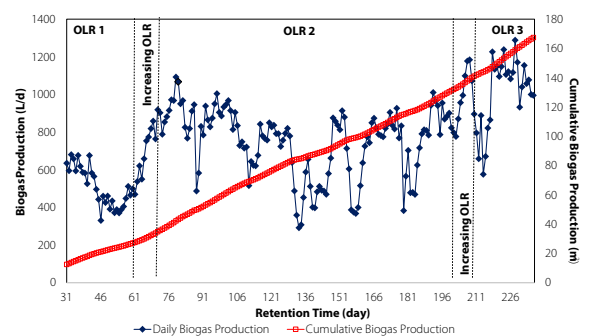


Figure 5: Daily and Cumulative Biogas Production during continuous operational phase

The pH of digestate during the different organic loading rates was observed carefully, and whenever the pH value was found to be lower than the optimum range for methanogenic activity (6.5), the retention time for digestion was increased. FOS/TAC analysis, a simple titration method for assessing stability of digester, was used in this study. TAC value is an estimation for buffer capacity of sample and FOS corresponds to volatile fatty acid. The optimum FOS/TAC ratio for anaerobic digestion stands between 0.3 – 0.4 in which biogas production is maximum. Lower

FOS/TAC ratio means the micro-organisms in the system are starving and the digester should be fed with more substrate, whereas higher FOS/TAC ratio denotes that the system is overfed.

As shown in Figure 6, relatively stable performance was observed at OLR of 1 kg VS/m³.d, with FOS/TAC ratio around 0.1 and pH value around 6.7. However, FOS/TAC ratio increased from 0.1 to 0.35 at OLR of 2 kg VS/m³.d. On Day 86, it reached to 0.68 and the pH dropped to 6.42. As a remedial measure, the retention time was increased by reducing the feed. Same situation happened on Day 110, 128, 132, 142, 155 and 181. On these mentioned days, the biogas yield and methane yield also reduced consequently. Finally, at OLR of 3 kg VS/m³.d, the FOS/TAC ratio reached its peak (1.9) and the pH value decreased to 6.2. Therefore, alkalinity buffer was added to the reactor, in addition to the increase in retention time. This study demonstrates that through this novel and accurate indicator of FOS/TAC ratio, any irreversible process failure could be prevented in anaerobic digestion systems.

Alkalinity serves as an indicator of buffer capacity in anaerobic digestion system to prevent acid build-up in the digester. Therefore, sufficient amount of alkalinity is required for proper pH control. Throughout the experimental study, alkalinity was found to be in steady range. However, alkalinity value increased occasionally above the optimal range during addition of buffer to overcome low pH and high FOS/TAC.

Similarly, sCOD concentration was found to be higher, whenever the performance of the digester

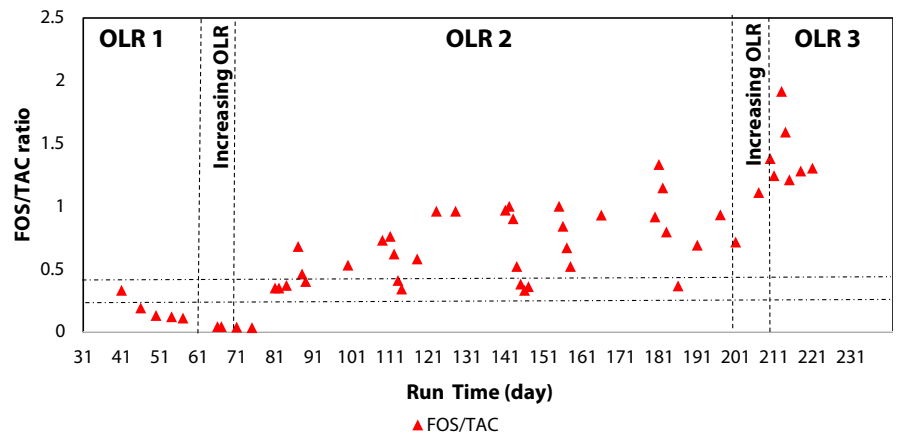


Figure 6: Trend of FOS/TAC in different organic loading rates

decreased at higher FOS/TAC and higher OLR of 3 kg VS/m³.d. This may be attributed to lower methanogenic activity at low pH. Ammonia is formed during degradation of protein and nitrogen rich substrates. The presence of NH₄ in anaerobic digestion is necessary for bacteria growth, but in higher concentrations NH₄ may lead to inhibition of the biological process (Zhang et al, 2014). Digestion failure could be caused at ammonia concentration of 1700 – 1800 mg/L (Khalid et al, 2011). In this study, the concentration of ammonia was found to be between 498 – 812 mg/L, which is below the inhibition range. The biogas yield, methane yield and solids reduction in digestate were taken into account as the indicators to assess the performance and efficiency of each loading rate. Figure 7 presents the overall performance of the anaerobic digestion system.

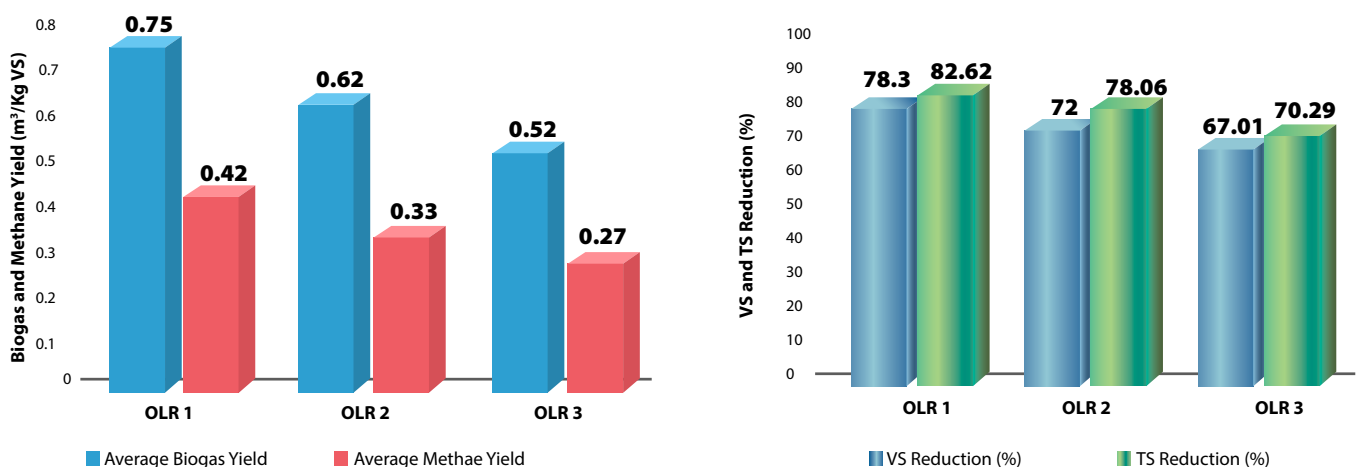


Figure 7: Overall performance of anaerobic digestion system

Theoretical methane production rate for digestion of food waste is 0.4–0.5 m³/kg VS (Heo et al., 2004). The highest methane yield observed was 0.42 m³/kg VS at OLR of 1 kg VS/m³.d with highest biogas yield of 0.75 m³/kg VS. As the loading rate increased, the methane yield and biogas yield decreased. 0.62 m³ and 0.52 m³ biogas yield with 0.33 m³ and 0.27 m³ methane yield was observed for OLR of 2 and 3 kg VS/m³.d respectively. The removal efficiency of TS and VS reduced with increase in organic loading rate. The highest VS reduction efficiency of 78.3 % was obtained at OLR of 1 kg VS/m³.d. The removal efficiency of VS was 72 % and 67.01% at OLR of 2 and 3 kg VS/m³.d respectively. TS removal efficiency was 70.7 %, 66.5 % and 54.98 % for OLR of 1, 2 and 3 kg VS/m³.d respectively, which are higher than value reported by Usack et al. (2012).

Centralized Monitoring of Decentralized Anaerobic Digestion Systems

The study tested remotely monitored network of anaerobic digesters in terms of ease of operation and maintenance and efficacy. It was found that the decentralized monitoring system exhibited several distinct merits over non-automated or high cost management alternatives. The reasonably simple online monitoring of AD process was

realized, and a rapid and accurate evaluation of AD reactor status was provided to both research groups simultaneously. In addition, the automatic storage of real-time data online provided a reliable, and time saving method of data acquisition. In a research context, these features facilitate wider collaboration and knowledge sharing. This allows the central station, where expertise is located, to pass the message for onsite remedial measures such as dosing with chemical corrective treatments. This would however still require on-site intervention, but one which did not demand any specific skill sets.

The novelty of Anaerobic Digester at AIT by employing programmable logic controller and in-situ online biogas monitoring system enabled to remotely track its performance and make precautionary measures as depicted in Figure 8. The crucial information on parameters such as pH, Temperature and ORP, available on real-time basis, along with simple laboratory analysis of representative samples helped to closely monitor the process stability of the digester. Moreover, these novel monitoring systems reduced reliance on complex procedures – that needs to be followed otherwise which are not viable at a decentralised level due to their cost and lead times. This energy positive digester being operated in real life conditions, significantly reduced the cost to maintain the operating temperature. Any unauthorized access to the premises of Anaerobic

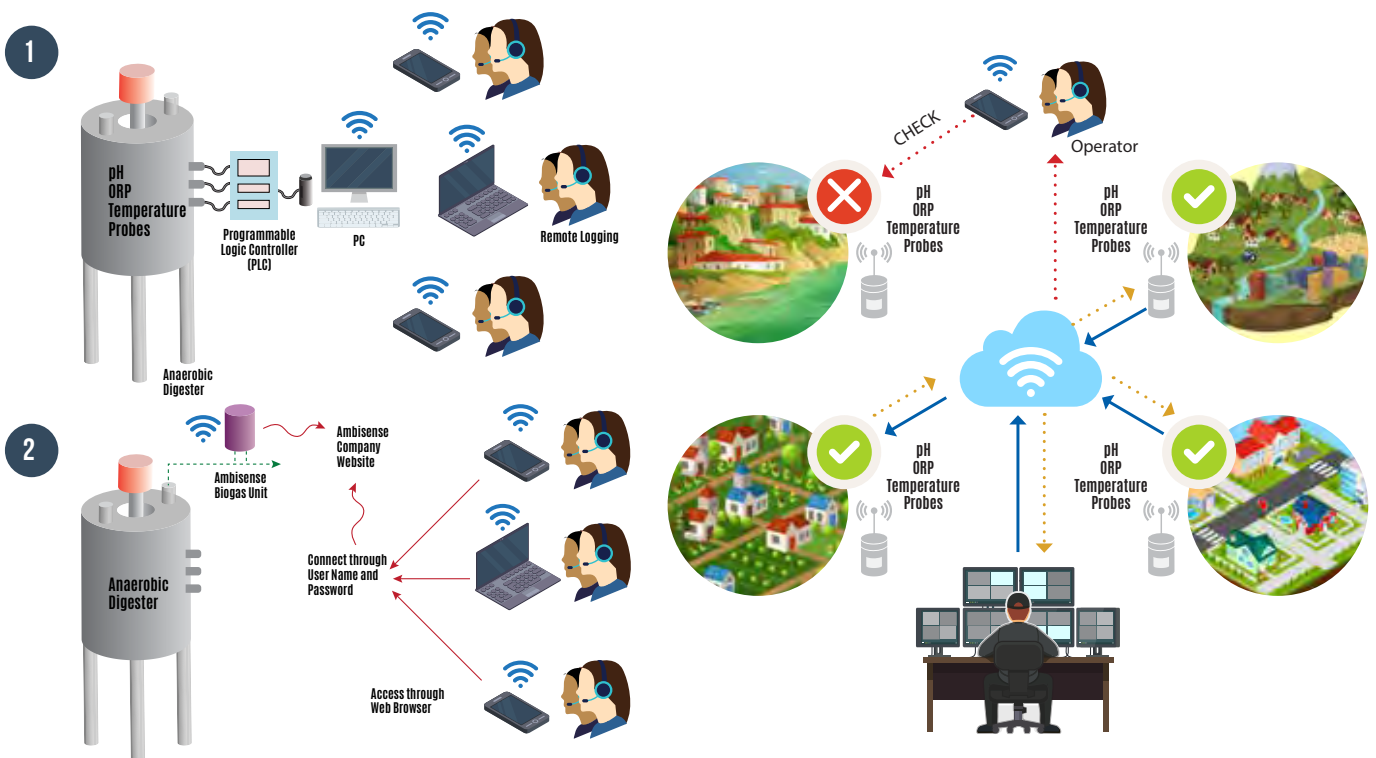


Figure 8: Online monitoring of anaerobic digester

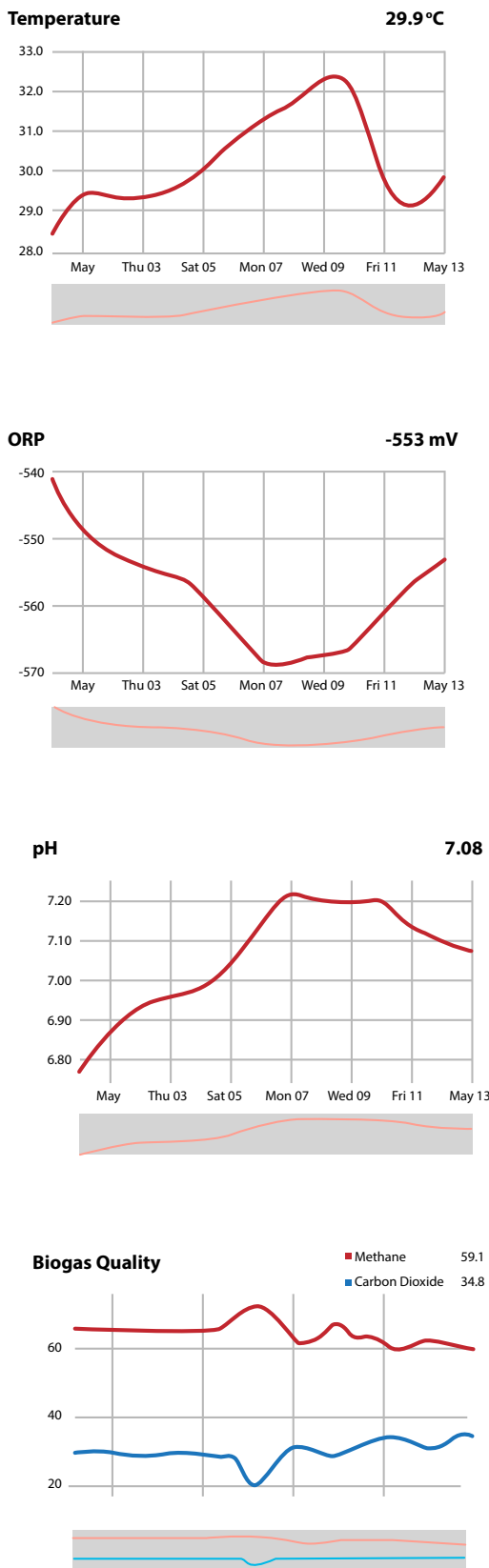


Figure 9: Mobile Dashboard Application showing digester performance

Digestion system with sophisticated equipment could be prevented through CCTV monitoring system in place. Safety of the operator is ensured through monitoring the pressure built up in the digester headspace. The system also included energy conservation efforts like motion sensing night light which automatically turns on when motion is sensed and turns off after no activity. The mobile dashboard application accessible at <http://biogester.solutions.ait.asia> provides remote and user friendly information about the plant to the community as shown in Figure 9.

Hence, to address the need for low cost methods of Anaerobic Digestion control and management at the community-scale, the implementation of a decentralised network of two Anaerobic Digestion plants linked by a central monitoring system has been piloted. The real time, and simultaneously shared data of reactor parameters proved beneficial as it enabled off-site monitoring of reactor status at multiple sites which minimises requirement for on-site supervision and specialist intervention. Off-site monitoring of biogas and other process variables enabled a rapid reactive response to maintain reactor stability and consequently biogas quality.

Conclusion

The paradigm shift to decentralized anaerobic digestion together with the advent of 'Industry 4.0', will lead future biogas plants to be installed and operated as centrally monitored community scale anaerobic digestion systems. These highly efficient Biogas Plants 4.0 will be associated with better management, operation and maintenance. A pilot scale decentralized IoT based wet mesophilic anaerobic digester for food waste treatment was designed, developed and installed, to serve as a classic model of futuristic biogas plants. The average biogas yield and methane yield reduced with increase in organic loading rate. The average methane yield of 0.42, 0.33 and 0.27 m³/kg VS with VS reduction of 78.3%, 72% and 67% were achieved at organic loading rates of 1, 2 and 3 kg VS/m³ respectively. This study also demonstrated a novel FOS/TAC method for monitoring of performance and stability of anaerobic digestion system. 🌐

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JUNE

Eleventh U.S. National Conference on Earthquake Engineering- Integrating Science, Engineering & Policy in Los Angeles, California



The Eleventh U.S. National Conference on Earthquake Engineering was held in downtown Los Angeles, California from 25-29 June 2018. Dr. Naveed Anwar, Executive Director, AIT Solutions, submitted a conference paper with co-author S. A. Reddy his former student, now part of his Civil and Structural Engineering Unit, on Seismic Performance Evaluation of High-Rise Building with RC Flag Wall systems. The paper evaluates the seismic performance of flag wall structural systems (i.e. the RC walls in selected floors, not reaching the foundation) used as an alternative to the conventional outrigger system and also provided the detailed analysis is carried out for various configurations of flag walls using a case study of a high-rise RC building. Dr. Naveed Anwar also joined the dinner reception hosted by Computer and Structures Inc., USA to celebrate the invaluable contributions of Ray Clough and Edward Wilson to the earthquake engineering profession through their numerical models.



Singapore Engineers Attend Workshop on Design of Tall Buildings organized by Philippines Institute of Civil Engineers Singapore Chapter

A three-day seminar workshop on Analysis and Design of Tall Buildings was organized by the Philippines Institute of Civil Engineers Singapore Chapter in collaboration with the Association of Structural Engineers of the Philippines (ASEP) on 15-17 June 2018 in Singapore. ASEP invited AIT structural engineering expert Dr. Naveed Anwar, Executive Director, AIT Solutions and his team of senior structural engineers to conduct the seminar workshop.



Beat Plastic Pollution - If you can't reuse it, refuse it

The School of Environment and Resource Development (SERD), AIT and the Wildlife Enforcement Monitoring System (WEMS) Secretariat at the AITS jointly organized an event to commemorate the World Environment Day on Tuesday, June 5 at the Milton E. Bender Auditorium, AIT. Mr. Surendra Shrestha, Vice President for Development, during his address, highlighted the significance of the day and urged AIT community to take action in line with the theme "*Beat Plastic Pollution*".

A panel consisting of Dr. Krishna R Salin, Associate Professor of Aquaculture and Aquatic Resources Management, Dr. Jonathan Shaw, Executive Director of AIT Extension and Deputy Director of Regional Resource Center for Asia and the Pacific (RRC.AP), and Mr. Guilberto Borongan, Coordinator and Senior Programme Specialist of RRC.AP expounded on the topic "*Humanity's love of plastics: Is sustainable obtainable?*", and a special film titled "*ALBATROSS*" by Chris Jordan was screened to underscore the humanity's infatuation for plastics and subsequent impact on one of the remotest parts of the world.



Performance Based Structural Design of Tall buildings: Designing of Safer Infrastructure

The two-day event (international seminar and hands-on training workshop) on *"Performance Based Structural Design of Tall Buildings"*, held on 1-2 June 2018 at AIT provided an opportunity to practicing engineers, structural designers and researchers to interact, learn and gain/exchange experience about the state-of-the-art prevailing use of performance-based approach for the design and assessment of tall buildings with various experts.

MAY



Visionary Event Underlines the Role of Structural Engineering in Developing Resilient Urban infrastructure

Academic institutions and industry play a significant role in the development of well qualified and well-trained engineers to develop innovative solutions to tackle the challenge of rapid infrastructure development and that is why the AIT through AITS in collaboration with Computers and Structures Inc. (CSI), USA organized a visionary event titled *"Structural Engineering: Backbone of Built Environment, Future Proofing our Infrastructure"* held on 31 May 2018 in Bangkok. The event was followed by a dinner talk titled *"Empowering the Next Generation of Structural Engineers"* by the renowned structural engineering and pioneer of earthquake engineering software Mr. Ashraf Habibullah, President/ CEO of Computers and Structures Inc. CSI, USA.



International Conference: Concrete and Steel Technology, Engineering and Design (CASTED 2018)

The Association of Structural Engineers of the Philippines Inc. (ASEP) organized an international conference on Concrete and Steel Technology, Engineering and Design (CASTED 2018) held on 24-26 May 2018 in Manila, Philippines. Dr. Naveed Anwar, Executive Director, AIT Solutions was invited as one of the keynote speakers. He delivered a lecture on Concrete-Steel Composite and Mixed Components for Efficient Structural Systems. Other keynote speakers came from Spain, Qatar, Singapore, and Japan.

APRIL



Performance-based Design of Tall Buildings in Pakistan

To equip the practicing structural engineers and designers with various advanced skills and knowledge to tackle with the recent challenges of urbanization, complexities in structural forms and innovative systems, the NED University of Engineering & Technology (NEDUET) in collaboration with AIT Solutions and AIT organized a two-day seminar and workshop on *"Performance-Based Structural Design of Tall Buildings: Making Buildings Safer for Pakistan"* on 20-21 April, 2018, certified CPD by Pakistan Engineering Council, at NED, Karachi.



Visit to Research and Innovation for Sustainability Center (RISC)

AITS team led by Dr. Naveed Anwar had a fruitful meeting with Research & Innovation for Sustainability Center (RISC) team headed by Dr. Singh Intrachooto, Chief Adviser, at Magnolias Ratchadamri Boulevard, Bangkok in April. Dr. Naveed presented about ongoing initiatives of AIT, and proposed areas for collaboration. RISC showed interest to collaborate with AITS particularly in the area of affordable housing.



What and How the Future Civil Engineers will Continue to Learn?

By Naveed Anwar

The evident importance of civil engineering as the oldest engineering discipline which mainly deals with the built environment that encompasses much of what defines modern civilization is inarguable.

What and How the Future Civil Engineers will Continue to Learn?

The evident importance of civil engineering as the oldest engineering discipline which mainly deals with the built environment that encompasses much of what defines modern civilization is inarguable. To tackle with today's rapid development, there is a need to produce highly capable and skilled future generation of civil and structural engineers. Academic institutions and industry play a significant role in the development of skilled human resources and accelerate the process of continuous learning.

Therefore, I drew special attention to what is that the civil and structural engineers should learn, how, and what are the factors that can boost continuous learning in this discipline.

In 1956, the bloom pyramid, a taxonomy of teaching, learning, and assessment was devised by Dr. Benjamin Bloom in order to promote higher forms of thinking in education which was later revised in 2001. It serves as the framework of teaching, leaning more towards skills rather than content, to ensure all orders of thinking are exercised in students' learning, including aspects of information searching. The Civil engineering traditionally moves up from the lowest levels of taxonomy and are challenged to reach the higher levels.

The Civil Engineering Body of Knowledge for the 21st century designed a roadmap for civil engineers, based on the foundational, technical, and professional aspects of civil engineering mapped with the six levels of achievements comprising of knowledge, comprehension, application, analysis, synthesis, and evaluation. Mostly, the undergraduate programs are designed to cover the basic three levels of achievement that are knowledge, comprehension, and application of the foundational, technical, and professional aspects. Whereas, the high level of achievement can only be attained through specialization and Prelicensure Experience.

In this era of transformation and innovation, civil engineers should have strong base of basic and applied knowledge, creative soft skills with exposure to all dimensions of community development to focus on national and urban infrastructure, water cycle, international projects, and special areas such as integration with technologies in civil engineering, drones, 3D printing, artificial intelligence and many other technological innovations. Structural engineering, as a part of civil engineering, is believed to be the backbone of physical infrastructure development that give shapes to buildings, bridges, tunnels, dams, communication towers, industrial plants, and expressways.

Mainly, the development in this discipline depends on the cause-and-effect mechanism. The chief underlying causes that trigger development are natural or man-made hazards and changes that occurs with time, which rises the phenomena of force and displacement resulting in deformation and stress to infrastructure. The question is, is this effect acceptable? The major difficulty to answer this question lies in defining the causes, determining actions, effects of these actions on structures, defining acceptability level of these effects, and ensuring these effects are acceptable.

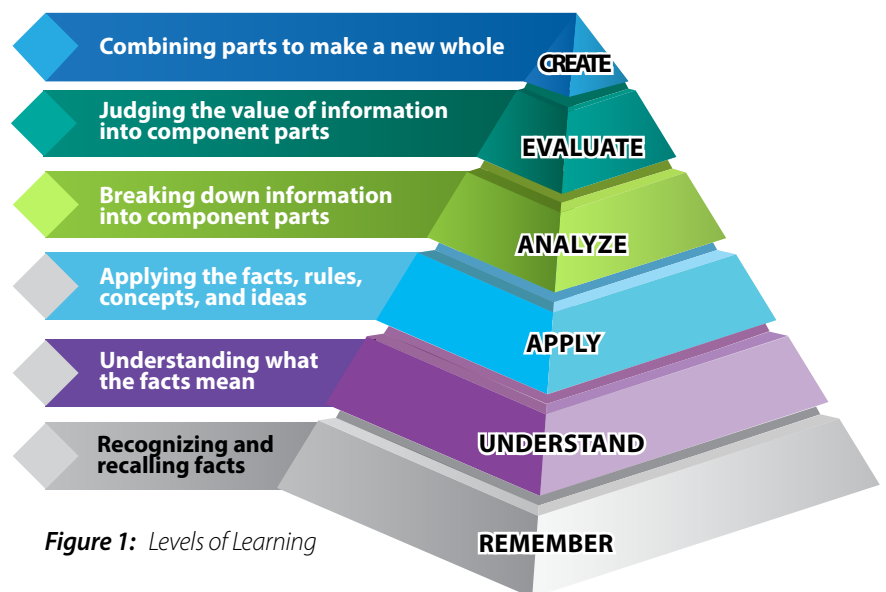


Figure 1: Levels of Learning



Author:



Naveed Anwar, Ph.D.

Executive Director,
AIT Solutions
Director, Asian Center
for Engineering Computations
and Software (ACECOMS),
Affiliate Faculty,
Structural Engineering,
Asian Institute of Technology

On the progression scale of design approaches, primarily the intuitive and code based design covers wind resistance, while, the performance based design deals with earthquakes and are likely to exhibit less life-cycle costs than prescriptive designs as they are based on clearly defined performance objectives. Then comes the consequences and risk based design and resilience based design. He mentioned that this is the game played between the following few basic quantities:

- Length, Mass, Force
- Time, Displacement
- Stiffness, Damping, Energy
- Resources

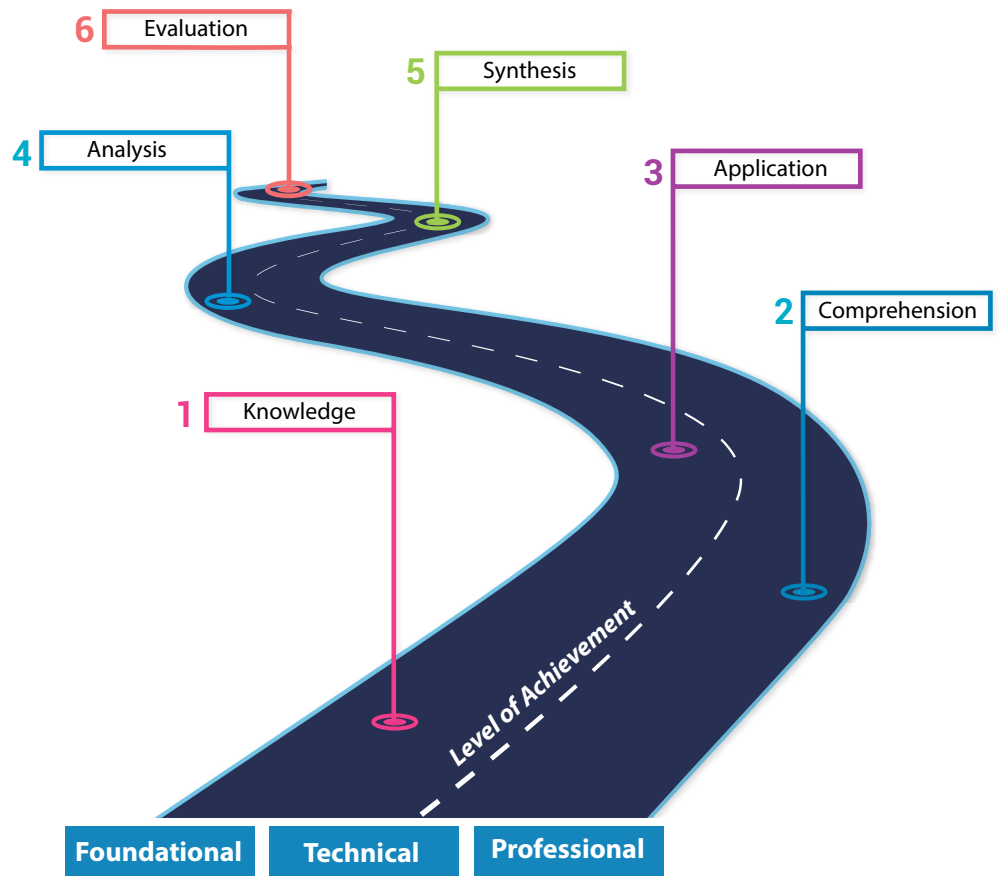


Figure 2: Based on Civil Engineering Body of Knowledge for the 21st Century by ASCE

“Roadmap on the future research needs of Tall Buildings” published by the Council on Tall Buildings and Urban Habitat (CTBUH), mainly focuses on five important research areas: development and implementation of real-time structural monitoring of completed tall buildings, validation of modeling assumptions for wind and seismic loading, improving tall building protection from multi-hazard events, development of design criteria to determine appropriate safety levels, and development of holistic performance based multi-hazard design and analysis of tall buildings.

Now, to look into the aspect of how to ensure continuous learning, the key skills required include: understanding physical meaning of quantities, establishing relations between quantities, stimulating and visualizing the cause and effect cycle, creating efficient configuration and proportioning effectively communicating the outcome. Simulation is also a wonderful tool for learning, it is the process of creating and analyzing a digital prototype of a physical model to predict its performance in the real world. It helps

designers and engineers understand whether or not, under what conditions, and ways in which a part could fail, and what loads it can withstand.

In this regard, a balanced and unique ecosystem is needed which can connect the learning with employment. Lifelong learning and continued professional development should be vital aspects of this type of ecosystem. AIT has played a significant role in developing this kind of ecosystem through teaching and practical experience in structural engineering, and intermittently contributing through valuable key initiatives. AIT is now offering a Professional Master Degree in Structural Design of Tall Buildings (PM-TB) through its Civil and Infrastructure Engineering Department under School of Engineering and Technology. PM-TB will be available under AIT Share, a knowledge platform that provides access to the knowledge generated at AIT through online lecture videos and related courses offered in AIT, is a significant initiative in this regard.

Validation of modeling assumptions for wind and seismic loading, improving tall building protection from multi-hazard events, development of design criteria to determine appropriate safety levels, and development of holistic performance based multi-hazard design and analysis of tall buildings.

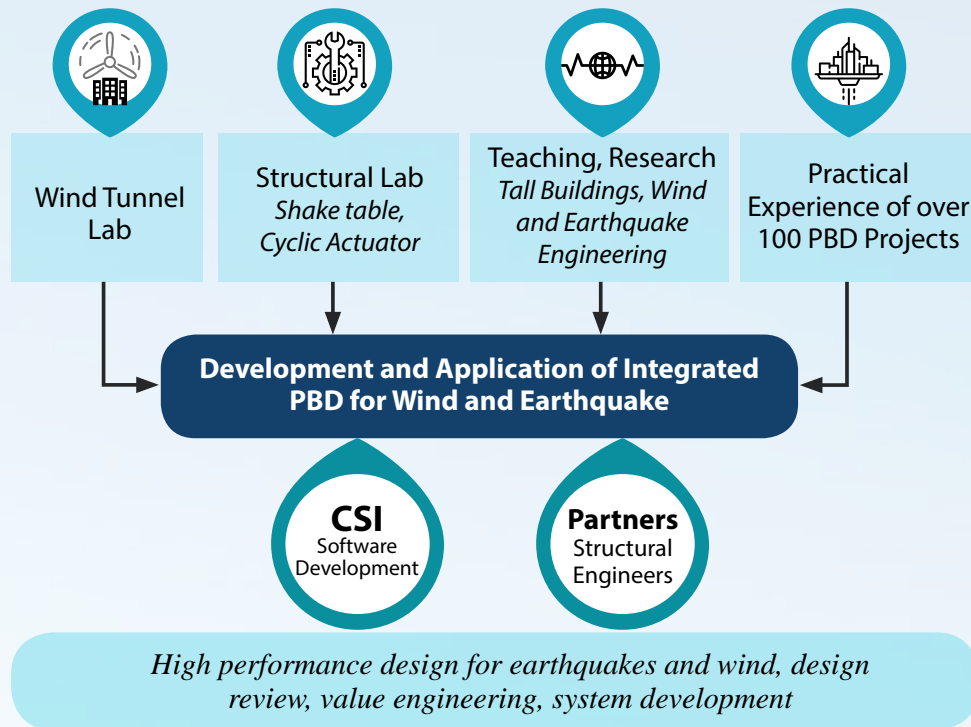


Figure 3: AIT's Experience in Structural Engineering (as basis for future learning)


Moreover, understanding the need of the time for civil engineering discipline, AIT has designed and introduced the professional master degree program in civil engineering with specialization in structural design of tall buildings, where you can avail the best opportunity to learn from experts and enhance your capabilities without leaving your job. With a view to help produce next generation of engineers that have greater understanding, skills and tools to design and construct a safer build environment, Computers and Structures Inc., USA has also developed the tools and Platform for engineering education and learning. ETABS Clouds Viewer, SAP 2000 Cloud Viewer, CSI sections, and CSI units are the softwares that are already being released, whereas Frame2D, RC beam, Section Stress, PS stress, PM interaction, Stress-Strain, Steel Sections, Rebar Selector, Material Library, Faculty assistant, and students are in testing stage along with many others in the development stage.

Similarly, machine learning and artificial intelligence have changed the traditional iterative, computationally intensive and time consuming way of architectural design to code based design and performance based design. Real time reporting from instrumented structures through sensors in the building, sensor log, digitized sensor data, PEA cloud and PEA mobile application opens up another way of learning.

Civil engineering is considered totally safe profession during the fourth industrial revolution with 1.9% of automation as compared to computer programmers, and accountants according to an online survey which generates the probability of automation of professions. In the end, I recommend my favorite book "*The Tower and the Bridge (The new art of structural engineering)*" by David P. Billington. 📖

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Visionary Event Underlines the Role of Structural Engineering in Developing Resilient Urban Infrastructure

May - June 2018 | Event

Our region has seen rapid infrastructure development in the last few decades, and is not showing any signs of slowing down. Such rapid and large-scale development leads to a greater need for the qualified and well-trained engineers who can provide innovative and reliable solutions, and get them through the implementation at an acceptable cost and time.

Academic institutions and industry play a significant role in the development of such human resources, which is why Asian Institute of Technology through AIT Solutions in collaboration with Computers and Structures Inc. (CSI), USA organized a visionary event titled **Structural Engineering: Backbone of Built Environment, Future Proofing our Infrastructure** to bring together industry leaders and experts to share their knowledge and expertise.



From left: Dr. Karoon Chandrangu, President, KCS & Associates; Prof. Sinéad C. Mac Namara, Associate Professor, School of Architecture, College of Engineering Honors Core Faculty, USA; Dr. Goman Ho, Arup Fellow, Global Leader of Tall Building, Skills Network, Adjunct Professor of HongKong Polytechnic University; Prof. C. V. R. Murty, Director, Indian Institute of Technology Jodhpur; Mr. Ashraf Habibullah, President/CEO, Computers and Structures Inc. CSI, USA; Engr. Antonino 'Jojo' S. Aligaen, Head, Construction Management Department, Real Estate Division OCLP Holdings, Inc., Philippines; Prof. Pennung Warnitchai, Professor, Asian Institute of Technology; Engr. Jose A. Sy, President SY^2 + Associates Inc. Philippines



A rich mix of speakers including renowned architects and professional engineers engaged in mega projects, academia working on the development of new methodologies and influencing building codes, software developers who create the tools that engineers use, and developers that ultimately engage and utilize these professional for execution of the projects were invited to present at this event held on **31 May 2018 at Siam Kempinski Hotel Bangkok.**



The event was followed by a Dinner Talk titled ***Empowering the Next Generation of Structural Engineers*** by the renowned structural engineering and pioneer of earthquake engineering software Mr. Ashraf Habibullah, President/ CEO Computers and Structures Inc. CSI, USA.



Dr. Naveed Anwar (right) interviews Arch. Marshall Strabala and invites him to join the advisory board of AIT's new offering Professional Master Degree in Structural Design of Tall Buildings.



Mr. Ashraf Habibullah and former AIT President Professor Worsak Kanok-Nukulchai have been friends since they were doing their postgraduate studies at University of California Berkley.



The Dinner Talk was attended by H.E. Dr. Subin Pinkayan, Chairman, AIT Board of Trustees and H.E. Mrs. Mary Jo A. Bernardo-Aragon, Ambassador of the Embassy of the Philippines to Thailand



Technical Seminar and Workshop on PBD of Tall Buildings

The visionary event was followed by a **Technical Seminar and Workshop on Performance Based Structural Design of Tall Buildings, Designing for Safer Infrastructure** on 1-2 June 2018 at the Asian Institute of Technology.

During the technical seminar, experts discussed the latest structural design philosophies and performance-based design procedure, and provided an account of recent developments and trends in the modeling, analysis and performance evaluation of high-rise buildings with emphasis on various issues, challenges and opportunities. Based on practical experience obtained from the detailed structural analysis and design of a large number of high-rise buildings, experts also shared some important insights into the nonlinear and dynamic behavior of buildings and useful recommendations for an effective design and enhanced structural performance against wind and earthquake loads.

The workshop focused on hands-on training sessions for various software and computational tools required to carry out performance-based design, and on practical demonstration to conduct various analysis procedures with emphasis on the interpretation of analysis results. 🏗️



Designing Resilient Structures for Sustainable *Built Environment*

Role of AIT Solutions, Asian Institute of Technology

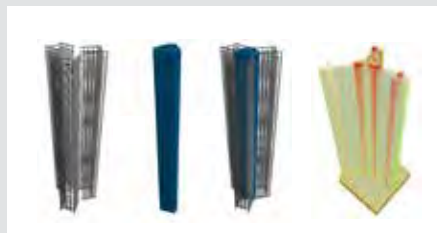
Urbanization is one of the major global challenges of this era. An efficient way to accommodate rapidly growing urban population is to develop vertical cities with tall buildings, transportation infrastructure such as expressway, tunnels and bridges. The built environment of the future will need to be resilient and sustainable to ensure that our cities are livable and safe.

Structural Engineering and Structural Engineers play an important role in the design and development of safe and resilient built environment including tall buildings, bridges, and other urban infrastructure.

The Asian Institute of Technology (AIT), a unique post-graduate Institute, has successfully integrated its academic, research, labs, and professional experts in the area of Civil and Infrastructure to offer its expertise that focus on resilient structures for sustainable built environment.

These expertise include Performance-based Design (seismic design review) of tall buildings, Wind Tunnel Study of buildings and complex structures, Structural Health and Post-earthquake Building Monitoring, and development of efficient structural systems.

How Performance Based Design helps?



To review and confirm the reliability and performance of structural systems against earthquake, strong winds, and other natural hazards.

- Safer buildings with better reliability than traditional design approach
- Verification of the structural performance for specific hazards
- Use of more cost-effective and innovative solutions

How Wind Tunnel Studies help?



To reliably predict the wind loading on the cladding and the structural loading on tall buildings and complex structures

- Enhance the reliability and cost-effectiveness of structural design
- Ensure occupant comfort to motion sickness due to wind-induced motion
- Optimize cladding design in terms of cost-saving and risk of cladding failure
- Assure pedestrian comfort and safety for outdoor areas



How Structural Health and Post-earthquake Building Monitoring helps?

To efficiently use the recorded earthquake data in buildings to answer several important questions asked by different stakeholders, ranging from the government departments (about the overall seismic hazard of the country) to building residents (about the post-earthquake condition and safety of their homes). It will provide the building owners, building managers, structural engineers and government authorities with the structural assessment results and an overall picture of the seismic risk posed by the recent earthquake event.

CLIMATE CHANGE & the Built Environment



More than half of the global population resides in cities today and this number is projected to increase to 5 billion by 2030. Urbanization is occurring at a rapid rate, and 95% of urban expansion in the next few decades is expected to occur in developing countries.

Cities are at the forefront of climate change: they are responsible for emitting 70% of the global carbon dioxide emissions. Studies show that building infrastructure in rapidly urbanizing cities in developing countries could release 226 Gigatons of carbon dioxide by 2050, which is more than four times the amount used to build the existing developed-world infrastructure¹.

Cities today already bear the challenges brought by rapid unplanned urbanization, including safe and affordable housing, congestion, pollution and health issues and effective waste management. These urban challenges are further exacerbated by the impacts of climate change: coastal adaptation is becoming increasingly difficult, urban stormwater management issues are on the rise and urban heat islands are increasing.

C40² reports that about 70% of cities are already dealing with the effects of climate change, and nearly all are at risk. Moreover,

over 90% of all urban areas are coastal, putting most cities at a risk of flooding from rising sea levels and powerful storms. Having said that, it is also imperative to realize that cities can be the solution to climate change. Cities are at a unique position to combat effectively with climate change because city governments work closely with local bodies and are directly

accountable for city level decisions. City governments should therefore invest in low carbon construction, alternative resilient transport systems and climate mainstreamed planning and urban design. As a response, the science of cities is evolving and new concepts in the built environment are emerging, such as smart cities and urban resilience.²

Several studies on climate change in the built environment call for evidence-based urban design and planning, building materials, codes, land use planning, green spaces, among others. Eco-urban design philosophies that focus on spatial design to achieve resilience and sustainability are on the rise³. EcoDistricts is an eco-urban concept in North America, with projects in Denver, Austin, Washington D. C., Cambridge and Ottawa. Similar projects are also present in France and the United Kingdom (UK). A few such common practices are discussed here.

Green spaces in cities include vegetated areas

Author:



Subina Shrestha
Research Associate
AIT Solutions

such as parks, open spaces, and playgrounds. Parks also help create human and energy efficient cities that can curb greenhouse gas emissions. Linear parks and open spaces make compact living attractive and viable. Trail networks link individual parks, making them easier to bike and walk. Old rail lines can be transformed into greenways, and gardens planted on rooftops maximize limited space and curtail greenhouse gas emissions.

Every tree helps fight global warming by reducing the amount of greenhouse gases in the atmosphere and help cool cities. Some of the most livable cities in the world have ample green spaces too: Hyde Park in London, Central Park in New York, the Bukit Timah Nature Preserve in Singapore, Phoenix Park in Dublin to name a few. These parks are all attractions for inhabitants and visitors alike. Moreover, urban green spaces also contribute to environmental benefits. A network of parks and open spaces that include protected natural lands, ecological reserves, wetlands, and other green areas is critical to providing healthy habitats for humans, wildlife and plants in these densely built places. Such natural landscapes are vital to preserving regional ecosystems amid growing cities. In addition to these, urban green spaces also have health benefits: studies show that access to urban green spaces are associated with better perceived general health, reduced stress levels, reduced depression and more⁴.

Recent research focuses on the need to create or re-design urban areas so that they provide, integrate with, or support ecosystem services, and therefore reduce pressure on ecosystems.⁵ Integrating forest ecosystems in the built environment is one of the avenues currently being explored by Dr. Singh Intrachooto, Head at Research & Innovation for Sustainability Center (RISC), Bangkok.

Building codes and designs in cities include increasing building safety factors used for, incorporation of climate change adaptation factors or variations into codes and standards, where these factors allow for rapid updating of climatic design information and augmentation of climatic loads given evidence of likely increases in



Hyde Park, London (Photo credit: Leonard Bentley via Flickr)



Central Park, New York (Photo credit: www.weheartnewyork.nl)



Aerial View of Bukit Timah Nature Reserve and Hindhede Quarry (Photo credit: <https://www.nparks.gov.sg>)



Phoenix Park, Dublin (Photo credit: <http://takeahike.ie/2017/03/11/the-phoenix-park/>)

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risks over the lifespan of the structure and modification of climatic designs or design load criteria based on climate change model projections over the structure's lifespan⁶. Likewise, passive cooling in buildings, green roofs, use of renewable energy sources, upcycled or recycled construction materials can also be included in design planning.

Efficient management of public transportation in the built environment can encourage the use of public vehicles and reduce dependency on private transportation. Use of high-speed trains in megacities such as New York, Bangkok, Delhi, Tokyo, etc. has contributed to managing traffic congestion while reducing travel times. Khon Kaen's smart city plan comprises of alternative urban development model for Thailand, with an emphasis on smart urban transportation using Light Rail Technology.

In addition to these, various design tools are available to assess climate risks that can then aid in decision making. The Public Infrastructure Engineering Vulnerability Committee (PIEVC) protocol and the Climate Change Hazards Information Portal (both developed in Canada) can help developers and asset managers assess climate risk. Climate-smart design tools will provide a long-term strategic benefit to cities. The built environment creates urban heat island (UHI) effects, which amplify heat waves and can be deadly to vulnerable elderly and infirm populations. UHI can be mitigated through spatial planning, including the strategic use of green space. UHI impacts can also be mitigated by designating and maintaining cooling stations.³

Architectural protocols such as LEED encourages patterns of resource use and community dynamics that increase resilience to the impacts of climate change. LEED, or Leadership in Energy and Environmental Design, is the most widely used green building rating system in the world. Available

for virtually all building, community and home project types, LEED provides a framework to create healthy, highly efficient and cost-saving green buildings. LEED certification is a globally recognized symbol of sustainability achievement.⁷

Addressing climate change in the built environment possess several challenges for urban development. However, this can be addressed with effective urban design planning, stringent building codes, tools for assessing climate risks in urban areas and effective policy planning and implementation. This calls for strong collaborative research and partnerships among city governments to tackle the global challenges of climate change.

The Asian Institute of Technology (AIT) has been working in the field of climate change in the built environment - the School of Environment, Resources and Development (SERD) and School of Engineering (SET) are involved in several climate change projects and research, and work in collaboration with government, non-government and other academic institutions on climate change policies and research.

AIT prides itself in being a green campus, with a Green Campus Initiative that is based on the principles of sustainability. The "*Healthy AIT Eco Campus Project*" aimed to improve the overall wetland ecosystem health on campus. Residents are encouraged to cycle around the campus and the use of two-wheelers on campus is prohibited. Moreover, the newly established Urban Lab at AIT Solutions is an inter-disciplinary research initiative cutting across thematic areas to provide smart solutions for challenges posed by urbanization. Urban Lab looks at the cities as the solution which opens up immense opportunities for innovation in technological, behavioral, and governance that can lead in an era of smart societies. 🌐

NEWS IN BRIEF

January-March 2018

MARCH



Understanding of Tools and Techniques in Using SAP2000

ACECOMS, AIT Solutions, and AIT jointly organized the two-day training on Understanding of Tools and Techniques in Using SAP 2000 on 31 March, 2018 at AIT Conference Center. Introduction to SAP2000, Structural Modeling using SAP2000, Structural Analysis and Design of SAP2000, Tutorial Example for Analysis and Design of Simple Structure, Steel Structure, RC Building, and Tutorial Example for Nonlinear Analysis and Advanced Features, were the main topics included.



Seminar Workshop on Analysis and Design of Tall Buildings in Cebu

AIT Solutions, AIT and the Association of Structural Engineering of the Philippines, Inc (ASEP), jointly organized a seminar workshop on Analysis and Design of Tall Buildings on 14 – 17 March 2018, Cebu, Philippines. This seminar and workshop covered various topics that professional engineers will find very useful including progression of structural design approaches, performance-based design, procedures, value engineering, wind effects on buildings and structures and wind tunnel model tests, conceptual design in structural system development and application of artificial neural network, dynamic response of tall buildings, smart systems for structural response control, and performance-based evaluation of non-structural components. Hands-on training of performance-based seismic design using ETABS 2016 was also conducted.



The 7th Annual Vertical Cities Conference held in Thailand

The 7th Annual Vertical Cities Conference was held at the Peninsula Bangkok, Thailand from 7-9 March 2018. Featuring international case studies and award-winning projects, this event engaged world class developers and trendsetters in one venue to share and discuss innovative projects from the industry leaders. Dr. Naveed Anwar, Executive Director, AITS, chaired one of the sessions on Engineering, Construction, and Smart Materials. During this session, he presented the topic "Assessing Cost Effective Configurations Based on a Review of 100 Tall Buildings." Since 2014, Dr. Naveed has been a regular keynote speaker in Vertical Cities held in various countries including Singapore and Dubai.



Gone Adventurin Visits AIT, Shares Ideas on Circular Economy

AITS team led by Mr. Justin Finch, Head, Business Development, met with Mr. Ashwin Subramaniam, CEO, Gone Adventurin, a business consultancy and program execution partner focused on driving the circular economy in Asia. The discussion focused on the initiatives and activities of each organization while exploring potential partnership in waste reduction solutions.



FEBRUARY

School of CHANGE MAKERS



JANUARY



Meeting with Makati Development Corporation, Philippines

During the meeting with Makati Development Corporation in March, AITS proposed to provide a system for Ayala Land (ALI) projects that would incorporate real time seismic interpretation of the building. Basically, the system would gather seismic/motion data that the building receives, and use it to analyze structural integrity of the building. AITS is working on several tall building projects in the Philippines ensuring building safety and resilience against natural hazards like wind and earthquake.

School of Changemakers Discusses Ideas with AIT Solutions Team

A team from AIT Solutions and School of Change Makers met on 27th February to include [ilab] in the incubation ecosystem. [ilab] will send the plan and timeline of the International Tiger-Leong camp to get feedback and to further discuss on how the camp could be more social innovation-oriented. Also, School of Change makers will help to create a framework for innovation camp to bring on-board the ideas and concept of incubation. AITS will share "why" we need this and "where" the critical gap is impeding us from reaching our goals. Innovation Lab can provide R&D backstopping, technical and IT support to the teams graduating out of incubation pipeline.

AIT and PIM-CPAIL Explore Opportunity to Collaborate

Mr. Phornvit Phacharintanakul, Vice President, Academic Affairs, Mr. Siam Choksawangwong, Vice President, Administrative Affairs, and CPAIL/PIM directors and officers as well as AIT representatives headed by Dr. Naveed Anwar, Exec. Director, AITS, met to explore the possibilities of collaboration at CPAIL Academy Building. The discussions were summarized in three key points: PIM and AIT will further explore collaboration specifically in the areas of robotics, IT, and automation solutions; PIM and AIT will identify industrial challenges and issues and will jointly organize Hackathons and mentorship programs; AIT and PIM will develop a draft concept note through which immediate collaborative activities can be listed.

AIT Builds Knowledge City Police Station Using Its In-house Technologies

AIT constructed a new Knowledge City Police Station adjacent to its main gate in less than three months using a combination of Habitech and Ferrocement technologies. AIT Solutions was involved in the design and construction of this project, and also documented the construction process using Drone technology as a model for people to get familiar with the cost-effective, green, and safe way of building a house or any building.



Nspire by Netsol and AIT to Organize the Next Hackathon

Nspire by Netsol Technologies and Innovation Lab[iLab] discussed the possibility to organize a regional Hackathon event that focuses on Fintech and Blockchain, two of the biggest disruptive technologies in the 21st century. Dr. Naveed Anwar visited Netsol office in Lahore to meet with Mr. Ayub Ghauri, Head of Nspire, who had visited [iLab] during the last quarter of 2017 to meet with AIT students and give advice on entrepreneurship. Mr. Ayub invited [iLab] to work jointly in some initiatives and be part of the selection process in their next intake. Nspire also sent a team to visit [iLab] early this year to start the collaboration.

SCG Keen to Collaborate with AIT

AIT Solutions team led by Dr. Naveed Anwar had a meeting with SCG Digital Transformation, SCG Chemical, SCG Packaging Team on 31st in January to discuss initiatives related to Innovation Lab [iLab], AIT Online learning system, IT and Software Solutions, and ongoing initiatives on machine learning, computer vision, drone based construction monitoring, 3D modelling and mobile applications. The mode of engagement between AIT and SCG including co-development of solutions, issues of patents and ownership was also discussed. SCG was also interested in Machine learning for predictive maintenance, use of VR for learning and training, AR requiring precision up to 3MM, image processing for warehouse management.



AIT Solutions Executive Director Meets the Director of NIC Lahore at LUMS

Dr. Naveed Anwar, Executive Director, AITS, visited the National Incubation Center(NIC) Lahore at Lahore University of Management Sciences (LUMS) during his official trip to Pakistan in January 2018. Dr. Naveed met with Mr. Faisal Jalil Sherjan, Director Operations of NIC Lahore (formerly LUMS Centre for Entrepreneurship), one of the largest accelerators in Pakistan. They discussed how NIC and Innovation Lab [iLab] at AITS could collaborate in mutually-aligned areas. The visit was very useful as Dr. Naveed learned a lot from NIC Lahore particularly on how [iLab] could expand its initiatives in the future. Dr. Naveed also paid courtesy call to the Vice Chancellor of LUMS Prof. Dr. S. Sohail H. Naqvi whom he had first met when the Vice Chancellor was still the Executive Director of the Higher Education Commission (HEC), Pakistan.



Vice Minister for Finance Visits AIT to Explore Collaboration

H.E. Mr. Kiatchai Sophastienphong, Vice Minister for Finance visited the Asian Institute of Technology(AIT) together with his team to explore potential collaboration in the areas of robotics, machine vision and learning, agriculture, and post-disaster assessment. Dr. Naveed Anwar, Executive Director of AIT Solutions(AITS) welcomed the Vice Minister and his team. They visited Prof. Manukid Parnichkun at the robotics lab to discuss about the rehabilitation/ assistive technology. Dr. Matthew Dailey, Department Head of ICT shared information about Face Verification System; Mr. A.R. Subbiah, Director, RIMES Program Unit discussed about Rapid Post-Disaster Assessment for Fast Disbursement of Insurance Claim, and Mr. Ashim Neupane, Business Development, AITS, presented Solutions for Proposed Agriculture Estate.



How to Travel More Sustainably

And how it benefits local built environments

By Shayan Naveed



The world is getting smaller and it has become easier than ever to visit far-flung destinations at a click of a button. Travel has transformed into the powerful movement for people to expand their perspectives, open up to cultures and appreciate the finer things in life.

There is another aspect to travel that many don't talk about – the negative side effects such as over tourism, overuse of resources and a strain on the environment (carbon footprint).

But not all is lost. There are ways we can travel sustainably and make positive impact while still taking unforgettable trips.

Author:



Shayan Naveed
Lifestyle Writer



1 Choose a destination that values sustainability



More and more countries are shifting their development agendas to a greener society. European nations such as Switzerland, Finland, and Denmark take up the top slots while Pakistan, Qatar and Bangladesh rank the lowest in environmentally-friendly countries. Some countries that are over-promoting tourism risk the dangers of losing their authenticity and true character unless they have stringent sustainable tourism plans in place.

precedence. Instead, if destinations make their built environments more planned and sustainable, it heightens a traveler's experience when they visit.



Sustainable cities aren't about better places to visit, they're about better places to live

Travelers want to visit places that give them a look into authentic cultures and everyday lifestyles of the locals. These are eventually lost if unsustainable tourism practices continue to take

The more the tourists continue to visit the same megacities and popular destinations, the more unsustainable they continue to become. It essentially comes down to travelers to visit countries or cities that share the value of sustainability.

2 Always remember the 3Rs



Reduce, reuse, and recycle. This is the starting mantra for any environmentally conscious person. In travel these 3Rs are essential to sustaining the destinations we visit.



Reduce

The first in the hierarchy and the most important of the 3Rs is to reduce the use of materials. It basically means to consume less. Ditch cups, straws and other single-use plastics. Small initiatives not enough? When traveling reduce your carbon footprint. You could do this by taking public buses over private cars or trains over airplanes.



Reuse

If you can't reduce directly, the next step is to reuse the materials you are already using. More and more travelers are carrying their own water bottles, for example. This in turn reduces the waste of plastic. Reusing towels and other amenities at hotels also positively impacts the environment.



Recycle

This is the third and final in the 3R hierarchy. While recycling is prescribed when all else fails and should only be the last preference, it is an equally important and necessary practice. Recycling is a multi-tier responsibility that starts from the infrastructure and systems that governments and organizations need to build. It is then up to travelers, locals and residents to make sure they send their used materials to the right recycling units.



Plastic accounts for around 10 percent of the total waste we generate and 50 percent of the plastic we use is used only once and thrown away.



Take nothing but photos and leave nothing but footsteps

While the 3Rs are imperative in our everyday life, when we travel, they become even more important. We have a responsibility to make sure that we don't impact the destinations we visit in a negative way.

4

Sustainability goes beyond the environment

It's common for individuals to think that sustainability is about green practices and environmental consciousness. But it actually means much more than that. There is a human and economic side to it too.

3

Opt for green hotels

Hotels are becoming increasingly conscious about sustainability and going green. Most do the bare minimum while some are going the extra distance. If you are truly an environmentally and sustainable conscious traveler, opting for accommodation that share your values is a no-brainer.



2/3 tourists prefer or would consider staying at eco-friendly hotels

While there are still many people who would not stay at sustainable accommodations, it is mainly due to the fact that they are unfamiliar with what it really means. Somehow, they have a misconception that sustainable hotels are not at all luxurious and are uncomfortable. However, there are plenty of wonderful hotels and resorts that practice sustainability while still offering luxurious experiences.

It is important to reach out to these hotels and ask them the right questions about their sustainability practices. Do they use alternative source for energy like solar? Do they have a recycling program? Are most of their staff locals? What kind of initiatives does the hotel support?

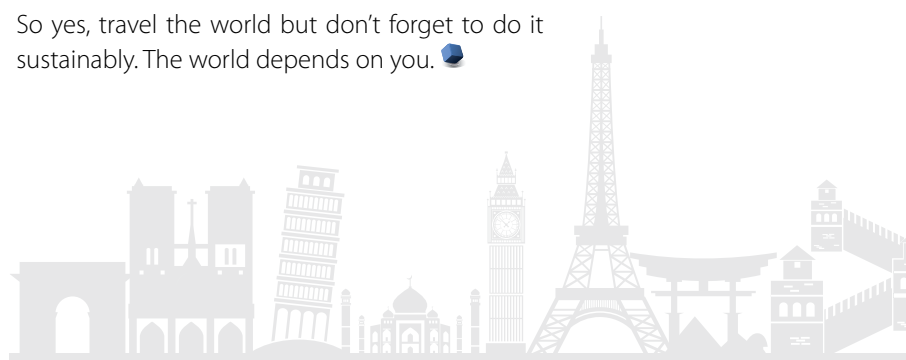
Green Globe is a great resource for finding sustainable hotels and resorts. Airbnb is another excellent alternative as it connects you directly to local homes and accommodation. While booking.com and other hotel booking engines might not have this option, searching for "top sustainable/ecofriendly hotels in [enter city]" on Google can give you some surprising options.

5

Just be responsible

The best way a traveler can be more sustainable is by being a responsible human being. Treat your destination like it was your own home by leaving it better than you found it. Whether that means cleaning up after yourself or doing some volunteer work to improve quality of life of the locals and the environment or spending money where the proceeds go to a charity that helps the community. It also means to be a genuine and kind person.

So yes, travel the world but don't forget to do it sustainably. The world depends on you. 🌍



A Sustainable Built Environment that Other Cities Can Learn From



Nestled in the south of India, neighboring the states of Tamil Nadu and Puducherry, lies a small town that endures to be an inspiring model for sustainable environment. Humble and spiritual in its

conception, Auroville is recognized as the first and only internationally-endorsed experiment in human unity through a sustainable living and green practices.

“ *The purpose of Auroville is to realize human unity* ”

Green Practices

Since the late 60s and 70s, a number of Auroville residents began extensive tree-planting initiatives to revive the land in the region and harvest rainwater. This led to over 50 ideas, projects and solutions in the areas of renewable energy, waste/water management, organic farming and many other environmental awareness programs. Many of these are still in practice today.



Annapurna farm

An organic farm covering 135 acres of land to grow crops, mainly rice using rainwater catchment ponds. The farm uses solar and diesel-powered pumps as the source of energy. It is also home to a research center for ecological farming. There are several other farms in the city that grow fruits, vegetables and other agricultural produce.



Aranya forest and sanctuary

A reforestation and restoration site that is also used for an educational center to spread awareness on ecology.



Auroville energy products

An initiative to produce high quality efficient materials for renewable energy technologies. Extensive work has been done on solar and hybrid (wind/water/diesel) technologies.



Sacred groves

A model for ecological community living using sustainable construction methods and recycled materials that reduce waste of natural resources.

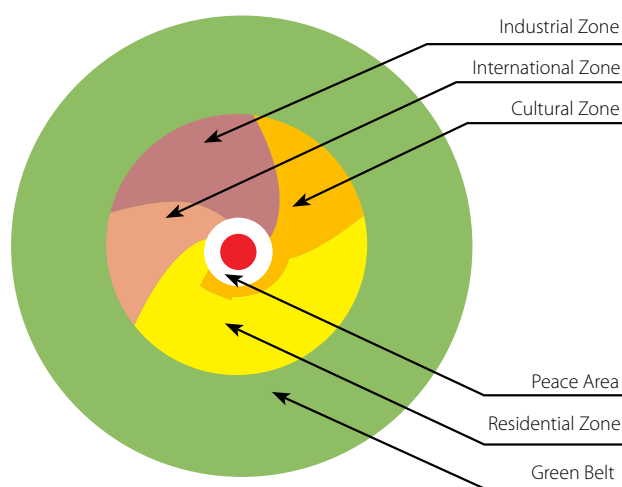


Sustainable Livelihood Institute

A large initiative that promotes sustainable rural development, which can also be applied to urban areas.

Auroville also has other projects and initiatives that are important in modern society and crucial in the composition of built environment – professional services hubs, social businesses, health, community, research, education and development centers that all practice sustainability.

Place Area, Cite Zones & Green Belt



Source: wikimedia.org

What Other Cities Can Learn from Auroville



Nidhi Gupta, a resident and consultant in Auroville says that in city planning, one cannot apply “*a one size that fits all kind of solution.*” While other cities are quite different from Auroville in context and conception, they can adapt processes of Auroville, by considering sustainability practices that are built with a holistic approach and not an added requirement.

For example, other cities can

easily adopt and implement practices such as decentralized wastewater treatment systems, rain water harvesting, building with local earth materials.

She adds that urbanized and modern cities need to encourage and incorporate policies that look at sharing instead of ownership. This can also help towards cities to better manage their ever-growing infrastructure demand.

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How I see a Perfect Built Environment

Travel bloggers share their perspectives



I imagine my city or built environment to be very planned and neat. Growing up in Bangkok, when I visit cities like Islamabad or Nakhon Phanom or even Singapore, I'm in total awe in regard to how beautiful and planned they are. Everything is in sections and blocks. If it is organized, it makes it easier to keep clean. There is also chance for less traffic because grids can be created to better manage logistics. I see more bicycle lanes and walkable areas for a healthier lifestyle and interconnectedness.

A perfect built environment also would not have designated areas for green spaces. They would be incorporated everywhere and holistically. Every community and sub communities should have green spaces, public health facilities and clean waste systems.

I also want to see more community-driven projects where people work together towards a common goal in making the city more livable.

After traveling to over 100 cities around the world, both major capitals and tiny villages, there are certain characteristics I've noticed that help to create a perfect built environment for humans.

One important thing is easy access to green spaces. Having parks and nature located a short distance from office buildings and homes gives people a chance to get outside more, making them healthier and happier.

Free community spaces such as libraries, parks, community gardens, and art spaces give people a chance to meet and connect. Paths for walking and cycling around a city are also important. Giving people the option to make healthy, safe choices like walking or cycling to get around also cuts down on emissions from vehicles.

Efficient, clean, and comfortable mass transportation options such as light rails, sky trains, subways and buses are all great to help people move around a city with ease. Efficient transportation out of the city and into nature is also very important.

These are just a few things I've noticed in my travels that have helped me enjoy a city more.

Cities all over the world are the primary source of growth and development for a country but at the same time, the largest consumer of energy and natural resources. It is high time, cities rethink their development models, urban planning and greening in a sustainable and eco-efficient way.

For me, an ideal city is collection of traditional local solutions and latest urban policies for integrating green concepts into their planning and managing processes. Promoting circular economy through usage of renewable energy, green (sustainable) transportation systems; efficient municipal waste management, wastewater treatment, green homes, eco-industrial parks are some of the sustainable practices that would build an ideal city.

Though many European cities, feature in the sustainable list, Sweden takes the top spot with the most sustainable country. With investments and efforts made in renewable energy sources, low carbon dioxide emissions, good governance practices and urban planning, it excels in all fields.

There is good lesson to be learnt by Asian cities from Sweden across all the fields mentioned above.



Kanika Srisothornwongse
Dose of Life



Jen Joslin
Two Can Travel



Ketki Gadre
Explore with Ecokats

The perfect built environment combines the best of city and nature. It has a wide variety of options for transportation, lodging, dining, and entertainment that is also in balance with nature and the environment. It would offer a variety of public transport systems (such as rail, subway, bus, and riverboat) that are both affordable and easy to navigate. Dining options should also be plentiful and range from simple street food to fine dining.

As a traveler I also enjoy visiting parks for recreation, relaxation, and to feel connected to the local scene. Parks are important for refuge within a concrete jungle. Additionally, to protect the environment there needs to be systems to manage the waste that naturally results from having a large population. All disposal systems should be focused on reducing and recycling waste.

To me, a perfect built environment needs to be well planned, safe & easily accessible to get around anywhere without a need of private transportation. It would encourage citizens to travel by foot or bicycle. This would be a more sustainable environment to live in, which means no traffic jam, air and noise pollution.

I really hope my home country, Malaysia would be inspired to become a city like Pontevedra in Spain in near future with its continuously active car-free initiatives at Ipoh & Kuala Lumpur at present.



Paul Moore
Chow Traveller

Sienny Yong,
Sienny Loves Drawing



NATURAL DISASTERS 2018

In 2018, natural disasters around the globe are occurring at an alarming rate. Earthquakes that demolish whole cities, wildfires that burn thousands of acres, and cyclones that cause mass flooding and property damage are recorded frequently and sometimes man-made mistakes also contribute to the disasters. There is a need to be aware of these disasters, be adequately prepared to mitigate and reduce the impacts, and minimize disaster recovery time. Following are some of the major disasters which occurred in 2018:

Oil spill in Colombia



Figure 1: Photo Courtesy: EFE (<https://www.telesurtv.net/english/news/Colombian-Oil-Spill-Kills-2400-Animals-70-Families-Treated-20180327-0031.html>)

Dated: March

Area: Magdalena River, Colombia

Death Toll: 2,400 animals

Cause and Damage: An oil well in northern Colombia burst, spewing an unclear amount of oil into the Magdalena River, a principal waterway that flows about 950 miles northward through the western half of the country. The crude killed more than 2,400 animals, including cattle, fish, birds, and reptiles, in the department of Santander. More than 1,000 tree species in the area have been damaged, and families have been relocated and treated for vomiting, headaches, and dizziness associated with the spill. Oil spills often have lasting effects, and the country has had other environmental problems.

Source: <https://news.nationalgeographic.com/2018/03/oil-spill-colombia-animals-killed-spd/>

Dust Storm in India



Dated: May

Area: Western and Northern India

Death Toll: 100+

Cause and Damage: The dust storm occurred at the start of India's monsoon season. Abnormal high temperatures, high winds and lightning by the storm destroyed houses and livestock, as well as uprooted trees and shut down electricity for many. Dust storms are common in this part of India during summer but loss of life on this scale is unusual.

Source: <https://news.nationalgeographic.com/2018/05/india-dust-storm-wind-fatalities-science-spd/>

Figure 2: Photograph by Manish Swarup, AP

Flooding and Mudslides in Japan



Figure 3: Photo Courtesy: Time/AP

Dated: July

Area: Southwestern Japan

Death Toll: 100+

Cause and Damage: During the first week of July 2018, heavy rains in southwestern Japan led to devastating floods and mudslides. The region reportedly experienced three times the amount of normal rain for all of July in a matter of days. The torrential downpours caused flooding and mudslides, which destroyed buildings, caked the land with mud, and left thousands stranded and displaced. Around two million people had to abandon their homes and retreat to safety.

Source: <https://www.bbc.com/news/world-asia-44762110>

Bridge Collapsed due to Heavy Rainfall in Genoa Italy



Figure 4: Photo Courtesy: Getty Images

Dated: August

Area: A section measuring about 200m of Morandi Bridge that carries a major road, the A10 toll motorway, which serves the Italian Riviera and links northern Italy to France.

Death Toll: 43+

Cause and Damage: The bridge was designed by Riccardo Morandi and completed in 1967, but reconstruction work was done in 2016. The cause of damage is not clear yet but there are many explanations

Source: <https://www.dezeen.com/2018/08/15/ponte-morandi-bridge-collapse-geoa-riccardo-morandi/>

Monsoon Season Flooding in the Philippines



Figure 5: Photo Courtesy: usatoday.com

Dated: July and August

Area: Marikina City, Manila, and Northeast Philippines

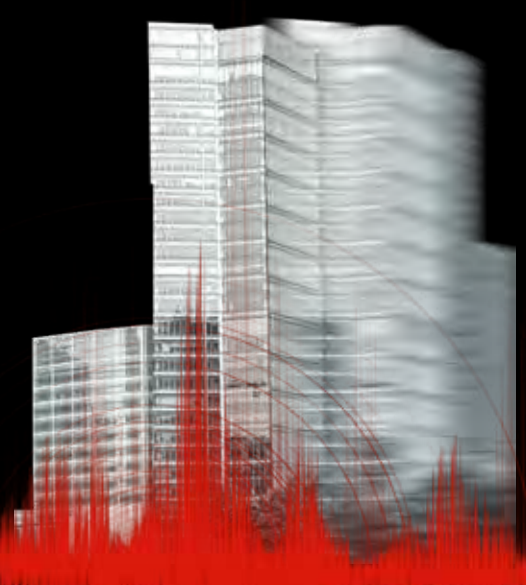
Death Toll: 8

Cause and Damage: Continuous heavy rain showers due to monsoon season brought floods to the towns and cities of Philippines. Many cities are under the state of emergency due to severe caused by the southwest monsoon enhanced by Tropical Storm "Josie" followed by the storm "Henry(Son-Tinh)", and storm "Ampil (Inday)" that had already led to the evacuation of thousands from their homes.

Source: <https://www.usatoday.com/picture-gallery/news/2018/07/22/monsoon-rains-cause-flooding-in-philippines/37052443/>

MAJOR EARTHQUAKES 2018

It has been a shaky year for 2018 so far and geologists have predicted the Earth could see about twice as many major earthquakes this year than in 2017, after the assessment of earth's movement data that showed a slowdown in the earth's rotation. The earth-slowng phenomena prompted equator to shrink slightly. As a result, the edges of tectonic plates squeeze together causing more earthquakes.



Lombok Indonesia Earthquakes



Figure 6: Photo Courtesy: <https://sputniknews.com/asia/201808281067525180-earthquake-indonesia-usgs/>

Dated: July and August
Area: Lombok, Indonesia
Death Toll: 500+

Cause and Damage: A destructive and shallow earthquake of 6.9 magnitude struck the island of Lombok, Indonesia. It was the main shock following its foreshock, a nearly Mw 6.4 earthquake on 29 July and was followed by another 6.9 earthquake on 19 August 2018. The epicenter was located inland, near Loloan Village in North Lombok Regency. Its rupture spread to the north and reached the sea, creating tsunamis. Severe shaking was reported throughout the entire island, while strong shaking was reported on the neighboring islands of Bali and Sumbawa.

Source: <https://reliefweb.int/disaster/eq-2018-000122-idn>

Fiji Earthquake



Figure 7: Photo Courtesy: USGS

Dated: August
Area: Ndoi Island, Fiji
Death Toll: Not reported

Cause and Damage: A 7.9 magnitude earthquake had struck the holiday island of Fiji in August. The quake was centered about 281km north of Ndoi Island with a depth of 559.6km.

Source: <https://www.news.com.au/travel/travel-updates/incidents/massive-earthquake-rocks-fiji/news-story/0b35939ce91a9117cb41bb772c6a4c90>

Recently, the Geoinformatics Center of the Asian Institute of Technology (AIT) has prepared change detection maps to help disaster rescue and relief operations following the Lombok earthquake in Indonesia. A Disaster Charter was activated on 6 August 2018 after the second earthquake of 6.9 magnitude struck the Indonesian island of Lombok.

Hualien, Taiwan Earthquake



Figure 8: Photo Courtesy: Central News Agency via AP Press

Papua New Guinea Earthquake



Figure 9: Photo Courtesy: <https://www.pulse.ng/news/world/earthquake-of-7-5-magnitude-strikes-in-n-papua-new-guinea-id8035264.html>

Oaxaca Mexico Earthquake



Figure 10: Photo Courtesy: <http://temblor.net/earthquake-insights/spasm-of-temblors-tests-earthquake-early-warning-for-mexico-city-and-beyond-6410/>

Dated: February

Area: Hualien, Taiwan

Death Toll: 17+

Cause and Damage: Due to the tectonic settings, Taiwan has a history of many strong earthquakes. The island is located within a complex zone of convergence between the Philippine Sea Plate and Eurasian Plate. An earthquake of magnitude 6.4 on the moment magnitude scale hit Taiwan along with 11 foreshocks of M 4.6 and greater. The epicenter was on the coastline near Hualien, which was the most severely affected area.

Source: https://en.wikipedia.org/wiki/2018_Hualien_earthquake

Dated: February

Area: Hela Province, Papua New Guinea

Death Toll: 160+

Cause and Damage: A 7.5 magnitude earthquake occurred in Hela Province, Papua New Guinea and the epicenter was 10 kilometres (6.2 mi) west of the town of Komo. Papua New Guinea lies within the complex zone of collision between the Australian Plate and the Pacific Plate, which converge at a rate of 107 mm per year at the earthquake's location. Assessments have shown significant damage and large landslides, and it is estimated that up to 465,000 people may have been affected by the disaster. A major aftershock with a magnitude of 6.2 M occurred in the Southern Highlands province close to the location of the earthquake.

Source: <https://reliefweb.int/disaster/eq-2018-000020-png>

Dated: February

Area: Oaxaca, Mexico

Death Toll: 14+

Cause and Damage: The 2018 Oaxaca earthquake of 7.2 magnitude occurred in the Sierra Madre del Sur in Oaxaca state in Southern Mexico. The hypocenter was located at a depth of 24.6 km and approximately 37 km northeast of Pinotepa de Don Luis. Oaxaca lies on the destructive plate boundary where the Cocos Plate is being subducted beneath the North American Plate. In the region of this earthquake, the Cocos Plate moves approximately northeastward at a rate of 60 mm/yr. The earthquake occurred as a result of thrust faulting at a shallow depth. A helicopter crash also occurred during the earthquake.

Source: https://en.wikipedia.org/wiki/2018_Oaxaca_earthquake

AIT Solutions (AITS), also as part of the Asia's high learning institute, has developed several structural engineering solutions focusing on disaster resilient built environment and organized many seminars, workshops and trainings to train young professionals about different tools and techniques to build disaster resilient structures, and enhance capabilities of structural engineers. AITS has carried out Performance Based Design (PBD) for more than 100 tall buildings and also offers its service for Wind Tunnel Testing (WTT) to ensure safety in built environment against wind and earthquake.

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2. <https://www.ranker.com/list/worst-natural-disasters-2018/lauren-slocum>

Innovative Market Place: Student Teams Pitch their Creative Ideas under Pressure

25-26 JULY 2018, THAILAND

Institutes like the Asian Institute of Technology (AIT) are a wellspring of knowledge that produce some of the best minds who can become the next global leaders. With this mindset, **the Innovative Market Place**, an idea competition was introduced by AIT to serve as a platform that not only challenges students to come up with best solutions that can create an impact in the society, but also sell their ideas in front of panel of experts.

The launch of Innovative Market Place was supported by Dr. Bindu N. Lohani, Member of AIT Board of Trustees and Former Vice President of the Asian Development Bank and was held on 25 July 2018 at the AIT Conference Center Auditorium. This competition is also a part of the AIT-Tiger Leong International Innovation and Leadership Camp, a 10-day interactive program designed to nurture and train young bright minds to be innovative changemakers and front-runners in an interactive, multi-cultural environment.

Twenty teams pitched their ideas before seven judges including Dr. Bindu N. Lohani; Dr. Yuosre Badir, Associate Professor, AIT; Dr. Tunyawat Somjaitaweeporn, Director, PIM Robotics and Automation Center (iCRAS); Mr. Robert J. Dobias, Advisor, National Research Council of Thailand; Mr. Sanya Chindaprasert, Head, SCG Chemicals Digital Business; Ms. Matsorn (Chu) Kitbumrung, Sr. Client Partner, NetSol Technologies; and Mr. Bjorn Harvold, Co-founder, Traveliko.

In the end, three teams that gave the most convincing pitch, with thier innovative ideas exactly in line with the competition's main theme of waste management and reduction stood out the most. These ideas had the potential to transform into a product or business that would have an impact to society.



Power Pads (converting your steps into energy) from AIT School of Management won the innovation pitch while two runners up were Left (over) Food to Good Life (converting food waste to animal food) from AIT-Tiger Leong Camp and Biomaterial from Human Waste (converting human waste to any eco-product) from AIT School of Management. The winner received 20,000 baht while the runners up got 10,000 baht each. The cash prizes were sponsored by Dr. Bindu N. Lohani, Mr. Robert Dobias, and AIT Solutions.



The launch of Innovative Market Place was supported by **Dr. Bindu N. Lohani**, Member of AIT Board of Trustees and Former Vice President of the Asian Development Bank .



Dr. Naveed Anwar, in his welcome remarks addressed the importance of providing a platform where innovators can pitch their creative ideas. He also explained about the themes of Innovative Market Place with.



Dr. Bindu N. Lohani
Member, AIT Board of Trustees
Distinguished Adjunct Faculty,
AIT



Ms. Matsorn (Chu) Kitbumrung
Sr. Client Partner, NetSol
Technologies



Mr. Sanya Chindaprasert
Head, SCG Chemicals Digital
Business

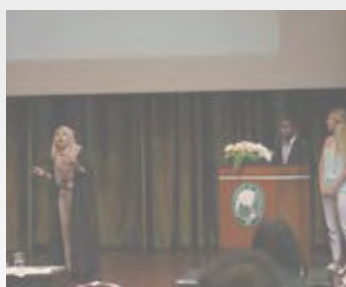


Dr. Tunyawat Somjaitaweepon
Director, PIM Robotics and
Automation Center (iCRAS)

Mr. Robert J. Dobias
Advisor, National Research
Council of Thailand

Dr. Yuosre Badir
Associate Professor, School of
Management, AIT

Mr. Bjorn Harvold
Co-founder, Traveliko



Empowering the Future Changemakers through AIT-Tiger Leong Innovation and Leadership Camp

16-26 JULY 2018, THAILAND

What started as a summer camp for bright and talented undergraduate students has now become a premier innovation camp in the region.

The third **AIT-Tiger Leong International Innovation and Leadership Camp** delivered yet another successful 10-day interactive program held from 16-26 July 2018 at the Asian Institute of Technology campus, Thailand.

Twenty-seven bright and talented students from 13 countries were selected out of almost 100 applications based on their knowledge of the latest global and local issues, creative self-intro video, and recommendation letter from school. Four student interns from Yunus Center at AIT, one of the collaborators for this year's camp also joined the line up.

This year's speakers and mentors comprised of professors, directors, CEO/founders, and industry experts. Activities included seminars and talks by expert speakers, campus tour at AIT's three schools, group activities and games, interactive workshops by AIT Yunus Center and School of Changemakers, field trip at CP All and Panyapiwat Institute of Management (PIM), site visit at Prince Mahidol Hall, and Bangkok tour with dinner cruise.

The camp also featured Innovative Market Place, an innovative idea competition for all students where winners could win exiting prizes by pitching their creative ideas that could provide innovative solutions to global issues using green and clean technologies. This challenge was a requirement for all camp students in order to apply what they had learned in the camp.



AIT-Tiger Leong International Innovation & Leadership Camp III
Inspiring Innovative Leaders of the Future

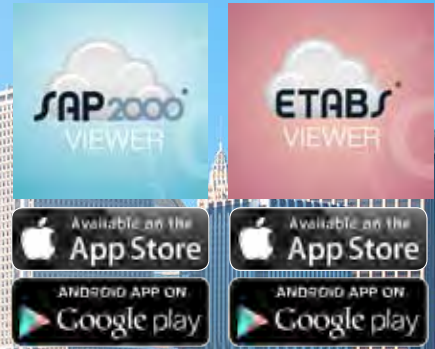


The participants include Shaira Binte Sarwar and Sharazad Hassan from Bangladesh; Chivit Chhoeun, Sam Kinhuoy and Sinal Hean from Cambodia; Wu Pengnian, Long Qianhui and Zhang Qian from China; Adarsh Agrawal, Ghazala Sahil Mirani and Sahil Valani from India; Ratri Bilqis Auwibi and Cathleen Ariella Simatupang from Indonesia; Suyuna Dadybaeva from Kyrgyz Republic, Khonphachanh Syboun from Laos, Ooi Wei Xin from Malaysia; Htut Wai Yan and Thinzarli Htut Htut from Myanmar; Dan Michael Sean A. Marocom and Ericson F. Flores from Philippines; Sabina Khusnutdinova and Ekaterina Shevchenko from Russia; Syuan-Fei Shih, Wen She Ping, Ying, Tzu Chen, Yi-Qiao Zeng from Taiwan; Palita Visanunyothin and Kamolkarn Subboonrueng from Thailand; and Le Hong Hai, Pham Huy Hoang and Duong Hong Nguyen from Vietnam.



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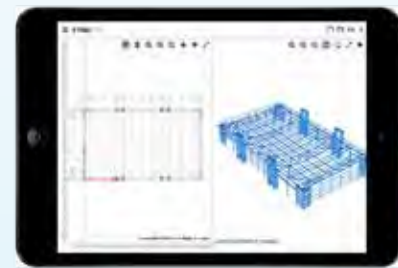


CSI Cloud is a new service enabling users to upload their SAP2000 and ETABS models to their Dropbox accounts via linked CSI Cloud accounts.

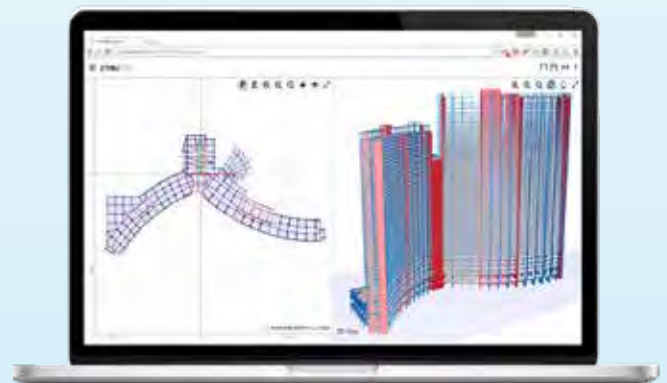
Engineers can then view their uploaded models in the new SAP2000 and ETABS Cloud Viewer apps, now available for iOS and Android.

ETABS and SAP 2000 Cloud Viewer

ETABS® & SAP2000® Cloud Viewer is a model and analysis results viewer app to complement the desktop version of the building analysis and design programs, ETABS and SAP2000. The app allows users to view their structural models and analysis results directly from a smartphone or tablet. It enables engineers and managers on the go to make quick, collaborative, and informed decisions about a building project from anywhere in the world.



Tablets



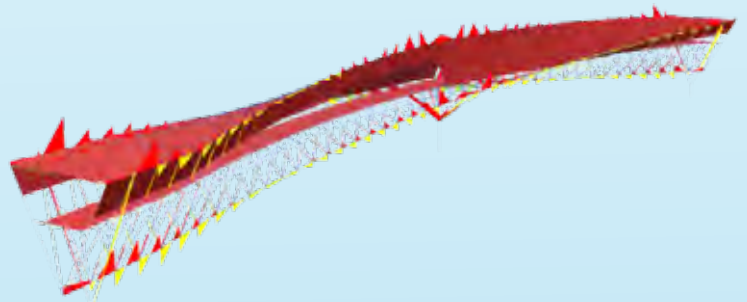
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