

A Step Towards Sustainable Future

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Fahim Ullah, Samad M.E. Sepasgozar

Preface

This volume comprises the abstracts of contributed papers presented at the First International Conference on **Carbon Neutral Built Environment**, **CNBT-I 2018** held on December 20-21, 2018, in Karachi, Pakistan.

CNBT-I 2018 is jointly organized by NED University of Engineering & Technology, Karachi, Pakistan and Institution of Engineers Pakistan (IEP), Karachi Centre.

The aim of this two days' conference is to bring together professionals in academia and research, practicing and consulting engineers/ architects, construction and energy industry professionals, public and private sector managers, builders, policy makers, assessors, certification and funding bodies and government officials concerned with climate change and sustainability projects and programs from all over the world, for engagement and exchange of thoughts and experiences regarding the concepts of climate change, sustainability and carbon neutrality.

NED University is the oldest institution and one of the leading engineering universities of Pakistan. On February 12, 2018, the worthy Vice Chancellor of NED University **Dr**. **Sarosh H. Lodi** has signed the **Talloires Declaration** to become Carbon Neutral Campus and brought Pakistan as a member of Talloires Signatory List. As an institution of higher education, concerned about the state of the world environment and the advancement of sustainable development, NED University shall strive to promote actions that will achieve a sustainable future. By signing the Talloires Declaration, a university agrees to Increase Awareness of Environmentally Sustainable Development, Create an Institutional Culture of Sustainability, Educate for Environmentally Responsible Citizenship, Foster Environmental Literacy for All, Practice Institutional Ecology, Involve all Stakeholders, Collaborate for Interdisciplinary Approaches, Enhance Capacity of Primary and Secondary Schools, Broaden Service and Outreach Nationally and Internationally, and Maintain the Movement.

The conference would provide a platform for real life case studies contribution would offer a stimulating environment to encourage discussion and exchange of ideas and would lead to endorsement of carbon neutrality in developing countries.

I would like to extend my appreciation to the Steering Committee, Advisory Committee and Organizing Committee for the devotion of their precious time and hard work to prepare for this Conference. Special thanks are due to our invited keynote speakers for their valuable contribution and our delegates for being with us and sharing their experiences at CNBT-I 2018, Karachi, Pakistan.

Prof. Dr. Saad Ahmed Qazi

Conference Chair

GREENHOUSE GAS EMISSIONS REPORT FOR NED UNIVERSITY OF ENGINEERING & TECHNOLOGY – A CASE STUDY OF MAIN CAMPUS

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ABSTRACT

Keeping in view the commitment made as a signatory of the Talloires Declaration to strive towards becoming a carbon-neutral campus, this article provides an overview of the work performed for the estimation of Carbon Footprint for the NED University of Engineering & Technology – Main Campus. The agents contributing towards the emission of greenhouse gases are listed and their effect is quantified in terms of total emissions for one year. A brief outline of the steps needed to offset the emission impact is also presented.

Keywords: Greenhouse Gas Emissions, Carbon Footprint, Green Campus

KEY DRIVERS FOR ORGANISATIONAL SUSTAINABILITY PERFORMANCE

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ABSTRACT

There is a growing pressure on construction organizations to improve their sustainability performance. However, there is little known to what organizational attributes helps to improve organizational sustainability performance of construction organizations. The aim of this study is to investigate the top drivers of organizational sustainability performance with in the construction industry. Under this objective the specific objectives are to: (i) examine the main internal and external drivers of organizational sustainability; (ii) rank these drivers in order of importance; (iii) develop a framework for practice. Data was collected from top Australian construction organizational culture and technology are the highest ranked drivers for organizational sustainability.

Keywords: Construction Organizations, Organizational Sustainability, Sustainable Built Environment

GREEN COMPUTING: TECHNIQUES AND CHALLENGES

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ABSTRACT

Nowadays, computer is being used not only in the organization, but also in homes, school, universities and many other places where there is a need of a workstation. With the usage of computers on daily routine consumption of energy is rising swiftly due to carbon dioxide is also increasing which causes environment effect. Green computing has gained various attentions from responsibility for the use of computer and related resources. The main point of green computing is to expand the effectiveness of the IT objects and its life cycle. Furthermore, it supports the reusing of useless electronic equipment. In this paper, we introduce the concept and history of green computing. Furthermore, we also explained the challenges of green computing and techniques of green computing to use IT related products in an efficient way so less carbon emission can be generated.

Keywords: Green Computing, Techniques, Recycling, Environment, Energy Consumption

COMPARATIVE ANALYSIS OF ENERGY EFFICIENT ROOFING MATERIALS FOR EXISTING BUILDINGS

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ABSTRACT

According to the research, the buildings consume the most part of energy, therefore, energy can be reduced in building by using the energy efficient materials. This study discussed the existing building of Department of Civil Engineering, NED University of Engineering & Technology as a case study, was thoroughly surveyed and modelled to compare the results of various materials used. The Energy Analysis was done for the selected area of the building based on existing conditions and energy efficient materials for roofing. The results of the study showed that energy consumption after the use of best energy efficient materials for roofing was reduced to 39%. This case study would help industry in many ways to promote energy retrofitting of existing buildings especially on the roof as most of the energy is dissipated from the roof.

Keywords: Energy Analysis, Energy Efficiency, Roofing Material, Existing Buildings

AWARENESS OF GREEN COMPUTING AMONG STUDENTS AND FACULTY OF NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

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ABSTRACT

Green Computing is getting more and more awareness due to growing of energy cost and increase of environmental effect. Green Computing is the study and practice of using the IT related resources in an efficient and effective manner so that consumption of energy can reduce. The main feature of Green Computing is to reduce CO₂ emission. The main objective of this research to verify awareness and use of green computing among student and faculty members at the university. In addition, to find out level of awareness and practices of green computing a questionnaire was distributed between engineering and non-engineering students and also to staff members of different departments. The result that we have calculated shows us that most people are not aware of green computing. Despite the fact that people are using an energy saving function of computers and other IT related products for their research, work, and study and for other purposes. Still, they are unaware of the concept of green computing. The research finding suggests that more awareness is required among pupil and employees so that approaches can be taken to reduce environmental effects. In this paper, we will explain the idea of green computing and also to increase more awareness of green computing among students and faculty members of the University.

Keywords: Green Computing, Energy Consumption, Awareness, Emission

OPTIMUM TILT ANGLES FOR ENERGY POLICY MAKING OF A CITY - CASE STUDY OF KARACHI

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ABSTRACT

Karachi city has significant solar potential available, whose proper assessment will lead to shorten energy supply demand gap. In this paper, optimum tilt angles has been evaluated for monthly, seasonally and yearly basis. A formula is devised to calculate shadow length fall by adjacent panel. This is helpful to get the total number of panels being mounted on a roof top without any shadow. Finally, a case study of pharmaceutical company has discussed where solar power plant implementation reduced the energy consumption of 25.39% from national grid. Results revealed that the monthly optimum tilt angles vary from 0° to 57°, receiving maximum solar energy of 2419.07 kWh/m2year. Similarly, the optimum tilt angles for winter, spring, summer and autumn are 52°, 9°, 0° and 38° respectively, receiving maximum solar energy of 2389.9 kWh/ m²-year. The half-yearly optimum tilt angles are 33° and 13°, with the yearly collected solar energy of 2249.09 kWh/m2-year and finally the optimum tilt angle for Karachi is approximately same as latitude i.e. 24° with the yearly collected solar energy of 2223.94 kWh/m2-year. Thus yearly and half yearly adjustments have minimal difference between them. This study will have remarkable effect on renewable and sustainable energy schemes of Karachi city and assumed to be the major recommendation of renewable energy policy strategy.

Keywords: Renewable Policy, Karachi, Optimum Tilt Angles, Resource Assessment

RETROFITTING OF EXISTING BUILDING USING ENERGY EFFICIENT MATERIALS AND THEIR IMPACT ON ENERGY REQUIREMENTS OF THE BUILDING – A CASE STUDY

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ABSTRACT

Rapidly growing population and global warming have changed the approach towards daily lives. These social and environmental changes have increased focus on policies towards conservation of natural resources and sustainable living. New strategies and techniques are being developed to re-evaluate the use of energy and to get maximum efficiency from this energy usage. Employing more efficient building methods in new construction and in renovation; energy consumption could be reduced, thereby saving money and reducing electric load growth; and also helps in reducing carbon emissions resulting from electric generation.

This research is mainly focused on retrofitting a model of an existing building and study the impacts of energy efficient materials on that building using BIM based tools. Architectural and structural features of the building are primary focus of this study neglecting HVAC system in the building.

Keywords: BIM (Building Information Modeling), Retrofitting, Energy Efficiency, Energy Efficient Materials, Existing Building

IMPLEMENTATION OF 360 VIDEOS AND MOBILE LASER MEASUREMENT TECHNOLOGIES FOR IMMERSIVE VISUALISATION OF REAL ESTATE & PROPERTIES

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ABSTRACT

Virtual and Augmented Realities (VR & AR) are increasingly utilised in construction and Real Estate industries. Due to the absence of immersive visualisation mechanisms that records the construction process and its defects, the clients can only discover any defects after their purchases. Such discoveries portray a negative image of the real estate agencies as some information may deliberately be held to attract customers who later upon the discoveries of such defects regret their purchase decision. To address these issues, this paper aims at developing and idealizing an immersive visualisation mechanism for buildings using VR based technologies to help post construction sales. The in-construction 3D videos, models and visualisations, made available to the buyers, will help them see the construction quality, workmanship and defects in real time to connect to their buildings and increase their purchase confidence. This paper based on field experimentation using 360 cameras, mobile laser measurement and VR gadgets, collects data from a selected building. Overall, the effects of visualisations on construction site management and processes are explored and a concept of using the data for post-construction sales is presented. The discussions may open avenues for new ideas generations, using the in-construction data to enhance real estate and property sales and address post purchase decision regrets by providing more and detailed information to the customers to make informed decisions. The customers can know about the defects and construction quality beforehand whereas sellers can control construction workmanship thus creating a win-win scenario and promoting trust based mutualistic relation.

Keywords: 360 Camera, Augmented Reality, Innovative Technologies, Mobile Laser Measurement, Real Estate Sales, Virtual Reality, Visualisation

RECYCLING OF WATER FOR A SUSTAINABLE CAMPUS LANDSCAPE

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ABSTRACT

Globally many universities have implemented actions to control the negative impacts of their activities on the environment and to become more sustainable in their operations. The campus landscape is a vital part of the campus life as it provides space for study, play, outdoor events and aesthetic appreciation. The main campus of NED University covers an area of approximately 40 ha. The campus has 6539 fully grown trees, a cricket ground and several other facilities including grassy lawns that require watering. The water supplied by Karachi Water and Sewerage Board hardly meets the campus water requirements. To save the precious and scarce fresh water supply, the university management decided in 2008 to install a wastewater treatment plant. The treated water is used to maintain and increase the campus green cover. Since 2008, thousands of trees have been planted on the campus and irrigated using the recycled water. The comissioning of wastewater treatment plant has not only prevented discharge of untreated campus wastewater into the sewer system but has also increased the campus green cover to about 50% and saves around 2700 m³ of freshwater monthly. The university management has already developed and approved a plan for enhancing wastewater treatment capacity to additional 68 m^3/day .

Keywords: Sustainable, Green, Wastewater, Recycling, Campus

INVESTIGATION OF THE CONSUMERS' INTERACTION WITH ONLINE REAL ESTATE PLATFORMS IN AUSTRALIA

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ABSTRACT

Online Platforms (OP) are increasingly being used for e-business in different sectors. With the advances in the internet-based business, OPs are increasingly being used for increasing global outreach and attracting more customers in different industries. Real Estate industry, following the global trends, has developed multiple OPs that are currently being used for property related business and purchase decisions. Although increasing used in the industry, Real Estate Online Platforms (REOPs) have never been investigated from the consumers perspective to document their experience of online property information search. The current study explores the REOP based information from the consumers' perspective in Sydney Australia. Based on 100 responses collected on a 16 questions survey, three hypotheses pertinent to REOPs are formulated and investigated. The results show that the majority of the consumers are aware of REOPs and are using it easily. Further, the OP design and context is giving a good impression to the consumers. However, when it comes to decision making based on the OPs, the consumers are not necessarily making better decisions. This is giving rise to postpurchase regrets among the real estate consumers. This anomaly is linked to lack of information provided on the REOPs such as the property photos, neighbourhood insights and real estate agencies' delayed response. The results are expected to lay the foundation for OP based technology acceptance in Real Estate.

Keywords: Real Estate Online Platforms (REOPs), Property Information, Online Platforms Acceptance, Technology Acceptance Model (TAM), Consumers Perception, Real Estate Management

ENERGY EFFICIENT APPLIANCES IN PAKISTAN

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ABSTRACT

With the alarming usage and depletion of fossil fuels, which has resulted in unprecedented levels of carbon emissions, more people are moving towards environmentfriendly, sustainable and energy efficient products. These may be seen in low-carbon building materials, shift to solar and electric cars, or the use of energy efficient home appliances.

Using energy efficient appliances may be the cheapest method to bring about a significant decrease in carbon emission.

This paper will offer an analysis of the existing trends in the usage of energy efficient appliances in Pakistan: the amount of awareness over the matter and its geographic and age demographic. The paper will also include a comparison of regular appliances with the newer, more efficient ones. Lastly, a conclusion on how energy efficient appliances can further help reduce the carbon footprint will be discussed.

Keywords: Energy, Efficiency, Pakistan, Carbon footprint, Carbon Emissions

THE PAKISTAN GREEN AUTONOMOUS TECHNOLOGICAL ASIAN WORLD FOR TRADABLE WATER AND DRENCHING GREEN TECHNOLOGY

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ABSTRACT

In this abstract, we introduced an innovative technique of green Asian Technological world which spray and automatic absorb water according to circumstances of this environments. The most important thing about this research paper is that it would operate automatically according to the requirement of plants. This research development is not only saved water but also spray the water according to the time which we fixed it.

Keywords: Green Technology, Autonomous, Pakistan Asian Technological World

EXHAUST EMISSIONS AND ITS CONTROL TECHNOLOGY FOR AIR POLLUTION PRODUCING ENGINES

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ABSTRACT

The automobiles play an important role in the transport system. With an increase in population and living standard, the transport vehicles as well as car population is increasing day by day. In addition to this, there is a steep increase in the production of two wheelers during last two decades. All these are increasing air pollution majorly in urban areas as there is greater density of these in these areas.

The main pollutants contributed by IC engines are CO, NOX unburned hydrocarbons. Other sources such as Electric power station and domestic fuel consumers also add pollution like NOX and SO₂ and particulate matters. In addition, the burning (i.e. CO₂ emission) is greatly concerned with the greenhouse effect.

In order to simplify the problem of air pollution and to save the health of earth, tailpipes devices can be fitted at the exhaust of diesel engines or engines producing soot and NOX, SOX emission in huge amount. These tailpipes convert the exhaust gases into useful ink. This ink now can be used directly in the printers.

This experiment was first performed by GRAVIKY LABS in MIT; while this experiment was applied in INDIA on the two wheelers, devices emitting huge amount of soot and harmful gases.

Keywords: Exhaust Emission, Control Technology, Tailpipes, Automobiles

PARABOLIC SOLAR COLLECTOR

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ABSTRACT

Solar energy is a renewable source of energy. It uses do not contribute to emission of greenhouse gases and other pollutants to the environment. This paper presents the development of a solar parabolic dish collector prototype for areas with high solar resource availability.

In this paper, the potential for a solar-thermal system for steam has been studied. A parabolic trough concentrator is made of gypsum board upon which a reflecting film is pasted. Through polished parabolic dish, solar radiations are concentrated into a specific area called focus, where thermal energy is generated by the working fluid. This working fluid exchanges the heat with water which converts water into saturated steam. For further power generation this system can be coupled with sterling cycle to achieve more power requirement. Moreover, this fluid will flow through a storage tank where a salt (HITEC) is present which stores most of its energy so that this system helps to provide power during evening.

Keywords: Heat Losses, Solar Concentrator, Thermal Efficiency, Temperature

INNOVATIVE APPROACHES FOR THE DEVELOPMENT OF CARBON NEUTRAL ENERGY TECHNOLOGIES IN PAKISTAN

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ABSTRACT

Presently, a number of global challenges like energy crisis, environmental pollution, global warming, poor public health, decline in agriculture, instability of economy, biodiversity, poor waste management, natural disasters, international political stress and many others are growing rapidly with the increase in population, industrial growth and an extensive consumption of fossil fuels which demand us to develop carbon neutral, renewable and sustainable energy technologies that have greater potential to address these challenges. Therefore, these challenges strongly motivated us to develop some innovative approaches for the development of carbon neutral energy technologies including solar energy system, biohydrogen to bioelectricity, solar based biodiesel and bioethanol production, waste-to-zero waste technology, utilization of wastes as heterogeneous catalysts for fuels production and development of biochars as biofertilizers. The main focus of this research is to build carbon neutral approaches that can effectively overcome the current global challenges of climate change.

Keywords: Carbon Neutral, Solar Energy, Bioelectricity, Biodiesel, Bioethanol

CARBON EMISSION, REDUCTION AND NET ZERO ENERGY BUILDINGS - A SURVEY

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ABSTRACT

Carbon emissions account for a huge amount of environmental pollution worldwide. These emissions occur from different sources. These sources can be as large as power stations or as small as burning of a small plastic cup. The Net Zero Energy buildings are economical yet environment friendly, because of which they are considered as part of the solution in building a carbon free, healthy environment.

NZEBs are generally known for their 'net' zero consumption of energy, which means that the overall energy used by a NZEB is equal to zero. A NZEB has both, electrical supply from the grid, and the ability to produce electricity on its own by the use of renewable energy resources. The NZEB is also known as 'zero carbon building', since the use of substances that produce carbon emissions is significantly reduced.

In this paper, various definitions of NZEBs have been surveyed to present an appropriate and more general definition according to its classification system. The NZEB are classified with respect to the site, source, emissions, and costs of the energy used.

The impacts of NZEBs on the environment have also been analyzed through the calculation of carbon emissions and their reduction. Since NZEBs use renewable energy as a major source of energy, they can play a vital role in reduction of carbon footprint. After a thorough study of research on NZEB and its effects on the environment, a conclusion has been established that building NZEBs can reduce carbon emissions to a minimum level, which will help to decrease the environmental pollution.

Keywords: Net Zero Energy Buildings, Zero Carbon Buildings, Carbon Emissions, Carbon Reduction

REDUCING CARBON EMISSIONS IN CONSTRUCTION INDUSTRY OF PAKISTAN THROUGH GREEN BUILDINGS AND BUILDING INFORMATION MODELLING

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ABSTRACT

Carbon emission at higher degrees is nowadays becoming a significant issue that leads to adverse problems like global warming, ill environment and unpredictable climatic changes etc. Construction Industry is on top in the list of agencies or industries producing carbon as it ejects an approximate of 1.8 Giga Tonnes of CO₂ yearly. The reason behind this is the use of conventional construction methods being adopted. Pakistan, being a developing country, also follows such traditional methods. One of the techniques used to cope up with this issue of excess carbon footprint is adoption of Green Buildings Construction Idea which is a pathway to sustainable green development. Such buildings not only have very low carbon footprint but are also more efficient in terms of Water, Energy and Material than the conventional buildings. Green Buildings employ the technique of Building Information Modelling (BIM) which is an efficient results producing approach of Autodesk Revit. Continuous endeavors have been made in bringing out the viability of BIM in facilitating the development of green buildings. Numerous functions of BIM have been studied, such as energy performance simulation, lighting analysis, and construction and demolition waste analysis. This paper, thus, brings out and validates the concept of low carbon emission in Construction Industry of Pakistan with the help of Green Buildings Studio and Building Information Modelling (BIM).

Keywords: Carbon Emissions, Construction Industry Pakistan, Green Buildings, Building Information Modelling, Autodesk Revit

REAL ESTATE TECHNOLOGY ACCEPTANCE MODEL (RETAM): CONSUMER FOCUSED BIG9 DISRUPTIVE TECHNOLOGIES FOR SMART REAL ESTATE MANAGEMENT

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ABSTRACT

Digital disruptive technologies are the integral component of the modern world. These technologies are transforming the global industries from traditional to more innovative and adaptive. However, the state of global real estate is yet to improve and is currently lagging the technology curve. Because of this lag, useful information is either not made available to the consumers or is shared too late that is raising concerns among the consumers. This results in larger vacancy rates and post-occupancy regrets among the consumers. The current study based on the concepts of Technology Acceptance Models (TAM), presents a conceptual framework for addressing the key needs of the four important stakeholders of the real estate industry including the consumers, government & regulatory authorities, agents & agencies and complementary industries. Based on comprehensive literature review of 213 articles, the needs of these stakeholders are assessed and addressed through the Big9 technologies namely drones, the internet of things (IoT), clouds, software as a service (SaaS), big data, 3D scanning, wearable technologies, virtual and augmented realities (VR & AR), and artificial intelligence and robotics. The resulting framework with a specific focus on the real estate consumers is expected to lay the foundation for introducing the missing technology acceptance model for real estate whereby these Big9 disruptive technologies are implemented in real estate industry and uplift it from traditional to smart real estate. This will reduce the postoccupancy regrets of the consumers and improve the relations between various real estate stakeholders.

Keywords: Real Estate Technologies, Technology Acceptance Model, Consumer Perspective, Big Technologies, Smart Real Estate

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