G H Patel College of Engineering & Technology

(A Constituent College of CVM University)

Civil Engineering Department

AICTE-ISTE Sponsored Refresher Program

"Energy Efficient Buildings"

1st to 7th December, 2021

Day 1: 1st December, 2021

Session 1: Inauguration:

Civil Engineering Department, G H Patel College of Engineering & Technology (A Constituent College of CVM University), Vallabh Vidyanagar, Gujarat, India organized AICTE- **ISTE Sponsored Induction/Refresher Program on "Energy Efficient Buildings" during 1st – 7th December, 2021** (online mode). Total 91 delegates from 30 Engineering Institutes and across 7 different states (Gujarat, Telangana, Andhra Pradesh, Maharashtra, Tamilnadu, Karnataka, Uttrakhand, Madhya Pradesh, and Uttar Pradesh) participated in the event.

The virtual inaugural session was conducted on 1st December, 2021. Dr. Khadeeja Priyan, Professor & Head of Civil Engineering Department and the Coordinator of the refresher program introduced the dignitaries and the program details. Dr. Himanshu Soni, Principal, GCET delivered the welcome address. Prof. B V Venkatarama Reddy, Professor (Retired in 2021), Department of Civil Engineering and Chairman, Centre for Sustainable Technologies, IISc, Bangalore, graced the occasion as Chief Guest. Prof. Reddy explained the importance of energy efficiency in building sector which consumes large amount of energy. Col B Venkat, Director Faculty Development Cell, AICTE and Prof. Vijay Vaidya, Executive Secretary, ISTE were present at the inauguration session. Col Venkat conveyed the vision of AICTE and the importance of faculty development programs for academic upliftment. Prof. Vijay Vaidya explained the role of ISTE in training of faculty members of various technical institutions through faculty development programs. The program was graced by the blessings of Er. Bhikhubhai Patel, Chairman, Charutar Vidya Mandal & President, CVM University. Dr. Snehal Popli, Co-coordinator of the program delivered the vote of thanks.

Session 2:Keynote Speech

Name of the Speaker: Prof. B. V. Venkatarama Reddy, Professor (Rtd.), and Chairman: Centre for Sustainable Technologies,IISc, Bangalore

Topic: Energy, carbon emissions and sustainability of built habitat - an overview

Prof. Reddy started his session with the explanation of sustainability, carbon emissions and energy in the built environment. Sir discussed two major issues related to sustainability that is Consumption of material and Pollution & emissions from the activities. The major difference between the embodied energy and operational energy in the buildings was discussed. Prof. Reddy explained life cycle energy of a building in the build environment. Sir has discussed various current rating systems for green buildings and pointed out that major emphasis is given on energy conservation and pollution reduction. Sir discussed about sustainability in construction sector. Prof. Reddy has shown various energy efficient buildings which are made of various waste materials such as rammed earth, straw bale, woody biomass and stones available at site. He also explained the method of construction using these materials. Finally he mentioned the activities carried out in C-BELT in Bangalore.

Session 3:

Name of the Speaker: Dr. Sanjay Mathur, Professor & Head, Department of Civil Engineering, MNIT, Jaipur

Topic: Energy efficiency measures & methodologies for buildings

Dr. Sanjay Mathur started the session by comparing the traditional Indian knowledge of "Panchtatva" with Environmentally Sustainable buildings. Sir focussed on Green buildings current rating systems and energy consumption pattern in Indian buildings. Dr. Mathur explained fundamental strategies which includes design strategy, management strategy, and use of renewable energy systems. Sir has focused the energy efficiency measures for buildings with reducing cooling system which contains use of appropriate units which release less amount of heat, use of efficient luminaries, pragmatic lighting etc. Dr. Mathur discussed energy efficient materials such as flyash based light weight aerated concrete blocks and precast hollow concrete. Sir then discussed about importance of building form with one practical example of one building in which 100 % energy consumption was reduced to 24% energy consumption. Dr. Mathur explained how matka roof and green roof help in reducing the ingress of energy in the buildings. Also, Sir has discussed about energy efficiency that can be achieved by proper selection of equipment, operation policy and maintenance of equipment. Lastly, sir explained earth air tunnel heat exchanger and double skin façade effects in the buildings.

Day 2: 2nd December, 2021

Session 1:

Name of the Speaker: Mr. Alpesh Mehta, Chartered Engineer and Founder Director Smart City Sustainable Technologies Int Pvt Ltd, Ahmedabad

Topic: HVAC System for Buildings

Mr. Alpesh started his session with the explanation of HVAC system and its use in the buildings. He explained that HVAC system is provided for the thermal comfort to the occupants. Sir discussed about space requirement, air distribution and piping, and external environment for the design of HVAC system. Mr. Mehta focussed centralized and decentralized system which includes portable electric heaters, electric resistance base boards, local ventilation systems, scope for energy efficiency, and energy performance index. Sir demonstrated case study on HVAC in Jupiter hospital system which is a 350 bed multispecialty hospital. Sir finally discussed about various agencies under government of India – BEE, MoP, BEE Eco Niwas Star rating clean development mechanism, modular heating, cooling and ductless ventilations for HVAC systems.

Session 2:

Name of the Speaker: Dr. B. Bhattacharjee, Professor, Department of Civil Engineering, Indian Institute of Technology, Delhi

Topic: Energy efficient Building Design & Materials in the envelope

Dr. Bhattacharjee started his session with effects of construction of buildings on environment. Sir discussed about building comforts related to micro climate change and thermal comfort in the buildings. Sir focussed on heat flow path in buildings with various images. Sir discussed in detail about various design parameters associated with thermal comfort. He focussed on design variables of building envelope. Sir explained all the design, construction and optimization criteria of energy efficient buildings. Passive and active features of the buildings were discussed. Along with thermal design process, he mentioned about heat transfer concepts in the buildings. Dr. Bhattacharji demonstrated Genetic Algorithm (GA), its coding, decoding and various other parameters in energy efficient building design. Lastly, sir discussed net zero buildings, solar energy variation and recent research scope in the area of sustainability.

Session 3:

Name of the Speaker: Dr. Ashok Kumar, **Scientist 'H' / Outstanding Scientist (Energy Efficient Building Technologies)** Head, Architecture & Planning Group CSIR- Central Building Research Institute (CBRI), Roorkee

Topic: Active and passive measures for Net zero energy buildings

Dr. Ashok started his session by introducing the work carried out by Council Of Scientific And Industrial Research–Central Building Research Institute. Sir explained in detail R & strategy for Make in India by Swachh Bharat Abhiyan and Smart village development. Sir gave emphasis on energy efficiency in building which is high priority area in most of countries. Sir explained how AC and heaters consume energy in the buildings. Dr. Ashok further explained climate change and carbon emission affects the EEBs. Sir continued his session with explanation of Net Zero energy building. Sir explained sustainability of rural and urban habitats. Active and passive design measures for energy efficient buildings were discussed in detail. Sir explained various energy efficiency performance levels with various

examples. Dr. Ashok discussed Roof construction details and thermal resistance of material in designing the energy efficient buildings.

Day 3: 3rd December, 2021

Session 1:

Name of the Speaker: Dr. Indrajit N Patel, Principal, Birla Vishvakarma Mahavidyalaya Engineering College, Vallabh Vidyanagar, Gujarat

Topic: Green Concrete for Sustainable Development

Dr. Indrajit Patel discussed about climate change in last 5 years and reasons for environmental deterioration. Sir discussed about importance of concrete, challenges and problems faced by construction industry. Dr. Indrajit also discussed reduction of greenhouse gases and utilization of green construction materials for sustainability which is a vision of our prime minister for nation. Sir highlighted the importance of green concrete for sustainable development. Sir also discussed about different material like fly ash, pozzolona, silica fume, slag, rise husk slag as an alternative or partial replacement of cement for sustainable developments & their environmental benefits. Sir covered information regarding Super plasticizers, high strength concrete, high performance concrete and its applications, under water concrete, self-compacting concrete, high volume fly ash concrete and many more used in future concrete technology.

Session 2:

Name of the Speaker: Dr. Khadeeja Priyan, Professor & Head, Civil Engineering Department, G H Patel College of Engineering & Technology,Vallabh Vidyanagar, Gujarat

Topic: Green Building: concepts, principles, and case-studies

Dr Priyan started her with the explanation of sustainable development. She discussed in detail 2030 agenda of 17 sustainable development goals (SDGs) introduced by UN General Assembly and adopted by all UN Member States in 2015. She explained fundamental principles of sustainable building design. Several sustainable initiatives such as Carbon footprint, energy audit, and indoor air quality audit were discussed in detail. She discussed Green Building movement in India. She mentioned about Indian Green Building Council (IGBC) which is under CII. She focussed on IGBC Rating Systems and parameters to be considered in it. She discussed the background for smart cities development. She also mentioned characteristics of a smart city as per European Concept. She considered few points such as smart economy people, governance, mobility, environment, and smart living. She explained Smart City Concepts and how it is useful in EEBs. Finally, Case Study of Paris City in context with Smart Cities (photo synthesis tower, Mangroove Tower etc) were discussed. Dr Priyan explained the details of Smart city mission in India, and its components such as Retrofitting, Redevelopment, Green Field, and PAN City solutions. Dr. Priyan also

explained in detail the case study of Gujarat International Finance Tech City (GIFT City), Gandhinagar, in the context with sustainable development.

Session 3:

Name of the Speaker: Dr. Rajiv Bhatt, Associate Professor & Head, A D Patel Institute of Technology, New Vallabh Vidyanagar, Gujarat

Topic: Green Building Rating Systems

Dr. Rajiv Bhatt started his session by explaining importance of Green buildings and its benefits. Sir explained various Green Building Rating systems such as LEED, GRIHA, SVGRIHA, and BREEAM. Sir discussed how green ratings helped in improving design process, economic benefits, reduces risk, improves quality of life, and offers recognition. Dr. Bhatt discussed about the process of getting certificate as green building. Sir mentioned how panchbhuta's 5 elements are incorporated under IGBC green building rating system. Dr. Bhatt explained 10 major points for Evaluation procedure of GRIHA. National green building rating system, Safety and sanitation criteria for construction workers are incorporated in GRIHA evaluation process. Sir gave the details regarding the fees structure of different rating systems. Dr. Bhatt informed about different Government incentives for green building projects in India (like Discounts in property tax, and provision of extra FAR. Government of India offers fast track environmental clearance for Green building projects. Finally, sir discussed case Study of L&T in terms of Green Rating system.

Day 4: 4th December, 2021

Session 1:

Name of the Speaker: Dr. Sachin Jain, Associate Professor, National Institute of Construction Management and Research (NICMAR), Pune

Topic: Construction Automation & Robotics

Dr. Sachin Jain started his session with automated construction and its importance in limiting the environmental impacts during construction through an informative video. Sir discussed about basic difference between manual work and mechanised work. He explained difference between mechanised work and robot work. Sir discussed advantages of digitization construction work. Sir explained what is robot and work carried out by robot. Sir focussed on comparison of industrial robot and construction robot in terms of mobility, environment, supply of energy, process design, programming and many more. Sir explained components of robots: Manipulator, Effectors, Mobility, Control, and sensors. Sir discussed how construction machine can be converted to fully autonomous robot using robot autonomy. Sir explained use of robots in construction such as drones for survey, SEM wall construction, 3D printing of house, wearable robot etc. Dr. Jain demonstrated Semi-Automated Machine

(SAM) used in construction of brick wall through video. Also, ESKO suits, Automated building construction and 3D printing was explained through video.

Session 2:

Name of the Speaker: Dr. Yash Shukla, Technical Director (Energy Systems), Centre for Advanced Research in Building Science and Energy (CARBSE) CEPT University, Ahmedabad

Topic: 3-dimensions of Building Energy Efficiency (Design, Construction, and Operation)

Dr. Yashkumar Shukla delivered his lectures on 3- Dimensions of Building Energy efficiency and this 3-dimnsions are Design, construction and Operation building. He focused on Energy consumption for space cooling in India and per capita cooling consumption and explained that 30% of global emission due to space cooling by 2050. Dr Shukla sir discussed the various steps for energy efficiency which includes parameters. He explained Iterative Design: Pre design, conceptual design and system design and building massive exercise: How to optimize the building cooling load. Sir also focused on Net zero building: consumption and generation of the energy should be same and explained various aspects to convert the building into net zero building. Dr. Shukla explained thermal comfort and Natural ventilation potential in the buildings. Sir discussed important criteria of wall construction with insulating layer which will help in EEBs. Sir mentioned important monitoring strategies in buildings. At the end of the session he shown the chart of finally energy consumption v/s generation chart for 58kw per hour project based on various survey. Also, he explained the effective cost will be 3 to 4% of project cost and within three to four years it will be covered through energy generation.

Session 3:

Name of the Speaker: Prof. Sudhanshu Bhusan, Professor & Head, Higher & Professional Education, National Institute of Educational Planning and Administration (NIEPA), New Delhi

Topic: National Education Policy 2020

Prof. Sudhanshu Bhusan started his session by explain scope of NEP 2020 in detail. Sir highlighted multidisciplinary approach in university and college and how to maintain it. Sir explained what liberal education system is and what the advantages of it are. Sir highlighted the challenges in restricting the education system. Sir focused that Higher Education Commission of India will work for universities and colleges instead of UGC and AICTE. The main focus of NEP 2020 will be outcome based education and standards of Higher education. There will be relation between graduate learning outcomes, program outcomes and course outcomes. There will be new system of Institutional Governance mechanism by which the institution will be guided. The development will be based on the SWOT analysis. The pedagogy will shift from teacher centric to learner centric. New pedagogy is required which will be student's participatory classes. Choices will be given to the students for the selection of various subjects of their interest. There will be greater scope for certificate course for the

diploma and UG students. NEP 2020 will also provide credit transfer facility and communication proficiency will be improved of the students.

Day 5: 6th December, 2021

Session 1:

Name of the Speaker: Dr. Sivakumar Palaniappan, Associate Professor, Civil Engineering Department, Indian Institute of Technology, Madras

Topic: Life cycle and energy analysis

Dr. Sivakumar Palaniappan started his session with introduction of sustainability concepts and definitions. Sir explained the inputs such as material, energy, water and land in building construction and outputs as global warming and pollution. Sir discussed in detail all the ecological principles such as cycle product life cycle, use of biodegradable materials, promote diversity and adaptation etc. Sir explained the difference between traditional construction and modern construction. Various phases of building cycle such as material, construction, operation and disposal was discussed in detail. Dr. Sivakumar explained the difference between Cradle to gate, Cradle to handover, Cradle to site, and Cradle to cradle. Sir focused simple and complex sustainability indicators. Sir discussed indirect embodied energy, direct embodied energy, operation energy and demolition energy. Sir explained eco efficiency assessment. Dr. Sivakumar discussed embodied energy directory of concrete, steel, clay, and ceramics materials from ICE database. Case study of Embodied energy of low cost house was discussed in detail. Sir explained three hotspots in building that is cement, rebar and brick which are major contributors in terms of energy requirement for low cost house. Type and functionality of buildings gives major contributors in any traditional and modern buildings. Sir, Also discussed case study of low income group type house. Sir focused on parameters that influence embodied energy of materials, construction process and buildings such as location, time period, quality of materials etc. Also, case study of comparison of GFRG buildings with conventional load bearing brick masonry buildings was discussed in terms of embodied energy. Finally, sir discussed about life cycle analysis of buildings, software's used in LCA and codes used for sustainable buildings.

Session 2:

Name of the Speaker: Dr. Chandan Swaroop Meena, Scientist & Assistant Professor (AcSIR), Building Energy Efficiency, CSIR- Central Building Research Institute (CBRI), Roorkee

Topic: Design Strategies for Energy Efficient Buildings

Dr. Chandan Swaroop Meena explained goals of 3E's (Environment, Energy and Economy) for the sustainable development. Sir discussed current scenario in terms of increase in CO2 and temperature. Sir discussed the scenario of energy consumption in India. Dr. Chandan

explained building energy optimization, how to reduce energy demand, renewable energy resources and performance indicators for energy efficient buildings. Sir explained the way and route of assessing the energy efficiency in buildings. Dr. Chandan demonstrated the assessment of one BHK house by simple model, conventional model, brickwork with insulation inside, and AAC block work without insulation. Sir explained the role of building envelope in EEBs. Dr. Chandan explained active and passive solar water heating system. Sir demonstrated mathematical model for the solar water heating system.

Session 3:

Name of the Speaker: Ms. Neetu Jain, Panache Green Tech Solutions PVT. LTD. Vadodara & Co-chairperson, IGBC Vadodara Chapter,

Topic: Energy Efficiency through Cool roofs and cool walls

Ms. Neetu Jain explained the activity of P Panache Green Tech Solutions in preparing green buildings. She explained the effect of rise in temperature in efficiency of the buildings. She discussed about various reasons responsible for heat generation. She discussed in detail the impact of solar insulation and various other solutions in reduction of indoor temperature. She explained cool roofs and cool tops in the EEBs. Parameters for good cool roofs and benefits of it are discussed. She mentioned various cool tops for different types of buildings. She explained all the fundamentals of cool wall systems and finally she discussed the requirement of selection of proper material for energy efficient buildings.

Day 6: 7th December, 2021

Session 1:

Name of the Speaker: Prof. Monto Mani, Associate Professor, Centre for Sustainable Technologies (formerly ASTRA), & Centre for Product Design & Manufacturing, Indian Institute of Science (IISc), Bangalore

Topic: Sustainability challenges in buildings

Prof. Monto Mani discussed about Sustainability challenges in building, also shared facilities and work carried out by SU desi lab. Sir discussed about satisfaction with life v/s Ecological footprints of various country, zero energy v/s energy zero, and problems with plastic waste. Sir also discussed about challenges faced because of modern transformation like emission of CO_2, and climate change. Sir also discussed about different impact associated with use of smart sensors, and safe lighting. Sir shared information regarding solar energy and Hunger v/s solar potential and also associated problems. Sir discussed about problems related to photovoltaic technology such as dust settling, cleaning technology, and energy demand of various buildings. Sir discussed about PV waste and its greener solution like use of such dead PV waste as material. Sir discussed about sanitation & their work in different regions, attitude of people & challenges they faced. At the end, sir discussed about various green technologies.

Session 2:

Name of the Speaker: Mr. Jitendra Khimlani, Psychological Counselling, therapist and NLP trainer, Vadodara

Topic: Wellness Mantra (A Session on Stress Management)

Mr. Jitendra Khimlani started his session with five minutes of meditation. He explained that there is a difference in energy level of body during the entire day. He mentioned various points for managing the energy levels of the body through five minutes pranayama three times during the entire day. Sir has explained Wellness Mantra such as Food, Sleep, Breath and Mediation. Sir has also discussed how stress free mind help in proper decision making. Sir has also explained importance of Sudarsankriya and at what point of time it is to be carried out. Finally, sir has given practice of breathing & meditation for few minutes to make us feel free and relaxed. Sir mentioned that these practice will be very fruitful if we make this as our routine.

Session 3:

Valedictory Function

The virtual valedictory function was arranged at 2:00 pm on 7th December, 2021. Dr. Khadeeja Priyan, Coordinator of the program introduced the dignitaries and summarized the whole program. Prof. Bhaskar Bhatt, Hon. Secretary cum Treasurer, ISTE Gujarat Section graced the occasion and appreciated the initiative taken by the department, the institute and CVM university and also discussed the role and objectives of ISTE. Dr. P M Udani, Director General CVM University discussed about the relevance of the program for energy efficiency in the building sector which consumes 1/3rd of the energy consumption in India. Dr. Himanshu Soni, Principal, GCET congratulated the Department of Civil Engineering for organizing the program successfully. The participants shared their feedback and Prof. Nirajkumar Mandowara, Assistant Professor and Co-coordinator of the program delivered the vote of thanks. National Anthem is played at the end of the programme.

Outcomes Achieved from the Programme

Due to high population increase and urbanization, all developing nations are focusing on building their cities and villages smart in order to make the livable area more sustainable and resilient. Construction sector is one of the largest industries in the country and this sector has been growing at a rapid pace, poses many adverse impacts to the environment. Nowadays, energy efficiency in the building sector gets a lot of appreciation. Net Zero energy building is a new concept wherein the total amount of energy used by the building on an annual basis is equal to the renewable energy created on the site. Advanced building materials with shifting properties known as smart building materials that are adaptable to external conditions are being introduced into the civil engineering industry. To abreast with these new technologies, the Department of Civil Engineering, GCET has organized AICTE-ISTE sponsored one week

Refresher Programme on “ENERGY EFFICIENT BUILDINGS”. The Refresher program mainly focussed on the available and advanced technologies which can be incorporated to plan and design energy efficient buildings.

The outcome achieved in this program:

- Participated faculty members have understood the recent advancements in infrastructural developments and how energy efficiency could be incorporated in building sector.
- Helpful for the faculty members to incorporate the concepts and applications in their academics and thus to fulfil social commitments.
- Ensure the adaptability to advanced technologies in building construction and thereby fostering a good team of budding engineers capable of facing the energy challenges globally.

This faculty development programme provided greater clarity on energy efficiency at building sector which is otherwise not available in the engineering curriculum. The participants across the country opined that the programme benefitted them to understand various dimensions of the said topic. In the era of outcome based education, the knowledge enhancement of faculty members will definitely be helpful for the students to understand this concept clearly.

This programme was a learning platform to interact with well-known resource persons from IISc Bangalore, IITs, NITs, CSIR-CBRI Roorkee, NICMAR, CEPT, IGBC and various industries working on this area. It enhanced opportunities for productive networking with fellow participants and resource persons. It also provided motivation to participants to organize similar programs at their institutes. The participants received awareness about the support & encouragement extended by AICTE and ISTE. Participants gave very positive feedback about various sessions and the timely conduction of technical sessions. The enthusiasm of the participants and the great encouragement from the resource persons generated a great motivation to the organizing team to coordinate similar events in the future. A good rapport could be created with the resource persons and the participants. Attending daily quiz at the end of day, maintained their focus in learning. According to the guidelines by AICTE-STE, one session on stress management was arranged, and it resulted in positive responses from the participants. Another session on National Education Policy (NEP) 2020, educated all the participants about new educational reforms which is implemented by GOI, its features and relevance.

The expertise of the resource persons was highly beneficial for the academic upliftment of the participants and their students. We hope, the programme was highly beneficial to faculty members of various engineering colleges to update their knowledge and academic activities in the form of classroom teaching, assignments, students’ projects, and contribution to research & development in the area of energy efficiency in buildings. From the feedback received from the participants, we came to know that this program was highly beneficial to all of

them. It was a great learning experience for the coordinator and the team, to organize a national level FDP. Hence, we express our sincere gratitude to AICTE & ISTE for providing us this opportunity to organize this program.