**Saturday, October 22, 2016 2:00PM – 5:00PM**

**Session F; Sustainability, Emerald Hall C**

**Session Chair: W. D. Walls, University of Calgary, Canada**

**2:00PM F.01 Hafiz Muhammad Ali, Adeel Arshad, Taimoor Ahmad Khan, Muhammad Nabeel, U of Engineering and Technology Taxila, Pakistan, *An Experimental Study of Square Profile Pin-Fin based Heat Sinks subjected to Latent Heat Thermal Energy Storage (LHTES) module* –** This paper reports the results of an experimental investigation of thermal performance of heat sinks with square profile pin-fins for passive cooling of electronics. Latent heat thermal energy storage (LHTES) module with inclusion of phase change materials (PCMs) n-eicosane and paraffin wax are being employed having two different phase change temperatures. Square profile of pin-fins of dimensions 1mm, 2mm and 3mm and no fin heat sink as a reference heat sink, made of aluminum are used as thermal conductivity enhancers (TCEs) for uniform heat flow through low thermal conductive PCMs. Constant heat densities of 1.58 kW/m², 1.98 kW/m² and 2.38 kW/m² are provided at the base of heat sink with plate heater adhered for mimic heat generated by electronics. Experiments are performed to investigate the enhancement time of electronic equipment operation under safe comfortable working conditions. Two different critical set point temperatures (SPTs) 45℃ and 65℃ of corresponding melting temperatures of selected PCMs, are chosen for comparison of enhanced time, ratio, and fin thickness. The results are then compared to explore the latent heat phase completion time, effect of heating rates, melting temperatures of PCMs and effect of PCMs.

**2:12PM F.02 Hafiz Muhammad Ali, Asadullah, Haris Ahmad, Khurum Khurshid, University of Engineering and Technology Taxila, Pakistan, *Transient Thermal Analysis for electronics cooling using LHESS (Latent heat energy storage system)*** – This research paper reports the result of an experimental investigation carried out to characterize the thermal performance of different configurations of PCM (phase change material) based pin fin heat sinks. n-eicosane is used as the PCM. Aluminum is used to make the heat sinks and the volume fraction chosen for the heat sink is 15%. This study also quantifies the effect of the heat transfer performance of the phase change material under constant and intermittent heat loads. Additionally a heat sink without pins is used for a baseline comparisons. A series of experiments are conducted at constant power level of 3-8 watts with a flux of the (1.58-2.78)KW/m2 in constant steps of the 1 watt. Extensive experimental investigations are carried out at varying power levels by applying the heat flux intermittently by keeping the heat input constant. Parametric studies have been conducted by changing volume fraction of PCM which is defined as the “the ratio of the volume of the PCM to the difference between total volume of the heat sink and total volume of the pins”. Performance will be figured out using temperature-time plots for heating and cooling phases for each power level and each volume fraction resulting specific scope to analyze the thermal design of the heat sinks can be judged. Thermal performance of the pin fin heat sinks for both latent and sensible region is included in this study.

**2:24PM F.03 Hafiz Muhammad Ali, Muhammad Bilal, Muhammad Hashir, Adeel Arshad, U of Engineering and Technology Taxila, Pakistan, *Experimental investigations on thermal performance of electronic devices using round pin heat sink incorporating phase change material* –** The ongoing advancements in technology have brought about radical changes in human life. Hand-held communications devices have started being extensively used in everyday purposes thus calling upon the need for the electronics to be more reliable as well as durable. Auxiliary applications coupled with ultra-modern technology in such electronics has hence become great challenge since it results in extra heat and poor performance of mobile devices. In the absence of suitable thermal management mechanism, the temperature rise and excessive heat within the device may cause it to encounter complete component breakdown and user disconcert. Small sizes of the hand-held devices summon for an effective method of thermal cooling which could utilize the most space available for heat transfer. In the past years, research has been carried out to hunt for an alternative solution of thermal management in PDAs that does not involve bulky set-ups like fans in conventional cooling. Phase Change Materials (PCMs) are being probed exceedingly in this area. The pivotal edge PCMs provide is their high latent heat of melting which enhances energy storage density. Change in phase occurring during melting of solid PCM gives way to absorb energy. As the PCM stores this latent heat in it, temperature rise is negligible with minor volume changes. Hence, the temperature only increases after phase change when heat is added. In addition to the above mentioned advantages, PCMs are most definitely more stable but less corrosive in case used with other materials. Both these characteristic properties make PCMs appropriate to be used in portable devices. The proposed methodology suggests, PCM can store heat to change its phase from solid to molten while the mobile device is emanating extra heat as result of operating heavy applications. Its phase could be regained by again radiating this heat to the surrounding when the electronic device is not being used. The only care to be taken in this scenario is not to run the heavy applications for time longer than that required for phase transformation of the PCM used. Our research aims to use the Phase Change Materials for the thermal management of hand-held devices and to encounter problems associated with its low thermal conductivity by using technique of pin-fin geometries to increase heat transfer surfaces as well as the rate. Also, the optimization of the amount of PCM will be the focus while devising suitable pin-fin geometry with in the hand-held devices. With the advancement of era, Smart devices with faster processing for longer period of time, the high heat generated should be transferred timely to sink for comfortable usage. PCM based heat sinks gives promising results in terms of heat removal because of high phase change enthalpy of PCM and very low change in temperature of Sink. This study focuses on further investigations of PCM based heat sinks geometry and parameters effecting rate of heat transfer in sink.

**2:36PM F.04 Abdul Saboor Imran, Sulman Nazr, Andraes Albercht, Poalo Lguli, Technichal U Munich, Germany, *Screen Printed Flexible and Energy Efficient Pressure Sensors* –** Flexible electronics, particularly sensors and sensing systems using inkjet print. Flexible electronics, particularly sensors and sensing systems using inkjet printing is an evolving energy efficient and energy saving technique that overcomes the limitations of time and cost as compare to conventional methods. Flexible pressure sensors have a wide range of applications in the automotive, biomedical, aerospace, health monitoring and renewable energy sectors. In this study, the goal is to create a forced inkjet printed capacitive based pressure sensor. Photonic sintering technique was used to enhance the performance of inkjet printed circuits. Different pillar structures and pillar diameters were examined to observe the performance of sensor that resulted in better sensor response.

**2:48PM F.05 Zulfiqar Khattak, COMSATS Institute of Information Technology, Pakistan, *Plate Fin and Pin Fin Heat Sink Various Designs Aspects* -** The paramount way of achieving the enhanced convective heat transfer rates in modern day engineering application in a limited volume are the Fins heat sinks. Allowing for the enormous increase in heat production densities, introduction of compact, cutting edge and high performance heat sink design are the focused area. Among various types of heat sink design discussed in literature, the staggered radial pin fin heat sink are the one of the optimal design with 10 % improved thermal resistance for constant mass. Paper deals with the critical review of different heat sink designs subjected to air as medium, limiting factors, their effectiveness, limitations of various techniques & recent advancements in the field of innovative heat sinks. The study initiates with brief & comprehensive discussion regarding importance of heat sinks, its methodology; its suitability for present day heat dissipation issues, statistical data of various heat sink designs and concludes with a rich discussion of work so far to propose strategy for future research. Key words: Heat sink, Convective heat transfer, Staggered Pin Fin, Thermal resistance, heat dissipation.

**3:00PM F.06 Shaheen Aziz, Talal Ashraf, Ahmed Nawaz, Marui Uqaili, Anam Hashim, Mehran U of Engineering and Technology Jamhsoro, Pakistan, *Di-Methyl Ether (Dme) Prospective In Terms Of Conventional Fuels In Pakistan From Gasification Of Aboriginal Coal* –** The whole world is facing increment in the stipulation of energy and for this purpose fossil fuels are burning readily to achieve the desire of energy. For making the world pollution free and to maintain the equilibrium in energy demand and supply, focus of the world is diverting towards clean, cheap, renewable and efficient fuel that can withstand with other conventional fuel. Coal Potential of Pakistan is 18.5.5 billion tons and is about more than the reserves of oil and gas in Arabian countries. Energy Crises and Environmental dilemma of Pakistan can be overcome by the production of DME fuel from gasification of aboriginal. It is estimated by the Bureau of Energy Pakistan that Diesel consumption by the transport sector and industries is round about 8 million tons. Pakistan consumes 5.37$ extra on importing diesel of 4.8 million tons. 58,613 million tons of LPG. It is estimated that Pakistan consumes 8 million tons of diesel yearly with the rapid increment of 5%. Pakistan bears the expenditure of 5.37 billion dollars for importing the diesel 4.8 million tons. This burden on the budget can be reduced by producing the DME from aboriginal sources as a substitute to conventional fuels. In terms of cost comparison, DME costs less than 40% than diesel. Pakistan is a rich country in terms of aboriginal reserves 185 billion tons coal can produce 92 billion tons of DME. By the end of 2020, Pakistan will import diesel of 9.18 billion dollars according to country requirement and cost of DME production 3.67 billion dollars. The fuel importing burden of budget in Pakistan till 2020 can be reduced to 5.51 billion dollars. DME can be used as an alternative to crude oil derived fuels in the boilers, combustion engines and domestic fuel.

**3:12PM F.07 Nigar Fatima Arif, Institute Of Management Sciences (IMS) Lahore, Pakistan, *Impact Of Energy On Economic Development Of Pakistan* –** In the economic growth of any country there are several forms of energy that display a very significant part whether it exists in any form like solar, hydro, wind, nuclear, coal along with other natural resources as well as those resources which have been created by human beings themselves. This paper will focus on the relationship of the economic development of Pakistan and the energy which is being utilized by considering the statistics from the last few years. Economic development will be taken as a dependent variable while energy that is being used will be taken as independent one. Data once gathered will then be analyzed with the help of SPSS software involving very common statistical techniques like regression, correlationing etc. It is expected that the results will display that how other sources of energy which are quiet cheap and inexpensive other than electricity, the issue of which is getting critical day by day can play a very important and valuable role in the economic development of Pakistan. The uniqueness of this paper lies in the fact that many new energy efficient resources will be recommended for utilization that could significantly play a positive role in the country’s economic development.

**3:24PM F.08 Anam Kalair, Naeem Abas, Nasrullah Khan, COMSATS Institute of Information Technology Islamabad, Pakistan, *Design of Zero Emission CFB Reactors for H2 and CO Production* –**Energy and environment are intimately interconnected systems. Fossil fuels combustions and agricultural waste decompositions are ultimate sources of toxic pollutants and green gases. Energy thrives on environment as life thrives on life. It is hard to abandon fossil fuels during energy phase and form transitions. Climate change, power crisis, environment, economic and food security problems epitomize a multiple spring suspended body likely to lose its natural equilibrium by minor perturbations. Zero emission technologies such as zero energy buildings, zero emission vehicles, zero emission agriculture, zero emission carbon and zero emission power are sustainable alternatives to reduce emissions. This paper describes the design of a circulating fluidized bed reactor used in sub-critical, supercritical, ultra-supercritical and integrated gasification combine cycle pulverized coal/biomass power plants for syngas (H2 and CO) production with zero emission of pollutants and greenhouse gases. This work shows that integration of circulating dry scrubbers, flare gas desulfurization and carbon capture & storage technologies allows using clean coal power technologies to produce environment friendly sustainable power.

**3:36PM F.09 Muhammad Rizwan Younis, U of Management and Technology Lahore, Pakistan, *Viscosity characterization of biofuel* –** Bio-oil is a major product of biomass fast pyrolysis that could potentially be used in motor engines, boilers, furnaces and turbines for heat and power. However bio-oil of bio liquid is not intended for direct use in motor engines. It will be gasified to produce synthesis gas. Bio liquid Process analytics provides bio-oil characterization and rheological characterization is a key process parameter in this analysis. The aim of this work is to evaluate the role of viscosity of organic condensate obtained from wheat straw. This has to be done by means of a model that is able to adequately describe the viscosity as a function of relevant process parameters. The developed model of temperature is helpful to investigate the drop of heat transfer in the heat exchangers of the organic condensate cycle when glycol is replaced by an organic condensate. Glycol is used as preliminary material during start-up of the plant and has a different viscosity than the organic condensate. Temperature, solid contents and water contents plays a significant role in affecting the viscosity of bio-oil. As temperature increases, the viscosity of oil reduces rapidly. Viscosity-temperature profile follows an Arrhenius-type-relationship, where the viscosity of the bio-oil decreases exponentially with increasing temperature. As solid content increases, exponential increase of viscosity takes place. By increasing water content, decrease of viscosity takes place on logarithmic scale. The range of water addition in organic condensate is possible up to a certain limit, after that limit it starts to separate out in two phases. Investigation of drop of heat transfer in heat exchanger shows that Nusselt number decreases with the increase of viscosity. Therefore, the overall heat transfer coefficient will decrease in case of organic condensate as compared to glycol. Overall, from this study, it can be concluded that viscosity is influenced by the key parameters determining the organic condensate cycle through intrinsic relationships as mentioned above.

**3:48PM F.10 Saba Arif, Danish Azhar, Muzaffar Ali, Hafiz Muhammad Ali, U Of Engineering And Technology Taxila, Pakistan, *Performance Analysis Of Different Configurations Of Heating And Cooling For A Multizone Building* -** Multi zone HVAC designing is important as considerable amount of the world’s energy is used for heating, ventilation, and air conditioning (HVAC) systems used in multi zones. Hospitals are one of most critical multi zone buildings. So, proper designing of multi zone building will lead toward high savings in energy. Key step towards this goal is development of simulation based analysis approach for performance analysis of different air distribution systems. There is huge diversity in HVAC configurations used in commercial and residential sector which makes it difficult to model. Most common types of configurations are; constant volume with reheat, dual duct and Variable Air Volume system, which is commonly found in large commercial buildings. Objective of this research is to investigate the impact of operational zoning and HVAC system operation strategies on energy performance of hospitals by maintaining comfort conditions. Load is calculated for each zone and optimized for creating multi zone building. Then after proper designing of central system, different HVAC configurations are designed for a hospital building. Afterwards, Energy simulation is used for forecasting best air distribution system for a multi zone building. Therefore; this research aims to simulate air distribution systems for energy saving potential for a hospital building in climate of Pakistan by developing different models in TRACE 700. Results show that COP of absorption chiller is highly dependent on components temperatures and out to be 0.78 in current research. Additionally, cooling capacities and NPV cash flow is determined for all three air distribution systems. According to results of economic analysis and cooling capacities, 52 ton load and required cfm in each zone is fulfilled by dual duct configuration in most efficient manner for multi zone buildings such as hospitals.

**4:00PM F.11 Tassadaq Hussain, Riphah International U, Pakistan, *Low Power Super Computing System* –** The evaluation in the information technology demands a processing system that can process big data and perform analysis, future prediction and give solutions in quick time. Therefore, a low-power and high-performance supercomputer architecture is required in all fields of academia and research, which manipulate and compute the information available in big data formats. The talk presents different high performance computing system architectures which are the CPU based Supercomputer, the CPU-GPU based Supercomputer and the Embedded Supercomputer system. To solve programmability wall, faces by the supercomputing system the speaker will discuss the different CPU, GPU and FPGA based parallel programming models for sciences and engineering applications. In order to get better efficacy from supercomputing system, the major issues such as programmability, portability, scalability, accessibility, performance, power and cost issues will be addressed. At the end of the talk, there would be a live demo of using one the top ranked supercomputer system developed by Barcelona Supercomputing Center Spain and UCERD Pakistan.

**4:12PM F.12 Saba Arif, Anam Nadeem, Danish Azhar, Muzaffar Ali, U Of Engineering And Technology Taxila, Pakistan, *Design And Experimental Investigation Of Circulating Liquid Cooled Vest (Jacket)* –** Human body generates heat by different processes including metabolism and performance activities. Then some part of this heat is dissipated by various actions like sweating, walking, eating etc. While extra heat generation causes heat stresses that effect human efficiency to perform any further activity. Thus, to provide comfort and ease to the body this additional heat must be removed. Personal cooling garments address such a problem by providing a portable solution to maintain desired body temperature. Several technologies in the international market related to personal cooling are being used but rarely used in underdeveloped countries like Pakistan despite of huge potential. This project aims to provide a handy and manageable solution in terms of fabricating a circulating liquid cooling vest at low cost using locally available equipment. In the current study, a vest of 60 W is designed according to ASHARE standard by taking an appropriate human activity. Afterwards, the vest is fabricated that employs circulation of water cooled through thermoelectric system, housing a heat exchanger, and batteries for powering it. Nylon is used as a vest frame material. Finally, a comprehensive experimentation is conducted at different intensity of activities for both genders in terms of seating, walking to determine its performance. The vest successfully lowered the body temperature down to the normal skin temperature of 31.5 C by providing a temperature decrement of around 2.5 oC that is acceptable for human comfort.

**4:24PM F.13 Ajab Khan Kasi, Jaffer Khan Kasi, Mustafa Ali, U of Balochistan, Pakistan, *Effect of pressure increases during increase of temperature in an autoclave for the growth of bulk ZnO single crystals* –** This article provides the importance of study of relation between the pressure and temperature to achieve the super-critical point of water to dissolve the ZnO powder which is insoluble in ordinary water, for this purpose a very low prize autoclave is fabricated which is now not able to use for the Growth of bulk ZnO but can be explained the behavior of boiling point of water at different pressures.

**4:36PM F.14 Ghulam Abbas, Balochistan U of Engineering and Technology Khuzdar, Pakistan, *Energy Monitoring System with Power line Communication* -** A correctly designed and installed monitoring system offers a deeper understanding of the functioning parameters of the ability & electrical system. A closed assessment of the generated data by a monitoring system can reveal a variety of overt and elusive chances. This paper authors aims to make an efficient PLC which measure the energy in proper way which consume less energy, details on design and implementation of an energy monitoring system for household electrical devices. The system under review performs measurements of power and energy consumption for numerous electrical devices placed throughout a building and sends usage data back to a central location to be uploaded online for consumer-friendly analysis. Although an entire system implementation was unsuccessful, significant insight was gained throughout the design and prototyping process. A correctly designed and installed monitoring system offers a deeper understanding of the functioning parameters of the ability & electrical system. A closed assessment of the generated data by a monitoring system can reveal a variety of overt and elusive chances. This paper authors aims to make an efficient PLC which measure the energy in proper way which consume less energy, details on design and implementation of an energy monitoring system for household electrical devices. The system under review performs measurements of power and energy consumption for numerous electrical devices placed throughout a building and sends usage data back to a central location to be uploaded online for consumer-friendly analysis. Although an entire system implementation was unsuccessful, significant insight was gained throughout the design and prototyping process.

**4:48PM F.15 Abdul Rehman Baloch, Ali Mardan Baloch, Institute of Information and Communication Technology, Pakistan, *Analysis of Social Economical Sustainability for Agriculture Using Renewable Energy in Rural Area of Jamshoro* –** The Energy for Environmental and Economical sustainability are crisis at global level. Other than renewable energy, there are numerous sources for generating energy are under manipulation where technology and information are very high. In future, smart and excellent investigation about renewable energy are much more inexpensive with levelled to other resources. An interconnection, with wind energy resource always available in the southern region district Jamshoro which is well known the city of â€˜Windâ€™ of Sindh province of Pakistan. The interconnection of agriculture farming through renewable energy like windmills are charming combination. With help of Irrigation method in which windmills water is supplied to fields at regularly for agriculture. This research has create initiation for local entrepreneurship in the area of utilize the investment to industrial windmill units driven through pumping as well as for population which depend on rain water for agriculture. The wind speed probability analysis based upon data available from secondary sources of selected area. The selected area analysis for future windmill installation water was pumped in desired seasons, which will appropriate for irrigate land through apparent irrigation methods for getting optimum agricultural productivity.