Book of Abstracts

2nd International Conference on Energy

ICOE – 2015

02nd - 04th September 2015

The International Institute of Knowledge Management (TIIKM)

Colombo, Sri Lanka

Committee of the ICOE- 2015

The International Institute of Knowledge Management (TIIKM)

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Official website of the conference

www.energyconference.co

Book of Abstracts of the 2nd International Conference on Energy, 2015

Edited by Prof. K.M. Nalin de Silva and Others

ISBN: 978-955-4903-31-9

Published by The International Institute of Knowledge Management (TIIKM)

Tel: +94(0) 11 3132827

Fax: +94(0) 11 2835571

Organized by:

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[01]

EXTREMELY LOW-COST ALTERNATIVES FOR THE OXYGEN REDUCTION CATALYST OF FUEL CELLS

R.M.G. Rajapakse [1], K.G.C. Senarathna [2]

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ABSTRACT

Fuel cells are devices capable of converting chemical energy change of the net reaction caused by the oxidation half reaction of a fuel that is taking place at the anode and the reduction half reaction of oxygen that is taking place at the cathode ($-\Delta G_{reaction}$) to electrical energy (nFE_{cell}). Fuel cells have become enabling energy technology for the world's energy portfolio. They offer clean energy more efficiently and constantly when compared to energy production by combusting gasoline and other fuels. Fuel cells, therefore, have the potential to replace the internal-combustion engine in vehicles and provide power in stationary and portable power applications because they are energy-efficient, clean, and fuel-flexible. They are alternative power sources for remote stations and places where grid supply is not available. The both oxidation half reaction of a fuel and reduction half reaction of oxygen demand highly expensive catalysts such as Pt and Pt/Rh, respectively, making the cost of fuel cells prohibitively expensive. Researchers, over the past two decades, have done extensive research programmes to reduce the costs of these catalysts and research has been carried out in four different strategies, viz., lowering the platinum group metal content by catalyst engineering particle morphology and crystal structure, alloying platinum with less expensive base metals such as Co, Mn, Ni and others, developing novel supports such as non-carbon supports and alternative carbon structures and researching non-platinum catalysts. We have been pioneered in developing non-platinum catalysts for the oxygen reduction half reaction of fuel cells by developing extremely low-cost catalysts based on nanocomposites of montmorillinite clay (MMT), electronically conducting polymers such as polypyrrole (PPY) and the reduced form of the oxidising ion. We describesystems such as Fe(II)/Polypyrrole/MM, Ag/Polypyrrole/MMT, Pd/Polypyrrole and Polypyrrole/Porphyrine structures and metalated Porphyrine structures, all of which show promising results for oxygen reduction and stand as substantially low-cost alternatives to currently used Pt-Rh catalyst for oxygen reduction half reaction of fuel cells. As such, fuel cell power can be harnessed at reasonably low cost in the near future for the environmentally benign greener power production.

Keywords: Low-cost oxygen reduction catalyst, Polypyrrole, Montmorrilonite, Irion(II), Silver, Palladium, Nanocomposite, Fuel Cells

PLENARY SPEECHES

[01]

STRATEGIES FOR IMPROVING CHARGE TRANSPORT IN NANOCRYSTALLINE TITANIUM DIOXIDE BASED SOLAR CELLS

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ABSTRACT

Solar cells based on hybrid Titanium dioxide (TiO_2) – organic nano-composites have been intense focused for more than two decades. Although extremely rapid progress on Perovskite-sensitized TiO_2 photoanodes was made with energy conversion efficiencies more than 18 %, there is still room for improvement through enhancing charge carrier mobilities of the nanocrystalline TiO_2 and hole transporting material.

This study focuses on enhancing the performance of hybrid TiO_2/Polymer solar cell by incorporating Multi-Wall Carbon Nanotube (MWNT) and dyes in nanocrystalline titanium dioxides and at the TiO_2/polymer interface, respectively. Both strategies significantly improve charge transport of porous Titanium dioxide and hole-transporting materials as confirmed by Time of Flight measurement. Overall power conversion efficiency of these solar cells which were incorporated MWNT and dye showed efficiency more than a factor of two in comparison with their respective control devices.

Key words: solar cell, carbon nanotube, TiO_2, polymer

[02]

EXPLANATION OF THE PHOTOCURRENT EFFICIENCY(Φ) ENHANCEMENTS, THROUGH THE CAN'S MODEL EQUATION FOR THE P-CUI SENSITIZED METHYLVIOLET-C_{18} (M-C_{18}) LB FILMS IN THE PHOTOELECTROCHEMICAL CELLS (PECS) AND CU/N-CU_2O/M-C_{18}/P-CUI SOLID STATE PHOTOVOLTAIC CELLS

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ABSTRACT

Photocurrent enhancements in a dye sensitized photoelectrochemical cell (PEC) with a Cu/p-CuI/M-C_{18} photoelectrode and a dye sensitized solid state photovoltaic cell (DSSC) with Cu/n-Cu_2O/p-CuI/M-C_{18}/p-CuI are studied by controlling the formation of dye aggregates of (Methylviolet-C_{18}) M-C_{18} Langmuir-Blodgett (LB) films on the p-CuI layer. LB films of M-C_{18} are deposited under biasing conditions during the LB film deposition process on p-CuI, Cu/n-Cu_2O/p-CuI and conductive glass plates with the three-electrode configuration set up coupling to the LB trough. LB films prepared under positive biasing conditions enhance the photocurrent quantum efficiencies for both PECs and DSSCs controlling and minimizing the formation of dye aggregates. The electrolyte used for LB deposition and photocurrent measurements is (10^{-2}M) Fe^{2+}+ Fe^{3+} (10^{-2}M) and (10^{-2}M) NaH_2PO_4-Na_2HPO_4, pH=6 buffer solution. Maximum photocurrent quantum efficiencies (Φ_{max} %) obtained are ≈22% for PECs and ≈ 20% for DSSCs, where the M-C_{18} LB film deposition applied potentials +0.3V versus Ag/AgCl. The mechanism of the photocurrent enhancement is discussed through the CAN's model equation, $\Phi = ADo–BDo^2$, where $A-=k_1k_2/F$, $B=Ik_1^2k_2[2k_6/F^3 + k_2k_4/k_3^2X^2F^2]$, $F=k_2+k_5Y+k_7+k_1I[1+k_2/k_3X]$. Experimental evidence for the formation of the aggregates of M-C_{18} LB films for the negative applied potentials and suppression of the aggregates with positive applied potentials are presented from absorption spectra, AFM pictures and fluorescence measurements of the samples. Conversion efficiency obtained is ≈ 2.5%, Voc ≈ 750mV and Isc ≈ 5.8mAcm^{-2} for DSSC fabricated with +0.3V versus Ag/AgCl applied deposition potential of M-C_{18} LB films.

[03]

NOVEL ONLINE ENERGY MONITORING DEVICE

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ABSTRACT

Fossil fuels, as the name suggests, are very old. But world fossil fuel reserves are finite and it's only a matter of when they run out not if. Annual consumption of energy over the global is equivalent of over 11 billion tons of oil in fossil fuels. Crude oil reserves are vanishing at the rate of 4 billion tons a year. If we carry on at this rate without any increase for our growing population or aspirations, our known oil deposits will be gone within next century. Availability of oil, natural gas, coal are respectively 40, 60 and 200 years and it's time to concern about alternative energy sources while considering energy saving and management. First step of energy management and saving is measure, monitor and control of consumption.

Normally energy is measuring by energy meters and most of the meters are traditional standalone energy meters. But traditional energy meters are no longer accept in energy arena anymore, since it provide raw data, not in real time, readings can't store or analyze. It's not enough to take a figure saying that total consumption is that much. Therefor now it's time to move for novel energy metering devices with high end tech overcome drawbacks of traditional meters. When it comes to novel smart energy meters, it gives access to real time energy data over different communication protocols. Users can collect, store, monitor analyze data real time for improving energy performance in consumption control, trend analysis, demand forecasting, preventive maintenance and health check (by signature analysis..), peak demand reduction, efficiency improvements, energy auditing by using novel smart energy meters.

[04]

LOW CARBON GREEN BUILDING DESIGN AND CONSTRUCTION

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ABSTRACT

A modern green building, which is also called as a sustainable building is designed to meet some specific objectives such as occupant health; using energy, water, and other resources more efficiently; and reducing the overall impact to the environment by applying proper mitigation system within the premises. It is a huge opportunity to use the construction resources efficiently while creating healthier buildings that improve human health, build a better environment, and provide cost savings. All the development projects lead to over-consumption of natural resources. This leads to serious environmental problems.

Currently, Building construction has an enormous and increasing impact on environment, and sustainable construction can lead to environmental protection at. At the same time, the selection of green building materials is a critical point to realize sustainable construction. Green building concept is the broad approach which is optimum use of natural resources, energy for the infrastructure development. The low cost eco-friendly house is the modern construction method which uses locally available material and unskilled labour and also reduces the construction time. Similarly, use of recycled material such as plastic, aggregates and wastes for the construction of pavement has considerable effect on the environment of earth. Another advanced method is the construction of low carbon building which uses sustainable materials like blended cement, compacted fly ash blocks, low energy intensity floor and roofing system, rammed earth walls and stabilized mud blocks etc. This ultimately results in reduction of greenhouse gases which will help to reduce greenhouse effect

ORAL PRESENTATIONS

[01]

PHOTOVOLTAIC PERFORMANCE OF $CACO_3$-COATED SNO_2-BASED DYE-SENSITIZED SOLAR CELLS WITH COMPOSITE LIQUID/QUASI-SOLID-STATE ELECTROLYTES

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ABSTRACT

As liquid electrolyte-based dye-sensitized solar cells (DSCs) have shown some practical limitations due to their sealing imperfections, leakage and solvent evaporation, the composite liquid/gel system has become a subject of study. The composite electrolyte is expected to circumvent the above problems to a certain extent without a significant lost of efficiency compared to liquid electrolytes. This study focuses on a comparative study of DSCs-based on $SnO_2/CaCO_3$ composite system in which liquid, gel and liquid/gel electrolytes are employed separately. Our previous studies show that $CaCO_3$ acting as a coating layer on SnO_2 suppresses recombination in SnO_2-based DSCs resulting in higher efficiencies. In this study, we have attempted to examine the effect of using a liquid/gel composite as the electrolyte in $SnO_2/CaCO_3$ system. Our basic device structure was FTO/$SnO_2/CaCO_3$/D358 dye/ electrolyte/lightly-platinized FTO counter electrode. The three different types of electrolyte mentioned above were used and their respective cell parameters were measured. The respective device efficiencies for Liquid-, liquid/gel- and gel- electrolytes were 5.50%, 5.30% and 5.00%. There I_3^- ion diffusivities were 6.70 x 10^{-6} cm^2 s^{-1}, 3.00 x 10^{-6} cm^2 s^{-1} and 0.39 x 10^{-6} cm^2 s^{-1}, respectively. The general trend of the results indicates that for $SnO_2/CaCO_3$-based DSCs there is no significant loss of efficiency due to the replacement of the liquid electrolyte by a pure gel- electrolyte or by a composite of the two. However, the use of a gel-based electrolyte could eliminate some of the practical limitations of the use of liquid electrolytes.

Keywords: Dye-sensitized solar cells, $SnO_2/CaCO_3$ composite system, liquid/gel composite system, diffusivity of triiodide ion, gel electrolyte, recombination

[02]

LI-DOPED SRI LANKAN VEIN GRAPHITE FOR RECHARGEABLE LITHIUM ION BATTERY ANODE

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ABSTRACT

Sri Lankan vein graphite has been categorized into four structurally distinct varieties, shiny-slippery-fibrous graphite (SSF), needle-platy graphite (NPG), coarse striated-flaky graphite (CSF) and coarse flakes of radial graphite (CFR). Sri Lankan vein graphite has been identified as promising anode material for lithium ion rechargeable battery and also purification, mild oxidation and alkali carbonates coating were able to enhance the anodic performances. The lithium-doping method have successful with natural graphite to decrease the irreversible capacity loss and improved capacity retention. Powder samples (<53 µm) of raw and purified NPG variety were mixed with lithium acetate (CH_3COOLi), weight ratio of 0.14 % (Li/graphite) separately and stirred with ethanol. The slurry was first vacuum dried to obtain powder samples, then calcined at 450 ^{0}C for 5 hour under air. Characterizations were performed by X-Ray Diffraction (XRD) techniques, Fourier Transform Infrared (FTIR) spectrophotometer and the electrical conductivity by the d.c. four probe technique. XRD results of the lithium doped graphite show reorientation of the planes of crystals parallel to the basal plane and the introduction of the new peaks at the 1600 to 1400 cm^{-1} wavelength region in FTIR provides sufficient evidence for the lithium doping on the active sites of graphite surface. Electrical conductivity of the treated graphite samples are still behaved in the semi conductivity range, exhibiting the sufficient electrical conductivity for the anodic application. Therefore, Lithium doping method can be successfully utilized to modify the Sri Lankan vein graphite with the aim of anode application in lithium ion rechargeable batteries.

Keywords: Vein graphite, Li-ion battery, Li-doping

[03]

SYNTHESIS AND ELECTRICAL CHARACTERIZATION OF LIBOB-BASED NANO COMPOSITE GEL ELECTROLYTE FOR LITHIUM-ION BATTERIES

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ABSTRACT

Rechargeable lithium-ion batteries have emerged as an excellent candidate over nickel hydride and lead acid batteries due to their high gravimetric and volumetric energy. Recently, researchers paid their attention on developing gel polymer electrolytes (GPEs) to overcome problems occurred due to liquid electrolytes such as leakage and solvent evaporation. However, GPEs exhibit lower conductivity values, possibly due to their crystallinity. In this study, polymer free novel gel electrolyte was prepared using lithium bis(oxalato)borate (LiBOB) salt along with propylene carbonate (PC) and ethylene carbonate (EC) with fumed silica as the gelling agent. First, liquid electrolytes were prepared by varying the Li:O ratio and obtained the best composition giving the highest conductivity of 7.1×10^{-3} S cm^{-1} at room temperature. Then the liquid electrolytes were gellified by introducing different percentages of fumed silica from the total weight of EC, PC and LiBOB, to the liquid electrolytes. The gel electrolyte comprises of Li:O ratio at 1:50 and 10% of fumed silica from the total weight of EC, PC and LiBOB gave the highest ionic conductivity of 5.29×10^{-3} S cm^{-1} at room temperature. This high ionic conductivity could be due to higher amorphous nature of the fumed silica based gel electrolytes. From the DC polarization measurement ionic nature of the gel electrolyte was confirmed.

Keywords: lithium-ion batteries, gel electrolyte, fumed silica, ionic conductivity, nickel hydride batteries, lead acid batteries

[04]

ENERGY USE, ECONOMIC OUTPUT AND TRADE: EVIDENCE FROM SUB SAHARAN AFRICA

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ABSTRACT

Economic output, trade and energy use are key macroeconomic variables of interest that tend to move together across time and as countries around the world continue to grow and develop there is an interest in learning more about the dynamic relationship between these variables. The paper studies the relationships between energy consumption, economic output and trade for a sample of 15 sub Saharan African countries over the period of 1980 to 2013. Using annual data observations it is found that the variables are non stationary and cointegrated. Thus the paper further employs panel cointegration technique and error-correction model(ECM) to investigate the relationship between the three variables. Panel cointegration test highlight a unidirectional relationship running from energy use to real GDP in both short run and longrun, and from energy use to exports in the shortrun. This implies that energy consumption cuts can have significant economic costs. The therapy causing the malady it was designed to avert. In contrast to earlier results, we find that these conclusions are more robust in the short than in the long run, suggesting that if technological change is accounted for, the growth and trade costs of energy consumption cuts should be lower.

Keywords: cointigeration, shortrun, longrun, stationary,error correction model ECM

[05]

IMPROVING TECHNICAL, ENVIRONMENTAL AND SOCIAL ASPECTS OF ELECTRICITY GENERATION USING BIOMASS: THE CONSTRAINS AND OPPORTUNITIES

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ABSTRACT

In the Sri Lankan context fuel wood and agricultural residues are the most common form of biomass available for electricity generation. However by 31st October 2012, only a 0.5MW biomass power plant which uses fuel woods was in operation. Convenient biomass which uses agricultural residues are the only biomass solution that operate effectively in Sri Lanka. As at the above date, there were 11MW of such plants in operation. The purpose of this study is to identify constrains and opportunities prevailing the biomass based electricity generation of the country. Further this study will evaluate the technical, environmental, and social impact on electricity generation by using biomass as source for electricity generation. The study initially comprises with a comprehensive literature survey followed by structured interviews with the experts in the industry. The study reveal that biomass has attracted interest as a primary energy source for electricity generation due to its potential as at low cost, indigenous supply of energy with considerable environmental benefits such as reduced carbon dioxide emissions, reduced soil erosion and restoration of degraded lands. Other advantages include social benefits, such as creation of local employment and improved availability of fuel wood for household us. Maintaining a regular supply of biomass to fuel the plant is the main challenge for effective implementation of commercial scale biomass plant.

Keywords: Biomass, Environmental Benefits, Renewable Energy, Sri Lanka, Social Benefits

[06]

IMPROVING THE ECO-EFFICIENCY OF PUBLIC RECREATIONAL CENTER BUILDINGS IN CANADA

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ABSTRACT

Indoor recreation is an integral part of the Canadian lifestyle. Hence, public recreational buildings have become salient parts of local communities. Studies show that the annual energy use intensity of aquatic centers ranges can be tree times more than that of an office building of similar size. Hence, recreational center buildings have become main contributors to the corporate carbon footprint of municipal governments. Currently, Canada is aggressively pursuing climate action agendas in federal, provincial and municipal levels. Improving the energy performance of recreational centres would support achieving the climate action goals stipulated by municipalities. The objective of this paper is to compare energy efficiency retrofit alternatives for a recreational center building. The target building is operated by a local municipality in British Columbia, Canada. An energy model of the public recreational center building would be created in a state-of-the-art energy simulation software. Innovative and proven energy performance enhancement approaches identified from the literature will be modelled to observe changes in energy consumption, GHG emissions and life cycle cost. Sensitivity analysis would be conducted to account for the data uncertainty. A scenario analysis would be conducted for simulated energy retrofits by considering various priorities of the municipal decision makers. Optimal energy alternative would be compared based on scenarios, eco-centric, sustain-centric and pecuniary-centric.

Keywords: Recreational buildings, climate change, energy retrofits, decision making

[07]

THE CHALLENGES OF EXTRACTING SUSTAINABLE DATA FROM INFORMATION SYSTEMS

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ABSTRACT

The rapid growing concern for environment has been the major motivation for businesses to raise the interest in more sustainable business practices. As a consequence business organizations have adopted initiatives to reduce the negative environment impact cause from business operations. In response to that organizations claim for information which is related to energy consumptions, transportation, process emissions, waste products and etc. In apparel sector, majority of business flows are supported by information systems but the focus for extracting sustainable data seems to be a burning issue for a long time in the industry. The purpose of this study is to identify those challenges to extract sustainable data from those information systems in apparel sector in Sri Lanka and through that identify solutions to overcome the challenges. The initial findings show that the amount of data available is huge and filtering the most relevant information out of them is a crucial task. Lack of consistency of information seems to be another challenge although data is available they are not organized in a proper way to analyze. Lack of integration is another challenge since different systems may provide different information on the same process and inability to extract sustainable data since current information systems doesn't have a feature to absorb those data. As a solution we propose a green information system which is an information system that has unique features to extract sustainable information from business activities.

Keywords: Sustainable data, challenges, green information system

[08]

INACCESSIBILITY TO MODERN ELECTRICITY SERVICES BY THE URBAN POOR IN DEVELOPING COUNTRIES

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ABSTRACT

With growing urbanization and more than 50% of the world's population living in urban areas a new face of poverty is evident, one in which informal urban communities cannot access or afford basic modern energy services for their development and empowerment. As an enabler of development processes, access to electricity in urban and peri-urban contexts plays a key role in providing possibilities and solutions to the urban poor. Energy poverty is no longer a rural-only phenomenon, and a concerted effort is needed to find solutions. Taking this into account, the Global Network on Energy for Sustainable Development (GNESD) initiated the Urban Peri-Urban Energy Access (UPEA) project in 2006. The objective of this study was to understand the barriers to energy access in the context of the urban poor in seven countries. Barriers from both the supply and demand sides for energy were investigated. Factors such as a lack of institutional coordination, weak alignment between energy policies and urban planning, and insufficient financial and social incentives appear to play key roles in constraining access to electricity for the urban poor. Overcoming these barriers will require innovative solutions in policies, decision-making, financing, multi-stakeholder dialogs, social inclusion, international cooperation, and knowledge sharing regarding good practices.

Keywords: energy poverty, energy access, informal urban settlements, innovative policies, good practice recommendations

VIRTUAL PRESENTATIONS

http://energyconference.co/2015/virtual-icoe-2015/

[01]

DEVELOPMENT OF SRI LANKAN VEIN GRAPHITE AND LOW-COST SYNTHESIZED MATERIALS FOR LITHIUM-ION RECHARGEABLE BATTERIES

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ABSTRACT

Rechargeable lithium ion batteries (LIB), at present, use expensive electrode materials such as synthetic graphite and transition metal oxides limiting their potential as cheap portable power source. Therefore, the present work attempts developing LIB with low-cost but performance enhanced anodes from Sri Lankan vein graphite and cathodes from locally developed $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$. Vein graphite was purified up to 99.98 % carbon by acid leaching prior to surface modification by mild chemical oxidation. Phase pure nano-scale $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ was synthesized by glycine nitrate combustion technique. The electrode materials were characterized by X-ray diffraction, Scanning electron microscopy and fourier transform infrared spectroscopy. Electrodes were prepared by tape casting the developed electrode materials onto respective current collectors. Finally, lithium ion coin cells were assembled using the developed electrodes with the non-aqueous liquid electrolyte. The initial discharge capacity of cell assembled with purified graphite was 98.8 $mAhg^{-1}$ and that of cell assembled with purified and surface modified graphite was 93.6 $mAhg^{-1}$ at C/5 rate between 3 and 4.2 V at room temperature. The coulombic efficiency of the cell assembled with purified and surface modified graphite increased to 100 % at the 9^{th} cycle while the cell assembled with only the purified graphite delivered coulombic efficiency of about 99.2 % at the 10^{th} cycle. This improvement of cycling performances may be due to the enhancement of graphite surface structure by mild oxidation. The results suggest that the electrochemical performances of LIB assembled with developed Sri Lankan vein graphite anode and the developed $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ cathode are promising.

Key words: Vein graphite, Lithium ion battery, cathode material

[02]

SUSTAINABLE MEMBRANE DISTILLATION

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ABSTRACT

The main purpose of this study is to develop a sustainable membrane distillation desalination (SMDD) system. Direct contact membrane distillation (DCMD) unit is connected directly to salinity gradient solar pond (SGSP). The used system contains 0.1047 m2 of hydrophobic hydroporos PTFE membrane module and a cooling pipe running all over the pond water surface. This system uses hot and high concentrated saline water that is extracted from non-convictive zone (NCZ) as a feed solution. Then, the brine discharges at the lower convictive zone (LCZ) of the solar pond. Therefore, if the saturated brine can be used to produce salts, there will not be any brine left over which may lead to low liquid discharge desalination. Furthermore, the cooling system pipe of permeate water is used as a wave suppression system where it is floating over the pond water surface. These waves are caused by wind driven currents which is responsible for undesirable pond surface mixing. The results are analysed and the system performance is being evaluated and will be presented in this paper.

Keywords: zero liquid discharge desalination, membrane distillation, solar desalination, and solar pond

[03]

ENERGY POLICY OF GREEN RATING SYSTEMS IN RELATION TO THE CONSTRUCTION INDUSTRY

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ABSTRACT

The construction industry and the built environment worldwide contribute to approximately 40% of the world's total energy consumption. This startling fact coupled with its robust contribution to GDP's and the economy of a country, highlights the vital importance of energy efficiency within this sector. This paper addresses energy policy in relation to the construction industry by using a compare and contrast method to evaluate popular energy conservation and efficiency programs frequently utilized by the construction industry in various parts of the world such as LEED, BREEAM, PassivHaus, Green Mark Scheme and the Green Rating Scheme. The study also breaks down the evaluation components of these programs to better understand the approach and apparent motives of these programs, namely scientific-based approaches as compared to business-based approaches and their respective effectiveness. The findings aim to assess stakeholder needs and evaluates buy-in for these different programs, in order to increase their respective impacts. Finally, the core focus areas that need to be considered in designing and implementing meaningful policies aimed at increasing energy efficiency in the construction industry are proposed. The key deduction of this paper is that when it comes to energy efficiency and green building programs across different world regions, one size does not fit all.

Keywords: Energy Policy; Construction; Energy Conservation; Sustainability

[04]

RENEWABLE ENERGY: A KEY TO SUSTAINABLE DEVELOPMENT

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ABSTRACT

Presently, 85% of current primary energy driving global economies comes from the combustion of fossil fuels and consumption of fossil fuels accounts for 56.6% of all anthropogenic greenhouse gas emission. Renewable energy sources can play a game changing role in providing energy services in a sustainable manner and, in particular, in mitigating climate change. This investigation gives an overview of the development and scope of CO_2 mitigation for clean and sustainable development. The use of solar drying of agricultural produce has good potential for energy conservation in developing nations, it was estimated that $1m^2$ aperture area can save 463 kg of carbon dioxide in life cycle .Biodiesel from nonedible vegetable oil reduces carbon dioxide emissions and petroleum consumption. Wind energy also present good potential in minimization of greenhouse gases where wind potential is available. The application of biomass gasifier at small scale industries is found suitable and it save considerable amount of conventional fuel. The improved cook stoves provide better kitchen environment to rural women and improve their health standards. This work explicitly points out the greenhouse gas emission mitigation potential depending on the use and availability of renewable energy.

KEY WORDS: ANTHROPOGENIC, GREENHOUSE GAS, SUSTAINABLE DEVELOPMENT, RENEWABLE ENERGY

[05]

INCORPORATING ENVIRONMENTAL EXTERNALITIES IN FUTURE ELECTRICITY MIX OF PAKISTAN

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ABSTRACT

The current research is aimed at the incorporating the external cost associated with power generation along with available fuel resources and power generation technologies, to find out the least cost future fuel mix. As the growing demand of electricity is increasing, fuel resources are along with increasing concerns of environmental issues. This situation has challenged the policy makers to make electricity supply possible in sustainable manner.

AnswerTIMES modelling framework has been used to develop PakistanTIMES model for the power sector of Pakistan. The model development is based on a number of assumptions and modelling parameters. The external cost of power generation have been incorporated to analyze the impact of GHG emissions on the overall fuel mix.

The power sector of Pakistan is analyzed with different scenarios like limiting import of fuels, limiting the CO2 emissions, and maximum utilization of indigenous resources.

Key words: environmental externalities, Pakistan, TIMES, electricity

[06]

RESEARCH ON BIOMASS COUNTY DISTRIBUTION AND COMPREHENSIVE UTILIZATION LAYOUT OF BIOMASS ENERGY IN JILIN PROVINCE

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ABSTRACT

Jilin Province of China is a typical farming, forestry and animal husbandry province, and produce huge number of straw, manure, forestry residue (referred to as forest waste), resulting in the burning of straw and feces to the rural environment has caused tremendous pressure. However, as raw material resources, straw, manure and forest waste has a certain economic value and high environmental value. On the one hand, through the comprehensive utilization of the biomass into green energy, organic fertilizers, make up the energy shortfall while reducing greenhouse gases, COD, and particulate emissions; on the other hand, it can be achieved regional ecological economy by rational distribution region with biomass energy starting point and organic fertilizer production, green agricultural production radiation. The paper analyzes the county distribution of the main biomass in Jilin Province. And then, it studies energy regeneration of biomass and events distribution of organic fertilizer and calculates the direct economic effect and environmental effect of recently biomass comprehensive development, according to the annual output of county biomass.

Keywords: Biomass, Energy regeneration, County distribution, Effect

[07]

MODELING, SIMULATING AND HEAT TRANSFER ANALYSIS AT UNGLAZED TRANSPIRE SOLAR COLLECTOR FOR BUILDING AIR CONDITION REQUIREMENT

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ABSTRACT

Unglazed transpire solar collector or UTC are kind of useful solar collector with high usage at industrial building or other building, introduced in the early nineties for ventilation air condition. nowadays. These collectors are used in all over the word, also recently lots of renewable energy research and investigation around this subject have done, major cause for saving energy and heating costs. This paper presents the details of a mathematical modeling and simulating for UTC used at 2 floor office building and collector heat transfer expressions, that the energy equilibrium equation were solved by the Matlab program. It predicts the thermal performance of unglazed transpired solar collectors over a wide range of collector body dimension design and operating conditions like plenum velocity sky factor coefficient. Results of the model were analyzed to predict the effects of key parameters on the performance of a UTC for a delivery air temperature for the office building heating air condition that the needed heat was determined by the Carrier Hourly Analysis Program V4. The parametric studies were carried out by varying the n-sky, Pitch, Perforation Diameter, Collector Depth, Plenum Velocity on the collector; Results indicate promising thermal performance of UTC in this dimension band, offering this kind of collector as a more useful alternate to glazed solar collectors for delivery air temperature for office building. The results of the model have been used to develop design restriction, which can be a valuable tool for a collector designer in optimizing the design and thermal performance of UTC. It also enables the prediction of the absolute thermal performance of a UTC under a given set of conditions.

Keywords: heat transfer, unglazed transpire solar collector (UTC), building air condition, carrier hourly analysis program v4., matlab, energy equilibrium equation