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Development of Demand-Side Management Strategies using Panel Meter and End user Feedback Information

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KEYWORDS : Energy Data, User Feedback, Demand Side Management, Micro-grid

The present study uses end users feedback and energy data from the panel meter to propose some demand side management strategies to reduce the electricity user at rural Ngarenanyuki secondary school, Arusha region. It was found that 47% of interviewed respondents agreed that there is an improvement in the academic performance, while 5% sees contribution of electricity in environmental conservation and availability of clean water at the school. The respondents also indicate that the electricity is mainly used for lighting (38%), printing (19%), charging (15%), workshop (15%) and pumping water (12%). On the other hand, the energy data indicates that high electricity consumption occurred early in the morning between 5 to 6 hours and early night between 18 to 22 hours. This is the time during which students are walking up and night study preparation respectively. The electric energy required by students for night preparation in 4 hours were estimated to be 1.36 kWh per day. The proposed strategies include; load shifting, use of more efficient appliances, restricting use of high power appliances and educating consumers about their micro-grid. Implementations of these strategies are expected to reduce energy use during peak hours, increase the system availability and reliability. For example, use energy efficiency lights such as Tronic (9 W) and AFRICABLIPER tube lights (18 W) on an existing micro grid system is expected to reduce the electric energy use by 27%.

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Solar Energy Deployment and Market Trends in Tanzania

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KEYWORDS : Solar Thermal, Solar Photovoltaic, Renewable Energy, Tanzania

The study present comprehensive report on the solar energy utilization in Tanzania with the special focus on currently installed solar PV systems and market trends. Furthermore, the strategies taken by the government and other actors to promote solar energy in the country are discussed. Solar energy offers huge potential for equatorial country like Tanzania which receives high level of solar radiation. Findings of this study reveal that there are ongoing efforts to tap this potential for both solar thermal and PV applications. However, its utilization is still in marginal stage due to technological related issues and the high initial cost associated with solar energy technology. To date, about 13 MW of solar PV electricity has been installed countrywide for various applications. The Power System Master Plan foresees that installation of solar power will reach 120 MW by 2016/2017 as the plan to expand power sector. There are also several private firms (such as Mobisol, M power, Rafiki power, etc) which have expressed interest in investing 50-100 MW of solar PV projects in the near future. Thus, solar energy technologies could help address energy access to rural and remote communities in Tanzania; and enhance energy security and climate change mitigation.

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Experiences on renewable energy as advanced appropriate technology for developing country sustainability

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KEYWORDS : renewable energy, wind, hydro, photo-voltaic, fresh milk, resource assessment

In this study, A few previous experiences on renewable energy application in foreign developing countries are introduced. KMOU lab leaded by the author has implemented academic level cooperation with Asia-Pacific countries, focusing on human resources capacity building by strengthening network between developing country universities and KMOU. The first cooperation was initiated by the successful KOICA program from 2009 to 2013 with Fiji University of South Pacific. The project budget was about three million US\$ covering the installation of 50kW photovoltaic power supply in USP campus, full renewable energy resource measurement equipment such wind mast, wave and tidal current assessment which are now deployed in several South Pacific Islands for accurate data acquisition, essential to renewable energy economy evaluation.

From 2013, a government R&D project funded by KETEP, MOCIE was started to facilitate Nepal small hydro power technology advancement by academic-industry collaboration between KMOU, Korean company and Kathmandu university, focusing on development of sand erosion proof technology, crucial in long and safe life guarantee for any hydro turbines which are vulnerable to flood season mountain sand attack. Research on turbine blade coating and easy-to-replace blade were continued and Nepal site demonstration test is under plan in the near future.

From this year, a new project supported by NRF program to develop a wind-photovoltaic hybrid power system for fresh milk preservation in Sri Lanka rural areas has been launched and will be continued for three years. More advanced details will be reported later.

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Cost-Effective Process Development for Large Area Smart Window

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KEYWORDS : Electrochromic device, Nanoparticle deposition systems (NPDS), Cost-effective, Smart window

Smart window which controls the light transmittance by changing its transparency is a technology used to reduce the loss of energy and enhance efficiency. As one of electrochromic devices, most of smart windows are fabricated by using coating technologies such as vapor-, solution- and solid particle-based processes. The most frequently used fabrication process is sputtering that requires high temperature and high vacuum environment which leads to high cost. In this research, a coating process called Nano Particle Deposition System (NPDS) was modified to fabricate large area smart window with low cost. Since NPDS process operates in low vacuum and room temperature environment, the cost would be much lower compared to sputtering process. Issues related to nozzle design, parameters for fabrication process, materials for electrochromic and electrolyte were dealt. The transparency, time and number of coloring/bleaching, cost, and solar transmittance of fabricated smart window were evaluated.

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Municipal Solid Waste to Energy: Challenges and Opportunities in Tanzania

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KEYWORDS : Municipal Solid Waste, Gasification, Waste-to-Energy, Composting, Landfill

Municipal Solid Waste (MSW) has been the main challenge to municipalities in the developing countries such as Tanzania, due to the increase in its production which is caused by technology development, community culture, urbanization and population growth. This is heightened by the scarcity of dumping site and environmental impacts associated with improper MSW management and disposal. It is estimated that by 2025 waste generation in the city of Dar es Salaam would increase to about 12,000 tonnes per day while in Arusha by 2014 the annual average MSW generation was reported to be 43,772 tonnes.

Many municipalities in Tanzania are currently using either open dumps or controlled dumps for MSW disposal whereas both methods does take little account in energy harvesting, environmental measures for leachate and harmful gas pollution such as carbon dioxide and methane. However, in recent years MSWs have been regarded as potential source of biomass for the production of renewable bio-energy.

Solid waste energy conversion technology is referred as Waste-to-Energy (WtE) which includes conversion method such as composting, anaerobic digestion, landfill, incineration, pyrolysis and gasification processes. However, with all these methods, waste composting and landfill are widely employed in Tanzania although they have environmental concern. Gasification process has outfitted other WtE methods as it is less polluting and also has enormous volume reduction in solid waste estimated to be about 90% but yet to be employed in Tanzania.

Therefore the purpose of this paper is to review previous and current studies on WtE technologies in Tanzania such as composting and landfill, asses its challenges and opportunities and propose MSW gasification process model suitable for Tanzania. Thus a thorough evaluation of the various WtE technologies would assist in the development of best WtE technology roadmap for future MSW to energy in Tanzania

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Reviewing Energy efficient Wireless Network Model for forest environmental monitoring

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KEYWORDS : Wireless Sensor Network, Forest Environmental Monitoring, Model,Algorithm

Forest temperature and relative humidity are two important environmental parameters for habitat monitoring, Soil contribution to global cycle and impact of soil animals caused by microclimate effect. Existing monitoring systems for forest environmental parameter lack in supporting real-time capture of every point of a forest at all times and early detection of fire threats. Solutions using wireless sensor networks, on the other hand, can gather sensory data values, such as temperature and humidity, from all points of the forest continuously, day and night, and, provide fresh and accurate data to other researchers and the fire-fighting center quickly. However, sensor networks face serious obstacles like limited energy resources and high vulnerability to harsh environmental conditions, that have to be considered carefully. In this paper, we propose a comprehensive model for the use of wireless sensor networks for forest temperature and relative humidity monitoring. Our model includes a packet forwarding mechanism in a collaborative Wireless Sensor network, algorithm that can find appropriate nodes to be awoken so that the paths that are long and heavy can be replaced by the shorter and lighter path and central data for collecting and storing remotely collected data.

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Performance Evaluation of Grid Connected Solar PV in the Tropical Conditions - a Case Study of Karume Institute of Science and Technology, Zanzibar

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KEYWORDS :

Solar photovoltaic (SPV) is one of the renewable energies expected to contribute a significant portion of the future energy needs in Tanzania. SPV use sun's light to generate electricity and Tanzania receives high level of solar radiation because is close to the equator. Due to the importance of the solar energy for generating electricity, the grid connected solar photovoltaic (SPV) power plants are also increasing worldwide. In Tanzania attempt has been carried out to connect solar PV in national grid power system like at Karume Institute of Science and Technology (KIST) in Zanzibar. However, detailed information on the performance analysis of the installed grid connected solar PV systems in Tanzania is limited. Therefore, the aim of this study is to comprehensively investigate performance of aforementioned solar PV- grid connected (75.63 kWp). The Normalized technical performance parameters of the plant are evaluated for the year 2016. The impact of height or distance from the roof, light intensity to the panel and angle of inclination on energy output of solar panel were investigated. First experimental set up included testing the power outputs of solar panel when placed at distance of 10, 15, 20 and 25cm from the roof. Another experiment was to test the panel's angle of inclination of 30°, 0°, 10°, 20° and 40°. The final experiment was to control light intensity by using aluminum foil placed at an angle of 30°, 45°, 50°, 55° and 60°. The results demonstrated that, the efficiency increased from 0.08 to 0.21 for the panel placed at 10cm to 20cm from the rooftop, respectively. This increase possible was because of cooling due to sufficient distance from the roof surface enabling enough natural ventilation.. Thus, the best performance were observed when the panels were placed at 20cm to 25cm from the roof surface, with an angle of inclination between 20° to 30° and light intensity when aluminum foil inclined at an angle of 45°. Annual average energy generated by the plant is 163.4743 MWh of the installed capacity energy which reduce the CO₂ emission of 97.431kg. It can therefore be concluded that, the performance of the grid connected PV system at KIST, Zanzibar is satisfactory in comparison with other systems from other tropical conditions

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Adaptive Reference Predictive Model- Architectural Design Review

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KEYWORDS : Architecture, Machine Learning, Complex Systems, Health and Environment

Timely prediction of the cases of cholera epidemics is essential in order to limit the size of an outbreak in terms of its duration and severity. Over the past decades, there has been great achievement in the development and implementation of epidemiological complex system models for effective prediction, transmission and overall understanding of cholera dynamics. However, most of these models have focused on adding more factors into its mathematical equations like, vaccination control factors, environmental effectors and its general dynamics to mention a few. It is very important to include all essential factors in the epidemiological complex system models so as to obtain accurate results of outbreaks' prediction. However, in the process of integrating more datasets/ factors in the epidemiological complex system models lead to the increase of their computational complexity. Since, it is very essential to integrate all required datasets/ factors in the model. This work extends the architecture of epidemiological complex system models, using cholera epidemic as a case study. Machine Learning is applied through the use of parallel programming techniques to reduce computational complexity of epidemiological complex system models. Architectural design with adaptive features is applied in redesigning the architecture to improve computational complexity.

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Ball treatment process as an alternative technology for plating

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KEYWORDS : Mechanical plating, Ball treatment, Alternative technology

Electroplating is the application of a metallic coating on a surface by means of electrolytic action. Electroplating are widely used in various industries for both functional and decorative applications. The greatest disadvantage of electroplating is hazardous pollutants used in process. For example, manufacture of hard chromium coatings using environmentally hazardous hexavalent chromium is prohibited in many countries. Fume control and waste disposal of spent acids and other chemicals are major problems for any plating process. It is difficult and expensive to dispose of all chemical waste. Searching for more environmentally friendly and cost-effective plating methods or design of alternative materials remain a critical technology challenge. A potential fabrication strategy for plating and creation of new multicomponent composite systems may be through the utilization of severe plastic deformation techniques. In this study, we demonstrate that intense plastic deformation induced by ball collisions can be an alternative technology for plating and can be effectively employed for solid state plating processes such as aluminizing and chromizing, as well as for fabrication of alternative complex composite systems. This is a room temperature process that does not involve any sophisticated equipment, creation of a controlled atmosphere, prolonged process cycle time and hazardous substance. The technique can be a prototype for a future environmentally friendly manufacturing.

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Appropriate technology based overseas volunteering project: A case study of SNU Global Volunteers in Kenya

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KEYWORDS : appropriate technology, overseas volunteering

In this study, the positive effects of applying appropriate technologies to the overseas volunteering project was evaluated through the case study of 2017 SNU Global Volunteers in Kenya , regarding the aspects of efficiency and sustainability. In recent years, the objective of overseas volunteering is changing from providing temporary workforce and supplies to helping the society's constant growth and sustainment by introducing appropriate technologies. Which emphasizes the significance of this study, as it would be the stepping-stone for analyzing the most efficient procedures and its outcomes of relating technical conveyance with the volunteering projects to Africa. The appropriate technologies applied to Kenya Volunteers were 1) rain water filtration system using bio-sand filters, 2) vaccine carrier developed by IDIM laboratory of SNU, and 3) solar panel installation. The evaluation was made directly from the participants of Kenya Volunteers, which supported our anticipation that applying appropriate technology would result in a more professional and effective assistance to the visited society. However, there were opinions stating that on our next volunteering projects, the selection and application of technologies should be considered more thoroughly through investigation so that the technologies would not only help the society maintain itself, but to help it improve and reproduce.

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Sustainability through Empowerment and Ownership

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KEYWORDS:

There have been a lot of efforts over the years to build capacity of the local individuals and to increase the effective usage of resources in developing countries. However, it is also known and accepted that the activities will not last long enough for meaningful impact on both individual and community level.

How does the sustainability come about? It needs to happen both individually and with the group.

Individually one needs to find who he/she is, their own identity; uniquely created, free to learn, imagine and create things, and to share their discovery with others. This does not happen with textbook learning or classroom instruction. This comes easier with concrete experience of 'make' process, namely taking the action to completion regardless of success or failure. Once a person goes through a process of making a thing, one's view about him/herself changes with greater view of possibilities. At that time, we can come in as coaches or mentors with different options to pursue and go through the process as partners. This can be repeated with more careful measure. The process matures each time it is repeated. After that, encouraging them to lead others with what he/she has gone through will help them rediscover who they are, empower them to serve others, and make contribution to the community where they belong.

However, individually they can go through hardship with many unknowns. That is why the group dynamics are needed. People in a safe group environment are encouraged to make things together (co-making) and share ideas to expand their work. Different talent and insights are shared for a bigger project and community work. Issues like drought, road conditions, drinking water and education can be shared toward a shared vision. Dreaming things together, members in a group are often bonded like a family.

A few principles involved in this process are; they are entrusted with responsibility, it is ok to make mistakes (involved in decision-making process), good efforts need to be recognized, and repeated tasks need to be shared with others – learning the management process and entrepreneurship.

In addition, the operation becomes effective with just a micro-scale 'power infrastructure'. This is the case of our empower community center with 1,000 watt solar power.

E3empower's Empower Community Center started with 5 different micro-enterprises, all powered by the solar electricity. An IT Café - copy center remains very successful after 3 years. Nyanda, the copy center manager, without any IT work experience, saw the opportunity and kept on learning different operations while conducting simple operations with commitment. Now he has opened a 2nd copy center, offering many services similar to a regular print shop. Because of this successful shop, others remain operational, a sustainability example.

The 2nd empower community center has developed a TV media center. Young adults from the US and from Arusha University in Tanzania put their hearts and minds together and launched a new business line for the community. Now it also has a bio-gas business, a water filter shop, a preschool, and a solar lamp shop. It has become a landmark of the off-grid rural village.

IT Education – we live in the information age. Things change very fast. IT education is now a life-time skill for everyone to have. Focusing on secondary school students with computer basics and programming skill with simple block coding like Scratch has proven that students remain engaged in learning processes, produce creative articles of their own, and are able to link with future jobs and services. We are now expanding it to STEM education with Robot coding lessons.

Case of Business Plan Competition – people were encouraged to develop their own business ideas. 70 teams applied for the competition in July 2016. 15 teams were selected and went through a lean-startup training. 5 finalists were awarded with cash grant and business coaching. After one year, 3 remain successful, 1 struggling and 1 got shut down by a new overly-restrictive government regulation (very unfortunate). They took the challenge with ownership and are on the path of sustaining empowerment.

iTEC: iTEC (Innovative Technology and energy Center Tanzania) is setting up an integrated system platform (maker space) to provide an opportunity to local people to develop/update a product/service design, and to redefine designs with state-of-the-art dependable power tools and CNC equipment. iTEC also provides an incubation center in appropriate technology, IT education and technology product/service business start-ups with entrepreneurship training.

Now it is time to bring HOPE to Reality. There are encouraging signs everywhere. Seniors and students will work together to bring greater impact to Tanzania.

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Performance analysis of bone charcoal sold in the Arusha region and design of school-scale filter system

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KEYWORDS : defluorination, bone charcoal, Arusha

Groundwater in Arusha shows a high concentration of fluoride which is known to have a profound effect on the teeth and bones. Considering Arusha's natural environmental and economic conditions, 'bone charcoal' has been used among several other methods to eliminate fluoride in groundwater. However, since the scale in prior studies has usually been limited to household use, data on making a filtration system for school scale is yet to be composed. Therefore, we conducted a quantitative analysis of the efficiency of the bone charcoal sold in Arusha to develop a proper filtration system working at the school scale. In order to obtain the adsorption capacity of bone charcoal, several tests were performed. As a result, the adsorption capacity was found to be 0.49mg/g and the lifespan of 30g of bone charcoal in 20ppm fluoride solution was 10hours. Based on this data, it is expected that the bone charcoal filter with the capacity suitable for the water quality of the schools can be designed and the use of the filter will have a positive effect on the water quality and improvement of the dental health of people in Arusha.

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I express our special thanks of gratitude to Dong sun Lee, director of Serving Friends International in Arusha branch, who gave us the golden opportunity to do this interesting project and helped us in every way preparing for this research. And I would also like to thank Student Directed Education Program in SNU for supporting us.

I-DREAM: a Collaboration Partner for Inclusive Development of Africa

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KEYWORDS : appropriate technology, Europe, Chad, regional development

Inclusive Development Research Association for Mankind (I-DREAM) is a non for profit, non-governmental charity organisation, established by Korean scientists and engineers in Europe, under French association law (association loi 1901). Although I-DREAM is registered in France, its members are distributed over Europe and its sister organisation is also working in Chad. The association pursues contributing appropriate technology to developing regions in the world, in particular Europe and Africa.

I-DREAM has organised diverse activities since 2013 within its members or in collaboration with external partners. Diverse conferences and events for the members have been held to disseminate appropriate technology. I-DREAM has researched several appropriate technology for sustainable development of regional community including eco-friendly architecture for African environment, bio-digester, agriculture-based resource circular industry and product design. In addition, international conferences and technology education programme on inclusive development have been organised for African communities. In order to encourage future generation, appropriate technology camps have been organised for youth in Europe, and hundreds of books for African children have been sent to Africa every year.

This presentation intends to explain the main activities of I-DREAM and discuss the collaboration opportunities with Tanzania. I-DREAM hopes to share its knowledge and experience from Chad with Tanzania.

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International Conference on Inclusive Development 2015

Development of Photovoltaic System and Commercialization Program for a Business in Mozambique

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KEYWORDS : Solar energy generation, Business model, Convergence education, Mozambique, Sustainability

This research is about the project to make solar power energy equipment development into a business that fits into the social and environmental circumstances of the local technology of Mozambique and their market demand in order to eradicate poverty and improve quality of life. This project not only delivered the necessary technology, but also aimed to optimize the cost efficiency by making maintenance fees unnecessary. This was attained through creating an environment of economically independent operators and combining them with business. A feasibility study through a community consultation was conducted to meet the needs and expectations of the local people of the pilot area. As a result, it brought societal, economic and environmental impacts on the project area through development and installation of solar power generator, commercialization support, development of solar power technology engineering and economic engineering. In addition, through continuous monitoring of the solar power generators that were installed, results can be compared with initial expectations. If data is collected for a year, the location's efficiency for a solar power generators compared to its estimated capability can be determined. This will prove to be useful projects in developing countries to boost development of rural areas without electricity..

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Implication of Empowerment Evaluation for the Tanzania-Korea Innovative Energy Technology Center

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KEYWORDS : Empowerment evaluation, iTEC, Sustainability, Tanzania, International development

Tanzania-Korea Innovative Energy Technology Center (iTEC) is designed to develop, and commercialize innovative & suitable appropriate technology and provide related education for the rural district of Arusha in Tanzania by integrating the sectors of renewable energy, agricultural transportation and distribution, public health and water, education and vocational training, and business innovation. Given the concept of the project, empowering beneficiaries is a key factor in achieving project success. Thus, this study explores empowerment evaluation (Fetterman, 1994, 2005, 2015), a relatively new approach to program evaluation which recognizes the beneficiaries as the main participants of the process of evaluation. Empowerment evaluation refers to the use of evaluation concepts, techniques, and findings to promote improvement of and self-determination by the program implementers and benefitting community. Its objective is to empower people to help themselves and to improve their programs using forms of self-evaluation and reflection, while also building their evaluation capacity. The empowerment evaluation approach holds significant implications for the monitoring and evaluation process and results of the Tanzania-Korea iTEC program in its effort to achieve capacity-building, community empowerment, and long-term sustainability.

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Appropriate Technology for Drinking Water Using Hybrid System Combined with Trickling Filter

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KEYWORDS :Appropriate Technology, Hybrid system, Rock filter, Drinking Water

About 800 million people in the world are not provided with water supply and most of them are located in the developing countries. These people are exposed to the risk of water- caused diseases such as diarrhea and disease-causing pathogen due to the failure of clean water supply. Thus, WHO (World Health Organization) is encouraging low-cost technology which is appropriate to domestic water treatment. Recently, the supply of appropriate technologies using MF membrane such as Life straw is concentrated on developing countries. However, surface water quality in these developing countries include SS which have organic matters with high concentration and large particles and in case of the filter such as Membrane, the amount and quality of processing water can be decreased due to the flux reduction caused by fouling. Therefore, in this study, it was focused to reduce the load of organic matters from the influx of MF Membrane and improve the effectiveness of water treatment. Toc removal during 45 days were resulted as the order of M-4>M-2>M-3>M-1. In spite of shock loading, M-2 and M-4 showed high TOC removal. Before MF, M-2 and M-4 showed high organic removal, it means organic matters were removed by BSF+MF. Backwashing of M-1, M-2, M-3 and M-4 was performed as four, two, three, no backwashing, respectively. M-4 is sustainable reactor to obtain clean water. <-4 using as pretreatment both BSF and TF indicated high arsenic removal as 97%.

ACKNOWLEDGEMENT

An Energy-Efficient Approach to Control Moment Gyroscope: ES-CMG Prototype

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KEYWORDS : CMG, power saving, energy efficiency

Control moment gyroscopes (CMGs) are used as a torque amplifier of an indirect actuator. One of the major drawbacks of CMGs has been known as its high power consumption. For the purpose of seamlessly producing the gyroscopic torque in the gimbal housing system, the flywheel should rotate at a high speed constantly. Nevertheless, the attitude control of many dynamical systems such as satellites, ships, and ground systems has been conducted through the high power consumption actuator, CMG. In the previous research, a CMG-based single-wheel robot system has been developed at Chungnam National University. Through the experience of the CMG development, there has been always a question about how to reuse and save the power of the high rotating flywheel system. In this paper, we develop a prototype named ES-CMG (Energy-Saving CMG) for the feasibility test of energy efficiency. In the ES-CMG, both the motor system and the generator system are utilized in the flywheel system. Firstly, the developed ES-CMG is introduced. The mechanical interface between the flywheel and the generator is developed by using a 3-D printer. Secondly, overall mechanism of the designed system is analyzed. Thirdly, the power efficiency of the proposed system is compared with that of a pure CMG architecture. Finally, the advantage and the disadvantage of the proposed system are discussed on the basis of experimental studies.

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Design and Implementation of a Mobile Cart for Carrying and Cooling Vaccines

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KEYWORDS : Mobile cart, vaccine, cooling and carrying

Doctors without borders(DWB) have reported that vaccination to children in advance for pre-protection from diseases can save lives of many people from infection by preventing diseases from spreading around. Since vaccination has to be done for as many people as possible for a limited time, Doctors have to travel to the innermost depths of countries. Then carrying vaccines in good condition to the operation place is the most important concern. Preserving Vaccines at an appropriate temperature is quite important in hot weather condition in Africa, East South Asia or South America. Specially, when Doctors have to travel long distance without transportation, vaccines should be well preserved. Two concerns to be tackled are preserving vaccines in good condition and carrying vaccines with ease.

In this paper, the feasible mobile cart for tackling the problems is designed and implemented. The cart is designed as a mobile robot platform with a cooling function such as a refrigerator. The cart is implemented such that a human can drive it with ease since it is actuated by dc motors. The refrigerator box has been built to fit the mobile cart. Cooling action of the refrigerator box is performed by using Peltier effect. Cooling performance of custom built refrigerator is also tested through experimental studies. In addition, energy saving factors are also discussed.

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Flow-electrode Capacitive Deionization System using Solar Energy

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KEYWORDS : Solar, Capacitive, Water, Deionization

The capacitive flow-electrodes have recently been studied for use in capacitive deionization (CDI) applications due to their continuous and easy scale-up characteristics. We are now planning a project to develop an emerging desalination technology based on the flow-electrode capacitive deionization (FCDI) in coupling with solar power generation.

In this project, we will design and build a solar powered FCDI system that supplies potable water to small communities without power-grid infrastructures using brackish groundwater or other ionic contaminant water as the water source. The major expected outcome of the project is a working FCDI desalination system that is solely powered by solar energy. Such a system includes a FCDI desalination cell, a flow circulation and water/flow-electrode storage system, a solar panel and power storage system, an automatic control system that coordinates the functions of the different subsystems.

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Sintering and electrical characterization of cubic zirconia compacts prepared from synthetic nanoscale powders by urea hydrolysis

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KEYWORDS : cubic zirconia, nanoscale powder, urea hydrolysis, conductivity, grain boundary.

Active nanoscale powders of cubic phase zirconia stabilized with yttria, gadolinia, and scandia were successfully prepared by urea hydrolysis. Synthetic cubic zirconia powders had homogeneous, nanoscale, and less-agglomeration characteristics. Dense pellets of grain size about 0.4 μ m exhibited grain boundary blocking resistance compared to the high frequency bulk resistance. Gadolinium doped system exhibited highest ionic resistivity. Yttria stabilized zirconia by urea hydrolysis in this work showed smaller ionic resistivity than the sample prepared from the commercial powder.

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Hydrogen Sulfide and Ammonia Removal from Biogas using Water Hyacinth-derived Activated Carbon

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KEYWORDS : cubic zirconia, nanoscale powder, urea hydrolysis, conductivity, grain boundary.

The presence of H₂S and NH₃ in biogas brings negative effects to environment, human health and properties used through corrosion. On the other hand water hyacinth plants pose a serious problem in aquatic life including interference of fish breeding sites and water ways. These effects bring a necessity to treat biogas before its utilization as well as looking for better solutions to reduce water hyacinth from water bodies. In this study water hyacinth-derived carbon (WHC) was prepared by carbonization at different temperatures (450- 650° C) then chemically activated with KOH to produce water hyacinth activated carbon (WHAC) at 700°C temperature for 30 min. The activation was at 1: 0.25, 1:0.5 and 1:1 WHC:KOH. The WHAC samples then were used as adsorbents for H₂S and NH₃ from biogas. It was found that carbonization temperature, gas flow rate, mass of adsorbents, and impregnating ratios have effects on the efficiency of the adsorbent. The adsorption capacity was found to increase with the increase in carbonization temperature; as carbon prepared at 450, 550 and 650°C afforded H₂S removal efficiencies of 22, 30 and 50%, respectively after 2 h, while NH₃ removal efficiencies of 42, 50 and 74%, respectively. The impact of activation ratio is clearly shown as the increase of KOH increased the adsorption capacity of the AC as arching of the AC increased. The highest ratio of 1:1 of carbonized material at 650°C removed 93% of H₂S and 100% of NH₃ after 2h of use. The adsorption capacity of NH₃ increased with the decrease in flow rate from 83 to 100% at flow rates of 0.11 and 0.024 m³/h respectively. H₂S and NH₃ were successfully removed from the biogas. These results have added a solution to clean energy and will solve the water hyacinth causing problems in aquatic environment.

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Comparative Study Between four Solar Water Heaters of Integrated Storage Type: Sand, Concrete, Clay, PCM

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KEYWORDS : water heating, solar energy, Thermal performance, Integrated Storage/collector .

This work represents an experimental study of four an integrated collector/storage solar water heater which storage is provided by different materials as concrete, clay, PCM and sand. We have followed the evolution of the temperature of solar water heaters in a Tunisian climate and compared the results to know which one has the best performance. The experimental results showed acceptable thermal performance for all water heaters but with a significant difference.

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Appropriate Monitoring Platform for Renewable Energy Plants in Nepal

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KEYWORDS : Monitoring, Renewable Energy, Arduino, Nepal

Even in non-urban and rural areas of developing countries, electricity is irreplaceable form of energy which powers up home appliances and especially lights for many home places. Yet, supplying electricity in such rural areas has not so much been an easy task due to the diverse geographical circumstances of the developing countries. To solve the aforementioned issue, renewable energy system that utilizes hybridized sources of solar, wind, hydro power was developed in Thingan, Nepal in the previous years. Generation of power from the hybrid systems was successful enough to benefit the lives of a few thousands of people in Nepal. As continuation and improvement of the former research, monitoring systems have been installed onto the power plants of Thingan. Since key issues with the hybrid systems installed in Thingan, as well as many other off-grid power plants are denoted with active monitoring, implementation of monitoring devices is necessary to stabilize the supply and analyze the demand of power. The monitoring systems were constructed based on the Arduino board which is easily accessible, cheap and multi-compatible. This system makes use of 16 sensors which measure up meaningful variables from each power source of the hybrid systems such as solar radiation, photovoltaic voltage and current. While measuring and gathering such information, delivery of the data is conducted and records them in the web page for analysis. A strong factor to consider when establishing such monitoring system in Thingan as well as many other regions of developing countries is 'affordability'. As conventional monitoring devices are manufactured with relatively expensive electrical components, it is not suitable to directly apply and use the monitoring gadgets in less developed regions. The fact that the newly fabricated monitoring systems in the research was designed with relatively cheap but fully functional parts in the context of affordability and also the high compatibility of application in other similar areas gives itself a spotlight for contribution to the field of renewable energy.

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Cyclopentadithiophene-Benzothiadiazole Polymer for solar cell applications: Review

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KEYWORDS : PCPDTBT, Bulk heterojunction, Charge mobility, Nanomorphology, Optimization, Power conversion efficiency

Conjugated organic polymers unite photo-electronic properties of semiconductors with mechanical flexibility of organic compounds in a structure that can be modified by modular chemistry at low temperatures in solution phase. Application of these polymers as p-type donor in photovoltaic devices has potential to revolutionize the solar energy harvesting through production of low cost, flexible and large area solar modules. Cyclopentadithiophene-Benzothiadiazole is a low band gap co-polymer that exhibits highly efficient photovoltaic activity in the visible and infra-red region of solar spectrum and has excellent charge carrier mobility necessary for high efficient solar cells development. A review of this polymer is provided. The characteristics, synthesis approaches, applications in photovoltaic devices and advancement optimization and material engineering for better efficiency and applicability are highlighted.

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Stokes flow around a moving obstacle in a microtube

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KEYWORDS : Axisymmetric flow, Circular tube, Complex eigenfunction, Disk, Drift velocity, Hagen-Poiseuille flow, Stokes flow

Axisymmetric Stokes flow around a disk in a circular tube is investigated on the basis of Stokes approximation, where radius of the disk located coaxially with the circular tube is arbitrary. The disk translates perpendicularly to its own plane along the center-line of the circular tube and there exists Hagen-Poiseuille flow far up- and downstream from the disk. The velocities of the translating disk and the Hagen-Poiseuille flow are given arbitrarily. The problem is investigated by analyzing Stokes equation using complex eigenfunction expansion and the least square method. The streamline pattern from the stream function and the pressure distribution of the flow fields are shown for some typical cases. The force exerted on the disk and the pressure drop due to the disk are calculated as functions of the radius of the disk. For a given velocity of the Hagen-Poiseuille flow in the tube, translational drift velocity of the disk is also determined. When the disk translates in the stagnant circular tube, a series of viscous toroidal eddies appears apart from the disk in the circular tube, as expected.

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Evaluation and Optimization of Manufacturing Process Considering DFM (Design For Manufacturing)

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KEYWORDS : Design for Manufacturing(DFM), Manufacturing Process, Tolerance

DFM (Design For Manufacturing) is devised first by Stoll at 1986. It is extended concept from DFA (Design For Assembly). DFM is concept that when design is processed, via considering many factors like manufacturing, try to reduce cost and increase quality. Nowadays DFM is extended to DFX(Design For 'X') like a DFE (Design for Environment) or DFaM(Design For additive Manufacturing)

To apply DFM effectively and organize optimized manufacturing process, exact and detail evaluation tool about vital values like Q/C/D (Quality/Cost/Delivery) of entire manufacturing process is essential with macro perspective. However, designer's view is normally focused on micro and detail field, researcher's view is normally vague, so studies about DFM lack specific evaluation about manufacturing process and changing design.

In this research, to develop evaluation tool that can be adjust generally to specific case, evaluation about manufacturing process is tried and adjusted to specific part, shroud, considering 3 factors, way to make a raw material/transfer time and cost between each process/ tolerance and availability/sequence of process, those are not normally handled by previous research.

Using result of research, defining rules and developing tools to design optimized manufacturing process to fabricated the part with given shape and constraints will be future work of this research.

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Review on Reducing Carbon Emissions from Transport Sector in Tanzania

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KEYWORDS : Carbon emissions, Transport sector, Greenhouse gases, Fossil fuels

In order for Tanzania to meet the obligation under United Nation Framework on Combat Climate Change (UNFCCC) in reducing Greenhouse gases (GHG) emission, various institutions and stakeholders have to undertake appropriate research and measures on how to reduce carbon emissions by sectors such as transport sector. Thus, the main aim of this study is to identify and bring awareness on sources of Carbon and Carbon Dioxide (CO₂) emissions on road transport, the efforts carried out by different authorities in Tanzania to mitigate carbon emissions, identify challenges and constraints, and highlight the way forward, including policy measures. All most 100% of Tanzania's road transportation energy comes from petroleum - based fuels particularly diesel and gasoline. Burning of these fuels for mobility contributes about 57.57% of total carbon dioxide emitted by the transport sector. The major causes of carbon emissions in Tanzania include high number of old (second hand) vehicles on the road, dependency on fossil fuel, poor road infrastructures, vehicle road congestion, lack of mandatory vehicle periodic emission test and vehicles maintenance. The carbon emission results on health, socioeconomic, and environmental effects. Currently, the government of Tanzania has started to carry out an initiative stage on reducing road transport emissions through improving road infrastructures and Construction of fly-over roads to mitigate road congestion, establishment of an authority (Dar es Salaam Rapid Transport Agency) responsible in designing and operationalize rapid transport network for the city of Dar es Salaam. Also, the government has launched out the first imported vehicle inspection center under two institutions National Institute of Transport (NIT) and Tanzania Bureau of standard (TBS) inspecting vehicle road worthiness and emissions. This will contribute significantly on reducing carbon emission in the country. In order to achieve the goal of reducing carbon emission from road transport, the government has to state in its policy a mandatory inspection and emission testing of all vehicle at specified time, reduce importation of old vehicles, set the age limit of the vehicle to be legally operate on the road, switching to alternative fuel and use of less emitting fuel like compressed natural gas.

ACKNOWLEDGEMENT

Vaccine Supply Management in Developing Countries: A Case Study in Tanzania with Vaccine Carrier

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KEYWORDS : Vaccine carrier, Critical temperature range, Peltier

Vaccine is considered the most efficient tool to prevent infectious diseases. Since vaccine should be stored in the proper critical temperature range, many types of vaccine carriers have been introduced to deliver vaccine from distributors to health posts. However, based on the field report from developing countries, large number of vaccines are thrown away during delivery. To reduce the number of wasted vaccines, in this research, a multi-functional vaccine carrier was developed. First, two prototypes of vaccine carrier, ice-box type and Peltier cooling type, are introduced and the cooling performance is evaluated in the controlled environment. Then, real-time monitoring of vaccine's condition is realized by satellite communication. It relays the location (GPS, global positioning system) and temperature data of the vaccine carrier to the web-server. To evaluate its working performance in developing countries, the vaccine carriers are tested in Tanzania. Real-time information of vaccine's status is uploaded onto the web server to allow checking and monitoring the data. Finally, few functionalities were integrated in the top lid of the vaccine carrier.

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Electrification of the Alpine Villages in Nepal

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KEYWORDS : Electrification, Vaccine Cold Chain, Power Plants, Plants Monitoring, Renewable Energy

While it is true that electricity enables human activities and provides irreplaceable convenience during day and night, the recipients of such technology have been mainly limited to the developed countries. In ways to cope with such limited access to the energy, it is inevitable for the developing countries to implement regionally specific strategies to harness electricity. In case of non-urban areas in Nepal whose geography entails lavish mountainous areas, conventional means of electrification is not suitable. In attempts to cultivate power sources from all natural environments and to electrify the high-altitude Alpine villages in Nepal, a five-year research has been carried out. With limited sources of power generation, combined renewable energy from wind, sun, and water were all extracted from the power plants installed by the Solar Volunteer Corps dispatched from Korea. With the available access to electricity, houses in the local villages were all electrically wired to use a light bulb. The usage of generated electricity in local health posts also expanded the vaccine coverage, possibly saving children with untreated diseases. As a result, many thousands of residents of local villages are now provided with at least the minimum amount of electricity needed to sustain their daily lives. The meaningfulness of the research lies in the real-life implementation of harnessed energy which also contributed to the welfare of the local villagers in Nepal.

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