

INTERNATIONAL CONFERENCE ESD - 2008

Energy

for Sustainable Development

Abstract Book

Jointly organized by

*Department of Chemical Engineering
Dawood College of Engineering and Technology,
Karachi- Pakistan.
www.dcet.edu.pk*

*Department of Chemical Engineering
COMSATS Institution of Information Technology,
Lahore -Pakistan*

PREFACE

To evaluate proposed solutions to the looming energy crisis one must understand the current world's energy system. It is important to know; how much primary energy is currently used world-wide and might be needed in 2100; the forms of energy sources, the end uses for energy and how much is currently supplied by fossil fuels; how important energy is to the welfare of people; the limitations of renewable energies and fossil fuels; and the potential for nuclear fission energy.

Energy resources and their utilization intimately relate to sustainable development. A sustainable energy system may be regarded as a cost-efficient, reliable, and environmentally friendly energy system that effectively utilizes local resources and networks. In attaining sustainable development, increasing the energy efficiencies of processes utilizing sustainable energy resources plays an important role.

The methods of improved energy analysis influenced the design and the manufacture of energy conversion devices. At the same time the need for waste reduction and cleaner environment is persisting and cannot be ignored.

Energy plays a critical role in reducing poverty and fuelling economic growth. Energy use and poverty are related in many ways. Poor people unable to use enough energy to support the activities that will increase their welfare including access to water, agricultural productivity, health care, education and job creation. The efforts by poor countries to meet the Millennium Development Goals, especially the goal of halving the number of poor, will be impaired unless adequate attention is paid to the crucial role energy services play in the development process, particularly in relation to the economic, environmental and social well-being of the poor.

To address the vital issues related to "Energy and Sustainable Development" an extensive debate is needed. The First International Conference, ESD-2008 has brought together hundreds of professionals from academia, industries, local enterprises and agencies to translate ideas, success stories, case histories, current trends, and technologies into solutions for energy security and environmental protection. The proceedings hold technical and research papers and review articles covering almost every aspect related to energy. The paper presented at ESD-2008 cover topics related to local, regional and global energy problems.

The number of themes and unequal distribution of the papers under these themes represents particularly the academic response to the call for papers. Issues of local concern and expertise are particularly well represented. Perhaps in future years it would be appropriate to encourage participation from a wider perspective.

The ESD-2008 Conference has initiated a dialogue among all the stakeholders in an area of immense importance which must result in specific actions, to craft suitable policies and to take the necessary action to protect and sustain the environment. We hope research papers and technical work presented in ESD 2008 proceedings will evoke interest and subsequent discussion and practical implementation not only by the delegate attending the conference, but also by others involved in energy related activities like industry, policy making, research and teaching institutions, NGOs and individuals working in private and public sector.

Engr. Abdul Waheed Bhutto
ESD-2008 Conference
Dawood College of Engineering and Technology,
Karachi-Pakistan
www.dcet.edu.pk

Editor in Chief: Abdul Waheed Bhutto

Editor: Aqeel Ahmed Bazmi

Associated Editors

Dr Haroon Jangda	DCET, Karachi
Dr Moinuddin Ghori	CIIT Lahore
Dr.Asadullah Khan	CIIT Lahore
Dr.M.Nadeem Kardar	CIIT Lahore
Engr Nisar Ahmed Pathan	DCET, Karachi
Engr M Hanif Memon	DCET, Karachi
Engr Rashid Beg	DCET, Karachi
Engr Fahid Iqbal	DCET, Karachi
Engr Iftakhar Memon	DCET, Karachi
Engr Akhtar Shah	DCET, Karachi
Ar Yaira Naeem Pasha	DCET, Karachi
Engr Sadia Karim	DCET, Karachi
Engr Rashid Mustafa	DCET, Karachi
Engr.Abrar Inayat	CIIT Lahore
Engr.Amjad Riaz	CIIT Lahore
Engr.Fahad Rehman	CIIT Lahore
Engr.Zakir Khan	CIIT Lahore
Engr.Ghulam Murshid	CIIT Lahore
Engr.Imran Aslam	CIIT Lahore
Engr.Faizan Ahmad	CIIT Lahore

Conference Patronage

Prof. Dr. Atta ur Rehman (Chairman, HEC)
Dr. S.M. Junaid Zaidi (Rector, CIIT)
Prof. Dr Nasim Ahmed (Principal, DCET)
Prof.Dr.Shoukat Ali Hayat (Director CIIT Lahore)

Advisory Committee

Dr Haroon Jandga	DCET
Dr. Moinuddin Ghauri	CIIT Lahore
Dr.Asadullah Khan	CIIT Lahore
Dr.Pervez Khalid Butt	CIIT, Lahore
Dr.M. Shamim Sabir	CIIT, Lahore
Dr. Nasir Mahmood	CIIT, Lahore
Dr.M.Nadeem Kardar	CIIT, Lahore
Dr Abdul Khaliq Ansari	MUET, Jamshoro
Dr. M A Damani	Karachi University
Dr. Wasiuddin Ahmed	Karachi University
Dr.Amjad Hussain Dilawari	UET, Lahore
Dr.Pervaiz Akhter	PCRET, Islamabad
Prof. Dr. Arshad Chughtai	PU, Lahore
Prof. Dr Niaz Ahmed	PU, Lahore
Prof. Dr. Hafiz-ur-Rehman Memon	MUET, Jamshoro
Engr Sohail A Soomro	MUET Jamshoro

Organizing Committee Members

Abdul Waheed Bhutto	DCET, Karachi
Aqeel Ahmed Bazmi	DCET, Karachi
Engr Nisar A Pathan	DCET, Karachi
Rana Singh Rajput	DCET, Karachi
Engr Ashfaque Wali	DCET, Karachi
Mula Bux Shaikh	DCET, Karachi
Javid Iqbal Mehar	DCET, Karachi
Mustaque Shaikh	DCET, Karachi
Imdad Memon	DCET, Karachi
Sadia Karim	DCET, Karachi
Engr. Abrar Inayat	CIIT Lahore
Engr. Amjad Riaz	CIIT Lahore
Engr.Zakir Khan	CIIT Lahore
Engr.Ghulam Murshid	CIIT Lahore
Engr.Imran Aslam	CIIT Lahore
Engr.Fahad Rehman	CIIT Lahore
Engr.Beenish	CIIT Lahore
Engr.Sidra Nisar Malik	CIIT Lahore
Miss Maryam Irshad	CIIT Lahore
Miss Kanwal Rasheed	CIIT Lahore

Design Development and processing team

Engr Fahid Iqbal	
Arif	
Sadia Karim	DCET, Karachi
Abrar Inayat	CIIT Lahore
Amjad Riaz	CIIT Lahore
Amir Alauddin	CIIT Lahore

Supporting Staff

Shakir Khan	DCET, Karachi
Fateh	DCET, Karachi
Iqbal	DCET, Karachi
Shakir Ahmed	DCET, Karachi
Sakinder	DCET, Karachi
Raees	DCET, Karachi

The Optimal Design of Energy Systems

Yehia El Sayed

Mechanical Engineering Consultant, 41658 Higgins Way,
Fremont, CA 94539, USA. and Professor Emeritus and President, Advanced

Energy Analysis

Email: aea87@comcast.net

The synthesis of a system and the design analysis of its devices is a mental process for design innovation and is as old as man's recognition for need for tools. The traditional approaches to the synthesis and the design of energy-intensive systems relied in the past on the intuition of experienced engineers and designers. Modest concern was given to fuel consumption and no concern was given to the environment.

Today both concerns are at their peaks. Fossil fuel resources are decreasing. World population is increasing coupled with an increased energy demand for a better standard of living. The need for waste reduction and cleaner environment is persisting and cannot be ignored. This situation did rise to a global level and did pose a hard challenge to the designers and the operators of energy-intensive systems. Cost-effective fuel saving became a focus of attention in the design and in the operation of these systems. System design became a complex multi-disciplinary process requiring specialized knowledge in each discipline. The operation aspects became more responsive to any miss-management of energy, emissions and waste disposal.

Many research and development projects emerged to target a new generation of energy systems that meet the challenge at both the producer end and the consumer end. Improved methods of system analysis for lower cost and higher efficiency became in demand to assist the intuition of system designers.

The methods of improved energy analysis influenced the design and the manufacture of energy conversion devices. Devices are designed for the system rather than selected from existing pre-designed lines of devices. The low cost of number crunching nourished the development of the methods of more intensive analysis.

Several analysis tools have been developed in the last two decades to meet the challenge such as thermoeconomics, pinch technology, artificial intelligence, genetic optimization and evolutionary algorithm. The tool discussed in this presentation is "Thermoeconomics". Its pillars are:

- Improved thermodynamic analysis via the concept of exergy.
- Improved costing analysis via design-based costing equations.
- Enhanced optimization via a simplified decomposition strategy.

Each of these pillars will be explained in detail along with application to a variety of systems power generation and cogeneration.

Keynote Lecture

Energy Sustainability

H. Douglas Lightfoot
Global Environmental and Climate Change Centre,
McGill University, Quebec, Canada
Email: dlightfo@aei.ca

To evaluate proposed solutions to the world's looming energy crisis one must understand the current world's energy system. It is important to know (1) how much primary energy is currently used world-wide and might be needed in 2100; (2) the forms of energy sources, the end uses for energy and how much is currently supplied by fossil fuels; (3) how important energy is to the welfare of people; (4) the limitations of renewable energies and fossil fuels; and (5) the potential for nuclear fission energy.

The resulting analysis shows that conservation and increases in energy efficiency are necessary and extend fossil fuel reserves but do not replace fossil fuels. The renewable energies of hydro, wind, solar, geothermal and biomass together are far too small to replace fossil fuels on the scale required.

The scale on which the world uses energy is enormous. The scale is so large that only nuclear fission energy has the capacity for long term replacement of fossil fuels and sustainability of world energy supply. It will take a long time to convert to nuclear fission energy and it will be at different rates in different countries. There are many small niche applications where renewable energies, conservation and energy efficiency can contribute towards being a bridge between now and the nuclear power age.

The most pressing problem facing sustainability issues is liquid fuels for air and road transport. There are no alternatives available on the scale required and it appears nothing is on the horizon. The purpose of this conference is to be a forum for promoting long term sustainability of energy supplies. Sustainability is necessary for improving the welfare of everyone by allowing energy consumption per person to increase as needed.

Keynote Lecture

Sustainability of Energy Resources

Dr Ernie Jowsey
Faculty of Development and Society
Sheffield Hallam University
Sheffield S1 1WB
United Kingdom
Email: e.jowsey@shu.ac.uk

A rational observer could be forgiven for taking a very pessimistic view of the world's

energy future. Even if we could stop all greenhouse gas emissions tomorrow our climate would continue to change due to global warming driven by over two centuries of manmade emissions. These changes, resulting in phenomena such as extreme temperatures and extreme weather conditions, are already affecting ecosystems and economies around the globe. This does not absolve us of our responsibility to influence the path that future energy consumption takes, however. There are things that can and must be done in order to ensure energy supply and to mitigate and ultimately address the challenge of rapid climate change.

Over the next few decades it will be essential to make more efficient use of the power we generate and to find non-fossil fuel sources of energy. This means developing more energy-efficient processes and improving electricity supply networks to cope with growing demand and the variations in supply that are a feature of renewable energy sources, such as solar and wind power. Local networks, linking small scale power plants with storage devices and local consumers may replace major national grid systems.

The important decisions in the choice of energy path to be followed will be driven, like everything else, by economics. Governments and people will act in their own economic self-interest in their decisions on energy production and consumption. If the economics of energy consumption are correct, then market forces ought to ensure an efficient, sustainable energy future. There are reasons, however, for believing that the economic signals being received by governments and consumers are not correct and this threatens the sustainability of energy consumption. Our responsibility as academics is to ensure that the costs and benefits of alternative energy sources are fully accounted for and that the economics of a sustainable energy future are correct.

Keynote Lecture

Energy security of Pakistan: challenges and their solutions

Dr M. Asif, PhD, CEng MEI

School of the Built and Natural Environment, Glasgow Caledonian University,
UK

Email: Muhammad.Asif@gcal.ac.uk

Energy security is one of the most prominent challenges facing the world. The article provides a comprehensive account of the energy security scenario of Pakistan. Going by its fundamental concept - adequate energy should be available without interruption and also at affordable price - the country faces serious challenges to its energy security. Statistics indicate that the vast majority of population (over 90%) lives in fuel poverty - they can not afford sufficient energy to maintain their homes within the comfortable temperature zone (22-25°C) by using air conditioning and heating during respective summer and winter seasons without spending more than 10% of their total income. Scarcity of energy is another issue - as of typical daily report of WAPDA during first week of January 2008, electricity supply in the country was 7,237MW against a demand of 11,509MW, registering a net deficit of 40%.

In view of the global geopolitical and military conflicts - which are mainly in the oil rich regions of the world - international energy market has become extremely volatile. Pakistan, being closely knitted to the Middle Eastern countries, is prone to be adversely affected by the

geo-strategical conflicts in the region especially when 80% of its oil requirements are met by imports from these countries. Pakistan also faces threats to its internal supplies. Since the major sabotage activity at Sui, on 11 January 2005, suspending the production of gas for nearly a week, the country has been facing a continuous streak of pipeline attacks though on a smaller scale.

In order to address these challenges, Pakistan has to diversify the supply mix and to proactively exploit indigenous resources i.e. hydropower and coal. Despite their promising potential, these resources have not been duly capitalized. For example, hydropower potential in the country is over 42 GW out of which only 6.5GW has been exploited. Similarly, 185 billion tones of coal reserves have so far delivered a humble 150 MW of electricity generation capacity. Renewable energy i.e. solar, wind and biomass can also make a very healthy impact on the national energy scene. Particularly, in terms of available solar energy Pakistan is amongst the richest countries in the world having an annual global irradiance value of 1900-2200 kWh/m²P. Energy conservation and management is also critical to be integrally adopted in the energy equation of the country in order to ensure a sustainable energy future.

Energy and sustainable development

Dr. S. R. Malik^a and A. Maqbool^b

^{a,b} NFC Institute of Engineering and Fertilizer Research, Faisalabad.

Email: drsrma@yahoo.com

Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. There are three dimensions of sustainable development those are economic, social and environmental. Energy is central to any discussion of sustainable development because it is central to all three dimensions. In terms of the economic dimension of sustainable development, energy is clearly an important motor of macroeconomic growth. In terms of the environmental dimension, conventional energy sources are major sources of environmental stress at global as well as local levels. In terms of the social dimension, energy is a prerequisite for the fulfillment of many basic human needs and services, and inequities in energy provision and quality often manifest themselves as issues of social justice.

Energy is central to improved social and economic well-being, and is indispensable to most industrial and commercial wealth generation. It is key for relieving poverty, improving human welfare and raising living standards. Although energy may be essential for development, energy is only a means to an end. The end is good health, high living standards, a sustainable economy and a clean environment. No form of energy - coal, solar, nuclear, wind or any other - is good or bad in it, and each is only valuable in as far as it can deliver this end. There are 30 energy indicators for sustainable development, classified into three dimensions (social, economic and environmental). These indicators are further classified into 7 themes: Equity, Health, use & production Pattern, security, atmosphere, land and water.

Energy Potential of Pakistan

Dr. S. R. Malik^a and A. Maqbool^b

^{a,b} NFC Institute of Engineering and Fertilizer Research, Faisalabad.

Email: drsrma@yahoo.com

Pakistan is a country gifted with all main natural energy sources but it is facing worst energy crisis of its history. Per capita primary energy supply of Pakistan is 0.30 Tons Oil Equivalent (TOE) compare to world average of 1.55 TOE. Per Capita Electricity generation of Pakistan is 581 KWH whereas the world average is 2657 KWH. Pakistan has estimated hydel potential of 46,000 MW whereas only 6595 MW is produced. There are considerable oil, gas, and coal reserves. The crude oil reserves are estimated at 27 billion barrels including 300 million barrels proven reserves. The level of production is presently 22.6 million barrels compared with the level of consumption of 100 million barrels. The natural gas reserves are 8 trillion cubic meters including the proven reserves of 0.8 trillion cubic meters. The level of production is presently 93 million cubic meters per day compared with the level of consumption of 82 million cubic meters per day. Pakistan is sixth richest country of the world in coal reserves. The coal reserves are 185 billion tons including the proven reserves of 3.3 billion tons. The level of production is 4.6 million tons and the level of consumption is 6.1 million tons. Pakistan is one of the ten developing countries, which have nuclear power stations. The two nuclear power plants of Pakistan are now providing 3.3% of electricity needs of the country. Pakistan has great potential of alternate energy like wind, solar, micro-hydel, fuel cell, tidal, biomass and bio gas. There is great potential for wind energy in sindh. Pakistan has 3000 hours of sunshine a year and so it has great solar potential. Although Pakistan has great energy potential but 24% of Pakistan's energy requirement depends on imports.

Sustainable Development under Clean Development Mechanism (CDM) - Big Words and No Change

Bob Lloyd^a, Srikanth Subbarao^b

^a Director of Energy Studies, Department of Physics, University of Otago, New Zealand.

^b Doctoral Scholar, Energy Studies, Department of Physics, University of Otago, New Zealand.

Email: srikanth@physics.otago.ac.nz

Climate change issues appear to be not sufficiently pressing to capture the sustained attention of developing countries when compared to more urgent issues such as access to clean water, food security, poverty alleviation and equitable energy access. Sustainability is not a large issue if you are hungry, poor, landless and without energy resources. In addition, the issue of the immediate cost effectiveness of renewable energy technologies in developing countries is often considered marginal compared to the uncertain costs associated with climate change and unsecured energy supplies. However, the global agenda of environmental and energy security concerns are currently driving the penetration of renewable energy alternatives. Thus it makes sense to capture the benefits of this agenda for developing countries. In this regards there is some urgency as implementing renewable

energy projects will become more difficult as we move past peak oil.

This paper examines the "Sustainable Development" aspect of the Clean Developmental Mechanism (CDM) under the Kyoto Protocol with regard to its current impact on crucial developmental issues with the main focus on the poor in developing countries. As poverty alleviation constitutes one of the major dimensions of sustainable development and as access to affordable energy is one of the key issues to mitigate poverty it can be concluded that renewable energy CDM (or energy CDM) projects have the potential to combat poverty.

The paper also discusses the immediate and urgent global concerns of developmental needs, energy and climate change whilst highlighting their influence on the poor in the developing world. The global response to address the above concerns in terms of renewable energy technologies, policies and strategies that can be instrumental in addressing the issues are analysed with main emphasis on CDM under the Kyoto Protocol including its progress and concerns.

The "Sustainable Development" concept as originated initially and the significance of the same under CDM in terms of its relevance to aid poverty alleviation and the current barriers and constraints for the delivery of satisfactory poverty reduction outcomes are deliberated. The critical issue of whether CDM can address poverty alleviation in developing countries has been discussed in context of the current structure of CDM in relevance to the existing market principles, transparency of the mechanism, economics and the daunting bureaucratic procedure involved. Potential options for a meaningful sustainable development concept under CDM and the requirement for changes to the current structure are also recommended with relevance to status of post 2012 negotiations, benefits of community based small-scale RE CDM projects and the possible way forward.

The paper concludes emphasising on the immediate priority required for streamlining the CDM including the framework for post 2012 regime in terms of providing long awaited benefits to the poor communities in developing countries.

Kyoto Protocol and its Implementation in Pakistan; Hurdles and Expectations

Hadeed Ahmed Sher^a, Sajid Iqbal^{b1}, Dr. Suhail Aftab Qureshi^a

^a Faculty of Engineering, University of Central Punjab, Lahore, Pakistan.

^b Department of Electrical Engineering, UET, Lahore,

¹ Email: sajid.iqbal@engg.ucp.edu.pk

In 1997 Kyoto protocol was adopted at the third session of Conference of the parties of UNFCCC in Kyoto, Japan. This protocol restricts the industrialized countries and those in transition to a market economy agreed to limit or reduce their emissions. On 16th February 2006 this protocol came into force. In Pakistan the government is also taking steps to reduce the pollution.

This paper discusses the possible low carbon emission electricity generation options by

keeping in view the current energy scenario of Pakistan and the new policy announced by the Government of Pakistan for renewable energy promotion.

Keynote Lecture

An Integrated Approach to Support Energy Policy Formulation and Evaluation

Andrea M. Bassi

Senior Modeler

Millennium Institute, 2200 Wilson Blvd. Suite 650

Arlington, VA 22201, USA

Email: ab@millennium-institute.org

With the release of the Kyoto Protocol and with increasing energy prices, national leaders have started investigating options for reducing energy consumption and carbon emissions within national borders. After ten years debating on whether the global and national economies would have been negatively impacted by the implementation of such measures, rising global concerns on climate change urge policy makers to find ways to reduce the carbon intensity of the global economy.

Various proposals to reduce energy consumption have been examined during the years. Some countries opposed to drastic measures, while others have taken the lead to support the diffusion of energy efficiency and cleaner energy.

Evidently different governments find themselves in different energy contexts that lead them to take dissimilar positions on energy issues. In fact, the extent to which society, economy and environment shape policies and react to their implementation change from country to country.

This study investigates whether contextualizing energy issues is relevant to provide energy policy formulation support aimed at finding sustainable longer term solutions. This research proposes the utilization of a holistic framework that incorporates social, economic and environmental factors and their relations to the energy sector to better contextualize global, regional, national and state energy issues. This framework, which includes feedback loops, delays and non linearity, is subsequently applied to case studies to investigate the long term performance of a selected number of policies under various scenarios.

On The Validity of Energy Policy Models

Hassan Qudrat-Ullah,

School of Administrative Studies, York University, 4700 Keele Street,

Toronto, ON, M3J 1P3, Canada,

Email: hassanq@yorku.ca

System dynamics based simulation models are becoming increasingly popular in the

analysis of important energy policy issues including global warming, deregulation, renewable energy, conservation and efficiency. The usefulness of these models is predicated on their ability to link observable patterns of behavior of a system to micro-level structures. This paper argues that structural validity of the simulation model -right behavior for the right reasons- is a stringent measure to build confidence in a simulation model regardless of how well the model passes behavior validity tests. That leads to an outline of formal structural validity procedures available in system dynamics modeling 'repertoire'. An illustration of a set of six tests for structural validity of a system dynamics model for energy policy analysis follows. Finally, some conclusions on the increased appeal for simulation models for energy policy analysis and design are presented.

Keynote Lecture

The transition from fossil-based to 100 per cent renewable energy systems

Brian Vad Mathiesen

Sustainable Energy Planning Research Group, Aalborg University

Phone (+45) 9940 7218,

Email: bvm@plan.aau.dk

The Danish energy system has undergone significant changes during the last 35 years. The total energy supply has been kept at a constant level during this period, and the supply has changed from being almost 100 per cent oil-based to a diverse supply based on various types of fuel. The energy system now has approx. 18 per cent renewable energy and more than 20 per cent wind power in the grid. More than 50 per cent of the electricity is produced by combined heat and power plants (CHP) and more than 60 per cent of the households are connected to district heating. This achievement is the result of a series of broad agreements made between the political parties in the Parliament. Through this consensus within energy policies, the long term stability of the measures taken is ensured. In October 2006, the Prime Minister announced that the long term goal is to create a 100 per cent renewable energy system, independent of oil, coal, natural gas and nuclear sources.

One such proposal for a 100 per cent renewable energy system is presented by the Danish Society of Engineers' (IDA) in its vision called Energy Plan 2030. The Energy Plan 2030 shows that it is technically and economically possible to restructure the Danish energy system. It is feasible to reduce greenhouse gas emissions by 60 % in 2030 compared to 1990, and the consumption of fossil fuels can be reduced markedly. Calculations show that more than DKK 15 billion (2 billion €) can be saved annually, if the changes proposed in the plan are carried out.

The Energy Plan 2030 proposal concerns the transformation of one specific energy system. However, similar long term proposals, taking into account local renewable energy potentials and possibilities, can create similar environmental and economic benefits. Reducing CO₂ emissions can be economically beneficial to other regions; however, this requires independent analyses of the technological alternatives in question.

Keynote Lecture

Analyzing returns to R&D investments in Renewable Energy Technologies

Dr. CAMILLA JOSEPHSON

Department of Economic History, Lund University

Box 7083, 220 07 Lund, Sweden

Telephone: Office +46(0)46-2227483, cell phone +46(0)730 772584

Email: camilla.josephson@ekh.lu.se

There is a growing consensus that stabilizing the greenhouse gas atmospheric concentration to a level allowing ecosystems to adapt to climate change, is only feasible through drastic technical change, which requires a massive research effort. Although the last decade shows increases in investments in R&D directed to cleantech and new energy technologies we are still in the dark concerning the results, especially in terms of holding back the levels of CO₂ and CH₄. Research activities are highly dependent on large investments, although few capital ventures invest in new R&D activities until having plausible prospects on risks and returns of such investments, hence new technologies are having difficulties in attracting sufficient amounts of capital to bring about a technical breakthrough.

The aim of this paper is to develop better methods of analyzing and comparing the efficiency of R&D investments. This will be realized by exploring a new approach to the measurement of efficiency and return to R&D investments based on the exploitation of a recently developed family of techniques in nonparametric efficiency analysis developed by Daraio and Simar (2005; 2007). Non-parametric efficiency analysis is specifically shown advantageous when applied on large detailed input-output datasets on disaggregate levels (using the software "R"). The project has exclusive access to a database covering all Swedish firms producing renewable energy technologies. An empirical analysis of this dimension will produce sufficient knowledge to theoretically describe the functional relation between inputs and outputs in R&D activities, which is crucial if we are to attract capital to the development of cleantech and renewable energy technologies on a large scale.

Analysis of Energy Strategies for Poverty Reduction in South Asian Nations

Abu Hena Reza Hasan

Associate Professor

Department of International Business

University of Dhaka

Dhaka 1000, Bangladesh.

Phone: 880 2 8115355; +8801711788638 (Mobile)

E-Mail: ahrhasan@yahoo.com

Energy plays a critical role in reducing poverty and fuelling economic growth. Energy use

and poverty are related in many ways. Level of poverty often defines the use of energy and energy deeply influences poor people's lives. Poor people unable to use enough energy to support the activities that will increase their welfare including access to water, agricultural productivity, health care, education and job creation. It is the expert opinion that the efforts by poor countries to meet the MDGs, especially the goal of halving the number of poor, will be impaired unless adequate attention is paid to the crucial role energy services play in the development process, particularly in relation to the economic, environmental and social well-being of the poor. With this background, the objective of this paper is to analyse energy strategies of South Asian nations to support poverty reduction. Recently five South Asian countries have prepared Poverty Reduction Strategy Paper (PRSP). The Bangladesh, Bhutan, Nepal, Pakistan and Sri Lanka have already developed PRSP and trying to implement it. This paper analyses the energy strategies in the PRSP of each country and then compare strategies of the five South Asian countries to evaluate strength and weakness of the strategies for poverty reduction. The analysis focuses on to identify energy concerns of the countries; to review how the countries have linked energy issues with issues with poverty; to understand strategies to overcome energy problems; and to review of sources of resources to ensure successful implementation of energy strategies. The outcome of this paper is a comprehensive understanding of ability of the countries to break the link between energy problems and poverty.

Energizing Pakistan

Seema Arifa, Ammar Ali Arif^b

^a Assistant Professor

Punjab College of Business Administration

University of Central Punjab

31 - Main Gulberg, Lahore Pakistan

Cell: 92-0300-6903863

Email: drarif00@yahoo.com

^b ACCA

Follow Studnet CFA

461-G3, Johar Town, Lahore, Pakistan

Cell: 92-0321-4141035

Throughout the history of the world, the new technologies have been replacing old ones, especially relating to the use of energy, from wood and coal, to mineral oil and electricity, etc. The times are again ripe for a shift; the nations are shifting to more efficient energy producing technology like nuclear technology or use of more economical and accessible resources depending upon the geography of the region. The energy crisis is global and is challenging the creative minds to seek optimum solutions which are eco friendly. However, such innovations are not easily accepted because any new energy technology will be perceived as risky (it is not tried and true like existing technologies) and the perception of risk will detract from the attractiveness of the new technology. Above all, the innovation is highly resisted in traditional societies, where everyone expects that his/her genuine claim over the use of existing source of energy must be recognized, giving rise to an enhanced competition in the market, inflation resulting into increasing costs. Here the "safe" decision is always perceived as to continue using and purchasing the existing technology, which reinforces its familiarity and encourages further use in the future.

The situation becomes further complex with the elaborate material culture created by modern civilization of science and technology, where energy like electricity is the sap of life running like blood and vitalizing the economic health of a society. We are ascertained of the fact that future prosperity of any country rests on the generous availability of the energy resources. On the other hand we are constantly alarmed by the depletion of the world's major natural resources, the fossils. These facts are motivating the futurists to look forward to alternate solutions to secure a better environment. Therefore, when we are looking at the energy crisis in Pakistan, we cannot overlook the issues raised by global community in both production and consumption of energy.

According to various sources Pakistan is currently facing a shortfall of about 1,000 mw of electricity and, according to the Private Power and Infrastructure Board, Pakistan's additional demand for electricity is projected to rise to 5,000 mw by 2010. Though, the Government of Pakistan is taking necessary steps and under the Vision 2030 programme, it has envisaged to increase the annual generating capacity of electricity to: 8,800 mw from nuclear, 32,660 mw from hydel, 19,910 mw from coal and 91,520 mw from gas and oil fired thermal power stations, against 462 mw from nuclear, 6460 mw from hydel, 200 mw from coal and 12,500 mw from gas/oil thermal stations at present. This programme comprises long term projects with a completion time ranging from 5 to 15 years.

Two very important questions rise here:

1. How will the nation be compensated till these projects are ready to meet the actual demand of the country? How can we ensure that our agriculture, industry and business will suffer minimum loss till we get these projects accomplished?

2. The other vital question is how we are going to raise money for these projects? With an economy going rapidly down due to energy crisis and the value of rupee depleting each day how can we assure sufficient economic and financial resources to accomplish these mega projects?

There is no doubt that hereby, not only long term planning for permanent sources of energies is required, but we are forced to look for quick fixes as well. Moreover, we will have to educate the masses to switch to alternate energy production and consumerism. Thus, we need visionaries who can look for economically efficient resources but also the technology improvisers, who can prepare cheap technology with the available resources. Hence, we reach at a conclusion that we need to look at this energy crisis in a much broader spectrum examining not only key issues, but analyzing the small, apparently insignificant variables, which by accumulating together can construct numerous social, cultural and economic barriers that our dreams would remain a wish and would never be realized as vision.

To handle such a complex and cumbersome situation, we must not be looking for radical solutions but practical innovations. This opportunity is provided to us by "system dynamics" a technique developed by Sloan School of Management, MIT, USA to look at complex problems by drawing a model of all possible behaviors and then creating balancing loops for the unwanted or undesired behaviors.

In the detailed paper: (1) First of all we will draw the model and simulations to represent the current energy needs of the country, (2) Secondly, we will identify the alternative solutions of economical, safe and clean energy production sources to suit the needs of our country. (3) Thirdly, we will discuss the social and economic barriers that impede the way of innovation and how we must tackle with these barriers to ensure the implementation of change.

The paper will also include a sample business plan to begin with safe and clean energy projects at small level needing lesser equity, so that we can avoid unnecessary burden of loans on already shriveled economy of the country.

R&D Efforts in Renewable Energy in the Middle East

S. U. Rahman

Center of Research Excellence in Renewable Energy

King Fahd University of Petroleum & Minerals

Dhahran-31261, Kingdom of Saudi Arabia

Email: srahman@kfupm.edu.sa

From the very event of kindling fire in the cave for heating and cooking, man kind's need for usable energy is growing. The coal was satisfying the needs at the beginning of the industrial revolution. It was considered relatively more convenient energy source as it could be used in steam engines. The steam engines satisfied the energy needs of the locomotives and prime drives of the industries. Later, it was replaced by liquid and fossil fuels, namely various petroleum and gas products. Fluid fuels are far more convenient. They can be transported with ease and are less messy in applications. It allowed the design of smaller engines. Consequently, they found much more application than what its predecessor fuel did.

The Gulf Cooperation Countries (GCC), being blessed with abundance of these fuels, quickly became the energy leaders of the world. Nevertheless, the mankind is facing two ugly facts related to the use of the petroleum and gas resources. The first fact is that these resources are limited and will not serve the humanity for ever. The other fact is that their use is associated with irreversible environment changes like global warming and depletion of ozone layer. Therefore not only it becomes the duty of our generation that we use the fossil resources more judiciously, but also come up with technologies that will cater to the ever-growing need of energy through renewable sources. In the case of the GCC, it is more than a social responsibility. Mastering the technologies of the renewable energy will help the GCC to continue to be the world energy leader. The GCC are equally blessed with solar energy, which is going to be the basic energy source. In addition, there are a number of places where wind energy could be harnessed easily.

It is instructive to retrospect a small piece of history related to development of petroleum related technologies. It is very interesting to note that these developments took place in geographically far away places while the largest petroleum reserves are in the Middle East. The Middle Eastern countries are still paying the dividends. The scenario is not very different in the case of the renewable energies. The Middle Eastern countries have potential of producing about 260 kW-h/m². This number multiplied with available unutilized area of the Arabian peninsula generates an astronomical figure that can satisfy the energy need of a significant part of the world for all times to come. This fact makes this geographical location more important after the oil is completely exhausted. Also, wind energy becomes very attractive in certain pockets of the regions. Let us now look into the amount of efforts that have been exerted towards development of renewable energy technologies in the GCC countries. According to a UNESCO presentation, the Middle East has negligible research/educational institutions devoted to this cause while Europe and Americas have more than 82% renewable energy related institutions.

It is very evident that the efforts towards technological development do not match the potential. It seems that the history is being repeated. During the period when petroleum related technologies were being developed, Middle Eastern countries did not have the resources. But this

time if the history is repeated we will not have answers for our next generations. GCC have the material and human resources to carry out this task.

Apparently, this fact has been recognized by the decision makers. In the recent past, there have been some activities in this direction. For example, initiation of Masdar initiative in UAE, announcement of support to clean energy by the Custodian of the Two Holy Mosques King Abdullah, initiation of the Center of Research Excellence in Renewable Energy by Saudi Government, and a number of other projects in Saudi Arabia, UAE, Oman, Bahrain and Kuwait. However, the magnitude of the efforts is far smaller than both the need and the efforts elsewhere.

In addition these efforts need to be consolidated to obtain the desired results, which is development towards generation of the intellectual properties. We will like to see a research center supported by various GCC countries that aims at furthering the knowledge and technology in the various areas of the renewable energy. It is also very important to increase the awareness of people on this important area. There should be exhibition centers dedicated in large cities. The subject should be introduced in the school curricula at appropriate level. The universities should be encouraged to get engaged in the relevant research and also offer courses. There should be some entities that encourage local business groups to venture in component and system manufacture of solar and wind energy.

Keynote Lecture

Renewable Energy For Sustainable Development

Sadiq H. Zaidi

President, Renaissance Energy Consultants

4 Bayberry Drive

Princeton, New Jersey, 08540

USA

Email: sadiqzaidi@renaissanceec.com

Inadequate power supply has emerged as one of the most serious infrastructure constraints on sustainable economic growth in the Asia and Pacific Region. Improvements in the efficiency of existing facilities and additional investments in traditional commercial power supply sources alone will not be sufficient to bridge the demand-supply gap. The heavy reliance on coal in the region as a fuel source for power generation has significant detrimental environmental impacts. Thus, power systems based on renewable energy sources (RES) such as wind ,solar, bagasse, biomethanation, municipal and agricultural wastes, mini-hydro, etc. are suitable candidates for alleviating some of the power shortages. Power generated from RES is economically attractive when compared with power generated from commercial energy sources if the economic costs of inputs and the environmental costs of fossil-based generation they displace are considered.

The competitiveness of RES vis-à-vis commercial energy sources rises further when the electricity tariffs are aligned to the long-run marginal costs. RES technologies offer investments opportunities to small entrepreneurs in power generation and provide alternative sources of energy, especially in rural areas that cannot be supplied by grid. There is , therefore, a challenge for the policy makers of the Region to create an enabling environment for the private sector to undertake development of RES.

Exergetic Performance Evaluation of Renewable Energy Resources for a Sustainable Future

Arif Hepbasli

Department of Mechanical Engineering, Faculty of Engineering,

Ege University, TR-35100 Bornova, Izmir, Turkey

E-mails: arif.hepbasli@ege.edu.tr

Email: hepbasli@egenet.com.tr

Energy resources and their utilization intimately relate to sustainable development. In attaining sustainable development, increasing the energy efficiencies of processes utilizing sustainable energy resources plays an important role. The utilization of renewable energy offers a wide range of exceptional benefits. There is also a link between exergy and sustainable development. A sustainable energy system may be regarded as a cost-efficient, reliable, and environmentally friendly energy system that effectively utilizes local resources and networks. Exergy analysis has been widely used in the design, simulation and performance evaluation of energy systems.

The present study deals with a comprehensive review of exergetic analysis and performance evaluation of a wide range of renewable energy resources (RERs). In this regard, general relations (i.e., energy, exergy, entropy and exergy balance equations along with exergy efficiency, exergetic improvement potential rate and some thermodynamic parameters, such as fuel depletion ratio, relative irreversibility, productivity lack and exergetic factor) used in the analysis are presented first. Next, exergetically analyzed and evaluated RERs include (a) solar energy systems; (a1) solar collector applications such as solar water heating systems, solar space heating and cooling, solar refrigeration, solar cookers, industrial process heat, solar desalination systems and solar thermal power plants, (a2) Photovoltaics (PVs) and (a3) hybrid (PV/thermal) solar collectors, (b) wind energy systems, (c) geothermal energy systems; (c1) direct utilization (district heating, geothermal or ground-source heat pumps, greenhouses and drying) and (c2) indirect utilization (geothermal power plants), (d) biomass, (e) other renewable energy systems, and (f) country based RERs. Studies conducted on these RERs are then compared with the previously ones in tabulated forms, while the Grassmann (or exergy flow) diagrams, which are a very useful representation of exergy flows and losses, for some RERs are given.

Potentials of Biomass as a Renewable Energy in Malaysia

Sanjayan Velautham^a, Ahmad Hussain^b

^aFaculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310,
Johor, Malaysia

^bKANUPP Institute of Nuclear Power Engineering, Paradise Point, Karachi,
Pakistan

Email: ahmadutm@gmail.com

This paper outlines the potentials of biomass as a leading renewable energy source in Malaysia. As a result of the depletion of oil and gas supply as an energy source, it is now necessary to develop alternative energy for the future. Biomass is a very broad term which is used to describe renewable resource that is part of the flow of resources occurring naturally and repeatedly in the environment. As such, it includes trees, crops, algae and other plants, as well as agricultural and forest residues. It also includes many materials that are considered as wastes by the society including food and drink manufacturing effluents, manures, industrial (organic) by-products and the organic fraction of household waste.

As the country aims to use 5% of the energy sources from renewable energy, growing crops for energy production in a sustainable manner offers the potential for biomass to become a significant source of renewable energy in Malaysia.

As the largest producer of palm oil in the world, Malaysia has rich resources of biomass in the form of Empty Fruit Bunches (EFB), oil palm shells and fibre that can be used as energy resources to supply heat, electricity or motion. Besides palm oil, Malaysia is also one of the major wood processing countries in the region. Therefore, Malaysia also has the potential to generate biomass energy from wood waste. Besides generating biomass energy from palm oil waste and wood waste, biomass energy can also be generated from rice husk, which are wastes produced from paddy.

The paper also presents the role that can be played by the government and local agencies to sustain the production of biomass energy resources and biomass technology advancement to further utilize the usage of biomass energy. The paper also discusses the environmental and socio-economic impacts by biomass production and usage. Finally, the paper concludes by looking into the future of biomass as energy for sustainable development in Malaysia.

Prospects of Wind Energy for Future Power supplies in Pakistan

M. Tayyeb Javed^{a1}, Motahhar Farooque^a, Khalid Waheed^a, Nafees A. Khan^b
a Pakistan Institute of Engineering and Applied Science, P.O. Nilore
Islamabad

¹ Email: fac076@pieas.edu.pk

^b UNDP/GEF Wind Energy Project, House 02, Main Nazim-ud-din Road,
F-10/4 Islamabad, Pakistan

The energy resources are diminishing throughout the world while the energy demand is rising steadily due to increasing population and improvement in life styles. The world is exploring new energy resources in order to fulfil the ever-increasing energy demand. Pakistan particular is the most energy deficient country where a shortfall of as high as 3500 MW is recorded in recent year. The Renewable Energy Technologies (RET's) are important and had gained the prime importance these days. This paper focuses on RET's specifically by wind power in Pakistan. The wind potential in different areas has been explored, including a vital area of about 9700 km² in Sindh. Wind power is a new energy resource in Pakistan's history, up till now main resources are Fossil Fuel contributing 65%, hydel 33% and nuclear only 2% respectively. Wind is an environment friendly resource and its appreciable contribution will be achieved in future. Paper

analyses the present energy scenario through wind power in Pakistan and leads to future progress in order to secure energy security in the country.

Keywords: RETs, Energy security, wind power, Pakistan

An assessment of wind energy potential as a power generation source in the capital of Iran, Tehran (35PoP 20' N; 51PoP 25' E)

M., Ghasemi Varnamkhastia¹, M. Khanalia, R. Abbaszadeha, A.R. Keyhani^b
^aPh.D. student in Agricultural Machinery Engineering Department, Faculty of Biosystem Engineering, University of Tehran, Karaj, Iran

Tel : +98-261-2801011, Fax: +98-261-2808138

¹ E-mail address: ghasemymahdi@gmail.com

^b Professor in Agricultural Machinery Engineering Department, Faculty of Biosystem Engineering, University of Tehran, Karaj, Iran

In this paper the statistical data of eleven years' wind speed measurements of the capital of Iran, Tehran, are used to find out the wind energy potential and other wind characteristics with the help of two method (meteorological and Weibull) and to evaluate of which at a height of 10 m above ground level and in open area. For this purpose, a long term data source, consisting of eleven years (1995-2005) of three-hour period measured mean wind data, was adopted and analyzed. Based on these data, it was indicated that the numerical values of the shape and scale parameters for Tehran varied over a wide range. The yearly values of k range from 1.91 to 2.26 with a mean value of 2.02, while those of c are in the range of 4.38-5.1 with a mean value of 4.81. Corresponding values for monthly data of whole year were found to be within 1.72-2.68 and 4.09-5.67, respectively related to k and c Weibull parameters. Results revealed that the highest and the lowest wind power potential are in April and August, respectively. It was also concluded that the site studied is not suitable for electric wind application in a large scale but the wind potential of which can be adequate for non-connected electrical and mechanical applications, such as wind generators, battery charging, and water pumping. In wind direction evaluation, it was found that the most probable wind direction for the eleven year period is on 180PoP, i.e. west winds.

Keywords: Wind power potential; Weibull parameters; Turbine; Wind direction; Tehran

Feasibility study of 10m³ solar assisted thermal insulated anaerobic digester for optimal performance in cold weather of Kashmir (Pakistan)

Aamir Siddiqui, Majid-ul-Hassan

Pakistan Council of Renewable Energy Technologies (PCRET)

H/No: A/427, Block 'J', North Nazimabad, Karachi - 74700, PAKISTAN

Email: amirsid50@hotmail.com amirsid50@yahoo.com

Energy crisis is one of the contemporary challenges that the government of Pakistan is facing now-a-days. About 70% of Pakistan's population resides in rural areas where village based households mainly rely on gas cylinders or wood to meet everyday energy demands. These conventional fuel sources are costly and an impending threat of the near-total environmental degradation of earth, especially in the mountainous regions of Kashmir and Northern Areas of Pakistan. In contrast, despite its possible demerits, the biogas option is quite a promising technology of tomorrow and, as such, we need to give it its due place today so that we remain conversant with this technology once it is fully mature in the rural areas.

A study of biogas energy utilization is particularly important and rewarding in that it can serve as a paradigm for the pollution free fuel. The designed biogas plant uses dairy dung for producing enough gas to satisfy the daily cooking needs of 10 persons. Biogas production in family-sized vertical biogas plants increases in summer and decreases in winter, proving unsuitable for cold areas.

This paper focuses attention on how to enhance the efficiency of currently used biogas plants by incorporating certain design modifications using available solar technologies so as to produce the optimum gas production during cold and rainy days. Enhancements of green-house effect, installation techniques and the economics of installing devices, such as solar tent and solar water heater, have also been thoroughly worked out.

The production rate of biogas energy varies from month to month during the year, however, the output figures have been worked out and are used in a reliable fashion to predict with accuracy the effectiveness of the performance of a specific 5m³ capacity solar assisted biogas plant. Thermal design applications are based on the principles of heat energy and the principal job used is the engineering design to arrive at the type of bio-solar equipment necessary to achieve the optimum results. We have touched on issues like enhancement of greenhouse effect and remodelling concepts for biogas production in cold environments.

This paper also constitutes the formulation and on-ground data using 5m³ capacity anaerobic digester. Moreover, in addition, to minimize the exponential rise in the inefficiency of the biogas production during cold or rainy days, this paper also focuses on problems related to design and construction of the biogas plant in the mountainous and rocky region. Design features of solar assisted anaerobic digester and principles related to solar heating mechanism have also been investigated. Practical results and data, on hourly basis in this regard, are also taken and compiled in this paper along with the related efficiency curves.

Keywords: Conventional fuel sources; Biogas plant; Dairy dung; Solar and thermal technologies; Anaerobic digester; Bio-solar equipment; Cold environment.

Solar PV Micro-Utility in Rural Bangladesh

Faisal Ahmmed

School of Business Studies, Southeast University

House No. 64/B, Road No. 18, Banani, Dhaka-1213, Bangladesh

E-mail: f_ahammed@yahoo.com

This paper deals with an innovative mechanism for meeting lighting needs of rural markets by solar energy which is term as Solar PV Micro-Utility. This is a new concept of solar PV extension, where power rather than system is offered to the consumer. Under this concept, nobody

will be the owner of the system, but somebody can get the lighting service by paying daily tariff. A local technician trained on solar PV is responsible for minor trouble shooting as well as for tariff collection. Eleven Solar PV Micro-Utilities have already been demonstrated in rural Bangladesh by a national NGO with the financial support of donor agency. Feedback from users indicates that the consumers are very much satisfied about the service. Financial analysis of one Solar PV Micro-Utility indicates that it can be an appropriate social business for NGOs.

Keynote Lecture

Photoelectrochemistry: A viable path for hydrogen generation

S. Ismat Shah

Materials Science and Engineering

Physics and Astronomy

University of Delaware

Email: ismat@UDel.Edu

Concerns about energy, climate change and environmental quality are driving force behind the research in non-carbon sources of energy. Solar energy is an important alternative, though the cost of existing technologies is prohibitively high and they are not likely to provide a significant fraction of the world's power. One of the "holy grails" in solar energy research is the photoelectrochemical splitting of water to make hydrogen and oxygen. In principle, this is much more efficient than the two step process of producing electricity (whether from solar or other sources) and using electrolysis to split water. Since the pioneering work of Honda and Fujishima, who showed in 1972 that photoexcitation of TiO₂ could achieve reduction of water to hydrogen, there has been an extensive effort to tailor titania and other wide band gap semiconductors for use as photocatalysts. Despite the promise of this result, no practical method for photocatalyzed fuel production has resulted.

I will describe the material and process issues that are related to the use of this alternate fuel production process and the recent results that show promise for the future of this technology. I will describe the ways and means of obtaining hydrogen by using materials and process that could withstand the challenges of photoelectrochemical splitting of water.

Hydrogen as Fuel

Prof. Dr. Javaid Rabbani Khan, Engr. Khuram Maqsood, Engr. Hashim Irfan
NFC Institute of Engineering & Fertilizer Research, Faisalabad

Periodic crises in the supply and price of fossil fuels have drawn attention to the fact that renewable energy sources are the only long-term solution to the energy requirements of the world's population. Molecular hydrogen is a future energy source/carrier that is being actively investigated as an alternative to fossil fuels. Hydrogen appears to be most promising because it burns to environmental friendly water when utilized. Biologically produced hydrogen may also serve as reductant for numerous microbial activities of environmental significance. It has a high calorific value, and can be transported for domestic consumption through conventional pipelines. The major application of hydrogen as energy is the fuel cell. Electricity could be produced locally,

even domestically, from Hydrogen and air, in fuel cells. Hydrogen can be mixed with methane in domestic gas supplies which will come with minimal revamp the equipment but the greatest benefits for HB2 Bexploiting is the thermodynamic advantage of fuel cells, converting chemical energy directly to electricity. Hydrogen gas is safer to handle than domestic natural gas and is also being considered as an alternative to batteries for electronic equipments. A future that depends on hydrogen is inevitable. Hydrogen economy will require the development of improved technologies for producing, storing, transporting, and utilizing hydrogen. This paper gives present and future scenarios of hydrogen as a fuel for the production of electricity and a power source for future generation of vehicles.

Keynote Lecture

Strategic Thinking on Hydrogen Energy and Technologies for Sustainable Development

Pelin YILMAZ

Associate Coordinator, IAHE

PhD Candidate, Merchant Marine College

Shanghai Maritime University

1550 Pu Dong Da Dao, Shanghai, P.R. of China

Research Assistant, Maritime Faculty -Istanbul Technical University

I.T.U Tuzla - Istanbul

Phone: +9 0216 3954501; Fax: +9 0216 395 45 00

E-mail: yilmazp@ itu.edu.tr

As energy is widely met by fossil fuels, technology development process results with several problems. Fossil fuel utilization have brought life threats on earth through accelerating climate change and pollution, causing thousands of people dying because of health and natural disasters. Furthermore due to the unbalanced distribution of the fossil fuels through the regions and the growth of energy demand through world population growth, global stability has been decreasing. As a result international tensions, environmental and economical changes, industrial and economical crisis occur around the world. Thus it is essential to be aware of the alternatives of fossil fuels that ensure the global sustainability.

Natural gas and biofuels are seen as the most important alternative fuels in short term, whereas in the long run, a substantial contribution is expected to be delivered by hydrogen and the fuel cell technology. The characteristic properties of hydrogen such as being the most abundant element in the earth, being a cleanest fuel when produced by renewables and when it is used make hydrogen a solution for the sustainable energy future. However, there are a lot of technical and socio-economical challenges to achieving a hydrogen economy. Transition to hydrogen energy does not only require development of new technologies but it also requires development of structural concepts and new approaches which need original and creative thinking process that refers to "strategic thinking". In this presentation hydrogen economy and its challenges will be explained. Furthermore, overcoming the challenges of hydrogen economy through strategic thinking process will also be presented.

Fabrication of Polyethylene Based Proton Exchange Membranes for Fuel Cells

Tauqir A. Sherazi^{a1}, M Akram Kashmir^{a2}, Shujaat Ahmad^{b3} and Michael D. Guiver^{c4}

^a Department of Chemistry, GC University, Lahore 54000, Pakistan

¹E-mail: sherazi_212@yahoo.com

²E-mail:mak@gcu.edu.pk

^b PIEAS / PINSTECH, Islamabad 45650, Pakistan

³ shujaat207@yahoo.com)

^c Institute for Chemical Process and Environmental Technology, National Research Council Canada, 1200 Montreal Road, Ottawa, ON, K1A 0R6, Canada

⁴Michael.Guiver@nrc-cnrc.gc.ca

Fuel Cell is in focus as a very low exhaust new dynamo system. Especially polymer electrolyte Fuel cells (PEFC) using proton exchange membranes (PEM) have attracted much attention for the electrical vehicle and other portable applications. Nafion (DuPont de Nemours LTD.) is a conventional perfluoro-sulfonic acid (PFSA) membranes used as PEM for PEFC. However, there are still several problems including its high cost @ US \$800/m². Novel membrane based on Polyethylene was prepared to replace the existing high cost PEM. Styrene was grafted onto ultra-high molecular weight polyethylene (UHMWPE) powder by gamma irradiation using a ⁶⁰Co source. Styrene grafted UHMWPE (PE-g-PS) powder was then converted into films by compression moulding technique followed by sulfonation. Styrene grafted and sulfonated UHMWPE (PE-g-PSSA) was then characterized to determine the ion exchange capacity (IEC) and degree of substitution (DS). The ion exchange capacity of the PE-g-PSSA was found to be 2.77 meq/g. The IEC value of the obtained membrane is about three times higher than those of commercial perfluoro-sulfonic acid membrane. In addition to its high IEC and low cost, PE-g-PSSA membrane has low methanol crossover, good mechanical strength and reasonable flexibility which are considered as the basic required properties for the membrane to use as PEMs. Owing to its merits, PE-g-PSSA membrane is considered as viable proton exchange membrane alternate to Nafion for Fuel Cells applications.

Keywords: Fuel Cell, Proton Exchange Membrane, Radiation grafting, Polyethylene, Ion Exchange Capacity.

Sustainability Considerations in the Production of Hydrogen from Biogas

Asim KHAN¹ Justin KAMP² Araz TAEIHAGH³ Asif MEHMOOD⁴ and Erlangga RISMANTOJO⁵

Department of Chemical Engineering, Chalmers University of Technology,
Gothenburg, Sweden

¹ E-mail: asimlaeeq@student.chalmers.se

² E-mail: ckamp@student.chalmers.se

³ E-mail: araz_taeihagh@yahoo.com

⁴ E-mail: asifmehm@student.chalmers.se

⁵ E-mail: er_rismant@yahoo.com

Through the search for alternative, renewable fuels and fuel carriers that significantly reduce CO₂ emissions and the dependence on fossil fuels, hydrogen appears to be promising automotive fuel. However, virtually all of the world's hydrogen is currently produced from fossil fuels.

Hydrogen can be produced from renewable feedstock such as biogas, which is produced by fermentation of organic material such as manure, municipal solid waste (MSW), wastewater sludge, or any other biodegradable feedstock, under anaerobic conditions.

The goal of this study is to evaluate the advantages of hydrogen production in a small scale unit and its use, and compares it with use of biogas as a direct source of fuel. Criteria used in this selection are thermal efficiency, CO₂ emissions, by-products and cost per kg of hydrogen followed by sustainability discussions.

In order to justify hydrogen production from biogas, a significant focus must be made regarding the sustainability of not only the design, but of the end use of the products. The sustainability considerations thus become complex layers that take into account the three pillars of sustainability .i.e. economy, environment, and society.

Keywords. Hydrogen, Biogas, Sustainability, Environment

Hydrogen Production by Immobilized Sulfur-Deprived Green Algae *Chlorella Vulgaris* under Different Light/Dark Cycles

Naim Rashid^a, Kisay Lee^b

^aDepartment of Environmental Engineering and Biotechnology, Myongji
University, Yongin, 449-728, S. Korea

^bDepartment of Environmental Engineering and Biotechnology, Myongji
University, Yongin, 449-728, S. Korea

Email: kisay@mju.ac.kr

Tel: +82-31-330-6689, Fax: +82-31-336-6336

Hydrogen was produced using green alga *Chlorella vulgaris* via a repeated two-stage cyclic process; (i) Stage I: a photosynthetic carbon fixation under CO₂ and light and (ii) Stage II: an anaerobic H₂ production in the absence of light and sulfur. *C. vulgaris* cells immobilized in agar were employed to facilitate prompt medium replacement and change in cultivation conditions between Stages I and II. For anaerobic H₂ production at sulfur-deprived condition, 30 mM

exogenic glucose was added at the start of Stage II, and cells were incubated in four different conditions for comparison: (i) fully dark, (ii) partially dark (dark during first 24 hours and then light thereafter), (iii) partially light (light during first 24 hours and then dark thereafter), and (iv) fully light conditions. Among the above conditions, the partially light condition showed best performance of H₂ production evolving total hydrogen volume of 530 ml/L at the maximum rate of 34.8 ml/h/L. The 3 days of photosynthetic period (Stage I) was essential to achieve continuous and enhanced hydrogen production, except for fully light condition, where 2 days growth period was enough to recover the production activity again after anaerobic H₂ production.

The glucose consumption has a direct relationship with hydrogen production. The evolution of hydrogen ceased soon after the complete consumption of glucose from the medium. The timing of glucose addition also affected the H₂ production. The addition of glucose at the beginning of sulfur-deprived anaerobic incubation (Stage II) was better for H₂ production than the addition after the establishment of anaerobic environment (about after 24 hours), where there the degradation of glucose and uptake by cells were not complete. The effect of pH in Stage II on H₂ production will also be discussed.

Techno-Economic Analysis of Hydrogen Fuel Cell as Backup Power Source for Essential Loads

Muhammad Shahzad Masood¹, Aftab Afsar and Ahmad Hussain
KINPOE, P. O. Box 3183, Paradise Point, Karachi, Pakistan
¹ Email: msmasood@email.com

In this paper the commonly used lead-acid battery backup power system is compared to the Polymer Electrode Membrane (PEM) fuel cell backup power system. PEM fuel cells have almost three times the specific energy of lead-acid batteries with an average of 65 Wh/kg. The PEM fuel cells have an electrical efficiency around 60%. Its most advantageous aspect is its uptime of hundreds of hours compared to just a few hours for battery powered backup systems.

Above parameters and a few more are compared to an existing battery-bank backup power source installed at Karachi Nuclear Power Plant (KANUPP). The existing system has two battery-banks. Each bank has a rating of 250VDC (2.08VDC per lead-acid cell), 1100AH, and only 30 minutes of designed up-time.

Economics of stationary fuel cells are rather complex. Initial cost of a fuel cell system is 2-3 times higher compared to an equivalent power battery-bank; but it is justified with sufficient savings in expenditures for energy over the lifetime of the system and highly improved reliability. A typical battery-bank has a life span of only seven years, whereas the PEM-FC has a lifespan of over 20 years. The compared PEM fuel cell payback-period analysis quantifies only 27 months to complete the economic picture.

The estimated initial cost of this system would be around US\$ 0.21 million; however, capital cost reductions are expected when discounting direct labor cost, material cost reduction, the learning curves effects of mass production, and most importantly hydrogen production cost reduction. The study suggests that the fuel cell based backup power systems should become an excellent option due to their improved reliability and substantially increased uptime.

Transport Biofuels and Global Sustainability

Geoffrey P. Hammond
Department of Mechanical Engineering
University of Bath, Bath. BA2 7AY. United Kingdom
Professor of Mechanical Engineering and Director of the International Centre
for the Environment (ICE)
Email: ensgph@bath.ac.uk

Road transport represents the fastest growing energy end-use sector globally. It is dominated by the use of petroleum products derived from crude oil. Consumption of oil is greatest in North America and Europe, whereas reserves are mainly concentrated in the Middle East. Energy security will inevitably become a major concern of both the industrialised nations of the 'North' and rapidly developing countries of the majority 'South' during the 21st Century. Another priority is the need to mitigate possible climate change impacts by reducing carbon dioxide (CO₂) emissions from human activities, including the combustion of automotive fuels. The search for sustainable transport fuels therefore lies at the heart of the environment and development nexus.

'Biofuels' are seen as one possible substitute for petrol and diesel for road transport vehicles. They can be produced from 'energy crops', animal waste, and waste from food processing. The CO₂ released when biofuels are consumed is notionally balanced by that absorbed during their production. It is consequently often regarded as a 'carbon neutral' process. However, fossil fuels are used during their production (embodied in fertilisers), and during cultivation, transportation and processing. There is only a modest potential for biomass cultivation in the Europe. Imports of first generation biofuels will therefore be required to satisfy the 10% European Union target for 2010. A switch to biofuel feedstocks produced via advanced, or 'second generation', biofuels using innovative conversion-processes might make the indigenous contribution greater.

The use of automotive biofuels will be examined in the context of the need to secure global sustainability. A balance must be struck between biofuel production, food security, water usage, and natural habitat destruction. Net energy analysis and an environmental life-cycle assessment will be used on a 'seed-to-wheel' basis, amongst other appraisal methods, to indicate the international impact of biofuels.

Renewable diesel oil production from slaughter waste

Arshad Muhammad^{a1}, Morgan Fröling^b
^{a,b} Chalmers University of Technology, Department of Chemical and
Biological Engineering, Chemical Environmental Science, SE-412 96
Göteborg, Sweden.
Tel +46-31-7725609, +46-73-5744926, Fax: +46-31-160062,
¹ muhammaa@student.chalmers.se

Primarily focusing on renewable waste into diesel oil. This study generates multiple benefits

including: Minimizing the demand for fossil fuel. Reducing the NOx, SO2 emissions into the environment. Replacing the synthesis fertilizer.

The study includes how much raw material is available in Göteborg and how much products; renewable diesel oil, liquid fertilizer and fuel gases can be obtained by using a process called Thermal Conversion Process (TCP) which has already been implemented in Carthage plant, Missouri, USA. To study the plant establishment, the detailed environmental analysis for suitable location is conducted by an environmental technique called Life Cycle Assessment where the global warming potential, acidification potential, eutrophication potential are compared between proposed Thermal Conversion Process and the present flow systems which is used for biogas and biomal production in Sweden. The proposed process is environmentally friendly and has reasonable payback period. The conclusion shows that establishing the plant at central part of Sweden is suitable rather Göteborg region.

Keywords: renewable waste, diesel oil, Thermal Conversion Process, life cycle assessment, global warming potential, acidification potential, eutrophication potential, bio gas, biomal

Production and Trade of Biofuels: A Strategy for Sustainable Development in Developing Countries

Lidia Cruza^a, Mauricio Pinheiro^b

^a Independent Researcher,

62, Canova Road SW, Calgary AB Canada T2W 2A6

lidiaisabel@hotmail.com

phone: 1(403) 477-3677

University of Calgary, 2500 University Dr, NW, Calgary AB Canada T2N1N4

Email: msouza@ucalgary.ca

Current issues in energy security and international urge to reduce gases emissions have created a potential global market for biofuels, especially those with high energy efficiency such as the ethanol. This global market, on the other hand, might be seen as an excellent opportunity for developing countries improve economically. This potential transpires from the fact that many developing countries have proper climate and, mostly, enough land and labor force to produce biofuels. In this respect, here we examine what and how biofuels can add with regards to job creation, industrialization process, and trade as a means to mitigate poverty. In order to support these claims, we explore the cases of two developing countries, Brazil and Tanzania.

Brazil has been an example of success with its production of ethanol at prices and levels of energy efficiency. The ethanol sector in Brazil has created thousands of jobs and accelerated the economic development and income of many citizens.

Tanzania, on the contrary, does not fit yet into the category of successful histories with biofuels as Brazil does. However, researchers from the Netherlands have pointed out the great potential of jatropha in that country. According to them, Tanzania has enough land and labor force to work on cultivation and industrialization process of jatropha, an indigenous plant that has a high oil yield and can grow even on infertile soil.

From our findings, it is essential that a bio-agreement between developed and developing

nations be setup so that new frontiers involving social, economic, and environmental responsibilities are established. Such a bio-agreement will not only guarantee that developing have a voice in the international market, but also ensure that biofuels being produced meet environmental and biodiversity guidelines.

Waste Frying Vegetable Oil as a Source of Biodiesel

Mr. Muhammad Tahir, Hafiz Asghar Ali, Abdul Sattar, Arshad Chughtai¹, M. Arif Butt

Institute of Chemical Engineering & Technology, University of the Punjab,
Lahore, 54590.

¹ Email: achughtai@icet.pu.edu.pk (Corresponding Author)

Waste frying oil was used for the production of fatty acid methyl esters (FAME), generally known as biodiesel. After the purification with the help of bleaching earth and activated carbon, the FAME were synthesized from the oil under acidic and basic catalysts using methyl alcohol for transesterification process. The crude FAME were distilled under vacuum to obtain pure methyl fatty esters (biodiesel). The average yield from basic catalyst was 90% and from acidic catalyst it was 93%. The fatty acid present in the FAME as observed through GC analysis were lauric, myristic, palmitic, stearic, oleic and linoleic acids, out of which palmitic and oleic acids dominated the acid profile of the FAME.

The physical and chemical characteristics of the biodiesel (FAME) and also that of petrodiesel were determined and compared. There were found to be; density (0.9344, 0.892) specific gravity (19.627, 26.67), Calorific value (31264.3, 29180). Flash point (80PoP, 76PoP), cloud point (-3PoPC, -3PoPC), pour point (-5PoPC, -5PoPC) and carbon residue (nil, nil) respectively.

Blends of biodiesel and petrodiesel were prepared and their physical and chemical properties were also found out. A gradual shift of different values from biodiesel to petrodiesel was observed as the percentage of petrodiesel in biodiesel was increased from 20 to 80%. This study suggests that low value recycled frying Oil can act as a good source of biodiesel.

The Fischer Tropsch Synthesis of diesel oil from biomass derived syngas

Arshad Muhammad ¹, Morgan Fröling

Chalmers University of Technology, Department of Chemical and Biological Engineering, Chemical Environmental Science, SE-412 96 Göteborg, Sweden.

Tel +46-31-7725609, +46-73-5744926, Fax: +46-31-160062,

¹ Email: muhammaa@student.chalmers.se

The Fischer Tropsch process is a well studied process for synthesising long chain hydrocarbon from carbon monoxide and hydrogen. Catalyst used in the FT process were prepared in lab and studied for their effect on CO conversion and selectivity to C₅+ hydrocarbon chains in a

reaction utilising a feed syngas with a low H₂: CO ratio. The purpose of this study was to compare the selectivity of the following catalysts, the Co/Al₂O₃ catalyst (FT catalyst) and Cu-Zn catalyst (Shift catalyst) in a fix bed reactor at 20 bars and 230C0. The FT catalyst is prepared by wet incipient method and shift catalyst by co-precipitation method. The Cu-Zn ratio was fixed at 1/1. Later four catalysts were prepared with different catalyst ratios of Co:Cu-Zn. Effect of temperature and gas hourly space velocity on conversion and selectivity was observed. We were successful in showing that as the Co ratio decreased in FT and shift catalyst, both the over all conversion of CO and selectivity to C₅+ hydrocarbon decreased. However the water gas shift activity was increased which may have lead to an increase in the possible conversions for a feed syngas with a low H₂: CO ratio.

Keywords: Fischer Tropsch, Shift catalyst, wet incipient, co-precipitation, Syngas, biomass, diesel.

Investigation of the effect of Fuel Injection Parameters on the Exhaust gases in a Diesel Engine

Leyla Otadi

Coventry University School of Engineering, Coventry, UK

Email: S.m.kimia@gmail.com

The internal combustion engine is one of the most important sources of polluting gas emissions in all of the world. In recent years many researches have been conducted in this area to decrease emission exhaust gases especially NO_x, CO₂ and CO. The fuel injection parameters in fuel system have great influence on the engine exhaust gas. In this present study the effects of injection timing and pressure, nozzle geometry and nozzle spray angle parameters on the NO and soot is investigated in OM 355 direct injection diesel engine. The results were compared with experimental available data. The obtained results are indicated that the 260 6 0__ nozzle is the best one between various nozzles that are investigated in this work.

Key words: NO_x, Soot, Fuel Injection Timing, Injection Pressure, Nozzle Geometry

The influence of ethanol blended diesel fuels on emissions from a diesel engine

R. Venkatesh Babu^a, S. Sendilvelan^b

^aResearch Scholar, Department of Automobile Engineering, Bharat University, Chennai - 600 073.

^bDean (Research), Dr. MGR University, Chennai - 600 095

Email: sendilvelan63@yahoo.com

The addition of ethanol to diesel fuel simultaneously decreases cetane number, high heating value, aromatics fractions and kinematic viscosity of ethanol blended diesel fuels and changes distillation temperatures. An additive used to keep the blends homogenous and stable, and an ignition improver, which can enhance cetane number of the blends, have favorable effects on the physicochemical properties related to ignition and combustion of the blends with 10% and 30% ethanol by volume.

The emission characteristics of five fuels were conducted on a diesel engine. At high loads, the blends reduce smoke significantly with a small penalty on CO, acetaldehyde and unburned ethanol emissions compared to diesel fuel. NO_x and CO₂ emissions of the blends are decreased somewhat. At low loads, the blends have slight effects on smoke reduction due to overall leaner mixture. With the aid of additive and ignition improver, CO, unburned ethanol and acetaldehyde emissions of the blends can be decreased moderately, even total hydrocarbon emissions are less than those of diesel fuel. The results indicate the potential of diesel reformation for clean combustion in diesel engines.

Keywords: Diesel engine; Ethanol; Emission; Acetaldehyde; Additive; Ignition improver

Biodiesel from Indigenous Castor Oil

Mohammad Harun Chakrabarti^{a,1}, Mehmood Ali^b

^a Associate Professor, Department of Environmental Engineering, NED
University of Engineering & Technology, Karachi, Pakistan.

¹ Email: harun@neduet.edu.pk

^b Assistant Professor, Department of Environmental Engineering, NED
University of Engineering & Technology, Karachi, Pakistan.

Bio-diesel is an alternative biodegradable and non-toxic fuel, which is essentially free of sulphur and aromatics. It is usually produced by a transesterification reaction of vegetable oil with a low molecular weight alcohol and the final products are methyl ester (bio-diesel) and glycerin. The catalyst used in this whole process is potassium hydroxide (KOH). The use of bio-diesel causes a sharp drop in the emissions of air pollutants and contributes towards more jobs and income, mainly in the rural areas of Pakistan, where the raw materials are produced. Bio-diesel has 11% more oxygen content as compared to petroleum diesel which helps in complete combustion of fuel having less hydrocarbons, CO₂ and particulate matter emissions. In this paper, we have studied the conversion of castor oil (from indigenous sources) into bio-diesel in a bench-scale experimental set-up, with an economical method. Castor oil was studied initially and useful results were obtained for comparison with International standards for air pollution emissions and mechanical properties related to the operation of a diesel engine.

Dehydration of Ethanol by Pervaporation using Polymeric Membranes

Muhammad Munir, Arshad Hussain, Ayaz H. Qureshi and Khairuddin
Sanallah

School of Chemical & Materials Engineering (SC&ME), National University
of Sciences & Technology (NUST), Islamabad, Pakistan.

Pervaporation is a membrane process primarily used for liquid separation. Presently this technique is used effectively for dehydration of organic liquids such as Ethanol, Isopropanol, Hydrazine and others. When the liquid mixture is in contact with a membrane, the minor component of the mixture is permeated through the membrane due to its higher affinity and/or

higher diffusivity in the membrane. The bulk of the mixture is restrained by the membrane. Processes involving phase-change (e.g. distillation) are energy-sensitive. Pervaporation involves phase change from liquid to vapour, however, this survives the issue of energy-sensitivity since it deals with the minor component (say 10% or less) of the liquid mixture. Thus saving energy by selectively evaporating the minor component and utilisation of efficient and selective membranes make this the most effective liquid separating technology. Efficiency and scope of this technique largely depends on the selection of membranes for liquid separation. High permeation flux and separation factor for dehydration of organic mixtures are the prime factors for the selection of membrane material.

Ceramic and Polymer based materials are broadly used as membranes for pervaporation process. There is a wide range of Polymers being used for dehydration of organic mixtures by pervaporation. Some of the well known used for this purpose are Cellulose acetate, polyvinyl alcohol, PVA/PAA and Nylon. Separation is characterised by high permeation through the polymer membrane along with enhanced selectivity for polymer membrane. To obtain high values of these two parameters, it is vital to select the right membrane as well as the optimum operating conditions. To address these issues there is a need of a hydrodynamic study focusing on to the diffusion across the membrane thickness as well as the effect of flow regime on permeation flux as well as the degree of separation. Thermal effect on the separation efficiency as well as the life of polymer membrane need also to be investigated. pervaporation facility was developed. The rig consisted of a feed tank equipped with heating arrangement, a centrifugal pump that can circulate the liquid at a rate of 10 lit/min to 38 lit/min. The membrane cell with a dia of 115 mm was used to remove water content from an Ethanol sample containing 5-10% water using polymeric membranes developed locally as well as commercial membranes. HPLC was used to analyse the results and Pervap flux was plotted against sample flowrate.

Bio-Diesel environmentally and socially sustainable fuel alternative for Pakistan

Muhammad Tayyab^{a1}, Kashif Mehmood^{a2}, Aqeel Ahmad Bazmi^{b3}, Dr. Nadeem Kardar^{b4}

^a Fellow Student, Bio Mass Conservation Research Group, Department of Chemical Engineering, COMSATS Institute of Information Technology, Lahore, Pakistan

¹ Email: mtayyab_786@hotmail.com

² Email: kf_mehmood@hotmail.com

^b Assistant Professor

Bio Mass Conservation Research Group, Department of Chemical Engineering,

COMSATS Institute of Information Technology, Lahore, Pakistan

³ Email: abazmi@ciitlahore.edu.pk

⁴ Email: nadeemkardar@yahoo.com

Energy economics, renewability and environmental safety factor bring people mind to think about alternative to natural fossil fuels. Currently Pakistan is badly immersed in energy crisis and

an effective sustainable energy resource helps to overcome tomorrow energy challenges. Biodiesel is one feasible alternative to petroleum diesel and a promising option to be implemented in Pakistan. Bio diesel is the clean burning alternative fuel for the diesel engines which are produced from domestic, renewable resources. This fuel is obtained from vegetable oils by process of transesterification, which changes the properties of oil significantly. Pure bio diesel can be used in unmodified diesel engines, and blending offers the best commercial potential.

In Pakistan, Government is working on promoting bio diesel as fuel for diesel engines for both commercial and domestic use. Biodiesel is safer for environment due to less GHG's, VOC's, Nox's and other hazardous materials emission. Biodiesel is considered readily biodegradable under ideal conditions and non-toxic. It got more attention due to its greater renewability as its feedstock is actually its product after combustion and this ensure it as greener and safer fuel. Pakistan's major population settles in rural area and country's income about 70%based on agriculture. Our country has vast potential to grow feedstock for bio diesel especially in the remote areas. Development in this sector will also increase agricultural revenue and create jobs, especially in the rural areas; this in consequence helps in better social growth. Paper contains study of bio diesel its economics and various parameters that favours truly as a ful of future.

Key Words : Biodiesel Production, Environmental and Social Impacts.

Keynote Lecture

Pakistan's Energy and Transport Policies: Complementary or Conflicting?

Dr. Muhammad Imran

Resource and Environmental Planning, School of People,
Environment & Planning, Massey University, NEW ZEALAND.

Email: m.imran@massey.ac.nz

Tel. + 64 6 356 9099 ext. 4352, Fax. + 64 6 350 5689.

Over the past decade, 'sustainable energy' has emerged as the universally agreed goal in the development field. Pakistan Vision 2030 clearly link between energy and sustainable development for an improved standard of living in urban and regional areas. The focus of the policy is to shift the energy use from oil and gas to alternate energy uses due to continuously rising oil prices and future depletion of local gas resources. Therefore, Federal Government Medium Term Development Framework (2005-10) plans to reduce their dependence on oil from 30 per cent in 2004 to 18.5 per cent in 2030. Similarly planning has been made to reduce dependence on gas from 50 per cent in 2004 to 45 per cent in 2030.

Transport is one of the largest sectors which conventionally depend on oil as well as gas throughout the world. Equally in Pakistan, the transport sector is the second largest (32 %) consumer of energy after industrial sector. The energy demand for transport is growing sharply. The reason behind this increase lies in government transport policy which works against to energy policy. The main aim of transport policy in Pakistan is based on promotion of the use of private vehicles by building larger and better roads. In contrast, energy efficient transport modes such as walking, cycling and public transport are declining particular in urban areas due to lack of investment.

The explanation of these policies that make things worse is the belief that encouraging Compressed Natural Gas (CNG) in transport sector will overcome the increasing demand. Although, CNG is environmental friendly fuel and will help to meet short term demand for transport. But in the long term, only promotion of CNG will not manage the continuously increasing motorization. Therefore, these contradiction in both policies need to be exposed in order to achieve energy targets set by Medium Term Development Framework and as well as the ambitions of Pakistan Vision 2030.

The purpose of this paper is to find a gap in energy and transport policies of Pakistan and suggest some measures to achieve long term vision of sustainable development. This paper provides instances in Pakistan, and with specific reference to the large urban areas. This demonstrates that lock-in energy and transport policies in a single paradigm led people to drive by using oil and CNG is creating unsustainable energy pattern. Documentary and contextual analysis will provide greater understanding of the ways energy and transport policies and practices evolved and worked separately over time. It will help to explore the picture of energy and transport policies to detect whether path dependence can be found in these policies. The research will significantly contribute to the debate of sustainable energy and transport in the context of developing countries.

A Step for the Future Sustainability in Pakistan: Conversion of Vehicle Fuel from CNG to HCHG & Their Environmental Effects/Benefits

Qandeel Fatima^{a1}, Usman Shoukati^{a2}, Shoaib Ghaffar^{a3}, Dr Murid Hussain^b

^a Fellow Student

Department of Chemical Engineering

COMSATS Institute of Information Technology, Lahore, Pakistan

¹ Email: qandeelgilani@yahoo.com

² Email: drusmanawan@gmail.com

³ Email: csg_rab@yahoo.com

^b Assistant Professor

Department of Chemical Engineering

COMSATS Institute of Information Technology, Lahore, Pakistan

Email: drmhussain@ciitlahore.edu.pk

The land of Pakistan is highly enriched with treasure of natural gas reservoirs due to that compressed natural gas CNG is abundantly used all over the Pakistan as a vehicle fuel. Natural gas can be blended with hydrogen to make HCNG. HCNG vehicle offers the potentials for immediate emission benefits, reduction in NO_x/SO_x emission, which eventually affects positively on our environment. At the same time they can pave the way for a transition of fuel cell vehicles by building early demand for hydrogen infrastructure and vehicle fueled with hydrogen based transportations for future. This paper will mainly focus the blends of H and CNG as a fuel and its benefits for the future of Pakistan.

Key words: CNG, HCNG, NO_x/SO_x, Hydrogen Fuel, Sustainability

Conservation Of Energy & Natural Resources by Recycling - Advanced Recycle Technology for Feedstock Recycling Of Waste Plastics

Prof. Dr. M. Farhat Ali

HEJ Research Institute of Chemistry, ICCBS, University of Karachi, Karachi

Email: mfali2k@yahoo.com

As the world population continues to grow geometrically (a century ago the world population numbered 1.6 billion. Today, the world population is 6.6 billion people), great pressure is being placed on arable land, water, energy, biological resources, and municipal solid waste (MSW), forcing us to reassess our use of the earth's resources and to institute environmentally friendly services. Efforts towards country's sustainability include recycling, purchasing environmentally sound products, energy and water conservation, alternative fuel vehicles and the greening of residence facilities.

Due to population increase, the demand for plastic products has steadily increased over the last 40 years. Since plastics are non-biodegradable, they cannot be easily returned to the natural carbon cycle; hence the life cycle of plastic materials ends at waste disposal facilities. In 2003, the Environmental Protection Agency (EPA) reported that plastics constituted a large part of the municipal solid waste (MSW) generated in the US (26.7 million tons or 11.1% of the MSW stream).

The current and common MSW management methods used are incineration and land filling. Both methods pose negative environmental impact. Although, there are incineration methods in which energy is recovered, incinerators generally produce greenhouse gases which are postulated as sources of global warming. Similarly, land filling poses the threat of methane emissions.

Recycling and reuse of plastics has obvious benefits of decreasing the amount of waste plastics that end up in landfills; however, the overall recovery of plastics for recycling is relatively small. In 2003, only 1.4 million tons (3.9 percent of total plastics generated) of plastics were recovered for recycling. The growing awareness in environmental concerns and the reducing landfill space have prompted research in alternative methods such as chemical recycling.

Chemical or feedstock recycling involves processes that convert plastic waste into petroleum feedstock, preferably gasoline range fuel. Although a viable option, this method can be costly. Contributing to the high costs is the fact that waste plastics are indeed mixtures of different materials having different compositions and thus requiring different processing conditions. Moreover, the chemical recycling (or cracking) of plastics has to be combined with other technologies, such as coprocessing with petroleum residue and coal.

The purpose of this presentation is to highlight the problems due to gross negligence in developing indigenous energy sources and to assess the conservation of energy and natural resources by recycling plastics waste in Pakistan. The necessity to adopt more sustainable methods of solid waste management will be discussed.

Waste-to-Energy -A Way from Renewable Energy Sources to Sustainable Development

Dr. Richa Kothari

Babasaheb BhimRao Ambedkar University, Lucknow, (U.P.), India

Email: kothariricha21@gmail.com

Sustainable development has been defined in many ways, including "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Many factors affect achieving sustainable development. Now a day, energy is key consideration in discussions of sustainable development. So, sustainable development requires a sustainable supply of clean and affordable renewable energy resources that do not cause negative societal impacts. Energy sources such as sunlight, wind and falling water are generally considered renewable and, therefore, sustainable over the relatively long term. Wastes and biomass fuels are also usually viewed as sustainable energy sources. Wastes are convertible to useful energy forms like biohydrogen, biogas, bioalcohols etc., through waste-to-energy technologies. In this article, possible future-energy-utilization patterns and related environmental impacts, potential solutions to current environmental problems and renewable energy technologies and their relation to sustainable development are discussed with great emphasis on waste-to-energy routes.

Keywords: renewable energy sources, waste-to-energy and sustainable development.

Challenging Economic Aspects of Thermoplastic Recycling

Khurram Hussain^a and Dr. MoinudinGhour^{ib}

^a Lecturer

Chemical Engineering Department,

CIIT Lahore

Fellow Student, M.Sc. Polymer Science & Engineering London Metropolitan University

Email: khurramh@ciitlahore.edu.pk

^b Department of Chemical Engineering

COMSATS Institute of Information Technology, Lahore, Pakistan

Email: drghauri@ciitlahore.edu.pk

The plastic industry has experienced a phenomenal growth during the last decade. In 1976, plastics became the most widely used material in the whole world surpassing the steel. Today it is a £140 billion per year industry -an industry greater than steel and aluminium combined. Plastics are now used in every segment of world business and in the daily life of every one of us. They are found either in the form of entire product as containers, and fast food packaging or in combination

with other materials part transportation, vehicle, computers, tools, recreational equipment, etc. Mechanical recycling for the same product or application is in highest demand and incineration and heat recovery in the lowest. According to state intervention the plastics are only recycled when the sum of all of the costs for collection, sorting and treatment does not exceed the marginal profit. If state sets ecological priorities, for example, conservation of resources or of space in landfills, this may mean dealing with volumes of waste that are uneconomical from the commercial point of view of a single company. It is known fact that plastics are "solidified petroleum". The heating value is stored in petroleum is almost unchanged. As 84% of petroleum resources are burnt to get energy, why its derivatives are not used as fuel. After mechanical recycling, there remain heavily contaminated articles, or else cross linked products contaminated with hazardous substances. The best way of reutilizing these portions is to incinerate them instead of dumping them diffusely on landfill. In this way their calorific value can be recovered. If sufficient amounts are available separate incineration plants are economical. After dehalogenation of some refuse this is done or polyolefin refuse are recycled meeting a certain criteria. Since waste incineration plants also have Hal absorbers in their flue gas scrubbers. This is one of the most easily accessible and cost-effective ways of recycling. Disposal costs for refuse incineration plants fluctuate within wide limits.

Key Words: Thermoplastic recycling, economics of feasible plastic recycling.

Oil Recovery from Scrap Tires Using Supercritical Decomposition with Toluene

Khadija Qureshia, Inamullah Bhattib, Hossam Adel Zaqootc Rashid Abrod

a,b Assistant Professor, Chemical Engineering Department, Mehran University of Engineering and Technology-Jamshoro-Pakistan

c PhD Scholar, Institute of Environmental Engineering and Management,, Mehran University of Engineering and Technology Jamshoro

d. Lecturer, Dawood College Of Engineering and Technology, Karachi

Increasing rate of auto mobiles around the world has augmented the demand of tires and as well increased the rate of waste scrap tires day by day. The existing system of waste tires disposal, incineration and thermal decomposing in the open areas generating toxic gases, which is depleting environment rapidly. The major composition of tire is based on the carbon material and its compounds therefore it is possible to recover petroleum oil in complex crude form in the reversing method. This study was carried out in the Chemical Engineering department at Mehran University of Engineering and Technology-Jamshoro, Pakistan. The decomposition unit was designed and fabricated locally and FTIR tests were carried out in the Institute of Chemistry at Sindh University-Jamshoro. Experiments were carried out at various temperatures (299, 305,308 and 309 °C) and pressure (500, 650, 750 and 800 psi) for 30 gm sample of tire. By measurement of the residual solids weight and further chemical analysis the percent decomposition and decomposition characteristics were evaluated with respect to temperature and pressure. Also by GC analysis of

decomposed oil, the major components of oil and their molecular weight were confirmed. Approximately 94.2 % of oil was recovered at 308 °C by applying pressure 750 psi. This study also showed that the hydrocarbon oil with molecular weight below 300 was obtained from automotive tire by supercritical decomposition with toluene. We hope that this work will help and assist the local authorities and decision makers in designing policies and plans to protect the environment from further pollution with respect to scrap tires waste.

Keywords: scrap tires, supercritical decomposition, temperature, pressure, GC

Keynote Lecture

Electric Power Industry History, Regulation and Modeling

Kemal SARICA, M.S.
Industrial Eng. Dept.
Bogazici University
Bebek - Turkey

Throughout the presentation the evolution of electric power industry will be investigated. The nature of electric power industry from the early year to current decade will be analyzed. How the technological and financial parameters of the system drive the market structure will be questioned. Simultaneously the modeling approaches used with each period will be introduced and philosophy behind those models will be analyzed. The new trend, deregulation in electric power industry, closed down the application field of conventional modeling strategies. The new modeling approaches will be investigated and the possible usage strategies with possible drawbacks and strongholds will be introduced. Some literature will be introduced for implementation and usability issues. The possible market structures and ownership issues will be discussed for future trends such nationalization and privatization cycles. As last point the future trends in modeling electric power industry will be discussed and comments will be made.

A Novel Control Strategy for Grid Connection of Photovoltaic Systems

M.Salimi¹ and B.Mozaffari²
Islamic Azad University - Science and Research
¹ Email: Mahdi_salimi2002@yahoo.com
² Email: Mozaffari_babak@yahoo.com

In this paper a novel control strategy for grid connection of PhotoVoltaic (PV) systems is proposed. The objective of this paper is to show that with an adequate control strategy, PV system can transfer DC link energy into grid, improve power factor of the electrical system and compensate harmonic currents of the utility. If the PV power generation is not enough to supply demanded power of the load, the utility will feed the active power demand of the load directly and the PV system will supply reactive and harmonic compensating components of the load current. With the utility fail, the power will be transferred from the PV system to the load. Finally, In order to validate the accuracy of proposed control strategy, grid connected PV system is simulated with MATLAB/Simulink toolbox.

Renewable Energy Integration. A Review of Emerging Distribution Network Control Techniques

Shahzad Memon¹, Tao Xu² Phil Taylor³
School of Engineering, Durham University, UK

¹ E.mail: s.a.memon@durham.ac.uk,

² E.mail: tao.xu2@durham.ac.uk,

³ E.mail: p.c.taylor@durham.ac.uk

Traditionally distribution networks are generally operated passively without the integration of distributed generation (DG). Recently, electrical power systems are shifting towards Embedded or Distributed Generation. This refers to a situation where many small generators are implemented as a partial substitute for larger power stations. This change poses new problems relating to real time control and management of large numbers of generators, which may be connected deep within the distribution network. It is well known that existing schemes for planning, dispatching and protection of central generators are not directly applicable to the new technology, and dispatching of small embedded generators is problematic. A number of new control techniques are being developed throughout the world to deal with this new set of engineering challenges. The new control techniques are often referred to as active network management. Many distribution networks are becoming active with bidirectional power flow therefore more active, real time and intelligent management techniques are required. The Active Network Management (ANM) concept focuses on the use of emerging information, computing and control technologies for the management of distribution networks operating in an increasingly complex environment. ANM is not simply a matter of controlling distributed generating units but of managing the network itself as well as energy storage and the demand side in some cases. In many case the existing technology could control these devices individually, but the challenge of managing these entities while also enhancing the performance of the distribution system remains a significant challenge. The paper will describe the emerging concepts, technologies and techniques being developed internationally in pursuit of effective active network management solutions.

Past, Present and Future of Computer Simulations

Syed Riaz Ahmed
Assistant Professor, Department of Mathematics
& Computer Science
North Georgia College & State University, 100 College Circle, Dahlonega,
Georgia GA 30597, USA
Tel : 706-867-2769. Fax: 706-864-1678.
Email: srahmed@ngcsu.edu

Computer simulations vary from a computer programs that run a few minutes, to network-based group of computers running for days. With the rapid advancement in the architecture and the speed of the processing of the processors, the introduction of multi-processors in a single machine, and the use of fiber-based transmission, the use of computer simulations is becoming possible in engineering, medicine, nuclear, space and other fields. Using computer

simulations, it is possible to study the past structure and the various changes that occurred on this planet and in the whole universe for billions of years ago, and what may happen in future, if some natural or man made disaster occurs in any part of the world. This type of simulation can help various government and international agencies to make adequate preparations to save human and other lives and infrastructure.

This paper traces the history, the current status and the future possibilities of using computer simulations to give the humans an opportunity to have a better possibilities of predicting the natural phenomena and providing a well-balanced and safe environment to lead a more productive and meaningful life. The paper also compares two widely used computer simulation programs that can reduce the cost of big engineering projects and can also be used in the feasibility studies. The paper also suggests possible uses of other computer simulation programs that can be used in various engineering industries in Pakistan to improve the safety and increase the export.

Analysis and Design of Electronic Load Controller for Synchronous Generator

Vaishali Jha^a, SATI Vidisha ^b, S. Gupta^c

^aUIT-RGPV Bhopal

^bC. S. Sharma

^c SATI Vidisha

This paper presents an analysis and design of an Electronic load controller for three phase synchronous generator suitable for stand-alone hydro power generation with constant input power. In such application water is freely available. The modeling of electronic load controller (ELC), used for power balancing at varying consumer load as required for standalone hydel generators driven by uncontrolled turbines, is presented. The implemented ELC consists of rectifier-chopper system feeding a resistive dump load, whose power consumption is varied through the duty cycle of chopper.

The Electronic Load Controller (ELC) is designed to maintain a constant electrical load on the generator. This is generally used for generators powered by hydro turbine. In such applications if the generator is loaded with constant power then the generator RPM remains constant and hence the output frequency will remain constant. It is assumed here that the quantum of water falling on the turbine blades and the water head is constant

Application of Computational fluid dynamics - Optimal cooling of hardware components

Faizan Ahma^{a1}, Dr. Moinuddin Ghauri²

Department of Chemical Engineering

COMSATS Institute of Information Technology, Lahore, Pakistan

¹ Email: faizanahmad@ciitlahore.edu.pk

² Email: drghauri@ciitlahore.edu.pk

Computational Fluid dynamics (CFD) is the science of predicting fluid flow, heat and mass transfer, chemical reactions, and related phenomena by solving numerically the set of governing mathematical equations. The results of CFD analyses are relevant in conceptual studies of new designs, detailed product development, trouble shooting and redesign. CFD analysis reduces the total effort required in the experiment design and data acquisition. This paper includes the study of different aspects to find the best possible cooling solution for the hardware components using simulation in software FLUENT. The geometries and grids were generated in "GAMBIT" software. For the particular geometry, by introducing forced convection maximum temperature at the hardware components is reduced by approximately 10 degree Celsius, but including multiple fans have no particular effect on maximum temperature. Changing the orientation of hardware components by 90 degree upright, the maximum temperature achieved by natural convection is 15 degree Celsius. Thus by such a modification minimum temperature is achieved without fan.

KEYWORDS: Optimal cooling, Computational fluid dynamics, FLUENT.

Buoyancy profile effects in steeply inclined bubbly shear flow

K. Sanaullah^a and N.H. Thomas^b

^a Centre for Chemical Engineering & Material Sciences (CCE&M)

B-2, NHS, Sector F-11/1, Islamabad, Pakistan.

^b Aston University, Birmingham U.K

The flow regime observed in inclined bubbly flows (= 10 degrees from vertical), we call "segregated-disperse" (Sanaullah & Thomas, 1994; ST below), is characterized by two-layer flow (schematically shown in figure 1) in which bubbles are buoyantly confined to the upper layer but dispersed within it, not only due to the mean shear turbulence but also due to the turbulence associated with bubble fluctuating motions. We report measurements of two-dimensional fully turbulent and developed duct flows (overall length/depth, $L/D=60$; D-based Reynolds number $Re>104$) for inclinations to 30 degrees from vertical at low voidages (<5% sectional average) representative of disperse regime using tap water bubbles (4-6 mm) and smaller bubbles (2 mm) stabilised in ionic solution. Pitot and static probe instrumentation, primitive but validated, provided adequate (10% local value) discrimination of main aspects of the mean velocity and voidage profiles at representative streamwise station i.e $L/D =40$. Our results can be divided into three categories of behaviour. For vertical flow (0 degrees) the evidence is inconclusive as to whether bubbles are preferentially trapped within the wall-layer as found in some, may be most, earlier experimental work. Thus the 4 mm bubbles showed indication of voidage retention but the 2 mm bubbles didnot. For nearly vertical flow (5 degrees) there was pronounced profiling of voidage especially with 4 mm bubbles but the transverse transport was not suppressed sufficiently to induce any obvious layering.

Importance of 'segregative-disperse' regime was discussed with particular attention on interior shear layer in ST. Here another potentially important connection, drawn from our study, links to mixed convection in vertical (or nearly) single-phase flows where symmetric normal velocity profiles of pumped flows are distorted by axial buoyancy forces induced by sufficient wall temperature excess or deficit. Such mixed convection regime has been studied in detail (e.g. Jackson & Hall, 1979; Tanaka et al., 1987; Cotton & Jackson, 1990) in relation to phenomenon of buoyancy-induced laminarisation (figure 2) and it's capability to causing disastrous collapse for intensive heat exchangers.

Tariffs-Its Importance on Sustainability of Power Sector

Shah Zulfiqar Haider, PEng
General Manager
Noakhali Rural Electric Society
(Noakhali PBS), Bangladesh
Email: szhaider123@hotmail.com

Electricity supply is a service. Utilities should run on "No-Loss-No-Profit and Sound financial basis". This requires proper Tariff as Revenue from consumers is the main source of income. New lines should be constructed on Revenue criteria. The revenue earned from these lines should be reasonable to recover the capital, operational, maintenance and other costs in due time. Again all areas of the country or Utility are to be brought under electrification, i.e. "Area coverage electrification program" irrespective of revenue. The two concepts are contradictory. Again Politicians sometimes commit to provide electricity free of cost to its Consumers (voters) in irrigation areas or to the poor, but who will actually pay for this free electricity. The Tariff is not rationale or cost effective. The rich countries sometimes provide subsidy to its Utilities, whereas Developing or poor countries are discouraged to provide subsidy because of mismanagement. Cost of electricity and Tariffs are not in harmony. Why? The Utilities have to keep the cost at minimum. Another important aspect is to always procure or install best quality electrical products. Electricity is sometimes considered as Goods and by some as Service. In any case it is such a product whose quality cannot be ascertained before its delivery to its consumers. We need to provide best quality electricity. Again Electricity is a service which is required round the clock. For Off Grid areas we need Renewable energy which is expensive. Best thing will be to provide One time subsidy. Often we have to go for Privatization mainly due to inefficient management of state owned Utilities. In any case the Tariff should be such that the Total cost of providing electricity is recovered from total sale of electricity at its minimum possible tariff. We also need a complete Infrastructure and Energy master plan for the whole country.

A long-lasting solution of the power problems in Karachi by in-depth study and simulation of E.H.T network of K.E.S.C.

Syed Qasim Bukhari, Saad Akhter, Mohammad Umair, Sadaf Rehman

Student, NED University of Engineering and Technology, Electrical
Engineering Department
R-582/18 F.B.Area, Karachi
Email: qasimbukhari@live.com

With the increase of load shedding in the city, this research paper provides a feasible solution with all the future requirements of the next 10 years covered. The future load is forecasted using regression curves and MATLAB is used for this purpose. This work comprises of not only the problems and their solutions of the existing system, but also extends its boundaries to

provide a long lasting solution to the future power problems.

In the development of any electrical power-supplying network of large scale, load flow studies play a vital role. The transmission-planning engineer can discover system weaknesses such as low voltages, line overloads etc. These weaknesses can be overcome by the design studies involving changes in the existing system. The system model is then subjected to computer based testing in order to determine the weaknesses under contingency condition involving abnormal generation schedule or load level. Our project's main theme is the load flow study of the existing high tension system of Karachi Electric Supply Corporation (K.E.S.C.) and to suggest the location of the most feasible point for the new generating plant on account of this study. During our work main objectives on which we have to focus are to determine the voltage profile of the buses at the grid stations and losses of the transmission system.

The study would revolve around the analysis of the above-mentioned parameters on season and after that on monthly bases. Once we would make our decision about the location of new extension point, it would be included in the existing network and further extension points will be decided for the next year and so on. It will be necessary to check that the new extension should fulfill the power demand in such a way that on the occurrence of fault on any transmission system connected to that point, other lines must not come under saturation. This project comprises of large amount of theoretical calculations which will be solved by the assistance of computer software MATLAB.

Sustainable power supply- short term & long term planning

Shah Zulfiqar Haider, PEng
General Manager
Noakhali Rural Electric Society
(Noakhali PBS), Bangladesh
Email: szhaider123@hotmail.com

Electricity outage has become a common phenomenon in many countries. This is mainly due to shortage of electricity generation, transmission or distribution, limitation due to technical reasons etc. There are 2 types of Electricity shortage depending on timing, Peak-hour shortage and Off-Peak-hour-shortage. Economic Losses due Electricity supply interruption are immense. No nation can afford such huge losses. In order to have sustainable power supply system we need to develop a Corruption free administration in Power sector and it should be Performance oriented organization with no bottleneck in the administration. On the Planning side, the measures to minimize electricity use/misuse include,

SHORT TERM PLANNING

- a. Maximum use of Compact Fluorescent lamps & Electronic ballasts in Tube lights Saving 60% with minimum GHG emission.
- b. Markets, malls should be closure after evening.
- c. Staggering of weekly holidays of Industrial areas.
- d. Restriction in use of Air conditioners, Ovens Fridges etc in Peak hour.
- e. No excess lighting in markets, street light, Bill board etc
- f. System loss reduction Technical and non technical.

- g. Incentive/Penalty for System Loss reduction achievement or failure.
- h. Industrial & Irrigation consumer use restriction in Peak hours.
- i. Industrial Power saving devices use increase.
- j. Tariff increase not affecting poor consumers.
- k. Motivation to consume less electricity.
- l. Improvement of Generation, Transmission & Distribution system.
- m. Regular recovery of electric dues.
- n. Exploration of Cogeneration and electricity from Captive Power.
- o. Improvement of Management, HRD & proper remuneration.

LONG TERM PLANNING

- a) Preparation of 5-50 years Infrastructure & Energy Master plan.
- b) Master plan for Generation, Transmission & Distribution system.
- c) Exploration of various sources and type of Energy.
- d) Renewable Energy including ICS.
- e) Exploration of natural energy resources.
- f) Energy Efficiency through Energy Audit.
- g) Privatization of Electricity sector.
- h) Exploration for Energy & Electricity from other countries.
- i) Preparation for policies & rules/regulations keeping country's interest.
- j) Regular monitoring and updating of master plan.

Remember a penny saved is a penny earned. A megawatt of electricity saved is like an extra megawatt of electricity generated & 1 megawatt of electricity generation and transmission cost more than 0.7 million euro and 3 years of construction cost for the same.

Global Trends for Power Utilization - Electricity Crisis in Pakistan and Strategies to Overcome Power Shortage for Scio-Economic Growth

Syed Nazeer Alam^a and Nusrat Hussain^b

^a Assistant Professor,

Electronic & Power Engineering

Pakistan Navy Engineering College, NUST Karachi Campus

Email: nazeer@pnec.edu.pk

^b Lecturer

Electronic & Power Engineering

Pakistan Navy Engineering College, NUST Karachi Campus

Email: nusrat@pnec.edu.pk

Increased energy trend is a natural consequence of economic growth and improving living standards in the world. Pakistan suffers from dearth of infrastructure in the water, irrigation, power and transport sectors, this hinders growth and affecting all sectors of economy. At present our total energy capacity (19,479 MW) comes from oil, gas, nuclear and coal. The requirement of power is increasing at the rate of 40% by all sectors in Pakistan. Load shedding exceeded 4,000 MW this year has put bad impact in yield, health, education, science and economy of the country.

As our energy needs are immediate and depletion in gas reserves, water shortage and increasing oil price are of great concern. We would require 7,000 MW more power by 2010 to meet the increasing demand of energy and power from all sectors. In the next 25 years we would need 162,000 MW of electricity. At present Pakistan per capita power consumption is only 520 KWH where as world's is 2000 KWH. This paper provides some global useful energy generation and supply data comparison, information & description of coal reservoirs in Pakistan and suggests the way and means to overcome power deficit which is important indication from the point of view of socio-economic growth & progress, prosperity and integrity of the country. It is suggested that the strategies required to be implemented on emergent basis, short term and long term to acquire the targets in power generation and supply to meet economic challenges and improve upon living standard of people (45% who are still deprived from electricity) of country through some sensible policies and mutual understanding among Government, stakeholders, energy producers, commercial and domestic consumers.

Distributed Generation- Feasible in Pakistan or not?

Syed Qasim Bukhari

NED University of Engineering and Technology, Electrical Engineering

Department

R-582/18 F.B.Area, Karachi

Email: qasimbukhari@live.com

Distributed power generators are small compared with typical central station power plants and provide unique benefits that are not available from centralized electricity generation. Many of these benefits stem from the fact that the generating units are inherently modular, which makes distributed power highly flexible. It can provide power where it is needed when it is needed. And because they typically rely on natural gas or renewable resources, the generators can be quieter and less polluting than large power plants, which make them suitable for on-site installation at some customer locations. Distributed energy resource (DER) systems are small-scale power generation technologies (typically in the range of 3 kW to 10,000 kW) used to provide an alternative to or an enhancement of the traditional electric power system. Usually the problem with distributed generations is its high costs. We shall try to emphasis in this paper, a correct view of the it's cost in relation to its advantages. The structure of the electricity market itself presents some barriers to the adoption of distributed power. Any market rules or business practices that nullify the advantages of distributed power will slow market adoption. For example, owners of grid-connected distributed power generators can pay excessive and prohibitive charges for their connection to the grid as a backup power source, even if they never use any grid power. The timely emergence of a healthy distributed power industry is required to serve the basic needs of early adopters. For this to happen, quick action is required to remove some of the most pressing barriers, such as inappropriate or inconsistent codes and standards. The availability of new distributed energy technologies at a time when the electricity industry is open to competition and choice provides a great opportunity for rapid penetration of these technologies provided existing obstacles are removed. This paper will give a brief overview of the current technologies used and will also give idea for the future technologies that can be used.

This paper not only compares the different types of distributed generation but also extends its boundaries to their practicality in the region. The regions where distributed generation is being successfully utilized is discussed and compared with the facilities available in our region. Distributed generation is a good solution for the present power crises in our region. Though where it has some benefits, it has some disadvantages as well. In this paper, we shall discuss all the impacts of

distributed generation in our region. The complexity, technical problems and the economics of distribution generation is discussed briefly.

Keynote Speech

Pyrolysis of Waste Biomass and Municipal Solid Waste to Liquid Fuels

Arshad Chughtai

Institute of Chemical Engineering & Technology, University of the Punjab, Lahore 54590 Pakistan.

Email: achughtai@icet.pu.edu.pk

Considering the dwindling supply and escalating price of crude oil, waste to energy source is explored. A renewable energy source, biomass and municipal solid waste is suggested to meet the growing energy demand. It has been estimated that caloric value of agricultural waste streams is more than 50% of the total world annual oil consumption. Similarly, the heating value of MSW is reasonable for generation of waste derived fuels, a promising route for sustainable environment and energy. From the different available routes for biomass and municipal solid waste conversion to energy, pyrolysis has been selected for further research work. Pyrolysis being a proven technology is simple to operate and is also economical. Pyrolysis at short reaction times and intermediate temperatures will provide reasonable yield of biocrude oil, a substitute for fossil crude oil, and in addition char and medium-BTU gas are obtained.

The pyrolysis technique can also effectively be applied to other sources, like spent tires and polymer waste. This paper provides information regarding importance of pyrolysis, previous work on pyrolysis and future direction in this regard.

Biomass/Wood Pelletisation Power Plant: Solution to epileptic power supply in Nigeria.

Engr. BAMIGBOLA, Johnson Oladapo A (MIEE, MNSE)

Electrical/Electronic Engineering Department,

Faculty of Technology, University Of Ibadan, Nigeria

Email: fifiedapo@yahoo.com; joa.bamigbola@mail.ui.edu.ng;

Conventional energy sources are getting depleted gradually globally and most African countries are faced with incessant cut in power supply, a situation more prevalent in Nigeria, this is partly due to overdependence on hydro power generation system. This research was embarked upon mainly to find a cheaper source of electricity production as a result of increase in the search for different forms of renewable and sustainable energies available with Nigeria being chosen as the case study because of its population advantage.

This paper considered the possibility of adopting a biomass power plant which uses wood pellets mainly as fuel, the pellets were made from a blend of wood shavings, sawdust, dried waste-wood and rice/maize husk. From data collected, it was discovered that 1.5 million tonnes of woodshaving, wastewood, sawdust and rice/maize husk are currently burnt off annually.

2,000tonnes of wood pellets would be needed to achieve a daily production of 100KW of electricity using a small power plant.

From the business model developed, it was found that the plant is able to produce power at 65% of the present cost of producing a unit through hydro power plant. From the result obtained it was discovered that pellet power plant could be a feasible alternative for power generation in several parts of Nigeria, while the rate of returns on investment for foreign investors could be very high.

Keywords: Biomass, pellets, conventional energy, power plant

Biomass processes for sustainable energy in Pakistan

Muhammad Yasin, Aqeel Ahmed Bazmi, Amjad Riaz, Abrar Faisal
Department of Chemical Engineering COMSATS Institute of Information
Technology Lahore

Energy is a prime agent in the generation of wealth and also a significant factor in economic development. Pakistan is an energy deficient country and spends over 3 billions US dollars of foreign exchange every year to import oil with annual increase of nearly 1%. The demand for energy is increasing at an exponential rate due to the exponential growth of population and socio-economic sectors. The reserves of fossil fuels are limited and they are depleting very fast. The expansion of existing energy resources and exploration of new sources is an important exercise to be considered in order to sustain development initiatives. There has to be alternate energy sources which could fulfill the ever-growing gap between energy demand and supply. Renewable energy is a basic ingredient to reduce poverty and to allow sustainable development. Biomass has a potential to provide the major part of the projected renewable energy provisions of the future both for the developed and developing countries like Pakistan. Biomass is an important contributor to the world economy that can be utilized to meet a variety of energy needs, including generating electricity, heating homes, fueling vehicles and providing process heat for industrial facilities. It is a clean, renewable energy source that could dramatically improve Pakistan economy, environment and energy security. In this paper biomass conversion processes with their products are summarized and technical and non technical barriers are identified.

Energy Balance Analysis of Blast Furnace

Balkrishna M. Chodankar
Mechanical Engineering Department,
Government Polytechnic, Mayem, Bicholim-Goa
INDIA

Ph.: (0091832)2361235, (0091832)6410772

Fax: (0091832)2361235

E-mail: bmchodankar@gmail.com

Production of steel by blast furnace process is the predominant technology in the world today. Apart from being an intense energy consumer and being the main reason of production costs, blast furnaces are substantial green house gas producers. The blast furnace produces pig

iron by the reduction of hematite (Fe_2O_3) and magnetite (Fe_3O_4) with coke. The consumption of coke per ton of hot metal in some of the blast furnaces in India and some other developing countries is much higher than the international standards and needs critical analysis. The necessary carbon and high temperature required by the reduction process makes the blast furnace an energy balance center. In this study, carried out on a mini blast furnace in India, the limits of the blast furnace have been chosen as the control volume. By the identification of the energy sources that move in and out of the control volume, the energy sources have been fractioned and categorized. The monitoring is carried out at each category of input and output. The analysis helps in providing effective use of energy and reduces the green house gas emissions. The study suggests that out of the total heat input supplied, the required energy for reduction of iron is 39.8% and that contained in the latent energy of blast furnace gas is 34.2%. In this study, the model presented in the "Japanese Steel Making Handbook" has been taken as a reference.

Conversion of Coal into Liquid Fuel by Fischer Tropsch Process Using New Catalyst

Usman Shoukat^{a1}, Qandeel Fatima^{a2}, Shoaib Ghaffar^{a3}, Dr Murid Hussain^b

^a Fellow Students

Catalysis Engineering Research Group
Department of Chemical Engineering

COMSATS Institute of Information Technology, Lahore, Pakistan

¹ E-mail: drusmanawan@gmail.com

² E-mail: qandeelgilani@yahoo.com (Corresponding author)

³ E-mail: csg_rab@yahoo.com

^b Assistant Professor

Catalysis Engineering Research Group
Department of Chemical Engineering

COMSATS Institute of Information Technology, Lahore, Pakistan

drmhussain@ciitlahore.edu.pk

Pakistan is coal rich country. Coal can be converted into liquid fuel such as gasoline and diesel. The major coal to liquid production process is the Fischer Tropsch process, involving conversion of coal into gas and then into liquid fuel (gasoline, diesel). In Fischer Tropsch process catalyst is key to the process. In this process Fe base, Co or zeolite catalysts are commercial catalyst. So to replace these conventional catalyst nanoporous materials supported catalysts are proposed. In this paper we have focus on the improvement of Co catalyst by using mezoporous Silica/ mezoporous carbon instead of conventional catalyst.

Key words: Coal purification, Fischer Tropsch Process, Catalyst, Liquid Fuel

Energy consumption in Pakistan using co-generation technology

Abrar Inayat ^{a1}, Dr. Moinuddin Ghauri ^b, Imran Aslam ^c, Amjad Riaz^d
^{a,b,c,d} Department of Chemical Engineering, COMSATS Institute of Information
Technology, Defence Road, Off Raiwind Road, Lahore, Pakistan
¹ Email: abrar.inayat@gmail.com

The rising demand of energy in Pakistan offers the meeting challenges for the optimum generation and utilization of energy. There is a strong need to improve the commercial strategies, as the implementation of co-generation & tri-generation technologies is not yet able to compare with the energy saving strategies of developed countries. This study discusses the technological, economic & environmental aspects of district heating system using co-generation technology (Heat & Power together). Instead of single independent home energy & heating, co-generation decreases the commercial & financial problems of a society and is more environment friendly. As Pakistan natural gas recourses are depleting, so the proper utilization of available resources is a need of time. Boiler systems will be run by natural gas which produces not only steam to warm the society but also run the steam turbines for power generation. Co-generation technology in Pakistan not only gives the significant energy but also saves the indoor heating cost of a society. The use of co-generation technology is helpful in energy consumption of the country especially in winter when people consume natural gas at a big scale using room heaters & natural gas geezers.

The co-generation technology is also helpful in the reduction of air-borne pollutants caused by natural gas room heaters which is one of the big issues in every winter in Pakistan and may lead to death casualty. Moreover it may contribute towards social economic benefits for societies, transportation and industries.

Key words: Co-Generation, Power, District heating system, Natural gas, Pakistan

Coal-based development plays key role in economy of Pakistan

Engr. Abdul Waheed Bhutto
Assistant Professor,
Department of Chemical Engineering,
Dawood College of Engineering and Technology,
Karachi.

Because of the links between reliable electricity supply, GDP growth, and living standards, many of the nations with emerging economies are attempting to increase access to reliable electricity supply. The need to increase their citizens' access to electricity has led many governments of the emerging economies to implement a variety of strategies, such as privatization to increase investment in the electricity sector, enacting government policies to encourage investment from potential foreign participants, and introducing rural electrification schemes aimed at bringing electricity to rural communities, both to improve standards of living and to increase the productivity of rural societies.

The discovery of coal in Balochistan Province of Pakistan during the late 18th century led to its commercial utilization mainly by the North-Western Railways during the colonial regime. Well-developed coalfields are located in Punjab, Balochistan and Sindh Provinces. Present coal reserves of Pakistan are estimated around 184.5 billion tons.

Coal utilization in power production will remain on low priority in Pakistan due to its poor quality, high cost of mining and transportation. The energy infrastructure has been transformed in to oil/ gas technologies and reversion to coal can only take place by competitive pollution free technologies. The cost of production of coal is lowest in Sindh at the same time it has largest coal reserves.

New technologies are available in world market to produce several chemicals and petrochemical including pitch, creosote oil, naphthalene, phenol, pyridine, benzene, toluene, xylene, ethylene, propylene, polyesters, plastics, synthesis gas, acetic acid, acetic anhydride from coal. This article discusses issues related to the introduction of emerging technologies in Pakistan.

Energy conservation and construction management using coal wastes as thermal insulation building materials for low income housing.

Abdul Bari Mangia^a, Engr. Zahid Hussain^b and Engr. Dr Attaullah Maher^c

^a Research Officer

^b Principal Research Officer, CWHR

^c CWHR Chairman CWHR

The important issue of saving of energy from different sustainable developments gets importance day by day in our country due to many reasons, firstly, an alternative material and its production technology needs to be adopted in Pakistan for energy conservation with simple management. Issues and opportunities for utilization of alternative insulation material including wastes of national coal reserves can be utilized as cheaper energy saving building material or substitute in our local construction industry. Secondly, for meeting actual target of saving of energy through most effective sustainable development strategies, In House R&D works have been conducted at the CWHR with the objective to identify some of the better ways to utilize wastes of coal materials produced in millions of metric tones daily in our different coal mining areas of country for recommendation of other source of energy in the form of cheaper insulation building material used.

According to the World Bank Report, approximately 200 billion ton of Coal reserve is available in Pakistan. Out of this 200 billion, 175 billion Ton of reserves is available in Thar. The main issue and opportunity for coal is in Pakistan is to utilize wastes of coal of Pakistan as building material. Some efforts were used to collect some of experimental samples of coal wastes from Lakhra Power, unit works in district Jamshoro, Sindh works based on coal firing for generation of electricity. The Lakhra Power Station produces above than 250 ton daily fly and bottom ashes as an industrial coal wastes, and there is no use of these coal ashes, although using these ashes, light weight aggregates, typical concrete mixes for production of insulation materials, alternative wastes Viz on cellular plastic materials, such as, expanded polystyrene and polyurethane foam materials can be developed. Using coal ashes, masonry elements and cement replacement material can be developed for energy saving benefits. Near to Lakhra Power Station, there is large coal mines are available, known as shale coals

or carbon content fine clays of particle size " 1/256mm'. Using Lakhra coal mines developed thermal insulation bricks, both solid and hollow bricks of size 9" x 4 1/2" x 3" thick, fly and bottom ashes of Lakhra Power Station were used _ to manufacture lightweight bricks.

Under preliminary laboratory investigations, tested different types of bricks and blocks of size 9"x 6"x 3" thick casted with experimental materials fly ash 50% and ordinary clay 50% by weight, also used 50 % bottom ash with clay by weight on improved brick or block moulds develop by the CWHR. The bricks are light weight, insulated, having accurate dimensions, can be fired at any bricks kiln to save agriculture clays mostly used in manufacture of unfired bricks. Using fly ash , lime and gypsum plaster ,developed cheaper mud or clay soil stabilizer, for making cement less stabilize masonry blocks .These substitutes masonry products can be recommended for a variety of insulation applications. In this paper, authors discussed energy saving parameters keeping in view of utilization of coal wastes as cheaper alternative building materials with reference to lab results achieved after under taking preliminary R&D works.

KeyWords: Energy Conservation .Coal in developing countries .Coal wastes as building materials. Thermal Insulation. Cellular plastic materials. Low cost housing. Local construction Industry.

Power Generation from Coal and Introduction of New Technologies for the Construction of Low Cost Thermally Insulated Earthquake Resistant Houses In Pakistan o A Rapid Boast To Economic Growth

Mr. Abdul Bari Mangi Mr. Zahid Hussain

Council for works & housing research ministry of science & technology, Govt. of Pakistan, F-40, Site, Hub river road, Karachi

Pakistan is fortunate to have enormous deposits of coal reserves in its territory. According to the World Bank report there are approximately 200 billion Ton of coal reserves in Pakistan. Out of this 200 billion, approximately 175 billion Ton of reserves is in Thar , Sindh area and remaining 25 billion Ton is in different provinces in Pakistan. These coal deposits are low graded anthracite and sub-bituminous typed and have high moisture and sulfur contents. Pakistan is undergoing power shortage. The existing thermal and hydel power is expensive. Empirical studies have shown that power generation is cheaper with coal fired power generation. Hence Pakistan has great potential for power generation by utilizing its own coal reserves with cleaner and advanced technology prevalent these days in world over. Government of Pakistan has a plan to increase its power generation to 10000MW by coal. The statistics shows that Pakistan contribute to 2-3% share of power generation by coal in its energy mix as compared to 60% in USA and 40% in India and hence there is potential to increase coal share in energy upto 50%. With the establishment of coal based power plant from indigenous coal reserves, enormous economic activities will be started. The wastes of coal like colliery wastes and wastes from boiler like fly-ash and bottom -ash will be used for the manufacturing of building materials like blocks, lightweight aggregates, bricks and consequently low cost thermally comfortable houses can be constructed in enormous scale in throughout Pakistan benefiting common people. This will boost up economic activities throughout country and in addition will also give various useful products like Synthetic Gypsum., chalks", building admixtures etc Hence power generation from coal will help in introduction of new technologies in Pakistan.

Coal Fired Power generation Potential of Balochistan

Engr. Faisal Mushtaq^{a1} and Engr. Fahad Mir^{b2}

^a Assistant Professor

^b Lecturer

Department of Chemical Engineering, Balochistan University of Information Technology, Engineering & Management Sciences, Takatu Campus, Quetta.

¹ Email: faisalqta@hotmail.com

92-0321-2493009

² Email: mirfahad@hotmail.com

92- 0333-7896828

Industrialization in Balochistan is always been stressed for the prerequisite for the economic development of the province. One reason for the slow growth of this sector is the lack of an adequate and dependable electricity supply; moreover electricity is also in high demand for domestic use. Meeting this need may not only over burden that existing infra structure but also put pressure on coal and gas resources that are used for thermal electricity generation.

Balochistan produces 40.2 % of the primary energy of Pakistan in the form of natural gas coal and electricity. Of the total mineral fuel reserve of the country, Balochistan contain more than 33 % of the natural gas, about 9 % of the coal and about 2 % of the probable oil reserves. About 81 % of the province energy requirement meets to the use of fire wood 9 % from dung cakes.

Renewable energy resources might help to solve the energy crises of those remote areas where it is difficult to provide electricity through transmission lines .more over the use of renewable technologies will surely reduce pressure on fossil fuels reserves, trees and shrubs. The major obstacle to a wide use of energy power systems in rural areas is one that almost all such technologies face high initial cost including that converting it into use able form and storage as compare with the conventional commercial systems. Other obstacle include lack of practical information on installation ,use and maintenance lack of competitive range of appliances ,lack of technical support and lack of funds for operation and maintenance

The share of coal in the overall energy is only 6% and this percent merely is one percent of the electric power generation of Pakistan. The unexploited coal resources of Pakistan may generate more than 1, 00,000 MW of electricity for the next 20 years by converting coal to a clean gas, which can then be burned like natural gas with combined-cycle turbine.

There are number of coal fields in Balochistan. However, the major coal fields are Sor-Range/ Degari, Khost/Sharigh/Harnai/Ziarat, Mach and Duki. The total coal reserves are about 217 million tones, of which 32 million tones are considered mineable. The thickness of coal seems ranges from 0.3 to 2.3 meter. Balochistan Coal is classified as sub-bituminous to bituminous and the heating value ranges form 9,637 to 15,499 Btu/lb. it has low ash and high sulfur coal, and is considered suitable for power generation. Small power plants up to 25 MW can be setup in each coalfield.

Keywords: RETs, Energy security, wind power, Pakistan

Energy Conservation- A Case Study

Atmaram V. Gaonker
Electrical Engineering Department,
Govt. Polytechnic, Mayem, Bicholim,
Goa , India - 403504
Office Phone & Fax: 91 832 2361235
Email: rugaruby@rediffmail.com

In India, most of the power generation is met through non-renewable sources of energy. It is understood that these resources will get depleted soon. Moreover, usage of these resources leads to environmental damages such as air pollution, global warming etc. Energy conservation measures are essential to attain energy sustainability and also to increase profitability. In this paper, a case study of energy conservation at Polytechnic Institute having 33kV electrical installation is presented. Initially, large amount of energy cost saving was achieved by lowering contract KVA demand. Subsequently, cost saving was achieved by power factor improvement, by connecting the capacitors at the load centers instead of working on central automatic capacitor bank. The central automatic capacitor bank was found not giving desirable results due to KVA load of the Institute was far below the minimum load at which it was not functioning. This was a design problem, which did not anticipate the actual loading. Further energy saving was achieved by reducing fixed losses at the transformer. More energy conservation opportunities were identified and analyzed for cost benefit and proposed for implementation. These include, redesign of transformer for optimum efficiency utilization, use of new/efficient technology in existing electrical equipments/fixtures and healthy maintenance practices. Data and information analysis /evaluation carried out for understanding energy use pattern and trends by using different techniques. In short, energy and cost savings was achieved by reducing KVA demand, improvement of system power factor and minimizing losses in transformer. Further savings are proposed by redesign, use of new/efficient technology and maintenance practices.

Key words: KVA demand, power factor.

Environmental Impact Assessment of Nuclear Desalination Plant at KANUPP

Muhammad Saleem^a, Waqar Murtaza Butt^b and Muhammad Saleem Ayub^c

^a Principal Engineer, KANUPP Institute of Nuclear Power Engineering
(KINPOE),

KNPC, (PAEC), Karachi

Email: i_am_saleem@yahoo.com

^b Director General, Karachi Nuclear Power Complex,
KNPC, (PAEC), Karachi

^c Project Director, NDDP, Karachi Nuclear Power Complex,
KNPC, (PAEC), Karachi

P.O.Box No. 3183, Karachi, Pakistan.

Due to limited water resources and growing demand over a billion people worldwide lack access to sufficient water of good quality. Pakistan is entering a period of severe water shortage, which may create chaos in water distribution and its use. Pakistan is among 17 countries listed under "absolute water scarcity". Water scarcity in the near future will be the single greatest threat to human health, the environment, and the food supply. Better water conservation, water management, pollution control and water reclamation are all part of the solution to projected water stress. Desalination technologies have been well established since the mid-20th century and widely deployed in the Middle East and North Africa.

Most desalination today uses fossil fuels, and thus contributes to increased levels of greenhouse gases. However, nuclear power plants provide cleaner environment. Both nuclear and desalination technologies are mature and proven by experience, and are commercially available. A Nuclear Desalination Demonstration Plant (NDDP) of 1600 m³/d capacity is being installed at Karachi Nuclear Power Plant (KANUPP) which is a 137 MWe pressurized heavy water reactor.

A Nuclear Desalination Plant (NDP) can impact the aquatic environment mainly by subjecting the aquatic life to possible temperature increase and salinity changes in the vicinity of the cooling water and brine discharges. Any wastewater effluent, which will be discharged from the NDDP, may have some adverse effects on the marine life and general environment. In order to protect the environment and comply with the requirement of the Pakistan Environmental Protection Agency (PEPA) an Environmental Impact Assessment (EIA) for the discharged effluent from NDDP was carried out. In the present work baseline study was carried out for project location, climate, water resources, and ecology. Checklist has been prepared for identification of possible environmental impacts of the project and marked according to their insignificance. Specific conclusions of the study and recommendations have also been provided in this paper. Mitigation measures have been recommended to minimize environmental impacts identified during the assessment.

Application of Extended Finite Element Methods (X-FEM) for Cracked bodies.

Anser Pervez

Department of General Mechanics RWTH Aachen University,

GERMANY.Tel: +49 241 8094605

Email: anser@iam.rwth-aachen.de

Mesh generation in three-dimensions for crack growth simulations is still a challenging task. Because of accurate prediction of crack growth remeshing is required after each calculation. In existing frame of work the extended finite element method (X-FEM) overcomes difficulties associated with the meshing of cracked surfaces. With the help of X-FEM computational challenges linked with mesh generation are overcome because X-FEM does not require finite element mesh to conform cracks. Also with the help of X-FEM higher order elements or special finite elements can easily be used.

The X-FEM makes the best use of this framework to model geometric features that are independent of the element boundaries, allowing for accurate simulations of crack growth and evolving material interfaces without remeshing. The method is therefore ideally suited for the fracture analysis of FGMs, and in particular for examining the detailed effects of composite microstructures near a crack tip. The other method for cracked body simulation is the mesh free method, despite the fact that this

method is very suitable to represent cracked bodies but it is not compatible with current FEM method, the second drawback with this method is its higher computational cost. In this paper an introduction to X-FEM is presented along with its comparison with mesh free method.

Environmental problems faced by humanity, a case study of acoustic noise impact at thermal power plant (T.P.P) Pakistan Steel Bin Qasim Karachi

Engr. Zaheeruddin Memon (A.Prof. (R)
Q.A.Engg.University)

P.O.THARUSHAH-67480Distt: Naushahro FerozeSindh(Pakistan)

Ph: +92 242 433534,Cell: +92 03013802732

Email: zhr_mem@yahoo.com, memon_zaher@hotmail.com

Energy crises and consequential threat to world economies is no doubt one of the main problems for developing countries with special emphasis on Pakistan. As such Environmental impacts in energy producing plants needs to be given parallel consideration as well.

Noise being one of deadliest pollutants in urban areas of Pakistan; it may result in adverse effects on human health. These effects may result in reduction of work output, lack of efficiency, impairment of hearing, vague feeling of annoyance, increased incidence of heart disease, eye sore, blood pressure, accidents at work, irritation, speech interference, sleep disturbance, work interference, cancer, headache, tension, digestive, respiratory, nervous problems and other many physiological & psychological effects on human system.

To assess the impact of Noise on human health detail survey made, by investigating the workers/staff at Thermal Power Plant (TPP) Pak Steel BinQasim Karachi.

About 94% staff was not satisfied, facing different type of diseases due to Occupational Noise Level found more intensive i-e 97- 114 dB (A), which was higher one as against maximum permissible exposure limit i-e 85-90 dB (A) Leq for 8 hrs/day (40 hrs/week) 5 days a week, quite safe for the workers as allowed by the Intl. Stds. Orgn. (ISO) EEC and other developed counters.

This paper has Suggested safety measures to over come Health Hazards. For attenuation of Occupational Noise impact at work, Reduce Breakdowns, Improve Efficiency of Plant & Economical Growth. Finally holding Seminars and Workshops creating awareness among workers regarding Potential health hazards.

Key words: Occupational Health, Safety Measures

Advanced Technology for Anaerobic Conversion of Organic Waste Producing Biogas, Electric and Thermal Energy and Sterile Biological Mineral Fertilizer

Ali Rahman Alkhalidani
Graduated in Energy Engineering, Qatar
Email: Saeed_rezai43@yahoo.com

The advanced anaerobic biomass conversion technology represents a new ecologic and economic solution for solving problems of organic waste management in municipalities, agriculture and food industries and realizes a natural circulation of biomass with a very efficient production of high-graded biogas for energy use (electric and thermal) and precious sterile mineral fertilizer for farming.

Generally the anaerobic digestion process is the best-balanced method for biomass conversion for renewable energy production using up to 95% of the organic input. The described advanced technology enables a profitable marketing with energy and fertilizer for any investor due to the specific construction and using proven industrial processing methods, which ensures a high energy yield with a low plant investment. The waste conversion concept fulfils all valid EU-guidelines for modern waste management and prevention of air, water and soil pollution. Therefore EU-subvention for this technology is available and reasonable as well as reimbursement for supplied electric energy into the public grid.

The residual biological waste is converted to a sterile, ecological fertilizer which contents a natural balanced amount of minerals according the feed stock and free of volatile ammonia and which can be adapted to the seasonal requirements of plant farming. The biogas plant is designed as a closed, smell-free stand-alone unit, which can convert every kind of organic waste from municipalities (including sewage sludge), agriculture (manure, straw, grass...), food industry (slaughter waste), restaurants etc. Most of the organic waste will be converted by a multi-stage wet fermentation process to a highquality biogas (80% methane), which is used for electric energy production within a block power station (gas motor with generator) whereby thermal waste energy is reused partly for the process itself and available for other external energy consuming processes like drying in agriculture or heating of green houses or even cooling by adsorption heat pump systems.

Sugarcane, A source of immense energy for Pakistan

Aftab Ahmed Memon
(0346-3755834)

Pakistan is land of opportunities, teaming with natural resources and agriculture. Sugarcane crop is also included in the above statement. Pakistan is the 5th largest sugarcane producing nation. It is 7th in terms of sugar production and 8th in consumption. The sugar industry is the second largest industry of Pakistan and contributes in ways. For example: it adds nearly 20 billion rupees annually in federal, provincial and local taxes and GST. Sugarcane industry is the direct source of bread and butter for about 120,000 Pakistanis and indirect employment is around 4 million.

The sugarcane crop cultivation in Pakistan currently occupies nearly 5 % of the total cultivated area and accounts for nearly 17 % of the gross value added by all crops. There are 76 sugar mills in Pakistan, out of which a dozen are in the Badin Concessions (An area where British Petroleum Pakistan Exploration & Production Inc. operates). For our purposes, we will concentrate on that particular area only. Lot of oil and gas production fields of the state owned Oil Company OGDCL like Daru gas facilities and Tando Alam oil complex etc. are also there. This area is the most Southern part (lower Indus basin) of province Sindh. Huge sugarcane crop is harvested each year in that area. This huge production accounts for low price for farmers.

Looking at the current oil prices, the world seems shifting toward alternate energy resources and Pakistan isn't an exception. The nation has a comprehensive plan for that too. Unfortunately, the enormous opportunity to use sugarcane to produce ethanol---gasoline is lowest in the priority list of both oil companies like BP and the government. This particular sector has plethora of opportunities for all parties involved (operating company, government, farmers and people of Pakistan!)

Determination of energy consumption of Carnation flower grown in Mahallat region of Markazi province- Case Study: Mahallat, Markazi province of Iran

Shahin Rafiee
Associated professor
University of Tehran
Department P of PAgricultural Machinery Engineering,
University of Tehran, Karaj, Iran
Email: shahinrafiee@ut.ac.ir

Greenhouse farming is a growing industry in many countries. Because producing out of season, it consumes high energy. Markazi province has second status from the viewpoint of area of ornamental plants in Iran. Area of ornamental plants in Mahallat region is 70% from entire area of cut flower farming in Markazi province of Iran.

The aim of this study is to determine the input energy consumption of Carnation flower grown in greenhouse in Mahallat region of Markazi province. For this purpose, the data for the production of Carnation flower were collected in 60 greenhouse farms by questionnaire.

The greenhouses were chosen by random sampling method. The results revealed that total energy consumption was 955.18 GJ/1000m² and specific energy (energy consumption for any limb) for Carnation flower was 7.8 MJ. The results showed that among energy sources, Diesel fuel inputs contained the highest energy with 96% and followed by electricity with 2%. This indicated an intensive use of diesel fuel for warming in greenhouse cut flower production that can lead to problems associated with it such as global warming. Therefore, there is a need to pursue a new policy to force producers to undertake energy efficient practices to increase the yield without diminishing natural resources.

Key words: Greenhouse, Carnation flower, Energy consumption, Specific energy.

Determination of energy consumption of Rose flower grown in Mahallat region of Markazi province- Case Study: Mahallat, Markazi province of Iran

Shahin Rafiee
Associated professor
University of Tehran
DepartmentP of PAgricultural Machinery Engineering,
University of Tehran, Karaj, Iran
Email: shahinrafiee@ut.ac.ir

Energy, economic and environment are three important factors for defining the behavior of agricultural production systems. Greenhouse production because producing out of season, consumes high energy. The aim of this research was to examine the energy equivalents of inputs in greenhouse Rose flower production in the markazi province of Iran. Markazi province, which is one of the most important produce of cut flower centers in Iran. The data used in the study were obtained from 98 local tomato growers using a questionnaire. The farms were chosen by random sampling method. The results showed that the amount of energy consumed in Rose flower production was 1313.35 GJ/1000m²P. About 90% of this was generated by diesel oil and 8.9% from electricity. The specific energy (energy consumption for any limb) of Rose flower production was determined to be 13.74MJ. These findings reveal that intensive input use in Rose flower production, especially diesel oil, gives a high flower yield but also raises some problems like environmental pollution and global warming. It was concluded that energy use management at farm level could be improved to give more efficient and economic use of energy. Thus, new policies, emphasizing energy consumption without degradation of national resources, should be designed for such farms.

Key words: Greenhouse, Rose flower, Energy consumption, Specific energy.

Biomethanation (Bioenergy) Potential of Corn-Glucose Factory Liquid Composite Waste

A.K. Salunkhe^a, A. M. Deshmukh^b
^aDept. of Microbiology, K. R.P. Kanya Mahavidyalaya, Islampur Tal. Walwa
Dist. Sangli-415 409 (M.S.) India.

^bDept. of Microbiology, Dr. B.A.Marathwada University
Subcentre, Osmanabad-413 501 (M.S.) India.
Email: amdeshmukh1@rediffmail.com

Biomethanation potential of corn-glucose factory liquid composite waste have been studied. One litre (1-L) capacity biogas digesters were selected for testing of primary biomethanation potential of waste and it was found that satisfactory amount of biogas was produced at optimum retention time of 25 days, at pH 7.5 and at 38 °C temperature. Scale-up studies on biomethanation

of waste in 5-L, 25-L and 125-L biogas digesters showed that per cent methane content was gradually increased. The results are discussed with COD and BOD values in the present work.

KEY WORDS: Acclimatization, Seeding Material, Methanogens

Green Building Movement in India - Catalysts and Course

Prasad Jadhav

Post-Graduate Research Assistant

RiSE Unit, Dublin Energy Lab.,

School of Architecture,

Dublin Institute of Technology,

Bolton Street, Dublin 1, Ireland

Email: prasjad@yahoo.com

The Green Building Movement spearheaded by CII Godrej GBC since 2001 has come a long way. With a meagre green building footprint of 20,000 sq.ft in 2003, today green buildings of over 25 million sq.ft are being constructed all over India. More than 100 buildings have been registered in India under the LEED rating program. There has been tremendous learning from the construction of various green buildings. This paper captures the lessons learnt over the years. LEED India NC (New Construction), a fully indigenous rating to suit the National context has been launched effective 1 Jan 2007. LEED India CS (Core & Shell) has also been launched effective Sep 2007. The Indian Green Building Council (IGBC) would administer the LEED India rating system.

While designing these buildings as Green, there have been many challenges and alongside these challenges there have been enormous opportunities for various stakeholders - architects, builders, developers, manufacturers and others. The market for green building materials and products is estimated to reach Rs.15000 Cr by 2010. Service providers from India will have opportunities to offer green building services to other countries as well. The Indian green building movement is surging ahead and well poised to reach greater heights, in the years to come.

Integrating Green Building Practices into Housing and Building Construction

Engr Zahid Ali

B.E (civil), M.Engg. (AIT, Bangkok)

P.E, Member CATBUH (Hong Kong)

Email: isloo2006@yahoo.com

The modern construction has produced the most uneconomic buildings and houses which are supported by most expensive devices of heating and cooling. Not much use of day light advantages and extensive use of glass which limits contact of fresh air. Houses are designed and constructed with little thought given to the environmental impacts of building materials used and

long-term maintenance and operation. Housing and building conditions needs to be improved by following green building principles during planning, designing and constructing housing projects. Sustainable house / building is a structure that is planned, designed, built, renovated, operated, or reused in a resource-efficient manner. Green building construction is planned to achieve certain objectives such as protecting occupant health; using energy, water, and other resources more efficiently; and reducing the overall impact to the environment. Buildings in view of the materials from which built, cause a tremendous effect on the environment both during construction and use. They consume natural resources to supply the materials from which they are built and are the main source of energy and water consumption. The paper will deliberate about integrating green building practices into building construction for minimizing overall impact to the environment.

Energy and Associated Emission Analysis in Office Buildings

Saidur R

Department of Mechanical Engineering

University of Malaya

50603 Kuala Lumpur, Malaysia

Email: saidur@um.edu.my

In this paper energy consumption of office buildings have been estimated. Energy consumption of major equipments has been identified. Energy intensity a measure of building performance has been estimated for Malaysia and compared with other countries as well. It has been found that air conditioners are the major energy users (57%) in commercial building followed by lighting (19%), lift and pumps (18%) and others (6%). Different ways/options to reduce/save building energy consumption have been formulated, amount of energy saved by these options have been quantified and emission reduction associated with the above savings have been quantified as well. From the data analysis, it has been found that huge amount of energy can be saved for the above policy measures/options. Moreover, significant amount of emissions can be reduced for the associated energy savings for different policy measures.

Analysis of Ventilation System of Car Assembling Shop Floor- Implementation of New Theory

J M Sreenivasulu^a, Dr. D Mohan lab

^a Student, Refrigeration and air conditioning engineering Division, Mechanical Engineering Department, College of engineering, Guindy, Anna university, Chennai -25

E.mail: Jms340@yahoo.co.in, Jms340@gmail.com

^b Asst Professor.

Refrigeration and air conditioning engineering Division

Mechanical Engineering Department

College of engineering, Guindy

Anna university, Chennai -25

Generally industries occupies more volume and as well as space. Among the industries car assembling shop floor also one in which assembling of different parts takes place. So, to make the work so many equipments and man power is needed, where chance is more for heat generation. Due to the continues working of equipments and as well as people, heat load which prevails inside the shop floor is more. Due to such type of environment the people who works won't be comfort which effects the productivity of the industry.

To take up the heat load there are so many methods like, direct evaporative cooling system, air washer system, chilled water system, and air conditioning system. But the main draw back of evaporative cooling system is the indoor RH will be increased which effects some of the components and processes. Chilled water, air washer and air conditioning systems need initial high cost and as well as running cost. To make the conducive environment inside the shop floor one can use "indirect evaporative cooling system" which works on "Maistenstenko cycle"

in Indirect evaporative cooling system there is no increase of RH and as well as no heat load conversion takes place as in the case of direct evaporative cooling system. It consists mainly two sub sections dry and wet section, in one section (dry section) ambient air flows and in another (wet section)water is vaporized by taking up the heat from the ambient air. To take up the water vapour some of the dry air is send to the wet section. The air which comes out of the system will be nearly at the due point temperature of the ambient.

theoretically calculations and optimization are done for the car assembling shop floor in which 100 TR load is prevailing inside. For this the analysis says that it needs only 20% of the power compare to the conventional evaporative, chilled water systems e.t.c. The space required for the system is also very less compare to the conventional one.

Engineering Education and Major Challenges In Sustainable Development in Pakistan

Muhammad Salim Khan
York University, Toronto, Canada

Sustainability was initially regarded by many engineers as a new attack. Gradually, the message that sustainable development is a challenge and not a burden for the engineering community has grown. Professionals committed to fostering sustainable development have urged an in-depth study of the curriculum and the restructuring of research in engineering institutions of higher learning. The focus is on engineering, more than on the natural and physical sciences or on social sciences, because the activities that drive the industrial state - the activities that implement scientific advance - are generally rooted in engineering. Moreover, engineers are known as "problem solvers" and if economies are becoming unsustainable because of engineering, it is natural to ask whether engineering as an activity and as a profession can be redirected toward achieving sustainable transformations. Integrating sustainable development cannot be achieved just by putting a social science course into an engineering curriculum; the cultural divide is too large to be bridged in this way. This paper will analyse recent changes that have taken place in engineering education in Pakistan with major challenges ahead for sustainable development.

A study on Risks and opportunities related to sewage

irrigation

Zeeshan Shahid^a and Ghulam Murshid^b

^a Fellow Student

Department of Chemical Engineering
COMSATS Institute of Information Technology,
Defence Road, Off Raiwind Road, Lahore, Pakistan
Phone: (+92)-346-5404875
Email: zeeshan1234@hotmail.com

^b Lecturer (Corresponding author)

Department of Chemical Engineering
COMSATS Institute of Information Technology,
Defence Road, Off Raiwind Road, Lahore, Pakistan
Phone: (+92)-345-4308330
Email: hmurshid@gmail.com

Using treated wastewater for agriculture, provides a means through which sewage effluent can safely be re-used. Globally 20 million hectares producing nearly four per cent of food are irrigated with wastewater. The main reasons of sewage irrigation are drought, high content of plant nutrients and year-round access of farmers to this source. However, the use of raw sewage in agriculture is not without danger. The major risk in utilizing domestic effluent is food contamination by pathogenic micro-organisms and outbreak of water-borne diseases. Irrigation with raw sewage containing high level of trace elements and heavy metals is likely to be toxic to plants and also poses risk to human-health.

Keywords: Sewage irrigation, Agriculture, Opportunities, Risks

Health Risks of Irrigation with Untreated Wastewater of Tanneries

Muhammad Aslam¹, Ghulam Murshid², Zeeshan Shahid³, Zahid Hussain⁴

Department of Chemical Engineering,
COMSATS Institute of Information Technology,
Defence Road, off Raiwind road Lahore, Punjab, Pakistan.

¹ Email: aslamnoor@gmail.com

² Email: hmurshid@gmail.com

³ Email: zeeshan1234@hotmail.com

⁴ Email: ahrarzahid@gmail.com

This study focuses on the effects of effluent generated by the process industries of Pakistan in general and tanneries in particular. Untreated wastewater is used for irrigation in over 80% of all Pakistani communities with a population of over 10,000 inhabitants. The absence of a suitable alternative water source, wastewater's high nutrient value, reliability, and its proximity to urban

markets are the main reasons for its use. Two case studies in Pakistan give the impact of untreated wastewater use on health, environment and income. The results showed a high increase in hookworm infections among wastewater users and a clear over-application of nutrients through wastewater. Heavy metal accumulation in soil over a period of 30 years was minimal, and it shows initial signs of excess levels in soil and plant material. The paper describes untreated wastewater irrigation that poses serious health and environmental risks that cannot be ignored. While the risks to consumers may not be excessive, as most vegetables grown in land irrigated with wastewater are eaten cooked, the risks to farmers practicing flood irrigation cannot be ignored. Fresh water as a commodity generates concern being an exhaustible resource and due to environmental issues related to its degradation preserving the quality and availability of fresh water resources however, is becoming the most pressing of many environmental challenges for Pakistan. Perhaps, because water is considered a cheap readily available resource, there is not enough appreciation just how much stress human demands for water are placing on natural ecosystems. The paper will contain the background; steps taken by the government and present condition of drinking water and effluent which cause different health risks in Pakistan. Process water and industrial waste water are as diverse as industry itself. However, they do have one thing in common: Constantly high processing quality is required everywhere, demanding absolutely reliable and safely functioning plant.

Comparison of zeolite and silica based sorbent for the desulfurization of liquid fuels

Imran Aslam, Dr. Moinuddin Ghauri, Abrar Inayat, Muhammad Yasin
Department of Chemical Engineering,
COMSATS Institute of Information Technology,
Defence Road, off Raiwind road Lahore, Punjab, Pakistan.

Deep desulfurization of distillate fuels has attracted much attention in worldwide due to very stringent environmental regulations. Legislative regulations call for the production and use of clean fuel for environmental protection purpose. Also, the amount of sulfur present in the conventional fuel constraints the on-board and on-site application of fuel cell. Therefore, the deep desulfurization of distillate fuel is being studied intensively in research area for the production of cleaner fuel. There is on going research to develop the new techniques along with the modification of existing technologies. The aim of this work was to study the adsorptive desulfurization of kerosene and diesel. For this purpose batch experiments were performed to study the adsorption capacity of sorbents based on zeolite and silica gel. Results based on these experiments were analysed to compare the desulfurization potential of zeolite and silica gel. Adsorption isotherms obtained at different temperature were analysed to see the adsorption capacity at different temperature and also for the comparison of different sorbents.

Application of IR radiation THERMOMETRY TO temperature measurements in process industry

Zakir Khan, Dr. Moinuddin Ghauri, Ghulam Murshid

Department of Chemical Engineering, COMSATS Institute of Information
Technology, Defence Road, Off Raiwind Road, Lahore, Pakistan

¹Email: zkhan@ciitlahore.edu.pk

²Email: drghauri@ciitlahore.edu.pk

³Email: gmurshid@ciitlahore.edu.pk

All bodies radiate energy to their surroundings proportional to their absolute temperature. Although the emitted radiation of a body includes all wavelengths, the region in which the amount of radiation is significant to industrial temperature measurement extends from 20°C to 3000°C. The radiation that covers this range is called infrared and can be distinguished on an electromagnetic spectrum. The infrared radiation is detected by infrared thermometer and that can be displayed in units of temperature after being compensated for ambient temperature variation. The infrared radiation is detected by infrared thermometer that can be displayed in units of temperature after being compensated for ambient temperature variation.

This review paper includes study of all important variables such as object emissivity, transmissivity coefficient (related to CO, CO₂, H₂O, etc), Object focusing, Exact distance evaluation between object and infrared thermometer device, etc.

Keywords: Radiation thermometry, Pyrometer, Non contact temperature measurements, IR camera