



Role of Transitional Fuels on Sustainable Development

Sadiq Ali Shah^{1*}, Ali Nawaz Sanjrani¹ and Hussain Bux Marri²

¹Department of Mechanical Engineering, Mehran University of Engineering and Technology, Shaheed Zulfiqar Ali Bhutto Campus, Khairpur Mirs, Pakistan

²Department of Mechanical Engineering, The Benazir Bhutto University of Technology and Skill Development, Khairpur Mirs, Pakistan

*Corresponding Author: Sadiq Ali Shah, Department of Mechanical Engineering, Mehran University of Engineering and Technology, Shaheed Zulfiqar Ali Bhutto Campus, Khairpur Mirs, Pakistan.

Received: April 26, 2019; Published: June 17, 2019

DOI: 10.31080/ASMI.2019.02.0277

Abstract

There is growing emphasis worldwide on improvement cum replacement of conventional fuels in order to lessen dependence on fossil fuels and to stop process of environmental degradation. Fuels performance is measured in terms of its availability in raw and refined energy form and its impact on the users and environment. Renewable energy sources are considered alternatives to fossil fuels. However switch over from the fossil to renewable is gradual since their inception. During the transition from conventional to environmentally sustainable fuels, combined traditional and renewable fuel strategy is proposed for different sectors of economy. Therefore, a study is carried out for evaluation of role of transitional fuels on existing levels of energy mix. Results of the study reveal higher performance, low variable costs, positive impact of transitional fuels on the environment and user. It also reveals emergence of sustainable development process.

Keywords: Solar and Wind; Hybrid Energy; Alternative Fuels; Sustainable Development

Introduction

The conventional fuel's role is questioned on many international, national and regional energy forums on account of problems of depletion, environmental degradation, inaccessibility to low density population areas and rising costs [1]. All out efforts are made to resolve the problems associated with existing fuels. Alternative available energy sources are considered a feasible solution [2,3]. However, its implementation phase is subject to certain technological, social and economic requirements. Such barriers have resulted in slowing the process of utilization of alternative energy sources and have resulted in numerous challenges to the modern way of living [4,5].

Global energy scenario is characterized by individual and institutional initiatives on small scale towards sustainable and economically feasible energy supply based on individual and institutional energy demands. In this regard role of wind, solar and biomass is worthwhile in overall energy mix [6]. However the process of adoption of these fuels and related technologies is not uniform through the world on account of differences in available technology acquisition level and condition of economy in developed and developing world.

These challenges lead to the development of a combined strategy of alternative energy utilization scenario characterized by fossil fuels and renewable and underlining the need to supplement energy needs with renewable energy sources [7]. In this paper, the role of transitional energy sources based fuels and their impacts on environmental sustainability are analyzed. The transition process towards nontraditional energy sources has started before 2000 despite its low pace in developing countries and considerable pace in developed countries and it is bound to pay rich towards sustainable development process in energy sector [8].

Another important dimension towards utilization of alternative fuels during the transition period is awareness regarding utilization of existing renewable energy i.e. solar, wind and biomass technologies [9]. Level of awareness and availability of latest technologies through the world is not uniform or available, which points out remarkable progress in developed countries and poor performance in developing and underdeveloped countries [10,11].

Therefore, transitional fuel potential assessment is carried out with an objective to evaluate its impact on energy supply mix to demonstrate the capability of these alternative energy fuels toward

ds energy self-sufficiency and environmental sustainability in the long run.

Methodologies

Transitional energy utilization, environmental sustainability, economic affordability and alternative fuel utilization possibilities are considered important tools to evaluate the performance of transitional fuels in the present and in the near future. Following methodologies are used in the research work.

1. Energy Scenario analysis
2. Alternative energy utilization model
3. Environmental impact analysis
4. Costs analysis

Alternative fuel utilization analysis

Renewable energy sources in combination with fossil fuels are used in the analysis as an alternative energy source and method to replace existing alone fossil fuel energy supply system. In this analysis workability of solar photovoltaic electrical power generation, wind energy electrical generation, solar heating technologies and biomass waste such as Bagasse utilization methods as alternative energy sources for thermal, coal and natural gas based electrical power generation and natural gas supply based cooking methods are evaluated.

Alternative energy utilization model

In order to assess the possibility of transitional fuels as a result of alternative energy generation process for catering domestic, commercial and industrial needs, development of an energy utilization model is essential. Therefore an alternative energy based transitional fuel utilization model is developed to gain an insight on the nature of energy products to be produced in the short and medium run.

Environmental impact analysis

In order to evaluate environmental benefits of transitional fuels it is necessary that a comparative analysis is carried out on basis of environmental neutralization of emission problems associated with the existing fuels. Therefore a comparative analysis of solar, wind, energy sources is carried out to evaluate its environmental impact on the society and economy.

Cost analysis

Economic feasibility is an essential factor in the success of existing or proposed energy utilization method. Therefore a fixed and variable cost analysis of the alternative energy based fuels and utilization methods are carried out.

Results and Analysis

The results of solar photovoltaic electrical power generation, solar cooking, solar water disinfection and distillation reveals that in comparison to the public utility electrical thermal power supply, which is decentralized, and continuous during the solar shine hours and from battery storage during the evening and night depending on the scale of photovoltaic or solar thermal electric power generation. Solar energy was also tested for meeting cooking needs by utilization of parabolic solar dish cooker instead of natural cooking stove. The sample food cooked comprises only capital costs and thereafter no other variable costs excluding negligible expenses incurred on solar dish cleaning.

An alternative energy comprising indigenous available renewable energy source leads to the use of solar and wind energy for generation of not only electrical energy for meeting domestic and commercial electrical power needs but also production of industrial products such as nitrogen, oxygen, ammonia and urea using the processes of air separation, ammonia and urea synthesis processes. Therefore it is possible to meet through these alternative energy sources and methods to meet not only electrical power, cooking needs of domestic sector but also to satisfy energy needs of industrial and commercial sector.

The environment analysis reveals considerable reduction of the environmental emission due to use of non combustion process without use of coal, natural gas and oil in energy generation processes. Therefore alternative energy sources that produce transitional fuels are environmentally safe and user safety is ensured to considerable level. In this regard an emission reduction analysis was performed to see the amount of emissions reduction per kW of electrical energy generation through solar and wind energy, which was almost negligible in comparison to emissions produced by same amount of electrical energy generated through coal, natural gas or oil.

Cost analysis reveals that running or variable costs of electrical power thermal based generation through solar photovoltaic or natural gas consumption through use of solar cooker can be avoided. However, capital costs are involved in alternative energy fuel generation methods, which varies according to scale of solar power generation. However, 10-20% of capital costs maintenance costs are incurred biannually due to replacement of exhausted batteries or cells if are used for storage of energy generated in the day for onward utilization in the evening and night.

Conclusion

Transitional fuels produced through indigenous renewable energy sources are feasible in the short and medium run to meet suitably the energy needs of domestic, commercial and industrial sector efficiently, effectively and environmental friendly manner on account of their accessibility, availability and economic affordability. Therefore these fuels are in use during the transition phase of switch over from fossil fuels to renewable fuels.

Bibliography

1. Shah S A., *et al.* "Utilization of solar energy as a sustainable source of clean water production". *Sind University Research Journal* 46.3 (2014).
2. Shah S A., *et al.* "Hybrid Energy Based and CO₂ Sequestration Capable Desert Potential development". *NUST Journal of Engineering Science* 3 (2010)
3. S A Shah., *et al.* "Comparative Emission Analysis Of Bituminous Coal, Sugarcane Bagasse and Rice Husk". *Sind University Research Journal* 48.3 (2016): 685-688.
4. Lloyd B and S Subbarao. "Development challenges under the Clean Development Mechanism (CDM)- can renewable energy initiatives be put in place before peak oil?". *Energy Policy* 37.1 (2009): 237-245.
5. Harijan K., *et al.* "Renewable Energy for Managing Energy Crisis in Pakistan." *Springer-Verlag Berlin Heidelberg* 7 (2007): 449-455.
6. Shah S A., *et al.* "Case Study of Electrical Energy Requirement for meeting various needs in a desert dwelling". *Mehran University Research Journal* 32 (2013).
7. MacKay DJC. "Sustainable Energy-without the hot air". E-Book, UIT Cambridge, England 3 (2008): 1-15.
8. Shah S A., *et al.* "Energy and Emission Benefit Analysis of Solar Powered Electrical Power Generation in Pakistan". *Sind University Research Journal* 45.2 (2013): 417-420.
9. Shah S A and Sanjrani A N. "Performance Evaluation of Mono Crystalline Silicon Solar Panels in Khairpur, Sind, Pakistan". *JOJ Material* 2.3 (2017).
10. Shah S A and Zhang Y. "Prospects of Coastal Solarization for Freshwater and Electricity Production" *ISESCO Science and Technology Vision* 6.10 (2010): 82-87.
11. Shah S A., *et al.* "Lack of energy infrastructure and its effects on living standard in underdeveloped areas of Sindh". *Science International (Lahore)* 28.5 (2016): 125-127.

Volume 2 Issue 7 July 2019

© All rights are reserved by Sadiq Ali Shah. *et al.*