RECENT DEVELOPMENTS ON BIOMASS UTILIZATION FOR BIOENERGY PRODUCTION IN PAKISTAN

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Abstract

Till to date, Pakistan is facing a shortage of electricity, unplanned electricity shutdown for several hours might be due to the endearment to fossil energy resources causing socioeconomic and environmental limitations. This study provides an overview of the recent bioenergy sector of the country and recent developments towards bioenergy production from renewable resources. This study also shows a deeper look of lignocellulosic biomass potential resources which could provide bioenergy by off-grid electricity on a larger scale. The study concludes that lignocellulosic residues are the favorable source of eco-friendly, implementable, viable and provides zero emissions bioenergy production in Pakistan.

Keywords: Biomass, Bioenergy, Developments, Pakistan

Research Highlights

1. Study provides an insight into the potential of lignocellulosic bioass to bioenergy
2. Biomass is appeared as viable, sustainable and environmental-friendly resource for bioenergy in Pakistan

Research Objectives

This paper presents an overview of the generation of bioenergy in terms of bioenergy production by effective utilization of lignocellulosic residue as a cheap energy resources in the country by exploring alternative assessment in spite of fossil fuels. Our study concludes with key findings and recommendations with alternative solutions which should be focused by establishing proposed policy framework for waste residue based power generation.

Methodology

In this paper, the data is collected from analysis purpose from various authorized resources such as Pakistan Economic survey, Pakistan Council of Renewable Energy, Alternative Energy Development Board, articles, chapters and published data. The analysis is performed to overview the previous and forecast requirement of bioenergy potential. The viable solution for this energy crisis in the country could solve through bioenergy blend perspective. The agricultural potential resources in the country for are identified and discussed as alternative transportation fuel. Lastly, based on the analysis and discussion, future policy recommendation are tabulated. Below is the scheme to propose the biomass flow process towards energy and materials production.

Fig. 1: Biomass processing flowchat towards bioenergy

Results

Biomass is appeared as potential environmental-friendly and viable option for bioenergy generation.

Resource (1-3). Various identified locations of residues, including crop & animal wastes, and non edible residues possess the viability to produce electricity through less greenhouse gases (Fig. 2) (4).

Fig. 2: Pakistan biomass agricultural resource (4)

The research observation reveals that there is a huge, abundant potential resources of agricultural resources, animal wastes and solid wastes are available in the country. These alternatives resources appeared as the viable options for bioenergy production along with eco-friendly solution with very less greenhouse gases emissions (5). Wood can be utilized as cheap fuel which can meet the 48% of the domestic need. On the other hand, crop and animal wastes could meet the requirement of 32% of the energy demand. In the country, there are 85 industries

for producing sugar from bagasse. They are contributing electricity of 5800 GWh to meet the requirement (6). There are five major agricultural residues which are corn stalk, rice straw, bagasse, wheat straw, and cotton stalks. These residues are contributing towards the 6.43, 8.94, 17.86, 35.6, and 50.6 Mt of production, respectively. The estimated electricity power generation potential is approximately 5000 MW from the animal wastes. On the similar basis, the solid municipal wastes potential are estimated for thermochemically & biochemically are 560 kWh/t and 220 kWh/t, respectively.

Fig. 3: (a) Electricity demand-supply and CPEC project estimation, (b) sector-wise biomass contribution towards electricity generation(6)

Findings

As per the analysis, following policy recommendation should be considered for long term benefits by utilizing biomass resources for bioenergy production (Table 1);

Application	Potential	Key Observation	Recommendation
Energy conversion & management	More exploitation of all indigeuous biomass resources	Due to lack of data collection, inappropriate management and energy mix strategy, country is facing hurdles to utilize cheap fuel for energy.	1. Formulate energy portal data to record updated information 2. Updation required in biomass resources mapping 3. Encourage off-grid electricity generation from biomass
Industrial and Transportation	Environmental friendly biofuel suitable for greenhouse gases mitigation for climate	1. Lack in policy for maximum utilization of biofuel in inustrial scale with tariff 2. 2. Fog challengeges	1. Wood fuel/pellets can be used for boiler and furnace 2. Utilization of biochar as fertilzier for agricultural sector 3. Friendly tax policy for biofuel market
Power Production	Biomass can produces the power of about 63 MW, producing a total of about 146 MW from bagasse-fuel built power plants, generating a total energy of 547 GWh.	Power plants have to adopted biomass fired power generation technologies	Micro-grid concept can be utilized in Pakistan for control, better electricity production

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Author's Biography

Dr. Salman Raza Naqvi is currently working as an Assistant Professor at the School of Chemical & Materials Engineering, National University of Sciences & Technology Islamabad, Pakistan. His research domain encompasses biomass & bioenergy, biofuels production using thermo-chemical conversion processes and waste-to-energy projects, especially waste residues conversion to solid, liquid and gaseous fuels. He worked at BASF SE Germany in process engineering department after completing MSc Chemical Engineering from Technical University Dortmund, Germany. Dr. Naqvi has published more than 53 impact factor journal papers with citation around 610 and H-index equal to 16.