



Potential of biomass for bioenergy in Pakistan based on present case and future perspectives



Salman Raza Naqvi^{a,*}, Sana Jamshaid^b, Muhammad Naqvi^c, Wasif Farooq^{a,d},
Muhammad Bilal Khan Niazi^a, Zaeem Aman^a, Muhammad Zubair^e, Majid Ali^e,
Muhammad Shahbaz^f, Abrar Inayat^g, Waheed Afzal^{h,**}

^a School of Chemical & Materials Engineering, National University of Sciences & Technology, Islamabad H-12 54000, Pakistan

^b School of Chemical Engineering, Yeungnam University, Gyeongsan 38541, South Korea

^c School of Sustainable Development of Society and Technology, Mälardalen University (MDH), Sweden

^d Department of Chemical Engineering, King Fahd University of Petroleum & Minerals, Dhahran 31261, Saudi Arabia

^e U.S Pakistan Centre for Advanced Studies in Energy, National University of Sciences & Technology, Islamabad H-12 54000, Pakistan

^f Biomass Processing Lab, Center of Bio Fuel and Biochemical Research (CBBR), Department of Chemical Engineering, Universiti Teknologi PETRONAS, Bandar Seri Iskandar, 32610 Perak, Malaysia

^g Department of Sustainable and Renewable Energy Engineering, University of Sharjah, United Arab Emirates

^h School of Engineering, University of Aberdeen, Aberdeen AB24 3UF, Scotland, UK

ARTICLE INFO

Keywords:

Future energy mix
Gasification
Agriculture residues
Waste
Biofuels

ABSTRACT

Future energy security and environmental issues are major driving forces for increased biomass utilization globally and especially in developing countries like Pakistan. For efficient utilization of indigenous biomass resources in the future energy mix, it is important to gain knowledge of current energy system in various sectors. Some of the technologies and initiatives are under development to achieve transition from non-renewable resources to renewable resources, and reducing fossil fuel dependency and greenhouse gas emissions. Recently, number of proposals has been presented for the development of sustainable biofuels production methods for promise for accelerating a shift away from an unsustainable approach to possible sustainable production practices or a sustainable social, economic and environment. This article presents an extensive literature review of the biomass-based renewable energy potential in Pakistan based on current energy scenario and future perspectives. It also highlights the availability of the indigenous and local biomass resources and potential biomass conversion technologies to convert such resources to bioenergy. The drivers for utilization of indigenous biomass resources in future energy mix and challenges regarding awareness among stakeholders and R & D to fill knowledge gaps are economically restraints. The article concludes with suggestions on future directions and policies for effective implementation of biomass based renewable energy production.

1. Introduction

The world's energy primarily depends upon fossil fuels and consumption is expected to increase rapidly [1]. It will cause depletion of non-renewable fossil fuel resources, global warming and future energy security. Numerous technologies and initiatives are under way to partially replace non-renewable resources with renewable resources and reducing fossil fuel dependency and greenhouse gas emission [2]. Bioenergy cannot play a vital role to replace petroleum-based products with renewable alternatives, but it can also provide additional energy. The energy shortages in the form of electricity and gas have a direct

impact on basic utilities as well as on the industrial economy [3]. In Pakistan, the cost of fossil fuel is one of the primary reasons for the energy crisis, since the domestic consumers and the local power industry utilized natural gas and furnace oil to generate heat and electricity [4]. To address such issues in the developing countries like Pakistan, biomass is considered as a potential resource. It is abundantly available in considerable quantities within the country. The renewable energy sources are interesting due to their low environmental impacts and providing the eco-efficient solution for developing and developed countries. European Union (EU) is generating approximately 71% of electricity from the renewable energy sources [5,6].

* Corresponding author.

** Corresponding author.

E-mail addresses: salman.raza@scme.nust.edu.pk (S.R. Naqvi), Waheed@abdn.ac.uk (W. Afzal).

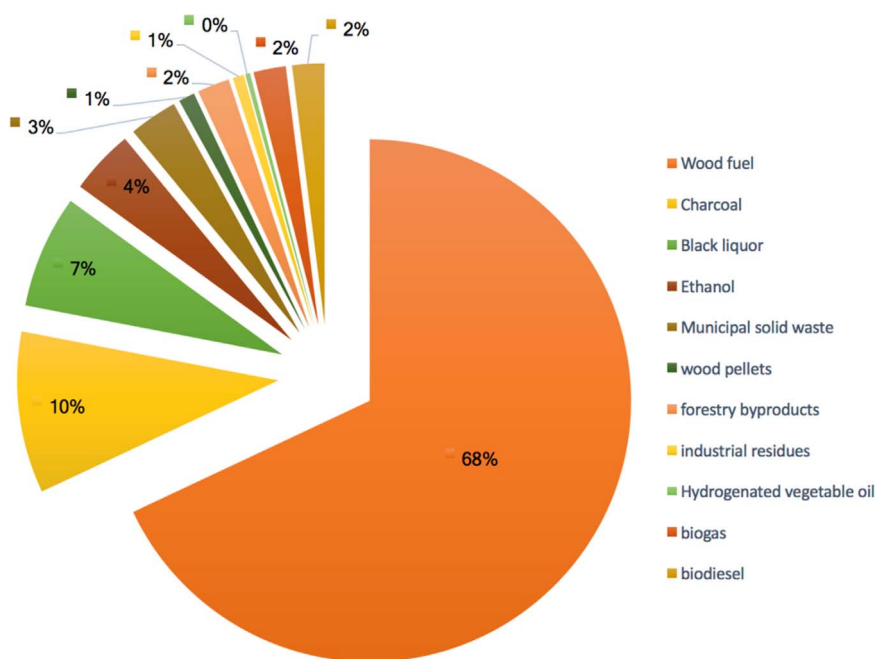


Fig. 1. Global biomass distribution as primary resource [7].

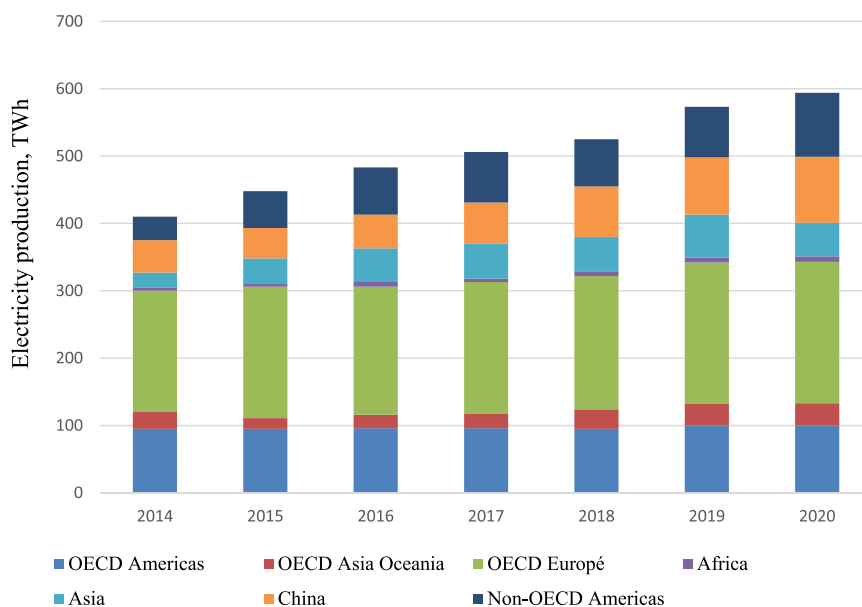


Fig. 2. Regional biomass-based electricity production from 2014 and forecast till 2020 [9].

Biomass as a flexible resource of renewable energy can play a vital role to meet the global demand profiles in energy sectors like electricity, buildings and transport. Among renewable energy, biomass is one the largest energy source that represents 14% out of 18% renewable energy in global energy mix [7]. Currently, biomass represents about 10% (50 EJ) of global total primary supply of energy and contributed 370 TWh of electricity production in 2012 [8]. It is interesting to note that the final product from biomass conversion varies significantly based on different regions, i.e. wood fuel and charcoal for domestic heating and fuel in small scale industries in Asia and Africa, various liquid biofuels in Americas, and polygeneration of biofuels, heat and power production in Europe. The regions with large biomass resource availability also have substantial share of bioenergy reflecting in their total energy mix. Based on World's biomass energy data, Fig. 1 shows the distribution of different biomass resources as global primary energy supply. According to IEA, biofuels

have potential to meet about 27% of global transportation fuel requirement by 2050 that shows biofuels have considerably large potential to be expanded for future sustainability. The electricity generation accounts for 1.5% of global electricity production. Fig. 2 shows biomass-based electric power generation in different regions from 2014 to 2016 and also forecast production till 2020 [9].

The developed countries are utilizing waste streams in the energy system as feedstock for a renewable energy production. However, the developing countries like Pakistan are still lagging behind the right methodology and execution of biomass as an alternative renewable energy resource. Currently, about 18% of the global total energy consumption comes from the renewable energy resources including biomass, hydro power, wind and solar energy [10]. Pakistan is one of the countries that is experiencing a severe energy crisis leading to adverse social and long term economic problems [11–13]. However, the country is focusing to utilize available indigenous sources, like

Download English Version:

<https://daneshyari.com/en/article/5482030>

Download Persian Version:

<https://daneshyari.com/article/5482030>

[Daneshyari.com](https://daneshyari.com)