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CURRENT POSITION

Indian Institute of Technology Bombay Mumbai
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EDUCATION

Tezpur University Tezpur, Assam
Ph.D., Energy 2015
Thesis**:** Decentralised renewable energy generation from rice straw residue in Sonitpur District of Assam, India: A study on resource assessment and potential greenhouse gas emission

Tezpur University Tezpur, Assam
M.Sc., Environmental Science 2007

RESEARCH AND TEACHING EXPERIENCE

Indian Institute of Technology Bombay Mumbai
Institutional Postdoctoral Fellow 2018-present
Life cycle assessment of energy, carbon and water footprint of sugarcane biomass electricity and ethanol in Maharashtra, India

Jawaharlal Nehru University New Delhi
Dr. D S Kothari Postdoctoral Fellow 2015-2018
Assessment of bioenergy potential and greenhouse gases emissions in Uttar Pradesh, India

Darrang College Tezpur, Assam
Assistant Professor, Environmental Science 2014-2015

Tezpur University Tezpur, Assam
Senior Research Fellow/Junior Research Fellow 2008-2011
Agro-climatic zone based renewable energy resource mapping in Assam

GRANT AND FELLOWSHIP

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ETH Zurich, Standford University

Fulbright Fellowship 2013-2014
University of California, Davis

Academic Visitor 2013
University of Nottingham, UK

NET-JRF in Environmental Sciences 2012
University Grant Commission, India

Senior Research Fellowship 2012
Council of Scientific and Industrial Research, India

RESEARCH PUBLICATION

SUBMITTED/UNDER PREPARATION

1) **Hiloidhari, M.**, Banerjee, R. and Rao, A. B. Life cycle assessment of sugar and electricity production under different sugarcane cultivation and cogeneration scenarios. *Journal of Clearner Production* (Under Review).
2) **Hiloidhari, M.**, Banerjee, R. and Rao, A. B. District-level variation in resource potential and life cycle energy-carbon-water footprint of bagasse cogeneration–the case of Maharashtra, India. To be submitted to *Renewable and Sustainable Energy Reviews*.

3) **Hiloidhari, M**., Banerjee, R. and Rao, A. B. District-level life cycle assessment of ethanol production from sugarcane juice, molasses and bagasse in Maharashtra, India. To be submitted to *Renewable and Sustainable Energy Reviews*.

PUBLISHED

4) Mathuriya, A.S., **Hiloidhari, M**., Gware, P., Singh, A. and Pant, D., 2020. Development and life cycle assessment of an auto circulating bio-electrochemical reactor for energy positive continuous wastewater treatment. *Bioresource Technology*, *304*, 122959.
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12) **Hiloidhari, M**., Medhi, H., Das, K., Indu Shekhar Thakur, I.S. and Baruah, D.C., 2017. Bioenergy and carbon sequestration potential from energy tree plantation in rural wasteland of North-Eastern India. *Journal of Energy and Environmental Sustainability* 2, 13–18.
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BOOK CHAPTER

25) **Hiloidhari, M**. and Kumari, S., 2020. Biogas upgrading technologies and their life cycle environmental performance. In *Emerging Technologies and Biological Systems for Biogas Upgrading*. Elsevier (Forthcoming).
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JOURNAL REVIEWER

1) Renewable and Sustainable Energy Reviews
2) Process Safety and Environmental Protection
3) Renewable Energy
4) Bioresource Technology
5) Energy Strategy Reviews
6) Journal of Cleaner Production
7) Computers and Electronics in Agriculture
8) Energy Reports
9) Applied Energy
10) Energy, Sustainability and Society
11) Scientific Reports

RELATED PROFESSIONAL EXPERIENCE

1) Assisted Ph.D. students of IIT Delhi, JNU and Tezpur in research conceptualization, methodology, writing.
2) Assisted M. Tech. and M.Sc. students of Tezpur University in Masters Degree Thesis.
3) Assisted lead PI (Prof. D C Baruah, Dept. of Energy, Tezpur University) in successfully preparing research proposal of nearly INR 2 crore under the India-UK research collaboration.
4) Actively involved in establishing Student Exchange Program between EMPA, Switzerland and Department of Energy, Tezpur University.

REFERENCES

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Prospect and potential of biomass power to mitigate climate change: A case study in India

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ABSTRACT

Biomass has often been regarded as a promising renewable energy resource to mitigate climate change. However, what will be the impact on global surface temperature if biomass replace fossil fuel remain unclear. This paper, through a case study in Uttar Pradesh, India address this issue by assessing biomass resource potential to reduce fossil fuel demand and mitigate climate change. Impact of biomass power related GHG emissions on global surface temperature is estimated using the Absolute Global Temperature change Potential (AGTP) climate metric. Uttar Pradesh can produce 71 Mt surplus biomass annually, equivalent to 7298 MW power. Power density of biomass range between 0.10 and 0.25 Wm^{-2}. Significant amount of GHG emissions reduction is possible if biomass replace fossil fuel as a power source in the region. Annual GHG emissions associated with 1 MWh of power derived from coal, natural gas and biomass would cause 4.10×10^{-7}, 2.40×10^{-7} and 1.25×10^{-7} mK rise in global surface temperature, 100 years after an initial emission, indicating potential of biomass power to mitigate climate change. Variation in spatio-temporal distribution and low power density could be delimiting factors in large-scale deployment of biomass power.

1. Introduction

Biomass is currently the single, largest source of renewable energy worldwide, supplying nearly 9% of the total global primary energy demand (IEA, 2017). In 2016, around 500 TWh of electricity was generated from biomass, accounting for 2% of world electricity generation. In India as of 2017, nearly 8.5 GW of grid connected biomass power have been installed, equivalent to 14% of total installed renewable power capacity of the country (MNRE, 2018). Biomass power potential in India is 23 GW and the top five states (in terms of installed capacity) are Maharashtra, Uttar Pradesh, Karnataka, Tamil Nadu, and Andhra Pradesh (MNRE, 2018). India's biomass program is primarily focused on biofuel (Dhinesh and Annamalai, 2018) and agro-forestry residue-based biomass power (Singh, 2017).

Biomass is a spatio-temporally distributed resource. Biomass power projects are generally occur in a decentralized manner, such as at the local administrative level (village/district). Local inventories on biomass would be more conducive for aligning supply and demand and moderating transportation cost (Liu et al., 2016). Prior knowledge of biomass availability allow power plant management to arrange for alternative fuel during lean period of feedstock supply. Identification of spatial distribution pattern of biomass help optimizing supply-chain, which in turn reduce logistics cost (Ko et al., 2018). Knowledge of power density is also important for biomass supply-chain logistics consideration. Such database are not readily available for many regions of India, jeopardizing long-term viability of biomass programs of the country.

Like fossil fuels, biomass power generation also result in GHG emissions, but less than its fossil counterpart (Cherubini et al., 2009). The climatic impact of GHG emissions is commonly expressed in Global Warming Potential (GWP) climate metric. Although the name suggest, however GWP does not lead to equivalence with temperature or other climate variables (Myhre et al., 2013). As alternative, Shine et al. (2005) proposed the Global Temperature change Potential (GTP) climate metric to

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Bioelectricity from sugarcane bagasse co-generation in India–An assessment of resource potential, policies and market mobilization opportunities for the case of Uttar Pradesh

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A B S T R A C T

Strong potential exists in India for bioelectricity (biomass-derived electricity) to meet the rising, domestic demand for energy. In order to fill the anticipated need, precise assessments of the resource potential are necessary as well as regularly-tracked resource inventories and apt policy. Studies addressing these aspects of energy management are limited for India, particularly in terms of energy planning at the local level. The current research evaluates the prospects for bagasse co-generation in Uttar Pradesh, the largest sugarcane-producing state in India. Specifically, the geo-spatial pattern of bagasse harvestable distributions and bioelectricity potential are assessed, along with policies and market mobilization directions for optimizing increased adoption of biomass energy. Results show that Uttar Pradesh has the potential to produce 27.05 million tonnes of usable bagasse annually. Major, sugarcane producing regions are identified within the western and north-eastern agro-climatic zones. Specific to power generation, the state could produce 1.93 GW of bioelectricity from sugarcane bagasse. At the agro-climatic zone level, the bioelectricity potential varies between 2.46 MW (Vindhyan zone) and 655 MW (western plain zone). When considered at the district level, the potential varies from 66 kW in Firozabad to an upper bound of 232 MW in Muzaffarnagar. The latter estimate indicates that some districts of Uttar Pradesh could be transitioned to 100% renewable electricity from bagasse co-generation. In conjunction with the ongoing growth path for India and energy access considerations, we recommend more strategically-focused energy policies, including auctions, regular resource-mapping, and zoning that can catalyze biomass energy adoption, while mitigating the greenhouse gas footprint of India.

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Review

Emerging role of Geographical Information System (GIS), Life Cycle Assessment (LCA) and spatial LCA (GIS-LCA) in sustainable bioenergy planning

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HIGHLIGHTS

- GIS, LCA & spatial LCA application in bioenergy are of increasing importance.
- Resource assessment, logistic planning, plant design could be optimized using GIS.
- Bioenergy system with better environmental performance can be designed using LCA.
- Uncertainties in LCA must be addressed for its better applicability in bioenergy.
- Spatial environmental impacts of bioenergy could be addressed using spatial LCA.

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Geographical Information System
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ABSTRACT

Sustainability of a bioenergy project depends on precise assessment of biomass resource, planning of cost-effective logistics and evaluation of possible environmental implications. In this context, this paper reviews the role and applications of geo-spatial tool such as Geographical Information System (GIS) for precise agro-residue resource assessment, biomass logistic and power plant design. Further, application of Life Cycle Assessment (LCA) in understanding the potential impact of agro-residue bioenergy generation on different ecosystem services has also been reviewed and limitations associated with LCA variability and uncertainty were discussed. Usefulness of integration of GIS into LCA (i.e. spatial LCA) to overcome the limitations of conventional LCA and to produce a holistic evaluation of the environmental benefits and concerns of bioenergy is also reviewed. Application of GIS, LCA and spatial LCA can help alleviate the challenges faced by ambitious bioenergy projects by addressing both economics and environmental goals.

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Impact of time expenditure on household preferences for cooking fuels

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ABSTRACT

Access to energy for cooking is one of the major challenges that rural India faces. Most of the rural households of North-Eastern India rely heavily upon fuelwood and traditional open-fire cookstoves for cooking activities. And everyday collection of fuelwood is time-consuming. Hence, women often gather fuelwood to make charcoal. While the use of charcoal has some advantages, it is not clear whether the investment of time in making charcoal is worthwhile. In this paper, we compare household time investments for fuelwood and charcoal production. The study is done using survey data on Napaam village situated in Sonitpur District of Assam, Northeast India. We developed a model to analyse fuelwood needed and time spent upon the introduction of improved cookstoves and/or charcoal production. This analysis reveals that improved cookstoves using fuelwood results in the least time expenditure on the production of cooking fuel. Whilst introducing charcoal marginally reduces the amount of fuelwood, but increases time spent on cooking, due to the time required to produce the charcoal. Hence, rural households who make their own charcoal spend more time on producing cooking fuel than those households relying on direct use of fuelwood.

1. Introduction

Energy access is one of the basic issues of rural areas and is a key to socio-economic progress for developing nations. In rural areas it is not always possible to secure a continuous supply of energy where often there is no connection to a central grid. In most of the developing countries, bioenergy serves as the primary fuel for rural people [1]. In fact, bioenergy can provide independent and decentralized energy in rural areas [2–4].

Fuelwood is the most vital source of bioenergy, providing 9% of the global primary energy supply [5,6]. It is an essential energy source for cooking, for water and space heating, for cooking feed for livestock and for rice beer preparation in rural areas [7]. However, there are also several disadvantages to the use of fuelwood. First, the growing use of fuelwood leads to deforestation. Furthermore, for rural households, precious time is lost in the collection of fuelwood, thereby reducing time for other productive work which might help to increase their financial resources [8–12]. Yet, it can be difficult to secure an adequate supply of fuelwood [13–15]. It is estimated that about 20% of the time per day is spent for the collection of fuelwood alone [16]. There is a steady growth of fuelwood consumption, though the growth has been slow in recent years [17].

Dependence on fuelwood often leads to drudgery for women and children and as a result prevents women from engaging in income-generating activities [18]. Therefore, various programs have been implemented to reduce biomass consumption by introducing efficient cookstoves and improved technologies to produce cooking fuel [19–22]. Several studies have investigated the energy transition of cooking fuels and time investment on fuelwood collection, focusing on financial, behavioral or technological aspects [23,24]. In general, these studies conclude that transition fuels like charcoal and briquette are more efficient and favorable choice for a cooking fuel. However, these studies were based on commercially available cooking fuels, which is not relevant for many rural households. If a household has to make their own cooking fuel, as in case of rural areas, the time spent on making cooking fuel i.e. charcoal must be taken into account. These studies confirm that there are significant amount of various cooking fuel

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Development and life cycle assessment of an auto circulating bio-electrochemical reactor for energy positive continuous wastewater treatment

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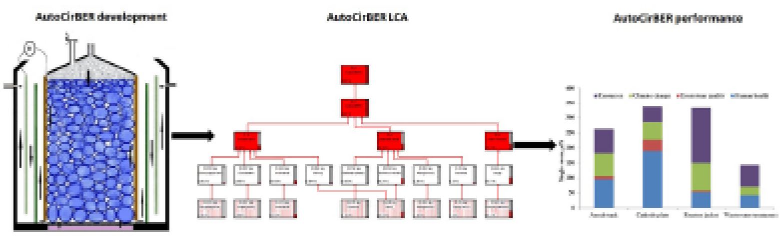
GRAPHICAL ABSTRACT



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ABSTRACT

Bioelectrochemical systems like microbial fuel cells (MFCs) are quaint systems known to metamorphose the chemical energy of organic matter into electrical energy using catalytic activity of microorganisms. A novel continuous Auto Circulating Bio-Electrochemical Reactor (AutoCirBER) was developed to fulfil the gap of 'simple, inexpensive and compact design' that can continuously treat larger amount of organic wastewater at shorter residence time and without consuming external energy for liquid mixing. AutoCirBER eliminated the need for external agitation for liquid-mixing and therefore, energy requirements. AutoCirBER was operated in continuous-mode and hydraulic retention time was optimized. The reactor underwent performance check-up viz. COD removal, net power output, columbic efficiency, sludge generation and an attributional life cycle assessment (LCA) was also conducted. AutoCirBER was sustainable to run in continuous-mode and showed more than 90.4% of COD removal, and 59.55 W.h net annual energy recovery. Experimental LCA of AutoCirBER also displays its environmental feasibility in longer run.

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