BHASKARA

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Editorial

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Over the last 3 years, the growth of solar sector in India for power generation has been a phenomenal success story. This can be primarily attributed to a major policy decision- National Action Plan for Climate Change (NAPCC) of which the National Solar Mission is one of them. The mission had a target of 100 GW for Solar by 2022 and later revised to achieve 100 GW by 2022. Further, an ambitious renewable energy target of 175 GW by 2022 has been set with wind and biomass contributing 60 GW and 10 GW respectively.

One of the major challenges with Renewable Energy (RE) is its intermittent nature. This imposes a challenge on grid stability which can lead to multiple issues including blackouts. The possible method to supply steady power from RE sources is to either have storage or hybridisation. The project SCOPEBIG attempts one such method to address this concern. It combines the solar thermal route and combustion & gasification methods in biomass for generating 3 MW power.

In India, it has been observed that the standalone biomass power plants have a major issue of supply chain and variable costs of feedstock. Similarly, standalone solar thermal power plants, at lower capacities have higher capital investments resulting in expensive energy costs. However, a right combination of these two technologies (both using thermal route for power generation) can yield a lower cost of power plus reduced dependency of biomass consumption. The project also aims to address

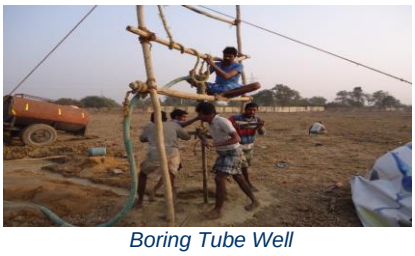
SCOPEBIG Project Executive Committee meeting held on March 14, 2016

capacity building in co-ordination with the local panchayat, for power plant operation and maintenance, biomass supply chain and other ancillary activities. This project aids in showcasing hybridisation of renewable technologies which could be a model for replication especially for de-centralised and rural applications. With these hybrid models, both the solar and biomass targets can be achieved.

A primary survey has been completed to ascertain the biomass availability in the project vicinity. It's promising to note that there are adequate suppliers willing to participate in this project along with providing a storage warehouse for biomass (rice husk). Further the key clearances have been received and the erection activities will commence soon.

Project Updates

- Completed land and site development
- Construction Water is ready
- Identified potential rice husk suppliers
- Obtained key statutory clearances



Boring Tube Well

Site Development Work

In this Issue

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Updates from News Articles

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1. *GE to build world's largest commercial biomass-fired power plant*

GE was selected by Mechelen-based Belgian Eco Energy (BEE) to build a largest Biomass fired power plant of capacity 215 MW in Ghent, Belgium. GE provides the overall design, engineering, construction and integration of in-house components for this plant. Wood chips and agro residues are the major fuel sources, which will be burnt in circulating fluidised bed boiler. This supercritical plant is expected to reach over 60% efficiency when operated in cogeneration mode. Out of the total capacity, 110 MW is apportioned to supply thermal energy to the industries and households within the district. The commercial operation is planned in 2019.

Source:
http://biomassmagazine.com/articles/12963/ge-to-build-worldundefineds-largest-commercial-biomass-fired-power-plant

2. *ENEL Green Power inaugurates a triple renewable hybrid plant in the US*.

Enel Green Power (EGP) built a 33.1 MW capacity of geothermal plant at Nevada in 2009. Later the plant was combined with 26.4 MW of solar photovoltaic system and a 2 MW parabolic trough-based solar thermal system. Energy production from geothermal technology dips during the warmest and sunniest times of the day. Solar is complementary at these time periods due to its peak production. It was found that the solar system increased the production from geothermal plant by 3.6%. This 61.5 MW triple hybrid power plant generates an annual energy of 200 million units. This facility received honors and awards four times towards technology advancement.

MW Triple Renewable Hybrid Plant at Nevada

3. *Biomass now energizing 300,000 homes*

The Philippines has 18 biomass power plants of total capacity 241 MW and these plants are energising more than 300,000 homes. Apart from this, 166 MW of captive power plants are installed in the country for private industrial consumption. The country has two large plants of capacity 46 MW by Universal Robina Corp and 34 MW by Victorias Milling Co. Inc. Biomass fuels for these plants are mainly bagasse and rice husk. The country is motivated by the facts that biomass is carbon neutral, adds value to the farm crops, reduces dependency of foreign oil, and generates income for poor, through employment creation in biomass supply chain.

Source:
http://interaksyon.com/article/126239/biomass-now-energizing-300000homes

Updates from Journal Articles

1. *Logistics issues of biomass: The storage problem and the multi-biomass supply chain*

In this study, the storage of seasonal biomass for year-round power production has been explored. Storage on the power plant site is preferred over storage at source (farmlands) or at intermediate locations, considering logistical and cost issues. Three storage options – ambient storage, covered storage without drying, warehouse storage with drying (using flue gas heat) were examined. Storage costs of these options increase, while storage space requirements decrease in the order mentioned. The study concludes by stating that it is important to consider the trade-off between costs of storage technology (e.g. land area, infrastructure and handling) and the cost incurred from loss of biomass energy content (due to moisture content). Sourcing multiple types of biomass has also been suggested to address limitations of seasonal availability, provided biomass conversion technology (e.g. gasifier) is able to handle the different fuels.

Source: Rentizelas, A. A., Tolis, A. J., & Tatsiopoulos, I. P. (2009). Logistics issues of biomass: The storage problem and the multi-biomass supply chain. Renewable and Sustainable Energy Reviews, 13(4), 887–894.
http://doi.org/10.1016/j.rser.2008.01.00

2. *Hybrid solar–biomass power plant without energy storage*

The study models a parallel arrangement of steam supply from solar field and biomass combustion boiler for a 3 MWe turbine. The share of solar steam was restricted to 50% of total steam to avoid boiler operation at low load levels. A simplified thermodynamic model with mass and energy balance equations was implemented for a rice husk based plant hybridised with a parabolic trough solar field. Increasing the contribution of solar energy from 10% to 50% of the total energy input increases the plant fuel efficiency from 15% to 34% and the hybrid plant thermal efficiency from 10% to 14.3%. There is also an optimum boiler pressure for each level of solar contribution when the hybrid plant thermal efficiency is high. This optimum pressure decreases with increasing solar contribution because the mean temperature of heat addition increases with pressure, resulting in higher heat losses from the solar field.

Source: Srinivas, T., & Reddy, B. V. (2014). Hybrid solar-biomass power plant without energy storage. Case Studies in Thermal Engineering,2,75–81.
http://doi.org/10.1016/j.csite.2013.12.004

3. *Thermodynamic performance of a hybrid power generation system using biomass gasification and concentrated solar thermal processes*

This study investigated a way to efficiently integrate solar steam with a biomass Integrated Gasification Combined Cycle (b-IGCC) power plant. Firstly, a semi-kinetic gasification model was developed to accurately assess the performance of a bubbling fluidised bed gasifier. Secondly, optimal heat integration of a solar thermal stream (coming from a solar tower receiver using molten salt as the heat transfer fluid) was carried out using the HEATSEP method and Pinch Analysis. Solar heat was integrated to produce steam for the bottoming steam Rankine Cycle of the b-IGCC, while also using a part of the steam for gasifying the biomass.

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Significant improvement in the overall plant efficiency (as compared to standalone b-IGCC case) was reported when thermal input from the solar field increased from 0 to 15 MW. A further increase in the solar share improved the overall efficiency only moderately.

Source: Tanaka, Y., Mesfun, S., Umeki, K., Toffolo, A., Tamaura, Y., & Yoshikawa, K. (2015). Thermodynamic performance of a hybrid power generation system using biomass gasification and concentrated solar thermal processes. Applied Energy, 160,664–672. http://doi.org/10.1016/j.apenergy.2015.05.084

Interview

A.J. Sander Grootjes
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Biomass & Energy Efficiency

Q. *What is your opinion on rice husk-based compared to other fuel based biomass technologies?*

A. Rice husk is an interesting fuel for gasification, because the problematic ash compounds in the fuel makes it difficult to use conventional technologies. Gasification makes it possible to convert the rice husk into a combustible gas that can be combusted in a conventional boiler.

Q. *Which type of biomass & technologies will be better for hybridising with solar energy through CSP route?*

A. The combination of biomass gasification with thermal solar is a logical combination. Adding the biomass gasification process makes it possible to produce steam during the hours that the thermal solar plant is not operational and increases the efficiency because the produced steam can be superheated to high temperatures. Superheated steam can be used to produce electricity in a steam turbine with high efficiency.

Q. *What are the limitations in Combustion & Gasification technologies?*

A. The limitations in biomass residues gasification and combustion are always related to the availability of the right quality of biomass. In the Netherlands most biomass projects use wood pellets and wood chips as fuel. The wood chips and wood pellets markets are mature now; this makes it easy to buy big amounts of biomass at the right price and quality. The rice husk market in India seems less mature, so I expect that the first plants will have problems in getting the right quality and quantity of fuel. If the market for rice husk development prices goes down then the quality control will get easier, similar to what happened with the wood chip marker in Europe.

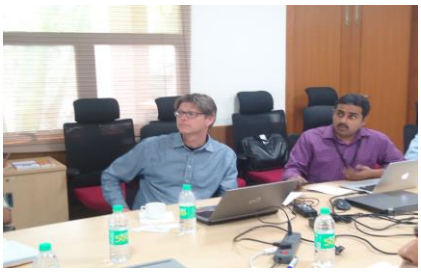
Q. *What are the major challenges you foresee in solar-biomass hybrid technologies?*

A. The biggest challenge in the project will be the development of the gasification technology, because gasification is a complex technology and rice husk is a difficult fuel.

Q. *What are your views on small-scale projects like SCOPEBIG in the country's growth & penetration?*

A. Combining thermal solar with biomass helps to increase to scale of installation. This will help to reduce the cost which helps in making projects economically viable. There are many locations in India where suitable biomass residues, like rice husk, are available. I think that there is a huge market for these type of plants after a successful demonstration in the SCOPEBIG project.

Project Executive Committee Meeting, March 14, 2016



Dr. Christiann van der Meijden (Researcher Bio Energy) in PEC Meeting

Consortium Partners

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