Case studies of biomass use in power and CHP plants in India

Janne Kärki • Arvo Leinonen • Markus Hurskainen
VTT Technical Research Centre of Finland Ltd

TECHNOLOGY FOR BUSINESS

Introduction / background

VTT - in co-operation with **Fortum**, **Valmet** and **UEF** - assessed the **current biomass production and utilisation practices in India** and then studied the **techno-economic feasibility of biomass use in power and CHP plants:**

- ü *Biomass raw materials assessment*
- ü *Biomass production and logistics costs*
- ü *Technology options for power/CHP plants*
- ü *Cost of produced electricity*
- ü *The overall economic feasibility*

Overview of biomass power in India

In 2012, the total installed **biomass power capacity** was 1200 MW_e, which is only about **0.6% of the total capacity**.

The estimated **biomass power potential is > 23 000 MW_e**.

Currently biomass is mainly used in dedicated power plants, whose average capacity is some 10 Mw_e and which can use up to 20 different kinds of biomass.

Case study I – Dedicated biomass power plant

The economic feasibility for investing into **a new dedicated 50 MW_{fuel} biomass power plant** in Tamil Nadu was studied with two fictional plant designs:

1) **"Indian technology plant"** characterised by a low electric efficiency, a low level of automation but also low investment and operation costs.
2) **"Western technology plant**" with higher efficiency and automation level at the expense of higher costs.

The agro and woody residues were considered to be collected from the fields manually and transported to the plants with small lorries. The calculated prices of the fuels were 6.1–9.7 €/MWh.

Both plants were found to be unfeasible without subsidies:

- Ø The calculated costs of electricity were 85 and 70 €/MWh for Indian and Western technology plants, while the electricity selling price was 59 €/MWh.
- Ø Renewable Energy Certificates (17.8 €/MWh) turn Western design option just about profitable.

As the results are highly dependent on various assumptions, **an interactive tool was developed** in order to allow the user to vary the main variables such as fuel prices, capital costs and peak load utilisation hours and see how they affect the results.

Figure 1. Transportation of coconut fronds to a power plant.

Figure 2. Biomass feeding system of a power plant.

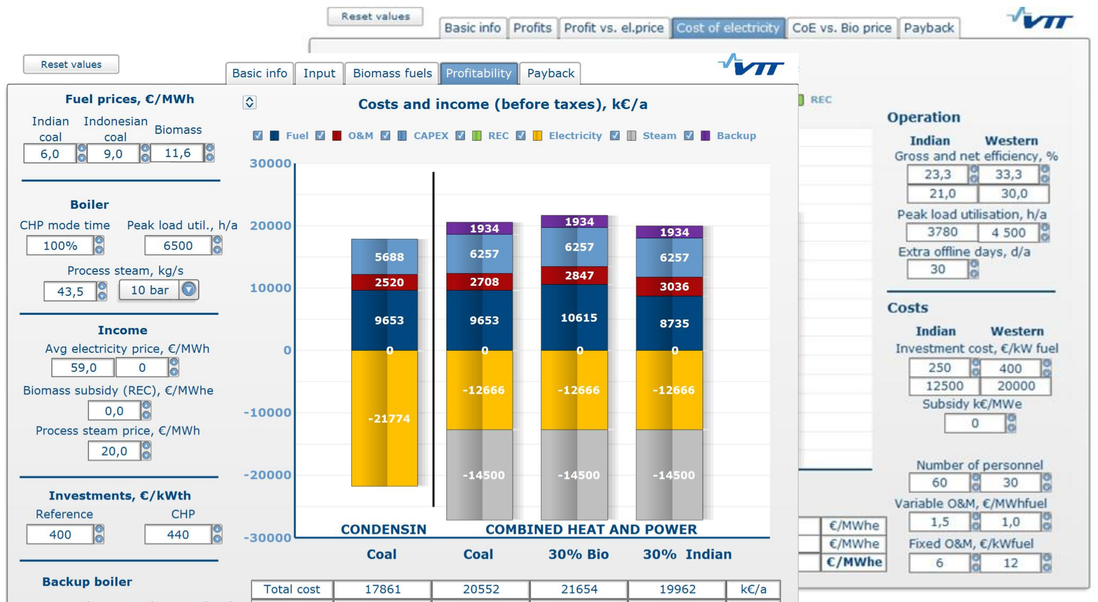

Figure 3. Snapshots of the interactive economic feasibility evaluation tools.

Case study II – CHP plant co-firing coal and biomass

Similar feasibility study was carried out for a **150 MW_{th} CHP plant producing electricity and process steam for industry.**

Three different fuel options were considered:

1) 100% imported coal
2) 70% imported coal and **30% biomass**
3) 70% imported coal and **30% Indian coal**
Reference: condensing power plant with **100% imported coal**

The biomass fuels were assumed to be **briquetted** at the collection centres. The price of briquettes was calculated to be 9.0–12.5 €/MWh (imported coal 9 €/MWh).

The CHP cases were found to be more feasible compared to the condensing power plant reference case and co-firing of domestic coal was favorable compared to using 100% imported coal. **For biomass co-firing, the high cost of briquetting dragged down the feasibility.** However, briquetting is not always necessary and in these cases biomass co-firing can be profitable.

Conclusions

There is a lot of potential for biomass based energy production in India but several factors - such as undeveloped logistics chains and rising biomass prices - hinder the development.

Co-firing biomass with coal can be seen as a potential way to cope with many challenges as coal secures the fuel supply and keeps the biomass prices under control as the plant has the option to choose its fuels.

This work has been carried out under the Sustainable Bioenergy Solutions for Tomorrow (BEST) program and in co-operation with Fortum, Valmet Power and University of Eastern Finland (UEF).

Contacts

Janne Kärki
Tel. +358 40 7510053
janne.karki@vtt.fi

Markus Hurskainen
Tel. +358 40 1831655
markus.hurskainen@vtt.fi

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