

T@W Good Practice Form

Title: Co-firing in carbon power plant with agri-pellets and ethanol production
Type: Cofiring and biofuels
Country: India
Location: Vidarbha Region in eastern part of state Maharashtra

Vidarbha at a glance

Area: 97,409 sq km
Crops: cotton, orange, rice
Minerals: coal, limestone
Industries: coal mining, cement, steel, polyester yarn, power plants
Major city: Nagpur (over 1 million population)
Thermal Power Plants: 3 with installed capacity over 4000 MW

Location of Thermal Power plant	Installed capacity
Chadrapur	2340 MW
Koradi	1100 MW
Khaparkheda	840 MW



Start date: -
End date: -
Technology Codes: Agricultural Waste, Coal combustion, Combined renewable energy technologies, Forestry and energy crops, transport

Sector Codes (from spreadsheet file, RE sheet):
Industrial technologies: General / other

General Description

Summary:

A combination of ethanol production and co-firing in power plants is planned in India. The co-firing will be done with the (abundant) residues of the ethanol production from Sweet Sorghum, leading to the optimal utilisation of the biomass and therefore minimum consumption of land, water and other resources.

Ethanol production:

Sweet Sorghum is a promising ethanol crop because it needs less water than sugar cane and has less climatic (tropic) requirements. It gives besides sugar (6 ton/ha, needed for alcohol) also grain for feed/food and much other biomass that can be pelletised. These other products help to reduce the cost of the single products. Considering that Brazil can produce ethanol at a low cost without using a large part of the sugar can makes it evident that this total utilisation is very positive for the economics.

Pelletising and cofiring:

A new technology allows to pelletise mixed and humid biomass without (thermal) drying, so low energy pelletising of agricultural residues becomes possible. Pelletising is important for large biomass projects, where collection and transport costs become important, as it allows to obtain high energy density and good storability of the biomass.

Co-firing these pellets with coal in power plants is relatively easy, requiring low investments (5 Euro/kW).

Therefore, it can lead to large scale projects, justifying overhead costs for CDM and a ROI of at least 0.15.

- Aims:** CDM, producing transport ethanol (and grains for food/feed), using the residues of the Sweet Sorghum to make agri-pellets and co-firing them in a coal power plant, trying to apply district heating.
- Summary of Results:** A first positive comment of Indian experts, contacts with large Sweet Sorghum farmers
- Financing:** Investors in ETS, possibly through Carbon Trade Platform
- Feasibility Study:** ETA looking for cooperation with Future Camp and Indian actor, financed by ETS investors in Italy or Germany.

Technical details

Technical details: New pelletising technology, innovative in the sense that it is able to pelletise mixtures of most biomass and to dry mechanically the biomass; micro-distilleries for Sweet Sorghum.

Energy data

Energy data: 20,000 ha of Sweet Sorghum plantation, resulting in 1,400,000 ton/year of fresh stalks, 56,000,000 litres /year of ethanol, 30000 ton/year of grains and 490,000 ton/year of material (humidity 12 -14 % ? I don't have data , it is justimate) that can be used for pellet production.

{based on 70 tone production of stalks / ha; @ 40liters of ethanol production/ tone of stalk i.e equivalent to 2800 litres/ ha; @ 1.5 tones of grains/ ha; raw material for pellets after extraction of juice @ 35% of the fresh stalks}

Energy saved/generated: In common units, 110 MW at 8760 hr/y (not mandatory)

If power plant has $\eta = 0.4$, then 1 ton of pellets corresponds with about 2 MWh of electrical energy, 1 million ton/y with 230 MW at 8760 hours/year. This means 10% cofiring for a large coal plant. This percentage is well practicable.

Environmental data

Environmental data: Depending on quality, 1 ton of pellets (18 MJ/kg) replaces more or less coal. Taking the highest quality (anthracite) to be prudent, the replaced amount is 0.6 ton or 1.54 ton of CO₂ is avoided for one ton of pellets. 1 ton of agri-pellets may have 10% less energy, avoiding 1.4 ton of CO₂.

CO₂: 686000 million ton
(1 million ton/y of agri-pellets will reduce emissions of CO₂ with 1.4 million ton/y)

Economic data:

Economic data: 1.03 million Euro/yr
(1.4 million ton/y of CO₂ at 15 Euro/ton CO₂ is 2.1 million Euro/y.)

Conversion of burners: @ Euro 5/ kW for 110MW conversion cost would be 0.55 million Euro
{Only the conversion of the boiler or the addition of pellet burners on it, at 5 Euro/kW and for 230 MW will cost 1.15 million Euro, appr}.

The value of the avoided CO₂. More calculations have to be made, but it must be considered that:

- Carbon has also a price (though it may be low in India);
- Transport of carbon (high operational cost) or of electrical energy (investment costs) is inevitable if the electricity or heat users are far from the coal mines, and will weigh up against the cost of biomass collection
- The value of avoided CO₂ will quickly rise and will probably be much higher at the time of realisation of this idea.
- Carbon combustion is costing the Indian society already much in terms of health (?) but also its economical impact.

Additional Information

India:

1. Abhay Siddham is a young entrepreneur from India with experience of 17 years in various development project with basic degrees in Agriculture, Industrial Management and Natural resources management. He is keen to establish Sweet sorghum based ethanol production unit at Central India (this is also traditionally a sorghum growing area). As he says, this approach not only help to produce ethanol but also provide farmers better remuneration apart from the other environmental benefits.

2. There is also a farming company in the energy-deficient state of Rajasthan, which showed recently interest in the same project.

The two organisations in India could cooperate and establish two CDM projects, possibly with different configuration, so that lessons can be learned from the comparison.

Germany: Future Camp

Italy: ETA

Belgium: European Biomass Industrial Association

Photo Library



Upper part of a Sweet Sorghum plant without grain



Stalks of Sweet Sorghum