CO-GENERATION, COMBINED HEAT AND POWER (CHP) OPPORTUNITIES IN RICE MILLING INDUSTRY

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Introduction

The contribution of the SME's in the national economy cannot be neglected, as they are having major share of national export earning and employment generation. Despite of being so important in national economy most of them are not included under EC ACT. As they are not included in EC Act their management hardly cares about Energy efficiency or energy audit even though they are under pressure of cost cutting, they try the other options.

There is vast scope of Energy conservation and co-generation in the small and medium scale industries (SME's). This is mainly because of the age-old inefficient practice and well-experienced non-qualified staff in these industries. Even if the qualified staff joins for the shake of experience it jumps to other big industry after getting sufficient experience this is because of low pay packages. These are the major barriers in the technological development of the SME's.

In the present paper our concentration will be on the one of such energy intensive industry i.e. RICE MILLING industry that is located all over India and have major contribution in national export earning. The reason for considering this particular industry is their number approximately 93000 rice hullers are located in various parts of our country producing 150 Millions tons rice annually. Most of them are engaged in primary milling in traditional way. Out of the above approximately 43000 modernized rice mills/hullers cum shellers in the form of raw and parboiled rice producers, with an average production capacity of 40-50 tons per day. These energy intensive traditional mills are characterized by inefficient use of rice husk. Some small power producers or captive power plants use the rice husks produced by them as fuel. These mills are facing an acute shortage of power due to frequent power cuts, leading to lower processing capacity and an increase in expenses as electricity is generated from diesel generator to meet the demand.

Utilization of the cogeneration system to meet the requirement of thermal and electrical needs specially for generating steam and or hot air for parboiling and drying of paddy will help in enhancing the energy efficiency and production capacity of rice mills. This will not only result in considerable saving but also leads to an increase in production capacity, a sustainable supply of electricity and additional revenue form the surplus electricity generated from saved rice husk.

RICE MILLING PROCESS OVERVIEW

Paddy is procured from the farmer, then cleaned in paddy cleaner with the help of air and then it is screened in the vibratory screens to remove heavy particles. This cleaned paddy is then sent for de-shelling or parboiling depending upon the product requirements.

In the process of parboiled rice paddy is soaked in hot water for about 6-8 hours, after which steam is bubbled in to a soak tank for 15 minutes and then water in soaking tank is drained out and paddy (containing 25-30% moisture) is dried by steam generated hot air to bring down moisture level to 12-13%, then it is sent for de-shelling.

The de-shelling of paddy is done in husker cum sheller. The husk is separated from rice by blowing air; husk free rice is separated in separators from un-husked paddy. Rice is then taken to polishing machine. Post polishing, barn is separated form rice by blowing air over the polished rice. The separated rice is screened in the vibratory screen to remove broken rice then packed and marketed.

ENERGY CONSUMPTION ALALYSIS OF RICE MILLS

In the above mentioned both the process (raw rice and parboiled rice) ratio of rice husk to the paddy is 1:0.2. Average size of rice mill is 40- 50 tons per day. Electricity consumption for raw rice process in the range of 17-23 KWh/ tons of paddy while for parboiled process it is in the range of 27-35 KWh/ tons of paddy. In the parboiled rice production water consumption is 1- 1.3 Cum/ ton of paddy. Average thermal energy requirement is in the range of 70000-75000Kcals/ ton of paddy. Rice husk is used for steam generation steam consumption is 750 kg/ ton of paddy while the husk consumption is 2-3 tons/ ton of paddy.

OPTIONS OF COGENERATION AVAILABLE FOR RICE MILLING INDUSTRY

In this paper our concentration is on the parboiled rice mills, which shares about 50-55% of the total capacity of rice milled in our country i.e. about 50000 parboiled rice mills.

Average energy requirement of parboiled rice mill is 27-35 KWh per tons of paddy per hour and thermal load requirement is 70000-75000 kCals per tons of paddy per hour. For the calculation of heat to power ratio we have to convert thermal load into equivalent electrical load.

Taking thermal load = 75000 Kcals / ton
= 75000/ 860 = 87.21KWth
Taking electrical load = 35 KWe
Heat to power ratio = KWth / KWe
= 87.21 / 35 =2.49

There are three options available for this heat to power ratio.

Option No I:

Use of reciprocating engine CO-Generation system for Combined Power and Heat Generation
Electrical conversion efficiency = 26 - 36%
Thermal recovery efficiency = 50%
Over all CO-Generation efficiency = 76 - 86%

Option No II:

Use of Extraction condensation steam turbine CO-Generation system for Combined Power and Heat Generation
Electrical conversion efficiency = 17 - 34%
Thermal recovery efficiency = 50%
Over all CO-Generation efficiency = 67 - 84%

Option No III:

Use of Biomass gasification system in Diesel engine CO-Generation system for Combined Power and Heat Generation
Electrical conversion efficiency = 23 - 38%
Thermal recovery efficiency = 50%
Over all CO-Generation efficiency = 73 - 88%
In this system of biomass gasification in Diesel engine, Dual fuel engine and 100% Producer gas engines are running successfully in India. Cost of electricity is very less in both cases but it is more economical in the case of 100% producer gas engine.

CONCLUSION

If the available potential in rice milling industry is properly explored by utilization of cogeneration system, cost of rice milling can be brought down and lots of tons of emissions of CO_2 can also be brought down. This will be an additional source of earning credits and increasing energy efficiency. Cogeneration is not only beneficial for sugar industry or large scale industry it is equally beneficial for rice milling and other SME's too.