ABSTRACT

The Tea industry in India has a 170 years old history. The credit for creating India's vast tea empire goes to the British, who discovered tea in India. The East India Company after losing its monopoly in China in 1832 has taken up cultivation of Tea in India (Assam) in 1834. The first commercial batch of Tea ever produced outside of China came from Assam in 1839. India is one of the world's largest producer and consumer of tea, which accounting for 27 percent of the world production and around 12–13 percent of the world tea export.

In South India, tea is grown in large tea estates as well as in small farms. Large tea estates have captive tea factories for processing tea; while small farms sell tea leaves for processing bought leaf factories. In all there are 350 tea factories in South India. All these tea factories rely heavily on biomass to meet their thermal energy requirements for tea drying. Tea processing is energy intensive with energy costs contributing to 30-40% of the total production cost, second only to labour costs in tea making.

The tea industry in our country has some inherent weaknesses due to the outdated equipments and old technologies that claims lower energy efficiency.

One of the main reasons for the high cost of production in the tea industry is the high energy consumption. It has been found that to produce a kilogram of made tea, an average 22.4 MJ of thermal energy is used. Eighty five percent of the thermal energy requirement is met by burning fuel wood of which 70% is rubber wood. As for as the thermal energy is concerned fuel wood and coal are the major energy sources for Indian tea sector, coal is predominantly used in northern India, where as fuel wood and lignite are mostly used in southern India.

The goal of this work is Energy Conservation in Small Sector Tea Processing Units in South India is "*to reduce energy consumption from tea processing units in India, thereby restricting*

COX emissions"; and the project objective is "*to remove barriers and develop new tuning control strategy for energy conservation and energy efficiency interventions in the tea processing industry in India*" so that large energy saving potential could be realized through the proposed strategy.

To achieve the energy efficiency, automation in Air-Heating Stove unit (excess air control, damper control, good insulation, maintaining ID fan) is essential in tea production.

The development of local technologies to harness the resources for tea processing and a life cycle energy cost analysis of the available technologies are carried out to assess the financial feasibility at tea production. From a financial standpoint, Air-Heating Stoves using wood are identified as a promising choice. The performance study at Air-Heating Stove reveals that ineffective **fuel combustion** takes place in the Air-Heating Stove. The problems associated with the design and operation of a locally fabricated Air-Heating Stove raised doubts about its applicability and productivity for the tea industry.

To render the combustion even more effective, we suggest a new automatic control strategy of New Modified Repetitive Control Strategy (NMRCS) at Air-Heating Stove in tea production. In simple terms, we can make the fuel wood burn more effectively, regardless of the fuel wood feeding method adopted by the operator. When this message spreads widely, we are sure that a substantial reduction in fuel consumption, electrical power saving, reduction of waste heat through chimney, CO_2 reduction and reduction in maintenance cost, can be achieved and thereby save much energy at Tea Industry.

Objectives of the work

- Development of Air-Heating Stove unit model in Tea industry.
- Design and development of New Modified Repetitive Control Strategy.
- Implementation of NMRCS in Air-Heating Stove unit in Tea industry.
- Computation of Energy Savings due to the new control strategy of NMRCS.
- Analysis of the NMRCS results.

***Project outcomes*:**

1. Awareness creation among target sector about energy efficiency technologies of relevance to tea units and inference of their adoption and their relation to profitability
2. Elimination of financial barriers that inhibit investment in energy conservation equipment
3. Adoption and procurement of equipment/practices
4. Learning, knowledge sharing and replication

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