PROJECT IN THE NEWS

'Solar heating can cut production cost'

P S Sundar | ENS
Coonoor, December 22

UNION Minister of State for Commerce and Power, Jairam Ramesh, has urged tea factories to go in for solar heating to save energy and production cost.

Launching the improved solar heating system at Glendale Tea Factory here on Sunday, he said, factories consumed one kg of firewood to produce one kg of tea. "If solar heating is adopted, you could save Rs 4 to 5 per kg of tea produced. Also, there would be a phenomenal saving of diesel and wood as some 30 trucks bring firewood to Nilgiri factories daily. Glendale has shown the way for the industry to follow," he said.

He urged Planters Energy Network (PEN), UPASI and Tea Board to jointly bring about renewable energy revolution in tea industry.

Tea Board executive director R D Nazeem said the Board is involved in UNDP project of 2 million dollars to promote energy conservation and tea industry's response has been encouraging as no marked improvement in energy efficiency has happened over the years. "We will treat Glendale as pilot project and extend solar heating scheme to others after close monitoring", he said.

Making power point presentation on solar heating, Dr C Palaniappan, chief executive, PEN, urged the Minister to create a separate centre to promote energy saving schemes.

K Gopalakrishnan, Glendale director, said the improved heating system entails 80 per cent thermal efficiency. "We have also installed electronic energy saving equipment to reduce power consumption," he said.

Jairam Ramesh unveiling plaque of improved solar heating system at Glendale Factory on Sunday. R D Nazeem (extreme right), Dr C Palaniappan (middle) and Ullas Menon (UPASI Secretary General) are also seen.

If solar heating is adopted, you could save Rs 4 to 5 per kg of tea produced. Also, there would be a phenomenal saving of diesel and wood

தேயிலை தொழிற்சாலைகளில் வெப்ப ஆற்றல் குறைக்கும் வழி: வால்பாறையில் கருத்தரங்கம்

The Dinamalar
December 13th, 2008

The Hindu Businessline
December 22nd, 2008

The Hindu Businessline
September 9th, 2008

Tea Board embarks on an energy conservation project

UNDP, Board invest $1 m each to cut carbon emission

Did you know – Energy Facts: Issue 3

Hydropower projects ranging from a few kW to 25 MW are categorized under *pico*, *micro*, *mini* and *small* hydro projects. When water flows from a height to a lower point, potential energy is released. Hydropower is the extraction of this energy in the form of mechanical energy, where flowing water drives the blades of a turbine. The turbines drive a generator that produces electricity, which is supplied through the grid or as stand-alone systems. The amount of hydropower available depends on the volume of the water flowing and the height from which it falls.

The Ministry of New and Renewable Energy aims to obtain 2% of the total grid interactive power generation capacity being installed from small hydro projects. The potential of SHP projects in the country is estimated at 15,000 MW.

During the period of 2007-08, a capacity of 70 MW has been installed up to 31.12.2007 and going by the current trends a total of 200 MW would be added.

In the state of Tamil Nadu, the identified number of potential sites is 176 with a total installed capacity of 499.31 MW.

{source: http://mnes.nic.in/annualreport/2007_2008_English/

Annual Report 2007-08, Ministry of New & Renewable Energy}

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Call for Innovators

Have you used or are you aware of an innovative idea to improve the energy efficiency in tea factories? Share it with us and it could be featured in the issue of EnConTea

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EnConTea

A Quarterly Newsletter of the Project -
Energy Conservation in Small Sector Tea Processing Units in South India

U N D P
GEF
TIDE

Issue - 3 **December 2008**

PROJECT IN BRIEF

The project - Energy Conservation in Small Sector Tea Processing Units in South India, has been initiated by the Tea Board to remove barriers to energy conservation and energy efficiency that inhibit the realization of large energy saving potential in the tea sector. This 4-year project is supported by the United Nations Development Programme - Global Environment Facility. The project's objective's is to remove barriers and to develop replicable strategies for energy efficiency and energy conservation interventions in the tea processing industry in South India. The objective would be achieved by:

a. Awareness creation among the target sector about energy efficiency / renewable energy technologies and their relation to profitability
b. Elimination of financial barriers that inhibit investment in energy conservation equipment
c. Adoption and procurement of energy efficiency / renewable energy equipment / practice
d. Learning, knowledge sharing and replication

INSIDE

EDITORIAL

Mr. R.D. Nazeem, I.A.S.,
Executive Director**,** Tea Board
National Project Director of the Project

Over the last quarter, there has been steady progress in project activities for energy conservation. So far, Energy audit teams have conducted 255 Preliminary Energy Audits (PEAs) and 13 Detailed Energy Audits (DEAs). Their efforts are commendable given that about 96% of operational tea factories in South India have been covered under the exercise. In analyzing the extensive data collected from the PEAs of the factories, we have been able to establish a baseline of current energy consumption (electrical and thermal) of tea factories in South India. The audits have resulted in identification of potential areas for energy conservation, and quantifying what would be the energy and cost savings.

The next crucial step is for each factory to implement the recommended energy conservation measures. There are 3 different approaches that we have outlined to support the implementation of the measures: (i) <u>ESCO mode</u>: An Energy Savings Company (ESCO) gets into the act of implementing the measures. This would eliminate the risk of non-delivery and guarantee the performance of new technologies adopted by tea factories. The factories can enter into a long term contract under this option, having to pay a percentage of the cost savings as fee to the ESCO. (ii) <u>Non ESCO mode</u>: An energy company assists tea factories in replacing and installing energy efficient methods and technology. There is a one time payment for their services and then on, the factory carries out the operations pertinent to energy savings. (iii) <u>Supplier mode</u>: The project has collected information and developed a database of equipment and resource suppliers to tea factories. The project can assist the factory owners in approaching the right supplier considering the specific needs of the factories. Factories can select equipments after considering their operational requirements. The project can assist tea factories by providing the services of technical experts and technicians who would oversee the implementation of energy conservation measures.

Work is underway to set up an energy laboratory in UPASI-KVK at Coonoor. The lab will also serve as a test center, enabling factories to check and correct their equipment for optimal functioning. It will assist the factories to link with servicing centers appropriate for their needs. As a one-stop resource center for all energy related issues for the tea factories, it will also undertake training and capacity building workshops for their mechanics and workers.

Use of renewable fuel sources is the answer to our long term energy needs. The Encon tea project has successfully promoted the use of agro-based briquettes in place of wood. As of now, 6 factories in Nilgiris district have replaced 80% of their wood needs with briquettes. Our team is also assessing the suitability of solar air heaters presently used in 2 factories to preheat the air that enters the air heaters.

The project had initiated its activities in Nilgiris district due to the higher density of tea factories as compared to other tea-growing regions in South India. It is heartening to note that factories in other districts of Tamil Nadu and in the states of Kerala and Karnataka have evinced interest in participating in energy audits and thereon implementing the suggested measures for energy saving. In December 2008, we plan to kick start the project's activities in other tea-growing regions of South India by conducting awareness programs in Valparai region.

We are happy to have set the energy savings ball rolling; we look forward to it gaining momentum and rolling on to as many factories far and wide.

(For Internal Circulation Only)

INTERVIEW WITH
MR. DEBASHISH MAJUMDAR, Chairman & MD, IREDA.

1. What is IREDA's role in promoting energy efficiency and its conservation? In which of the sectors (SMEs, agro industry…..) have these measures had a far-reaching effect?

IREDA was incorporated as a Public Limited Government Company under the administrative control of Ministry of New and Renewable energy (MNRE), Government of India. It is working as specialized public sector undertaking under the Ministry of New & Renewable Energy (MNRE) for promoting, developing and financing of new and renewable sources of energy and energy efficiency technologies and thereby accelerating the momentum of development and help in large scale utilization of renewable energy sources.

IREDA has been financing energy efficiency and conservation projects for past 10 years to cover industries like sugar, paper, textile, steel/sponge iron, heavy chemicals, cement, power generation and Demand Side Management Programme in electric utilities including ESCO projects in performance contracting/revenue sharing mode.

So far, IREDA has sanctioned 44 projects involving Rs 532.14 crores as loan amount in the sector. There has been growing awareness among the various sections of the society for energy efficiency and conservation and a number of entrepreneurs are showing considerable interest in setting up of projects in energy efficiency and conservation in their existing industries and also while setting up new projects.

2. What kind of loans/guarantees is offered to the industry (as in interest rates/subsidies)? Is it specific to an industrial sector?

IREDA provides loans to companies based on the credit rating of the company by IREDA. The interest at present varies from 14.5% to 15.25% p.a. with a repayment period of 10 years. Interest rates vary from sector to sector.

3. What are the various stages of a loan sanction? Please describe each stage in brief.

The company needs to submit duly filled up loan application form in the prescribed format of IREDA along with a Detailed Project Report (DPR). The loan application is then registered based on the basic eligibility criteria like credit worthiness of the borrower and the strength of the project. The application is then taken up for detailed techno-commercial appraisal for sanctioning the loan.

Brief flow chart for processing of a loan application is as under :-

4. Does IREDA have local branches/outlets for disbursement of loans? Which branch would serve the tea factories in Nilgiris district?

IREDA has its head office at New Delhi and two camp offices at Chennai and Hyderabad, which can assist in preparation of DPR and submission of loan application. However, sanction/disbursement of loan takes place from our New Delhi Office.

5. Can IREDA loans be availed in conjunction with other subsidies offered on energy efficient equipment by MNRE and agencies such as TEDA in Tamilnadu?

IREDA provides financial assistance for Energy Efficiency/Conservation projects. All the subsidies offered on EE Equipments by MNRE and other agencies are separate and may be availed.

6. Does IREDA provide guarantees in the form of risk insurance, or insurance on equipment to factories that implement innovative technologies?

No, IREDA does not provide any guarantees.

7. Are energy audits mandatory for a tea factory to avail IREDA loans for implementing energy efficient equipment? If so, are there set energy audit standards that must be followed?

Energy audits are required for implementing any energy efficiency measures and as such, Investment Grade Energy Audits are to be carried out and a DPR has to be prepared. Energy audits must be carried out by any of the accredited Energy Auditors.

8. Encon Tea is a project that aims to initiate conservation of electrical and thermal energy used in tea processing. What are the potential areas that IREDA can assist with financial support to help tea factories carry out the conservation practices?

In a tea Industry, various energy efficiency/conservation measures identified after energy audit at different stages of tea processing like leaf drying system, fermentation system can be considered for financing by IREDA. Further, basic energy conservation measures like lighting retrofits, waste heat recovery, fan and pump efficiency improvements, installation of variable frequency drives, etc. can also be considered. We can also consider alternate energy sources for tea industry like Combined Heat & Power System, Solar Hot Air System, Mini Hydro Power Generation, etc.

IREDA Loan Process Chart

Receipt of Application → Eligibility → Registration of Project → Technical / Financial / Legal Appraisal → Sanction of Loan → Loan Agreement / Documentation formalities → Disbursement linked to progress of project

ENERGY EFFICIENCY IN ACTION

A withering fan with energy efficient motor (5 hp) and nylon blades installed at Kaikatty INDCO tea factory

An energy efficient motor (5 hp) for ID fan installed at Bikkatty INDCO tea factory

Energy efficient tubelights (T5) at Kaikatty INDCO tea factory

Solar air heating system at Golden Hills Tea factory, Erinkadu

Trough load kgs/sq. ft	Moisture removal/hour (%)	Electrical energy consumed kWh/kg MT	% increase compared to the optimal load (%)
3	1.6	0.168	-
4	1.25	0.216	22
5	1.0	0.270	60

Table 2: Trough loading vs. Electrical energy consumption

Trough loading of 5 kgs per sq.ft. results in an increase by 60% of the power used under optimal conditions.

Energy saving by using energy efficient fans in withering process: Tea factories use axial flow fans for withering green leaves. In axial flow fans, air enters and leaves the fan with no change in direction. The materials used in axial flow fans are aluminium, fibre glass, reinforced plastic, and nylon. Table 3 provides a comparative assessment of aluminium blade fans with nylon blade fans.

ABOUT THIS NEWSLETTER

Tea processing requires large amount of thermal and electrical energy. In an effort to reduce energy consumption, and thus energy costs, the Tea Board of India has launched a project 'Energy Conservation in Small Sector Tea Processing Units in South India' aimed at promoting energy efficiency and renewable energy in the industry. A main objective of this project is creating awareness in the tea industry about energy efficiency and renewable energy and their relation to profitability, gathering data and information, and sharing knowledge. This newsletter has been released to meet the above objective.

ANNOUNCEMENTS

Establishment of Energy Laboratory-cum-Service centre at UPASI-KVK, Coonoor

Initiation of activities of the energy centre for supporting adoption of energy conservation measures by tea factories

Awareness meetings on energy conservation in Kerala and Karnataka

Supporting the implementation of energy conservation measures in tea factories

Detailed energy audits in tea factories

Parameters	Aluminium Blade fans	Nylon Blade fans
Withering Trough size (sq. ft.)	600 (100' * 6')	600 (100' * 6')
Air flow required (CFM)	27000	27000
Weight of green tea leaf loaded (kgs)	1800	1800
Fan Weight (kgs)	28	16
Motor Capacity (hp)	7.5	5
Elec. Energy used / hr (kWh)	4.3	2.1
Elec. Energy used/day (8 hrs /day) (kWh)	34.4	16.8
Elec. Energy cost @ Rs 4.70 kWh (Rs/day)	161.6	78.96
Cost of Elec. Energy used/kg made Tea @ 27% Out turn (Rs)	0.33	0.16
% of cost saved by using nylon blade fan (%)	-	51.5%

Table 3: Comparative assessment of aluminium blade fan with nylon blade fan

Results show that about 51% of energy costs can be reduced by using energy efficient nylon bladed fans. Due to lower weight and lesser number of blades in nylon blade fans, energy is conserved as compared to conventional aluminium bladed fans.

(About the author: Mr N. Radhakrishnan is Project Manager from TIDE for the Encon Tea project and works off the Coonoor office)

ENERGY CONSERVATION IN TEA PROCESSING

By Mr G Ramamoorthy

Tea processing is primarily a moisture removal process of the tea leaves {CAMELLIA SINENSIS}, where the moisture content is reduced from 80% to about 25% through the processes of withering, rolling and drying. Each of the dehydrating processes requires electrical energy, summing up to 86.7% of the total horsepower used (see figure 1).

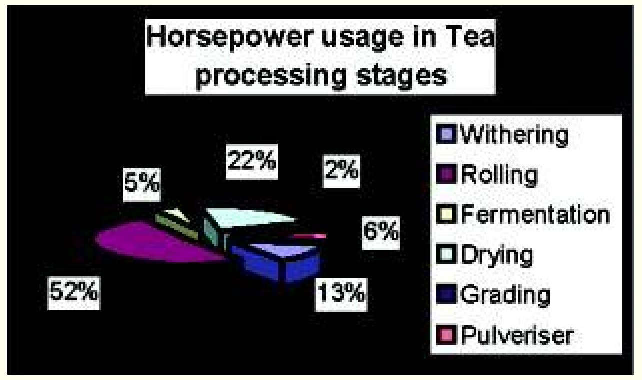

Figure 1: A major chunk of the electric power - 86.7% is used in moisture removal

The article presents potential areas in tea processing that can be addressed to conserve both electrical and thermal energy.

In Lighting

The standard 40 watts tubelights used for factory lighting can be replaced with those of 35 watts. The conventional choke used in the tubelight should be replaced with electronic chokes. Table 1 shows the energy and cost savings with the replacements:

	Total no. used	Units consumed/ year (12hr x 300 days)	Power savings / year (units)
Tubelights (35 watts)	100	12960	1440
Electronic chokes	100	1080	4320
Total Cost Savings/year = Rs 25,920/-			

Table 1: Energy savings in factory lighting

Raw material coarseness

There is a definite increase in power consumption when the coarse leaf component in the raw material goes up. Table 2 shows the percentage increase in power determined by the coarseness of the tea leaves.

Stage	Percentage increase in power compared to 15% coarseness of raw material	
	With 50% coarse leaf	With 25% coarse leaf
Rotorvane (10 hp)	115 %	33%
First CTC (7.5 hp)	267%	133%
Second CTC (5 hp)	83%	50%
Net cost savings/hour with 15% coarseness	**Rs 45**	**Rs 20**

Table 2: Consumption of power increases with increase in coarseness

The results help infer that the fine leaf composition must be 85% in order to avoid excess power consumption.

Withering process

In the withering process, the optimum power consumption has been recorded for a withering trough dimension of 75' x 6'. The power consumed and the costs incurred per kilogram of made tea is 0.15 units and Rs 0.67.

When a fan with 5 hp that is run continuously for 15 hours is replaced with a dual motor fan run at 5 hp for 8 hours and 3 hp for 7 hours, there is energy and cost savings as shown in table 3.

Details	Single speed (5 hp for 15 hours)	Dual speed (5 hp for 8 hours and 3 hp for 7 hours)
Power consumed (units/day)	55.78	45.68
Power costs (Rs/day)	251	205
Net cost savings/day is Rs 46		

Table 3: Power consumption reduces by 18.35% and costs by Rs 46/day when dual motor fans are used

Use of (FRP) Nylon Fan blades instead of cast iron/cast Al in the withering trough fans results in finite energy savings cast iron. Fans that operate at 5 hp, for a trough size of 80'x6', fan size 48" and for an air volume of 26000 cfm, when replaced with nylon blades, the power saved is 1872 units/year for a cost savings of Rs 8424/.

Rolling process

In a Cut-Tear-Curl (CTC) method, the power consumption in the rolling stage depends on the following factors: 1) Installed motor capacity, 2) Speed of the rollers, 3) Feeding rate of the green leaves, 4) Uniformity of feeding, 5) Roller meshing clearance, 6) Line voltage, and 7) Operating power factor.

The addition and increase of RC increases power consumption when compared to a NRC method as shown in table 3.

RC %	NRC	50 %	100 %	150 %
Percentage increase in power used (%)		9	23	45

Table 4: Power consumption increases with addition of RC

<u>Note:</u> Power consumption in rolling section highest in South Indian estate sector followed by South Indian bought tea sector.

At present V belts are used extensively for power transmission in the CTC machine. Use of flat belts in

CTC process have shown mechanical advantages that leads to less power usage -

- Frictional losses are more in V belts due to wedging in/wedging out actions
- V belts have a larger bending cross section which results in more bending loss
- Slippage is less in flat belts because of the larger contact area
- Flat belts have lesser frictional engagement and higher abrasive properties reducing their wear and tear
- Efficiency of a flat belt is higher than that of a V belt

Figure 2: Use of V belts in motors

A CTC machine (motor of 20 hp) handling a load of 800 kg WL/hr which uses flat belt results in power savings of 16 units/day, and cost savings by Rs 72/day.

Use full potential of installed capacity

In comparing the actual load to the full load capacity in each process, for both RC and NRC manufacture, it is seen that the actual load is always less than 50% of the installed capacity.

Use of star delta starter in motors

On starting a motor, they initially run on what is a star connection and then change over to delta connection. Star connection consumes lesser power than delta connection. In motors that use an automatic star delta starter, the starter changes automatically to star connection, when the load is below 70% and consumes less power. This does not happen in the conventional star delta starter.

Motor hp	30
Motor running hours since starter fixing	300
Power savings in units (delta 29A – star 20A)	5.9 units/hour
Units saved for 125 hours	737
Cost savings @ Rs 4.50/unit	**Rs 3316/-**

Table 5: Savings with use of star-delta starter

Drying process

Thermal energy is conserved by optimizing the air to fuel ratio which, is specific to type of fuel used in the drying process (see Table 6)

Fuel type	Calorific value (kcal/kg)	Fuel:Air ratio
Firewood (20% moisture)	3500	1:5
Coal	4700	1:5
Briquetted fuel	4700	1:5
Leco	6700	1:10

Table 6: Optimal air for different fuels used in the drying process

Combustion of the fuel is affected when the ID fan power is inadequate. This is indicated by the high carbon content in the ash. Table 7 shows a higher calorific value with adequate air.

Details	Ash Colour	Carbon content %	Calorific value/kg carbon
1 hp		30.16	2400 kcal/kg with limited air
2 hp		11.18	8200 kcal/kg with adequate air

Table 7: Combustion is maximized and carbon content reduces with adequate air

Variable frequency drive (VFD) used in ID fans helps to increase or decrease the fan speed used for combustion of fuel. In response to the inlet temperature sensor, the VFD regulates the fan speed such that optimum inlet temperature is maintained. Excess fuel consumption is thus prevented with use of a VFD.

Suitable heat recovery systems can be installed to absorb heat from flue gases and preheat the ambient air. Studies show that a saving of 25C can be achieved with heat recovery.

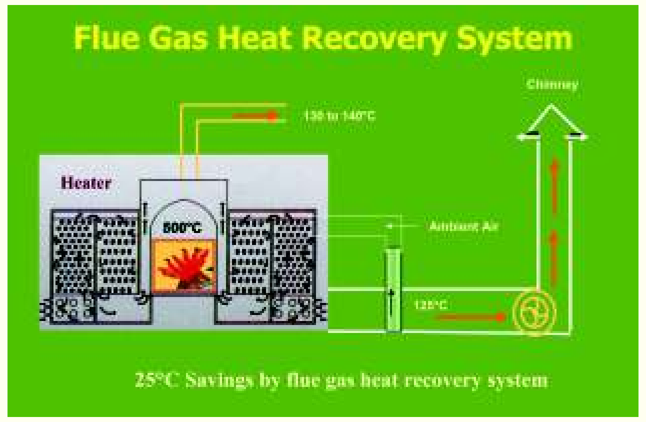

Figure 3: Schematic of a flue gas heat recovery system

Feeding of firewood to heat the air, is optimized by using sensors that detect the drier inlet temperature.

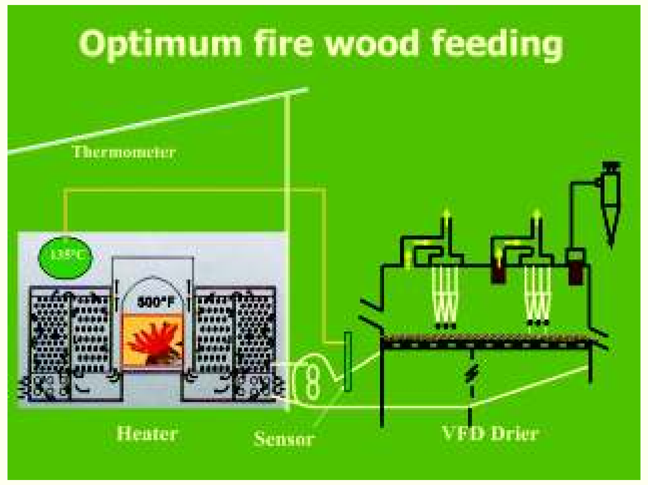

Figure 4: Sensor determines the inlet temperature and helps to optimize the fuel used.

Figure 5: Moisture increases in firewood stacked outside

Optimal moisture content of firewood

Thermal energy is conserved by using firewood with the optimal moisture content, which is 20%.

The calorific value is also affected. Moisture content - 60% gives 1409 kcal/kg and 20% gives 3428 kcal/kg.

{**About the author**: Mr G Ramamoorthy is a subject matter specialist and a member of Technical Advisory committee}

ENERGY CONSERVATION OPPORTUNITIES DURING WITHERING PROCESS IN BLACK TEA MANUFACTURE

By N. Radhakrishnan

The four main stages in tea processing are withering, rolling, fermentation and drying. The main objective of withering is to reduce the moisture content of green leaves from 75%-80% to 60-70% and depends on the method of manufacture. The process consumes one of the most in the context of the processing time, electrical energy and costs involved. Electricity used for withering the tea leaves constitutes anywhere between 15-50% of the total electrical energy consumed during tea processing. Several attempts have been made to achieve the desired withering percentage by using lesser quantities of energy. Energy consumption during the withering stage can be reduced by 1) improving the quality of raw material, 2) by maintaining the optimal thickness of leaf bed in the withering trough, and 3) by use of energy efficient fans.

Impact of leaf quality on energy consumption: Green tea leaves are classified as:

- fine leaves (two to three leaves and a bud, single and two leaves and soft banjis) and
- coarse leaves (above three leaves and a bud and hard banjis).

Fine leaves have more moisture, but the moisture removal time is low because of soft nature of the leaves. Coarse leaves have less moisture, but the moisture removal time is high because of hardy texture. The leaf standard (proportion of fine leaves and coarse leaves) impacts the electricity consumption. The data recorded in Table 1 is after a withering duration of 15 hours.

Leaf standard	Withering %	Moisture % of withered leaf	Time recorded for optimum withering %	Electrical Energy consumption (units / kg made tea)	Cost @ Rs. 4.50/ unit / kg made tea
100% fine	68	67	15 hrs	0.135	0.61
75% fine + 25% Coarse	72	64.6	17.7 hrs	0.159	0.72
50% fine + 50% Coarse	79	62.2	79 hrs	0.211	0.95

Table 1: Leaf standard vs. Electrical energy consumption

Power consumed to wither raw material with 50% coarse leaves is 56% more than a load that is made up fully of fine leaves. Accordingly, the energy costs also increase by Rs 0.34 per kg of made tea. Thereby, power consumption and electricity costs can be reduced by using a higher proportion of fine leaves.

Energy saving by maintaining optimum trough load: The withering trough is a rectangular duct that opens at one end to allow the inlet air blowing from the fans. The air flows over the entire length of the leaf bed, which also acts as an outlet for the moisture-laden air to escape. The optimal trough load for proper withering is 2 to 3 kgs of green leaves per sq.ft. with an air flow of 15 cfm (cubic feet per meter) per kg. Many tea factories regularly deviate from this optimal loading and load their troughs to an extent of up to 5 kgs per sq.ft. When the trough is loaded at this rate, the moisture-laden air is prevented to escape from the leaves in the trough. The consequent recycling of moisture-laden air in the withering trough plenum chamber back to the motor inlet causes backpressure to the motor. This in turn reduces the motor efficiency and relates to more power being used.

Figure 1: Withering trough loaded with green tea leaves for moisture removal

The results of an experiment to assess the impact of trough load to the power consumed are as shown in table 2. The withering trough was 1 sq. ft. with an air flow of 15 cfm per kg.