REPLACING EXISTING DRYERS WITH LSU DRYERS

(*For Vellore Rice Mill Cluster*)

Cluster Brief:

Paddy is the principal crop extensively cultivated in Tamilnadu and accounts for the third of total gross cropped area and nearly 60% of irrigated area in Tamilnadu. Rice is a product of milling of paddy hence rice milling is an important activity in Tamilnadu. In 2015-16, the State produced 8.7 million tons of rice accounting for about two- thirds of the total production of the food grains6. Yield-wise, Tamilnadu ranked first in rice production.

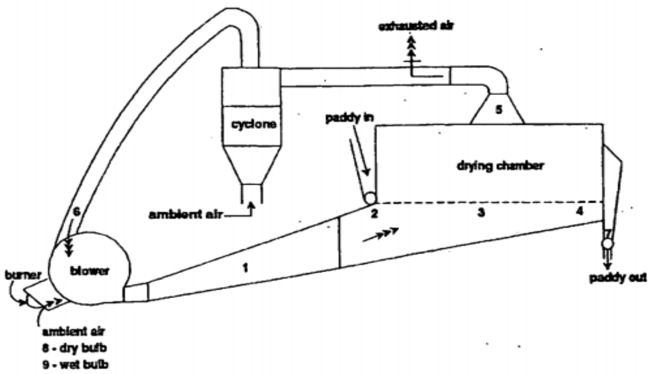
The Vellore cluster rice mills are concentrated in areas Arni (Tiruvannamalai District), Arcot and Vellore (Vellore District). Vellore is an old cluster as the mills have been operating since 1950's and a majority of these old mills are still in operation today. Periodically, new rice mills have been added in the cluster.

The Vellore cluster has about 340 rice mills spread across the areas of Arni (Tiruvannamalai District) and Arcot & Vellore (Vellore District). Out of this, about 150 rice mills are located in Arni and nearby villages Arunagiri Road, Sevoor, Rathanamangalam, and Vandhavasri within a radius of five km. The remaining 190 mills are concentrated in Arcot, Vellore, Gudiatham, Arakkonam, and Walajpet. The rice mills of the cluster have been in operation for the past five decades.

The Arni Paddy and Rice Merchants Association is the representing Association of the rice mills, which was established in the year 1974.

Existing practice:

A skeleton sketch of the existing dryer system is provided below, here the paddy is placed in a drying chamber and hot air is forced through the stationary grain mass until the desired moisture level is reached. This is a batch drying process where in the grain layer thickness is of 2.5-3.0 meters. The recommended airflow rates for this type of dryers range from 3 to 4 m^3 /min per ton of paddy. The grain is cooled in the same unit for 2 to 4 hours using ambient air.

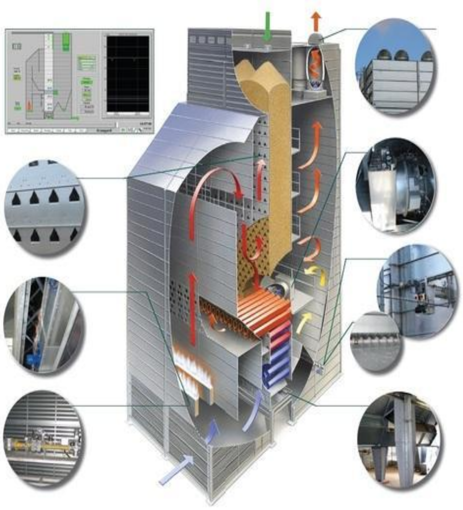


Existing flat-bed dryer

Here in fluidization takes place in the drying chamber where in the hot air is blown from the bottom of the bed. The steam based heat exchangers are in place at the blower suction which are used to raise the inlet ambient air temperature to desired levels. For the heat exchanger, a steam pressure is required of about 5kg/cm^2 (gauge). The main constrain of this type of drying system is that higher capacity blower is required, as such process required a sufficient air pressure for creating bubbling/fluidization effect at paddy bed in the drying chamber.

Proposed technology:

The proposed drying system is known as LSU dryers, these types of dryer consumes less energy as compared to the flat bed dryers. It has lower specific power consumption as well as lower steam consumption. The design increases the surface heat exchange area of the grains and hot air and reduces the time required for drying. More over as the blower is used for circulating hot air instead of generating sufficient pressure for fluidization. Thus, reduce the power consumption of the blower.

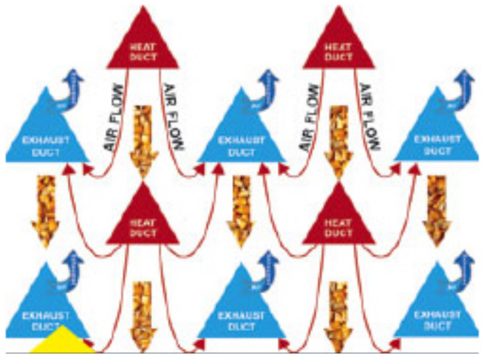


Cut section diagram of the LSU dryer

Justification of technology selection:

As shown in figure the rectangular drying chambers are having multiple air ports where from the hot air is passed, these air ports are designed in such a way that it increases the surface of contact between the paddy and hot air. More over the design also enhances the heat utilization factor of the system. The figure 4 shown how the system magnifies the heat utilization factor in the dryer.

Layers of inverted V-shaped channels (called inverted V ports) are installed in the drying chamber. Heated air is introduced at many points through the descending grain bulk through these channels. One end of each air channel has an opening and the other end is sealed. Alternate layers are air inlet and air outlet channels are places as shown in figure. The inlet and outlet ports are arranged one below the other in an offset pattern.



Efficient heat Utilization system

Energy & monitoring saving:

As per the existing dryer system, the air inflows in upward direction and the moisture content moves from the bottom to the upward direction due to which the moisture content of the of the paddy increase from bottom to top, which requires high heat and more time to dry.

But with the new type dryer, i.e. V Port type dryer, we have a large cross-sectional area which is diffused to paddy and flow of air is from left to right or right to left. Due to which the drying time of paddy decreases which results in the reduce consumption of the electricity and fuel.

The efficiency of the V-port dryer is more than existing type dryers.

Parameters	Existing System	New System
Capacity	24	24
Motor Wattage	22.35	11.18
Fuel		
Operating Hours	24	8
No. of Days	300	300
Electricity Consumption (per batch)	160920	26820
Fuel Consumption (per batch)	2546	2164.1
Electricity Cost	8.7	8.7
Fuel cost (per Kg)	10	10
Total Electricity Cost	1400004	233334
Total Fuel Cost	25460	21641
Reduction in energy cost		1170489
Capital cost for the project		2124000
Payback Period		1.81

* extracts of calculation provided

The benefits can be summarized as:

- ✓ 15 - 25 % reduction in fuel consumption
- ✓ 65- 80% reduction in power consumption
- ✓ Uniformly dried product can be obtained if the dryer is designed properly.
- ✓ The dryer can be used for different types of grains.
- ✓ Increases the production capacity.

Parameters	Units	Values
Annual thermal energy saving (one unit)	t/y	153
Annual thermal energy saving (one unit)	MJ/y	3069376
Annual electrical energy saving (one unit)	kWh/y	134100
Annual electrical energy saving (one unit)	MJ/y	482755
Annual total energy savings	MJ/y	3552131
Annual coal saving (considering 20% replication)	t/y	7638
Annual electricity saving (considering 20% replication)	kWh/y	6705000
Annual energy saving (considering 20% replication)	MJ/y	177606538.2
Annual CO_2 emission saving (one unit)	tCO_2/yr	121
Annual CO_2 emission saving (considering 20% replication)	tCO_2/yr	6035
Estimated investment in technology (one unit)	Rs in Lakh	12
Estimated investment in technology considering 20% replication (assuming price down due to demand aggregation)	Rs in Lakh	550
Total Investment	in million USD	0.79
Life time energy saving	TJ	1776
Life time CO_2 saving	tCO_2/yr	60345

Replication Potential:

Based on the discussion with associations, units, sample survey and energy audits, it is estimated that the technology has a replication potential of 16% in the cluster. Based on 16% replication, the overall project benefits will be as follows:

Availability of the technology

There are good many technology providers available in India and many of them have their base in Surat. The following are the technology providers available in the cluster.

1. Sri Vinayaka Engineering works.
2. APIT Pvt. Ltd.
3. Sri Amman Engineering works.
4. Shankar Engineering corporation.

Effect on the process

This technology will increase the quality of the rice production and will increase the existing production capacity.

Reasons for unpopularity:

This technology has yet not penetrated the cluster because of the following reason:

- ✓ Less knowledge on the dryer technology.
- ✓ Higher capital cost of the technology.
- ✓ No one has yet demonstrated the results of the technology to all unit owners in the cluster.