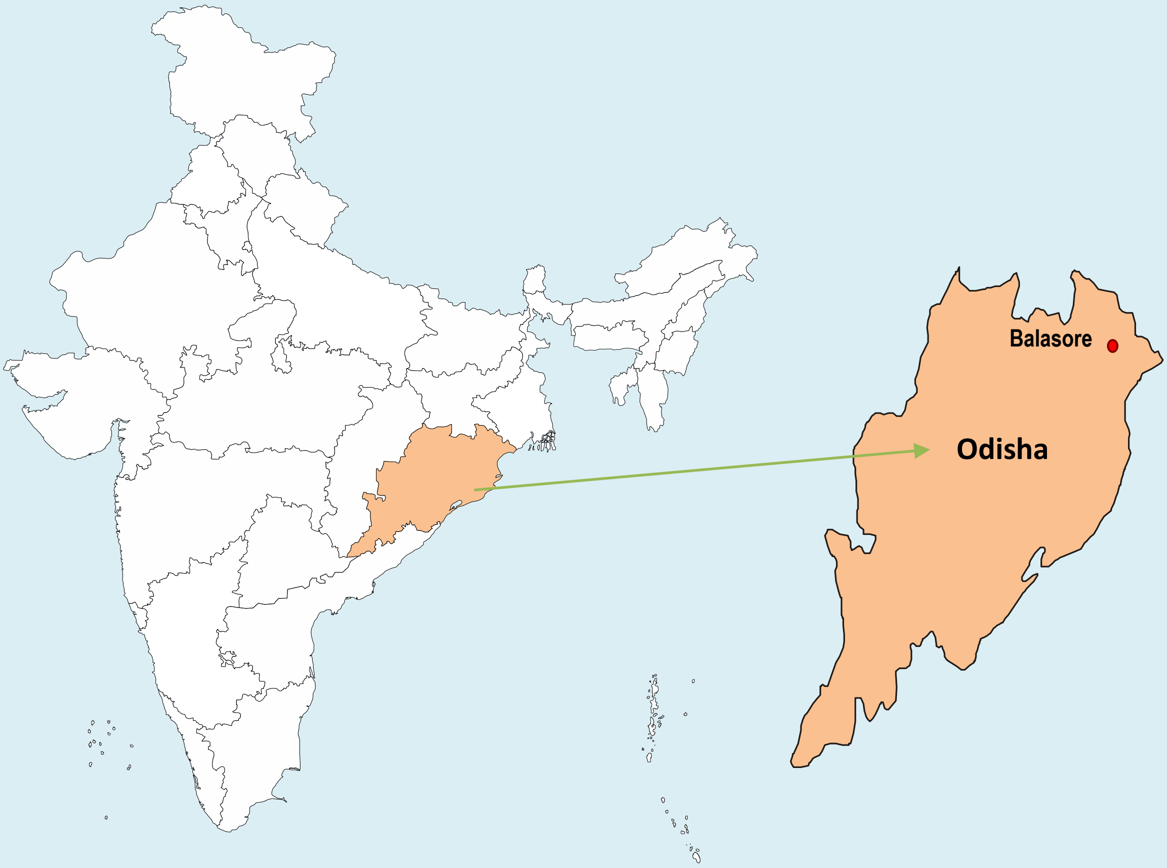
Cluster Profile
Balasore rice mills



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SAMEEEKSHA

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Balasore rice mills

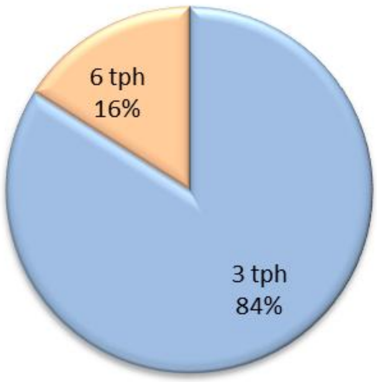
Overview of cluster

Balasore is one of the prominent rice clusters in the Odisha state. There are more than 2000 industries in Balasore district. There are more than 500 different types of industries which are located in industrial estates such as Bampada and Somnathpur spreading over an area of about 15 square kilometres around Balasore. The cluster comprises large, medium, small and micro industries, manufacturing products like chemicals, papers, tyre, oil, medicine, furniture, electronic products, rice and food items. Most of the rice mills are located within 50 km distance around Balasore town. The small and micro industries comprise mainly rice mills, fly ash bricks, ice factory, etc. Some of the medium and large industries include Birla Tyres, Balasore Alloys, Emami Papers, Orissa Alum Extrusion, Everest Industries and Indane Bottling Plant. The rice industries in Balasore provide employment to about 1500 people.

Balasore rice mills cluster in Odisha
Source: Google map

Product types and production capacities

A majority of rice mills in Balasore district are involved in producing parboiled rice. The important by-products from rice mills include (i) husk (23%) and bran (7%). Husk is used as in-house fuel in boiler and (ii) bran is sold outside for further processing. There are about 35 rice mills located in different locality or industrial areas of Balasore district. Of this, presently only about 25 mills are in operation. A majority of rice mills falls under MSME as defined by the Ministry of MSME.



Distribution of rice mills

Based on the installed capacity, the rice mills are categorized into two categories (i) Paddy processing capacity of 3 tonne per hour (tph) and (ii) Paddy processing capacity of 6 tph. About 84% of rice mills in the district are of 3 tph capacity and the balance 16% of units have an average processing capacity of 6 tph. More than 50 traditional aromatic paddy varieties with pleasant aroma are grown in various parts of the state. These indigenous scented paddy varieties[1] such as Kalajeera, Badsabhog, Neelabati, Krushnabhog, Govindabhog, Padmakeshari, Tulasiphoola, Chinikamini, Saragdhuli, and Thakurabhog are predominant in coastal belts, whereas a few traditional scented varieties such as Pimpudibasa, Karpurakeli, Kalikati, Laxmibilas, Jubraj, Durgabhog, Karpurakranti, and Makarakanda are common in the plateau regions of the state. A few popular variety[2] of rice using above grown paddy in the state are provided below.

[1] *source:* http://books.irri.org/TechnicalBulletin16_content.pdf *as assessed on 02 April 2016*
[2] *source:* http://dir.indiamart.com/balasore/rice.html *as assessed on 02 April 2016*

- Swarna rice
- Ratna rice
- Broken rice
- White rice
- Sonamasuri rice
- Miniket rice
- Basmati rice
- Gobindobhag rice

Annual estimated production of rice mills

Although there are about 35 rice mills, close to 25 rice mills are generally in operation. Further, the capacity utilizations of these mills are low, close to 50%. The total annual rice production from the cluster is estimated to be about 122,400 tonne.

Rice production from Balasore cluster

Installed capacity (tph)	Number of operating units	Production	
		tonne per year	Share
3	21	88,634	72%
6	4	33,766	28%
	25	122,400	

Raw material usage in cluster

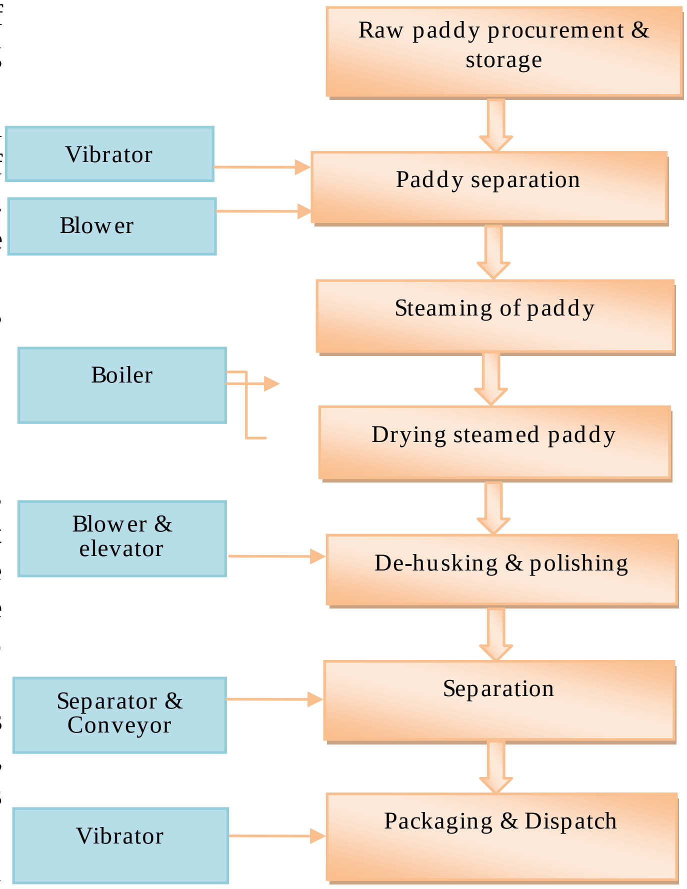
The major raw materials used in rice milling are paddy supplied by the government under PDS establishment. About 0.18 million tonne of paddy is processed per year in Balasore rice cluster. The industries are paid to the tune of Rs 300 per tonne of paddy towards processing charges along with reimbursement of transportation costs as per the existing rates. The processing charges are based on a yield ratio of 0.68 i.e. the rice mill will be reimbursed based on an output of 680 kg of rice per 1000 kg of paddy. However, the typical yield ratio of the local paddy is claimed to vary based on the quality of grains and contaminants present in raw paddy.

Production process

Paddy in rice mill under goes various processes and sub processes before it reaches to rice yard for bagging. The complete paddy processing to produce parboiled rice could be grouped into following major steps:

(1) **Paddy preparation**: Various contaminants namely rice straw, dust, stone, sand and seedless paddy is removed from paddy.

(2) **Steaming**: Paddy is heated using steam in two stages for full-parboiled rice or single stage for



Production process in rice mill

semi-parboiled rice. In case of raw rice, steaming operation is not required.

(3) **Drying**: Steamed paddy is dried either on open floor in sun light or by indirect heat transfer in hot air dryer system.

(4) **Milling**: Rice is produced along with by-products such as husk and bran. Husk is used as fuel in boiler. Bran, having 60% of nutrients in rice kernel, is used for making rice bran oil and other useful by-products such as poultry feed. Rice bran accounts for about 7% of total weight of paddy.

Technologies employed

The processing of paddy into parboiled rice involves the following equipment for processing of paddy:

(i) Boiler

Boiler is used for generation of steam and hot water. Steam is generated at a pressure of about 8 kg/ cm^2(g). The average capacity of boilers used in rice mills is 3 tonne per hour (tph). A majority of the boilers do not have any waste heat recovery system. In-house generated rice husk along with firewood is used as fuel in boiler. The rice mills do not use any instrumentation other than steam pressure gauge to monitor the operating parameters of steam generation and distribution system. Some of the large units use steam traps to improve the quality of steam at end-use points. Boilers used by smaller rice mill units are of obsolete design and do not have any monitoring and control system.

(ii) Steaming bowl

Steaming bowl-Larger unit

Steaming bowl-Smaller unit

Paddy is loaded into steaming bowls (soaking pits are generally used in traditional mills, which are inefficient). Hot water prepared by mixing steam with water is first circulated into the bowls for about 20 to 30 minutes in close loop. The temperature of hot water is maintained at about 60-70 °C for this purpose. After about 10 minutes of holding, the hot water from bowls is drained out. After draining, steam is directly injected into the bowls from bottom till the steam starts coming out from top lid. The used steam is condensed and drained out. The hot water and used steam are collected to passed on to effluent treatment section.

(iii) Dryer

In large capacity rice mills, steam drying is practiced for removal of moisture from processed paddy. The dryer comprises an indirect heat exchanger in which steam at about 8 kg/ cm^2 (g) pressure is used to exchange heat with ambient air to generate hot air which in turn removes the moisture from steamed paddy. In small capacity rice mills, wood fired dryers are used to generate hot air. The steamed paddy is moved to the top of dryer channel arrangement with the help of a bucket elevator system for repeated circulation in a counter flow arrangement to ensure complete drying. The bucket elevators are made of mild steel in old mills and the potential alterative is rice bucket elevator which would reduce the energy consumption to a significant extent. Steam traps are also used in large size mills to remove condensate formed in steam lines. Smaller mills do not have steam traps as well as not able to control steam quality.

Counter flow hot air dryer

(iv) Milling section

The dried paddy is shifted to milling section and stored in silos before converting the paddy into rice. The milling section comprises the following areas:

Destoning: In this pre-cleaning area, the carry-over along with paddy such as stones is removed in a vibrating platform having sieves.

De-husking: The husk is removed from the paddy, which produces brown rice. It is used as fuel in boiler for steam generation.

Whitening and polishing: De-husking produces brown rice, which comprises a brown layer called bran. The bran is removed from the brown rice in polishing area to produce white rice. Bran is a by-product rich in protein content and is used for producing rice bran oil and poultry products.

Milling section

Some of the utilities used in rice mills include pumps for water pumping, material conveying system and compressors for meeting compressed air requirement.

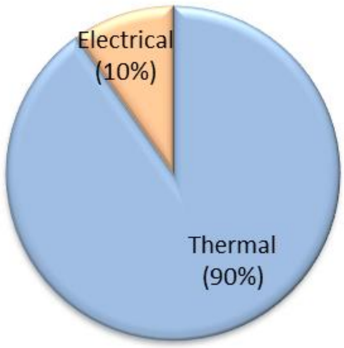
Energy consumption

The major energy forms used by rice mills in Balasore district include (1) husk (2) electricity, and (3) diesel. Electricity from grid is used for different motive loads in the processing sections, water pumping and blowers. Thermal energy in the form of steam/ hot water is used for soaking of paddy and subsequent drying in rice mills. Husk, a by-product in paddy processing is used as the fuel in boiler for generating steam and hot water. About 23% of husk is produced while processing paddy. Almost 75% husks produced in the mills are used for steam generation. Diesel is also used to provide electricity only in case of grid power failure. Generally, steam at 8 kg/cm^2 pressure is used in par-boiling section. The average capacity of boilers used in rice mills is 3 tph. Steam is used mainly for three purposes in a rice mill:

- Generation of hot water (around 60 ^oC) by steam injection, which is used for soaking of paddy in steaming bowls
- Direct injection of steam in steaming bowl during boiling of paddy
- Generation of hot air through indirect heat transfer in radiant heat exchanger towards drying of wet paddy after completion of steaming process

(i) Unit level consumption

The unit level energy consumption in a rice mill includes primarily rice husk, electricity and diesel. Paddy steaming and dryer sections account for major thermal energy consumption in a rice mill. The 'specific electrical energy consumption' (SEC) is estimated to be about 72 kWh per tonne of final rice in the cluster. The typical energy consumption of different capacities of rice mills are shown in table.



Break-up of energy consumption

Energy consumption of typical capacity of rice mills

Average capacity (tph)	Thermal energy (toe)	Electricity (toe)	Total energy (toe/yr/mill)
3	352	38	390
6	705	77	782

(ii) Cluster level consumption

At cluster level, out of 90% thermal energy share in total energy requirement, internally generated rice husk constitutes for about 82% and 8% from diesel consumption to meet back up power in a rice mill unit; only 10% of energy is met through electricity. The overall energy consumption of rice mills at the cluster level in Balasore is estimated to be 11,327 toe.

Total energy consumption of Balasore rice mill cluster (2015)

Energy type	Annual consumption	Equivalent energy (toe)	GHG emission (t CO_2)	Annual energy bill (million INR)
Rice husk*	31,050 tonne	9,315	-	-
Diesel	1,044 kilo litre	897	2,660	52
Electricity	13 million kWh	1,115	12,740	84
Total		11,327	15,400	136

* *inhouse generation during de-husking process*

Energy saving opportunities and potential

Rice mills offer significant scope for energy efficiency improvements both in thermal and electrical areas. These options are discussed below.

(i) Economiser for boilers

A majority of rice mills uses three-pass rice husk fired boilers generally without any 'waste heat recovery' (WHR) system. For example, an economiser put in a boiler will utilize the waste heat in flue gases and use it for preheating of feed water. As a thumb rule, about 6°C preheating of feed water would result in 1% energy saving. Considering the feed water to boiler is preheated up to 90°C, through preheating in economiser and improving condensate recovery, it would lead to about 10% saving in fuel. All the rice mills in the cluster can be benefitted with adopting waste heat recovery in boiler. The envisaged energy saving is 3105 tonnes per year of rice husk (equivalent to 932 toe), equivalent to a monetary saving of Rs 37 lakh.

(ii) Biomass gasifiers for power generation

The excess rice husk after steam generation in boilers can be used in biomass gasifiers for power generation. By improving the efficiency of steam generation and distribution system, the availability of rice husk in the mill can be optimised. This rice husk is used to generate producer gas, which is rich in carbon monoxide (CO) and hydrogen (H_2). This gas can be effectively utilised in internal combustion (IC) engines to replace completely/ partially diesel.

(iii) Solar water heater

Rice mills provide significant scope for adoption of solar water heaters that can be used for generation of hot water at about 60-70°C. Hot water is required in soaking of paddy in steam bowls. Further the boiler feed water can also be heated using solar heater before feeding to boiler at higher temperatures i.e. preheating of feed water that would help in saving rice husk. Boiler efficiency is expected to improve by 6% as efficiency improves by 1% for every 6°C rise in feed water temperature The estimated energy saving potential is 2450 tonnes per year of rice husk (equivalent to 735 toe). The equivalent monetary saving is Rs 2.94 million.

(iv) Others

A significant reduction in energy losses occur in areas such as steam distribution including insulation of steam, hot water line, boiler surfaces, steaming bowl and paddy dryer. The quality of steam generated can be improved by removing the condensate using steam traps. Further, it may be noted that the level of reuse of water from different processes in rice mills is quite low, which can be improved. On electrical side, pumping of (cold & hot) water and drives constitute important energy consuming areas have potential for energy efficiency improvements. Further, monitoring and control of operating parameters in different process sections e.g. temperature monitoring in hot water preparation area would help in operating the mill efficiently.

A list of energy saving options applicable for rice mill cluster in Balasore district is provided below. Based on the applicability and priorities, the rice mills can adopt energy efficiency options that would help in saving energy resulting in monetary benefits and reduction in GHG emissions.

Energy saving options for rice mills in Balasore district
Short-term
1. Insulation of steam, hot water piping and other hot surfaces
2. Steam traps for removal of condensate from steam lines
Medium-term
1. Economizer for preheating of feed water
2. Combustion control in boiler
3. Enhanced recycling of hot water drained from steaming bowl
4. Improvement of condensate and waste heat recovery from dryer
5. Replacement of mild steel buckets with rice buckets in elevator system
6. Use of EE motors in different drives
7. Switch to EE lighting
Long-term
1. Replacement of inefficient boilers with EE boiler
2. Solar water heater for preheating of water

Major stakeholders

One of the important stakeholders in Balasore rice cluster includes North Orissa Chamber of Commerce & Industry (NOCCI). NOCCI is the most proactive in the region. It has members from all categories of industries in five districts such as Balasore, Bhadrak, Jajpur, Mayurbhanj and Keunjhar. NOCCI has about 200 members of which around 70 industries are located in Balasore. The association addresses the issues related to the welfare and grievance of their member industries. The services offered by NOCCI include (1) policy advocacy and advisory services, (2) wider networking and business development, (3) education and training for greater competitiveness and (4) business services.

Balasore Chamber of Industries & Commerce (BCIC) is another prominent industry association enrolling the local rice industries including other industries as its members and very proactive to the cluster development. It is very common that the members and rice entrepreneurs in particular meet together to discuss about the common problems faced by the rice industries.

Other key stakeholders include District Industries Centre (DIC), government agencies and machinery suppliers. These actors provide various services to the rice units, such as training of workers, testing facilities, financial services, technical know-how, raw materials supply and supply of technologies. DIC and state level industry associations are generally engaged with the government on paddy procurement and related processing charges. They have very little experience and activities related to technology issues in the cluster; however the associations showed keen interest towards technology up gradation of rice mills including renewable energy applications.

Central Rice Research Institute (CRRI), Cuttack and Odisha University of Agriculture and Technology (OUAT), Bhubaneswar are two prominent state level stakeholders for rice milling sector in Odisha. CRRI is one of the leading rice research institutions of the country and was established in Cuttack in 1946. It is responsible to initiate, strengthen, and intensify organized rice research to support and to transfer technology relevant to the entire country. Similar to CRRI, OUAT is also responsible for the development of rice varieties for almost all ecosystems. Both the Institutes have developed more than 85 rice varieties suitable for almost all agro ecosystems and with tolerance of most of the major insect pests and diseases.

Major rice miller associations

Name of association	Location
Balasore Rice Millers Association	Balasore
All Odisha Rice Millers Association	Bhubaneshwar

Cluster development activities

The Balasore cluster has formed a ‘special purpose vehicle’ (SPV) to create a ‘common facility centre’ (CFC) for production of rice bran oil. The proposed SPV is registered as Balasore Rice & Rice Bran Cluster and trying to obtain financial support from MSME-DI (Cuttack) to establish required facilities at the CFC. This CFC can further be strengthened in future for capacity building activities such as training and provision of EE services.

About TERI

A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI (The Energy and Resources Institute) is deeply committed to every aspect of sustainable development. From providing environment-friendly solutions to rural energy problems to tackling issues of global climate change across many continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local and national level strategies to suggesting global solutions to critical energy and environmental issues. The Industrial Energy Efficiency Division of TERI works closely with both large industries and energy intensive Micro Small and Medium Enterprises (MSMEs) to improve their energy and environmental performance.

About SDC

SDC (Swiss Agency for Development and Cooperation) has been working in India since 1961. In 1991, SDC established a Global Environment Programme to support developing countries in implementing measures aimed at protecting the global environment. In pursuance of this goal, SDC India, in collaboration with Indian institutions such as TERI, conducted a study of the small-scale industry sector in India to identify areas in which to introduce technologies that would yield greater energy savings and reduce greenhouse gas emissions. SDC strives to find ways by which the MSME sector can meet the challenges of the new era by means of improved technology, increased productivity and competitiveness, and measures aimed at improving the socio-economic conditions of the workforce.

About SAMEEEKSHA

SAMEEEKSHA (Small and Medium Enterprises: Energy Efficiency Knowledge Sharing) is a collaborative platform set up with the aim of pooling knowledge and synergizing the efforts of various organizations and institutions - Indian and international, public and private - that are working towards the development of the MSME sector in India through the promotion and adoption of clean, energy-efficient technologies and practices. The key partners are of SAMEEEKSHA platform are (1) SDC (2) Bureau of Energy Efficiency (BEE) (3) Ministry of MSME, Government of India and (4) TERI.

As part of its activities, SAMEEEKSHA collates energy consumption and related information from various energy intensive MSME sub-sectors in India. For further details about SAMEEEKSHA, visit http://www.sameeeksha.org