Energy options for rice drying

www.rkbodisha.in

Rice Fact Sheet

What is energy in rice drying used for?
A mechanical dryer for rice needs energy for two purposes: 1. For moving air through the bulk of the rice grain. 2. For heating up the drying air so that it can absorb more water from the wet grains.

Why is the energy source important?
Energy cost constitutes the largest cost item in mechanical drying. Choosing the most appropriate energy source, therefore, has the highest potential to reduce drying cost. Some forms of energy are also more environment-friendly than others.

How much energy is needed?
The desired drying rate for optimum dryer use and grain quality is 1% moisture content per hour. To achieve this, around 1 m^3 of air with a temperature of 43°C needs to be moved through each ton of grain. For each ton dryer capacity, this requires 0.7-1 kW motor power for the blower and around 50 kJ h-1 energy for heating the air.

Energy options for moving the air Electricity
An electric motor is the ideal power source for fan. **Advantage:** • Easy to control, clean energy with low noise emissions. **Disadvantage:** • Expensive and often not available in rural areas.

Diesel or gasoline
When electricity is not available, a stationary, combustion engine can be used. **Advantage:** • Can be used for other purposes. **Disadvantage:** • Noisy operation with gas emissions

Free convection
A long chimney in which hot air moves upward can generate sufficient draft to move air through thin layers of grain. **Advantage:** No running cost
Disadvantage: 1. Very low capacity because the draft created by free convection can only work up to 47cm layer. **2.** High investment cost per kg dryer capacity. Our choice: Electric motor and rice husk furnace or Diesel engine and husk furnace

Energy options for heating the drying air Kerosene
Kerosene is the most commonly used energy source for rice drying. **Advantages:** • Easy to handle, store, and transport • Burners require little space and can be automated easily **Disadvantages:** • Kerosene is expensive and price is likely to increase further • Emission of CO_2 from burning fossil fuel Consumption: 1.8-2 L h-1 and per ton of paddy.

Rice hull
Rice hull is a by-product in the milling process and is often considered waste. **Advantages:** Available cheaply in sufficient amounts, often only transport cost. Renewable energy source: CO_2 that is released in burning is used by the rice plant. **Disadvantages:** • Low bulk density limits transport to short distances. • Limited flowability requires special fumace design or high labor requirement. Consumption: 4.5-5.5 kJ h-1 and per ton of paddy.

Solar energy using solar collectors Solar energy is freely available during the day and is environment-friendly. Assuming an average solar radiation of 500 W m^{-3} and 70% collector efficiency, 1 m^2 of solar panel can generate 1,260 kJ h-1 or roughly 15,000 kJ d-1. **Disadvantages:** • Most heat is needed when it rains or night when solar radiation is low. • High investment cost and space requirement--the solar collector area needed is around 10 times the area of the drying bin. • Temperature control is a major problem.

Alternative option: Low-temperature drying also called in-store drying or near-ambient air drying, uses ambient air with a relative humidity of less than 75% for slowly drying the grain to equilibrium moisture content. **Advantage:** • Very low energy requirement, mainly used to power the fan. **Disadvantages:** • In tropical climates, the air needs to be heated slightly (6-9 degrees) if relative humidity is above 75%. • Only advantageous in bulk handling systems.