Rice Husk as Boiler Fuel: Steam and Power Potential

Husk from paddy milled, its heat, the steam it raises at a boiler efficiency and enthalpy rise, the power at a turbine steam rate, and the ash.

Method: Definitions and mass and energy balances

Input parameters

Unit system: SI

Parameter	Value	Unit
Paddy milled	300.00	t/d
Husk share of paddy	20.000	%
Husk calorific value (as fired) Gross calorific value of the husk as fired (as received), on the same moisture basis as the husk share and the ash.	14.000	MJ/kg
Boiler efficiency (GCV)	70.000	%
Enthalpy rise feedwater to steam	2,700.0	kJ/kg
Turbine steam rate	5.0000	kg/kWh
Ash in husk (as fired)	18.000	%

Calculated results

Parameter	Value	Unit
Husk	60.000	t/d
Heat input	9.7222	MW
Steam	9.0741	t/h
Power potential	1,814.8	kW
Ash	10.800	t/d

Notes for this case

- Husk ash is mostly silica; keep bed and furnace temperatures below its fusion range and handle the ash dust-free.
- The power potential sends all the steam through the turbine: deduct process steam for parboiling and drying first.

Formula and method

$$\dot{M}_h = h\dot{M}, \quad Q = \dot{M}_h GCV, \quad \dot{M}_a = a\dot{M}_h, \quad \dot{m}_s = \frac{\eta \dot{M}_h GCV}{\Delta h}, \quad P = \frac{\dot{m}_s}{SSC}$$

Variables

$\dot{M}$	Paddy milled	kg/s
h	Husk share of paddy	-
GCV	Husk calorific value (as fired)	J/kg
η	Boiler efficiency (GCV)	-
Δh	Enthalpy rise feedwater to steam	J/kg
SSC	Turbine steam rate	kg/J
a	Ash in husk (as fired)	-
$\dot{M}_h$	Husk	kg/s
Q	Heat input	W
$\dot{m}_s$	Steam	kg/s
P	Power potential	W
$\dot{M}_a$	Ash	kg/s

Method and standards

Fuel energy chain.

Assumptions and limits

- Steady supply.
- Calorific value, husk share and ash on one moisture basis (as fired).
- The power potential assumes all the steam goes through the turbine; process steam (parboiling, drying) is not deducted.

References

- Definitions and mass and energy balances

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/chemical/textile-rice-oil/rice-husk-boiler-fuel

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.