CASE STUDY

DRI plant can achieve huge energy and cost savings by adopting waste heat recovery (WHR)-based power generation system

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Background

There are about 25 coal-based Direct Reduced Iron (DRI) industries in Durgapur district (West Bengal) engaged in sponge iron production. These units use rotary kilns in the production process. About 35–40% of heat input to the kiln is carried away in off-gases. The DRI industry does not have any waste heat recovery (WHR) system. It draws grid electricity to meet its electricity requirements.

Baseline

The coal-based DRI unit with 2×100 tonnes per day (TPD) rotary kiln capacity was operating without utilizing waste heat in off-gases. The temperature of off-gases is about 950°C from the After Burning Chamber (ABC). The off-gases are cooled to about 200°C in an air-cooled heat exchanger before letting out to the atmosphere.

DRI kiln

Parameters	Value
Number of rotary kilns	2
Rotary kiln capacity	100 TPD (each)
Actual production	95-100 TPD
Off-gas generation rate	25000 Nm^3/h
Off-gas temperature	950^0 C

Proposed WHR based power generation system

A study was conducted on the unit during 2024–25. The study indicated that the existing DRI kilns may be retrofitted with waste heat power generation system with steam route. It would include WHR based boiler for steam generation and the associated steam turbine and generator system. This would not only help in meeting the internal electricity requirements of the plant but would lead to generation of excess electricity which can be exported to the grid. The proposed WHR system would thus help in saving operating costs of the DRI plant, making it technically viable and economically attractive.

Energy saving

The WHR system would lead to an electricity geneation of 29.5 million kWh with a simple payback period of about 4 years. The system would further help in reducing emissions of 20,984 t CO_2 per year. Salient parameters of WHRB power generation system

Parameter	Value
Heat recovery potential per kiln	6.5 million kcal/hr
Steam generation potential per kiln	9.2 tonne/hr
Combined power generation capacity for 2 kilns	4.1 MW
Annual electricity generation	29.5 million kWh
Plant electricity consumption	2.9 million kWh
Net annual electricity export to grid	22.3 million kWh
Annual energy cost saving	₹ 893 lakh
Investment	₹ 3,694 lakh
Payback period	4.1 years
CO_2 emission reduction	20,984 t CO_2/year

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