

Solar-Coal Hybrid Power Plant: Techno-economic Analysis



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In

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Department of Electrical Engineering
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Bahria University, Islamabad

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A Thesis Presented to

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In partial fulfilment

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Dedicated to

My Respectable Parents

and

Sweet Siblings

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ABSTRACT

Electricity is the basic need of this era and power demand is rising over the worldwide day by day. There are many factors, which are influencing the energy market, so the energy system is becoming more and more complex. Four core challenges is needed to be addressed whenever to install a power plant; reliable power supply, economic efficiency, resources efficiency and environment protection. The main problem in the power system after generating the electricity is to maintain the continuity of the system according to the continuous changing demand. Whenever the variation in load occurred, the continuity of the system is disturbed so as the efficiency. Pakistan is currently depending on costly fuels and share of cheap energy resources (solar + wind and others) is negligible, which results in huge energy costs and badly affects the economic growth of the country. In the research, a solar-coal hybrid system is proposed which provides the facility to sort out these problems. The Integration of solar energy in existing or new fossil power plant makes the system reliable; cost effective, efficient and environmental friendly. The concept of using solar energy is to provide directly to the heat feed-water heating system or independently that helps in reducing of fuel (coal) consumption along with its associated penalties in terms of CO₂ and also improved the overall efficiency of the system. For using this concept of generation, two options will be discussed in this work. In the first option, solar heat is directly provides to the feed-water heating system and in the second option is to using solar and coal power plant as an independently source which integrated together and provides the overall output but the mainly focuses on the first method of generation. The calculations of the research are based on 100 MW solar-coal hybrid power plant. The Pakistan solar data has been analyzed and on the basis of results design of solar field proposed to get integration with coal fired 100 MW power plant.

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List of Abbreviations

DNI	Direct Normal Irradiation (W/m ²)
SCA	Solar Collector Assembly
GHGs	Green House Gases
CDM	Clean Development Mechanism
AC	Alternating Current
CO ₂	Carbon Dioxide
L.P	(Low Pressure Turbine, Feed-water heater)
H.P	(High Pressure Turbine, Feed-water heater)
CSP	Concentrated Solar Plant
PV	Photovoltaic
MWt	Megawatt Thermal
RE	Renewable Energy

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