

Environmental and Social Impact

1. Project description

Project sponsor is the M/s. Rajasthan State Power Corporation (RSPCL). The power plant consists of a single 35 MWe (equivalent) Solar Steam generating System and a 105 MWe combined cycle (Gas Turbine Generators, Heat Recovery Steam Generator, and 1 Steam Turbine Generator) unit. About 400 parabolic trough solar collector assemblies with about 545 m² of reflective surface each form the solar component. The resulting 219,000 m² area focuses the sunlight onto steel pipes, which carry a synthetic oil to transfer the heat to heat exchangers. The closed-loop steel pipes are insulated against heat loss by an evacuated enveloping glass tube. The steam generated in the heat exchangers, together with the steam from the gas turbine waste heat boilers, will drive a steam turbine coupled to an electricity generator.

Apart from the power plant installation, the project will include a spur pipeline for fuel (R-LNG) transport, an intermediate storage for an alternative fuel at the plant, a water-pipeline to the project site from the Jodhpur Lift Canal Scheme for delivering 15,000 m³ water/day to the project (about 21 km), and a connection to the grid to evacuate the energy via a switch yard which already exists on the project site. Also a housing colony and a green belt will be set up.

The project area as a whole is sparsely populated with irrigation from deep groundwater sources being the main activity near the project site. Around the project site there are farming settlements in small units, only east of the project site across the road Jodhpur/ Mathania there are workshops and a few houses. The village of Mathania with a population of about 10,000 is located about 2 Km north of the project site.

Approximately 100 hectare of uninhabited land has been acquired by GOR and is available for the project. The development works are partially complete.

An Environmental Impact Assessment Study has been prepared by AQURA LABS PVT.LTD, Sept. 1999, based on a study by National Environmental Research Institute of 1996.

2. Policy, legal, and administrative framework

Accelerated development of the country's renewable energy resources is a priority thrust area under India's National Environmental Action Plan. Located in the equatorial sun belt of the earth, India receives abundant radiant energy from the sun. In most parts of the country, clear sunny weather is experienced 250 to 300 days a year. Rajasthan is among the areas with the highest irradiation; availability of barren and sparsely populated land makes the State suitable as location for power stations based on solar energy. The Rajasthan State Government supports development both of solar thermal and solar photovoltaic power generation with emphasis on the private sector.

The Ministry of Environment and Forests (MOE&F) and the Central Pollution Control Board have laid down National Standards for air and water pollution control for standard configurations of thermal power plants. Even an Integrated Solar Combined Cycle (ISCC) power plant using Solar energy and a fuel such as RLNG is recognised to potentially generate

- air pollution resulting from the release of oxides of sulphur and nitrogen, suspended particulate matter, carbon monoxide, and hydrocarbons;
- water pollution resulting from the release of effluents from demineralizers, cooling tower and boiler blowdowns, miscellaneous oil and chemical wastes;
- Noise pollution from various plant equipment.

As per the Indian Law, power projects up to a capacity of 250 MW based on Naphtha can be granted environmental clearance from the State department of environment. The Rajasthan State Pollution Control Board (RSPCB) has carried out a public hearing at Jodhpur in which the public was invited for recording their objections, if any. No objections were received and after assessment of the project by a technical committee of RSPCB the project was granted no-objection certificate. The project was then submitted to the Department of environment, GoR for environmental clearance. The project was scrutinised by an expert committee and on their recommendation, in principle environmental clearance has been issued.

Since the plant has obtained all necessary environmental clearances for Naphtha which is environmentally more difficult and risky than R-LNG no further requirements for additional environment protection measures is expected. RSPCL verifies whether changes are required in the existing environment or the clearance due to R-LNG.

3. Baseline data

Baseline data on the environmental situation in Mathania prior to the project was already contained in an Environmental Impact Study of 1996 for a preceding alternative of the project design, carried out by the National Environmental Engineering Research Institute (NEERI).

Air

Based on results of assessments through a network of 20 ambient air quality stations, the study revealed that atmospheric pollutants - SPM, NO_x, SO₂ - are all well below the standards defined by the Central Pollution Control Board for rural/residential areas (values in microgrammes/m³):

	Minimum	Maximum	Arith. Mean	CPCB limit
SPM	39	181	102,2	200
No_x	3	38,5	13,7	80
SO₂	3	5,9	3,4	80

The maximum and minimum temperature in the study area vary between 42°C and 9°C. Maximum and minimum relative humidity is low.

Noise

Due to low human activities the noise levels at the project site seem to be almost solely of natural origin; the total noise measuring program included a commercial area (market in Mathania), a sensitive area (Government School, Mathania), and an industrial area (Maheshwari Industries). Noise levels were recorded at 20 stations (values in dB(A)).

	Project area	Commercial a.	Sensitive area	Industrial area
Day	40	60	52	67
Night	38	45	36	42

Water

There is a scarcity of water in the project area. Water is taken from deep wells and from the Jodhpur lift canal. The main purpose of the Jodhpur canal is the water supply of the town of Jodhpur. Ground water in the Mathania area has been assessed. A few samples collected for the baseline survey show high concentration of flourides and nitrates. All other water quality parameters, including heavy metals and bacteriological contamination, were found to

be well within the limits for drinking. The project will use the water from the Jodhpur lift canal. It is not envisaged to use ground water for the plant purposes and neither it is intended to further deplete ground water levels.

Soil

The soil in the area is not degraded, basically coarse sand with high porosity, alkaline and low to medium fertility.

4. Environmental impacts

Air

Among all the available fossil fuels, R-LNG with minimum pollutant emission is the cleanest fuel. The operation of the power plant may result in the following air emissions:

- air pollution resulting from the burning of RLNG, release of oxides of sulphur and nitrogen, suspended particulate matter, carbon monoxide, and hydrocarbons;

The emissions of SO₂, NO_x, and particulates from the Gas turbine power plant burning Naphtha with very low sulphur are expected to be much below the applicable standards (for GT/GCC plants):

SO₂ << 400 mg/m³ (World bank standard, no Indian standard available)

NO_x < 125 mg/m³ (World bank standard for gas fired turbines, 15% Oxygen)

Particulates < 150 mg/m³ (Indian standard)

The operation of the plant results in a marginal increase in the present very low atmospheric pollution in the area, which has been confirmed by baseline surveys.

Dispersion modelling and prediction of ground level concentrations show that the predicted values are well within the limits as prescribed by the Central Pollution Control Board (National Ambient Air Quality standards). Low NO_x burners to reduce NO_x emissions will be incorporated in the power plant design. The SO₂, NO_x, and particulate emission levels from the power plant burning R-LNG are expected to be much below respective Worldbank and Rajasthan Pollution Control Board guidelines. The maximum predicted concentrations (24 h average values in microgrammes/m³) for R-LNG as base fuel and a 40 m high stack are under the prevailing weather conditions of Mathania: 12µg/m³ for SO₂ and 17,6 µg/m³ for NO_x. When these values are added to the baseline values, the sum is still far below the permissible limit for rural and residential areas.

Noise

Due to absence of sensitive areas close to the plant site, the impact of noise due to the power plant is negligible. Equipment will be specified to meet a respective noise level of 85 dB(A) at one meter distance from the source of noise generation; where necessary, appropriate noise barriers will be installed. (The noise level at the houses next to the plant need to be determined).

Water

Current water allocation for the project by the GOR amounts to 7500 m³/day from the Jodhpur Lift Canal Scheme, located at a distance of 15 Km which will be pipeline connected. An enhancement to 15.000 m³/day has been sought since the initial allocation was based on only 35 MWe plant capacity. As the envisaged water allocation for power projects from the canal is far in excess of 7500 m³/day, no problem is anticipated with the provision of the additional water. However the most cost effective, environmentally safe and feasible water carriage, storage and disposal system for meeting the water requirement of the project from

either the Indira Gandhi Nahar Pariyojna directly or through the Jodhpur Lift Canal is further investigated in a „water carriage study“ commissioned by RSPCL. In the long run the project may have a certain impact on the deep water resources by providing additional electricity to the farmers to run the water pumps and enhance irrigation from deep ground water (at present the daily power supply is restricted to six hours). A concise analysis of availability and usage of water for drinking, irrigation and industrial purposes in the area will be provided in an additional EIA study, including a water balance and identification of competing uses as well as possible health impacts of release and use of water (irrigation) by the local population.

Water pollution results from the release of effluents from the demineralisation plant, boiler blow down, cooling tower blow down, run-off from fuel handling yard and the HTF system area, sanitary waste from the plant and the colony, waste water from the pre-treatment plant and miscellaneous oil and chemical wastes. The waste water mainly consists of acid, alkali, suspended solids and traces of oil and grease. Cooling tower blowdown also contains traces of toxic substances added to the cooling water as bio-fouling agent to prevent the growth of algae in the cooling water system. The total effluent from the plant is expected to be within 80 - 100 m³/hr.

A waste water treatment system will be installed to treat all waste water effluents from the plant. The system will be designed to meet respective standards of Government of Rajasthan and Government of India. Acid and alkaline waters would be treated in neutralization tank. Oil would be reduced using oil skimmers. DM Plant filter back wash and the conventional water treatment plant filter back wash water would be first taken to a settling tank for the removal of suspended solids and the settled water would be pumped to a guard pond. The thickened sludge would be disposed off by land filling.

The total effluent from the plant is expected to be about 80–100 m³/hr, of which approximately 50% is expected to be used for green belt horticulture (65 ha) and the balance either for horticulture development in the plant area or supply outside for irrigation purposes. However the exact requirements to use this water in agriculture have to be defined according to the local requirements.

Sludge from the water pre-treatment plant is the primary solid waste generated. It will be dried and disposed off by proper land filling or sold as organic fertiliser, depending on the carbon and residual salts content.

R-LNG

The power plant consumes around 5,189,867 MMBTU of LNG. The fuel will be supplied by a spur pipeline from Kota. The transport and handling of R-LNG poses risks for the environment, the neighbourhood and for the workers. The layout of the plant and the pipeline will be set-up according to advanced safety standards. Impacts of R-LNG transport and handling, risks of accidents at all relevant sites will be minimised by plant design and environmental management. The Environmental Impact Study for the gas supply pipeline will be prepared by the gas supplier.

Heat Transfer Fluid

The HTF is a synthetic oil. It is not considered hazardous according to Indian and U.S. standards, however in California, HTF is considered a hazardous substance. There is a certain risk of vapour emissions from valves and pump seals during normal operation, in case of accidental leakage soil pollution may arise. The workers handling the HTF have to use protective gears. Environmental and safety aspects of the HTF will be taken care in plant design and environmental management.

Waste management

In comparison to other power plants, R-LNG based power plants do not pose much liquid waste handling problems. Wastes during construction and operation will contain sludge from the water treatment, small quantities of hazardous wastes and waste oil as well as domestic waste. A landfill site has not been identified. That will be done during further project design.

Transmission Line

A 132 KV transmission line system is already in place. Relocation of the line will be necessary only on the project site. No negative impacts are expected.

Environmental management plan (EMP)

An EMP has been drafted as part of the environmental study. The plan will be reviewed and revised during further project design. During the construction phase emphasis will be on control of fugitive emissions from engine exhaust, construction, etc. Due to low sulphur content of R-LNG, SO₂ emissions during operation of the plant are negligible. NO_x emissions will be reduced by low NO_x burners.

A green belt will be developed around the power plant with an average width of 20 m. Due to low soil quality the choice of species would be limited to those which can withstand extreme arid climates.

5. Population, Socio economic aspects

The area around 25 km off the project site is thinly populated with a population density of 115 persons per km². The literacy rate is low (30%), the employment rate is 42%. Agriculture and animal husbandry are the major occupations of rural population in the study area. All villages are provided with electricity, but power cuts are frequent. There are about 51 hospitals, 16 dispensaries and three mobile hospitals.

There are no inhabitants on the land within the boundary of the power plant and therefore no resettlement and rehabilitation is required. The project area is government land, which is fenced for already two years. There have been no complaints against the fencing of the area. The project proposal has been presented in a public meeting to which the local population was invited. There were also no complaints against the project proposal at the meeting.

The project will have significant beneficial impacts such as employment, communication, education and other social benefits in regional environment. About 300 skilled and unskilled labourers will be needed during the construction stage. The management of RSPCL has proposed to give preference to local people providing employment in unskilled and semiskilled jobs. This will also reduce the risk of spread of sexually transmitted diseases during construction phase by migrant workers. During the O&M phase of the project, it is expected that 50 unskilled/skilled workers and 25 other category personnel will be employed by RSPCL/ the private operator.

6. Summary of environmental and social impact

The project area is sparsely populated with a semi arid climate and irrigation from deep groundwater sources being the main activity near the project site. There are no major industries in the project area. The village of Mathania is located about 2 Km north of the project. The power plant consumes around 5,189,867 mmBTU of R-LNG annually. The transport, and handling of R-LNG poses risks for the environment, the neighbourhood and for the workers. The lay out of the plant and the loading and storage areas will be according to

advanced safety standards, a management system will be put up to control all environmental and safety risks of the naphtha handling and of other hazardous substances to be used in the plant.

The operation of the plant will result in only a marginal increase in the very low atmospheric pollution in the area. A critical aspect is the scarcity of water in the project area. The water requirements of the plant will be met from the Jodhpur Lift Canal Scheme, located at a distance of 15 km which will be pipeline connected. The exact water requirements as well as the way of transport of water to the plant site and the secondary impacts of the additional water usage by the project and the impact of increased power supply in the area on the water resources will all be further investigated in a „water carriage study" and an additional EIA to be commissioned by RSPCL. In the long run the project may have a certain impact on the deep water resources by providing additional electricity to the farmers to run the water pumps for irrigation. A waste water treatment system will be installed to treat all waste water effluents from the plant. The total effluent from the plant is expected to be about 80-100 m³/hr, which will be used for agricultural irrigation.

A 132 KV transmission line is already in place. Relocation of the line will be necessary only on the project site. No negative impacts are expected. An environmental management plan has been drafted as part of the environmental study. The plan will be reviewed and revised during further project design. There are no negative impacts on the population in the area as no resettlement or rehabilitation is required

The project will be categorized as UR2 (environment and resource protection is a main objective) and requires the conduct of an Environmental Impact Assessment as already done.