Pre-Feasibility Report

FOR

Installation of GTG/HRSG Under Energy Reduction Scheme At Nangal Unit, Dist-Ropar, Punjab

PROJECT PROPONENT

NATIONAL FERTILIZER LIMITED
ADDRESS: A-11, SECTOR-24,
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PREPARED BY

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2.1 Introduction

2.1.1 Project & Project Proponent

National Fertilizers Limited (NFL) is one of the largest producers of nitrogenous fertilizer in the country having a capacity to produce 3.568 million tonnes of Urea per year along with various industrial products. NFL is presently operating fertilizer units at Panipat, Bathinda, Nangal and Vijaipur which are natural gas based plants with dedicated offsite and utility facilities. All NFL plants have been operating at more than their rated capacities.

Nangal plant was setup based on fuel oil/LSHS as feedstock to Ammonia plant in 1978. Subsequently, as per Guidelines of GOI, in order to reduce subsidy burden & Carbon footprint, NFL revamped the Nangal Unit by changeover of Feedstock from LSHS/FO to Natural Gas and commercial production on Gas was commenced in July 2013. The existing capacity of NFL, Nangal is 4.785 Lakh MT/year of Urea.

Considering higher Specific Energy consumption of Ammonia and Urea plants as compared to latest plants, NFL intends to further reduce the Specific Energy consumption of Ammonia / Urea plants at Nangal. The Report is in conformity to the New Urea Policy-2015 (NUP-2015) to bring down the Energy Consumption level less than 6.5 Gcal/MT of Urea.

To meet Specific Energy norms for Urea under New Urea Policy 2015 (NUP-15) and as per Energy Reduction Scheme of GoI, installation of GTG (Gas Turbine Generator) and HRSG (Heat Recovery Steam Generator) are proposed in the complex.

2.1.2 Nature of the Project

The basic objective of the project is to reduce the Specific Energy consumption of Ammonia-Urea plants of NFL, Nangal complex by identifying the inefficient areas/machines and implementing the Energy saving schemes so as to meet Specific Energy norms for Urea under New Urea Policy 2015 (NUP-15).

2.1.3 New Urea Policy- 2015

In May 2015, the Union Cabinet gave its approval to a comprehensive New Urea Policy 2015 for the next four financial years (June 2015 to March 2019).

The key objectives of the New Urea Policy 2015 are as follows:

- Maximise indigenous Urea Production to reduce import dependency and reduce subsidy burden on the government
- Promote energy efficiency to reduce Carbon-footprint (via energy efficiency) to make Urea production environment friendly. This will be done via revised specific energy consumption norms.

- Make Urea production plants to adopt best technology available and become globally competitive.
- Timely supply of Urea to farmers at the same MRP.

As per the new Urea policy-2015, the existing gas based urea units have been classified into following three groups based on preset energy norms:

- Group I includes the urea units having pre-set energy norms between 5.0 Gcal/MT to 6.0 Gcal/MT of urea.
- Group II includes the urea units having pre-set energy norms between 6.0 Gcal/MT to 7.0 Gcal/MT of urea.
- Group III includes the urea units having pre-set energy norms more than 7.0 Gcal/MT of urea.

Further these urea units have been given the following targets for energy consumption to be achieved in the year 2018-19.

i) For Group-I, target energy norms for the year 2018-19 would be 5.5 G cal/MT of urea (except for TCL-Babrala for which existing pre-set energy consumption norm of NPS-III i.e 5.417 Gcal/MT of urea will continue).
ii) For Group-II and Group-III, target energy norms for the year 2018-19 would be 6.2 G cal/MT and 6.5 Gcal/MT respectively.

NFL's Panipat, Bathinda and Nangal units fall under Group-III with energy target of 6.5 Gcal/MT of urea.

In view of prevailing policy of the government, NFL is in search of economically viable options to meet the target set by government.

The revamp of these units were done with complete change of front-end of ammonia plant i.e up to synthesis gas preparation. Back-end of ammonia plant and the urea plant are unchanged. In the utilities also, there is no change. After changeover of feedstock, presently, natural gas is used as feed and fuel to the reformer. However, coal is still used for steam and power generation, with natural gas as support fuel.

2.1.4 Need of the project

The need and justification of the proposed project is mentionedbelow:

- It will reduce specific energy consumption from 7.095 G cal/MT of urea to 6.5 G cal/MT of urea, in compliance with Govt. of India's NUP – 2015.
- It will lead to a substantial reduction in carbon foot-print and pollution load.
- It will reduce the subsidy burden of Government of India (GoI).
- It will maintain the profitability of NFL.

- It will maintain stability in indigenous / domestic market for Urea.
- Quality of prills will improve with the installation of natural draft Prilling tower.
- It will check the import possibilityof fertilizers to some extent and yield national savings
- There will be temporary employment generation during construction period.

2.1.5 Employment Generation

The existing manpower in the unit is adequate to meet the manpower requirements during operational phase. However, the project will generate employment opportunities during construction phase to persons, comprising semi-skilled and unskilled work force on contract basis.

2.2 Project Description

2.2.1 Location

The proposed installation of GTG (Gas Turbine Generator) and HRSG (Heat Recovery Steam Generator) will be done inside premises of NFL Naya Nangal, Punjab.The National Fertilizers Ltd., Naya Nangal complex is located West of Sutlej river, half a kilometer away from the Nangal -Una State highway No. 22 and is about 16 kms from Bhakra Dam. NFL Township is located on the North side of the NFL factory complex. Himachal Pradesh border is about 3 Km from NFL factory site. Height of NFL site is 204 M from sea level. Its longitude N = 310 - 22' - 34.68" and latitude E = 760 - 21' - 48.36".Maps showing general & specific location, project boundary, plant boundary,15 km sensitivity map, 10 km study area have been presented in Annexures 1 & 2.

2.2.2 Project description

The project is proposed by NFL for installation of GTG (Gas Turbine Generator) & HRSG (heat Recovery System Generation) under energy reduction scheme. As per Guidelines of GOI, in order to reduce subsidy burden & Carbon footprint, NFL revamped the Nangal Unit by changeover of Feedstock from LSHS/FO to Natural Gas and commercial production on Gas was commenced in July2013.

The proposed GTG will utilize natural gas as fuel to generate 20 MW (Net) power under site conditions. The hot gases exiting from the gas turbine will be led into the HRSG boilerof 100 TPH with a provision for superheating of 45 MT/hr of HP steam, where additional natural gas will be burned..

2.3 Site analysis

2.3.1 Connectivity

Naya Nangal plant is located west of Sutlej river, 0.5km away from the Nangal -Una State highway No. 22 and is about 16 kms from Bhakra Dam. Nangal Dam railway

station is at approx. 3 km, Chandigarh Airport isapprox, 100 km from the project site.

2.3.2 Land form, Land use and Land ownership

The project will be implemented within the premises of Nangal Unit of NFL.The identified land is devoid of vegetation and is a plain land.

2.3.3 Topography & Soil

The site is practically level as it is inside the boundary of the existing Unit. Elevation of the plot is approx. 204 m above MSL.

2.3.4 Climate of the area

The climate of the area is semi-arid to sub-humid. The temperature rises up to 46°C in summer and drops down to 2°C in winters. The climate of the district being dry, it becomes extremely hot during summer and extremely cold during winter. The cold season is from December to February and is followed by summer from March to June. Period from mid of September to end of November constitute post monsoon season.

2.3.5 Social infrastructure

Nangal city is located within 3 Km from the site, in Northeast direction. Nangal is an old city, and infrastructure available in the city is satisfactory.

2.4 Planning brief

2.4.1 Planning concept

National Fertilizers Limited (NFL) is one of the largest producers of nitrogenous fertilizer in the country having a capacity to produce 3.568 million tonnes of Urea per year along with various industrial products. NFL at present is operating fertilizer units at, Panipat, Bathinda, Nangal and Vijaipur which are natural gas based plants with dedicated offsite and utility facilities. All NFL plants have been operating at more than their rated capacities.

Considering higher specific energy consumption of Ammonia and Urea plants as compared to latest plants, NFL intends to further reduce the specific energy consumption of Ammonia / Urea plants at Nangal. The Report is in conformity to the New Urea Policy-2015 (NUP-2015) to bring down the Energy Consumption level less than 6.5 Gcal/MT of Urea.

2.4.2 Land use planning

The proposed installation will be carried out within the premises of the existing NFL, Nangal Unit.

Lay out map of the project area, demonstrating plants and facilities, has been presented in the lay out plan figure.

2.4.3 Infrastructure, amenities and facilities

A the proposed project will be carried out in the existing operational unit,the existing infrastructure, amenities and facilities required for construction and operation of the project are adequate.

2.4.4 Residential area

Development of residential area is not proposed, as the accommodation and support facilities presently available within NFL Township are adequate.

2.4.5 Green belt

Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants serve as a sink for pollutants, act as barrier to break up the wind speed as well allow the dust and other particulates to settle out there. It also helps to reduce the noise level to some extent. Being an environmentally conscious organization, NFL Nangal has deloped green belt and plantation in and around the plants and the township. Plantation has also been developed over the ash pond and around the water reservoirs. NFL Nangalis committed to continually expend and maintaing green belt within the plant premises, the township, over the exhausted areas within the ash pond and around the water reservoirs.

2.4.6 Social infrastructure

Nangal Unit of NFL is located within limits of Nangal Municipal Corporation, and has its own township for its employees. NFL Township at Naya Nangal has been provided with all infrastructure facilities, viz., family accommodations, Guest House, Expert Hostel, Hospital, power and water supply, School, parks, shopping Centre, etc. The existing facilities are adequate, and no additional facility is required.

2.4.7 Drinking water and sewerage system

The existing drinking water facilities and the sewerage system, including the STP, provided within NFL Township and the Unit are adequate. The proposed project will not require additional drinking water nor generate additional sewage.

2.4.8 Industrial waste management

Facilities for management of wastes, viz., solid liquid and gaseous wastes are in place and complying with norms and specific requirements of past ECs and consent to operate. The proposed project will lead to significant reduction in industrial wastes, i.e., coal ash, gaseous emissions like PM, SO2 and NOX, and wastewater.

2.4.9 Power requirement and source

The present power requirement of the unit is approx. 20.980 MW. On implementation of the scheme, the power requirement will come down to approx. 20.656 MW. The proposed Source of Power is captive from NG based GTG. Partial steam requirement shall also be met from HRSG of GTG.

- Single Gas Turbine with net production of 20 MW at site condition has been considered.
- HRSG capacity of 100 MTPH Generated steam at 90 kg/cm2g and 510° Cplus 45 MTPH of Superheating saturated steam

2.5 Rehabilitation and resettlement

The proposed project, i.e., the GTG/HRSG will be located within the premises of the complex, adjacent to the existing operational plants. Therefore, implementation of the project does not involve, land acquisition, rehabilitation or resettlement.

2.6 Project schedule & cost estimates

The total time schedule for completion of project would be about 24 months after the reciept of approval from concerned authorities.Construction activities will start after all statutory clearances, including environmental clearance to the project. The zero date will commence after completion of all the pre-project activities.

The project cost estimates for the facilities to be installed for the proposed Energy Saving Scheme in NFL, Nangal has been worked out to Rs. 262.06 Crores for Phase-1. However, the capital cost pertaining to Urea production has been worked out to Rs. 241.65 Crores on the basis of steam and power consumption for fertilizer production.

3. Introduction

3.1 Identification of project and project proponent

3.1.1 Project and project proponent

National Fertilizers Limited (NFL) is one of the largest producers of nitrogenous fertilizer in the country having a capacity to produce 3.568 million tonnes of Urea per year along with various industrial products. NFL is presently operating fertilizer units at Panipat, Bathinda, Nangal and Vijaipur which are natural gas based plants with dedicated offsite and utility facilities. All NFL plants have been operating at more than their rated capacities.

Nangal plant was setup based on fuel oil/LSHS with annual installed capacity of 3.3 LMT (1000 MTPD) of Urea in 1978. In 2001, capacity of Urea plant was augmented to 4.785 LMT (1450 MTPD) of Urea. Subsequently, as per guidelines of GOI, in order to reduce subsidy burden & Carbon footprint, NFL revamped the Nangal Unit by changeover of Feedstock from LSHS/FO to Natural Gas and commercial production commenced inJuly 2013.

3.1.2 Pre-Feasibility Report (PFR)

This Pre-feasibility report has been prepared to comply with the requirements of "Guidelines for Preparation of pre-feasibility report for obtaining prior environmental clearance in terms of the provisions of EIA notification, 2006", issued by the Ministry of Environment and Forests (J-11013/41/2006-1A.II(I) dated 30-12-2010. The report is based on the "Techno-Economic Feasibility Report on Implementation of Energy Reduction Scheme at NFL Nangal, Punjab", prepared by PDIL, and data and information regarding site & surroundings, etc. either provided by NFL or gathered from secondary sources.

3.2 Brief description of nature of project

3.2.1 Nature of the project

The project is proposed by NFL for installation of GTG (Gas Turbine Generator) & HRSG (heat Recovery System Generation) under energy reduction scheme. As per Guidelines of GOI, in order to reduce subsidy burden & Carbon footprint, NFL revamped the Nangal Unit by changeover of Feedstock from LSHS/FO to Natural Gas and commercial production on Gas was commenced in July 2013.

The basic objective of the proposed project is to reduce the Specific Energy consumption of Ammonia-Urea plants of NFL, Nangal complex by identifying the inefficient areas/machines and implementing the Energy saving schemes so as to meet Specific Energy norms for Urea under New Urea Policy 2015 (NUP-15).

To meet the objective of the project and for meeting energy norms for Nangal Unit, it has been identified that there are certain areas with scope of energy reduction and

hence it is proposed to implement the proposed energy saving schemes in two phases.

A. Installation of GTG & HRSG

In first phase, installation of a new GTG (Gas Turbine Generator), HRSG (Heat Recovery Steam Generator) of optimum capacity will be done as a prominent measure in Phase-1 for reducing the specific energy consumption of Ammonia-Urea plants for just meeting energy norms as per NUP-2015. The Phase-1 scope of study shall cover the following areas-

- Implementation of Energy Reduction Schemes at NFL Nangal.
- Existing source of power and existing power consumption for the complex.
- Existing steam network, consumption centres and steam balance of Ammonia Plant and Steam Generation Plant (SGP).
- Gas Turbine power generation capacity to be installed to meet the present and additional demand, if any, of Ammonia-Urea Plant and Steam Generation Plant.
- Steam generation capacity from the HRSG of the proposed GT.
- Balance Steam requirement from existing coal fired Auxiliary Boiler to meet the total steam requirement under normal plant operation and start-up conditions
- Energy calculation for the existing and proposed system.Configuration of Gas Turbine (capacity and number) for achieving minimum specific energy consumption.
- Reliability of the proposed system with GT to take care of typical emergency situations.
- Estimated investment for the proposed system of GT and HRSG including changes required in existing electrical system.
- Pay-back period and Internal Rate of Return (IRR) analysis of the proposed scheme.
- Sensitivity analysis: with respect to gas price and capital cost.

2nd phase of Energy Saving schemes, shall cover the following areas-

- Installation of add-on ammonia converter or S-50 Ammonia converter at downstream of existing converter for enhancing capacity and energy reduction.
- Replacement of internals of Syn Gas Compressor with energy efficient rotors/impellers
- Installation of new gas based auxiliary boiler as per requirement of steam in the phase-2

3.3 Need of the project and its importance to the country

The need and justification of the proposed project is mentionedbelow:

- It will reduce overall energy consumption leading to a substantial reduction in pollution load.
- It will reduce the subsidy burden of Government of India (GoI).
- It will maintain the profitability of NFL.
- It will maintain stabilit y in indigenous / domestic market for Urea.
- It will check the import possibility of fertilizers to some extent and yield national savings
- There will be temporar y employment generation during construction period.

3.4 Employment generation

Existing workers of the plant are sufficient to carry out the work related to the proposed activity regarding installatiopn of GTG & HRSG. However, if required skilled and unskilled labors will be procured form the nearby area.

The execution of the project has to pass through different phases like pre-project activities, design and engineering, procurement, civil works and erection, pre-commissioning, trial run/commissioning till the project finally goes in to commercial production. The success of the project will depend on the strength of the owner's project management cell that will monitor the various activities with vendors & detailed engineering contractor.

4. Project Description

4.1 Type of project

The project is proposed by NFL for installation of GTG (Gas Turbine Generator) & HRSG (heat Recovery System Generation) under energy reduction scheme. As per Guidelines of GOI, in order to reduce subsidy burden & Carbon footprint, NFL revamped the Nangal Unit by changeover of Feedstock from LSHS/FO to Natural Gas and commercial production on Gas was commenced in July 2013.

The basic objective of the proposed project is to reduce the Specific Energy consumption of Ammonia-Urea plants of NFL, Nangal complex by identifying the inefficient areas/machines and implementing the Energy saving schemes so as to meet Specific Energy norms for Urea under New Urea Policy 2015 (NUP-15).

4.2 Location

The proposed installation of GTG (Gas Turbine Generator) and HRSG (Heat Recovery Steam Generator) will be done inside premises of NFL Naya Nangal, Punjab.The National Fertilizers Ltd., Naya Nangal complex is located West of Sutlej river, half a kilometer away from the Nangal -Una State highway No. 22 and is about 16 kms from Bhakra Dam. NFL Township is located on the North side of the NFL factory complex. Himachal Pradesh border is about 3 Km from NFL factory site. Height of NFL site is 204 M from sea level. Its longitude N = 310 - 22' - 34.68" and latitude E = 760 - 21' - 48.36".Maps showing general & specific location, project boundary, plant boundary,15 km sensitivity map, 10 km study area have been presented in Annexures 1 & 2.

4.3 Alternate sites considered

No alternate site has been considered as the project isto be implemented in existing unit under energy reduction scheme of GoI.

4.4 Proposed Modifications

The Nangal unit has recently completed its feedstock conversion project. Presently the Ammonia Plant is running on Natural Gas. However, Steam and Power is generated from Coal. GTG and corresponding HRSG are considered for total requirement of power from Natural Gas as a revamp measure in present complex in order to reduce overall energy consumption of the complex. Accordingly following changes are envisaged:

Table - Details of existing as well as proposed modification

S. No.	Items	Existing System	Proposed modification
1.0	**Power Generation**		
1.1	Steam Turbo Generators	No STG are at Nangal and presently power is being sourced from State Power Grid	Grid Connectivity will retained but power will be generated from new GTG-HRSG
1.2	Gas Turbine Generators with net output at ambient condition	-	1 x 20 MW
2.0	**HP Steam Generation (in SGP)**		
2.1	Coal Fired Boilers	2 + 1	1 + 2
•	• HRSG (connected to GTG)	-	• 1 x 100Te/hr of Generated steam + 45 Te/hr Superheating steam

The proposed revamp scheme is only for power through GTG and corresponding HRSG. Along with New GTG-HRSG, operation of one Coal Fired Boileris proposed to meet the differential superheated HP steam requirement of the complex. Coal handling will be continuing because one Coal Fired Boiler will remain under operation. After stopping of one Coal Fired boilers, it is proposed to install GTG with net power generating capacity at site conditions of about 20 MW and HRSG (with additional firing provision) of 100 TPH along with additional capacity of super heating 45 MTPH of saturated steam. GTG-HRSG Package will be sufficient to generate total Power and partial HP Steam. Balance HP Steam will be supplemented by operating Coal Fired Boiler.Total power requirement of the complex (Ammonia- Urea complex and Industrial Products plants) will be met from the power generated by the new GTG.Balance power to the complex shall be imported from State Grid to keep it alive. GTG-HRSG shall be designed such that, in addition to generation of Superheated HP Steam, HRSG shall be capable of superheating part of saturated HP Steam generated in the Ammonia Plant. Balance superheating of this saturated steam shall be done in operating Coal Fired Boiler.

Followingchanges are required for the revamp (phase -1):

- GTG (1×20MWnet generation at site conditions)
- HRSG (1×100 TPH with a provision of superheating of 45 MT/hr HP saturated steam)

4.5 Power Consumption

The existing power consumption of the complex is approx 20.980 MW, however after implementation/installation of GTG & HRSG consumption of power will be reduced approximately to 20.656 MW. Comparison between existing power consumption &consumption after modification is tabulated below-

Sl. No.	Item	Existing (MW)	After Modification (MW)
1.	Ammonia Plant (Including Cooling Tower)	6.902	6.902
2.	Urea Plant (Including Cooling Tower)	7.810	7.810
3.	Steam Generation Plant	2.545	1.271
4.	DM Water Plant	0.182	0.182
5.	GTG & HRSG Plant	-	0.950
6.	Common Facilities, Services, Township etc	2.214	2.214
7.	Raw Water Plant	0.636	0.636
8.	Product Handling	0.091	0.091
9.	NAP + AN + NOx Plant	0.60	0.60
	Total Power	**20.980**	**20.656**

4.5.1 Compressed Air

The requirement of Compressed is sourced from existing supplies from plants and there shall not be any additional installation.

4.6 Resource Optimization

4.6.1 Energy Conservation

The basic objective of the proposed project is to reduce the specific energy consumption of Ammonia-Urea plants of NFL, Nangal. Considering higher specific energy consumption of Ammonia and Urea plants as compared to latest plants, NFL intends to further reduce the specific energy consumption of Ammonia / Urea plants at Nangal. The proposed project is in conformity to the New Urea Policy-2015 (NUP-2015) to bring down the specific Energy Consumption from 7.095Gcal/MT of Ureato less than 6.5 Gcal/MT of Urea.

4.6.2 Water Conservation

There will be no reduction of water consumption in the proposed projectexcept slight reduction water being used for ash handling owing to reduction of ash generation. .

4.6.3 Waste Minimization

The proposed project will reduce the waste generation significnatly. Replacement of coal by natural gas and discontinuing one coal fired boiler will reduce ash generation by more than 50%. Also, significant reduction in emissions of PM, SO2 and NOx into atmosphere is foreseen due to reduced coal consumption.

4.7 Water Requirement

4.7.1 Water

The source of water for the existing plant is Satlujriver and water stored in water reservoirs. No change in fresh water demand is foreseen.

4.8 Generation and Management of Wastes

4.8.1 Solid & hazardous wastes

No solid or hazardous waste will be generated due to the proposed activity. On the other hand, significant reduction in solid waste generation is foreseen due to replacement of coal-based STG by NG fired GTG, and discontinuation of one coal-fired boiler.

4.8.2 Liquid effluents

There will no additional reduction of any liquid effluent. Howevevr stoppage of one boiler post installation of GTG for power generation will reduce generation of blow downs from boilers.

4.8.3 Gaseous emissions

Significant reduction in emissions of PM, SO2 and NOx into atmosphere is foreseen due to reduced coal consumption.

5. Site Analysis

5.1 Connectivity

Naya Nangal plant is located west of Sutlej river, 0.5km away from the Nangal -Una State highway No. 22 and is about 16 kms from Bhakra Dam. Nangal Dam railway station is at approx. 3 km, Ludhiana Airport is approx, 70 km from the project site.

5.2 Land form, Land use and Land ownership

For proposed GTG-HRSG System, tentative area requirement is 65 mts x 80 mts. The installation of GTG & HRSG will be established within the premises of NFL Nangal.

5.3 Topography

The site is practically level as it is inside the boundary of the existing Unit. Elevation of the plot varies from approx. 204 m AMSL.

5.4 Existing Land use Pattern

The project will be implemented within premises of the existing NFL, Nangal.

5.5 Existing Infrastructure

NFL has setup its own township at the existing area where it has provided various social infrastructure facilities like transport, electricity, water facility and other basic amenities. They have also provided educational facilities and regulates various welfare activities within the area.

Plants and infrastructure existing within the premises of the fertilizer complex are as follows:

1. Raw Water Plant
2. DM Plant
3. Material handling
4. SGP
5. Ammonia Plant
6. Urea Plant
7. Industrial Products (Nitric Acid, Ammonium Nitrate plants)
8. Canteen
9. First aid
10. Petrol Pump
11. Material Storage
12. Ammonia storage, loading & unloading facilities
13. Urea conveying, Silo & Bagging Plant
14. Cooling Towers
15. 132 KV switchyard and other substations
16. Workshop & warehouse

17 Laboratory
18 D.G. Set for emergency power supply
19 Administration Block
20 Technical building
21 Parking Slots

Infrastructural facilities existing within NFL Township are as follows:

1. Self-sustained medical facility
2. Hospital
3. Shopping centre
4. Recreation centre & fertilizer club
5. Community hall to seat 600 persons
6. Post Office
7. ATM Facility in township
8. Bank facility in township
9. Canteen
10. Playgrounds with toilet facilities
11. Schools
12. Computer Centres
13. Religious/Worshipping Places- Temple, Church, Gurudwaraetc

5.6 Soil Classification

Two types of soils are found in the district-(1) Reddish chestnut soils which is seen in the northeastern part of the district, particularly in the Ropar and Anandpur Sahib blocks. These soils are loam to clay-loam in nature and decalcified and (2) Tropical Arid Brown soils (Weakly Solonized) are mainly found in rest of the area which are mainly calcareous sandy loam. The soils of the District vary in texture generally from loam to silty clay loam except along the Sutlej River and chos (seasonal canals) where some sandy patches may be found.

5.7 Climate of the area

The climate of the area is semi-arid to sub-humid. The temperature rises up to 46°C in summer and drops down to 2°C in winters. The climate of the district being dry, it becomes extremely hot during summer and extremely cold during winter. The cold season is from December to February and is followed by summer from March to June. Period from mid of September to end of November constitute post monsoon season.

5.8 Available Social Infrastructure

Nangal city is located within 3 Km from the site, in Northest direction. Nangalis an old city, and infrastructure available in the city satisfactory.

5.8.1 Houses

Houses are built on either side of the roads in the villages. Some of them are located near their fields. Most of the houses in the villages are pucca with few a kuchha houses.

5.8.2 Water supply

Villages mostly rely on hand pumps, wells and pond water. Ground water in the area is available at a depth10-15 m below ground level. Water collected in the ponds and drawn from tube wells is also used for irrigation.

5.8.3 Transport and Communication

Transport accessibility is one of the important factors required for the overall development of the area. All the villages have roads and means of transportation to the towns are by Bus, auto, two-wheelers, jeeps, etc. All villages in the area are well connected to SH-22.

5.8.4 Market Facilities

Commercial activities form the backbone of the economy. The study tends to tell the kind of employment it generates for the people of the area and the kind of employment it generates for the people of the area and the kind of services it provides for the attainment of a better living. Market facilities available at Nangal cater to the needs of the area, and are adequate.

5.8.5 Health Facility

Health is one of the most important development indicators, which needs to be studied to know the quality of life in the area. The site and surrounding villages are well connected to Nangal City. Health care facilities available in the area include Primary health centers in villages and government and private hospitals in Nangal City.

6. Planning Brief

6.1 Planning Concept

In view of New Urea Policy-2015 of the government, NFL is in search of economically viable options to meet the target set by government.

The revamp of theNangalunit was done with complete change of front-end of ammonia plant i.e up to syn gas preparation. Back-end of ammonia plant and urea plants are unchanged. In the utilities also, there is no change. After changeover of feedstock, presently, natural gas is used as feed and fuel to the reformer. However, coal is still used for steam and power generation. After feedstock changeover from Fuel Oil/LSHS to NG, the energy consumptions have been substantially lowered and hence energy norms have been revised to 7.095 Gcal/MT of Urea for NangalUnit.

After announcement of NUP-2015, NFL is eager to revamp the utilities for further reduction in energy consumption for urea production. The Report is in conformity to the New Urea Policy-2015 (NUP-2015) to bring down the Energy Consumption level upto 6.5 Gcal/MT of Urea.

6.2 Population Projection

Unskilled and semi-skilled work force during construction and operational phases will be drawn from local population. Skilled work force during operation and construction phases will stay at Nangal, and commute to the site. Thus, the increase in population due to the proposed project is not envisaged.

6.3 Land Use Planning

For proposed GTG-HRSG System, tentative area requirement is 65 mts x 80 mts. The installation of GTG & HRSG will be established within the premises of NFL Nangal.

Lay out map of the project area, demonstrating plants and facilities, has been presented in the lay out plan figure.

6.4 Infrastructure Demand

6.4.1 Physical Demand

Land: Tentative area requirement for installation of GTG & HRSG is 65 mts x 80 mts. The project will be implemented within premises of the existing NFL, Nangal.

Water: Existing water storage facilities are sufficient to cater the demand of the proposed project.

Energy: Total power requirement of the complex is approximately 20.656MW.**Construction material:** Construction materials include structural steel,

corrugated sheets, bricks; sand, cement, stone chips, etc. are available in the area and will be sourced from Nangal.

Plant machinery: The list of plant machinery has been provided separately.

6.4.2 Social Demand

On the basis of the preliminary site visit, the infrastructure demand in the villages assessed on the basis of need and priority. Health infrastructure of the study area are well established and are well connected through SH-22. Nangal having well established school and higher education institute for education purpose.

6.5 Amenities/ Facilities

As the plant is an existing unit, hence site office, small workshop, first aid room, stack yard & rest shelter are alreadypresent within the plant premises. Clean drinking water is available. The toilets are also; available separately for males and females.

7. Proposed Infrastructure

7.1 Industrial Area

7.1.1 Project Facilities

Proposed project facilities include installation of following within the premises of the complex:

1. GTG with net generation capacity of 20 MW under site conditions
2. HRSG with supplementary NG firing, to generate 100 TPH with a provision of superheating of 45 MT/ hr HP saturated steam

7.2 Residential Area

The NFL Township has been provided with adequate number of dwelling units, supported by Gest House and Expert Hostel. The proposed project will not generate additional employment opportunity. Further, skilled and un-skilled work force required during construction phase of the project will be drawn from nearby population, who will commute from their own homes.

7.3 Green Belt

Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants serve as a sink for pollutants, act as barrier to break up the wind speed as well allow the dust and other particulates to settle out there. It also helps to reduce the noise level to some extent. Being an environmentally conscious organization, NFL Nangal has deloped green belt and plantation in and around the plants and the township. Plantation has also been developed over the ash pond and around the water reservoirs. NFL Nangal is committed to continually expend and maintaing green belt within the plant premises, the township, over the exhausted areas within the ash pond and around the water reservoirs.

7.4 Social Infrastructure

Nangal Unit of NFL is located within limits of Nangal Municipal Corporation, and has its own township for its employees. NFL Township at Nangal has been provided with all infrastructure facilities, viz., family accommodations, Guest House, Expert Hostel, Hospital, power and water supply, School, parks, shopping Centre, etc. The existing facilities are adequate, and no additional facility is required.

7.5 Connectivity

The project site, located within premises of the fertilizer complex, is well connected by road and railway siding. No additional connectivity is required.

7.6 Drinking Water Management

The existing drinking water facilities are adeuate to meet demands of the proposed project. Potable water is available at various locations within the complex. Sanitary installations as well as safety showers are also available. A dedicated water tank will be provided to meet the potable water requirement.

7.7 Sewerage System

The existing sewerage system within the complex premises and the township is adequate. Additional sewerage system is not required.

7.8 Industrial Waste Management

The existing waste management system is adequate and is as per norms. On implementation of the proposed project, significant reduction in waste generation is foreseen. No new waste generation is foreseen.

7.9 Solid Waste Management

The proposed project will lead to significant reduction in solid waste generation. The existing solid waste management system will continue to operate, at a lower load.

7.10 Power Requirement & Supply / Source

The present power requirement of the unit is approx. 20.980 MW. The proposed Source of Power is from NG based GTG. Partial steam requirement shall also be met from HRSG of GTG and rest of steam requirement will be fulfilled from one coal fired boiler.

8. Rehabilitation and Resettlement Plan

The proposed project, i.e., the GTG/HRSG will be located within the premises of the complex, adjacent to the existing operational plants. Therefore, implementation of the project does not involve, land acquisition, rehabilitation or resettlement.

9. Project schedule and cost estimate

9.1 Project Schedule

9.1.1 Pre-Project Activities

The pre-project activities to be completed before the physical execution of the project are briefly enumerated below:

i. Approval of the project by the board of the company.

ii. Submission of application for obtaining Environmental clearance to the state and Central Pollution Control Board.

iii. Appointment of Engineering Procurement Consultant (EPC).

iv. Firming up of list for procurmement.

All the activities mentioned above should be completed before the 'zero date' of the project i.e. before the commencement of the active phase of the project. Project Implementation Period

The total time schedule for completion of project would be about 24 months after the reciept of approval from concerned authorities. Construction activities will start after all statutory clearances, including environmental clearance to the project. The zero date will commence after completion of all the pre-project activities.

9.2 Project Cost

The project cost estimates for the facilities to be installed for the proposed Energy Saving Scheme in NFL, Nangal has been worked out to Rs. 262.06 Crores for Phase-1. However, the capital cost pertaining to Urea production has been worked out to Rs. 241.65 Crores on the basis of steam and power consumption for fertilizer production. An approximate break-up of the project cost estimates is given in table below-

Table: Estimated Project Capital Cost (Rs. Lakhs)

Sl. No.	Particulars / Items	Total Cost	Cost pertaining to Urea
A	**Supply Cost**		
	Gas Turbine Generator (20MW at ambient condition)	6572	6060
	HRSG (equivalent to 100MTPH along with additional super heating capacity of 45 MTPH of saturated steam)	4086	3768

	Bulk Material (Pipes, valves, Fittings, Electrical & Instrumentation)	3197	2948
	Total Supplies (A)	**13855**	**12776**
B	**Incidentals on (A)**		
	Excise Duty @ 12.5%	1732	1597
	Sales Tax @ 2%	312	288
	Inland Handling @ 3%	416	384
	Insurance @ 1%	139	128
	Total Incidentals (B)	**2599**	**2397**
C	**Erection**	**1663**	**1533**
D	**Civil Works**	**2078**	**1916**
E	**Design, Engineering & Procurement**	**970**	**894**
F	**Project Management & Procurement Charges**	**450**	**415**
G	**Startup & Hookup Expenses**	**1850**	**1706**
H	**Contingency (5%)**	**1058**	**976**
I	**Interest During Construction**	**1683**	**1552**
	Total Capital Cost in Rs. Lakhs	**26206**	**24165**

9.3 Basis of Estimation

The basis of estimates is as follows:

9.3.1 Supply Cost

For cost of GTG and HRSG, budgetary quotation has been obtained from reputed suppliers of the equipment and for bulk material (Pipes, valves, Fittings, Electrical & Instrumentation).

9.3.2 Construction Cost

The civil Construction cost and Erection charges have been estimated on percentage basis as per the data available for already executed similar projects. .

9.3.3 Incidental Charges

The incidental chanrges have been estimated based on following rates:

Excise Duty & Education Cess	12.5% on supplies
Salse Tax	2.0 % on supplies and duty
Inland Handling	3.0 % on supplies
Insurance	1.0 % on supplies

9.3.4 Start up and Hook up Expenses

Theses expenses have been considered against pre-commissioning of GTG & HRSG, one complete cold startup of the plant and three intermediate plant trippings.

9.3.5 Contingencies

A contingencies of 5% has also been considered to cover the unforeseen expenses during project execution.

9.3.6 Sensitivity Analysis

To have an idea of weaknesses and strengths of the project proposal, sensitivity analysis has been done. The sensitivity analysis of the proposed project has been carried out with respect to gas price and capital cost. Here the economics of the project is based on the differential savings/benefits due to proposed scheme over existing one. The effect of above variations on IRR and Payback have been worked out and presented below and

Sl. No.	Particulars	Capex (Rs. Lakhs)	NG Price (Rs./Sm^3)	Payback period (Years)	IRR (%)
A	**Base Case (Revenue Model)**	**24165**	**18.47**	**9.39**	**3.72**
B	**With Variation in Project Capital Cost**				
	(-10%)	21749	18.47	8.02	5.09
	(-5%)	22956	18.47	8.72	4.37
	(+5%)	25373	18.47	10.06	3.12
	(+10%)	26581	18.47	10.72	2.58
C	**With variation of Gas Price**				
	6 US$/MMBTU	24165	13.85	13.79	0.75
	7 US$/MMBTU	24165	16.16	11.15	2.25
	9 US$/MMBTU	24165	20.78	7.94	5.18
	10 US$/MMBTU	24165	23.09	6.69	6.61
D	**Based on Capital subsidy**	**24165**	**18.47**	**4.98**	**8.00**

From above table, it is evident that at higher price of Natural Gas, proposed scheme is more viable for NFL. In case the support of GoI by retaining existing energy norms for 5 years is notified as capital subsidy, the payback period is 4.98 years, IRR is 8% and is better as compared to Revenue Model.

9.3.7 Labour and Overheads

Annual expenditure towards salary and wages has not been considered as the said project can be handled by existing man power available in the unit for the purpose of various labour activities associated.

9.3.8 Repair, Maintenance and Insurance

The annual expenses towards repair, maintenance and insurance have been estimated at the rate of 1% of project capital cost.

10. Analysis of proposal (Final recommendation)

Ammonia and Urea plants have improved their Energy efficiency over the years. Improvement in Energy efficiency is a result of concerted efforts of the industry by implementing various Energy saving schemes. The declining trend in Energy consumption of Ammonia and Urea plants over the years is the testimony to the hard work imparted by company.

NFL Nangal unit is desired to reduce its plant energy in view of NUP-2015 by implementation of following schemes in two phases.

NangalUnit has no Captive power plant and after commissioning of AFCP, the requirement of captive plant is essential for Nangal unit.Most of the ammonia urea plants on Natural Gas have their own captive power plant or gas turbo generator. One of the reasons for less energy consumption of latest plants is provision of GTG cum HRSG as dedicated power source and energy reduction measures. Therefore requirement of GTG cum HRSG at Nangal is essentially required for plants stability and energy reduction.By installing GTG cum HSRG at Nangal energy can be reduced. It is therefore, recommended for installation of GTG along with HRSG at Nangal for Energy saving measure in Phase-1.

Presently Ammonia Plant has single Ammonia converter i.e. S-200 (M/s HaldorTopsoe) whereas latest plants has come up with add-on converter with higher Ammonia conversion. Therefore, it is recommended to install add-on Converter of Ammonia Synthesis (S-50for energy saving owing to reduction of loop pressure and higher conversion in add-on Converter.

The front end of Ammonia plant has already been revamped up to Ammonia Synthesis section. However, Ammonia Synthesis Compressor has been retained as such and is in service since 1978 having less polytropic efficiencies as compared to the latest compressors. Therefore,NFL intends to revamp internals of this compressor for Energy saving scheme in Phase-2.

Presently, steam requirement of the complex is met through coal-based boiler. The coal-based boiler is not as efficient as NG based boiler. With the implementation of above schemes in Phase-2, NG based boiler may be installed and its capacity can be decided while implementing the schemes in Phase-2

Installation of GTG cum HRSG will reduce the Energy from existing norm of 7.095 Gcal/MT to just near the new Energy normsi.e 6.5 Gcal/MT of Urea as per NUP-2015.

However, after implementation of GTG & HRSG in Phase-1, NFL can go for implementation of other Energy saving schemes along with new NG fired auxiliary boilers in phase-2 wherein more energy saving is envisaged in addition to eliminating the other problems associated with operation of existing coal fired boilers.

Therefore, NFL intends to install GTG along with HRSG as a prominent measure in Phase-1 for reducing the specific energy consumption of Ammonia-Urea plants.

10.1 Recommendation

As per present NUP 2015 policy, NFL intends to go for implementation of the Phase-1 scheme to reduce the losses as detailed below:

- GTG with net power generation of about 20 MW at site conditions.
- Corresponding HRSG having generation capacity of about 100 MT/hr as fresh steam generation plus 45 MT/hr of steam superheating.
- Retaining operation of one existing coal fired boiler.