PRE-FEASIBILITY REPORT

FOR

PROPOSED AMMONIA & NPK FERTILISER COMPLEX

At

N. Kothapalli & Gachakayalapora Villages,
Uppalaguptam & Katrenikona Mandals
East Godavari District, Andhra Pradesh, INDIA

Project Proponent:

M/s Konaseema Fertilizers & Chemicals Limited
6-2-913/914,2nd Floor, Progressive Towers
Khairatabad, Hyderabad-500004, India
Mail : konaseemafertchem@gmail.com, konaseemafertchem@yahoo.com
CIN No. U10100AP1996PLC024035

Environment Consultant:

Bhagavathi Ana Labs Pvt. Limited
(A Bureau Veritas Group Company)
7-2-C-14, Industrial Estate, Sanathnagar,
Hyderabad 500018

August 2017
EXECUTIVE SUMMARY

For manufacture of Ammonia, which is essential for production Urea, DAP, NPK fertilizers, the feed stock is natural gas. Hindustan LNG company has taken steps to install a project for importation of Liquified Natural Gas (LNG) and re-gasify the LNG to convert it into gas for supply to various consumers. The HLNG Project will be coming up near a port in East Godavari District, which is being set up by Andhra Pradesh State Government. Fertilizer units are the major consumers of natural gas. Konaseema Fertilizers & Chemicals Limited (KFCL) proposes to take advantage of availability of natural gas as feed stock from HLNG and accordingly is taking steps to establish a large fertilizer complex in proximity to the HLNG project. This location will enable KFCL for obtaining natural gas at a cheaper price, as substantial charges involved for transportation of the gas to distant locations can be avoided.

The other major advantage for locating the fertilizer complex near a port is importation of large quantities of raw materials like sulphur, potash and MOP required for manufacture of Sulphuric Acid and Phosphoric Acid and phosphatic fertilizers.
### Salient Features of the Project

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0</strong></td>
<td><strong>Name of the Organization</strong> : Konaseema Fertilizers &amp; Chemicals Ltd., (KFCL) 6-2-913/914, 2nd Floor, Progressive Towers, Khairatabad, Hyderabad</td>
</tr>
<tr>
<td><strong>2.0</strong></td>
<td><strong>Project Location</strong> : 216 to 245, 451 to 675/1, of N.Kottapalli Village, Uppalaguptam Mandalam, Survey No.960 to 970 of Gachakayalapora, House of katrenikona, Katrenikona Mandal,</td>
</tr>
<tr>
<td><strong>3.0</strong></td>
<td><strong>Plant Capacities (MTPD)</strong></td>
</tr>
<tr>
<td></td>
<td>i) Ammonia Plant - 2 x 2500</td>
</tr>
<tr>
<td></td>
<td>ii) Urea Plant - 1 x 4000</td>
</tr>
<tr>
<td></td>
<td>iii) Sulphuric Acid - 4500</td>
</tr>
<tr>
<td></td>
<td>iv) Phosphoric Acid - 1500</td>
</tr>
<tr>
<td></td>
<td>v) DAP - 3000</td>
</tr>
<tr>
<td></td>
<td>vi) NPK - 3000</td>
</tr>
<tr>
<td></td>
<td>vii) CPP - 2 X 150 MW (Captive power plant)</td>
</tr>
<tr>
<td></td>
<td>viii) Utilities and Offsite facilities</td>
</tr>
<tr>
<td><strong>4.0</strong></td>
<td><strong>Plant Stream Days</strong> : 330</td>
</tr>
<tr>
<td><strong>5.0</strong></td>
<td><strong>Annual Production (MMT)</strong></td>
</tr>
<tr>
<td></td>
<td>a) Ammonia : 1.65</td>
</tr>
<tr>
<td></td>
<td>b) Urea : 1.32</td>
</tr>
<tr>
<td></td>
<td>c) Sulphuric Acid : 1.50</td>
</tr>
<tr>
<td></td>
<td>d) Phosphoric Acid : 0.50</td>
</tr>
<tr>
<td></td>
<td>e) DAP : 1.00</td>
</tr>
<tr>
<td></td>
<td>f) NPK : 1.00</td>
</tr>
<tr>
<td><strong>6.0</strong></td>
<td><strong>Annual requirement of Raw Material &amp; Utilities</strong> :</td>
</tr>
<tr>
<td></td>
<td>- Natural Gas (MMSCM) : 5.6</td>
</tr>
<tr>
<td></td>
<td>- Process Water (MGD) : 20</td>
</tr>
<tr>
<td><strong>7.0</strong></td>
<td><strong>Power (MW)</strong> : 2 x 150</td>
</tr>
<tr>
<td><strong>8.0</strong></td>
<td><strong>Project capital Cost (Rs.Crore)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong> : <strong>Rs. 9,000 (Rupees Nine Thousand Crores)</strong></td>
</tr>
</tbody>
</table>

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PROMOTERS:
The Hindustan LNG (HLNG) group, a reputed industrial house of Andhra Pradesh with more than three decades standing, is a professionally managed conglomerate.

Founded in 1996 HLNG was incorporated by MSP Rama Rao. To capture opportunities in power generation, the Company has invested in Konaseema Gas Power Limited (KGPL), the Natural Gas based Combined Cycle Power Plant with a capacity of 445 MW (Phase-I) and has been Supplying power to APTRANSCO. The KGPL is in the process of adding another 820 MW (Phase II).

HLNG Group also invested in Orissa Power Consortium Limited for implementing hydro based power projects. Currently Orissa Power Consortium Limited operates Samal Barrage Hydro Electric Project of 5 x 4 MW (20 MW).

The promoters have examined the following sites for location of the industry.

Site – 1 : Survey No. 451 to 675/1, Extent of 1177.34 acres., of N.Kottapalli Village, Upalaguptam Mandalam, East Godavari Dist. Andhra Pradesh
          Survey No.960 to 970 of extent 87.37 acres, Katrenikona Village (Gachakayalapora), Katrenikona Mandal, East Godavari Dist. Andhra Pradesh.

Site –2 : T.Nakkapalli, Visakhapatnam

Site –3 : Bhavanapadu, Srikakulam
CHAPTER-II

PROJECT DESCRIPTION

Description of the processes for manufacture of Ammonia, Urea, Sulphuric Acid, Phosphoric Acid, DAP and NPK formulations are given below.

Brief Outlines of the Processes

Ammonia Plant

Natural gas is the raw material and its requirement is 5.0 MMSCMD. For manufacture of ammonia, a mixture of pure Hydrogen and Nitrogen in the ratio of 3:1 is needed. Hydrogen is obtained from natural gas, which contains about 90% of methane (CH\textsubscript{4}) and nitrogen is obtained from atmospheric air. The manufacturing process is briefly described below:

Catalytic Desulfurization is employed for removal of any sulfur components in the natural gas. The Natural Gas is mixed with steam in a particular ratio, preheated and sent into the primary reformer.

The primary reformer comprises of a large furnace in which a number of banks of vertical tubes loaded with nickel catalyst are suspended and through which the mixture of steam and natural gas flow through. Temperature is maintained at about 800°C and pressure of 30 kg/cm\textsuperscript{2}. A part of the natural gas is burnt outside the tubes in the furnace at temperature of about 1000°C. The natural gas steam mixture is reformed into raw synthesis gas which comprises of Hydrogen, Carbon monoxide, Carbon dioxide, water vapour, etc. The heat from the flue gases is utilized in preheating some of the feed streams and also generating high pressure steam. Gases from the primary reformer are sent to the secondary reformer.

In the secondary reformer, residual amounts of methane are further converted to hydrogen, etc. using a special catalyst. Compressed air at about 30Kg/cm\textsuperscript{2}
is introduced into the secondary reformer which not only supplies the required quantity of nitrogen but also converts the methane.

The reformed raw gas contains, in addition to the required hydrogen and nitrogen contains CO and CO$_2$ also and these have to be removed to obtain a mixture of pure hydrogen and nitrogen in the ratio of 3:1.

As it is very difficult to remove carbon monoxide, it is converted to carbon dioxide in a catalytic converter which operates at a temperature of 450 to 500°C.

Another catalytic reaction with a different catalyst is subsequently used to fully convert the CO coming out of the high temperature converter. The low temperature converter operates at a temperature of about 350°C.

The raw synthesis gas leaving the CO conversion stage contains Hydrogen, Nitrogen and Carbon dioxide. The CO$_2$ is removed from the gas mixture by absorbing it in a solvent. There are various proprietary solvents, like Mono ethanol amine, Activated potassium carbonate solution, MDEA, etc. The solvent after absorbing the CO$_2$ is separately regenerated for removal of all the CO$_2$ and the regenerated solvent is re circulated for CO$_2$ absorption. CO$_2$ which is stripped out from the solvent is pure and suitable as feed stock for manufacture of Urea. It is accordingly sent to urea plant.

The gases coming out from the CO$_2$ absorption section still contains small percentages of CO$_2$ and some CO also and as these are injurious to ammonia synthesis catalysts, these residual CO$_2$ and CO are converted to methane (CH4) which is inert gas and not harmful to ammonia synthesis. The gas mixture coming out of the methanation step contains only Hydrogen and Nitrogen and in the ratio of 3:1 from which ammonia can be synthesized.

From thermodynamics and equilibrium considerations, ammonia synthesis is carried out at a pressure of about 150 Kg/cm$^2$ in a catalytic reactor. For this purpose the gas mixture is compressed in centrifugal compressor which
operates at a speed of about 15000 rpm, the compressor is driven by a steam pressure of 110Kg/cm\(^2\). The steam is generated in the waste heat boilers in the ammonia plant itself, utilizing heat from reformer flue gases, secondary reformer exit gases and also from gas turbine exhaust hot gases.

The ammonia synthesis reaction is an exothermic and reversible reaction. Ammonia concentration in the reactor exit gases is around 20% and the gases are subjected to deep chilling to a temperature of -33°C, when the ammonia is condensed and separated. The remaining gas mixture of Hydrogen and Nitrogen is again re-circulated into the synthesis loop.

Ammonia storage:- Anhydrous liquid ammonia boils at -33°C. As the temperature increases ammonia vaporizes building up pressure inside the storage vessel. For large capacity ammonia plants, the product ammonia is stored at -33°C in storage tanks which operates at atmospheric pressure. There is provision of 2 x 10,000 MT atmospheric ammonia storage tanks for the proposed project, which is specially designed for the low temperature operations. Automatic instrumentation is adopted for maintaining the important parameters inside the storage tank for safety reasons and double walled, high integrity storage tanks are employed with automatic pressure controls with refrigeration systems, which liquefies ammonia vaporizing in the tanks liquid ammonia is put back into the tank. Special ammonia pumps are used for drawing out ammonia from the tanks for safety reasons.

**Urea Plant**

Urea is the most sought after fertilizer, particularly for paddy cultivation, due to its agronomical advantages and also because of its high concentration of the hydrogen nutrient. On a worldwide basis urea is the most popular solid nitrogen fertilizer.

Urea is manufactured by reacting ammonia with CO\(_2\) under a pressure of about 150 Kg/cm\(^2\). CO\(_2\) required for manufacture of urea is obtained from ammonia.
plant as a byproduct during the purification processes of raw ammonia synthesis gas. Chemical formula of urea is \( \text{NH}_2-\text{CO-NH}_2 \).

The urea manufacturing process comprises of two steps as given below

**Formation of Ammonium Carbonate** - \( 2\text{NH}_3 + \text{NH}_2 \text{CO} \rightarrow \text{NH}_4 \text{CO NH}_2 \)

**Dehydration of Ammonium Carbonate** - \( \text{NH}_2 \text{CO} \text{NH}_4 \rightarrow \text{NH}_2 \text{CO NH}_2 + \text{H}_2\text{O} \)

The first reaction takes place in the liquid phase and to monitor the liquid phase in the reactor a corresponding pressure of about 150 Kg/cm\(^2\) is used.

**Manufacturing Processes**

The process steps are outlined below:

The major steps in the manufacture of urea are:

- Compression of carbon dioxide to 150 atm. Pressure.
- Pumping of liquid ammonia by plunger pumps to 150 atm.
- Admission of Ammonia and Carbon dioxide into a specially designed reactor for synthesis of urea under 150 atm. Pr.
- Stripping of unconverted ammonium carbonate solution into ammonia and carbon dioxide gases.
- Stage wise decomposition of remaining ammonium carbonate into ammonia and carbon dioxide.
- Condensation of ammonia and carbon dioxide gases as ammonium carbonate solution and its recycle into the system.
- Evaporation of urea solution.
- Prilling of concentrated urea melt from top of a tall prilling tower for formation of urea prills and bagging.
Manufacture of Sulphuric Acid

The manufacturing process steps are briefly outlined below:

1. Melting of solid sulphur

   Solid sulphur of high purity (99.5% pure) is charged into a melter, which has steam coils for heating. The sulphur is heated to form liquid.

2. Filtration

   The liquid sulphur is pumped through a filter and the filtered sulphur is stored in a separate compartment of the melter, equipped with steam coils for maintaining the sulphur in liquid state.

3. Combustion of sulphur to form sulphur dioxide

   The molten sulphur is sprayed into a preheated furnace through a specially designed automising burner, along with dried air for combustion. The sulphur forms sulphur dioxide after combustion.

   The equation is \( S + O_2 \rightarrow SO_2 \)

   The gases coming out of the furnace are at a temperature of 950\(^\circ\)C to 100\(^\circ\)C and contain 10.0 to 10.5 % of sulphur dioxide.

4. Conversion of sulphur dioxide to sulphur trioxide \( SO_3 \) (\( SO_2 \))

   Double catalysis – Double contact (DCDA) contact process is used for conversion of \( SO_2 \) to \( SO_3 \), using vanadium pentoxide catalyst.

   The chemical equation is \( SO_2 + \frac{1}{2} O_2 \rightleftharpoons SO_3 \) (Exothermic reaction)

   The catalytic reactor contains four catalyst beds. The gases leaving each bed are cooled in external heat exchangers to increase the rates of forward reactions. The gases leaving the 3rd catalyst bed are admitted into an Inter Absorption Tower (IAT) to absorb the SO3 already formed. The gases leaving the IAT, having very little SO3 content are admitted into the 4th bed to complete the conversion reaction. Removal of SO3 by absorption in the IAT before the 4th catalyst bed facilitates final
conversion based on the reversible equilibrium reaction. Any acid mist carried along with the gases leaving the IAT is removed in efficient candle type demisters.

(5) Final absorption:

SO3 containing gases leaving the last bed of the reactor are admitted into another Absorption Tower (Final Absorption Tower or FAT) for completion of absorption of SO3.

Absorption of SO3 in IAT and FAT is carried out in circulating concentrated sulphuric acid of 98.5% concentration. Water is added into the circulating acid to maintain the acid concentration.

(6) Drying Tower

Process air admitted into the sulphur furnace for production of SO2 must be free from any moisture and to ensure this, the air is passed through a drying tower in which a circulating stream of sulphuric acid if 98.5% concentration removes all the moisture content in the air and the dried air is blown into the sulphur furnace.

(7) Heat Recovery

All the chemical reactions in the process are highly exothermic and all the heat is efficiently recovered in heat exchangers and waste heat boilers.

(8) Tail gases from the final absorption tower

The tail gases from the final absorption tower contain SO2 and SO3 within the permissible statutory limits and are sent out through a stack of about 40 M in height.

A block diagram of the process steps is attached.

**Manufacture of Phosphoric acid**

Raw materials are Rock Phosphate and Sulphuric acid

The main process steps are the following:

1. Phosphate Rock Grinding

   Phosphate Rock is ground to a fineness of 70% less than 150 MM in closed circuit ball mills.
2. Reaction System

- Rock Phosphate has the general chemical formula of Ca10(PO4)6(F,OH)2 for fluorapatite rocks and Ca10(PO4)6-x(F,OH)6-x(CO3)x(F,OH)2+x for sedimentary rocks.

- The rock phosphate is reacted with concentrated sulphuric acid when the tri calcium phosphate in the rock is converted into phosphoric acid and insoluble calcium phosphate.

- Re-circulating dilute phosphoric acid is mixed with concentrated sulphuric acid in a mixer and the mixed acid is admitted into the reactor compartment. Ground rock phosphate is also added into the same compartment.

- The reactor comprises of a large circular rubber lined tank with a separate, agitated reaction sections, with large acid in circulation. A temperature of 800°C is maintained, by passing the slurry through a vacuum flash cooler, in which degassing also takes place.

- Rock phosphate reach with sulphuric acid forming phosphoric and gypsum and hydrogen fluoride. The overall chemical reaction is given below:

\[
Ca_{10}(PO_4)_6 F_2 + H_2 SO_4 + 2OH_2O \rightarrow 6H_3 PO_4 +10(CaSO_4.2H_2O) + 2 HF
\]

- Filtration equipment, a part of the overall reactor separates the acid from insoluble calcium sulphate, which is in its dehydrate form. The filtration is followed by two stages of washing to ensure removal of soluble P2O5. The filtration is connected to a vacuum system for easy filtration.

- The various compartments in the reactor are in movement in sequence to maintain continuous operation of the system. At the end of the washing stage, the cake of calcium sulphate (gypsum) is discharged from the filter by tilting action and the filter is given a thorough washing for clearing any retaining solid particles. Vacuum is released during cake discharge period and air is blown in the reverse direction for discharge any residual solids. Filtration systems employ tilting pans and travelling belts with vacuum arrangements.
3. Phosphoric acid concentration

Forced circulation, single stage evaporators, under vacuum, are used for concentration of the acid to 48% concentration. The evaporators have heaters, flash chambers, condensers, vacuum pumps and circulating pumps. The phosphoric acid is highly corrosive and the heaters are fabricated from graphite and the rest of the equipment are rubber lined.

4. Exhaust gases from the evaporators are scrubbed with water in scrubber, with circulation, recovering fluorine as hydro fluosilicic acid.

A block diagram of the process steps is attached.

**Manufacture of Phosphatic Fertilizers**  
(DAP and NPKs Complex Fertilizers)

1. Di ammonium Phosphate (DAP)

DAP has a high P2O5 content of 46% and nitrogen content of 18% by weight. It is a very popular fertilizer and is used all over the country. The process comprises of the following major steps:

1.1 Pre-Neutralization

Phosphoric acid is partially neutralised with anhydrous ammonia in a pre-neutraliser, maintaining a mole ratio of ammonia to phosphoric acid around 1.4. The reaction is exothermic and the slurry formed contains a mixture of mono and di-ammonium phosphates. A pipe reactor is used for the pre-neutralization.

1.2 Granulation

The partially neutralized slurry in the pipe reactor is admitted into a rotary drum granulator. The pipe reactor partly extends into the granulator, into which the slurry is sprayed. Further quantity of ammonia is added through spargers into the granulator to increase the more ratio of ammonia to phosphoric acid to 2. The heat generated in the pipe reactor and granulator during the neutralization evaporates a large part of the water in the slurry.

Any un-reacted ammonia escaping from the granulator is scrubbed with weak phosphoric acid and water and the solution is recycled into the granulator. Over size and undersized product granules from the product screens are also recycled in to the granulator.

The chemical reactions of neutralization are
NH3 + H3PO4 → NH4H2PO4
NH3 + NH4H2PO4 → (NH4)2HPO4
(DAP)

1.3 Drying, Screening, Cooling and Finishing Operations

The material from the granulator is discharged into a rotary drier, in which it is heated by heated air, reducing the moisture content in the material to less than 1%. The dried product is separated into three fractions on a double deck screen. The oversize material is crushed and mixed with fines and recycled into the granulator, while the proper size material is cooled, coated if necessary and sent to bagging or storage.

1.4 Scrubbing system

Un-reacted ammonia vapours from granulator along with dust carried over, is scrubbed in two stages using dilute phosphoric acid for recovery. Particulates in the gases from dryer and cooler are collected in cyclones and the gases are scrubbed in scrubber. The exhaust gases are sent out through stack.

2.0 NPK Fertilizers

The Phosphoric fertilizers plant is laid out in two streams, with one stream dedicated for production of DAP and the second stream is used for production of NPK complex fertilizers, of popular NPK formulations, with different concentrations of Nitrogen, P2O5 and K2O based on demands from farmers. These fertilizers contain all the three primary plant nutrients.

2.1 The process of manufacture is generally same as for DAP.

To obtain the required NPK formulation, measured amounts of solid urea, potash and filler (sand or dolomite) are also added into the granulator. The slurry from the pipe-reactor (pre-neutraliser) is discharged into the granulator, as in the DAP process and granulated along with the required ammonia, urea, potash and filler, to obtain the desired formulation of NPK. Sulphuric acid is also added into the neutralization system, if required. The further steps are the same as is in the DAP process.

Block diagram for the DAP and NPK is attached.
**Electrical Power Generation:**

The modern fertilizer plants have a very high degree of automatic instrumentation control systems and are extremely sensitive to power interruptions and dips. A reliable source of electrical power is absolutely necessary to ensure smooth, efficient and uninterrupted operation of the plants. The latest plant designs are based on the in-plant, captive power generation, with back-up supply from the State Electricity Boards. The critical and essential machinery are connected to the captive power, while the outside power is used for non-essential drives. In line with this strategy, gas turbine generator sets with associated Heat Recovery Steam Generation (HRSG) to generate HP Steam using heat of exhaust gases from the gas turbine, are also included in the utilities and off site sections. This mode of power and steam generation is more efficient relative to conventional steam turbine generator sets. Two gas turbine sets, each of 150 MW capacity will be installed.

A programmable logic controller (PLC) based supervisory load management system for electrical power supply and distribution will be installed.

Emergency diesel generator set of 2 MW capacity will be provided to meet emergency power requirements for shutting down the plants in case of failure of other system’s power supply.

**Pollution Control Measures**

It will be ensured that necessary in-built pollution abatement systems are provided by the Process Licensors at the design stage and the statutory standards will be incorporated in the contracts with the Process Licensors and Engineering Companies and performance guarantees would be monitored for compliance.
Project Schedule and Implementation

From “0” date (Financial Closure), the project construction and commissioning is expected to be completed in about 40 months.
The site selected and preferred has the following details.

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Details</th>
<th>Preferred site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Address of Site</td>
<td>N. Kothapalli &amp; Gachakayalapora Uppalaguptam &amp; Katrenikona Mandals, East Godavari District Andhra Prasdes, PIN Code 533222 Phone: 98480 50040</td>
</tr>
<tr>
<td>2</td>
<td>Nearest Bus Station</td>
<td>Amalapuram 12 km’s</td>
</tr>
<tr>
<td>3</td>
<td>Nearest Railway Station</td>
<td>Kotipalli, 23 KM’s</td>
</tr>
<tr>
<td>4</td>
<td>Nearest Airport</td>
<td>Rajahmundry, 57 KM’s</td>
</tr>
<tr>
<td>5</td>
<td>Nearest Seaport</td>
<td>Kakinada, 40 Km’s</td>
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<tr>
<td>6</td>
<td>Extent of Land</td>
<td>1264.71 acres</td>
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<tr>
<td>7</td>
<td>Source of Fresh Water</td>
<td>Godavari River</td>
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<tr>
<td>8</td>
<td>Source of Natural Gas Feed Stock</td>
<td>Hindustan LNG Limited</td>
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<tr>
<td>9</td>
<td>Classification of Land</td>
<td>Waste land</td>
</tr>
<tr>
<td>10</td>
<td>Existing Plantation</td>
<td>No Vegetation</td>
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</tbody>
</table>
CHAPTER-V

PLANNING IN BRIEF

The proposed project consists of manufacturing units for Ammonia, Urea, Sulphuric Acid, Phosphoric Acid, DAP and NPK formulations along with the required utilities and offsite facilities. The broad provision of plants and facilities to be made for the proposed project are presented in table.

**Facilities Required**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Plants &amp; Facilities</th>
<th>Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>a) Land</td>
<td>1264.71 acres</td>
</tr>
<tr>
<td></td>
<td>b) Land Development</td>
<td>As per requirement</td>
</tr>
<tr>
<td>2</td>
<td>Natural Gas Transportation and metering</td>
<td>By Pipeline, Metering station provided (Qty about 5.0 MMSCMD)</td>
</tr>
<tr>
<td>3</td>
<td><strong>Product Storage &amp; Handling</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Silos for storage of Rock Phosphate, Sulphur, Muriate of Potash (MOP), Urea and DAP/NPK.</td>
<td>1,000,000 MT of Rock Phosphate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25000 MT of Sulphur</td>
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<tr>
<td></td>
<td>b) Ammonia Storage Tanks</td>
<td>40000MT of MOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20000MT of Urea</td>
</tr>
<tr>
<td></td>
<td>c) Sulphuric Acid Storage Tanks</td>
<td>30000 MT of NPK</td>
</tr>
<tr>
<td></td>
<td>d) Phosphoric Acid Storage Tanks</td>
<td>2*10,000 MT of Ammonia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2*15,000 MT of Sulphuric Acid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2*10,000 MT of Phosphoric Acid</td>
</tr>
</tbody>
</table>
6. **Product Transport System**
   Road, Sea, Coastal & Canal routes

**Utilities and Offsite Facilities**

7. **Cooling Towers**
   Provided

8. **Power Generation & Supply**
   
<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>a. Power Generation</td>
<td>2x150 MW</td>
</tr>
<tr>
<td>b. Substation for receiving Power from State Grid</td>
<td>Facilities Provided</td>
</tr>
<tr>
<td>c. Emergency D.G. Set</td>
<td>(1+1) 2000KVA</td>
</tr>
<tr>
<td>d. Power distribution</td>
<td>As per requirement for each plant and facility.</td>
</tr>
</tbody>
</table>

9. **Steam Generation Facilities**
   
<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>HRSG</td>
<td>2x160 MTPH HP Steam</td>
</tr>
<tr>
<td>Service Boiler</td>
<td>2x160 MTPH HP Steam</td>
</tr>
</tbody>
</table>

10. **Water Supply & Treatment**
    
    |   |   |
    |---|---|
    | a. Pump House | Near the river |
    | b. Raw Water Treatment | Provided |
    | c. D.M.Water Plant | Provided |
    | d. Condensate Polishing Unit | Provided |

11. **Yard Piping**
    Provided

12. **Instrument Air Facilities**
    Provided

13. **Inert Gas Generation**
    Provided

14. **Safety & Fire Fighting System**
    including fire water ring with Hydrant System
    Provided

15. **Effluent Treatment**
    Facilities provided as per requirement

16. **Auxiliary services, workshop equipment, laboratory equipment, weigh bridge, fire engine, continuous monitoring system, NDT**
    Provided
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>General &amp; Welfare Facilities</td>
<td>Provided</td>
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<tr>
<td>18</td>
<td>Transport Facilities</td>
<td>Provided</td>
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<tr>
<td>19</td>
<td>Construction equipment</td>
<td>Provided</td>
</tr>
<tr>
<td>20</td>
<td>Township &amp; Public Building</td>
<td>Provided</td>
</tr>
<tr>
<td>21</td>
<td>Non-Plant Building</td>
<td>Provided</td>
</tr>
</tbody>
</table>

equipment, telephone & telecommunication, Public Address System, etc.,
Pollution Control Measures

Details of effluents:

Ammonia Plant: (Liquid Effluent):

The Ammonia Plant will be based on steam reforming of natural gas. Excess steam is used in the Primary Reformer for process reasons and this excess steam is subsequently condensed and it constitutes a part of the liquid effluent.

Steam is used in the turbines which drive the synthesis gas and refrigeration centrifugal compressors. This condensed steam is the other source of the liquid effluent. The process condensate from the steam reforming section contains impurities like carbon dioxide, ammonia, methanol, etc.

This condensate is heated in a stripper having steam for removal of these impurities and the stripped condensate is utilized back in the plant as boiler feed water (make-up water) after polishing. A part of this condensate is also utilized for cooling inside the jackets of reformed gas transfer pipeline, secondary reformer, etc.

Gaseous Effluents

A flare stack in the plant, about 40 mts in height, is connected with a header which receives vent gas from the plant sections during plant start up and shut down periods, from safety valves, etc.

Flue gases from the primary reformer furnace are cooled in a waste heat boiler for raising steam and are vented at a safe height through a stack at about 120°C.

Anhydrous liquid ammonia product storage tanks:
2 tanks of 10,000 MT capacity each.

These tanks store product ammonia at 33°C.

These tanks are of Double Integrity type (as per API 620 code). The tanks have two walls made of steel suitable for holding low temperature ammonia, with special insulation in between the walls and also on the outside of the outer wall.

Refrigeration compressors system is equipped with automatic instrumentation to compress and liquefy ammonia vapour emanating from the tank due to heat leakage from outside.

Oil Spillages:

Generally, there is no entry of oil into the liquid effluent. However, any oil spillage on the ground getting into effluent is removed by a Diesel Oil separator.

**Urea Plant:**

Liquid effluent, needing treatment, emanating in the urea plant, comprises process water and steam condensate from vacuum systems of carbonate decomposers. These are collected in a waste water tank. Drain water containing ammonia and urea are also sent to this tank.

The liquid from the waste water tank is pumped into a stripping column and heated by steam.

Free ammonia and carbon dioxide in the solution are stripped out. Solution from the middle of the stripping column containing urea and traces of ammonia and carbon dioxide, is pumped into hydrolyser, in which medium pressure steam of 40 Atm. Pr. is used for deep hydrolysis of urea, which is converted back into ammonia and carbon dioxide. This solution is pumped into lower portions of the stripping column, in which low pressure steam strips off the ammonia and carbon dioxide.
The ammonia vapour and carbon dioxide from top of the stripper condensed and used in the process.

Treatment of Occasional waste from the Urea plant

An off spec effluent pond and a guard pond, each about 40,000 m³ capacity would be formed. The off spec pond allows solar evaporation and natural hydrolysis, releasing ammonia and carbon dioxide to the atmosphere at a slow rate. There would be no liquid discharge from this pond.

The guard pond stores effluents which can be used for irrigation or discharged out. This liquid effluent meets the prescribed statutory norms for irrigation purposes.

Off sites and Utilities

Effluents from cooling towers, sand filters, rain regeneration in water treatment unit are directed into the guard pond.

Flare Stack

Hydrogen, methane, carbon monoxide and ammonia released from the ammonia plant are burnt out in the flare stack. Catalytic converter and low Nox burn maintains Nox level.

- Sampling and Monitoring
- Ambient air monitoring
- High volume air sampling unit for carrying out
  a) Suspended particulate matter.
  b) Ambient gas sampling for simultaneous collection of 4 gaseous pollutants with accessories like timer, time totalizer, time reset and rotameter.
c) Gas/liquid chromatography with detector for analysis of hydrocarbons CO, CO₂ in ppm range in stack emission and in ambient air.

d) Wind direction indicators, temperatures, etc.

Stack Emissions

Isokinetic stack monitoring units on stacks of Ammonia and Power generation units.

**Lab Equipment for monitoring effluents**

Noise pollution

Noise level not to exceed 75 dB during daytime and 70 dB during night time at battery limits. 90 dB at 1 M from running equipment. Silencers to be formed wherever necessary.

Liquid effluent:

a) pH : - 6.5 to 8.5

b) BOD for 5 days at 20° C (mg/l) : - 30

c) Oil and grease Hexavalent chromium : - 0.1

d) Total chromium (units) : - 2

e) Colour and odour : - 100

f) Free Ammonia as N : - 5

g) Ammonia calcium nitrate as N : - 50

h) Total nitrogen as N : - 100

i) Zinc as Zn : - 5

j) Other metals as prescribed
Gaseous emissions from stacks:

- Hydrocarbons : - 15ppm
- Sox : - 40 ppm
- Urea dust : - 150 mg/Nm3

Ground level emissions:

- Ammonia : - 850 micro gms/Nm
- Hydrocarbon : - 160 micro gms/Nm
- Sox : - 80
- Nox : - 80

**Sulphuric Acid** :

1. The catalysts in the first bed and the last bed will be doped with Ceasium, which will enable higher efficiencies of conversion and also helps in reduction of sulphur dioxide in the stack gases.

2. Sophisticated instrumentation will be provided for automatic controls of the processed parameters.

3. During start up periods and emergency situations, escape of larger quantities of SO_2/SO_3 into the atmosphere is possible. To avoid environmental pollution on this account, an efficient two-stage scrubber system with alkali liquid circulation after the Final Absorption Tower will be provided.

4. (i) Concentration of Sulphur dioxide in the stack gases will not exceed - 950 mg/NM³.
   (ii) Acid mist / Sulphur dioxide - 50 mg/NM³.

**Phosphoric Acid** :

1. Gases from flash cooler connected to phosphoric acid reactor and from phosphoric acid concentration evaporators will be scrubbed with water in a scrubber. The water is re-circulated in the scrubber with the acid concentration builds upto 18% to 20%. This acid, known as Hydro Fluo Silicic Acid is a valuable bi-product. This acid is used as a flux in electrolysis cells in aluminum metal refineries.
2. Gypsum, which is obtained as a precipitate in the filtration of Phosphoric Acid, will be stored outside in dry form. There is a good market demand for gypsum in cement industries, road construction, etc.

DAP & NPK:

1. Gases from the reaction section will be scrubbed in a scrubber with dilute phosphoric acid and sent out as tail gases.

2. Gases coming from dryer, cooler, screens, etc. will be directed into cyclone separators to arrest particulate matter and then scrubbed with dilute phosphoric acid in scrubbers.

3. i. Fluoride content in the effluent gases will not exceed 25 mg/NM$^3$  
   ii. Particulate matter in the gases will not exceed 150 mg/NM$^3$.

4. Liquid Effluents:

   i. pH - 7 to 8
   ii. Phosphate as P - 5 mg/litre
   iii. Fluoride as F - 10 mg/litre
   iv. Ammoniacal Nitrogen - 50 mg/litre
   v. Free Ammoniacal Nitrogen - 4 mg/litre
CHAPTER-VII

REHABILITATION AND RESETTLEMENT

The preferred site N. Kothapalli & Gachakayalapora Villages Uppalaguptam & Katrenikona Mandals, East Godavari district, Andhra Pradesh does not include any habitation and as such there is no rehabilitation and resettlement of project affected families.
CHAPTER – VIII

PROJECT SCHEDULE AND COST ESTIMATES

From the effective date of commencement of the project, the project construction and commissioning is expected to be completed in about 40 months with a Project Cost of Rs. 9000 Crores

PROJECT IMPLEMENTATION PLAN & TIME SCHEDULE

A number of studies and approvals from various agencies/ institutions/ authorities will be required before embarking on physical implementation of the project. PDIL who has prepared the techno economic feasibility report has listed the following required activities.

- Submission of TEFR to Department of Fertilizers, GoI, for getting in principle approval.
- Acquiring Land with due concurrence with state authorities.
- Negotiations for gas supply and price commitment from gas supplier/marketer.
- Preparation of Risk Analysis Study, Environment Impact Assessment (EIA) study and clearance by State and Central Pollution Control Boards.
- Soil investigation work for ascertaining soil characteristics of the area identified for setting of the main plants and offsite facilities.
- Discussion and agreement with Andhra Pradesh Power Transmission Authorities regarding Grid Power supply for the project.
- Appointment of Prime Engineering Consultant (PEC) to assist the Owners in pre-project and project activities, ITB, selection of process licensors, engineering contractors and site supervision and monitoring.
- Selection of Process Licensors
• Preparation of DPR.
• Obtaining final approval from GoI.
• Obtaining financial clearance and commitment from financial institutions and creditors.
• Finalization of contracts with foreign collaborators for grant of licenses, basic engineering package, assistance in supervision and other services for ammonia/urea plants.
• Firming up the capacity of off-sites facilities and project scope.
• Finalization of plant layout.
• Route survey and firming up of arrangements for transportation of ODC equipment.
• Preliminary division list for indigenous and imported equipment to enable in locating the origin of imported equipment, thereby identifying the probable sources of foreign exchange.
• Drawing up of a project implementation plan on the basis of a network of activities.
• Organization of owner’s Project Management Team.
• Apart from the above activities, some more activities may also be encountered during the pre-project stages which have to be addressed as per requirement. Many of the above activities have to be carried out simultaneously to save time. The pre project activities may take around one year based on the complexity of the issues.
Manner of Implementation

The implementation of the project will be carried out on partial LSTK Basis.

- Under the proposed methodology, Ammonia and Urea Plants, inside their battery limits, are offered to LSTK contractor, who is experienced and reputed for such work. Technomont, Teenip, Linde, etc., carry out such assignments a Project Management Consultant (PMC) will be appointed for execution of all other jobs relating to offsite facilities, etc.

- The Project Management Consultant is entrusted with the following responsibilities:

  (i) Preparation of all technical specifications for individual package units, issuing inquiries, evaluation of offers, recommendations to VFCL for selection, etc. The selected contractors for the packages will complete the jobs on fixed lump-sum basis.

  (ii) Co-ordination between all the contractors, working at the site. Residual engineering work

  (iii) Site surveys and development

  (iv) Supervision, monitoring, review of progress, reporting, etc.

  (v) Initially, PMC will help KFCL in selection of Process Technology Licensors, Construction Contractor for Ammonia and Urea Plants, etc.

  (vi) Time schedule for completion of project construction is 3 years 6 months from Zero date.
# PROJECT COST SUMMARY

<table>
<thead>
<tr>
<th>Category</th>
<th>Total (Rs. In Cr.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Land and site development</td>
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</tr>
<tr>
<td>a) Land</td>
<td>200</td>
</tr>
<tr>
<td>b) Site development expenses</td>
<td>100</td>
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<tr>
<td>2. Civil Works</td>
<td>600</td>
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<td>3. Plant &amp; Machinery</td>
<td>5200</td>
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<tr>
<td>Ammonia Plant</td>
<td>2200</td>
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<tr>
<td>Urea Plant</td>
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</tr>
<tr>
<td>Phosphoric acid</td>
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<tr>
<td>Sulphuric Acid</td>
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<tr>
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<td>Spares</td>
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<td>4. Project Management Charges</td>
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<td>5. Project Engineering Fees</td>
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<td>6. Commissioning Charges</td>
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<td>7. Contingency</td>
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<tr>
<td>8. Working Capital Margin</td>
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<td>9. Interest During Construction</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>9000</strong></td>
</tr>
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</table>
Project Sensitivity Map

Legend
- Project Site
- 10km Radius

Reference: Google Maps

<table>
<thead>
<tr>
<th>S/no</th>
<th>Sensitive Area</th>
<th>Distance from Site</th>
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<tbody>
<tr>
<td>1</td>
<td>Mangrove Forest</td>
<td>5km - SE</td>
</tr>
<tr>
<td>2</td>
<td>Gawain River</td>
<td>10km - SE</td>
</tr>
</tbody>
</table>

Prepared by: M. Chinthanayal
Date: 11-06-07
Verified by: D.T.