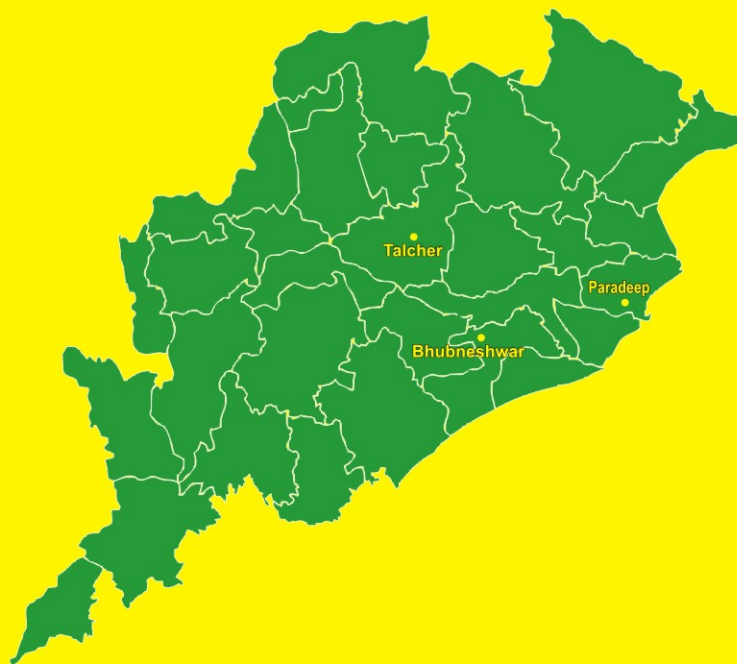




Talcher Fertilizers Limited Odisha



Coal Based Ammonia/Urea Plant
Utilizing Clean Coal Technology



A Joint Venture of

-  GAIL (India) Ltd. (GAIL)
-  Coal India Ltd. (CIL)
-  Rashtriya Chemicals & Fertilizers Ltd. (RCF)
-  Fertilizer Corporation of India Ltd. (FCIL)

Capacity :

Ammonia : 2200 MTPD
Urea : 3850 MTPD
(1.28 MMT Per Year)



ABOUT FCI & ITS REVIVAL

In 1971, the Fertilizer Corporation of India Ltd. (FCIL), set up Talcher Unit over an area of 902 acres in the district of Angul, Odisha which is located about 126 km away from Bhubaneswar to produce urea using coal as feed stock. Licensor for the Coal gasification was M/s Krupp Koppers, Germany and for Ammonia and Urea units Ammonia synthesis, M/s Tecnimont, Italy.

Commercial Production of Ammonia and Urea commenced on 01.11.1980 with Ammonia and Urea production capacity of 900 and 1500 Tons per day respectively. However due to frequent power restriction, obsolete and mismatch of technology and precarious steam balance the plant could not be sustained. The Board for Industrial and Financial Reconstruction (BIFR) declared the FCIL sick in 1992 and in 2002 Government of India initiated actions to close the company.

Due to shortage of domestic Urea and availability of large land banks, infrastructure and tied-up rail, water & electricity in the units of FCIL, GOI in the year 2007 decided to revive all units of FCIL. Government of India approved Policy for new investments in the Urea Sector in September 2008 and constituted Empowered Committee of Secretaries (ECOS) in October 2008 with the mandate to evaluate all options of revival of closed units of FCIL/HFCL and to make suitable recommendations for consideration of the Government. In August, 2011, the Cabinet Committee on Economic Affairs (CCEA) had approved the Draft Rehabilitation Scheme (DRS) for revival of all the Units of FCIL and HFCL. DRS envisaged revival of Talcher Unit by the consortium of M/s. Rashtriya Chemical & Fertilizers Limited (RCF), M/s Coal India Limited (CIL) and M/s GAIL (India) Ltd. (GAIL).

ABOUT TALCHER FERTILIZERS LTD. (TFL)

The "Talcher Fertilizers Limited" (TFL), a consortium of four state-run companies GAIL, CIL, RCF and FCIL was established in December 2014 to revive the Talcher unit. Joint Venture Company was incorporated on 27.10.2015

with contributing equity of GAIL, CIL and RCF being 29.67% each while FCIL retaining 10.99% equity. Projects & Development India Limited (PDIL) is the PMC for the project.

COAL INDIA LIMITED

Coal India limited (CIL), is a 'Maharatna' Company under Ministry of Coal. It was formed in November, 1975 as a holding company to manage the coal mines nationalised in between 1971 to 1973, with 78.85% of its equity, owned by Government of India and is world's largest hard coal producing company. It has core competence across the entire gamut of the coal business value chain. The business domain includes exploration, planning and design of mines, coal mining operations, coal beneficiation and marketing. CIL meets 42% of the nation's primary energy demand and caters 81% of the nation's coal requirement. The net worth of CIL as of March' 16 is ₹ 33,879.00 crore.

GAIL (INDIA) LIMITED

GAIL (India) Ltd., a 'Maharatna' Company is a Central Government undertaking under Ministry of Petroleum & Natural Gas (MoP&NG). GAIL was incorporated in August 1984. GAIL has built a large network of Natural Gas pipelines covering over 11,000 km; two LPG Pipelines covering more than 2,000 km; six Gas Processing plants for production of LPG and other liquid hydrocarbons, with a combined production capacity of 1.39 MMTPA, and a gas based integrated petrochemical plant of 810,000 TPA. GAIL is laying the 2610 km long Jagdishpur-Haldia-Bokaro-Dhamra Pipeline Project for developing Natural Gas Infrastructure in the States of Uttar Pradesh, Bihar, Odisha and West Bengal as a part of "PRADHAN MANTRI URJA GANGA PIPELINE PROJECT". The net worth of GAIL as of March' 16 is ₹ 30,584.87 crore.





RASHTRIYA CHEMICALS & FERTILIZERS LIMITED

Rashtriya Chemicals & Fertilizers Limited (RCF), is a 'Mini-Ratna' Public Sector Undertaking under the administrative control of Ministry of Chemicals and Fertilizers. RCF is engaged in manufacture and marketing of fertilizers and industrial chemicals. The company was carved out of the erstwhile Fertilizer Corporation of India Ltd. at the time of re-organisation in the year 1978. Presently, RCF is having two production facilities, one at Trombay in Mumbai and the other at Thal in Alibag city which is 100 km from Mumbai. RCF manufactures Ammonia, Urea and Chemicals like Methanol, Nitric Acid, Sulphuric Acid, Phosphoric Acid and Nitro Phosphate fertilizers of different composition. The net worth of RCF as of March' 16 is ₹ 2,829.12 crore.

FERTILIZER CORPORATION OF INDIA LIMITED

Fertilizer Corporation of India Ltd. (FCIL) is a Central Government undertaking under the administrative control of Ministry of Chemicals and Fertilizers. Due to non-viability of the operation of fertilizer unit, Government of India decided to close the fertilizer plants. The net worth of the company has become negative and the corporation was referred to BIFR in April 1992 under the sick Industrial Companies (Special provision under Act 1985).

MANAGEMENT OF TFL

Management of Company is being managed by the Board of professionally qualified personnel. The Board consists of seven (7) members, two (2) each from CIL, GAIL and RCF, one from FCIL. Managing Director (MD) / Chief Executive Officer (CEO) of the company is Shri J. S. Saini from GAIL and Chairman is from RCF.

PROJECT CONFIGURATION

Project Description :	Coal Gasification based Ammonia Urea Complex
Capacity :	Ammonia : 2200 TPD Urea : 3850 TPD
Project Cost :	₹ 9800 crores

The project broadly consists of Coal Gasification Unit, Ammonia Plant with design capacity of 2200MTD and Urea Plant with design capacity of 3850 MTPD along with associated facilities, including coal based captive power plant. The project will have an output of 1.28 MMTPA of 'Neem' coated prilled urea using coal as feedstock. The total estimated cost for setting up New Coal based Ammonia-Urea Complex at the existing plant site of FCIL is approx. 9800 Crore which will be financed through equity from shareholders and debt from financial institution in Debt: Equity ratio of 70:30. The project is expected to be mechanically completed by 2nd Quarter of calendar year 2021. The unit will utilize about 4 MMTPA coal from Talcher Mines. There is also provision of blending upto 25% Pet-coke to handle high ash content in coal. The pet-coke requirement is about 0.32 MMTPA and will be largely made available from Paradeep Refinery of Indian Oil Corporation Ltd. (IOCL).

PROJECT CONFIGURATION

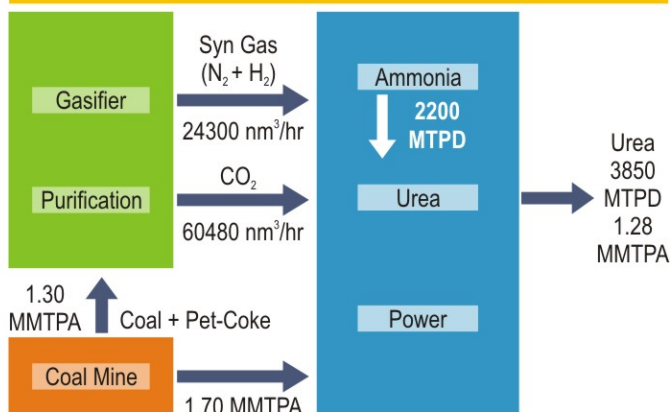


Fig 1 .Current Project Configuration

UREA SCENARIO IN INDIA

Urea is pre-dominantly used in our country as fertilizer. As per the demand estimates by Fertilizer Association of India the projected demand supply gap for Urea in India is 11 MMTPA. At present, all the ammonia plants in India are based on petroleum feedstock/ natural gas. In India two coal based fertilizer plant of FCIL's in Talcher, Odisha and Ramagundam, Telangana were operational during 1980 to 1990. The majority of urea plants in India are currently using natural gas both as a feedstock and fuel. In view of high deficit in the present supply of urea in the country which is likely to further increase substantially in future, Government of India has planned to utilise the huge reserve of coal in the country for manufacture of urea

using the suitable coal gasification technology. India's annual requirement of urea is about 32 Million Tonnes. In the fiscal year 2016-17, domestic production was 24.5 MMT and rest was imported. The revival of fertilizer units will boost productivity of agriculture, which account for about 15% of India's US\$ 2.11 trillion economy and employ three-fifths of its 1.30 billion people. The revival of five fertilizer plants will add 7.50 MMTPA of urea. In fiscal year 2015-16, the production of urea in India was 24.5 MMT and the import was about 8.5 MMT. As indicated by FAO, UN in calendar year 2017, the world-wide demand of urea is 158 MMT and the supply of urea will be about 172 MMT.

COAL USAGE IN POWER PLANTS AND ITS ENVIRONMENTAL IMPACT

(a) Global Scenario

Approx. 40% of current global electricity is produced by Coal fired power plants. Power generation is responsible for 42.5% of global CO₂ emission and 73% of this is attributed to Coal fired power plants which emit about 950 gm of CO₂ per kWh. One ton of Coal combustion per day generates 0.9 ton of CO₂. Globally, 2 G. tons per annum of CO₂ is emitted by coal based plants along with NO_x, SO_x and fly ash which are major players in acid rain and ground level Ozone (smog). Further, Coal based power plants are single largest emitter of Mercury emissions, accounting for over 50% of the mercury pollution caused by humans. Coal burning power plants release fine particles of Sulphates, Nitrates, Sodium Chloride, Carbon and mineral dust. Additionally, Coal burning power plants continue to speed up global warming by filling atmosphere with vast amounts of CO₂.

(b) Indian Scenario

India is the world's 3rd largest Coal producing country and 4th largest importer of Coal. It is expected that India will increase its Coal production to 1 billion ton by 2020. In the year 2017, 60% of total electricity generated in India was Coal fired. Most of the coal based plants are direct firing/burning and emit 50% to 120% more CO₂ per kW of power generated. Among approximately 200 Coal based power plants of different size and capacity, about 40% are older than 20 years and cause more pollution. Most of the installed Coal based power plants are up to 500 MW and are based on pulverized fire units which are cause of pollution. A few circulating fluidized bed boilers using high Sulphur Lignite are also being operated which emit SO_x into atmosphere. So there is enormous impact on environment due to emission of greenhouse gases and other pollutants from Coal based power plants.



PARIS AGREEMENT, APRIL 2016, COMMITMENTS AND CLEAN COAL TECHNOLOGY IN INDIA

As India aims to increase its power generation capacity in the coming years, a significant portion of increased capacity shall come from Coal itself. However, India has been focusing on clean Coal technologies in line with commitments related to Climate Change. Under the Paris Climate Agreement, India has pledged to focus on clean Coal technologies such as Coal Gasification which are more environments friendly. Under the Paris Agreement

ratified on 22nd April, 2016, India has committed to reduce greenhouse gases to 4.1% from current levels of approx. 6.0% for holding increase of global temperature below 2°C (5561 G. tons reduction in CO₂ by 2030). From 1880 to 2016, world has experienced 1.3°C rise in temperature hence strict measures are required to arrest further increase in temperature. Accordingly, clean coal technologies are being encouraged by India.

TALCHER FERTILIZERS LIMITED- A CLEAL COAL TECHNOLOGY

Talcher Fertilizers Ltd. (TFL) is using Coal Gasification for production of Ammonia/Urea. Pollutants like Carbon Dioxide are recycled for production of Urea and other

by-products like Sulphur are recovered and are marketed. Further, Ash containing harmful heavy metals is converted to inert slag which is essentially non - hazardous.

PROCESS DEPLOYED IN TALCHER FERTILIZER LIMITED

Conversion of Coal to Ammonia/Urea using gasification process involves following Unit Operations:

i. Coal preparation

Coal is milled to fine particles and dried to improve conversion efficiency before being fed into the gasifier.

ii. Air Separation

The air separation unit concentrates oxygen from air to help facilitate the reaction in the gasifier. The nitrogen is used as an inert carrier gas and for ammonia synthesis.

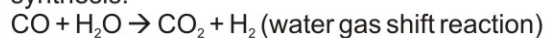
iii. Gasification

Gasification converts coal to syngas at a high efficiency by partial oxidation of coal with oxygen to mainly carbon monoxide and hydrogen. The coal ash is melted and recovered as a marketable stable glassy slag.



iv. Shift

In the water gas shift reaction, carbon monoxide in the syngas reacts with water to form carbon dioxide and hydrogen. High purity hydrogen is required for ammonia synthesis.



v. Gas Clean – up (CO₂ and Sulphur removal)

The raw syngas contains traces of impurities like trace minerals, particulates and Sulphur as well as carbon dioxide that are removed in the cleanup section. Sulphur can be sold and Carbon Dioxide is used in Urea production.

vi. Ammonia synthesis

In the ammonia synthesis, hydrogen reacts in the presence of a catalyst with nitrogen from the air separation unit to form ammonia.

vii. Urea production

The ammonia is reacted with the carbon dioxide which was removed from the syngas in the gas cleanup section to produce liquid urea. The urea solution is then dried and granulated, an easily transported and user friendly form of nitrogen.



BLOCK DIAGRAM OF COAL BASED AMMONIA UREA COMPLEX

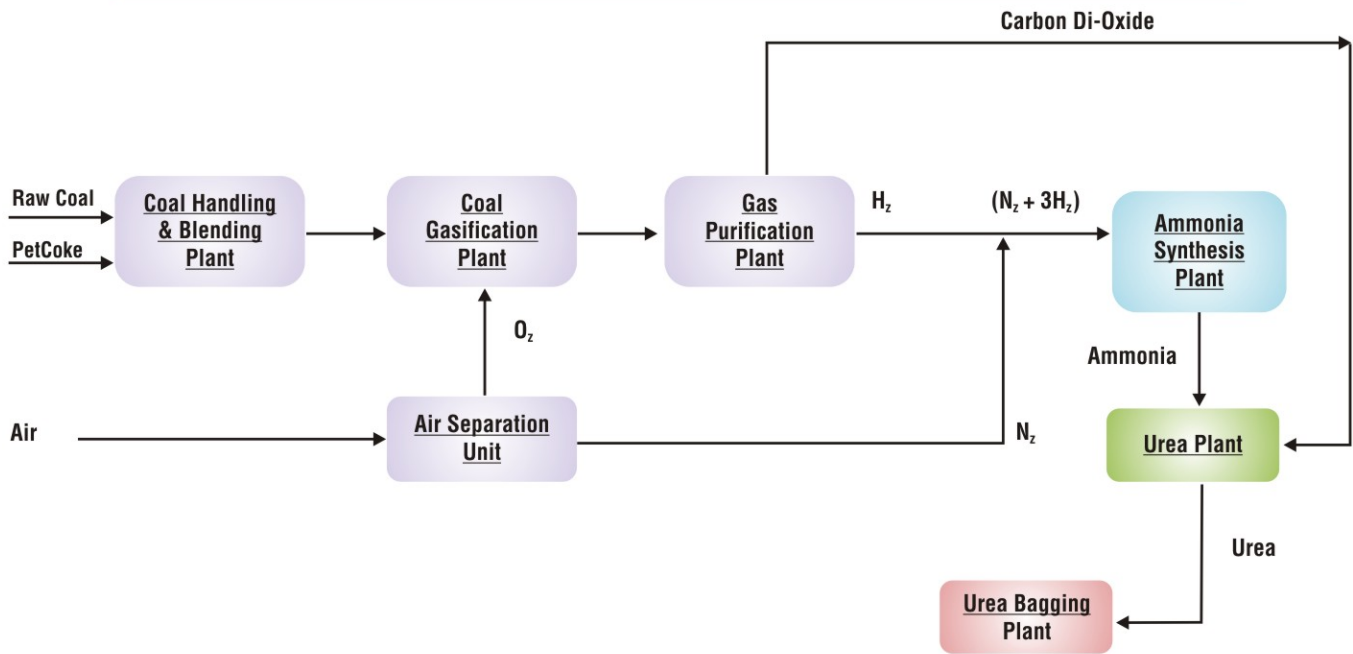


Fig 2. Block Diagram of coal based ammonia urea complex

ENVIRONMENTAL BENEFITS OF TALCHER COAL GASIFICATION

Talcher gasification process provides following benefits w.r.t environment:

- i. Carbon Di-Oxide (CO₂): Commonly called greenhouse gas which is emitted from coal is captured in closed loop process and recycled for production of Urea.
- ii. Sulphur: This component of Coal (up to 0.8%) and Pet Coke (up to 8%) is separated as it is a saleable by-product.
- iii. Mercury, Arsenic and Particulate Matter (PM): Ash is formed in gasification from these inorganic impurities in coal and is largely converted to vitreous slag, which is essentially non-hazardous, inert and only half the volume of fly ash. This is a saleable commodity and is used in road surface, cement additives and sandblasting grit.
- iv. NO_x refers to Nitric Oxide and Nitrogen Dioxide. Coal usually contains 0.5% to 3% N₂ on dry weight basis, most of which converts to harmless Nitrogen gas.
- v. Coal transportation from mine to plant (approx. distance of 10 km) is via an enclosed conveyor belt as a result, there will be negligible free particle pollution en-route to plant.

It is evident from above, that the gasification process which is adopted at Talcher unit is a Clean Coal Technology emitting negligible CO₂, SO_x, NO_x and free particle emissions as compared to directly coal fired processes.





COAL SOURCING

The coal which will be the feedstock for the fertilizer plant will be derived from its coal block "North of Arkhapaal" in Talcher, Odisha in which 50% of the block was allocated on 09.11.2016 by the Ministry of Coal for the project. The area is partially explored and thus the coal resources are in indicated category. The indicated coal resource of the northern part of "North Arkhapaal" is of 920 MMT and the area of the block is 11.62 km². The coal is of non-coking type with grade varying between G-9 to G-14. Detailed

exploration of the coal block is being taken up to in conjunction with CMPDI to ascertain the recoverable reserve. It is envisaged that the coal block will come into production in six year time. However till the commencement of production from the coal block, the feed will be derived from Bhubaneshwari Coal Mine of CIL in Talcher for a period of 4 years under agreement of bridge linkage.

SOCIO-ECONOMIC IMPACT

The revival of fertilizer complex will produce tangible beneficial impacts on the life quality and socio-economic status of the area. The revival of closed coal based fertilizer unit in Talcher, Odisha will trigger a great economic boom in eastern part of the country as it will generate opportunities in the form of direct and indirect employment in the region. The estimate is as follows:

During Construction period of four years	: 10,000 Max.
Direct in Plant	: 550
Indirect in Plant	: 2500
Direct in Coal Mine	: 60
Indirect in Coal Mine	: 400
In the surrounding area for miscellaneous jobs	: 1000

The production of urea from the plant will be available to the nearby farmers, increasing their crop yield. The

by-products of the gasification unit like sulphur and slag will be used in many industries and in construction units. Growth of such industries will also promote employments to the local people.

The project envisages addressing the wider goal of Socio Economic development through a social investment strategy for the communities around the proposed project. By investing in social projects in the neighbouring community, it seeks to increase the benefits to the local population and contribute towards meeting community's expectation of benefits from the project. The project will contribute towards human resource development, direct & indirect employment to local people, increase in employment opportunities and reduction in migrants to outside for employment and increase in consumer prices of indigenous produce and services, land prices, house rent rates and labour prices.



A revolution in Clean Coal Technology



Talcher Fertilizers Limited



ADMAN

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