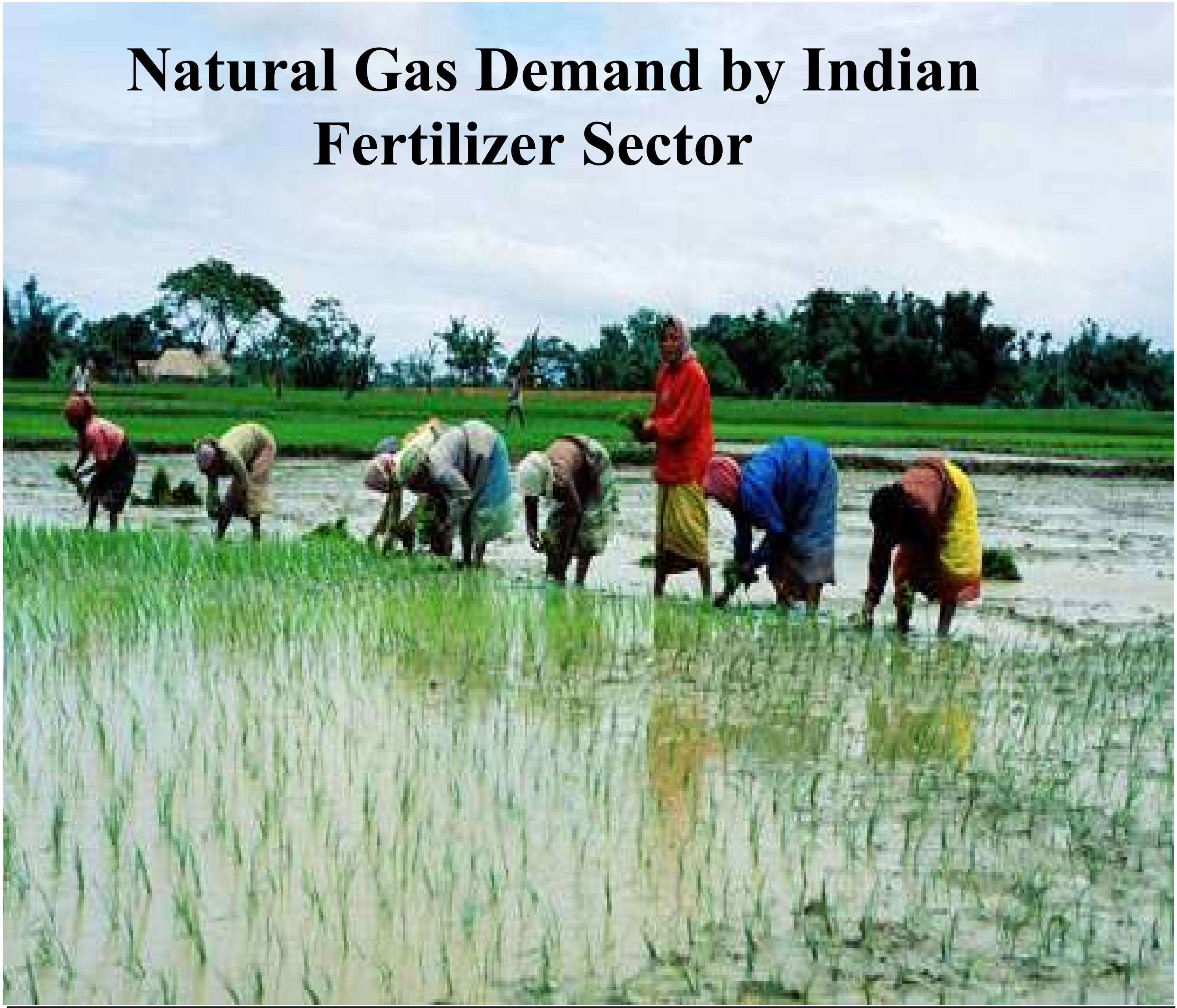
Natural Gas Demand by Indian Fertilizer Sector



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Executive Summary

Introduction

Food grain production in India has stagnated at around 200 million tons (MT) in the last decade spanning 1996-97 till 2005-06. The net sown area is also stagnant at around 140 million hectares for the last four decades. The government has targeted 4% growth rate in agriculture sector and this can be achieved through scientific application of modern and continuously developing technology. The farm inputs such as fertilizers should be available to the farmers on time, in required quantity and at affordable price. Feedstock for the fertilizer industry should be available in adequate quantity to facilitate operation of the industry at its full capacity. Urea is one of the farms input used by Indian farmer to enhance their farm productivity.

The feedstocks used for manufacturing urea are NG, naphtha and LSHS/FO. The nitrogenous fertilizer industry prefer NG as a feedstock as it provides fertilizer at least cost. The manufacturing process designed on NG feedstock consumes less energy and has higher product yield vis-a-vis other feedstock.

The price of NG is implicitly subsidized for anchor customers viz. fertilizer industry, and the power sector. They are charged at a rate determined under Administered Price Mechanism (APM). Currently NG is supplied to fertilizer industry at US$1.98/ MMBTU. In the global market the gas price is linked with the price of crude (which is very volatile), and varies from $4.00 to $12.00/ MMBTU. The sources of APM price gas supplies are from existing gas wells of ONGC and OIL whose volume is declining. Fertilizer industry would have to rely more on market gas. Ministry of Petroleum and NG (MOP&NG) has constituted a regulatory body to monitor the oil and NG market and safeguard the two sectors from volatile crude market.

The fertilizer subsidy is growing and reached Rs161.27 billion in 2005, which was 0.5% of GDP at market price. The growing burden of subsidy raises a number of questions.

Objectives of the study and questions posed

The current study explores the impact of a range of policy reforms on gas demand by the fertilizer industry and analyzes the political economy of such reforms.

- How will reform of retail prices for farmers' impact demand for fertilizers and subsequent fuel choices?
- Will easing of import restrictions drive down demand for NG?
- What would be the impact of APM reforms for pricing of NG on the fertilizer industry?
- Will the new plants be guaranteed subsidized gas supplies and will the policy of subsidizing gas for existing plants remain in place?
- Will Greenfield gas based plants compete against existing plants or only new capacity expansion?
- Will equity share in fertilizer production in which Indian fertilizer producers engage in joint ventures in gas-rich countries be viewed as the equivalent of domestic production, imports from the world market, or some middle ground between the two?
- How will the NPS introduced by the government in 2003 and subsequent reforms impact fuel switching in existing plant using naphtha and fuel oil?

Methodology

This study projects the development in this sector in next two decades, while considering identifiable constraints envisaged in these domains, expected business environment of operation of the chain and challenges expected of political economy. Similar to each business environment, there are many stakeholders associated, who have considerable stakes in efficient working of the chain. The identified stakeholders are farmers, fertilizer manufacturer, fertilizer importers, Government, NG producers, gas transporters, general public, and taxpayers. The concerns and interests of each stakeholder are different. . The study does not attempt to resolve any conflict of interest, but to evaluate the parameters of concern, and how they shape-up in next two decades. Government regulates the fertilizer industry and the market, and the associated NG market. Each of these sectors has dominant public sector units as major players. The government sustains these with explicit and implicit subsidy. The subsidy burden is a prime issue with government, and the study attempts to assess the nature of the burden.

A literature survey was done to analyze the (a) projections made by different researchers and the technique and parameters used for their study. (b) The relevant data were compiled from (i) Fertilizer Statistics 2005-06, published by The Fertilizer Association of India, New Delhi and (ii) Economic Survey. The report of the Working Group on Fertilizer, Planning Commission, provides an idea of the constraints on the growth of agriculture. Information was collected on the recommended fertilizer mix for each region of India. The existing irrigation facilities, irrigation development plans, progress in land use, and cropping pattern etc were reviewed. The collected data were analyzed to understand farmers' behavior and its correlation with critical dependent parameters e.g. earning potential. The prime factors identified for computation of urea demand projection, for next two decades are real price of urea for the farmers, rainfall index, gross sown area, and gross irrigated area. An OLS (Ordinary Least Square) log-log econometric model is used to project N nutrient demand under various price scenarios.

The range of future gas requirements to meet projected fertilizer domestic production target, impact of subsidy etc. was assessed from scenario analysis. Scenarios are constructed considering the following likely reforms:

(a) Three different scenarios for gas prices are considered depending upon availability of gas. These three scenarios are summarized as full availability of APM gas, partial availability of APM gas i.e. 32% of total gas demand through APM gas and rest will be market priced gas and no APM gas – gas would be available at $5.15/MMBTU to industry.

(b) The farm gate prices of urea are examined over 20 years for 3 scenarios: current price at constant, gradual increase on subsidized price and international price. In NPS reform, all units using naphtha and fuel oil as feedstock are expected to convert to gas based units, and the price of urea is determined in open market.

(c) Allocation of 100 Kg to all farmers is assumed at subsidized price irrespective of their land holding and rest would be sold at competitive market determined price.

(d) Two scenarios of self-sufficiency are considered in which 95% or 70% of the projected demand would be met through domestic production.

A set of storylines is developed from scenario analysis to project fertilizer sector for next two decades.

Findings and Recommendations

Though agriculture's share in India's GDP is constantly decreasing with passing years, agriculture still provides employment to a sizeable section of work force. Increasing population and consequent food demand has made it inevitable for the government to have a viable agriculture policy to ensure food security. Agricultural land is a limited resource, which cannot be increased much. Therefore, intensive farming is an option to increase food production by increasing per acreage yield. Production per acre can be increased with high dose of fertilizer application along with improved irrigation facility. We assume the quantities rose as follows:

- IRADe analysis of urea demand for the previous twenty-five years indicated that the variable is sensitive to real price of urea, level of irrigation, and rainfall index. For Rs4830/ton urea farm gate price the projected urea and natural gas demand are 52 MT and 30 BCM respectively in the year 2025. However, when farm gate urea price is effectively increased by 1.97% every year, urea and natural gas demand decrease to 49 MT and 28 BCM. At Rs11250/ton of urea farm gate price, the demand reduces to 40MT and 23BCM for urea and NG respectively for year 2025.

- NG is recognized as the most efficient fuel among the available fuel choices. It is also seen that the production cost of urea from gas based plant is lower than all other feedstock. As a cost cutting exercise fuel switch to NG will be an obvious choice for the industry. Once the transition from other feedstocks takes place by 2010, the demand of natural gas will be directly proportional to indigenous production requirement. Easing of import restrictions will result in reduction in domestic urea production. Natural gas demand falls from 30 BCM to 22 BCM in year 2025, when self-sufficiency level is reduced from 95% to 70%.

- It is observed the price of NG has significant impact on estimated cost of production of urea per metric ton. Reduction in the availability of APM gas calls for a tremendous rise in subsidy for industry. It is estimated that if the entire gas requirement is met through APM gas with 95% self-sufficiency and constant farm gate price of urea, the subsidy requirement is of Rs. 179 billion However, in the event of complete discontinuation of APM gas supply (i.e. only market priced NG) to the industry, the subsidy rises Rs.339 billion.

- The government can ensure APM priced gas from the existing operational gas fields but their volume is declining. The APM gas is shared with the power sector. It will not be feasible for the government to sustain total NG supply to fertilizer sector at APM prices. In the study it is observed that the estimated APM gas available for fertilizer sector declines from estimated 7.82 BCM in 2005 to 2.56 BCM in 2025.

- Different scenarios of green field plants and the existing plants are evaluated in terms of cost parity. It was evident that the retention prices of urea manufactured from the green field plants were higher due to capital related charges for the same price of natural gas. The Industry has to devise ways to decrease the retention price in association with the Government. The retention price is higher for higher price of natural gas. To promote investment in future for green field plants, they can be provided with APM gas or equivalent subsidy for first few years to enable them to compete with existing plants getting APM gas.

- The projected cost of production of urea from domestic green-field plants using market priced gas is higher than the current import parity price. The issue of sourcing of urea needs should be analyzed within the constraint of price, and scheduling of supply. The international urea market is highly sensitive to the demand and supply ratio. In view of new investment in urea industry in gas rich countries, it is projected that there will be surplus in urea availability. The Government in association of industry should plan for long-term urea import at an affordable cost, and minimize procurement from spot market.

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- The Government has notified New Pricing Scheme (NPS) for urea in the year 2003, after examining the recommendation of Expenditure Reform Commission and Expert committee set up by Department of Fertilizer. The policy is the mandate of Government of India to all fertilizer units manufacturing urea to convert their manufacturing process from Naphtha/ fuel oil/ LSHS feedstock to NG and/or liquefied natural gas before 2010. The extension of the policy is that all new/green field plants will be natural gas based plants. Natural gas demand for fertilizer sector will increase from 8.27 BCM in 2005 to 21 BCM in 2010, due to this policy mandate. The NPS has directed easing of essential commodity act in phases, by permitting units to sell part of their produce in regions of their choice. Government has reduced freight cost equalization subsidy by Rs. 100 per metric ton for non – ECA sales. The operational units are located mainly in the northern and western states of India. The government has been able to manage the demand of each region.

The government is embroiled in gas subsidy, fertilizer subsidy and food subsidy. If one is reduced then the other goes up in the same proportion. However, given that each day the fiscal discipline is getting tighter, gas subsidy should not be hidden in corporate accounts of gas companies. If they are shown in a transparent manner in the accounts of the fertilizer sector, they are more likely to be watched under fiscal discipline constraints. That is to say gas should not be subsidized.

The farm gate price of urea has been constant for many years. Hike in farm gate prices could be considered as step towards cutting down subsidy to the industry to make it efficient and competitive. Compensating industries on “cost- plus” basis does not promote cost reduction through technological innovation and efficiency improvements. On the other hand total subsidy elimination through competitive market pricing leads to increase in food costs and less food production due to low use of fertilizer. Gradual transition may help in the long run.

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Chapter 1

INTRODUCTION

1.1 Role of Fertilizer in Indian Economy

Fertilizer industry plays a vital role in the development of Indian agricultural sector. Agriculture provides a crucial link between, rural, industrial and service sectors of the economy. Historically, Indian economy has been primarily dependent on agriculture. Agriculture was able to generate economic surplus, and the accumulated capital from the surplus fertilizer induced the industrial revolution. Industry in turn provided means in the form of fertilizer, farm machineries, irrigation facilitating equipments, and technology to improve performance of agriculture. As the agriculture sector developed, the complexity of technology and farm management increased. The success of agriculture depends upon correct combination of technology and farm practices. The success of green revolution, in the agriculture sector generated awareness on new developments in science and technology. The new technologies give us opportunity to obtain higher yield from the farmland and also facilitate use of many hectares of land considered unsuitable for farming by conventional methods.

India has witnessed significant growth in agriculture sector after introduction of fertilizer responsive high yield variety seeds of rice and wheat. The government initiated measures in order to motivate Indian farmers to use fertilizers, one of these being the introduction of subsidy under retention price scheme (RPS[1]), in 1977. Government policy in this sector has been guided by their concern of small and marginal farmers, and landless laborers in rural area. Fertilizer subsidy provided to farmers has been successful in one sense. The consumption of fertilizer nutrient increased from 0.7 kg per hectares (year 1951-52) to 106.7 kg per hectares (year 2005-06) (Fertilizer Statistics, 2006). The increase in consumption of fertilizers however had its concomitant impact on subsidy burden. The subsidy burden increased from Rs. 5.05 billion in 1981-82 to 161.27 billion in 2005-06 (Fertilizer Statistics, 2006), while food production increased by three to four times (Ministry of Agriculture, 2006). Introduction of RPS was also an effort to promote domestic production of fertilizer, under which manufacturers were given "cost-plus" price (Working Group Report, 2006). This led to a four-fold increase in domestic production of nitrogenous fertilizer from 3,143.3 Mt in 1981-82 to 11,332.4 Mt in 2005-06 (Fertilizer Statistics, 2006).

In the year 1991, the government abolished the RPS for P and K but continued with RPS for urea (Ministry of Fertilizer, 2006). In the year 2003, government introduced new pricing scheme for urea (Pricing Policy for Urea, 2006). This distorted the relative prices and has led to excessive use of N with respect to P and K. Recently greater importance is given to balanced application of fertilizer. The fertilizer mix is recommended in the ratio of plant nutrient N (Nitrogen), P (Phosphorus), and K (Potassium). For typical Indian soil, average mix recommended is 4:2:1 for N: P: K (Future of Plant Nutrition Research, 2006). The actual mix varies depending on the soil of application, its deficiencies and nature of crop. Nutrient N is the primary component of Indian fertilizer basket. The popular commercial product for nutrient N is Urea, which accounts for 82% of nutrient N provision for agriculture sector[2].

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[1] Retention Price-cum-Subsidy Scheme, 1977: Gazette Notification (Resolution) No.166 (24)/77-FDA dated 01.11.1977

[2] Calculated by IRADe, based on fertilizer consumption trend in India for last ten years

One of the constraints for development of fertilizer industry in India is raw material availability. The feedstocks for urea manufacturing are NG, naphtha, and fuel oil/ LSHS.

The economic and technical issues associated with urea plants in India are:

Urea is provided to Indian farmers at a subsidized price known as "farm gate price". This was initiated initially to induce farmers to adopt use of chemical fertilizer, considering their limited purchasing power. Progressively, the use of fertilizer by Indian farmers increased and with it, the subsidy burden on the central government budget also increased significantly as the government did not raise farm gate price adequately.

Plants, operating on NG as feedstock are more efficient and the costs of production in these units are lower. In production of ammonia/urea the basic component required from feedstock is hydrogen while the carbon portion is chemically converted to CO_2 (Handbook on Fertilizer Technology, 2000). NG has considerably higher hydrogen to carbon ratio as compared to other feedstock. NG based fertilizer plants are provided with gas at a price known as the APM price. The outputs of gas from fields of ONGC, OIL are marketed to power and fertilizer sector at APM prices, and are also referred as APM gas. The APM price is quite low, and cost of manufacturing of urea using APM gas as feedstock is low.

The weighted average cost of production of urea (calculated according to NPS guidelines), as on April1, 2006 for units grouped under pre-92 gas-based unit was Rs. 5, 592 per MT, post-92 gas based units was Rs. 6,626, for pre-92 naphtha-based units at Rs. 17, 417 per MT, for post-92 naphtha based units at Rs.15, 643, Rs.11, 910 per MT for FO/ LSHS units and Rs. 9, 691 for mixed energy plants (Planning Commission, 2002). (The figures are to be viewed in light of the facts that while, APM gas is available at concessional price, naphtha and fuel oil/LSHS are procured at market price.) The GOI has directed the urea-manufacturing units using naphtha or FO/ LSHS feedstock to retrofit their units to use NG feedstock (Indian Fertilizer Industry, 2006). The likely implication of this decision will be sudden increase in demand of NG by fertilizer sector in coming years.

1.2 Political Economy: Indian Fertilizer Sector

The agriculture sector accounted for 22% of GDP in 2005-06 (Union Budget, 2006). It covers economic activity which sustains two third of national population. The GDP growth in this sector over the past decade was only 2% while the cumulative GDP growth is 7%, and 9% over the last three years (Economic Survey of India, 2006). Before independence, India had a history of famines and at independence India inherited an agriculture sector that was handicapped by low productivity due to lack of irrigation and conventional farming practices bereft of technological inputs. Wheat and other grains, pulses, cooking oil, sugar etc. were rationed. Independent India stressed agricultural development right from the first five-year plan. However, it was only during the mid nineteen sixties that high yielding varieties seeds became available and Government of India was able to motivate a few states to apply correct combination of agricultural inputs guided by modern science and technology.

The "Green Revolution" dramatically increased food grains production in the country, which concentrated on three main components as inputs to agriculture namely, high yield variety (HYV) seeds, irrigation and chemical fertilizers (Paradigm Shift in Fertilizer Sector in India). These endeavors showed dramatic results on the food grains production in India, helping India become self sufficient in food grains and remains so. Since the population in India is growing substantially and becoming richer, more and more food grains production will be required to sustain food grains self-sufficiency.

In the early nineteen sixties, government had to deal with famine. The government had to ensure distribution of food grains to its masses, as well as food grain self-sufficiency. The government imported food grains, exercised control over the production, import, stocking, transportation and farm gate price of food grain and fertilizers. This was further reinforced by reports of non-availability of fertilizers at right time, in right quantity and at right place. Fertilizer, as an input, is very crucial in ensuring high level of productivity. Self-sufficiency in fertilizer production (urea) was accorded high priority by the government.

To boost the economic potential in the rural sector, GOI has targeted agricultural growth rate of 4% in the eleventh five-year plan (2006-07 to 2011-12) for the agricultural sector (National Agriculture Policy, 2006). For accelerating agricultural aggregate GDP growth to 4%, balanced use of fertilizer has to be achieved by the end of eleventh five-year plan. Political and administrative authorities are to play a vital role in implementing scientific recommendations i.e. balanced fertilization, technological change, shift in cropping pattern, value added cropping, private investment in industry and infrastructure associated with agricultural sector, and reforms in fertilizer and agricultural pricing policy to this goal to be met. The agricultural sector is highly subsidized, the price of urea and other forms of N fertilizer are protected by a concession scheme and a minimum support price is provided to farmers for a number of crops. The pricing policy favoring urea[3] has skewed fertilizer mix used by farmers, resulting in decline in yield response of fertilizer.

In view of dynamic nature of technological development in agricultural sector, erratic rainfall, shift in cropping pattern, growing importance of agro-processing and entry of organized retailing have created new policy challenges. The growth in population has generated additional pressure on agricultural land. In such a scenario the average yields of farms have to increase significantly, which can be ensured by proper use of HYV seeds, augmentation of irrigation and balanced and sustainable use of fertilizers.

Indigenous fertilizer industry accounts for around 115 fertilizer-manufacturing units (Fertilizer Statistics, 2006) producing a wide variety of fertilizers, provides employment directly and indirectly to millions of people. GOI has spread the message of modern agricultural technology to farmers by providing nationwide extension services. The GOI has come up with a National Agricultural Policy in July 2000[4]. The agricultural sector and associated fertilizer industry is regulated by GOI policies and the subsidy schemes implemented with modification from time to time. The economic reform of 1991, has failed to provide effective policy direction to the agricultural and fertilizer sector, which is acceptable to all the stakeholders. There was hardly any investment in fertilizer (urea) industry during the 10th five-year plan and production capacity was almost stagnant during this period (Paradigm Shift in Fertilizer Sector in India, 2006). Furthermore, no new urea

[3] In the year 1991, the government of India introduced structural change in Indian economy, known as economic liberalization. The government tried to introduce reform process in fertilizer sector by decontrolling the system of subsidy for all fertilizer except urea. The decontrol of Phosphatic (P) and Potassic (K) fertilizers resulted in a sharp increase in the prices of these fertilizers vis-à-vis the price of urea. The NPK ratio got distorted to 9.7:2.9:1 in 1993-94, which was 5.9:2.4:1 in 1991-92? In order to cushion the impact of the increase in prices of these fertilizers, the government introduced a concession scheme on sale of decontrolled fertilizers. Currently, the NPK ratio stands at 6:2.4:1.

[4] Agricultural Policy, 2006

plant was commissioned during the 10th Five Year Plan, except for a small addition to the capacity from BVFC, Namrup II, after its revamp. Chambal Fertilizers, Gadepan, commissioned the last urea plant (unit-II) in October 1999. Fertilizer sector has failed to attract more investment due to low returns under highly restrictive pricing policy (adverse to industry). The Retention Pricing Scheme (RPS), provided for a 12% post-tax return to the units. In recent years, due to under-recoveries under various heads, the units were getting much lower returns. It is studied that returns from this sector have remained relatively low (Annual Review, CRIS INFAC, 2006) as shown in the table below:

Table1.1 Urea Companies – Key Performance Indicators

	2000-01	2001-02	2002-03	2003-04	2004-05
Operating margins (%)	13.83	13.75	11.82	11.22	10.43
Return on Capital Employed (%)	9.24	10.20	8.37	8.92	10.39

Source: CRIS INFAC

Fresh investment from private, public, and cooperative sector in fertilizer Industry has been negligible. Today the sector needs incentive for growth. The food production of the country has also stagnated at 200 Million MT per annum in recent years.

1.3 Concerns of Stakeholders

The project aims to study the supply chain, beginning with supply of NG to fertilizer (urea) manufacturing units, and concludes urea supply to farmers. The operation and management of supply chain involves direct and indirect participation of many stakeholders, each with considerable stakes in the total process, which generates conflicts of interests. The government has to administer and manage the supply chain optimally with the cooperation of each stakeholder, by creating win-win situation for all participants. The study calculates various parameters, which are of interest to the stakeholders, and analyzes how these parameters would shape up in future by using scenario analysis methodology. Brief listing of interests of the stakeholders is as follows:

- Farmers want higher yield from their cultivable land, and for this they need adequate quantity of fertilizer at an affordable price. They desire low fertilizer prices to increase their profit.

- The Government is the ultimate minder of weaker section of the society, and has to protect the self-consuming farmers and landless farmers by ensuring sustenance. At the macro level it has chosen to maintain a certain self-sufficiency ratio in food-grain to safeguard against natural deviations. Challenges before the government are, budget support for all the schemes to benefit weaker sections, and creation of infrastructure to sustain assistance to agriculture sector.

- The stakes of fertilizer manufacturers primarily are profit oriented, and business opportunity on a long-term scenario. The RPS scheme ensures 12% post tax profit on their net worth at 85 percent capacity utilization, while the units with good performance earned higher return on their capital. They plough back their profits for future modernization and expansion projects.

- NG producers would like to sell gas at market-determined prices. The future exploration and production tasks associated with oil and NG sector are highly capital intensive; their success rate of well discovery is low. NG producers need market protection to remain in business. Currently, the gas supplied from ONGC and OIL is priced according to APM. The government has encouraged import of liquefied NG (LNG). Considering the shortfall in demand of NG, the gas producers are inclined toward the market mechanism for gas prices determination.

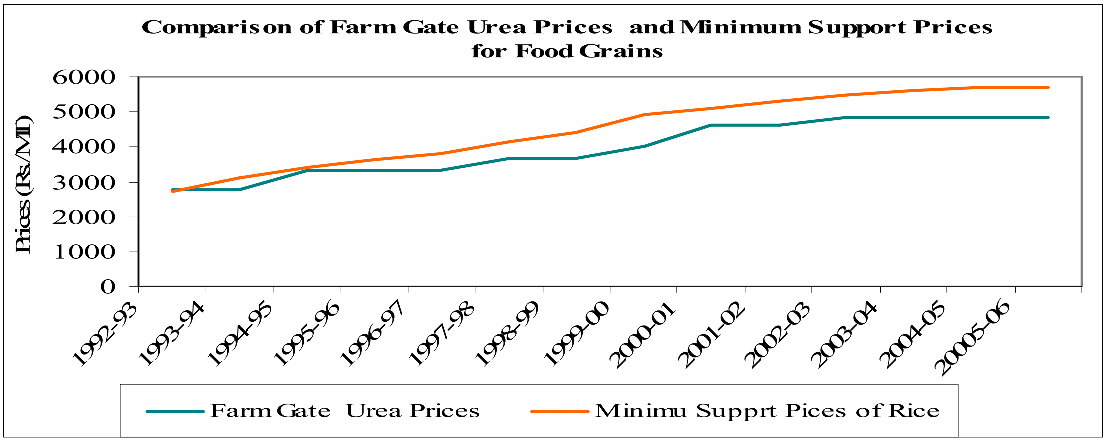
- The government action of providing subsidy is sustained through adequate revenue generation by taxation. The government has its defined procedures of taxing the taxpayers. The taxpayers want the government to get rid of subsidy scheme to reduce their tax burden. General Citizens want cheap food and also guarantee of government that prices of food item would not fluctuate. The government can ensure this by controlling prices and ensuring food self-sufficiency.

1.4 Governments Rationale for Subsidy

Government of India is concerned with welfare of rural population. The earning potential of rural population is through agriculture, and rural non-farm sector (handicraft, small manufacturing units etc.). The rural non-farm sector is poor in most of the states. The percentage share of agricultural GDP is declining. Consequently, the relative income capacity and purchasing power of rural population are declining. The rural populations are the biggest consumer of their own agricultural product. Fertilizer subsidy scheme induces small and marginal farmer to use fertilizer (who have limited marketable surplus) on their land. Raising price of fertilizer as well as of agricultural produce can hurt these farmers who grow for self-consumption.

The current farm gate price of urea is substantially lower than not only domestic cost of production but also imported urea and urea imported from joint ventures (JVs) abroad. In both cases there is a subsidy burden. If market price cannot be charged to farmers, the government has to pay the price difference between farm gate price and the landed cost of fertilizers- indigenous and/or imported. As a policy matter, it is up to the Government to decide as to who bears the burden, and how much subsidy burden can the government bear**.** The primary criticism of the subsidy scheme is that, the subsidy scheme is designed for farmers/ poor farmers, while much of benefit of the scheme reaches the richer farmers. IRADe analysis shows how the benefit of the subsidy is shared amongst the fertilizer manufactures, the feedstock suppliers, and farmers. Fertilizer prices have not been in congruence with food grains prices (fig1.1). Determining the market price is a notional exercise since government can ill-afford to give up price regulation on urea. Figure shows that the fertilizer prices grow at best as the minimum support price (MSP) given to the farmers for food grains. If the price grows more than MSP then the cost of food production will go up and MSP will increase. At best the landed cost of import could be considered as the benchmark price.

Fig1.1 Rising Trend of MSP (Rice) and FGP (Urea)

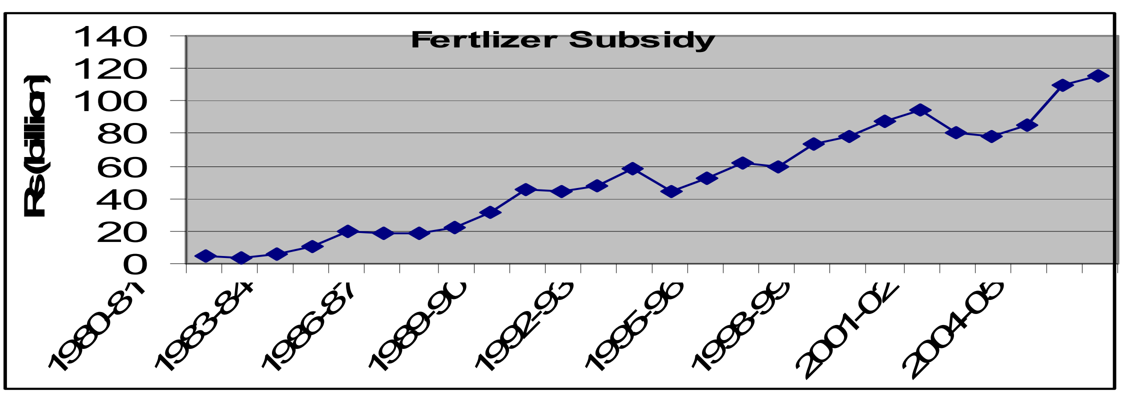


Source: Department of Agriculture and Cooperation, Ministry of Agriculture, 2005-06
Ministry of Chemicals and Fertilizers, 2005-06

Efficiency or inefficiency of manufacturing unit should account for subsidy to the producers. If there are technological, vintage or feedstock reasons for unit's inefficiency, it needs to be judged in the historical perspective unless it is found that the plant could be scrapped and replaced by a more "efficient" plant, which will call for large capital investment. Given the same parameters as described above if one plant performs better than the other, due to the quality of operating management it can be unequivocally said that one plant is more efficient than the other.

The growing use of fertilizers by the farmers and the rising cost of oil prices have spiraled up the budget provision for the subsidy (Fig1.2). The industry has the additional problem of managing their working capital under increased feedstock prices, and often delayed realization of subsidy amount from the government. The subsidy scheme protects the industry from many variables, but there appear other hidden factors apart from working capital issue, which makes the sector unattractive for investment. In the last decades few fertilizer units had to close down, resulting in loss of domestic production.

Fig1.2 Historical Trend of Rising Subsidy to Urea Industry



Source: Ministry of Chemicals and Fertilizers, 2005-06

1.4 International Spot Price Trend of Urea and Correlation with Crude oil Price

Table 1.2 clearly depicts a correlation between the trend of international spot price of urea and the trend of price of crude oil (notwithstanding some aberrations due to spurt in demand). Since the price of crude oil is expected to be looming within the range of $50-75/bbl it can be safely assumed that the spot CIF price of urea will remain well above $ 250/MT.

Table1.2 Crude oil and Urea Price Multiplier

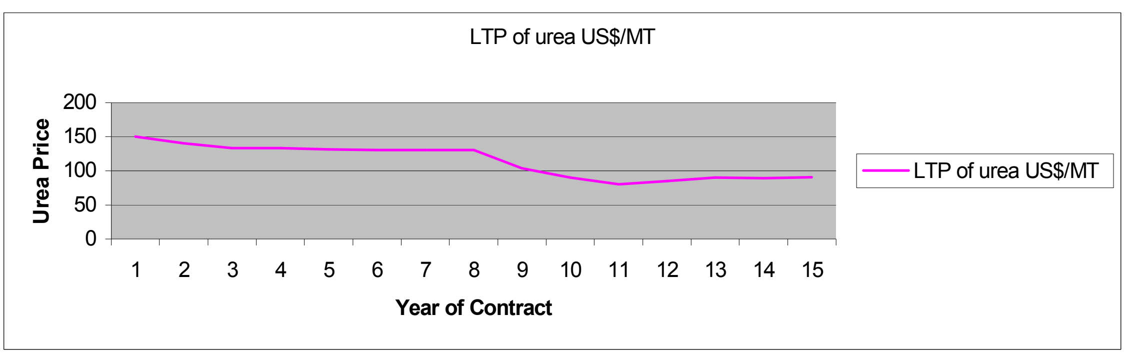
Year	Petroleum $/Barrel		Urea	
	Dubai (1)	UK Brent (2)	Ukraine (3)	Multiplier (4)=(3/2)
1993	14.96	17.00	94.40	5.6
1994	14.83	15.83	131.39	8.3
1995	16.13	17.06	193.93	11.4
1996	18.54	20.45	187.48	9.2
1997	18.1	19.12	127.93	6.7
1998	12.09	12.71	103.05	8.1
1999	17.08	17.74	77.71	4.4
2000	26.09	28.31	101.12	3.6
2001	22.71	24.41	95.30	3.9
2002	23.73	25.00	94.34	3.8
2003	26.73	28.85	138.90	4.8
2004	33.46	38.30	175.29	4.6
2005	49.20	54.44	219.04	4.0
2006	58.31	63.57	197.75	3.1
			Average	6.0
			Average since'1999	4.1

Source: International Financial Statistics, 2005-06

1.5 Import of Urea from Oman India Fertilizer Company (OMIFCO)

The contracted price by OMIFCO, a joint venture for fertilizers, shown in figure 1.3 indicate that long-term contract could help lower average cost of imported urea and bring down the subsidy burden. The FOB price paid by the Government for import of urea on Government account during the year 2004-05 was ranging between US $149 per MT to US $ 257 per MT (Sixth Report, Standing Committee, 2004-05). However, the long-term price (LTP) of urea to be imported from OMIFCO is fixed as per the Urea Off-Take Agreement (UOTA) figure1.3.

Fig 1.3 OMIFCO Contracted Price for Import of Urea

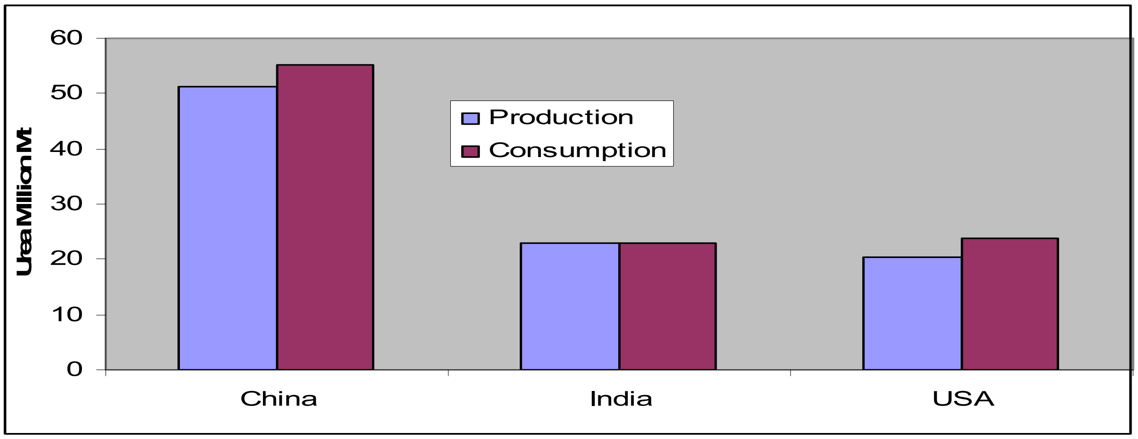


Source: Sixth Report Standing Committee On Chemicals & Fertilizers (2004-05)

1.6 Production and Consumption of Nitrogenous Fertilizer in Major Fertilizer Consuming Countries

China, India and USA are three major consumers who account for approximately 55% of total nitrogenous fertilizer consumption of the world (International Fertilizer Industry Association, 2005-06). These three countries stand at the top three positions not only in consumption but also in production of fertilizer fig1.4. Though total consumption of Urea in India, and USA is a substantial proportion of total world consumption the per hectare consumption in these three countries are significantly low compared to many other countries fig1.5

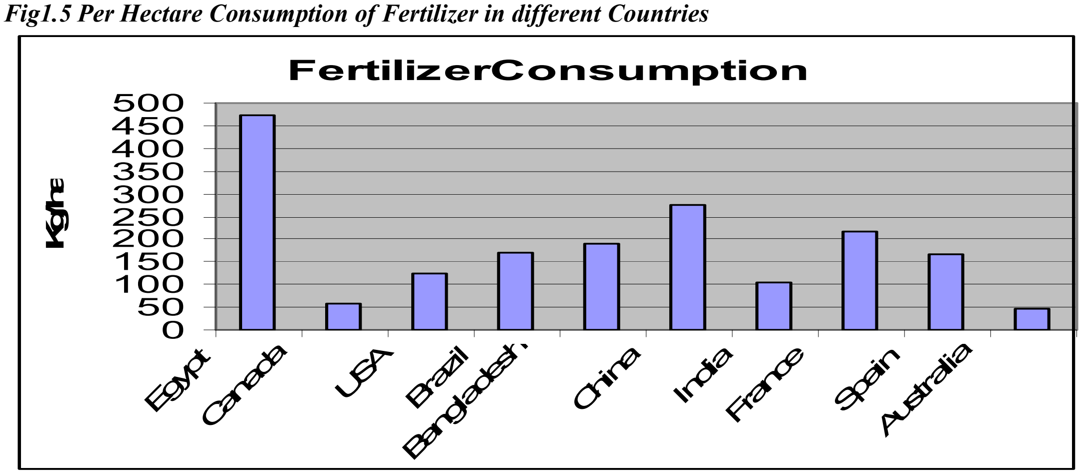
Fig.1.4 Major Consumers and Producers of Nitrogenous Fertilizer of World in 2002-03



Source: International Fertilizer Industry Association, 2005-06
Ministry of Chemicals and Fertilizers, 2005-06

Note: Nitrogen (N) requirement is converted into Urea equivalent.

Fig1.5 Per Hectare Consumption of Fertilizer in different Countries



Source: Fertilizer Statistics 2005-06, Fertilizer Association if India

1.7 Strategy to Import Urea

A promising strategy would be to have joint ventures in Middle East with long-term price bound contracts like the one with OMIFCO, which will serve the duel purpose of stabilizing average urea cost in India and bring down the subsidy bill. Import of urea thus will offset foreign exchange outgo for gas feedstock, which will be anyway imported for indigenous production of urea. Another option would be to maximize production from the existing units since urea plants are capital intensive and capital related charges alone notwithstanding their modern technology, energy efficiency and capital related charges the total cost of production are expected to be well above that of old plants with depreciated capital.

1.8 NG Market

NG consumption in India has grown significantly during the last two decades from around 1,200 million standard cubic meters (MMSCM) in 1980 to around 25,000 MMSCM in 2000 at a CAGR of over 17% (International Energy Outlook, 2006). Despite the high growth rate, the share of NG amongst the various primary energy sources remains at a level of around 8% as against a world average of 24.72% (BP Statistical Review, 2007). A major reason for the same is the supply constraint due to domestic production levels, which have stagnated in recent years this is expected to go up as new fields, which are discovered, are commercially exploited.

NG is the most preferred feedstock for production of fertilizers because it has the highest hydrogen to carbon ratio (hydrogen is used for production of ammonia and thereafter urea and other derivatives while the carbon portion is converted to CO_2 chemically by an endothermic reaction wasting its calorific value unproductively). Hydrogen as weight percent in Methane is 25% as compared to 15% in naphtha and 0% in coal. The net calorific value of methane is 11,954kcal/kg while that of naphtha is around 10,000 kcal/ kg and that of coal (100% basis) is 7,831kcal/kg (Handbook on Fertilizer Technologies, 2000).

The present cumulative NG availability of 120 MMSCMD meets only 46% of present, demand (MOP&NG, 2006-07). Not anticipating any sizeable discovery in India, import of LNG was planned in a big way (15 terminals were planned) (Natural Gas in India, 2006). The quantity initially being planned for import will be barely sufficient to bridge the current gap. For few years the indigenous supplies would be inadequate to meet demand of NG. If the NG industry has to grow in tandem with the national economy, import of gas in lieu of some liquid hydrocarbons is a must. It would be foreign exchange neutral and help to achieve a cleaner environment with better thermal efficiency.

The NG market has now expanded to a national scale with significant domestic production and presence of substantial transport and distribution network. NG forms approx. 8-9% of the total primary energy consumption in the country (Integrated Energy Policy, 2006)). As the preferred fuel with benign environmental quality, it is poised to gain a significant growth in the country in near future.

It would serve the economy of the country better if NG/ LNG goes towards replacement of liquid fuels where it has better-cost economics and would also help in containing the total import bill on Petro products. In order to ensure that NG industry grows at a brisk pace as desired, a number of key parameters- demand drivers need to be set right. The main ones amongst them are:

1.8.1 Supply Adequacy

Presently and in foreseeable future, the supply quantity is going to lag far behind the potential demand (Future of Natural Gas in India, 2006). All efforts and enabling policy initiatives need to be focused on increasing availability of gas on a sustainable basis.

1.8.2 Infrastructure

In order to be in a state of readiness to reach the customers when resources are available, a robust transportation and distribution network should develop in step with availability. The distribution infrastructure should have an open access,

1.8.3 Deregulation

Deregulation of domestic gas prices is happening gradually. The government had announced an increase in price of APM gas in July 2005 for core sector consumers and deregulating prices for other consumers. R-LNG has also been successfully marketed at landed cost of import plus transportation cost and private/JV producers have been permitted to charge market-determined price. Because of these developments, nearly 50% of the market today is buying gas at market-determined rates—a significant change when compared with the scenario in the recent past.

The price of R-LNG supplied by Petronet LNG Limited (PLL), the main supplier in the Indian markets at present, is also expected to undergo a significant change beginning January 2009, when the currently existing cap is lifted. The incremental LNG to be sourced in the Indian market is also expected to be available at higher prices than contracted hitherto, given the tight demand-supply levels for LNG. Gas supplies in the domestic market—from diverse sources, both domestic and imported—are expected to increase substantially over the medium term. Domestic gas availability is expected to be more than double over the next five years due to discoveries by Reliance Industries Limited. Later the quantities could be further augmented by commencement of production from discoveries made by ONGC and GSPCL.

Demand for gas for fertilizer production estimated by Hydrocarbon Vision 2025 on the basis of per capita requirement for food grains, fertilizers required to attain the necessary production, the share of urea to sustain this yield (excluding imports of 2 MMT through the forecasting period) and consequently the gas required to produce this urea are shown in Table 1.3.

Table 1.3 Projected Demand For Gas From The Fertilizer Sector

	2002	2007	2012	2025
Gas Demand (MMSCMD)	54	64	83	105

Source: Hydrocarbon Vision 2025

1.9 Sectoral Demand Analysis-Fertilizers

For plants, which are using naphtha or fuel oil as feedstock and/or fuel, their replacement by NG or even LNG is a foregone conclusion purely on economic considerations. Apart from price competitiveness of NG/LNG vis-à-vis the liquid fuels (all three are linked to the price of crude), NG has a stoichiometric advantage since what is required for ammonia production is hydrogen and hence NG will have the lowest consumption norm per tone of ammonia (Corporate Strategies in Fertilizer Sector).

Currently, out of total urea production of 19.81 MT, 39% is naphtha based that can easily change over to gas having a potential demand of 5.4 BCM or 14.82 MMSCMD[5].

[5] IRADe Analysis

1.10. Supply of NG

NG has been utilized in Assam and Gujarat since the sixties. There was a major increase in the production & utilization of NG in the late seventies with the development of the Bombay High fields and again in the late eighties when the South Basin field in the Western Offshore was brought to production.

Almost 70% of India's NG reserves were found hitherto in the Bombay High Basin, South Basin and in the state of Gujarat. Bombay high field produces associated gas while the rest is produced as free gas. Most of the domestic production of gas comes from the Western offshore area. The South Basin and Tapti fields in the Western Offshore and the gas fields in Tripura and Andhra Pradesh (K.G. Basin) are the main producers of free gas. While the existing gas fields are expected to deplete production in future it will be more than made up by new discoveries made by Reliance, GSPC and ONGC.

For the year 2002-03, out of the total production of 88.81 MMSCMD of NG in the country, ONGC produced 65.87 MMSCMD, OIL produced 4.44 MMSCMD and Gas production by Pvt. Players / JVs was 18.51 MMSCMD (NG in India, 2006).

Table1.4 Production of NG Source Wise

	2001-02	2002-03	2003-04	2004-05	2005-06
ONGC	65.87	66.41	64.61	62.97	61.92
OIL	4.43	4.78	5.17	5.51	6.00
Private/JVs	11.11	14.81	17.78	18.58	21.00
Total production	81.41	86.00	87.56	87.06	88.92

Source: Ministry of Petroleum and Natural Gas, 2005-06

Note: Actual supply to the market is lower because of internal consumption, recovery of higher hydrocarbons and flaring. For instance, supplies were only around 75 MMSCMD in 2005-06 from domestic production as against production of 89 MMSCMD.

Going forward, however, supplies in the domestic market are likely to increase substantially. By 2011, the total supply can reach to the extent of 250 MMSCMD (Indian Natural Gas Sector, ICRA, 2006).

Table 1.5: ICRA's Estimates on Gas Availability (in MMSCMD)

	2006-07	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Domestic Gas:					
ONGC	46.92	46.42	45.42	43.42	41.42
OIL	5.00	5.00	5.00	5.00	5.00
PMT	11.35	12.50	13.50	15.00	15.00
Ravva	1.90	3.50	4.00	4.00	5.00
Cairn	3.73	3.70	3.60	3.50	3.30
GSPC-Niko	3.70	3.50	3.30	3.00	2.80
RIL-KG basin	0.00	0.00	10.00	40.00	40.00
RIL-NEC	0.00	0.00	0.00	3.00	12.00
GSPC-KG basin	0.00	0.00	0.00	10.00	40.00
CBM gas	0.00	2.00	3.00	5.00	5.00
Sub Total	**72.60**	**76.62**	**87.82**	**131.92**	**169.52**
Imported Gas:					

PLL, Dahej	19.80	21.60	21.60	24.60	30.60
PLL, Kochi	0.00	0.00	0.00	0.00	4.50
Shell LNG, Hazira	3.60	4.50	5.40	6.30	6.30
Dabhol LNG*	0.00	5.67	7.56	18.00	18.00
Myanmar pipeline/CNG ships*	0.00	0.00	0.00	15.00	20.00
Sub Total	**23.40**	**31.77**	**34.56**	**63.90**	**79.40**
Grand Total	**96.00**	**108.39**	**122.38**	**195.82**	**248.92**

Source: ICRA Report

*Note: * Supply sources are less certain*

The estimates mentioned do not include possible supplies from Iran LNG (18 MMSCMD), Ennore/Mangalore LNG (9 MMSCMD), Iran-Pakistan-India (IPI) pipeline (60 MMSCMD) and the Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline (40 MMSCMD).

Global NG market Scenario is not very encouraging. The technology of transport and application of NG have improved, thus promoting accelerated growth of LNG markets and consumers of NG. The depletion rate of existing well is higher than the new discoveries of NG reserves with potential of commercial production. The ratio of global replenishment of NG supply to depletion rate is 36% (Energy Statistics, 2006). Global gas consumption is to grow at five trillion cubic meters, at a compounded annual growth rate of 2.4%, while the gas consumption of Indian market is estimated at 127 billion cubic meters with CAGR of 5.9% (International Energy outlook, 2006). The optimism is justified by recent national economic growth and discoveries of gas reserve on the eastern coast by RIL, ONGC, and GSPC. All these reserves are deep-water reserves. The RIL has projected to provide gas to consumers from their reserves discovered in the year 2002, by mid 2008 or early 2009. There are reports of major finds of NG in the KG basin. The private Exploration & Production organizations have successfully made the discoveries in various blocks. They have been permitted to put NG up for sale to the consumers, at the market driven prices, as per New Exploration & Licensing Policy (NELP). Indian fertilizer industry is getting subsidized NG supplies at around $3.00/MMBTU (Natural Gas in India, 2006). The source of APM supply gas is declining. In future, the fertilizer industry will have to buy their feedstock from private suppliers.

The domestic gas supply is increasing at a slow pace. In next three to five years, the NG availability is likely to grow by 2 to 3 times; the likely availability is expected to be between 150 to 200 MMSCMD, which also includes import of LNG (Natural Gas in India, 2006).

1.11 Future Gas Demand in India (Limitations of Economic Model)

Earlier production process of crude oil had the constraints of processing associated gas, thus it was flared. To promote use of associated gas, government provided discounted price for the gas. The government costing was based on upstream cost of E&P. Market had negligible role in pricing the commodity.

The consumer base of NG developed rapidly. Subsequently, the government embarked on dual pricing system for NG i.e. APM gas price and market price for gas sold by private players. NG to fertilizer, power, small consumers ratified by judicial verdict are provided gas at an APM rate and the other consumers are provided at a government regulated market rate. The LNG users are paying for gas at a contractual rate.

Foreseeing the stagnating production of oil and gas from land and shallow water exploration activity, government initiated the idea of deepwater exploration. The deep-water exploration task needs huge investment. GOI opened the E&P sector for private sector participation. They formulated New Exploration Licensing Policy (NELP), for awarding the task of exploration and production of identified sedimentary basins on the open bid system. Till date, six rounds of NELP bidding have taken place, and 55 blocks covering a total area of 3, 52,191 sq km were put on offer[6]. Under NELP, the successful bidder can sell the gas from their discoveries at a market-determined price. However, as per the provisions of the production-sharing contract (PSC), the government has an option to take its share in cash or in kind.

Therefore, the scheme de-regulation of domestic gas prices is gathering momentum. R-LNG available to Indian market is being sold at the market prices. In a long-term scenario, the gas production from the APM field will decline, and it is expected that the sectors using APM gas will have to use market priced gas and have to economically and financially sustain production.

At a global stage, the NG prices are linked to crude prices, and thus NG prices have been volatile in recent times. GOI have instituted a regulatory body 'Petroleum and NG Regulatory Board' (PNGRB) to manage the oil and gas.

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[6] Ministry of Petroleum & Natural Gas, Government of India, 2005-06

Chapter 2

POLITICAL ECONOMY OF FERTILIZER PRODUCTION

2.1 Indian Fertilizer Industry Historical Perspectives:

The year 2006 was the centenary year for Indian fertilizer industry. In 1906, the first manufacturing unit of Single Super Phosphate (SSP) was set-up in Ranipet near Chennai with an annual capacity of 6400 MT. The first synthetic nitrogenous fertilizer capacity was set up at Belagulla in Mysore in 1941. The Fertilizer & Chemicals Travancore of India Limited (FACT) at Cochin, Kerala and Fertilizer Corporation of India (FCI) unit in Sindri, Bihar (now Jharkhand) were the first few large sized -fertilizer plants set up in the nineteen- forties and fifties. The implementation of green revolution strategy in the late sixties (1966) gave an impetus to the growth of fertilizer industry in India (WTO Consistency of Indian Fertilizer Policy, 2004). The seventies and eighties then witnessed a significant addition to the nitrogenous fertilizer production capacity.

At present, there are 57 large size fertilizer units in the country manufacturing a wide range of nitrogenous, Phosphatic and complex fertilizers. Of these, 28 units produce urea, 20 units produce DAP and complex fertilizers, 7 units produce low analysis straight nitrogenous fertilizers and remaining 9-manufacture ammonium Sulphate as by-product. Besides, there are about 68 small and medium scale units in operation producing single super phosphate (SSP). The total installed capacity of fertilizer production was 12.06 Million MT of nitrogen and 5.62 Million MT of phosphate as on 01.04.2005. The production of fertilizers during 2003-04 was 10.63 Million MT of nitrogen and that of phosphatic fertilizers was 3.63 Million MT of phosphate. During 2004-05, production of nitrogen and phosphate was 11.38 Million MT and 4.06 Million MT respectively[7].

Overall consumption in nutrients terms in the last five decades has increased from 0.07 million metric tons (MT) in the year 1950-51 to about 18.39 Million metric tones (MT) in 2004-05. Accordingly, per hectare consumption of fertilizers, which was less than 1 kg in 1951-52, has gone up to the level of 96.7 kg per hectare in 2004-05. Similarly, the production of nitrogenous (N) and phosphatic (P) fertilizers taken together has increased from a mere 0.03 Million MT in 1950-51 to 15.40 Million MT in nutrients terms in 2004-05(Fertilizer Statistics, 2006).

Government of India introduced Retention Price scheme (RPS) for various fertilizers based on recommendation of Expert Committee Report. The RPS for nitrogenous fertilizers (except ammonium chloride) was introduced in November 1977. Under the RPS, manufacturers were given a cost plus price that would provide a post tax return of 12% when the plant is operated at 85 percent of its capacity. The RPS was fixed plant by plant even though neither the expert committee nor any of the subsequent committee had recommended a plant wise RPS. One of the results of RPS has been that the capacity use has averaged 120 percent and for some plant as high as 140% as manufacturers understated plant capacities. The plant-wise RPS continued till 2003, when it was replaced by a group-wise RPS (Pricing Policy for Urea Manufacturing, 2003).

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[7] "Fertilizer Statistics 2005-06" Published by The Fertilizer Association of India

With effect from August 25, 1992, all phosphatic and Potassic fertilizers were decontrolled. Consequent upon the decontrol of phosphatic (P) and potassic (K) fertilizers, the prices of these fertilizers registered a sharp increase vis-à-vis the price of urea and the NPK ratio got distorted to 9.7:2.9:1 in 1993-94, which was 5.9:2.4:1 in 1991-92 i.e. the year immediately preceding the decontrol of these fertilizers (Current Status of Fertilizer Industry, 2001). In order to cushion the impact of the increase in prices of these fertilizers, the Government introduced a scheme of concession on sale of decontrolled fertilizers. Over the years, the scale and coverage of the concession has increased substantially to give impetus to the demand for consumption of these fertilizers and to ameliorate the nutrient imbalance in the soil, which is essential for sustaining the desired growth in agricultural productivity.

The pre-dominant increase in urea capacity took place during 1980's and 1990's. There has been a significant increase in consumption and production of fertilizers from 1977 to 1997 because of steady pricing policies pursued by the Govt. of India. This resulted into substantial increase in the food grain production at around 26% per decade as under (Agricultural Statistics, 2004):

Table 2.1 Food Grain Productions and Consumption of Nutrient

Year	Food Grain Production (Million tonne)	Consumption of Plant Nutrients (kg/ha)
1961-62	83	2
1971-72	105	16
1981-82	133	34
1991-92	168	70
2001-02	211	91

Source: Fertilizer Statistics, 2000-01, Fertilizer Association of India

The nutrient consumption level in India at present is around 100 kg per hectare, when compared to developed countries of more than 300 kg per hectare; this leaves further scope in the consumption growth of urea (International Fertilizer Association, 2006). No new urea plant has been set up after 1999 due to stagnation in the consumption levels, limitation of feedstock availability and lack of clarity on fertilizer pricing policy.

2.2 Feedstock Situation and Economics of the Industry

If the basic premise of self-sufficiency has to be retained, at least the existing production facilities and whatever de-bottlenecking or expansion is technically feasible at marginal cost needs to be nurtured. The additional requirements projected for future, can be planned as import, if off take agreements on similar lines as in OMIFCO's case can be achieved, and green-field plants based on NG feedstock are promoted. It is favorable to maximize the production from existing units since the urea plants are capital intensive and for new plants, capital related charges alone put the total cost of production well above the old plants.

2.3 Evolution of Policy

Taking into account the fact that output price of food grains has not increased significantly (largely indicated by procurement price), fertilizer prices charged to the farmers cannot be increased to the market price (import parity price).

2.3.1 Impact of Urea Pricing Policy on Food grain Production

Urea has played a big role for the increase in the food grain production and making the country self-reliant. Most of the farmers being marginal and small, the capacity to afford the use of chemical fertilizers are largely dependent on the pricing pattern. The same has been proven after the decontrol of phosphatic and potassic fertilizers in 1992-93, which resulted into drop in consumption of these fertilizers and subsequently, the Government, had to introduce the ad-hoc concession scheme. The food grain production, which crossed 200 MT mark has been stagnant for quite some time. To achieve the target of food grain production, further increase in the consumption of fertilizers is essential. Requirement of NPK nutrients vis-à-vis food grain production targets are given in table2.2.

Table2.2 Food Grains Target and Nutrients Requirements

Year	NPK Nutrients (Million tones)	Food Grain Target (Million tones)
2002-03	20	218
2011-12	28	337

Source: Fertilizer Statistics, 2000-01, Fertilizer Association of India

2.3.2 The Farm Gate Price

The government and the political system have their commitment to rural welfare. As already pointed out any increase in farm gate price would hurt the large number of small and marginal farmers. No politician and government machinery is likely to significantly alter the farm gate price.

2.3.3 Feedstock Prices

Even those plants, which had committed quantities of gas tied up as a condition of project implementation, are not able to receive promised quantity of APM gas. The fertilizer producers will have to fend for themselves on supply as well gas price front for additional gas.

2.3.4 Naphtha and Fuel Oil/LSHS

In the initial stages, these feedstocks were priced at a concessional rate for fertilizer sector. Later on, this concession was withdrawn and the units were asked to procure naphtha at competitive rates. Currently, naphtha price (equivalent price on calorific value basis) is 50% higher than that of even RLNG[8].

2.3.5 New Pricing Scheme (NPS)

The retention price scheme was implemented to provide fertilizers at subsidized price to Indian farmers. There were few reasons (a) to induce farmers to use fertilizers and produce more food, (b) to compensate farmers for the output price they received. Gradually the RPS yielded the benefits envisaged in the scheme (Anticipated Impact of New Fertilizer Policy, 2003). There were few criticisms for RPS. The government expenditure on fertilizer subsidy was increasing, without yielding equivalent benefits and the total benefit of subsidy was not reaching the farmers. It was felt that subsidy burden was getting out of bounds, and part of the burden could be attributed to inefficiencies of the fertilizer producers. An Expenditure Reform Commission (ERC) was constituted to examine the issues pertaining to fertilizer subsidies and review of RPS. The Department of Fertilizer, GOI examined the recommendation of ERC, and introduced a new scheme in the form of NPS (New Pricing Scheme) replacing RPS. Under NPS the plants are grouped based on the feedstock (NG, naphtha, fuel oil/ LSHS and mixed) and vintage (year of commissioning of Plant i.e. pre1992 / post 1992). Average retention price was calculated for each group, within defined

[8] IRADe Analysis

guidelines. Re-imbursement of the subsidy to a plant in a given group would be based on the weighted average retention price for the group. This system had an in built mechanism to promote efficiency i.e. it acts as a disincentive to economically inefficient plants.

NPS was introduced in a phased manner i.e. stage-I, Stage-II and Stage-III. The stage I was effective from April 1, 2003 to March 31, 2004. The stage II was effective from April 1, 2004 to March 31, 2006. The stage III came into effect from Oct 1, 2006 and will be valid till March 31, 2010 (Pricing Policy for Urea Manufacturing Units, 2003).

In stage I, Group concession scheme replaced the unit wise retention pricing scheme for subsidy computation for Urea. Based on feedstock used and vintage data, the urea units were grouped as (1) Pre 1992 – NG, (2) Post 1992 – NG, (3) Pre 1992 – Naphtha, (4) Post 1992 – Naphtha, (5) FO/ LSHS (6) Mixed feedstock (if NG / Naphtha % in feedstock is >25% and < 75%). The group concession price is computed as follows

In Step-I, the retention price (RP) of each unit is computed, and a weighted average retention price and the dealer's margin of the units are computed. Units having exceptionally high or low retention price, i.e. having RP beyond +/ - 20% with reference to group average computed in Step-I are treated as outliers in their respective groups. In Step-2, the final weighted average group retention price is computed after excluding the outliers. The four cases are as follows:

(1) The units having RP beyond (-) 20% of weighted average group retention price i.e. outliers are compensated based on actual RP costs.

(2) The units having RP within the -20% of weighted average group retention price (WAGRP) and WAGRP are compensated on their actual RP of the unit.

(3) The units having RPS within +20% of weighted average group retention price and WAGRP; are compensated upto group average RP irrespective of their actual costs.

(4) The units having RPS beyond the +20% of weighted average group retention price are compensated upto weighted average group retention price plus 50% of the difference between their respective RP and the group average.

In Stage-I the allocation of urea under the ECA was restricted up to 75% and 50% of installed capacity (as reassessed) of each unit during Kharif (Kharif harvesting season is from April to September) 2003 and Rabi (Season starts from October to March) 2003-04, respectively. The Department withheld the power to make necessary adjustments in determining ECA allocation in case the estimated/actual production during the year is below the reassessed installed capacity. The remaining urea production was available to the manufacturers for sale to the farmers anywhere in the country. Manufacturers were permitted to sell urea to complex manufacturing units on the principle of import parity price or to export, with the condition that no subsidy/ concession will be payable on that quantity and it will be computed towards the quantity permitted for decontrolled sale.

In stage I the quantities sold under ECA (Essential Commodities Act), units were permitted equalized freight in continuation of earlier scheme. The urea sold under outside ECS, equalized freight has been reduced by Rs100 per ton of urea[9] Equalized freight schemes were worked out on the basis of average normative lead and rail-road mix of each unit for the last three years i.e.2000-01, 2001-02 and 2002-03. Suitable adjustments were granted in the event of rail freight revision.

In the stage II, case four provisions of stage I had been removed. The new scheme, did not propose any capping on production of urea. The alternate use or sale of by-products such as ammonia, CO_2 etc. was permitted, in case they were considered surplus beyond the reassessed capacity for urea production. The final concession would be determined on the reassessed installed capacity. The additional production beyond the installed capacity would receive concession if it were mopped up under the ECA allocation. The feedstock/ fuel ratio for the entire production was taken into consideration for assessing the concession[10]. Reduction in the rates of concession on account of capital related charges were also notified.

The department of fertilizer under Ministry of Chemicals and Fertilizers recently issued notification on "Policy for Stage-III of New Pricing scheme for Urea Manufacturing Unit"

The Stage III of NPS has similar guidelines for calculating concession rates of urea manufacturing units[11]. The recommendation has updated energy consumption norms and capital related charges for estimation of group concession (Policy for Stage-III of New Pricing Scheme).

[9] Source: www.fert.nic.in/pricepolicyurea.asp

[10] Source: www.fert.nic.in

[11] www.fert.nic.in/docs/policy_for_stage-III.pdf

Chapter 3

STATE OF INDIAN FERTILIZER INDUSTRY

3.1 State of Domestic Fertilizer Sector

The demand of fertilizer is projected to grow significantly in the coming two decades. The GOI is committed to meet the projection, through proactive action. The initiatives of GOI to meet the projection of demand for urea are as follows:

- Initiate expansion and capacity addition of existing units and enhance the capacity and efficiency of the units through revamping, retrofitting, and de-bottlenecking of existing fertilizer units.
- Setting up of joint venture projects in the countries having abundant availability of cheap raw materials, having contractual provision of buy back of fertilizer in the pattern of OMIFCO.
- NG is the preferred feedstock for manufacture of urea. The indigenous NG supply is constrained, and is being used in power, fertilizer, transportation, and domestic sectors. In order to augment supply, gas import in form of LNG is being encouraged. The RLNG used in fertilizer sector will be priced at a negotiated price between importer and the company.
- DOF is looking at the possibilities of revival of some of the closed units by setting up brown-field projects depending upon availability of gas.
- Taking up Greenfield projects for urea manufacturing, a new plant is planned at East Coast Township, Nellore, and Andhra Pradesh.

In addition to revamping of existing NG based plants, expansion project can be considered another viable option to enhance urea production capacity of existing plants. There is a proposed

All the naphtha and fuel oil/LSHS based units are to be modified for gas feedstock. It is assumed that the change will not bring forth any change in existing production capacity as it is observed that the both ammonia and urea synthesis reactor (downstream processes) will remain the same. The estimated time frame for the change over would be 2 1/2 years from the start date of implementation.

During the conversion phase, through de-bottlenecking or revamping or modernization route, the plant should exploit opportunities of increasing their capacities and improving efficiency of the process. The conversion process and the associated steps taken to increase urea production capacity by using NG feedstock will increase demand of NG for fertilizer sector. It has been decided that new and expansion projects of Urea will be given concession based on their Long Run Average Cost (LRAC), according to policy announced for new and expansion projects (Natural Gas in India, 2006).

The government has decided that the available APM gas would be supplied to only to the power and fertilizer sector after meeting the requirement of specific end user as per commitment under various court orders. DOF, MOPNG and Ministry of Shipping have also explored the feasibility for forming a consortium for importing LNG for fertilizer plant and supplying RLNG to different manufacturing sites through a dedicated pipeline of fertilizer industry.

The Gas availability from the existing wells of ONGC and OIL is decreasing, along with it the APM gas allocated for fertilizer sector is also decreasing (Indian Natural Gas Sector, ICRA, 2006). The current price of APM NG is Rs3200/ thousands cubic meter, while the price of available R-LNG is $4.00/ MMBTU. The price of NG is given in *table3.1:*

Table 3.1 Price of NG

Customer	Land-fall Price Post-July 2005 (Rs./tCM)	Land-fall Price Post-June 2006 (Rs./tCM)	Current landed Cost to Consumers (Rs./tCM)	Current landed Cost to Consumers ($/MMBTU)
Power, Fertilizer & Approved end User	3200	3200	5477	3.07
CNG, Small Consumer Offtake< 50 tCM/day	3200	3840	6277	3.52
Other Consumer	6893	8482	11134	6.22
Core Sector Consumer NE	1920	1920	2674	1.50
Other Consumer NE	3515	5089	6044	3.38

Source: ICRA Study, 2006

The Petroleum and NG Regulatory Board Act, 2006 (PNGRB Act) came into force in India in April 2006 (MOP&NG). The act provides for the creation of Petroleum and NG Regulatory Board (PNG Board) with following powers.

(A) Protection of Indian consumer's interest by fostering fair trade and competition among those engaged in refining, processing, storage, transportation, distribution, marketing, import and exports of petroleum (defined by the PNGRB Act as including crude oil), petroleum products and NG including laying of pipelines for transportation of petroleum, petroleum products and NG.

(B) To ensure adequate availability of petroleum, petroleum product and NG in the Indian market.

(C) Monitoring prices and taking corrective measures to prevent restrictive trade practices in relation to petroleum, notified petroleum, petroleum products and NG.

(D) Secure equitable distribution of Petroleum and Petroleum Products.

(E) Impose fee and other charges.

(F) Regulate the technical standards and specification including safety standards in activities relating to petroleum, petroleum products and NG. The DGH will not fall under the jurisdiction of PNGRB.

3.2 Joint Ventures Abroad:

Anticipating tight supply situation in availability of NG, GOI is encouraging Indian fertilizer companies to establish joint ventures production facilities for urea in the countries having rich NG reserve. The companies in association with GOI must establish buy-back arrangement. This scheme is also encouraged for phosphate fertilizer, and there are three phosphoric acid manufacturing plants are being commissioned with the participation of Indian companies in Senegal, Morocco, and Jordan. A JV urea manufacturing plant, Oman India Fertilizer Company (OMIFCO), with annual capacity of 1.654MT/annum is operational at Oman. The company is a joint venture between IFFCO, KRIBHCO, Oman Oil Company (Ministry of Chemicals and Fertilizers, 2006).

3.3 Revival of Closed and Sick Units

Union cabinet in their meeting in September 2002, decided to close down entire fertilizer plants of Hindustan Fertilizer Corporation Limited and Fertilizer Corporation of India Limited due to their non-viability. The Jodhpur Mining Organization, i.e. Dehradun & Saladipura unit of Pyrites Phosphates& Chemical Ltd. (PPCL) and later PPCL, Amjhore were closed down (Current Status of Fertilizer Industry, 2001).

Keeping in view the Fertilizer Association of India projections, that by the end of 11th five-year plan, the gap between consumption and domestic production will widen to a figure of 16 MT of fertilizer, GOI is considering the option of revival of closed and sick units. All these units have a planned industrial set up of electricity supply, water resources, railway siding, prime land, and a township.

GOI is studying option and mode of revival. Some of the options are (a) Existing profit making Fertilizer PSUs can take over management of sick/ closed units, (b) To issue 'Expression of Interest' for joint ventures for revival of "Gas Based –Brownfield" fertilizer plant, without infusion of capital or guarantee being sought from the Government. (c) Setting up of a new joint venture project with the public / private equity participation with non fertilizer sector, preferably petrochemical complex or power plant etc. (d) Any other viable model of cooperation with private, public, cooperative sector entrepreneur, ensuring fertilizer production at reasonable price, with any other viable economic activity.

The cost charts are prepared for estimating the impact of revamping, de-bottlenecking, brown-field, green-field projects on subsidy at the current price (Rs 4830) is given in annexure 2.1

3.4 Transportation of Fertilizers:

Railways and roadways are the two principal means of inland transportation of goods and services. In India railways dominate long distance transportations of heavy materials, as it is the cheapest among available means. 74 percent of total transportation of fertilizers is by railways remaining being managed by roadways (Fertilizer Statistics, 2006). To facilitate smooth and economical transportation railways has devised a mechanism to charge carriage cost for heavy goods under different categories and per tones per kilometer carriage cost is fixed (Ministry of Chemicals and Fertilizers, 2006).
Transportation cost = Volume of goods in tons * Distance traveled in kilometer * Freight multiplier for that category.

Table3.2 Volume of Fertilizer Moved By Rail& Road

Year	Quantity moved by rail ('000 tons)	Share of rail movement to total (%)	Quantity moved by road ('000 tons)	Share of road transport to total (%)
2005-06	31,721	74	11145	26

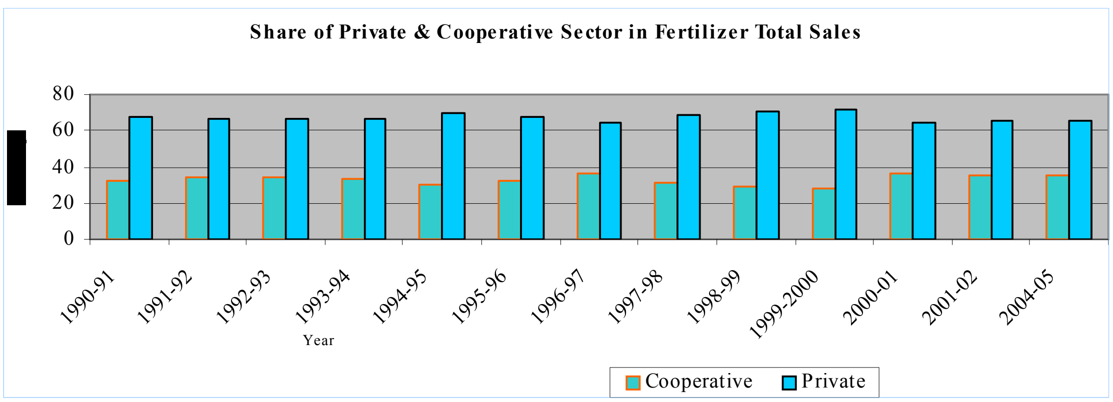
Source: "Fertilizer Statistics 2005-06" Published by Fertilizer Association of India

3.5 Fertilizer Distribution

Distribution of fertilizer is being done through cooperatives, agencies and private retailers. These cooperative agencies are functioning in villages where farmers are required to be members of the same. Being a member of the society, they can easily obtain fertilizer that is made available to these societies from time to time. These societies run under the state government and states are responsible for their proper functioning, whereas, anyone can buy fertilizer from private retailers. In India, there are number of cooperative societies and private retailers, who all are responsible for the distribution of fertilizer. These societies and retailers are functioning well at present. The figure 3.1 and 3.2 shows the trend in number of fertilizer sales and sales points between private & cooperative sector, in India.

Figure 3.2 shows that sales points of private retailers have continuously increased ever since 1990 rather than cooperative agencies that have lost their share from 35 to 21 from 1990 to 2006, in terms of distribution points (Fertilizer Statistics, 2006). It shows that private retailers have been rather aggressive in comparison to cooperative/ government, in the process of opening new selling points and to further exploit the opportunity of fertilizer sales to various customers.

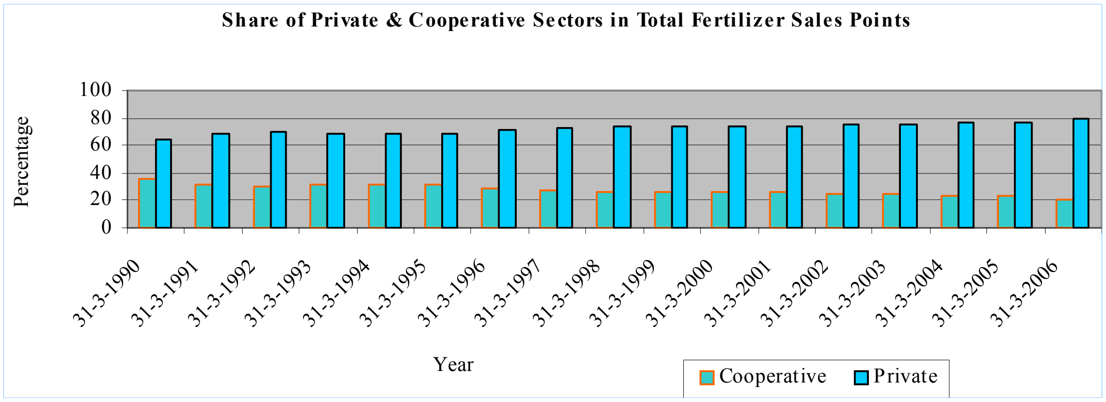
Figure 3.1 Share of Cooperative and Private in Total Fertilizer Sales



Source: "Fertilizer Statistics 2005-06" Published by Fertilizer Association of India

However, the cooperative agencies have not been that very enthusiastic to open the new selling points, but have increased the share in total distribution pie of fertilizer since 1990-91 (figure-3.1). The share for cooperatives in fertilizer sales has increased marginally from 32 percent in 1990-91 to 34 percent in 2004-05 (Fertilizer Statistics, 2006).

Figure3.2Percentage Share of Cooperative & Private Agencies in Total Fertilizer Distribution points



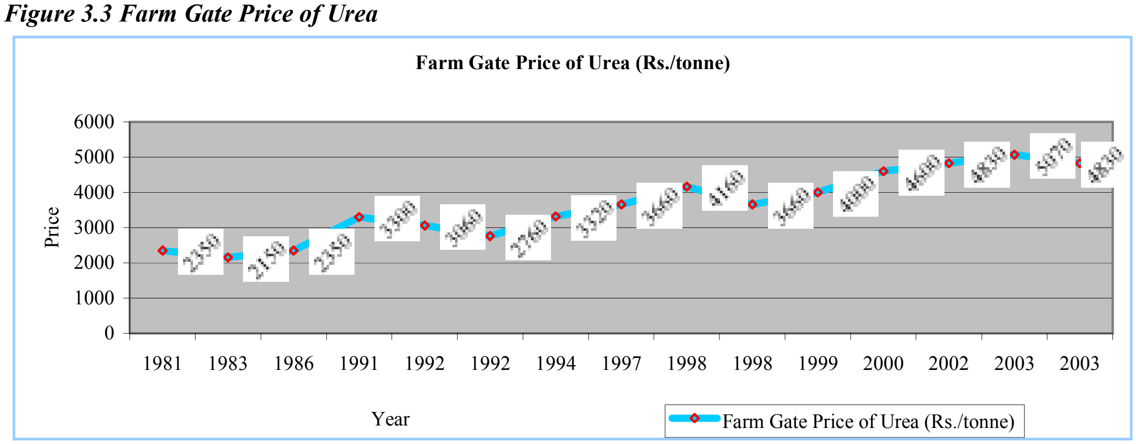
Source: "Fertilizer Statistics 2005-06" Published by Fertilizer Association of India

3.6 Farm Gate Price:

Consumer prices of fertilizer have always been controlled in the country. Even when government had declared decontrolling potassic and phosphatic fertilizers, it had to revert back to exercising control in terms of declaring "Indicative MRPs" and also declare a concession scheme. Initially, as a strategy for 'Green Revolution' the government wanted to provide incentive for increased usage of fertilizers for increased food grain production. Since then, the GOI has not been able to increase the fertilizer prices substantially. As a result it is evident from the figure given below that in last 25 years the farm gate price of urea has effectively only doubled while the domestic cost of production (mainly due to rise prices of petroleum feedstock) and the international price of the same have increased manifold.

Prices of feedstock have also increased substantially, in this period. Due to this, the cost of production of fertilizer has gone up. Increase in the energy prices and other costs have led to a substantial increase in the cost of fertilizer. Consequently, the cost of urea has gone higher but relatively consumer prices of the same have been stagnant. In 2003, once the farm gate prices of urea were set at Rs.5070, but soon it was rolled back to Rs. 4830 (Ministry of Chemicals and Fertilizers, 2006). Since then, there has been no formal announcement of increase in farm gate price of urea despite, the Prime Minister's view that the government can not bear the subsidized prices of various commodities any more.

Figure 3.3 Farm Gate Price of Urea



Source: "Fertilizer Statistics 2005-06" Published by Fertilizer Association of India

Chapter 4

METHODOLOGY

4.1 Fertilizer Demand Projection:

The production of fertilizer is continuous whereas the demand for fertilizer is seasonal. It is a constant endeavor of the government to ensure the supply of fertilizer to farmers at the right time in sufficient quantity, which would be conducive for agricultural growth and imperative for the well being of farmers. To fulfill this basic objective, a proper demand estimation of fertilizer is crucial. In addition, it will also help to plan for the supply of feedstock and other raw materials for the other related sectors. A realistic demand will enhance the overall efficiency of the sector.

Putting in perspective the fundamental of a realistic demand estimation model of fertilizer, several committees constituted by the government and industry (private and government undertakings) have projected the demand for fertilizer in India for different crop seasons. Table 4.1 summarizes the available projected demand estimate of Alagh committee 2005 and FAI 2005.

So far available various demand projection methodologies followed by Alag committee 2005 or FAI are projecting the demand for urea till 2011-12. Urea is an important fertilizer having wider implication on total subsidy and NG requirement by the fertilizer industry, excruciate the needs of a model, which can project demand for a long horizon. Alag committee to project urea demand has used model developed by National Center for Economics and policy Research (NCAEPR). They follow normative approach, which worked out demand as the quantity of the fertilizer needed to produce specified level of agriculture output and positive approach, which estimated the quantity of fertilizer demanded corresponding to different scenarios of variables. FAI has adopted population nutrition, and food grain target and multiple regression approach. IRADe model is an auto regression time series analysis, which assumes fertilizer demand, is a factor of availability of irrigation facility, Price of output and rainfall.

4.2 Explanation of Variables Taken into Consideration in the Model:

In India the quantum of net sown area is limited. For last few years it is fluctuating around value of 140 million hectares. With the constant increase in population the pressure on arable quality land is increasing. The natural response is to increase the cropping intensity, by planned irrigation there and by increasing the gross cropping area.

Water is an important component of agriculture factors of production. Water demand is affected by the area irrigated with groundwater and by surface irrigation efficiency, inclusive of rainfall. The demand of water is sustained by rainfall, groundwater balance of the area, and the irrigation facility developed in the area.

The rainwater charges the rain fed rivers and replenishes tank storage and wells. Water harvesting method like the management of tank systems, check-dams etc induces storage and recharging of ground water. These factors underscore sustainability implications of irrigation infrastructure, more so in semi-arid and deficit rainfall conditions. The performance of rainfall in a year is an unpredictable variable. The importance of rainfall on irrigation, cropping intensity can be evaluated. The rainfall performance index (base value for normal rainfall has been taken as 100) has been used to evaluate the growth in gross cropping area, to estimate cropping intensity. Thus, rainfalls as well as irrigation both are needed for demand projection.

4.2.1 Fertilizer Price

Demand and real price (price adjusted for agriculture GDP deflator) of fertilizer are inversely related. The benefits of farmer is associated with price of output (food grains), which is not subject to a high volatility and it is capped by government due to its high share in whole sale price index (WPI) and its adverse impact on the poor section of society. On the other side, agriculture prices are also related to international price, which is heavily subsidized under the pressure from farmers lobby, by the concerned governments around the world, notably EU and the USA. Under WTO obligations, countries have to open their agriculture sector.

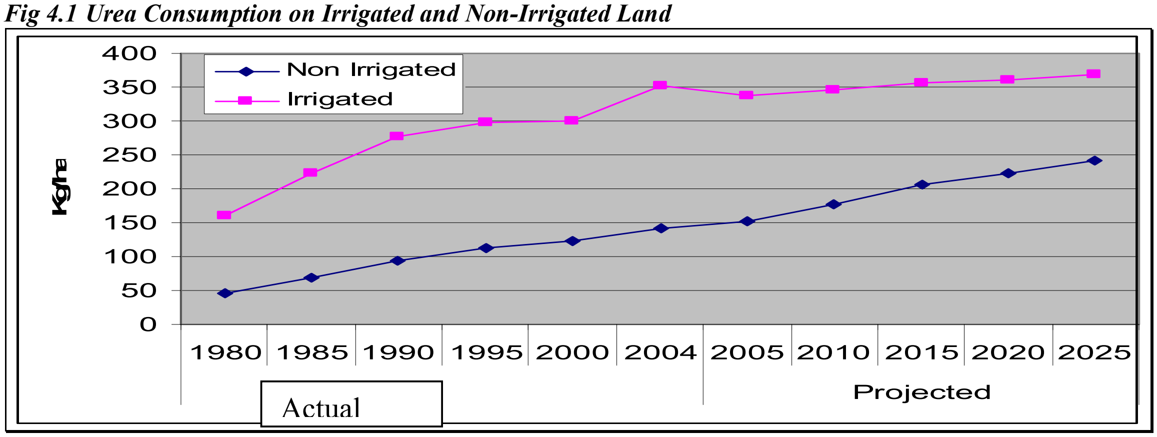
4.2.2 Ratio of Gross Area Irrigated to Sown Area

To cope with the rising demand for food grains and to boost agriculture growth government has assigned a high priority to the sector. Greater emphasis is provided to cover most of the sown area under irrigation facility. Consequently, share of gross irrigated area is increasing. Fertilizer is used extensively on irrigated land. Availability of irrigation facility also increases crop intensity and promotes adoption and use of high yielding variety seeds, which requires high dose of fertilizer. HYV seeds are used mostly on irrigated land, as it needs extensive irrigation facility to grow. HVY seeds require heavy dose of fertilizers.

Availability of irrigated land ≅ Extensive use of HYV seed ≅ Heavy dose of fertilizer ≅ higher demand of fertilizer**.**

Taking into account implication of availability of gross irrigated area on fertilizer consumption, it is taken as an independent variable in the model. Urea consumption per hectare changes significantly with the availability of irrigation facility fig 4.1.

Fig 4.1 Urea Consumption on Irrigated and Non-Irrigated Land



Source: Ministry of Chemicals and Fertilizers, 2005-06
IRADe Analysis

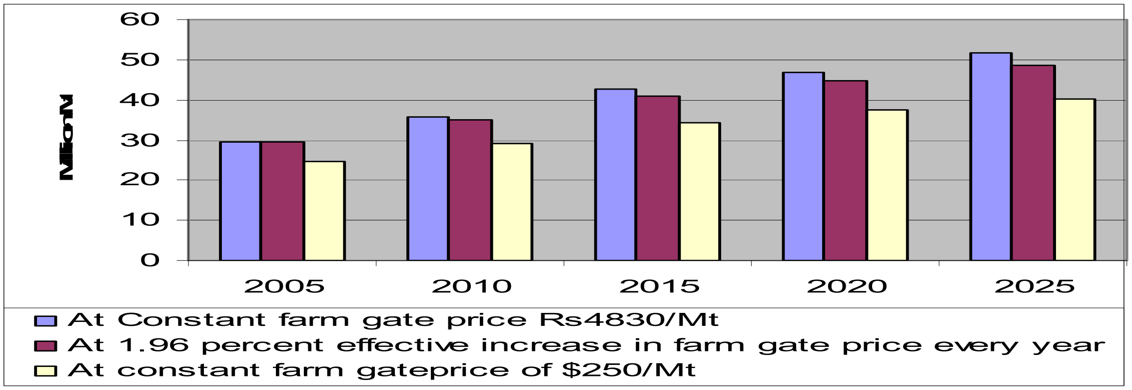
4.2.3 Rainfall

Rainfall from monsoon is vital for use of chemical fertilizer in India. Rainfall dictate consumption of fertilizer in a year, an adverse weather situation would lead to reduction of fertilizer consumption in a year and corollary to this a good weather would lead to a high consumption. Rainfall as a percentage of long-term average value is a good yardstick for the measurement of weather and consequently consumption of fertilizer.

4.3 Projected Demand of Fertilizer Under the Described Scenario

Gross irrigated area is projected for the subsequent years using equation (4.2) and then after by using equation (4.1) total demand for fertilizer is projected, the projected figures are summarized in the figure 4.2

Fig.4.2 Correspondence of Projected Urea Demand to Farm Gate Prices



Source: IRADe Analysis

** 10 percent increase in farm gate urea price at every five years interval.*

Note: *Assumption undertaken for fertilizer demand projection are given below*
The regression equation has used Farm Gate price (Urea) as one of the explanatory variable and "N" consumption as explained variable. This was safely taken because Urea accounts for more than 81% of total "N" requirement. Rest of the 19percent requirement of "N" comes from other fertilizers like DAP, Ammonium Sulphate, ACL, CAN MOP, SOP, etc.

Table 4.1 Projection of Urea Demand by FAI and Alag Committee

Year	Alag Committee (Million MT)	FAI (Million MT)	IRADe Projection
2006-07	21.4	24.3	
2007-08	22.08	25.3	
2008-09	22.70	26.2	
2009-10	23.3	27.1	
2010-2011	24.0	27.9	35.64*

Source: Ministry of Chemicals and Fertilizers, 2005
** Projection is done at every five-year interval basis.*

Projected urea demand is not very sensitive to price (price elasticity of urea demand) as an effective 1.97 percent increase in price every year leads to a decrease in demand by a mere 65 at the end of 2 decades. Even with the substantial rise in fertilizer prices to $250 /Mt does not lead a significant reduction in gross fertilizer demand. These swift price responses of demand to price illustrate low price elasticity of demand.

Chapter 5

POLICY ANALYSIS

NG demands by Indian fertilizer industry are sensitive to changing government policies with respect to the. Increasing subsidy burden to the fertilizer industry has forced the government to review the existing policy towards the industry and to devise a mechanism. Which would be acceptable to all the stakeholders, reduces the subsidy outflow of state exchequer, and at the same time be conducive for the growth of agriculture sector. To realize this objective government proposes reforms on different fronts. The present paper has tried to estimate the demand for NG by fertilizer industry and subsidy under different scenarios, which are defined as the different means of reforms taken by the government on different fronts. It is assumed that NPS will continue and all the plants running on Naphtha and LSHS/FO feedstock will switch to NG feedstock by 2010.

Several scenarios are built based on the anticipated reforms likely to take place in the future in fertilizer Industry to regulate the market and reduce the subsidy outflow, at the same time keep government priorities at place. These reforms are identified as followings:

5.1 Farm Gate Price (FGP) of Urea

The FGP determination is a more of political issue rather than consideration of economic efficiency. Price determination is being done under the influence of farmers' lobby and pro-farmers political parties. The NPS covers the compensation paid to manufacturer for transport and distribution till farmers procure the fertilizer. One of the criticisms of Fertilizer subsidy has been that the total benefit of subsidy does not reach the marginal and small farmers for whom the subsidy scheme was designed. In 1991, government tried dual price scheme that is, a limited quantity is available with subsidy and remaining at market price. The government is in the process of developing a scheme by using smart cards, by which a quota of urea fertilizer will be provided to small and marginal farmers. Present study has assumed following likely urea FGP and their implications for the industry.

P_1 = Current urea FGP (Rs4830/ton) will continue till 2025.
P_2 = An increase of 10% in FGP at every five year (an effective increase of 1.97% every year).
P_3 = FGP equivalent to import parity price which is Rs11250/ton till 2025.
P_4 = Dual pricing system where each farmer household will get 100Kg of Urea at subsidized price of Rs4830/ton and rest they need to buy from market at import parity price of Rs11250/ton.

5.2 APM Gas Availability

Being a high priority sector, the fertilizer industry receives 32 percent of total available APM gas. However, the changing gas market and other economic, environmental and geo-political scenarios have forced the government to revisit the existing policy. It is quite likely that in future fertilizer industry will have to rely on market priced gas to meet their soaring requirements as the existing APM gas supply sources are declining. To capture the essence of likely reforms following 3 NG supply scenarios are considered in the present study.

G -Gas Pricing

G_1 - Fertilizer industry is guaranteed unlimited supplies of NG at APM price.
G_2 – APM supplies declines, and new demand is met with available private gas at reasonable market price.
G_3 – All gas is available at free market price.

5.3 Structural Reform of Fertilizer Producer

Structural reforms consist of prescribing a self-sufficiency level for fertilizer production and to analyze policy measures to rationalize subsidy burden attributed to the sector. The government decided sometimes back that for the sake of food self-sufficiency, 95% fertilizer must be produced domestically. For self-sufficiency, following two probable scenarios are considered:

I_1= 95% self-sufficiency (95% of total demand will come from domestic production and rest 5% will be imported). Although the earlier belief that India must produce 95% of its requirements are in question. India has already violated and it had imported 21.5% of its domestic requirement in 2006-07 (Annual Report, 2006-07 Ministry of Fertilizer, and government of India)

I_2 = 70 % self -sufficiency level (70% of total demand will come from domestic production and rest 30 % will be imported).

Another viable option to meet urea demand requirement by setting up of a joint venture plants in gas rich countries is also considered as a scenario in the study. Whether the production from joint venture plants abroad should be considered under defined self-sufficiency level or not is a political question.

5.4 Outputs

Under the different assumptions in the reference and policy, following outputs have been obtained under different scenarios.

- Demand for NG
- Total subsidy paid by government (with the share of producer and farmer).
- Domestic vs. imported fertilizer breakdown

Table 5.1 Scenarios Generated for Government Policies

Variables	Policy Rationale
Farm gate urea price	
1) Constant Rs 4830/ton till 2025	Subsidy to increase food production by promoting extensive use of fertilizer
2) 10% increase in every interval of 5year	A mild increase in price to reduce burgeoning subsidy to the industry
3) Equivalent to import parity price Rs11250/ton	Absence of protection regime
4) Dual price 100kg at subsidized price and rest is sold at open market price	Protection of interest of marginal and poor farmers

Availability of APM gas 1) Full availability of APM gas 2) Partial availability of APM gas equivalent to 32% of total industry demand 3) Market price gas	To keep urea cost of production at low Cutting down subsidy outflow to industry to make it competitive Rationalization of gas distribution No preferential treatment as well as elimination of gas subsidy completely
Self sufficiency level 1) 95% Self sufficiency 2) 70% Self sufficiency 3) Joint Venture plant in gas rich countries	Protection of food security and hedge against unlikely mayhem in international urea market Efficiency improvement of domestic fertilizer plant Rationalization of fertilizer subsidy with keeping food security at prime
Policy Mix	Optimal solution with taking care of interest of all the stakeholders

5.5 Reference Scenario:

Under this scenario, all the fertilizer plants are assured full supply of APM gas. Government has set a 95% self sufficiency target i.e. 95% requirement of urea will come from indigenous plants and only 5% will be imported. The existing NPS will be in the operation but all the plants running on any other feedstock than NG will switch to NG by 2010.Keeping the rest of the assumptions constant, demand for urea, NG and subsidy for various purposes are calculated for constant farm gate urea price. For year, 2005 different agents (Producer, farmer and importers) subsidies are calculated based on the IRADe developed subsidy calculation mechanism.

Table5.2Unlimited APM gas availability and constant farm gate urea price (Reference scenario)

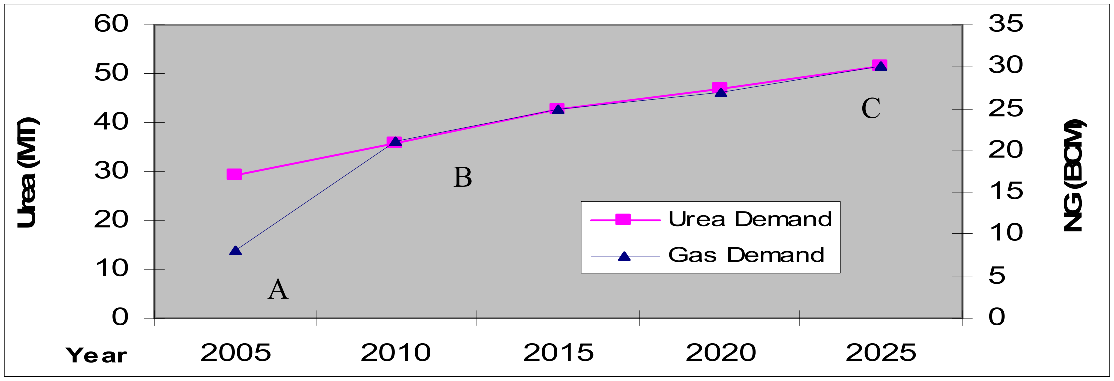
Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	27904	33860	40547	44627	49057
Required Urea Import (‘000 tons)	1469	1782	2134	2349	2582
Effective Gas Price ($/MMBTU)	1.98	1.98	1.98	1.98	1.98
Demand for Gas (BCM)	8.17*	21	25	27	30
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	78.66	104.55	113.43	132.82	159.77
Subsidy to Producers (Rs. Billion)	15.38	-	-	-	-
Subsidy to Farmers (Rs. billion)	58.56	87.35	119.76	139.53	161.00
Subsidy for Import (Rs. Billion)	10.30	12.50	14.97	16.47	18.11
Total Subsidy (Rs. Billion)	84.24	99.85	134.73	156.01	179.11

Source: IRADe Analysis

* Actual gas consumed by the fertilizer industry

If the Urea farm gate price is maintained at a constant level of Rs4830 per tons until 2025, domestic demand for urea fertilizer rises from 29 Mt to 51 Mt an increase of 75 percent in two decades. This rise in domestic urea demand leads to a rise in domestic urea production requirement from 27 Mt to 49 Mt for the same period. NG demand by domestic fertilizer industry is a function of domestic urea production requirement, which rises from 8.17 BCM to 30 BCM a rise of 267 percent in two decades. Total Subsidy burden rises from Rs.84 billion to Rs.179 billion during the same period.

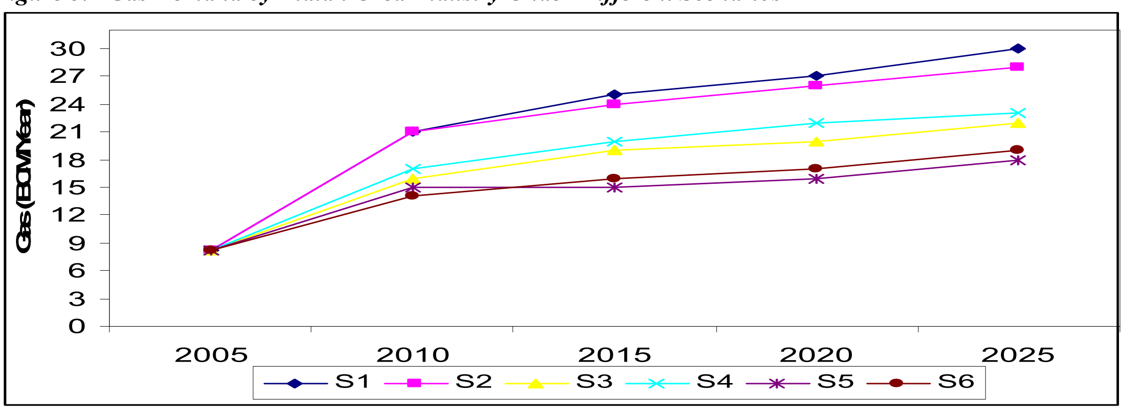
Figure 5.1Urea and NG Demand under Reference Scenario



Source: IRADe Analysis

Change in urea farm gate price results in the change in urea demand and consequently gas demand and subsidy to various agents. Demand for gas is increasing with the same slope as the demand for area except during the transition period (AB, Fig 5.1). A rapid increase in gas demand during this period is taking place on account of fuel switch by the plants running on other feedstock to NG but after the transition phase NG demand by industry is increasing with a constant slope.

Figure 5.2 Gas Demand by Indian Urea Industry Under Different Scenarios



Source: IRADe Analysis

Note: Gas demand is a function of farm gate urea price and self-sufficiency level and distribution.
Demand for gas for year 2005 is the actual consumption (8.17BCM) by the industry.
S1 = Constant farm gate Urea price and 95% self-sufficiency.
S2 = Urea farm gate price increases effectively by 1.96% every year and 955 self-sufficiency.
S3 = Constant farm gate urea price and 70 % self-sufficiency.
S4 = Farm gate urea price would be at the level of $250/Mt till 2025 and 95% self-sufficiency.
S5= Farm gate urea price would be at the level of $250/Mt till 2025 and 70% self-sufficiency.

S6= Every farmer will be provided 100Kg of Urea at subsidized price (Rs4.83 /Kg) and rest of the quantity will be sold at market price (Rs11.25/Kg)

NG demand to the industry is sensitive to the policy variables i.e. changing policy measures changes demand for NG also. Demand for NG, which is to 30BCM for year 2025 under reference scenario drops down to 18BCM for 70% self-sufficiency and $250 urea farm gate price for the same year.

5.7 Simulation of scenarios

5.7.1 Scenario 1A Increased Farm Gate Urea Price

Keeping rest of the assumptions constant as the reference scenario demand for urea, NG and subsidy is calculated. In this scenario farm gate urea price is increased by 10 percent at the interval of every 5years.

Table5.3 Unlimited APM Gas Availability and Increasing Farm Gate Urea Price

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Increased Farm Gate Price of Urea (Rs./MT)	4830	5313	5844	6429	7072
Total domestic Urea demand (000 tons)	29391	34936	41007	44685	48632
Required Indigenous Urea Production (‘000 tons)	27904	33189	38957	42451	46200
Required Urea Import (‘000 tons)	1487	1747	2050	2234	2432
Effective Gas Price ($/MMBTU)	1.98	1.98	1.98	1.98	1.98
Demand for Gas (BCM)	8.17	21	24	26	28
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	78.66	94.62	102.36	119.35	142.89
Subsidy to Producers (Rs. billion)	15.38	-	-	-	-
Subsidy to Farmers (Rs. Billion)	58.56	68.07	74.60	71.52	64.82
Subsidy for Import (Rs. Billion)	10.30	11.41	12.30	12.10	11.61
Total Subsidy (Rs. Billion)	84.24	79.48	86.90	83.62	76.43

Source: IRADe Analysis

It can be seen that the price elasticity of the demand for urea is not very significant a rise of price by 46 percent from Rs4830 per MT (reference scenario) to Rs7072 Per MT for year 2025 leads to a fall in demand by a mere 6 percent. This fall in demands result as a fall in NG demand by indigenous fertilizer sector from 30 BCM to 28 BCM. However, this change in urea farm gate price has significant implications on the subsidy outflow. This subsidy will by 2025 fall by Rs103 billion i.e.58 % over the reference scenario due to rise in urea price.

5.7.2 Scenario 1B High urea farm gate prices (commensurate to import parity price, $250/ton)

Unlimited APM gas and urea farm gate price has risen to the level of Rs.11250/ton. Unlimited supply of APM gas to all the fertilizer plants will be ensured, imports restriction will be enforceable until 2025 i.e. 95 percent self – sufficiency level will be prescribed and 5 percent domestic demand will be meet from abroad. NPS is dismantled in favor of more market based pricing scheme; urea farm gate will increase to match with import parity price and it will be Rs11250 per tons until 2025.

Table5.4 Farm Gate Price at marketrate$250/ton

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea (Rs./MT)	11250	11250	11250	11250	11250

Total domestic Urea demand (000 tons)	24533	29178	34251	37323	40214
Required Indigenous Urea Production (‘000 tons)	23306	27719	32538	35457	38203
Required Urea Import (‘000 tons)	1227	1459	1713	1866	2011
Effective Gas Price ($/MMBTU)	1.98	1.98	1.98	1.98	1.98
Demand for Gas (BCM)	8.17	17	20	22	23
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	67.66	80.01	86.41	100.68	119.30
Subsidy to Producers (Rs. billion)	15.1	-	-	-	-
Subsidy to Farmers (Rs. Billion)	-	-	-	-	-
Subsidy for Import (Rs.billion)	.73	.87	1.02	1.11	1.19
Total Subsidy (Rs. billion)	16.11	.87	1.02	1.11	1.19

Source: IRADe Analysis

At a high urea farm gate price commensurate to import parity price (Rs11250 /Mt) demand for urea reduces substantially for 2025 by approximately 21 percent from 51 Mt in reference scenario to 40 Mt. Consequently, demand for NG by fertilizer sector slashed down to 23BCM a decline of 23 percent in for year 2025 against reference scenario. However, subsidy has gone down to insignificant level, subsidy to farmers and producers are nil. Retention price of none of the indigenous fertilizer plant is beyond this farm gate urea price level. Subsidy is only going to subsidize imported fertilizer price, which is hovering above the farm gate urea price.

5.8 Scenario set 2: 70 percent self-sufficiency and full APM gas availability

Under this scenario impact of import restriction and availability of NG at different prices, on the demand of NG and subsidy to the different agents (Producer, farmer and import subsidy) are analyzed.

5.8.1 Scenario 2A: Unlimited APM gas and 70% self sufficiency

All plants receive unlimited supply of APM gas. Import restriction is liberalized under this scenario only 70 percent domestic urea demand will be ensured from indigenous plants and 30 percent will be imported. NPS will continue until 2025 and all plants will be converted to NG feedstock only by 2010. Urea farm gate price will remain same until 2025.

Table5.5 Unlimited APM Gas Availability and70% Self sufficiency

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	20561	24949	29877	32883	36147
Required Urea Import (‘000 tons)	8812	10693	12804	14093	15492
Effective Gas Price ($/MMBTU)	1.98	1.98	1.98	1.98	1.98
Demand for Gas (BCM)	8.17	16	19	20	22
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	61.10	72.62	79.80	93.80	113.24
Subsidy to Producers (Rs. billion)	15.38	-	-	-	-
Subsidy to Farmers (Rs. Billion)	58.56	44.16	68.04	82.61	98.43
Subsidy for Import (Rs. billion)	61.81	75.00	89.81	98.85	108.66
Total Subsidy (Rs. billion)	135.75	119.16	157.85	181.46	207.09

Source: IRADe Analysis

Reduction of self-sufficiency level decreases indigenous production target and hence domestic demand for NG. Domestic NG demand for year 2025 is 22BCM compared to 30BCM of reference scenario. Under this scenario, a major portion of subsidy goes to subsidized imported fertilizer. In the year 2025, imported fertilizer eaten up 52 percent of total subsidy to the industry and rest 48 percent of subsidy goes to farmers and producers share is nil.

5.8.2Scenario 2B Limited APM Gas and 70% Self Sufficiency:

This scenario is constructed by keeping rest of the assumption constant as in scenario 2A except limited supply of subsidized APM gas.

Table5.6 Limited APM Gas Availability and 70% self sufficiency

Year	2005	2010	2015	2020	2025
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	20561	24949	29877	32883	36147
Required Urea Import (‘000 tons)	8812	10693	12804	14093	15492
Effective Gas Price ($/MMBTU)	2.09	3.68	3.92	4.31	4.79
Demand for Gas (BCM)	8.17	16	19	20	22
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	32.28	29.51	21.96	17.71	13.04
Subsidy to Producers (Rs. billion)	18.35	10.44	12.47	17.64	26.75
Subsidy to Farmers (Rs. Billion)	62.38	84.30	121.11	149.12	180.36
Subsidy for Import (Rs. Billion)	61.81	75.00	89.81	98.85	108.66
Total Subsidy (Rs. Billion)	142.54	169.74	223.39	265.61	315.78

Source: IRADe Analysis

Compared to scenario 2A only subsidy burden is increasing from Rs.207 billion in scenario2A to Rs.315 billion in scenario 2B in year 2025.

5.8.3 Scenario 2C No APM Gas and 70% Self- Sufficiency:

No more subsidized APM gas would be available to fertilizer sector by keeping rest of the assumptions constant as scenario 2A.

Table5.7 No APM Gas Availability (Gas at Market Price Only) and 70%self sufficiency

Year	2005	2010	2015	2020	2025
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	20561	24949	29877	32883	36147
Required Urea Import (‘000 tons)	8812	10693	12804	14093	15492
Effective Gas Price ($/MMBTU)	4.55	4.85	4.65	4.85	5.15
Demand for Gas (BCM)	8.17	16	19	20	22
Subsidy to Producers (Rs. billion)	18.25	15.23	18.91	24.08	32.21
Subsidy to Farmers (Rs. billion)	91.55	109.87	137.19	160.81	188.24
Subsidy for Import (Rs. billion)	61.81	75.00	89.81	98.85	108.66
Total Subsidy (Rs. billion)	101.70	200.10	24592	283.74	329.11

Source: IRADe Analysis

As expected subsidy burden increases from Rs315 billion in scenario2B to Rs329, billion in scenario 2C for year 2025 because of increased retention price.

5.9 Scenario Set 3: Gas Availability

5.9.1 Scenario 3A Limited APM Gas:

In this scenario, supply of APM gas to fertilizer industry declines in future, forcing fertilizer plants to meet their NG requirement by gas made available from different sources. Other assumptions are the same as in the reference scenario: Self-sufficiency level will be at 95 percent. Plants running on naphtha, FO/LSHS feedstock will switch to NG feedstock, and farm gate price of urea will remain constant.

Table5.8 Limited APM Gas Availability

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	27904	33860	40547	44627	49057
Required Urea Import (‘000 tons)	1469	1782	2134	2349	2582
Effective Gas Price ($/MMBTU)	2.09	3.97	4.10	4.44	4.88
Demand for Gas (BCM)	8.17	21	25	27	30
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	32.28	29.51	21.96	17.71	13.04
Subsidy to Producers (Rs. billion)	38.15	14.11	18.39	27.89	42.86
Subsidy to Farmers (Rs. Billion)	109.53	147.94	193.71	227.45	265.23
Subsidy for Import (Rs. Billion)	10.30	12.50	14.97	16.47	18.11
Total Subsidy (Rs. Billion)	157.98	174.55	227.07	271.82	326.20

Source: IRADe Analysis

With Limited availability of APM gas the cost goes up and hence the subsidy increases to Rs326 billion in 2025 compared to Rs.179 billion in reference scenario an increase of 82 percent.

5.9.2 Scenario 3B: No APM Gas:

Subsidized NG supply to the fertilizer industry will discontinue completely and all the plants have to purchase NG at market price for their feedstock requirement. Other assumptions are the same as in reference scenario. Thus imports restriction will remain enforced i.e. 95 percent of domestic fertilizer consumption will come from indigenous plants and import will contribute 5 percent of demand. Plants running on Naphtha and LSHS/FO will be converted to feedstock by 2010. Urea farm gate price will remain at the same level.

Table5.9 No APM Gas Availability (Gas at Market Price Only)

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	27904	33860	40547	44627	49057
Required Urea Import (‘000 tons)	1469	1782	2134	2349	2582
Effective Gas Price ($/MMBTU)	4.55	4.85	4.65	4.85	5.15
Demand for Gas (BCM)	8.17	21	25	27	30
Subsidy to Producers (Rs. billion)	38.15	25.17	28.82	37.19	50.25
Subsidy to Farmers (Rs. Billion)	138.69	167.08	205.70	236.21	271.12
Subsidy for Import (Rs. Billion)	10.30	12.50	14.97	16.47	18.11
Total Subsidy (Rs. Billion)	187.14	204.75	249.49	289.87	339.48

Source: IRADe Analysis

Compared to reference scenario the only change is in the level of subsidy burden. It increases to Rs.339 billion in 2025 from Rs179 billion in the reference scenario.

5.10 Scenario 4: Policy Mix (Rising Urea Price by 1.97% Annually and Availability of APM Gas)

5.10.1 Scenario 4A Rising Urea Price with Limited APM Gas:

In this scenario, supply of APM gas to fertilizer industry declines in future, forcing fertilizer plants to meet their NG requirement by gas made available from different sources. Other assumptions are the same as in the reference scenario: Self-sufficiency level will be at 95 percent and the urea farm gate price decreases by 1.97% every year.

Table5.10 Limited APM Gas Availability and Increasing Farm Gate Urea Price

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Increased Farm Gate Price of Urea (Rs./MT)	4830	5313	5844	6429	7072
Total domestic Urea demand (000 tons)	29391	34936	41007	44685	48632
Required Indigenous Urea Production (‘000 tons)	27904	33189	38957	42451	46200
Required Urea Import (‘000 tons)	1469	1747	2050	2234	2432
Effective Gas Price ($/MMBTU)	2.09	3.95	4.08	4.42	4.86
Demand for Gas (BCM)	8.17	21	24	26	28
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	32.28	29.51	21.96	17.71	13.04
Subsidy to Producers (Rs. billion)	38.15	2.88	6.33	14.25	26.85
Subsidy to Farmers (Rs. Billion)	109.53	127.23	143.51	145.18	142.97
Subsidy for Import (Rs. Billion)	10.30	11.41	12.30	12.10	11.61
Total Subsidy (Rs. Billion)	157.98	141.52	162.14	171.53	181.43

Source: IRADe Analysis

With Limited availability of APM gas the cost goes up and hence the subsidy increases to Rs181.43 billion in 2025, but increased urea farm gate price has controlled the substantive rise in subsidy.

5.10.2 Scenario 4B: No APM Gas and Increasing Urea Price:

Subsidized NG supply to the fertilizer industry will discontinue completely and all the plants have to purchase NG at market price for their feedstock requirement. Other assumptions are the same as in reference scenario. Thus imports restriction will remain enforced i.e. 95 percent of domestic fertilizer consumption will come from indigenous plants and import will contribute 5 percent of demand.

Table5.11 No APM Gas Availability (Gas at Market Price Only) and Increasing Farm Gate Urea

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Increased Farm Gate Price of Urea (Rs./MT)	4830	5313	5844	6429	7072
Total domestic Urea demand (000 tons)	29391	34936	41007	44685	48632
Required Indigenous Urea Production (‘000 tons)	27904	33189	38957	42451	46200
Required Urea Import (‘000 tons)	1469	1747	2050	2234	2432
Effective Gas Price ($/MMBTU)	4.55	4.85	4.65	4.85	5.15
Demand for Gas (BCM)	8.17	21	24	26	28

Subsidy to Producers (Rs. billion)	61.85	12.08	15.33	22.42	33.41
Subsidy to Farmers (Rs. Billion)	112.76	146.74	155.98	154.37	149.21
Subsidy for Import (Rs. Billion)	10.30	11.41	12.30	12.10	11.61
Total Subsidy (Rs. Billion)	184.91	170.23	183.61	188.88	194.23

Source: IRADe Analysis

Non availability of APM gas added up to the cost of production of indigenous fertilizer producer which should be compensated by budgetary allocation but at the same time rise in farm gate urea price even by a small margin has contained subsidy burden considerably.

5.11 Scenario Set 5: Policy Mix (Urea Price Rs 11250/ton and 70% Self Sufficiency)

Under this scenario impact of managed import, and dismantle of NPS leads to increase of urea farm gate price to Rs11250 per tons are analyzed for the demand of NG by the industry and the subsidy to the different agents. Gad is supplied at APM price.

Table5.12 Unlimited APM Gas Availability and Urea price at $250/ton

Year	2005	2010	2015	2020	2025
Constant Farm Gate Price of Urea (Rs./MT)	11250	11250	11250	11250	11250
Total domestic Urea demand (000 tons)	24533	29178	34251	37323	40214
Required Indigenous Urea Production ('000 tones)	17173	20425	23175	26127	28149
Required Urea Import ('000 tones)	7360	8753	10275	11197	12064
Effective Gas Price ($/MMBTU)	1.98	1.98	1.98	1.98	1.98
Demand for Gas (BCM)	8.17	15	15	16	18
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	58.47	66.92	65.14	75.76	89.65
Subsidy to Producers (Rs. Billion)	15.38	-	-	-	-
Subsidy to Farmers (Rs. billion)	-	-	-	-	-
Subsidy for Import (Rs.'000 billion)	4.37	5.20	6.10	6.65	7.17
Total Subsidy (Rs. billion)	19.75	5.20	6.10	6.65	7.17

Source: IRADe Analysis

Managed import coupled with the high farm gate price reduces subsidy burden as well as NG demand by the fertilizer industry substantially. This scenario also assigns a larger proportion of subsidy outflow to subsidized imported fertilizer and the most vulnerable section (farmers) are not getting anything in subsidy. Even producers subsidy component is nil under ensured unlimited supply of NG to fertilizer industry but the situation changes a bit when gas supply at different prices to industry changes. Gas demand by industry under this scenario reduces to only 18 BCM in 2025 compared to 30BCM under the reference scenario.

5.12 Scenario 6: Scenario Dual Pricing of Urea (Quota System)

Subsidized NG supply to the fertilizer industry would not be sufficient to meet the entire industry demand; some part of their feedstock demand would have to be met at market price. Imports would be liberalized i.e. only 70 percent of total domestic demand will satisfied from the indigenous production and 30 percent of demand will be meeting from imported urea. NPS policy would remain enforceable. Demand for urea is estimated as follow:
Total domestic urea demand/consumed (D) = $D(P_m) + S(P_a) - S(P_a)^* \{D(P_a) / D(P_m)\}$
Where $D(P_m)$ = Demand of Urea at market price (Rs.11250 per tons).

S (P_a) = Urea supplied to farmers at subsidized price (Rs4830 per tons) under quota system (No of farmers household * 100Kg of Urea).
D (P_a) = Demand of urea at subsidized price (Rs.4830per tones).

Table5.13Limited APM Gas Availability, 70% Self sufficiency and Quota System For Urea Distribution

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea charged for urea sold under quota (Rs./MT)	4830	4830	4830	4830	4830
Farm gate price charged for urea sold under free market system (Rs/MT)	11250	11250	11250	11250	11250
Total domestic Urea demand (000 tons)	26437	31274	36534	39698	42771
Required Indigenous Urea Production (‘000 tons)	18506	21892	25574	27789	29939
Required Urea Import (‘000 tons)	7931	9382	10960	11910	12831
Effective Gas Price ($/MMBTU)	2.09	3.58	3.80	4.22	4.71
Demand for Gas (BCM)	8.17	14.51	16.11	17.39	18.64
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	32.28	29.51	21.96	17.71	13.04
Subsidy to Producers (Rs billion)	-	-	-	-	-
Subsidy to Farmers (Rs. Billion)	13.45	29.99	32.39	36.99	42.51
Subsidy for Import (Rs. Billion)	55.63	65.81	76.87	83.53	90
Total Subsidy (Rs. Billion)	69.08	95.80	109.27	120.52	132.50

Source: IRADe Analysis

Dual farm gate pricing of urea system has significant implication on the domestic urea consumption. It reduces from 51 Mt under reference scenario for year 2025 to 42 Mt for the same period a reduction of 18 percent. NG demand which, is a function of domestic urea production target, decreases by 37 percent from 30 BCM under reference scenario to 19BCM for year 2025. 68percent of the total subsidy outflow is going to imported fertilizer and only 32 percent is going in farmer’s kitty in 2025. However, producers share in tax pie is nil.

5.12 Scenario Set 7: Cost of Self-Sufficiency

5.12.1 Scenario7A:

Under this scenario, urea farm gate price is kept constant Rs4830/ton. Domestic fertilizer plants are ensured unlimited APM gas supply and self-sufficiency is kept at 95% of total domestic fertilizer demand. Import parity price $100/ton FOB is considered.

Table5.14 Import at $100 from joint venture plant in gas rich country and 95% Self sufficiency

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	27904	33860	40547	44627	49057
Required Urea Import (‘000 tons)	1469	1782	2134	2349	2582
Effective Gas Price ($/MMBTU)	1.98	1.98	1.98	1.98	1.98
Demand for Gas (BCM)	8.17	21	25	27	30
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	78.66	104.55	113.43	132.82	159.77

Subsidy to Producers (Rs. Billion)	15.38	0.00	0.00	0.00	0.00
Subsidy to Farmers (Rs. billion)	58.56	86.05	118.46	138.23	159.70
Subsidy for Import (Rs. Billion)	1.50	1.82	2.18	2.40	2.63
Total Subsidy (Rs. Billion)	75.44	87.87	120.64	140.63	162.34

Source: IRADe Analysis

Feasibility of import from joint venture plants set up in the gas rich country which has a potential to supply urea at $100/ton need to be explored as it will reduces subsidy out flow substantially. Decision to set up new green field plants domestically should be taken only after doing the cost and benefit analysis. Cost of production of joint venture plants established abroad and cost of production of domestic green field plants need to be accounted. By the simulation result it is clear that subsidy on import of fertilizer has reduced substantially toRs1.5 billion compared to reference scenario in 2005 and it is rising to a mere Rs2.63 billion.

5.12.2 Scenario7B:

Domestic self-sufficiency level is reduced to 70% and limited APM gas is supplied to the industry.

Table5.15 Import at $100 from joint venture plant in gas rich country and 70% Self sufficiency

Year	2005	2010	2015	2020	2025
Constant Farm Gate Price of Urea (Rs./MT)	4830	4830	4830	4830	4830
Total domestic Urea demand (000 tons)	29373	35642	42681	46976	51639
Required Indigenous Urea Production (‘000 tons)	20561	24949	29877	32883	36147
Required Urea Import (‘000 tons)	8812	10693	12804	14093	15492
Effective Gas Price ($/MMBTU)	2.09	3.68	3.92	4.31	4.79
Demand for Gas (BCM)	8.17	16	19	20	22
Subsidy on subsidized NG supplied to fertilizer industry (Rs. Billion)	32.28	29.51	21.96	17.71	13.04
Subsidy to Producers (Rs. billion)	18.35	10.44	12.47	17.64	26.75
Subsidy to Farmers (Rs. Billion)	62.38	84.30	121.11	149.12	180.36
Subsidy for Import (Rs. billion)	8.98	10.90	13.06	14.37	15.80
Total Subsidy (Rs. billion)	89.72	105.64	146.64	181.14	222.92

Source: IRADe Analysis

With increased level of self sufficiency and limited APM gas available, import subsidy component of subsidy has increased due to higher urea import requirement in volume terms and total subsidy to the industry also has increased substantially compare to reference scenario for all the years starting right from 2005 to 2025. This subsidy differential could be considered as the cost of self –sufficiency and limited supply of APM gas.

5.13 Consolidated Scenarios Results:

The table 5.16 presents consolidated results for 2025.

Table 5.16 Consolidated Results of all the Scenarios

Scenario	Gas Demand (BCM) in 2025	Subsidy (Rs. billion) in 2025	Gas Subsidy* (Rs. billion) in 2025	Effective Subsidy (Rs. billion) in 2025
Farm gate urea price				
Constant Rs 4830/ton, full APM gas, 95% self-sufficiency	**30**	**179**	**160**	**339**
10% increase in every 5 year interval, full APM gas, 95% self-sufficiency	28	76	143	219
Equivalent to import parity price Rs11250/ton, full APM gas, 95% self-sufficiency	23	1	119	120
Dual price (100 kg at subsidized price and remaining requirement at market price), limited APM gas, 70% self-sufficiency	19	133	13	208
Availability of APM gas				
Constant farm gate price, full APM Gas, 95%self-sufficiency,	**30**	**179**	**160**	**339**
Constant farm gate price, limited APM gas (equivalent to 32% of industry demand), 95%self-sufficiency,	30	326	13	339
Constant farm gate price, Market price gas, 95% self-sufficiency,	30	339	00	339
Self-sufficiency level				
Constant farm gate price, full APM gas, 95% Self sufficiency	**30**	**179**	**160**	**339**
Constant farm gate price, limited APM gas, 70% Self sufficiency, Joint Venture in gas rich country (import at 100$/ton)	22	223	13	236
Constant farm gate price, full APM gas, Joint Venture plant in gas rich countries (Import at 100$/ton), 95% Self-sufficiency	30	162	160	322
Policy Mix				
Constant Farm Gate price, full APM gas, 95% self-sufficiency,	**30**	**179**	**160**	**339**
Constant farm gate price full APM gas, 70% self-sufficiency	22	207	113	320
Constant farm gate price, Limited APM gas, 70% self-sufficiency	22	316	13	329
Constant farm gate price, Market price gas, 70% self-sufficiency	22	329	00	329
10% increase in the farm gate price at every 5 year interval, limited APM gas, 95 % self-sufficiency	28	181	13	194
10% increase in the farm gate price at every 5 year interval, market price gas, 95 % self-sufficiency	28	194	00	194
Farm gate price at Rs. 11250/ton, full APM gas, 70% self-sufficiency	18	7	90	97

Note: Reference scenario is kept in bold.

**Gas subsidy is calculated as a volume of gas supplied to industry multiplied by the difference of market gas price ($5.15/MMBTU) and APM gas price ($1.98/MMBTU).*

Some conclusions can be drawn from this summary:

Gas demand is sensitive to farm-gate urea price and decreases from 30 BCM to 23 BCM as price changes from present Rs. 4830 per tonne to the import parity level of Rs. 11250 per tonne.

- Domestic gas demand falls by 8 BCM when self-sufficiency level is lowered from 95% to 70% keeping all other factors unchanged.

- Domestic gas demand is least at 18 BCM when self-sufficiency target is lowered to 70% and farm-gate price is set to full import parity price. Thus the impact of the two changes together is smaller (12 BCM) compared to the sum of effects of individual changes (8 BCM + 8 BCM).

- The subsidy level depends largely on farm-gate price when the fertilizer industry subsidy and implicit subsidy on gas price are considered together. The split however is important as the fertilizer subsidy comes from the budget and affects fiscal deficit, but the gas subsidy is hidden in the accounts of public sector corporations.

- When gas subsidy is added to the fertilizer subsidy, one gets the effective subsidy for the entire range of options, as presented above. Merely reducing APM gas supply to the industry and leaving urea farm gate price untouched does not have any significant implication on effective subsidy. Because an increase in input cost due to reduced APM gas supply, increases the retention price and ultimately adds to the total subsidy burden. This implies cutting APM gas supply to industry without doing anything else merely shifts the incidence of subsidy from public sector oil companies to department of fertilizer. Decreasing self-sufficiency level and increasing urea farm gate price are the two important reforms, which could reduce subsidy burden.

- Farm gate price and availability of APM gas volume are two important determinants of total subsidy outflow to the sector. A small change in urea farm gate price leads to a significant decline in subsidy.

- Changes in the availability of APM gas leads to a noteworthy rise in subsidy demand by the industry. APM gas supply reform does not lead to a significant change in effective subsidy.

- Decreasing self-sufficiency level leads an adverse impact on the subsidy and setting up joint venture in gas rich country also has an offsetting impact on subsidy requirement.

Chapter 6

SUMMARY AND CONCLUSIONS

The study analyzes the implications of various policies associated with the fertilizer (urea) industry and their impact on the long-term demand for NG and growth of fertilizer sector. The major variables are farm gate price, availability of subsidized NG, share of domestic urea production or self-sufficiency levels. Urea industry is an anchor customer of NG and hence availability of NG at a reasonable price can sustain healthy growth of the sector.

Fuel switch by all the plants from other feedstock to NG leads to a sharp rise in NG demand for fertilizer sector. The consumption level of NG rises from 8.27 BCM in 2005 to 21 BCM in 2010. This switch is expected to complete by the year 2010. Subsequently, the demand of NG for fertilizer sector is proportional to the projected demand of urea that will be produced in the country.

Analysis of urea demand for previous twenty-five years indicated that the variable is sensitive to real price of urea, level of irrigation, and rainfall index. Estimating demand equations using these variables, urea demand, gas demand and subsidies are calculated up to the year 2025. For brevity, we only discuss the results for 2025.

The demand of urea has been projected for the next two decades for different farm gate prices. In the year 2025, reference scenario farm gate price is Rs.4830/Mt and projected urea demand and NG demand for 95% self-sufficiency are 52 MT and 30 BCM respectively. However a marginal increase in farm gate price of urea by effectively 1.97% every year reduces urea and gas demand to 49 MT and 28 BCM respectively. Increase in urea price by a small margin does not lead to a significant impact on urea demand but making urea price equivalent to import parity price ($250/ton FOB price) reduces urea demand to 42 MT and corresponding NG demand to 23 BCM.

The subsidy of NG was incorporated for calculation of the total subsidy burden. It was observed that the price of gas has significant impact on cost of production per ton of urea. Assuming a scenario, that the industry is provided with total gas requirement at the APM price of $1.98/MMBTU, the implicit subsidy burden would be estimated at Rs. 34 billion in 2005 and Rs. 107 to 153 billion in 2025. The subsidy paid to industry is dependent on farm gate price, and volume of urea consumption. As the projected demand of urea and NG price increases the estimated subsidy payable to industry increases. For market based import parity urea farm gate price and full APM priced gas availability; the subsidy payable to industry is zero, but still a significant subsidy in the form of gas subsidy is received by the industry. The subsidy payable for the reference case is Rs. 178 billion. Analysis of self sufficiency policy based on the subsidy payable to urea manufacturers is misleading, as with APM gas the subsidy payable to industry is less, for 95% self sufficiency scenario, while it is more for the same scenario for market priced gas. It is prudent to analyze self-sufficiency policy in the context of total subsidy burden on government. The analysis was conducted for sourcing of import from joint venture fertilizer companies at US$ 100 per ton. The effective decline of subsidy burden of government at 70 percent self-sufficiency was estimated at 28 percent for reference scenario and 38 percent if in addition farm-gate price is hiked by 10 percent every five years. In some composite policy scenario availability of APM priced gas is assumed to decline for fertilizer sector.

Total requirements can be met through

(i) Domestic production from green-field and brown-field plants
(ii) Indian companies establishing joint venture companies in gas rich countries, like Oman India Fertilizer Company,
(iii) Import of urea.

Such scenarios can be evaluated in terms of cost parity. The Industry has to devise ways to decrease the cost of production. The green field plants can be provided with APM gas for first few years to stabilize their operation. Major gas discoveries in recent times have been in the offshore sedimentary basins. The new urea manufacturing plants can be established at the landfall region to make them more economical as the gas would be available to near vicinity. The government should approve the plants with capacity, which is found efficient on economic scale.

The government subsidizes urea to promote the use of fertilizers by the small farmers and to keep the food cost low while compensating the differences between the retention price (cost-plus some profit) and the subsidized price. Thus, the government is embroiled in gas subsidy, fertilizer subsidy and food subsidy. If one is reduced then the other goes up in the same proportion. However, given that each day the fiscal discipline is getting tighter, gas subsidy should not be hidden in corporate accounts of gas companies but shown in a transparent manner in. the account of the fertilizer sector.

The farm gate price of urea has been constant for many years. Hike in farm gate prices could be considered as step towards cutting down subsidy to the industry to make it efficient and competitive. Compensating industries on “cost- plus” basis does not promote cost reduction through technological innovation and efficiency improvements. On the other hand total subsidy elimination through competitive market pricing leads to increase in food costs and less food production due to low use of fertilizer. Gradual transition may help in the long run.

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Appendix

Fertilizer Demand Estimation:

To estimate the per hectare demand for fertilizer, we used 26 years (from 1978-79 to 2003-04) of data on the per hectare consumption of fertilizer[12], inflation adjusted price of fertilizer[13], rainfall index[14] and ratio of gross irrigated and gross sown area (in Million hectares).

To make the model simple only fertilizer cost is assumed as a proxy for the cost of production, which farmers will take into account for the calculation of their profit from the farming. It is further assumed that the farmers will be able to receive a constant[15] market price for their produce; same price is taken for the self-consumed food also. Profit from the farming is calculated as the difference between values[16] of output and input. We use P_{ti} to denote the profit of an individual farmer i from farming at any t. P_{yt} denote price of output, which is same for all the crops irrespective of type and quality. Y stands for the output quantity. P_{ft} is the farm gate price of fertilizer at any time t. f symbolize the amount of fertilizer used to get the desired level of crop Y.

Crop yield is a quadratic function of dose of fertilizer used, yield increases with increased use of fertilizer with decreasing rate, i.e. initial dose of fertilizer increases crop yield significantly but as we keep on increasing the dose of fertilizer the rate of consequent increase in crop yield decreases. Use of fertilizer is a function of farm gate price of fertilizer, availability of irrigation facility and rainfall. Profit of farmers from the farming is negatively related to the price of fertilizer i.e. a higher fertilizer price will dampen down farmer's profit. Availability of irrigation facility is also an important determinant of fertilizer dose to be used. A better irrigation facility will promote use of high yielding varieties (HYV) of seeds, which require a higher dose of fertilizer. Rainfall also determines the dose of fertilizer. A higher rainfall in a particular year will induce higher dose of fertilizer (as the rainfall is a good substitute of better irrigation facility) and consequently lead to higher fertilizer consumption in the same year.

Maximize farmer's objective function.

Profit $(P_{ti}) = (P_{yt} Y - P_{ft} f)$……………………(i)

= (Value of output – Value of input.)

Where

$Y = (\alpha + \beta f - \mu f^2)\, g\,(A_{irrig} / A_{sown})$……………….(ia)

$f = f\,(Pf/P_y, A_{irrg} / A_{sown}, R)$………………………(ib)

By differentiating equation (ia) with respect to fertilizer dose "f" we get Y'' a negative factor, which shows Y increases with increasing f with decreasing rate.

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[12] Ratio of total fertilizer (Ministry of fertilizer, Government of India) in the country and gross sown area (agriculture census)

[13] Farm gate Price of (Ministry of fertilizer, Government of India) fertilizer in Rs per quintal divided by agriculture GDP deflator. Agriculture GDP deflator is defined as the ratio of agriculture GDP at current price and agriculture GDP at 1991 price (Central statistical organization, New Delhi).

[14] As percentage of normal rainfall, economics survey of India, 2005-06

[15] Same price is taken for all the crops. Price will be same through out the spatial jurisdiction and across the time.

[16] Market Price multiplied by quantity.

$Y'' = -2\mu f\, g\,(A_{irrg} / A_{sown})$ (a negative factor)

We use f^t to denote the per hectare demand for fertilizer in the country in year t, $P^t{}_f / P^t{}_{agr}$ stands for the real price of fertilizer in year t, $A^t{}_{irrg}/ A^t{}_{sown}$ denote the ratio proportion of gross irrigated and gross sown area in year t and R^t denotes rainfall index. The estimated equation then reveals the proportional impact of all these variables on the per hectare demand for fertilizer f^t in year t. We then estimated the following equations (figures in the brackets of first and second rows below each coefficient show the estimated t-statistics and standard errors respectively, corresponding to the each variable)[17].

$$\underset{\substack{(7.936)\\(.644)}}{\operatorname{Ln} f^t = 5.111} - \underset{\substack{(-1.715)\\(.073)}}{.124} \operatorname{Ln} (P^t{}_f/P^t{}_a) + \underset{\substack{(3.076)\\(.341)}}{1.050} \operatorname{Ln} (A^t{}_{irr}/ A^t{}_{sown}) + \underset{\substack{(4.319)\\(.048)}}{.206} \operatorname{Ln} (R^t) \ldots\ldots\ldots\ldots\ldots \quad (4.1)$$

Further to estimate, the gross sown area a separate model is constructed. Gross sown area depends on the availability of gross irrigated area and the expectation of rainfall in the same year[18]. We use $A^t{}_{sown}$ to denote gross sown area in million hectares in year t, $A^t{}_{irr}$ indicate the available gross area having irrigation facility in year t and R^t denotes the rainfall index in year t. The estimated equation then shows an econometric relation of gross irrigated area and rainfall with gross sown area (figures in the brackets of first and second rows below each coefficient show the estimated t-statistics and standard errors respectively, corresponding to the each variable)[19].

$$\operatorname{Ln}(A^t{}_{sown}) = \underset{\substack{(30.722)\\(.123)}}{3.793} + \underset{\substack{(8.680)\\(.023)}}{.198} \operatorname{Ln} (A^t{}_{irr}) + \underset{\substack{(6.016)\\(.021)}}{.129} \operatorname{Ln} (R^t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4.2)$$

Model Validation

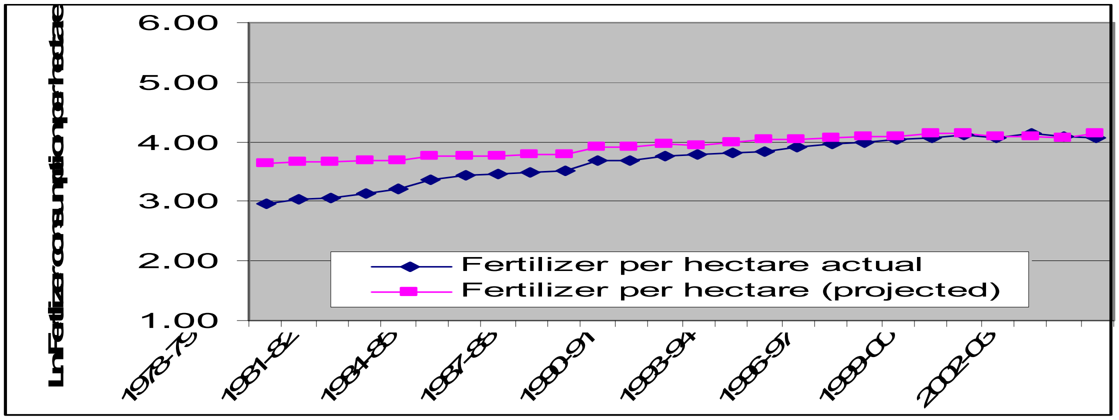
In order to validate the model, a plot comparing the actual and estimated per hectare consumption of urea over the observed time period is plotted in fig.4.2

[17] Auto regression time series model was estimated by taking 26 (from year 1978-79 to 2003-04) data points. Since the error term was auto-correlated, Cochrane orcutt iteration procedure was used to estimate the suitable model. 14th iteration gives the good result with d-statistics 1.107. The R-square for the model is .557 and the standard error of estimate for the model is .034.

[18] Farmer's decision to sow crop is dependent on the expected rainfall in the year. Though rainfall has a significant implication on the crop selection, expectation of higher rainfall will tilt cropping pattern in the favour those crops, which require better irrigation system.

[19] Auto regression time series model was estimated by taking 26 (from year1978-79 to 2003-04) data points. Since the error term was auto-correlated, Cochrane orcutt iteration procedure was used to estimate the suitable model. 3rd iteration gives the good result with d-statistics 1.779. The R-square for the model is .865 and the standard error of estimate for the model is .012.

Actual and Projected Urea Consumption Per Hectare



Source: IRADe Analysis

Estimation of NG Demand: Methodology

Projected demand for "N" (in 000 tones) using the "Urea demand estimation model" is, used for computation of Gas Requirement and Subsidy burden for the corresponding future years. The N demand has been converted to Urea demand-using assumptions (a) Urea contains 46% N.

For the calculation of retention price under NPS (New Pricing Scheme) indigenous urea manufacturing plants are categorized under following groups based on vintage and feedstock. These classifications are kept constant for subsidy calculation.

(1) Fertilizer units using NG feedstock – commissioned before 1992

(2) Fertilizer units using NG feedstock – commissioned after 1992

(3) Fertilizer units using Naphtha feedstock

(4) Fertilizer units using FO/ LSHS feedstock

(5) Fertilizer units using mixed gas (Naphtha > 25%, rest NG) feedstock

(6) Additional urea Fertilizer required over and above cumulative sum of present fertilizer units capacity. Wherever the additional capacity was computed having negative value, the value for that scenario was made equivalent to zero. The energy requirement value for the year 2005 for each tons of Urea was used on average of actual reported value. For subsequent years 2010, 15, 20, 25 are shown in Table 4.1.

Energy Requirement for per Unit Urea Production (Gcal)

	1	2	3	4	5	6
2005	6.16	5.67	7.74	9.26	6.96	5.25
2010, 2015, 2020, 2025	6.16	5.67	5.67	6.00	5.67	5.25

It is assumed that by the year 2010, and onwards, all the urea production units will be operating on NG feedstock only. The switch over to NG will lead to a decline in energy consumption and new energy consumption parameters have been used for further computation.

The demand for NG has been calculated on the basis of energy efficiency[20] of the various groups. The energy efficiencies of the respective groups are the weighted mean of unit energy consumption of all the plants in groups. Total energy requirement of a group of a specified capacity in a given year is the product of the total capacity of the concerned group and its unit energy consumption. All energy requirements are calculated in British Thermal Unit (BTU)[21]. Further, total gas requirement in a year is calculated by using another conversion factor (1 MMBTU= 27.8 SCM) (Integrated Energy Policy, 2006).

It is assumed that the existing gas based indigenous urea plants will keep producing in the future using the currently available set of technology, therefore their energy efficiency level (Pre 92 and Post 92 group 6.16M Kcal/tones and 5.67 M kcal/ tones respectively) will remain same in the future. But, the plants running on any other feedstock will switch to NG and energy efficiency of these new plants (switched from naphtha and energy feedstock to NG) should match to the present level of energy efficiency of post 92 gas groups, i.e. 5.67 M Kcal/ tones of urea. While the average energy efficiency of fuel oil plant group is assumed at 6.00 M Kcal/ toned urea[22]. Whereas, for the additional capacity to be added, whether from a green field plant or else from a brown field, the average energy efficiency is assumed to be 5.25 M Kcal/ tones urea.

Estimation of Compensation to Urea Industry: Methodology

Total compensation/subsidy given to the industry is distributed among three different heads and their respective shares in total subsidy are as follow:

1) Producers subsidy (S_p)
2) Farmers subsidy (S_f)
3) Subsidy on imported fertilizer (S_i)

Total Subsidy $S = S_p + S_f + S_i$

Farmers subsidy (S_f) = $\sum^{n}_{g=1}(RPSg - FGP) * Q_g$ where "n" is number of group.
Where RPS = Retention price (Cost of production) of urea including transport cost.
IPP = Import parity price of urea at farmers gate
FGP = Farm gate price
Where Q_g = Quantity of Urea produced by a plant in a group "g" (Group wise classification under NPS reform is taken here).

Producers subsidy (S_p) **= RPS** – IPP

Subsidy on imported fertilizer (S_i) = (IPP – FGP) Q_i
Where Q_i = Quantity of imported urea consumed.

[20] Energy efficiency reveals the energy requirement by a plant, to produce 1 tones of urea.
[21] conversion factor (1Kcal= 3.968 Btu) is taken into consideration
[22] reference: Report of the working group on Fertilizer Industry for the Eleventh Plan 2007-08 to 2011-12, Department of Fertilizer, Ministry of Chemicals and Fertilizers, Government of India

Subsidy for a group is the difference of retention price and the farm gate price of group for subsequent years. The difference multiplied with the total production/capacity groups; give total compensation requirement of the group, in a given year. Computation of retention price is an important factor of compensation estimation. Retention price has three heads Capital retention charges (CRC), Variable cost and Conversion cost.

For Pre-92 and Post-92 gas groups, energy cost comprises 65% of the total variable cost. Computation of the retention price for the group, at varying gas prices is a function of changing total variable cost (energy cost at new gas price) while, the capital charges and conversion costs are presumed to be constant. Resultantly, the retention prices for the groups, varies with varying gas prices depending upon the availability of APM and market gas and their respective prices. For other groups variable cost is computed by considering the revised energy efficiency (energy efficiency when converted to NG feedstock). The costing of gas for fertilizer sector, is done by taking following assumptions:
(a) The price of APM gas is assumed to be US$ 1.98 / MMBTU, and the fertilizer sector gets total requirement of APM gas needed by the sector.

(b) APM gas supplies declines, and the decline rate has been assumed to be 4 BCM in five years. The APM gas is distributed to each anchor customer and share of fertilizer is 32% of available APM Gas. The additional demand of gas is met with cheap private gas (We have taken LNG price projection). The weighted average cost of Gas is computed for further calculation.

(c) All Gas used by the fertilizer sector over the APM gas is priced at the free market price.

(d) The quantum of available market priced gas considered here take a substantial jump, because of Gas Discovery by the Reliance Industries Ltd. (Production is expected to be commissioned by 2009 latest).

The Retention Prices have been Computed Using Formula and Parameter as Indicated in the table:

Feestock: Gas (Pre 1992)	CRC +CC + .65*VC*(ACF/APM) +. 35*VC	CRC= 2266, CC=704, VC=3197 (with ensured unlimited APM gas supply).
Feestock: Gas (Post 1992)	CRC +CC + .65*VC*(ACF/APM) +. 35*VC	CRC= 2266, CC=704, VC=2731(with ensured unlimited APM gas supply).
Feestock: Naphtha (Pre 1992)	CRC +CC + (ACF*45*EC*3.967)	CRS=2369, CC=1200
Feestock: FO/LSHS	CRC +CC + (ACF*45*EC*3.967)	CRS=2369, CC=1200
Feedstock: Mixed	CRC +CC + (ACF*45*EC*3.967)	CRC= 4066, CC=1200
Additional Capacity	CRC +CC + (ACF*45*EC*3.967)	CRC= 6099, CC=1200
CRC = Capital Retention Cost	CC = Conversion Charges	VC = Corresponds to 1-1 2000
VC = Variable Cost	ACF= Average Cost of Fuel	EC = Energy Consumption

** CRC = The standard assumption here is Fuel switching, expansion and revival projects (brown field), de-bottlenecking projects and New plants (Green Field Projects) are carried on capital raised from the market. A target debt-equity ratio is maintained.*

1) Interest cost considered is 12 Percent on debt amount.

2) Pre – tax return on equity considered is 18 percent.

3) 15 years plant life is considered (Depreciation Period).

** CC = A fixed cost of Rs.1200/ tones of Urea is considered for all kinds of projects.*

** VC = Comprises of the cost of raw materials and utilities.*

Assumed NG Price in India (US$/ MMBTU)

	2005	2010	2015	2020	2025
APM Gas	1.98	1.98	1.98	1.98	1.98
Imported LNG	6.50	6.93	6.64	6.93	7.36
Imported Pipeline	4.55	4.85	4.65	4.85	5.15
Domestic Private	4.55	4.85	4.65	4.85	5.15

Source: PESD Team

Estimation of Subsidy on the Provision of Subsidized NG Supplied to Urea Industry: Methodology

Currently Urea industry is getting dual subsidy benefits in the form of receiving APM NG supply and subsidy paid to urea manufacturing unit (Difference of retention price and farm gate price). Implicit subsidy provision for supply of NG is calculated as follow:

Implicit subsidy due to APM gas supply = $(P^{m}_{g} – P^{apm}_{g})* Q_{apm}$

Where

P^{m}_{g} = Free market price of NG.

P^{apm}_{g} = Price of APM gas supplied to fertilizer sector

Q_{apm} = quantity of APM gas supplied to fertilizer sector in BCM

For computation of RPS, weighted average price of Gas has been considered i.e. effective price of NG at which it is supplied to the urea industry. RPS value is used for calculation of subsidy paid to urea manufacturing unit, according to NPS (New pricing scenario).

$P^{e}_{g} = (Q_{m}* P^{m}_{g} - Q_{apm}* P^{apm}_{g})/Q_{i}$

Where Q_m = Quantity of gas supplied at market price.

Q_{apm} = Quantity of gas supplied at APM price.

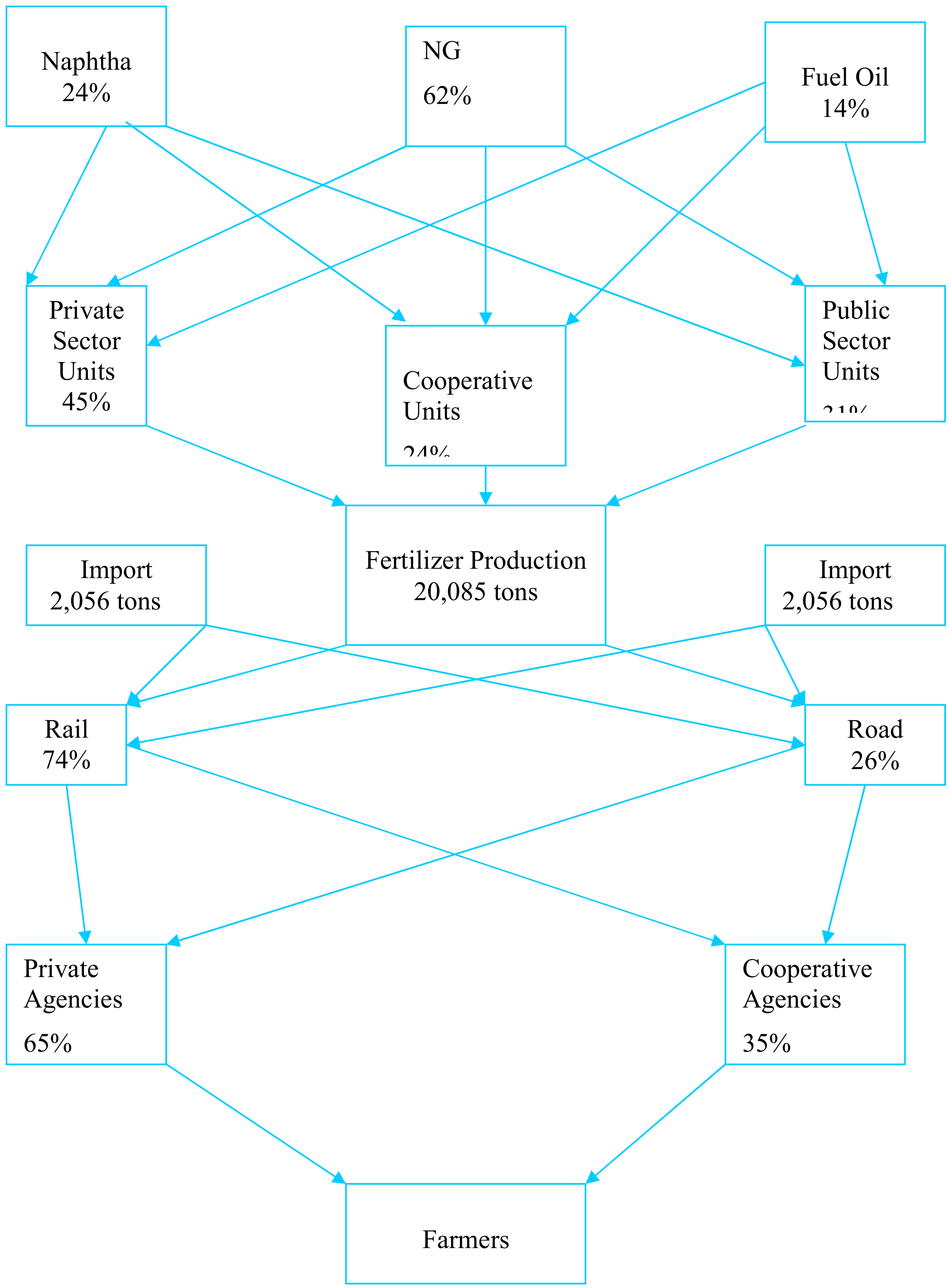
P^{apm}_{g} = Price of APM gas.

Q_i = Total quantity of gas supplied to industry.

P^{e}_{g} = effective price of NG at which it is supplied to the urea industry.

ANNEXURE I

Fertilizer Industry Structure in India



Annexure II

A Flow Diagram Showing Fertilizer Industry Structure