CHAPTER TWO

PROJECT JUSTIFICATION

2.1 SITE JUSTIFICATION

The Nitrogenous Fertilizer Plant (Urea), IEFCL-Train2 Project, constituted mainly the Ammonia and Urea Plant, will be sited in Indorama Eleme Fertilizer & Chemicals limited facility within Indorama complex. A thematic map of the study area can be found in Appendix 2.1. See also the drawing of the complex showing the relative positions of the proposed Ammonia and Urea plant. (Appendix 1.1).

The site has well established off-sites infrastructures and other related facilities for the project to support efficient operations. Other advantages that justify the sitting of the Ammonia and Urea plant in the existing Indorama complex includes: available land with proper soil conditions and a distance of about 15 km from Onne Port (that will be used and adequately equipped to market Urea Fertilizer product), with good marine conditions and limited influence from monsoon weather.

Site selection considered also the geographical and meteorological conditions of the location area (as will be described in chapter 4), in order to take into account any potential effect deriving from air inversion or trapping of pollutants and where prevailing winds are towards sensitive areas. A physical map of the study area, showing the relevant morphological features of the site (within a range of 5 km radius), can be found in Appendix 2.2.

2.2 NEED

The gross imbalance in the supply and demand of fertilizer for agricultural productivity in Nigeria goes to support the need for expansion of existing fertilizer plant.

The recent Federal Governments Gas revolution policy (See Chapter 1, paragraph 1.6.2.3) which authoritatively orders the use of gas for the setting up of fertilizer plants in various parts of the country amongst other uses emphatically supports the need for this project.

Natural gas apart from supplying energy for power has found uses in agricultural and manufacturing sectors to realize the objective of the unsuccessful "Green Revolution" (See Chapter 1, paragraph 1.6.2.3) thereby contributing to the food security and quality of life for the population, reduction of greenhouse gases into the atmosphere and global warming. The project will improve the use of nation's gas resources thereby avoiding wastage of natural resources that contributes to greenhouse gas emissions resulting to global warming.

Natural gas is the primary raw material for the production of ammonia and resultant carbon dioxide for production of urea fertilizer. The use of associated gas by the Train2 project which either to flared from the oil production fields will now be another beneficial attempt to reduce gas flaring.

According to Central Bank of Nigeria, Energy Market Analysis for October 2015, Nigeria's gas reserve is approximately 187 tcf (trillion cubic feet), as such Nigeria, is described as a gas province. Although Nigeria is blessed with abundant gas resources, not much of it has been harnessed, with the nation's primary focus being on crude oil production. The domestic gas market is generally under developed with a record of high gas flaring and a significant percentage of available natural gas being exported as liquefied natural gas.

According to NNPC monthly financial and operation report for July 2017, monthly gas production is at 245.66 Billion Cubic Feet (BCF) translating to average daily production of 8.1BCF, while the natural gas consumption rate of the new fertilizers plant is at 89,600,000 cubic feet of gas per day (about 0.09 BCF)[1], which would cut down on quantity to be released to the environment through gas flaring.

From the period of July 2016 to July 2017, a total of 2,878.49 BCF of gas was produced representing an average daily production of 7,271.08 mmscfd during the period, distributed among Joint Ventures (JVs) 67.87%, Production Sharing Contracts (PSCs) 24.21% and NPDC 7.92% (see Table 2.1).

[1] Natural gas consumption including Fertilizer production (included auxiliary boiler and extra power generation) needs.

Table 2.1 Monthly National Gas Production in BCF and mmscfd

PERIOD	JV	PSC	NPDC	TOTAL
	BCF	BCF	BCF	BCF
Jul-16	139.58	54.64	17.70	211.93
Aug-16	98.90	57.94	17.06	173.90
Sep-16	132.60	54.90	17.40	204.90
Oct-16	144.80	56.50	18.30	219.60
Nov-16	158.66	52.89	17.35	228.90
Dec-16	157.00	45.70	17.42	220.13
Jan-17	159.62	55.79	15.85	231.26
Feb-17	138.62	49.40	15.11	203.14
Mar-17	160.03	51.64	15.24	226.91
Apr-17	174.78	52.75	14.80	242.32
May-17	172.22	54.30	16.18	242.70
Jun-17	152.47	53.77	20.91	227.15
Jul-17	164.32	56.68	24.66	245.66
Total	1,953.60	696.92	227.98	2,878.49

PERIOD	JV	PSC	NPDC	TOTAL
	mmscfd	mmscfd	mmscfd	mmscfd
Jul-16	4,502.56	1,762.65	571.12	6,836.33
Aug-16	3,190.21	1,869.14	550.24	5,609.58
Sep-16	4,418.40	1,829.70	579.50	6,827.60
Oct-16	4,671.90	1,821.90	588.70	7,082.50
Nov-16	5,288.53	1,763.09	578.34	7,629.97
Dec-16	5,064.57	1,474.30	562.03	7,100.90
Jan-17	5,149.07	1,799.65	511.30	7,460.02
Feb-17	4,950.89	1,764.41	539.68	7,254.98
Mar-17	5,162.16	1,665.88	491.54	7,319.58
Apr-17	5,826.00	1,758.00	493.19	8,077.19
May-17	5,555.59	1,751.63	521.89	7,829.11
Jun-17	5,082.24	1,792.34	696.91	7,571.50
Jul-17	5,300.78	1,828.50	795.55	7,924.83
Average	4,935.61	1,760.09	575.38	7,271.08

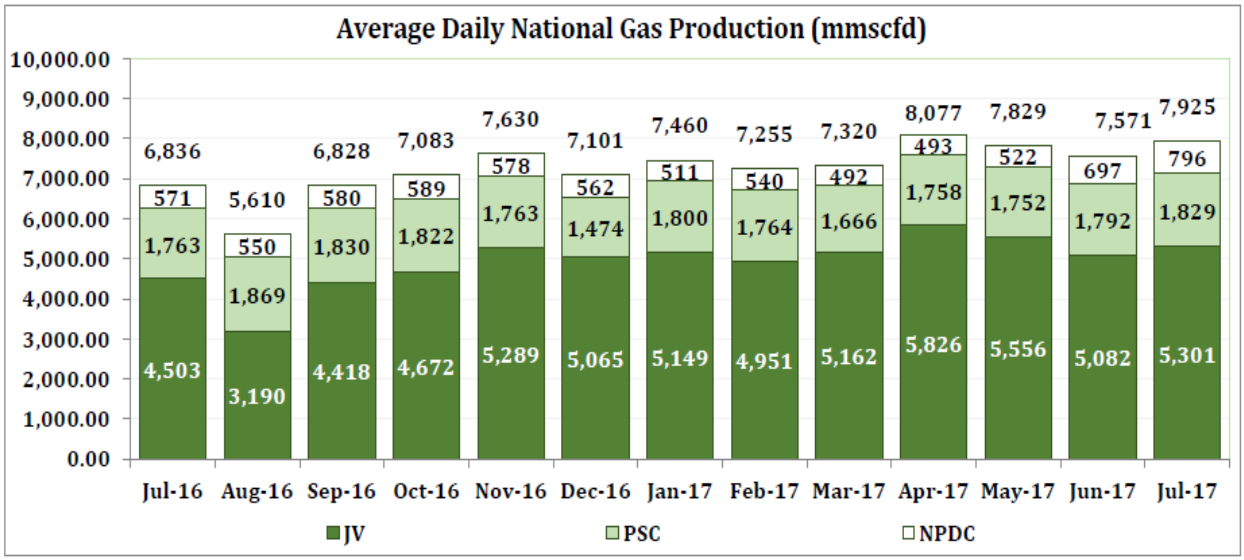

Figure 2.1 Average daily National Gas production in mmscfd

In Nigeria, use of fertilizer in the year 2016 was estimated at 12.6 kg/ha (FMARD 2016) slightly above sub Saharan average of 9 kg/ha but much below the 200 kg/ha recommended by the United Nations Food and Agriculture Organization (FAO). Over-dependence on external supply was brought about by the substantial availability of budgetary resources to support imports and overvaluation of the local currency in the past. During the late 1980s and mid-1990s, domestic fertilizer production of the total supply varied between 46 and 60 percent (Ogunfowora 1993 cited in Phillip et al. 2009).

The situation deteriorated, in the early 2000s as all the nitrogen phosphorous & potassium (NPK) fertilizers used in Nigeria was imported in the absence of any domestic production as a result of the closure of the only producing plant, the National Fertilizer Company of Nigeria (NAFCON) for repairs. From 2006 to 2008 production trickled in but was still below consumption required per hectare of land. In 2008, 370,676MT of nitrogen, 60,793MT of Phosphate and 40,428 MT of Potash, types of fertilizers were imported as against local production of 12,500MT of Nitrogen, 6,500 MT of phosphate and 6,800 MT of Potash types of fertilizers. This disparity in local production and importation affected fertilizer consumption in kg/hectare of arable land in Nigeria (See Table 2.1). Adesina (2008) observed that soil nutrient mining is killing Africa particularly in Nigeria where more than 60kg/ha of nutrient loss was recorded in 1995-1997 & 30-60kg/ha in 2002 -2004. A major reason for the high soil nutrient deficiency is low level of fertilizer use in Africa compared to the rest of the world. Adesina (2008) viewed fertilizer as a “Golden Bullet” to rapid agricultural growth.

Therefore, the domestic production of Nitrogenous fertilizer from both IEFCL Train1 and Train2 projects will add value to the need for adequately addressing the low fertilizer consumption scenario of the country.

Table 2.2: Fertilizer production, import, and consumption in Nigeria 2002-2017

Fertilizer type	Element	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Nitrogen fertilizers (N total nutrient)	Production quantity in nutrient (tones of nutrient)	0	0	3,800	4,868	20,821	12,505	0	54743	31998	65940	369910	235000	170000	281750	695000
Phosphate fertilizers (P205 total nutrient)		0	0	2,200	2,779	12,540	6,553	0	24108	5100	5738	6376	6440	6440	611	
Potash fertilizers (K20 total nutrient)		0	0	2,450	3,066	14,314	6,803	0	0	0	0	0	0	0	0	0
Ammonium nitrate	Import quantity (MT)	2,849	2,437	0	0	0	0	83199	54955	1013	4927	1319	66	36	0	0
Ammonium sulphate		4,709	517	74,420	76,490	78,619	24,260	4622	5496	25455	132	11417	12391	4181	11804	27679
Diammonium phosphate (DAP)		5,009	466	0	0	0	19532	24438	49	0	0	0	0	200	5500	5250
Monoammonium phosphate (MAP)		219	20	30,000	25,000	22,000	0	19571	0	0	0	6612	1462	33	29	49
NPK complex > 10kg		97,605	25,770	0	0	0	0	12800	0	0	0	231000	295000	345000	165000	380455
Potassium chloride (Muriate of potash)		2,946	10,810	11,000	10,000	11,000	12,219	8663	0	16825	21834	35374	14640	22188	7484	4165
Superphosphate other		0	0	8,000	10,000	11,000	14,718	0	0	0	20000	0	22682	0	16200	16600
Urea		288,252	77,207	39,000	417,900	306,900	75,864	1400	8000	370000	120000	100434	598616	291966	120455	21013
Nitrogen fertilizers (N total nutrient)	Import quantity in nutrients (MT of nutrients)	94,400	137,603	39,000	211,047	160,104	43,508	141000	45000	240000	85000	100000	352782	175000	61	1370
Phosphate fertilizers (P205 total nutrient)		41,400	49,432	17,040	14,800	13,240	11,634	64000	12000	67000	36000	56000	78000	51000	1320	24040
Potash fertilizers (K20 total nutrient)		30,400	42,712	6,600	6,000	6,600	7,331	78000	16000	68000	43000	74000	57000	41203	1582	499
All	Fertilizer Consumption in kg-ha of arable land	4.53	6.4	4.55	7.2	10.04	4.21	5.88	5.26	12.21	6.56	11.38	17.8	10.9	12.66	17

From the graphical illustrations in the figure 2.3 below, it can be deduced that the dependence on foreign imported urea fertilizer in to Nigeria dropped drastically from 2016 owing to the coming on-stream of the IEFCL Train1 plant, which will further be consolidated by the proposed IEFCL-Train2 project.

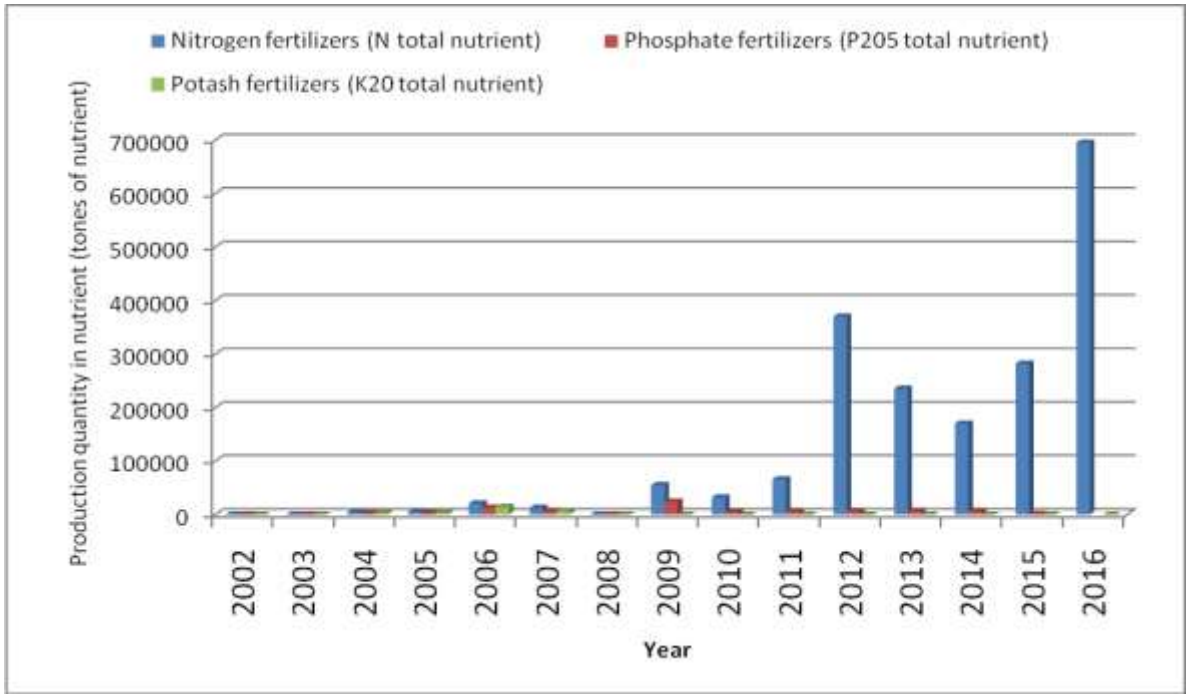

Fig 2.1 Fetilizer production in nigeria from 2002 to 2016

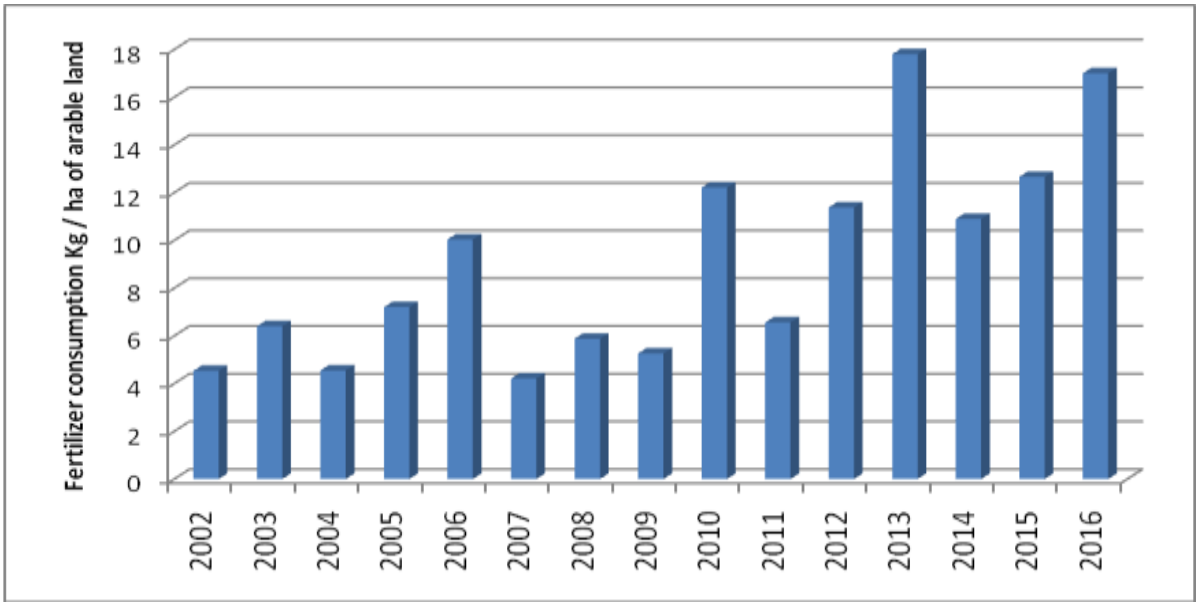

Fig 2.2 Fetilizer consumption in kg-ha of arable land 2002 to 2016

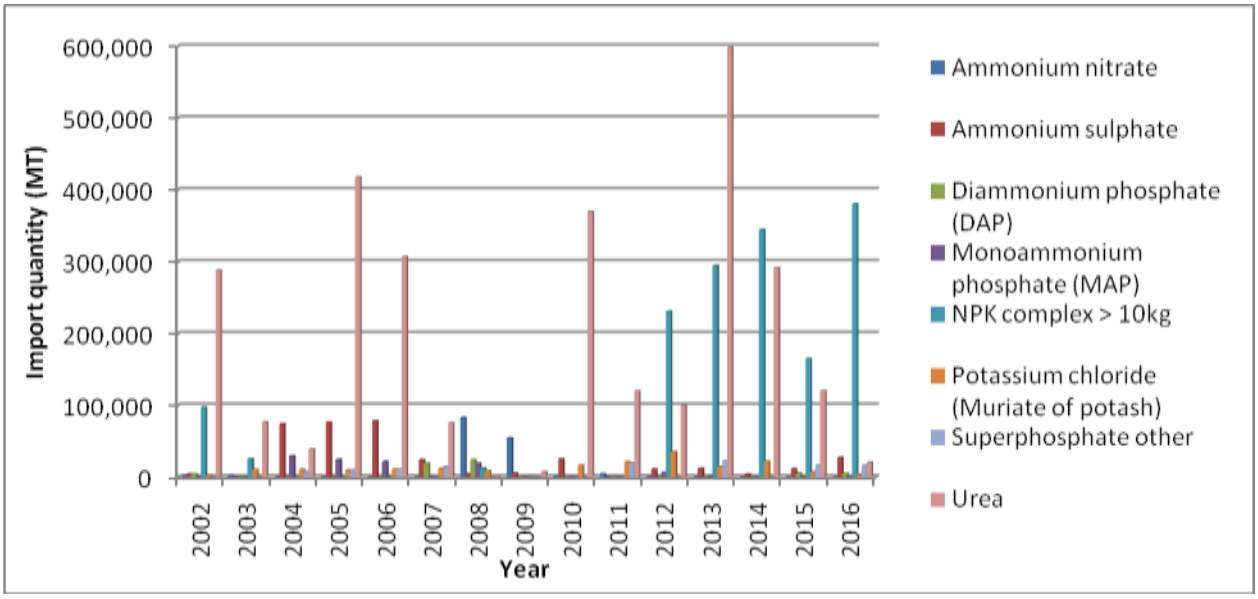

Fig 2.3 Fetilizer importation in nigeria from 2002 to 2016

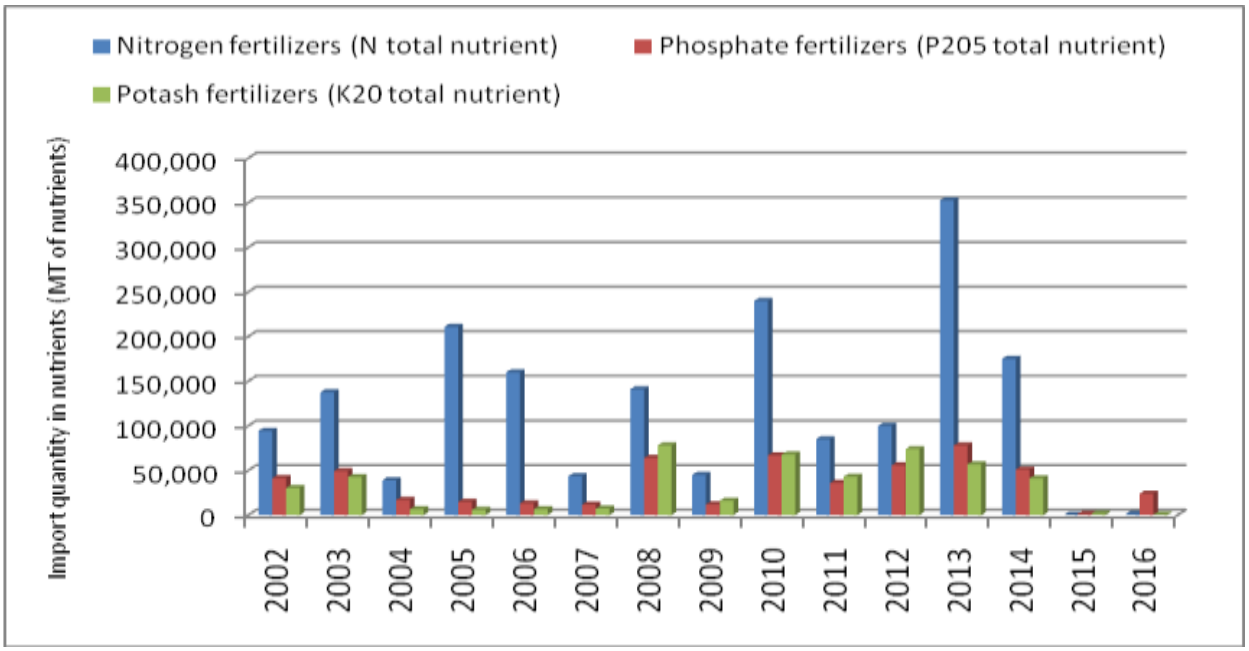

Fig 2.4 Fetilizer import quantity nutrients (MT of nutrients) in nigeria from 2002 to 2007

The arable urea outlook also favors the need for Nigeria to endeavor to share in the global market. Urea is widely used in Nigeria as fertilizer product because it's high "N" nutrient content. It is used in blending to form other types of fertilizer. Most of these plants will be found in China, India, Iran and Latin America. The demand for urea fertilizer is growing in

developing countries as well due to population growth, changes in per capita income, food preferences and increase in food prices.

The above information emphasizes how essential and necessary this project is, as it will help to solve the urgent need for a strategic investment program to increase the availability and use of fertilizer in the much needed Green Revolution in Nigeria that will usher in food security for Nigeria in the long term.

2.3 VALUE

The fertilizer project will help to improve the share of agriculture in Nation's Gross Domestic Product (GDP). Agriculture, a dominant sector in the Nigerian economy since 1960's, engages about 70% of the population directly and provides more than 75% of non-oil foreign exchange earnings (IEFCL Market Survey, 2010). In 1960s, the agricultural sector used to be the most important sector in terms of contribution to domestic production, employment and foreign exchange earnings. However, due to non-availability of fertilizer, poor crop yields led to agriculture being uneconomical. As a result, the land under cultivation has been reducing over the years.

The agriculture sector of Nigerian economy, however, contributes significantly to rural employment, food security, non-oil foreign exchange earnings and industrial raw materials, with the largest share of about 22.97% real GDP in Quarter 2 2017 (National Bureau Statistics).

The trend in the share of agriculture in the GDP shows a substantial variation and long-term decline from 60% in the early 1960s through 48.8% in the 1970s and 22.2% in the 1980s. In 1993 (at 1984 constant factor cost) crops, the major source of food in Nigeria, accounted for a share of around 30% of the GDP (IEFCL Market Survey, 2010).

For the future, it is noticeable that considering a moderate growth rate of 2%, the population will reach 240 million by 2030, thereby at least doubling the food demand (IEFCL Market Survey, 2010).

At the moment the majority of population dependent on agriculture currently lives below the poverty line due to very poor land yields. Provision of fertilizers at affordable prices will help to achieve higher yields to meet the demands of growing population as well as to uplift large part of the population out of poverty.

The following reasons are limiting the use of fertilizers in Nigeria:

- Higher price
- Low fertilizer Quality
- Non-availability of fertilizer at times due to complete dependence on imports
- High cost of credit & transport
- Lack of proper education and information with the farmers.

As such and to keep pace with population's growth rate, Nigeria requires a high investment/growth rate policy for agricultural sector, the key element for which is an efficient functioning of the fertilizer sector.

The investment by IEFCL Management to set up one more facility for the production of 2300 MTPD Ammonia and 4000 MTPD Urea at its existing facility at Port Harcourt (Rivers State, Nigeria) will help improve domestic production, reduce importation, enhance supply/distribution networks and provide new employment opportunities for the growing job demand of young Nigerian population.

2.4 SUSTAINABILITY

2.4.1 Technical Sustainability

The proposed project is expected to be technically sustainable because of the proven technology from international technology licensors employed in the Train1 facilities which are already in operation. Train2 project will be a replica of the Train1 plant. The Train1 plant has also proven to be economically viable, with a minimal environmental, social and health impacts to personnel and the environment.

Strict adherence to internationally accepted engineering design and construction standards as well as codes of practice that shall be adopted at all stages of the project are expected to ensure technical sustainability. The availability of technically competent human resources existing in Train1 assures the project sustainability as well as justifying the venture. Fertilizer production is a continuous process that requires no interruptions during operations either by gas or power supply. Thus, the high abundance of raw material (natural gas) available in Nigeria which is used as feed stock and also for power generation along with the technical know-how to operate the plant guarantees the sustainability of this project.

2.4.2 Environmental Sustainability

Incorporation of the recommendations of this ESIA at the appropriate stages of the project development is expected to ensure that the proposed Fertilizer plant is environmentally sustainable. In addition, strict adherence to the EMP shall ensure that every aspect of the proposed project is sustainable with minimal impact, especially as it concerns the natural environment and the people who inhabit it.

2.4.3 Social Sustainability

The need for the activity is borne out of IEFCL commitment to meet the ever increasing demand of Fertilizer nationwide to achieve food security and to create employment opportunities. The robust and all inclusive engagement of the host communities by IEFCL Management has endeared the project to the heart of the Chiefs, Elders, Opinion leaders,

Youth and Women of the host communities. This is evidence of the positive social acceptability of the project.

2.4.4 Economic Sustainability

The location and abundance of the major feed, capitalizing on Nigeria's competitive advantage in the form of gas reserve, ensures that the fertilizer plants will count on available resources. The availability of proficient manpower, the presence of a well-structured industrial area and the choice to realize a production (Nitrogenous Fertilizers) based on proven technology are further elements in favor of the business venture.

One other distinct advantage of this project which will surely ensure its sustainability is the fact that it will help to correct the imbalance in the supply and demand of urea fertilizer creating an enduring market.

Presently the per capita consumption of fertilizer is very low in Africa, and Nigeria in particular. The projection that the use of fertilizer per hectare should rise up to 50 kg/ha in 2015 from 13 kg/ha in 2009 gives it the enabling environment for sustainability. Moreover, the dependence of Nigeria on the importation of fertilizer (as showed in Table 2.1) further boosts the need of a more secured internal supply/distribution network.

Referring to the above, the project will improve the following areas of the economy:

I. The local economy and development of other downstream medium scale cottage industries like fertilizer blending plants;
II. Direct & indirect employment of local population;
III. Substantial indirect employment for plant construction, transportation and support services.

2.5 PROJECT ALTERNATIVES / OPTIONS

The availability of reliable source of the feedstock (Natural gas), well-endowed project site with all the resources required for a steady production of fertilizer, limited the considerations for site and production alternatives. The evaluation of alternate raw material such as coal, concluded that such options will not be economically viable. In view of this fact, availability of raw material and location assumed the critical factors. Alternative site for the factory or the use of alternative raw material which call for different manufacturing technologies would have stretched environmental safety, engineering technology and logistic requirements with concomitant high economic cost for design, engineering and construction.

Consequently, the decision arrived at choosing the option with the best site alternative, easy raw material availability and tested technical sustainability.

The following paragraphs therefore describe the alternatives and the reasons considered in selecting such options. The technological solution has been adopted as a consequence of the raw material selected. The "No project alternative" is finally discussed into a dedicated paragraph.

2.5.1 Option 1: Natural Gas as Raw Material

The usage of natural gas as major feed for the production of Ammonia and Urea was considered more cost beneficial and environmentally friendly than the usage of other raw materials, such as coal and biomass, in these respects:

i. The natural gas will be available at the plants battery limit. A separate authorization is in place to assure the delivery of such raw material;
ii. The reserve of the natural gas will suffice well above the life cycle of the plants;
iii. Natural gas is cleaner during breakdown to the useable components of CO_2, H_2 than Coal or Biomass;

iv. Coal or Biomass as major raw material for the project would be capital intensive because of the cost of trucking or transporting coal from the nearest commercial deposit (Enugu) to Project site in Eleme;
v. The environmental cost that would be incurred from the processing of coal or Biomass as raw material would be very uncompetitive. As a matter of fact, use of coal or biomass as feed for production of fertilizer would have more environmental implications, concerning in particular air pollution and residual waste management;
vi. The option of using coal or biomass would also demand land take, which can bring to loss of vegetation, biodiversity and other natural resources.
vii. Finally, if coal or biomass would be used as raw material, the engineering task and cost in developing the site for process units, utilities, waste water treatment, and offsite would be more significant.

2.5.2 Option 2: Use of Indorama Complex as Project Location

Locating the project in the existing Indorama Complex has numerous positive advantages over the acquisition of a virgin land based on the following reasons:

i. Land acquisition and associated socio-economic disadvantages would not be an issue, if the project is sited within the existing Indorama complex;
ii. The engineering tasks and cost involved in preparing a new virgin land are not necessary and required.

Choosing the Indorama complex as Fertilizer plant site is also advantageous since it is already endowed with power, water, wastewater treatment facilities, storage facilities, adequate and available manpower and technology.

2.5.3 No Project Alternative

This option as the title imply involves abandoning the idea of building the new plants. This option is anti-development as well as been detrimental to the nation's policy on Agriculture, and Food Security in addition to national economy. It will perpetuate the situation where

importation of the urea will be the only means of satisfying our agriculture and chemical industrial sectors. The no-project option would also deny the host communities, the huge benefit of acquiring skills and empowerment. Consequently this option is not likely to be considered a valid alternative to the realization of the project.